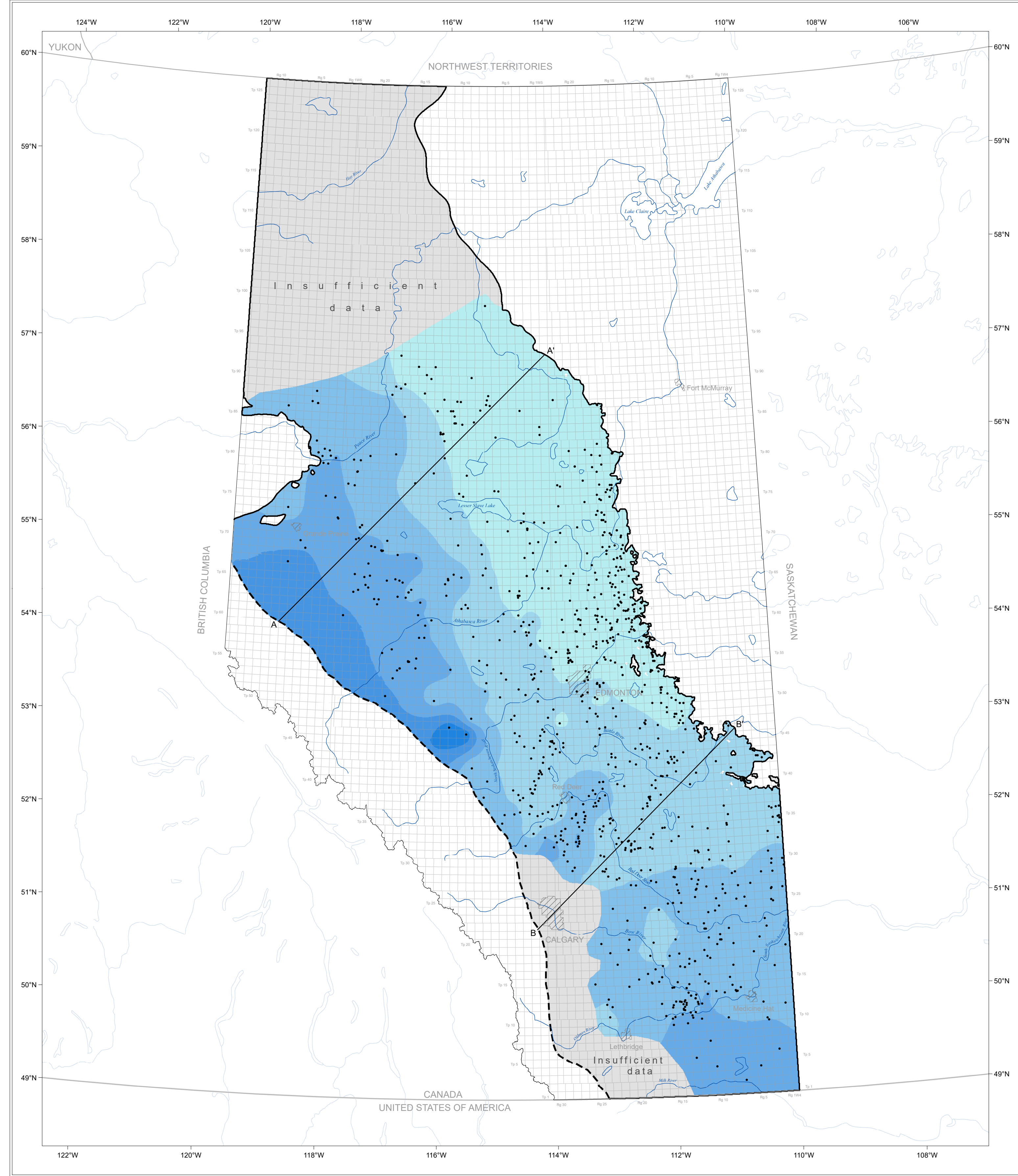
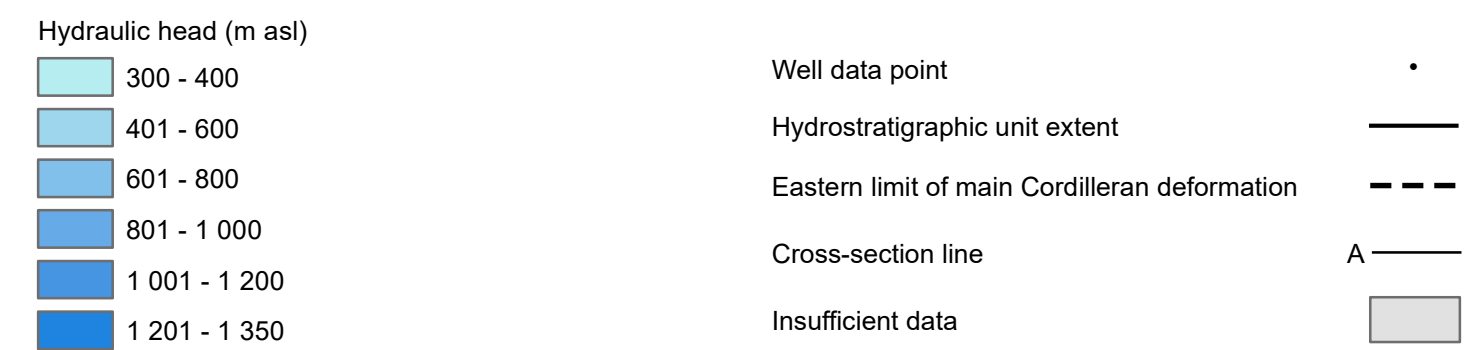


HYDRAULIC HEAD
WINTERBURN HSU



SYMBOL LEGEND



This map depicts the distribution of hydraulic head in the Winterburn hydrostratigraphic unit (HSU). The horizontal and vertical extent of the unit was adopted from the 3D Provincial Geological Framework Model of Alberta, Version 2 (Alberta Geological Survey, 2019a). The relationship of the Winterburn HSU with the units above and below as well as its geometry can be seen in Figures 1 and 2.

Methodology

The hydraulic head distribution map is a result of an empirical Bayesian kriging technique using publicly available pressure data from 914 drillstem tests for 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 or 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). Additional formation-scale hydrogeological maps for the Winterburn HSU are shown in Figures 5 and 6. Figure 5 illustrates the distribution of total dissolved solids in the Winterburn HSU. Figure 6 shows the water driving force (WDF) vector map for the Winterburn HSU. The WDF vector map allows identification of areas where the buoyancy effect of formation water density has the potential to change the inferred magnitude and direction of groundwater flow (Singh et al., 2017). Buoyancy appears to have some influence in the dark orange areas, where larger angles between the WDF vector and hydraulic gradient vector are observed.

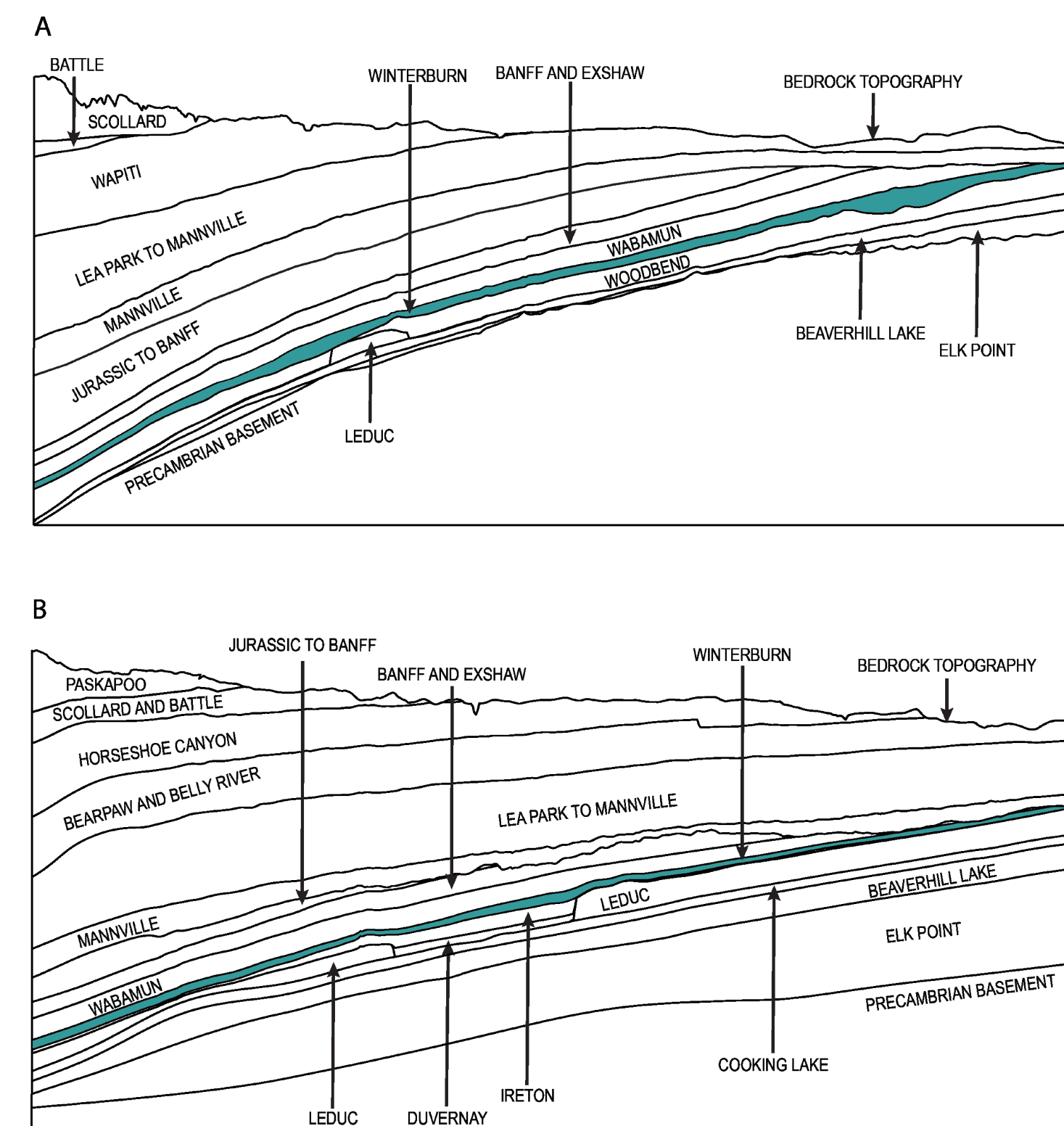


Figure 1. Schematic cross-sections identifying the geometry and variable thickness of the Winterburn HSU (not to scale). Strata within the Lea Park to Mannville and Jurassic to Banff intervals have not been subdivided at the scale of these cross-sections.

Acknowledgements

Data processing support by S. Stewart. Water driving force vector map created by A. Singh. Base data from the Atlas of Canada (Natural Resources Canada, 2012) and Spatial Data Warehouse, Ltd.

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Recommended Reference Format

Brinsky, J. (2022): Distribution of hydraulic head in the Winterburn hydrostratigraphic unit; Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Map 635, scale 1:3 000 000.

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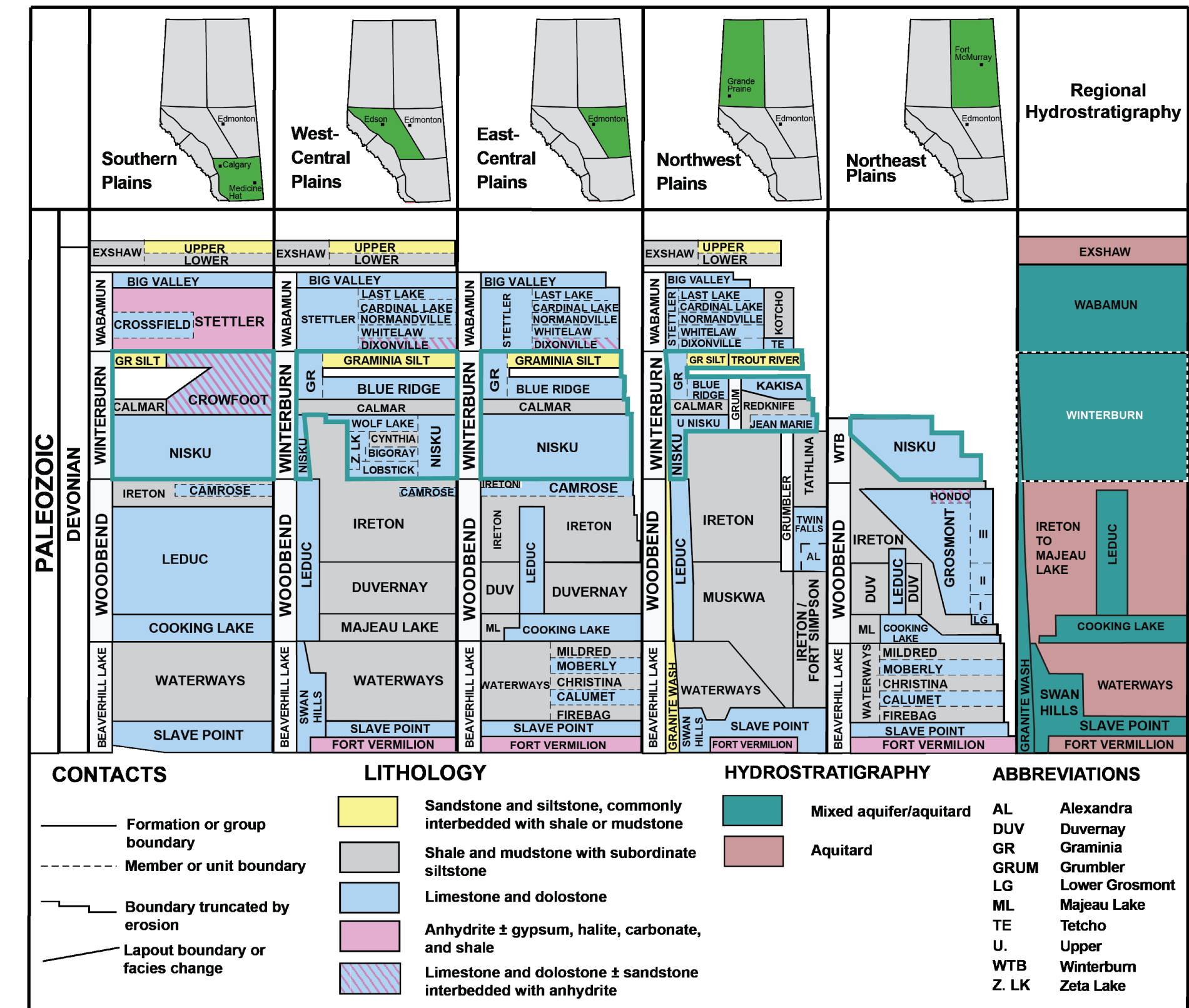


Figure 2. Regional lithostratigraphy and hydrostratigraphy (based on Alberta Geological Survey, 2019b). Solid teal lines highlight the Winterburn Group. Dashed white lines depict the Winterburn HSU within the regional hydrostratigraphy. Strata above the Exshaw Formation and below the Slave Point, Swan Hills, or Fort Vermilion formations are not shown.

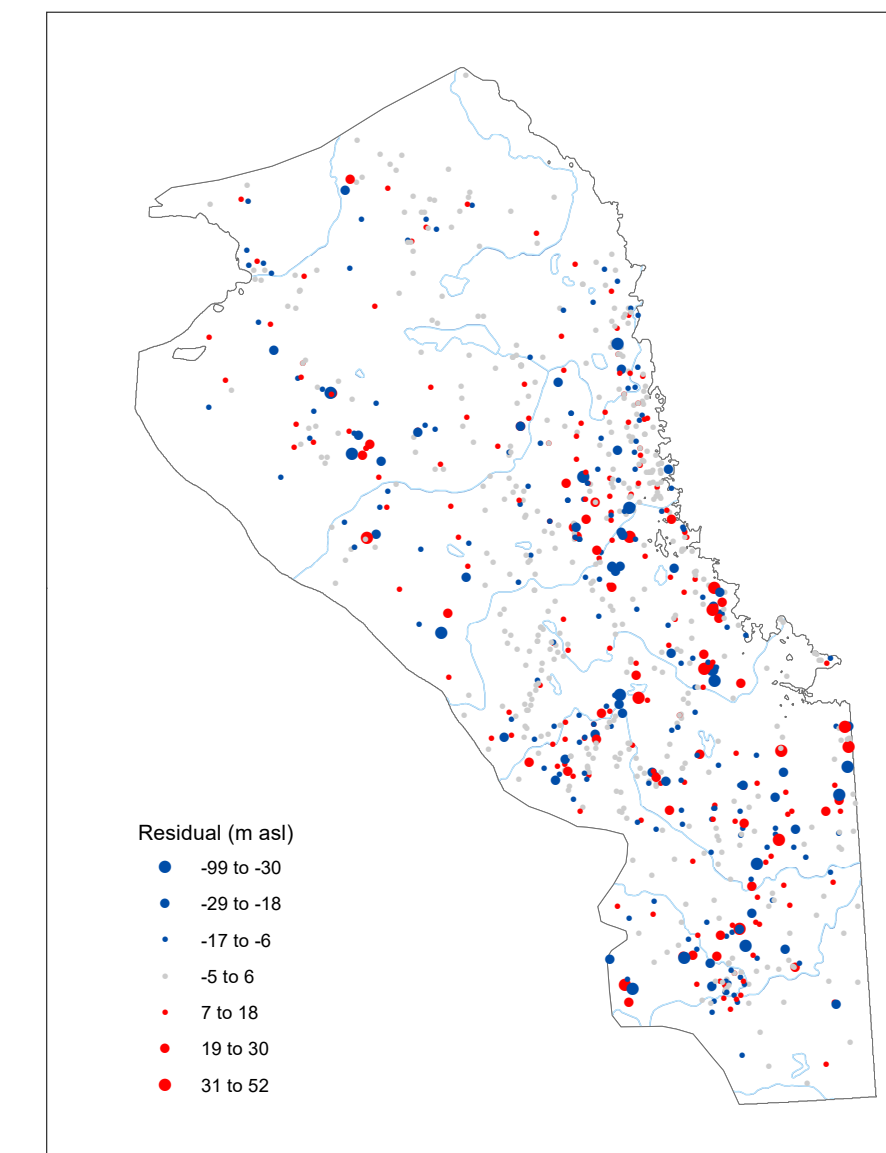


Figure 3. Calculated residuals between the modelled distribution of hydraulic head and measured values. Symbol classes are based on the standard deviation of the calculated residuals.

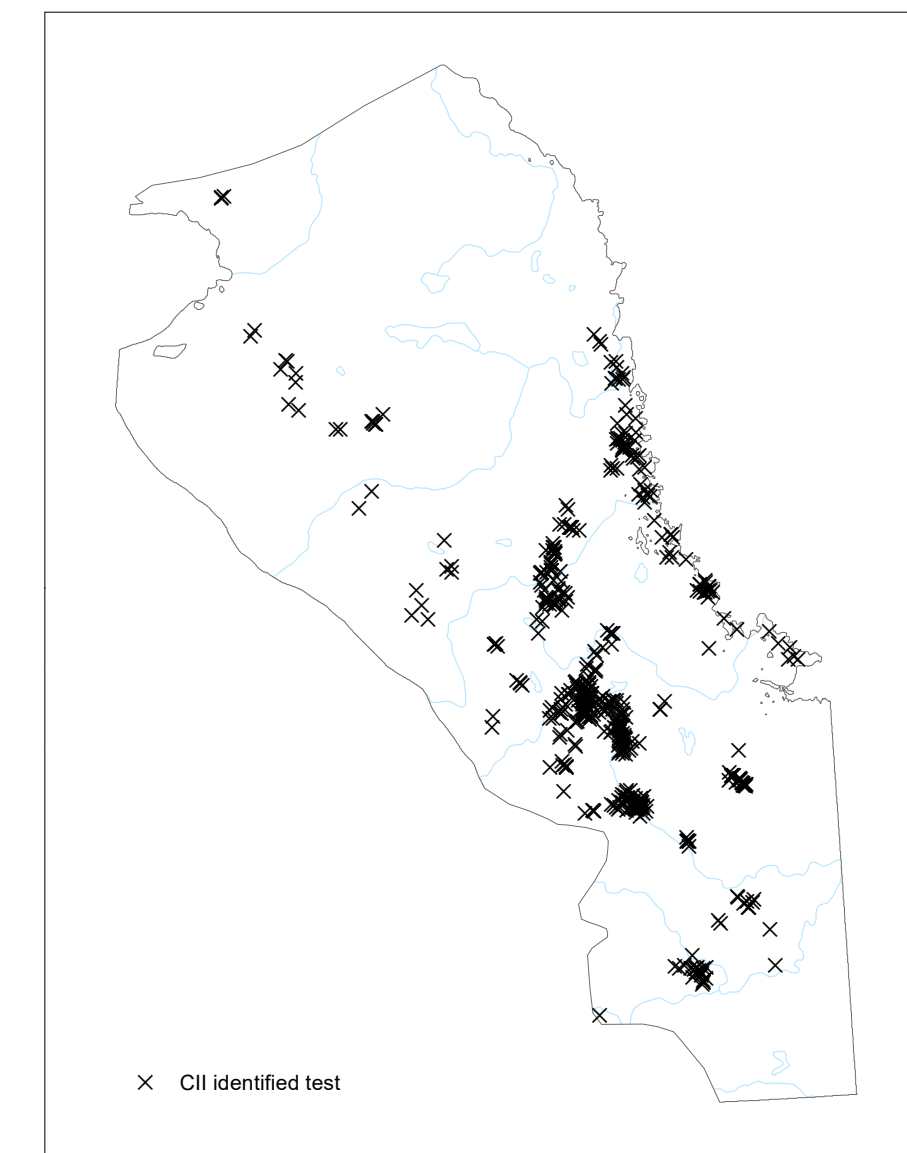


Figure 4. Location of tests that may have been influenced by production or injection and were removed during the Cumulative Interference Index (CII) process.

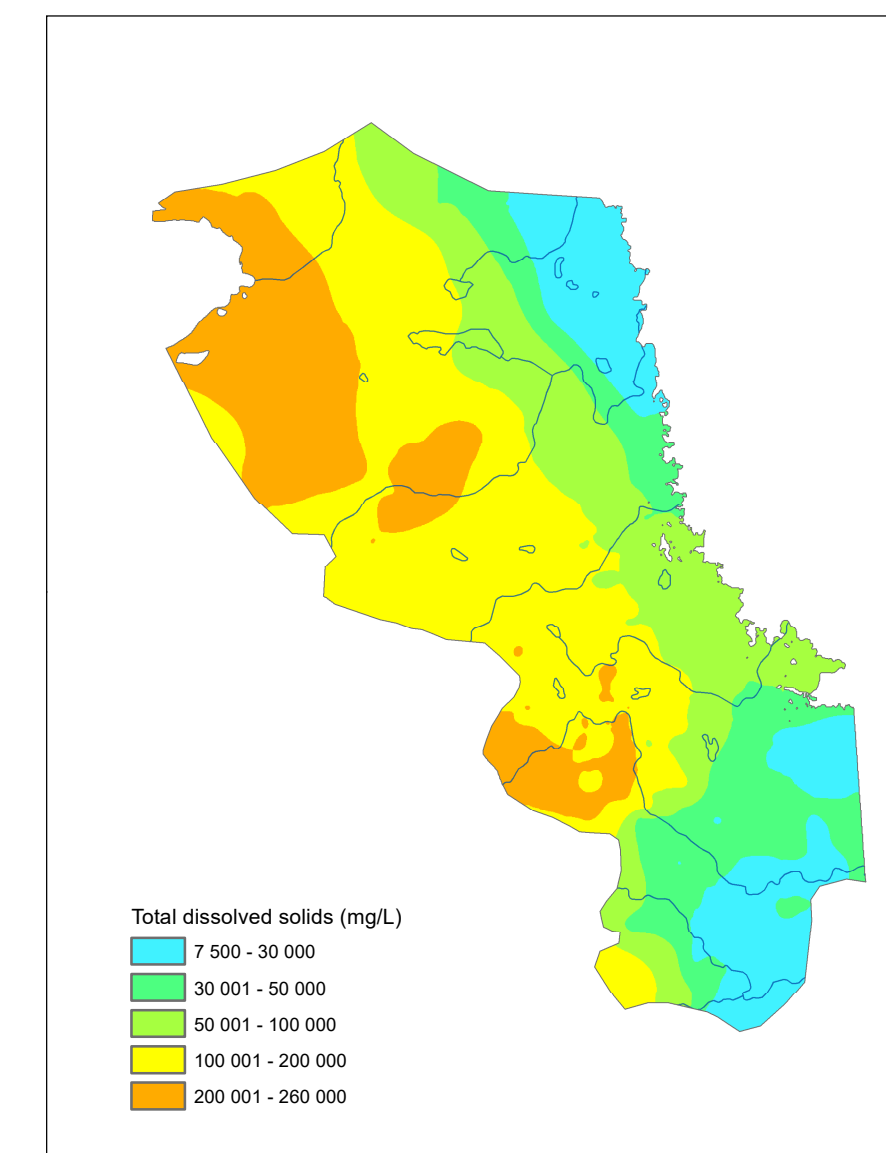


Figure 5. Distribution of total dissolved solids in the Winterburn HSU (Brinsky, 2022). The map extent is based on the spatial distribution of hydraulic head data and differs from the extent of the main map.

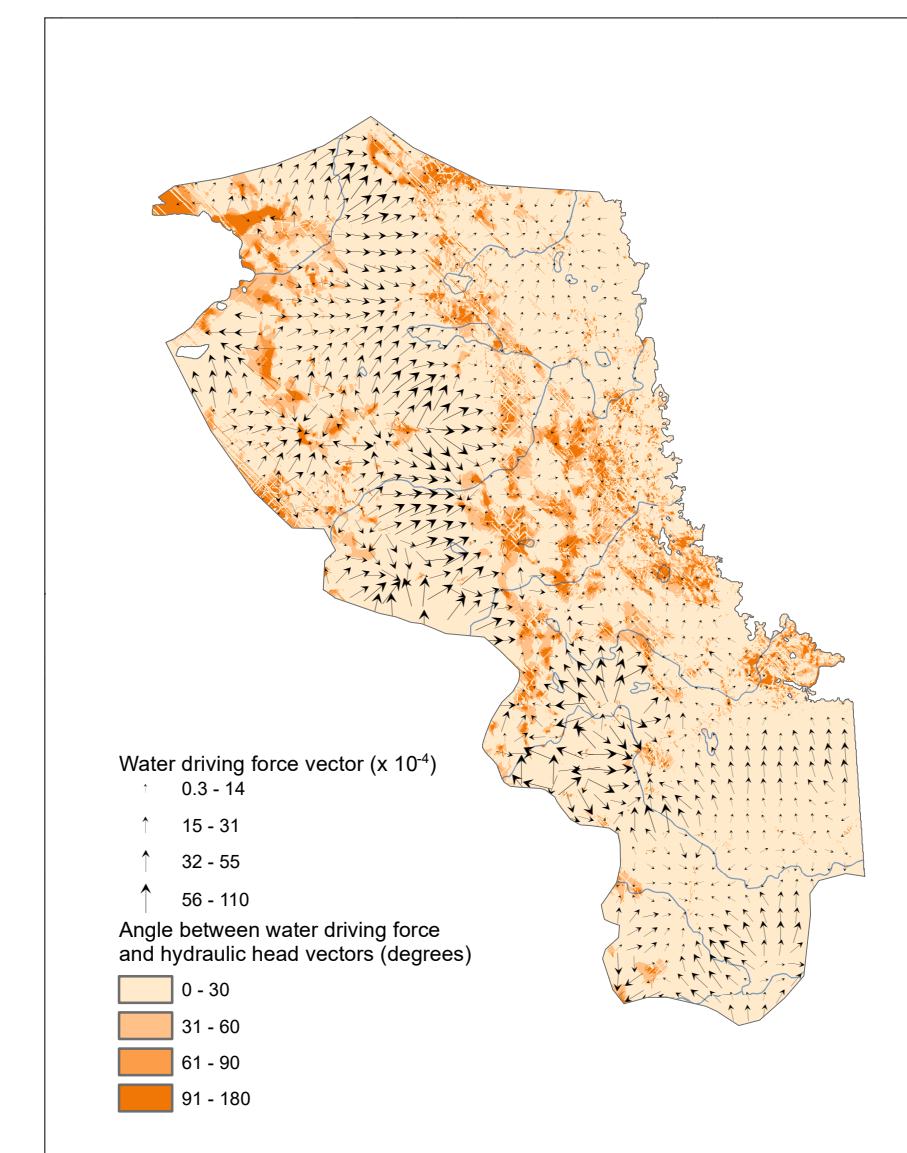
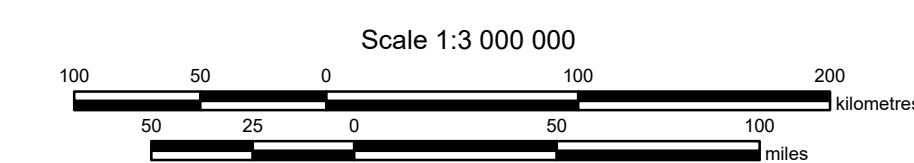


Figure 6. Water driving force vector map of the Winterburn HSU. The map covers only the area where the hydraulic head and TDS gridded surfaces overlap.

Map 635

Distribution of Hydraulic Head in the Winterburn Hydrostratigraphic Unit

Hydrogeology by: J. Brinsky



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

