

SYMBOL LEGEND

- Total dissolved solids (mg/L)
 - 7 500 - 30 000
 - 30 001 - 50 000
 - 50 001 - 100 000
 - 100 001 - 200 000
 - 200 001 - 260 000
- Well data point
- Hydrostratigraphic unit extent
- Eastern limit of main Cordilleran deformation
- Cross-section line
- Insufficient data

This map depicts the distribution of total dissolved solids (TDS) in groundwater in the Leduc 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 Leduc HSU with the units above and below as well as its geometry can be seen in Figures 1 and Figure 2.

Methodology

The TDS distribution map is a result of an empirical Bayesian kriging technique using publicly available data from 591 water chemistry analyses from oil and gas wells. A screening process modified from Jensen et al. (2013) was used to ensure that only representative formation water chemistries were used. Measured TDS values range from 7 070 mg/L to 278 163 mg/L. The final gridded map surface was clipped based on the spatial distribution of representative chemistry data. Residual values are plotted at each location (Figure 3) to indicate where underprediction or overprediction occurs compared to the measured TDS values.

Additional formation-scale hydrogeological maps for the Leduc HSU are shown in Figures 4 and 5. Figure 4 illustrates the distribution of hydraulic head in the Leduc HSU, with hydraulic heads calculated using fresh water density. Figure 5 shows the water driving force (WDF) vector map for the Leduc HSU. The WDF vector map allows identification of areas where the buoyancy effect of formation water density and the slope of the HSU 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 northwestern and central portion of the Leduc HSU, where larger angles (dark orange areas) between the WDF vector and hydraulic gradient vector are observed.

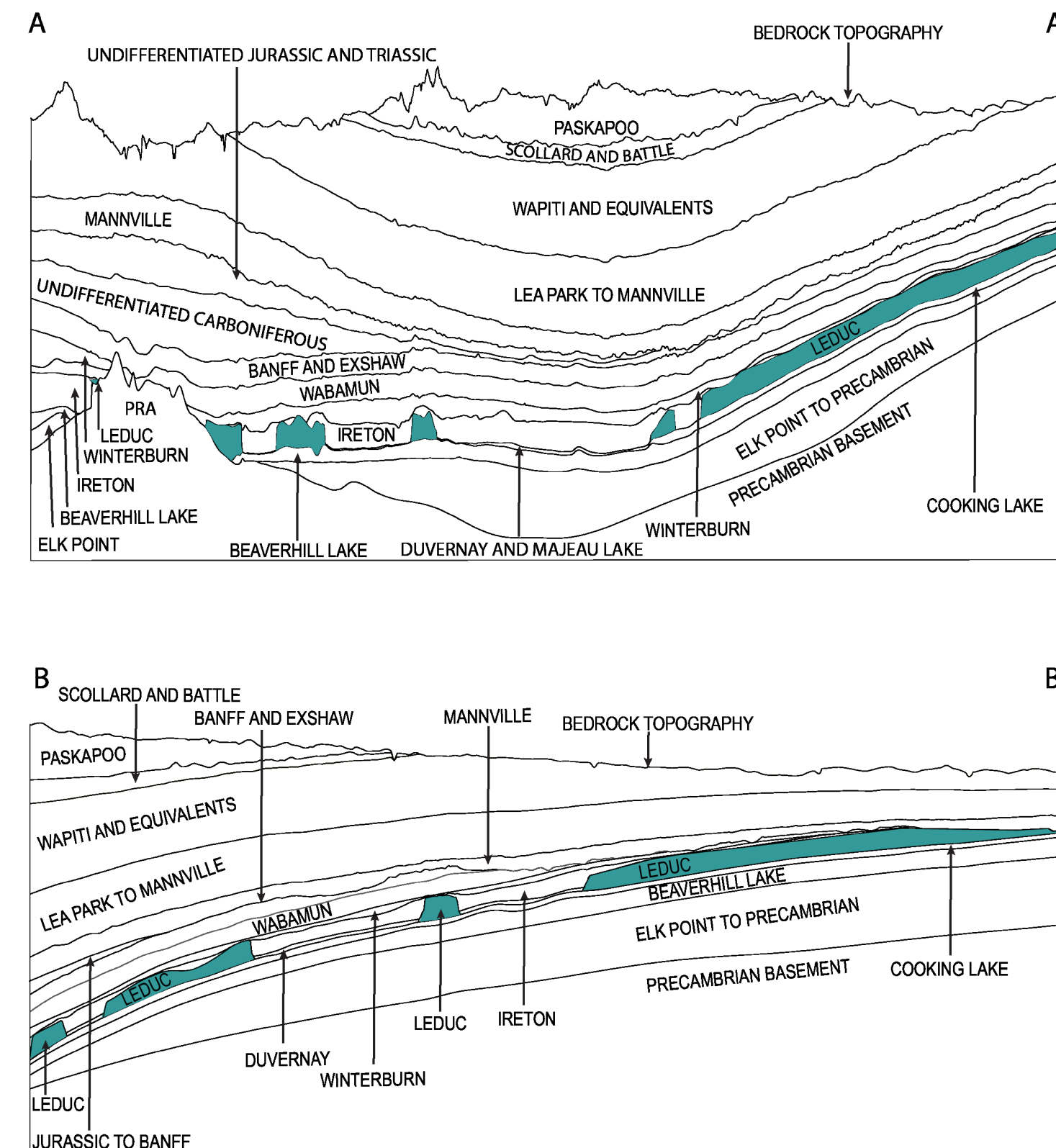


Figure 1. Schematic cross-sections (not to scale) identifying the geometry and variable thickness of the Leduc HSU. Triassic, Jurassic, and Carboniferous strata (excluding the Banff and Exshaw formations) have not been subdivided at the scale of these cross-sections. The location of the Peace River Arch (PRA) is shown on cross-section A-A'.

Acknowledgements

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References

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Recommended Reference Format

Brinsky, J. (2023): Distribution of total dissolved solids in the Leduc hydrostratigraphic unit; Alberta Energy Regulator / Alberta Geological Survey, AER/AGS Map 630, scale 1:3 000 000.

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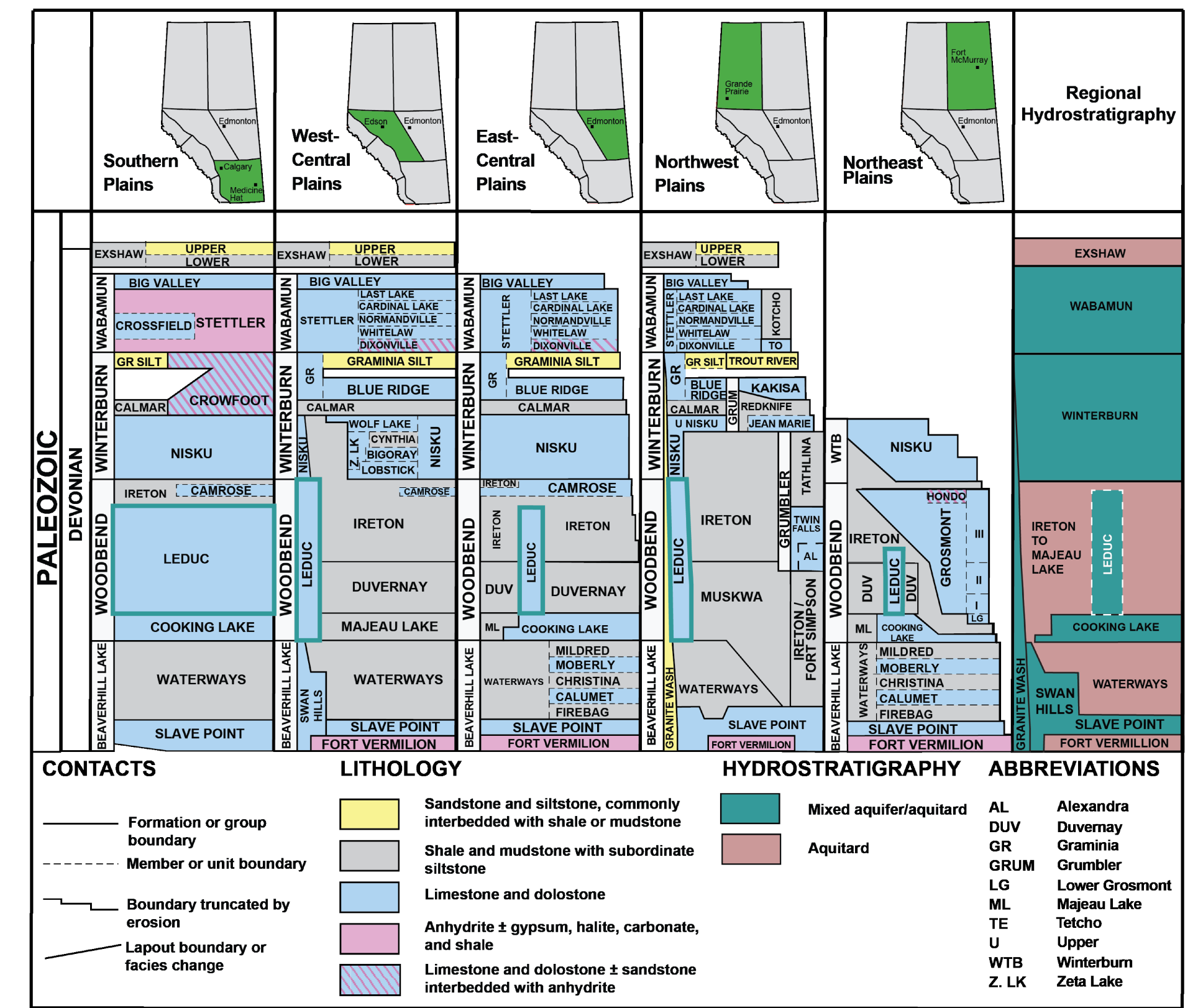


Figure 2. Regional lithostratigraphy and hydrostratigraphy (based on Alberta Geological Survey, 2019b). Solid teal lines highlight the top and base of the Leduc Formation. Dashed white lines depict the Leduc HSU within the regional hydrostratigraphy. Strata above the Exshaw Formation and below the Slave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

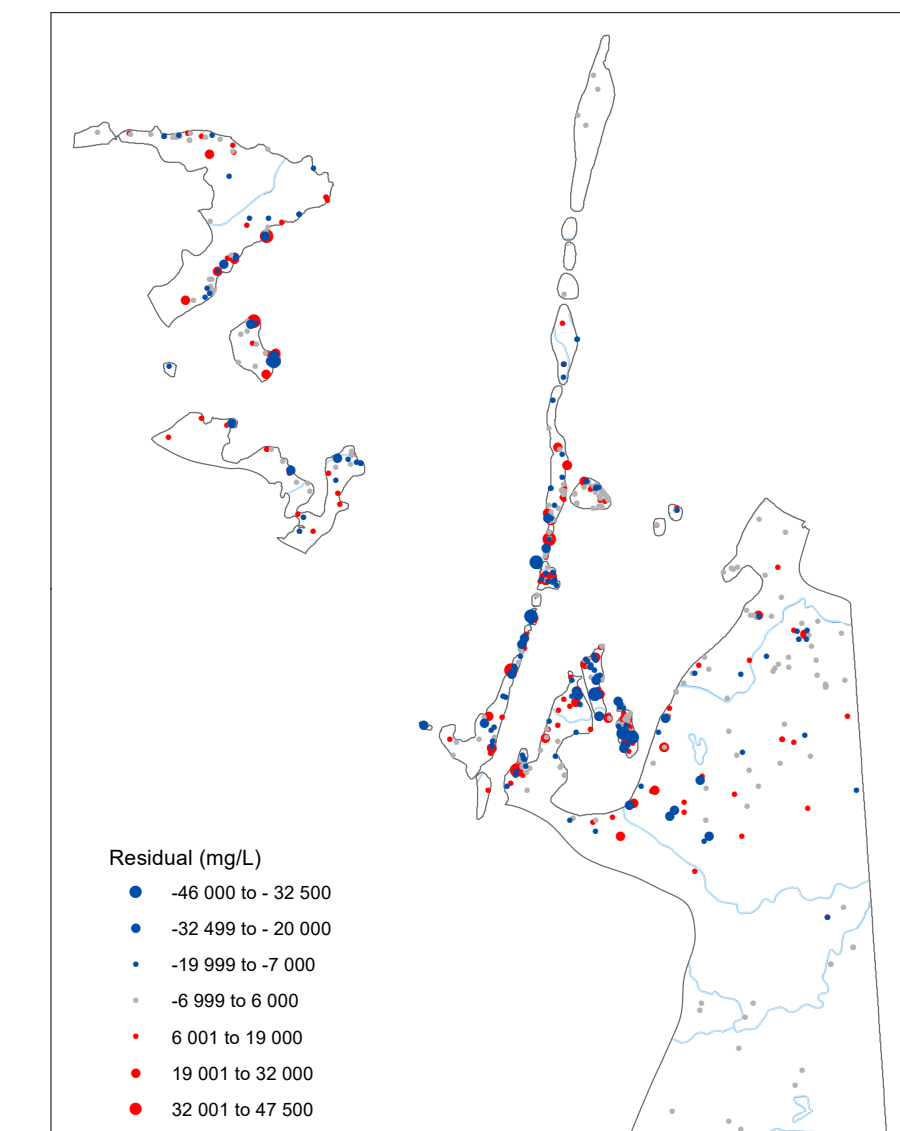


Figure 3. Calculated residuals between the modelled distribution of TDS and measured values. Symbol classes are based on the standard deviation of the calculated residuals.

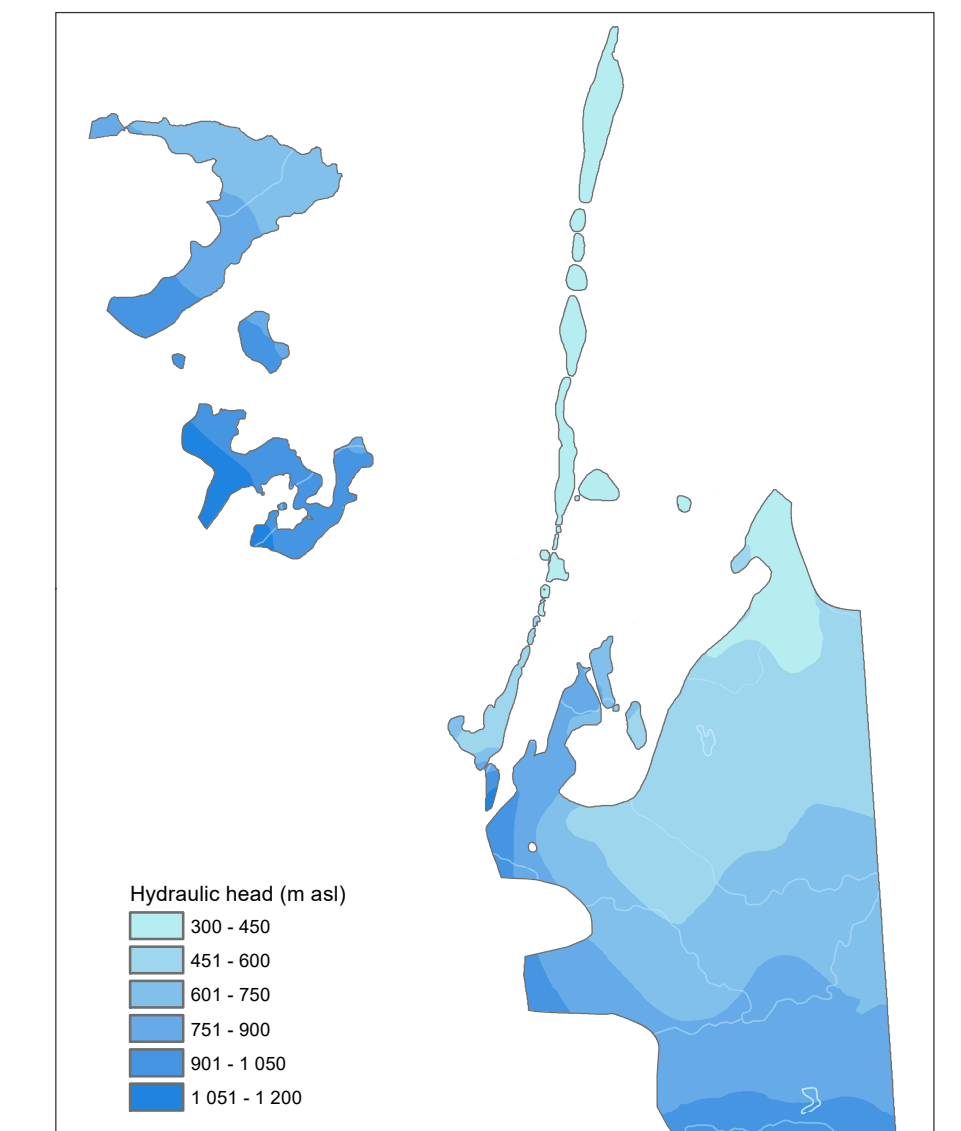


Figure 4. Distribution of hydraulic head in the Leduc HSU (Brinsky, 2023). The map extent is based on the spatial distribution of hydraulic head data and differs from the extent of the main map.

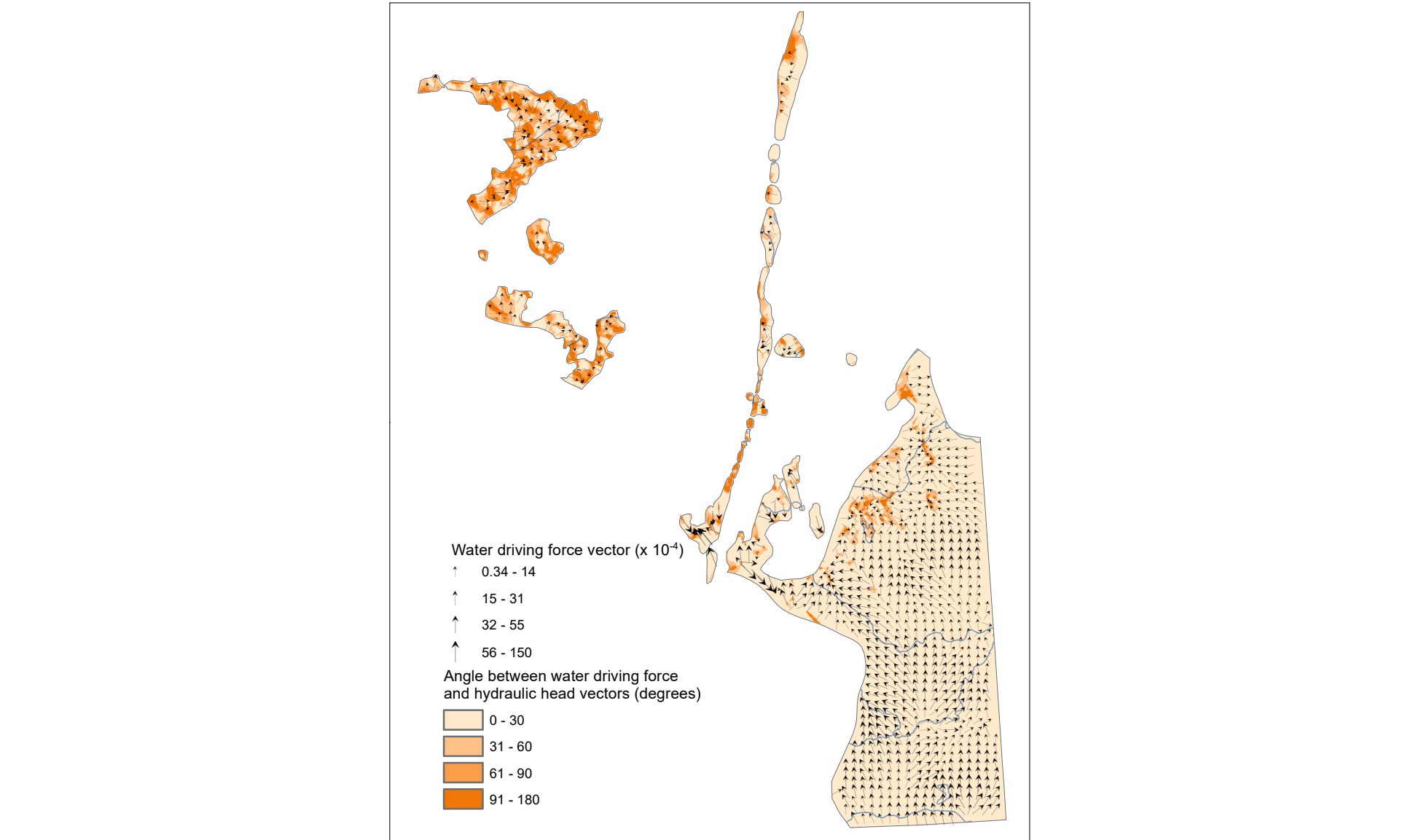


Figure 5. Water driving force vector map of the Leduc HSU. The map covers only the area where the hydraulic head and TDS gridded surfaces overlap.

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Map 630
Distribution of Total Dissolved Solids in the Leduc Hydrostratigraphic Unit
 Hydrogeology by: J. Brinsky

Scale 1:3 000 000

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

