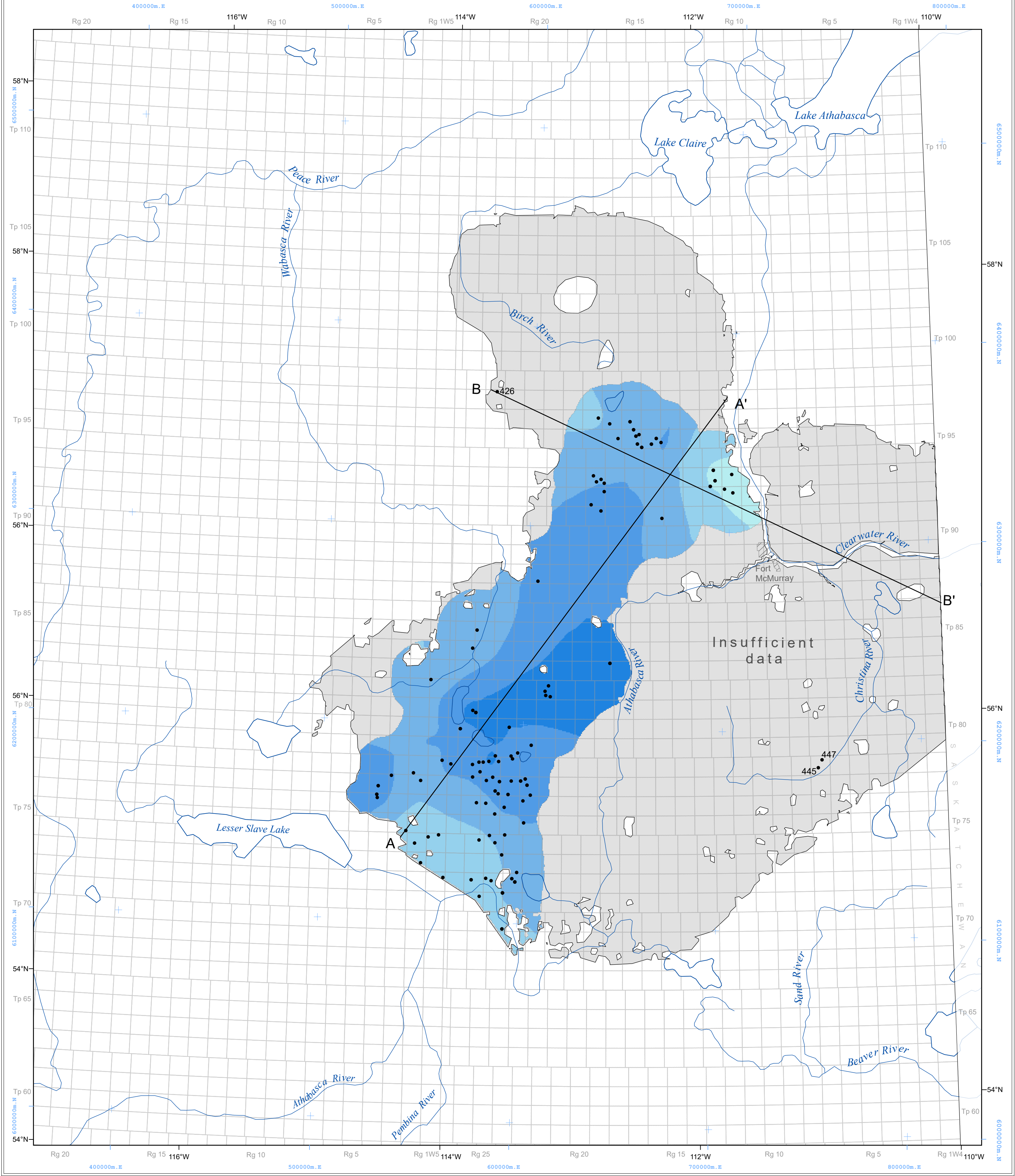


HYDRAULIC HEAD
WABISKAW HSU



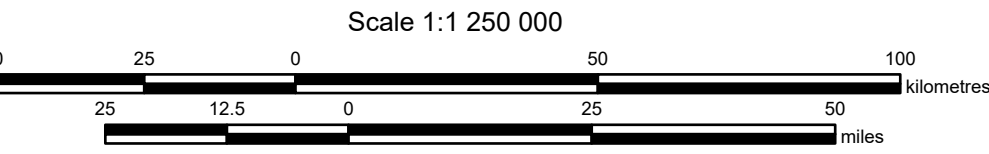
Alberta Geological Survey
www.agrs.aer.ca

Published 2025
ISBN 978-1-4601-5715-2

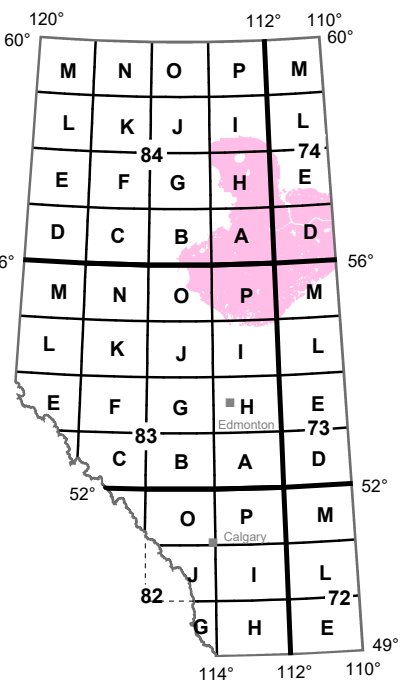
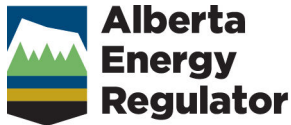
Map 650

Distribution of Hydraulic Head in the
Wabiskaw Hydrostratigraphic Unit

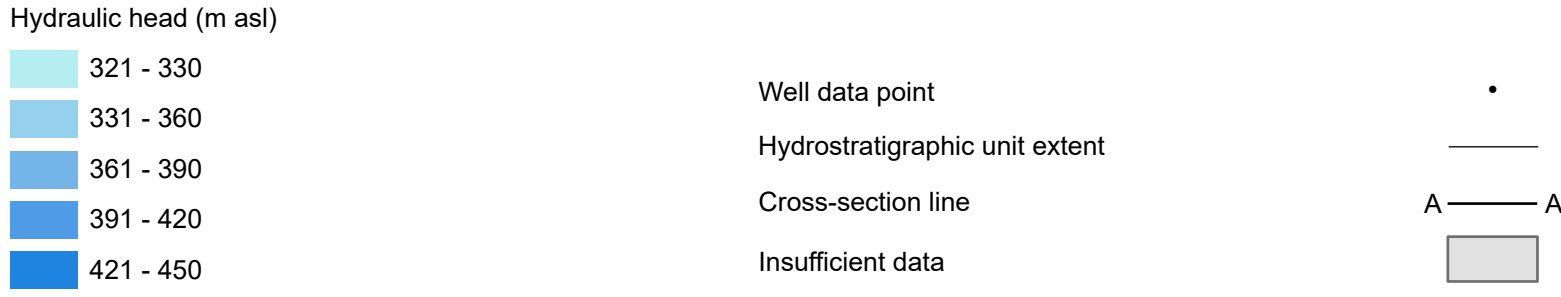
Hydrogeology by: A.D. Rubin, J. Brinsky and B. Welsh



Projection: 10 Degree Transverse Mercator
Datum: North American Datum, 1983



SYMBOL LEGEND



This map depicts the distribution of hydraulic head in the Wabiskaw hydrostratigraphic unit (HSU). The horizontal and vertical extent of the unit was adopted from the 3D Provincial Geological Framework Model of Alberta, Version 3 (Alberta Geological Survey, 2021). The relationship of the Wabiskaw Member of the Clearwater Formation with the units above and below as well as its geometry can be seen in Figures 1 and 2. The Wabiskaw Member, which is a distinct HSU within the Clearwater Formation, is mapped separately from the overlying Clearwater HSU as the regional hydrostratigraphy suggests that the latter is a weak aquitard and the former is a mixed aquifer/aquitard. The dual nature of the Clearwater Formation is discussed in more detail in Bachu and Underschlutz (1993).

Methodology

The hydraulic head distribution map is a result of an empirical Bayesian kriging technique using publicly available static water levels from 6 monitoring wells and pressure data from 107 drillstem tests from oil and gas wells. A screening process modified from Jensen et al. (2013) was used to ensure that only representative pressures were used to calculate equivalent freshwater hydraulic heads. The final gridded map surface was clipped based on the spatial distribution of representative data. Residual values are plotted at each location (Figure 3) to indicate where underprediction and overprediction occurs compared to the measured hydraulic head values. Using the methodology of Singh et al. (2017) the Cumulative Interference Index (CII) was determined and used to identify and remove tests that have been influenced by production or injection (Figure 4).

The location of total-dissolved solids (TDS) data points and their measured TDS are presented in Figure 5. The TDS data points were not gridded due to insufficient data coverage. The data source for each well used in the hydraulic head map is presented in Figure 6.

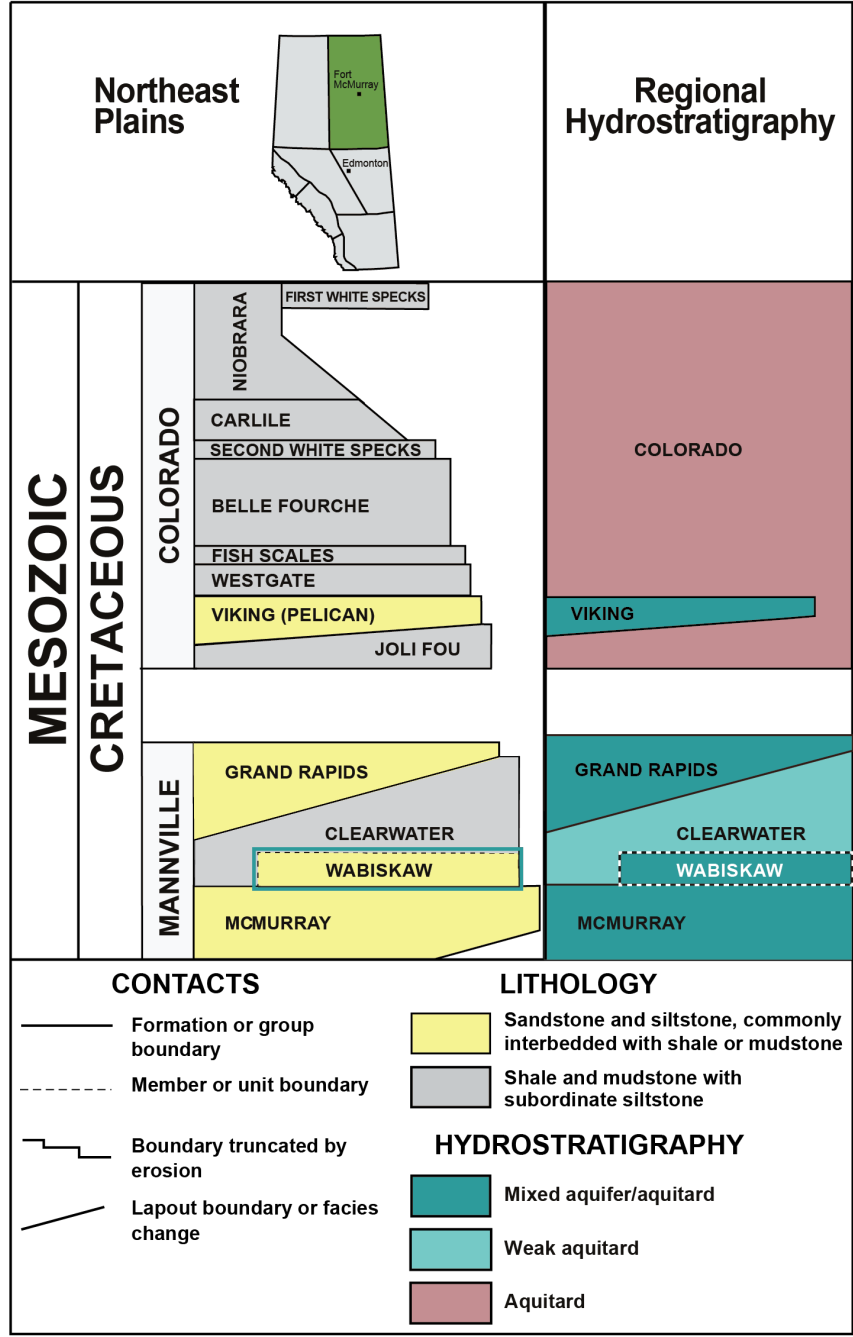


Figure 1. Regional lithostratigraphy and hydrostratigraphy (based on Alberta Geological Survey, 2019). Solid teal lines highlight the Wabiskaw Member of the Clearwater Formation. Dashed white lines depict the Wabiskaw HSU within the regional hydrostratigraphy. Strata above the Colorado Group and below the McMurray Formation are not shown.

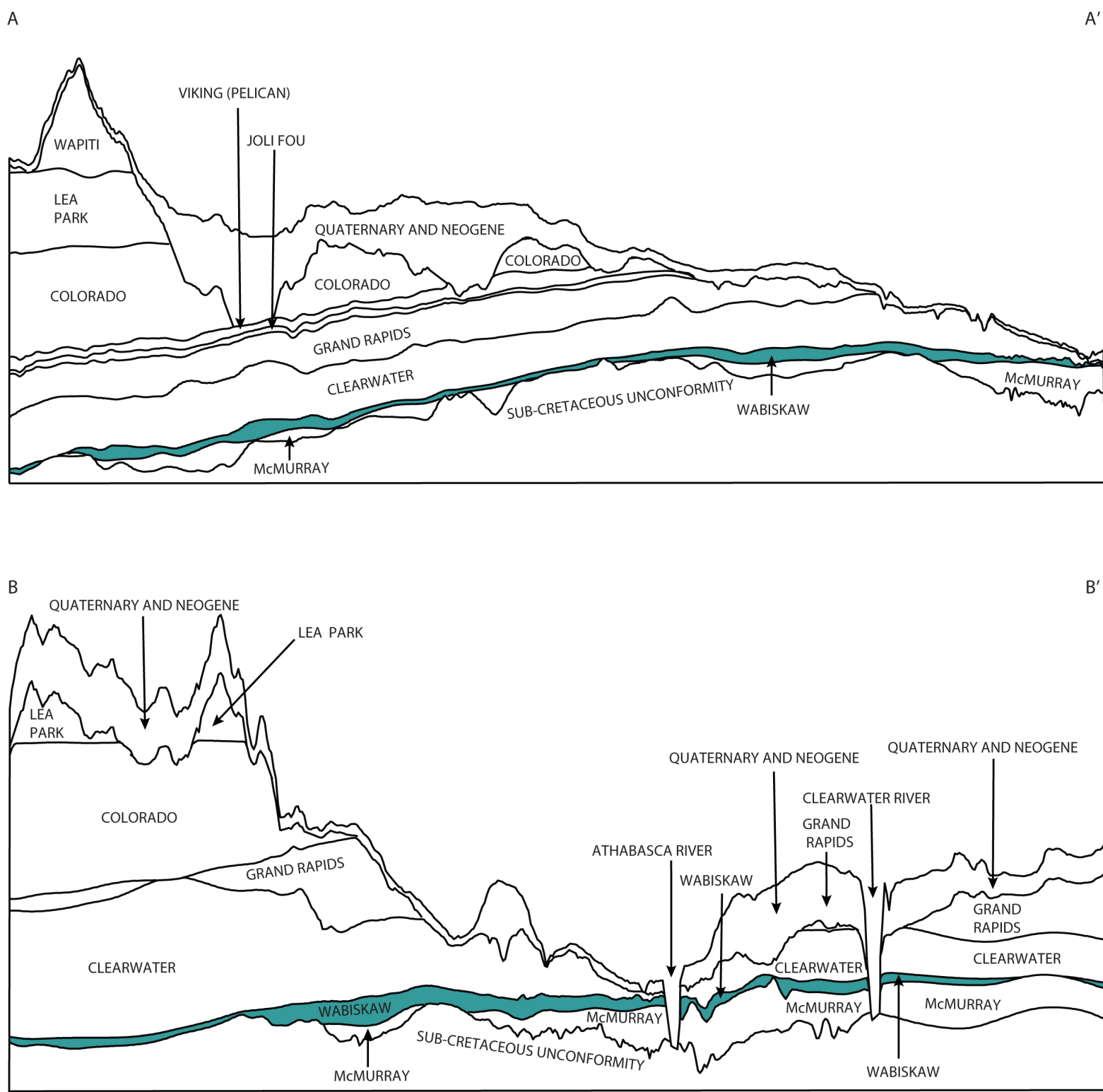


Figure 2. Schematic cross-sections identifying the geometry and variable thickness of the Wabiskaw HSU (not to scale).

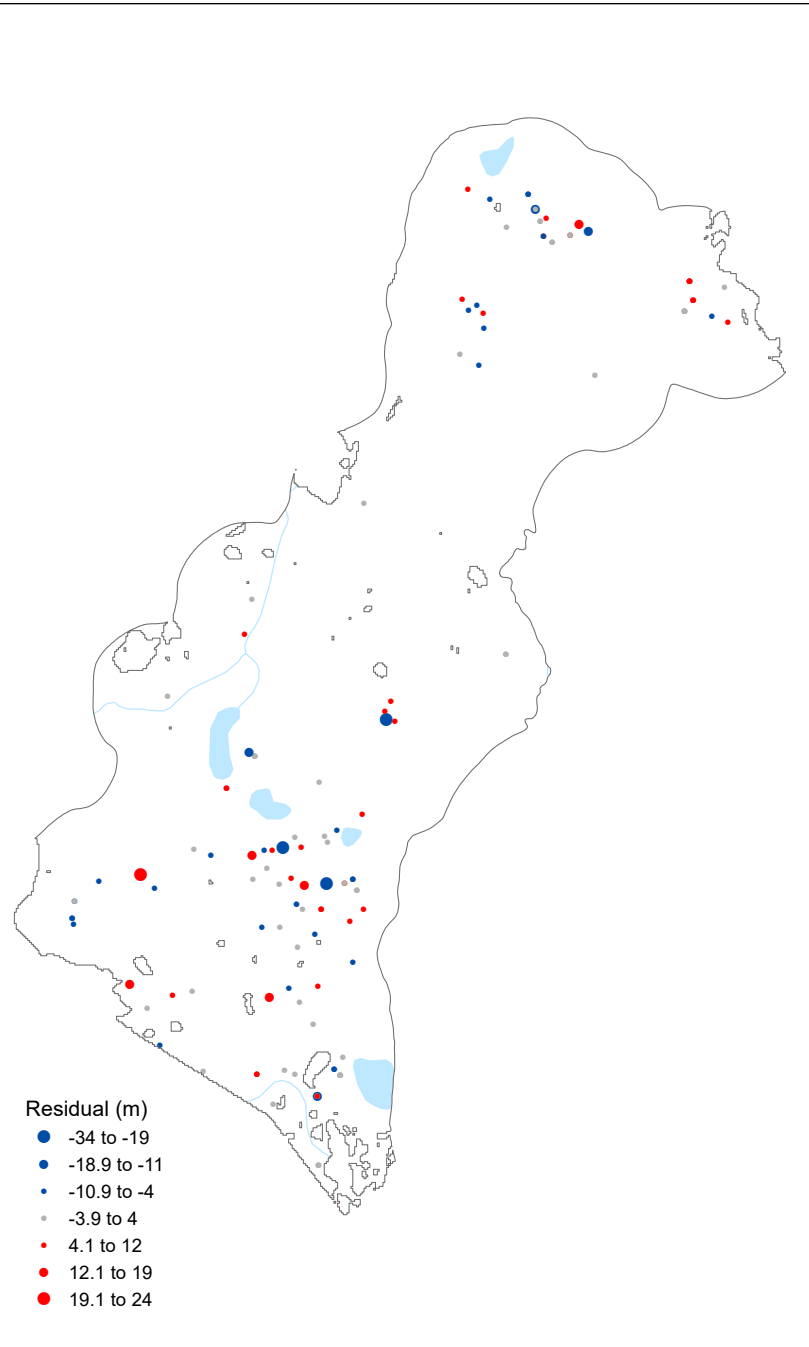


Figure 3. Calculated residuals between the modelled distribution of hydraulic head and measured values. Symbol classes are based on the standard deviation of the calculated residuals.

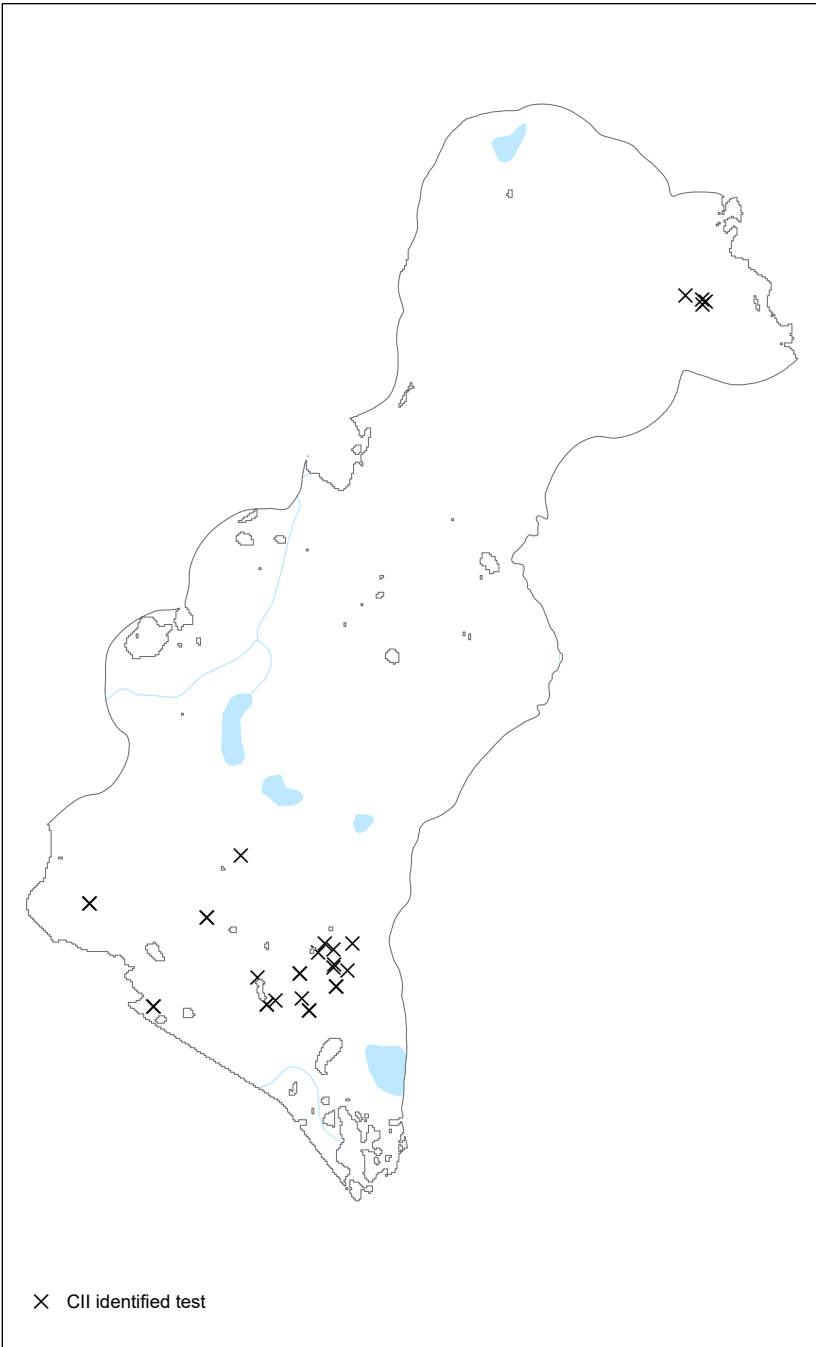


Figure 4. Location of tests that may have been influenced by production or injection and were removed during the Cumulative Interference Index (CII) process.

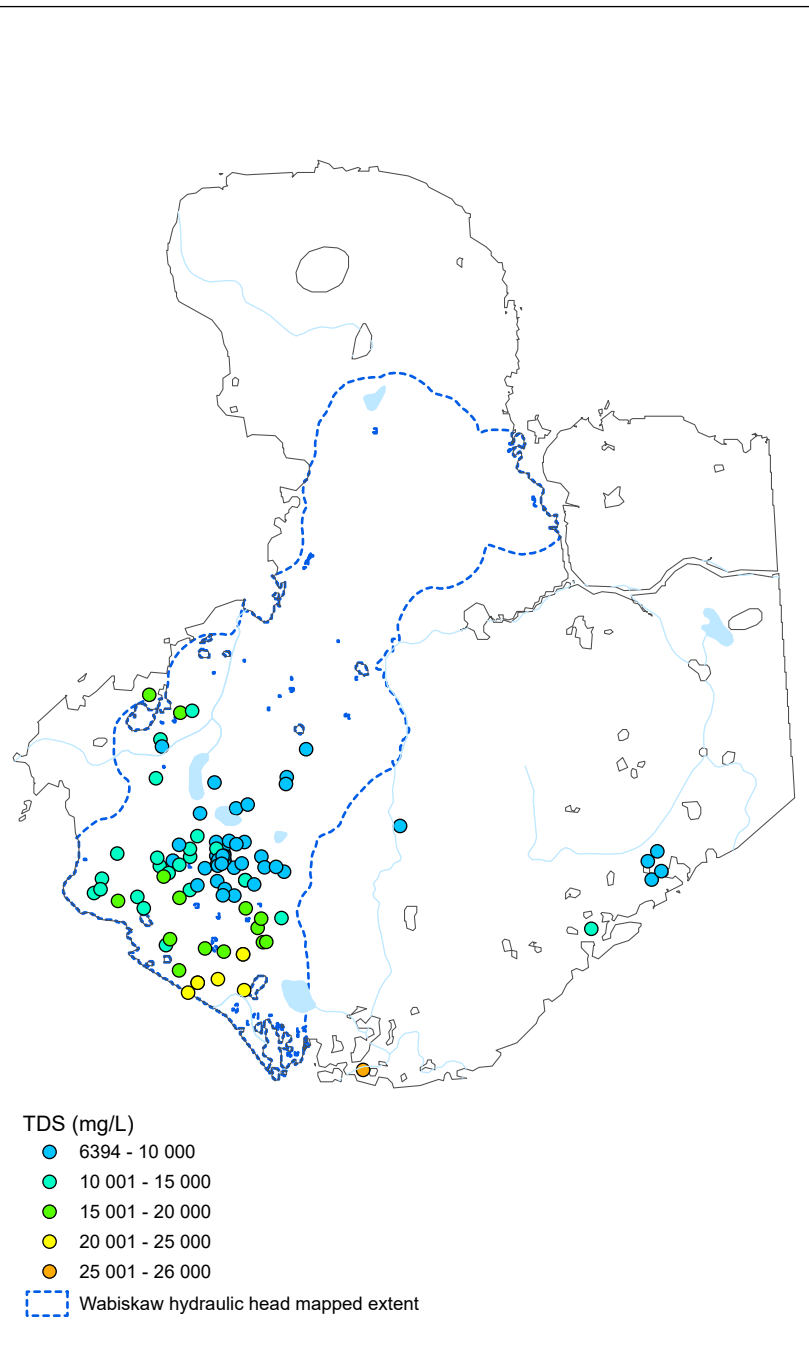


Figure 5. Data points of total dissolved solids (TDS) data with measured TDS in the Wabiskaw HSU.

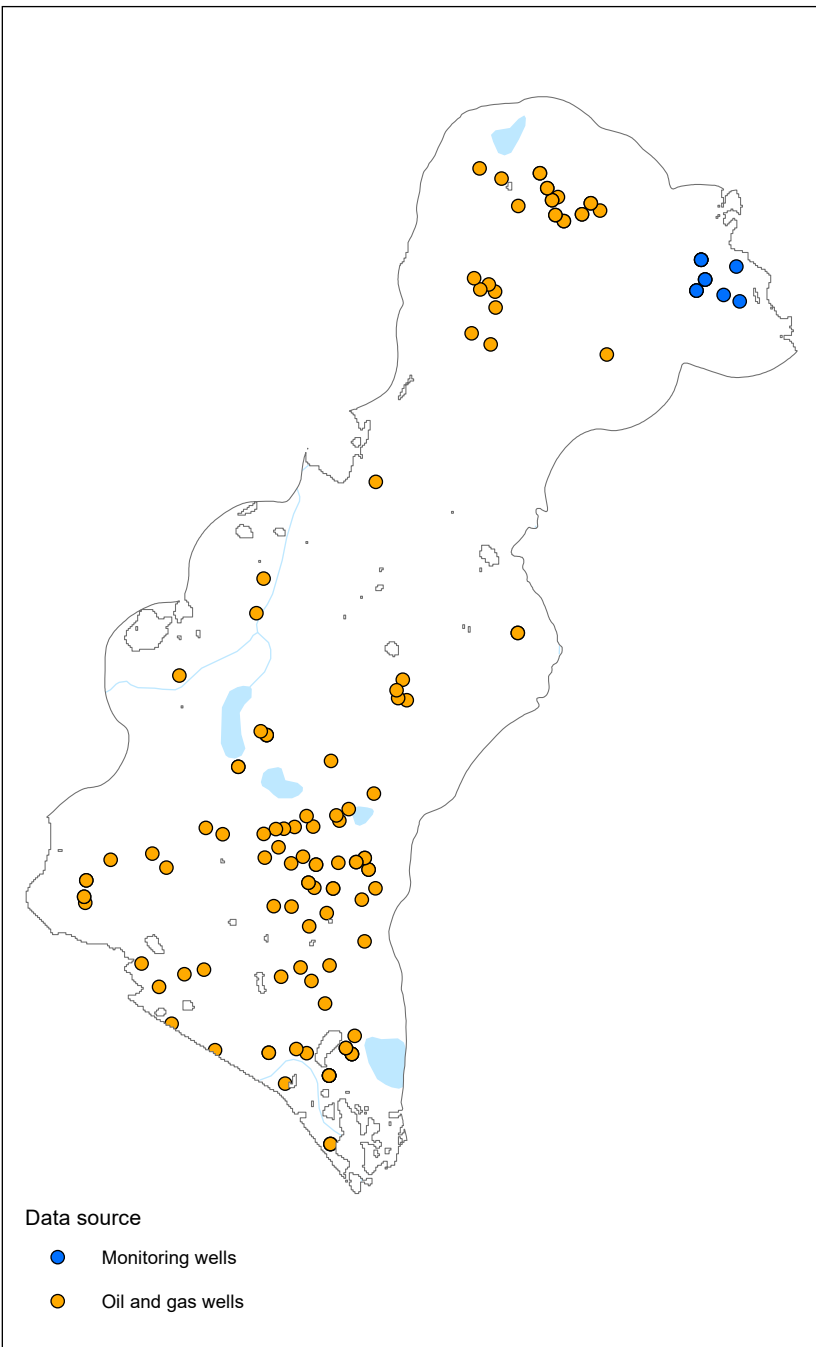


Figure 6. Data sources of hydraulic head data used to create the Wabiskaw HSU hydraulic head map. Data sources include monitoring wells and oil and gas wells.

Acknowledgements

Base data from the Atlas of Canada (Natural Resources Canada, 2012) and Spatial Data Warehouse, Ltd.

References

- Alberta Geological Survey (2021). Geological Framework of Alberta, version 3 (interactive app and map, methodology, model, dataset, story maps, web maps). Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Interactive Application <<https://gfa-v3-agrs-aer.hub.arcgis.com>> [May 2022].
- Alberta Geological Survey (2019). Alberta Table of Formations; Alberta Energy Regulator, URL<https://ags.aer.ca/publications/table_of_formations_2019.html> [August 2022].
- Bachu, S. and Underschlutz, J.R. (1993). Hydrogeology of formation waters, northeastern Alberta Basin; AAPG Bulletin, v. 77, no. 10, p. 1745–1768, URL<<https://doi.org/10.1306/BDF8F24-1718-11D7-8645000102C1865D>>.
- Jensen, G.K.S., Roston, B., Palombi, D. and Melnik, A. (2013). Saskatchewan Phanerozoic Fluids and Petroleum Systems project: hydrogeological mapping framework; in Summary of investigations 2013, v.1, Saskatchewan Geological Survey, Saskatchewan Ministry of the Economy, Miscellaneous Report 2013-4.1, Paper A-5, 10 p.
- Natural Resources Canada (2012). CanVec digital topographic data; Natural Resources Canada, Earth Sciences Sector, URL<<https://open.canada.ca/data/en/dataset/6ba2aa2a-7bb9-4448-b4d7-f164409fe056>>.
- Singh, A., Palombi, D., Nakevska, N., Jensen, G. and Roston, B. (2017). An efficient approach for characterizing basin-scale hydrodynamics; Marine and Petroleum Geology, p. 332–340, URL <<http://dx.doi.org/10.1016/j.marpetgeo.2017.02.015>>.

Recommended Reference Format

Rubin, A.D., Brinsky, J. and Welsh, B. (2025). Distribution of hydraulic head in the Wabiskaw hydrostratigraphic unit; Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Map 650, scale 1:1 250 000.

Disclaimer

The Alberta Geological Survey and its employees and contractors make no warranty, guarantee or representation, express or implied, or assume any legal liability regarding the correctness, accuracy, completeness, or reliability of the publication. When using information from this publication in other publications or presentations, due acknowledgement should be given to the Alberta Energy Regulator / Alberta Geological Survey.