

Lakes of Parkland County – Surface and Groundwater Characterization of Lakes in the Modeste and Sturgeon subwatersheds



<http://www.parkbridge.com/en-ca/nv-cottages/spring-lake-nv>

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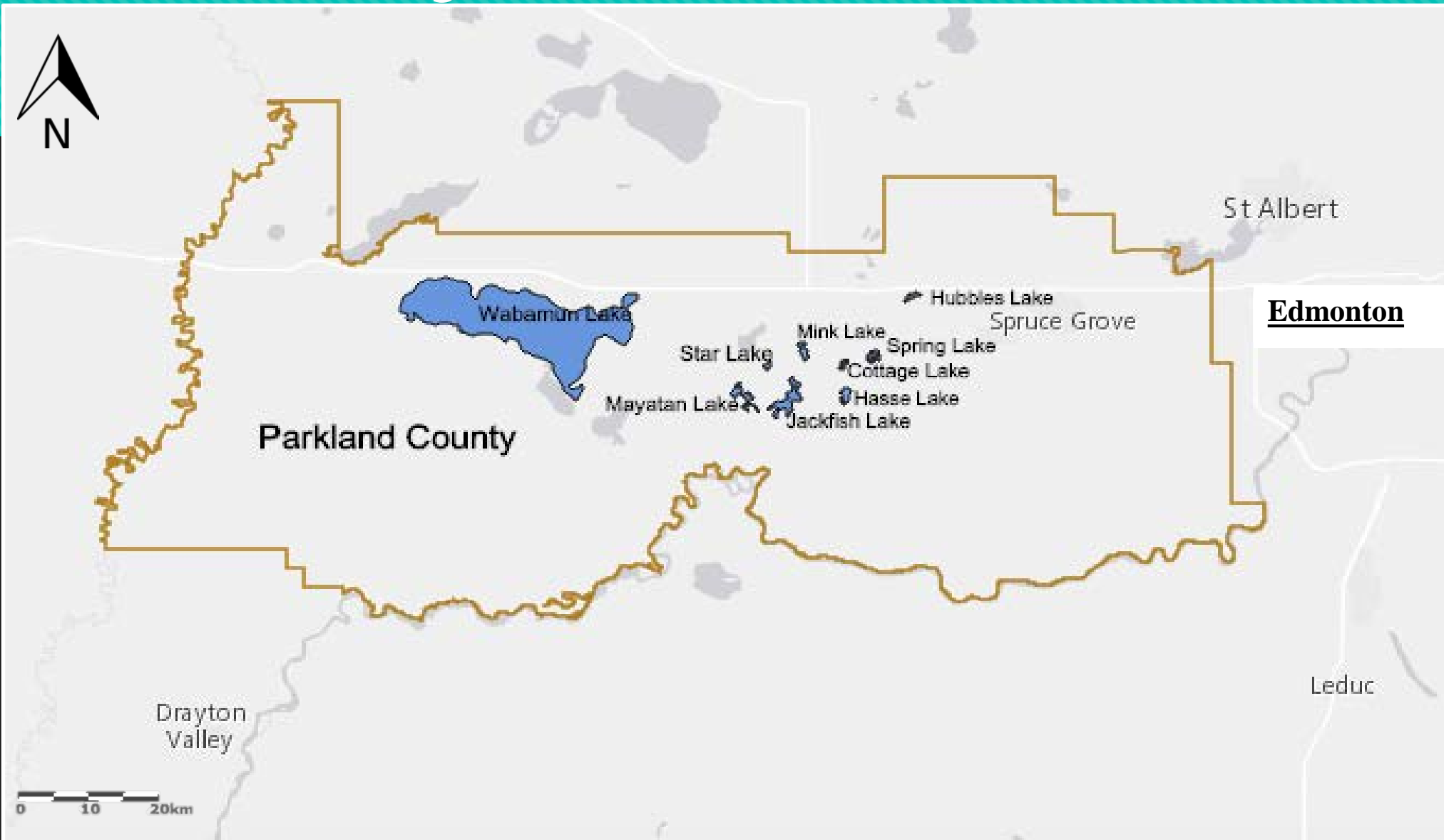
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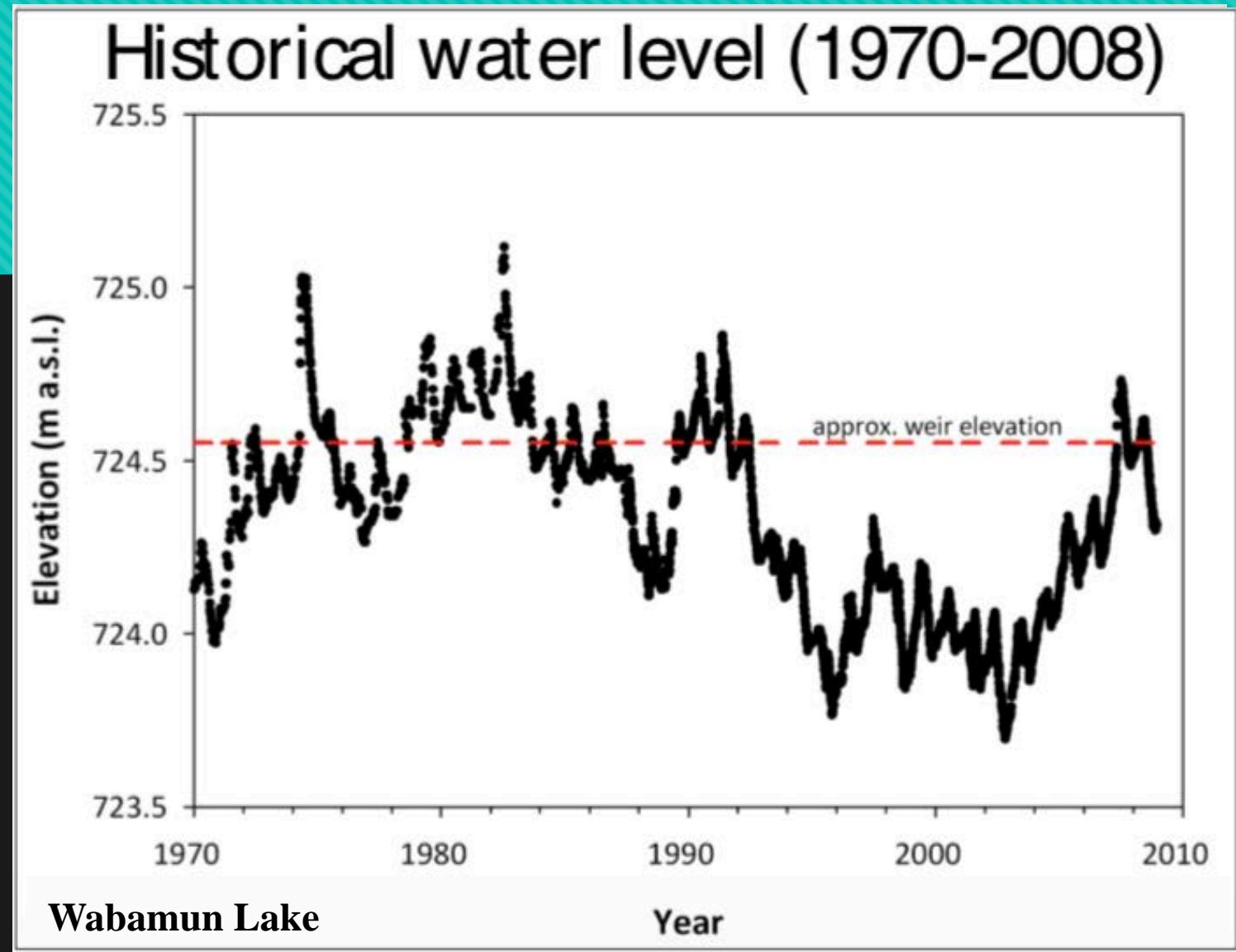
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The Study Area



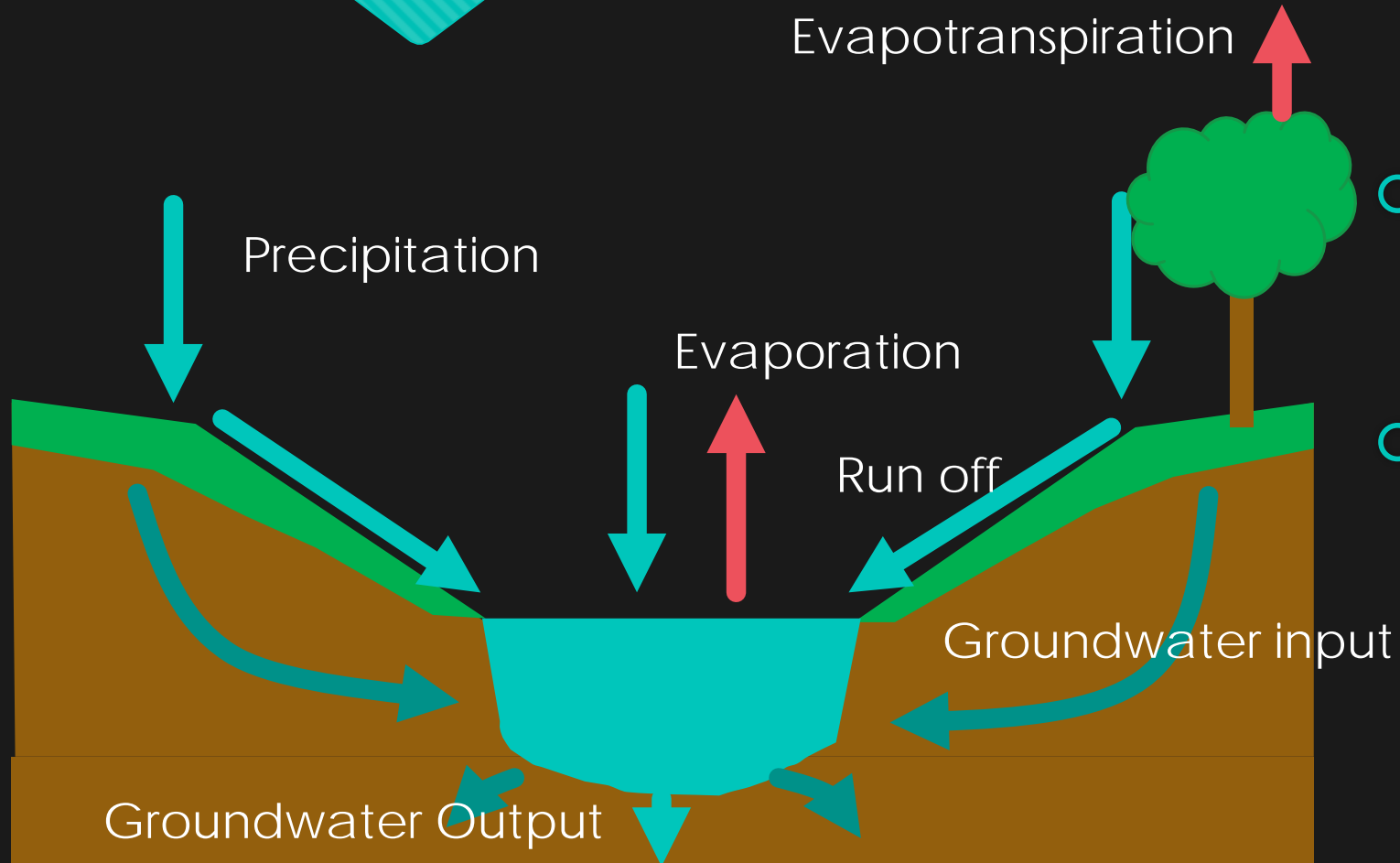
The Problem

- Parkland County showing uncharacteristic and consistent declines lake water levels



<https://exts2.aep.alberta.ca/CR-RecLakes/Maps%20and%20Posters/Forms/AllItems.aspx>

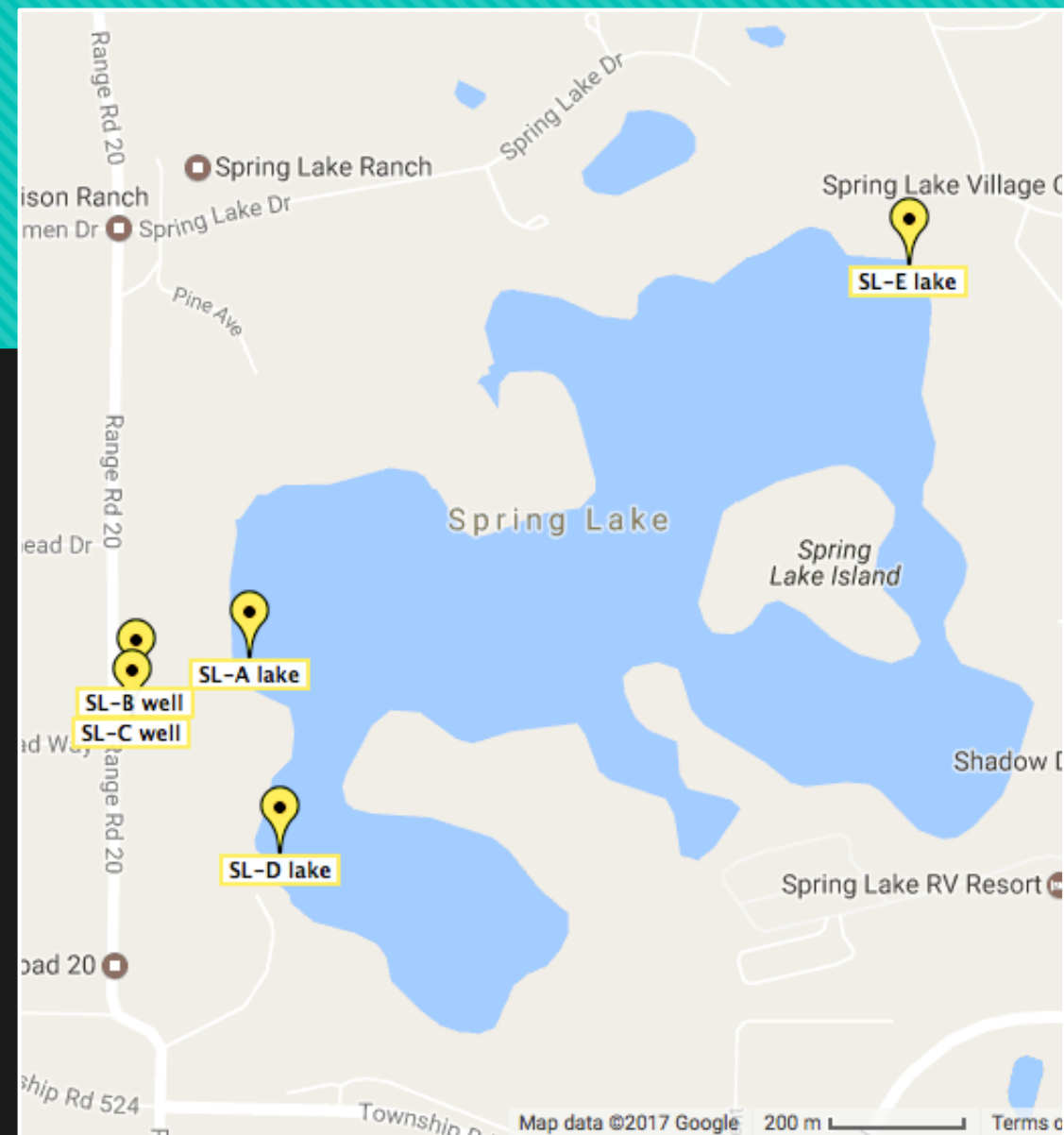
Objectives



- Quantify the hydrologic budget of the lakes of study
- Determine cause of declining lake levels

Methods

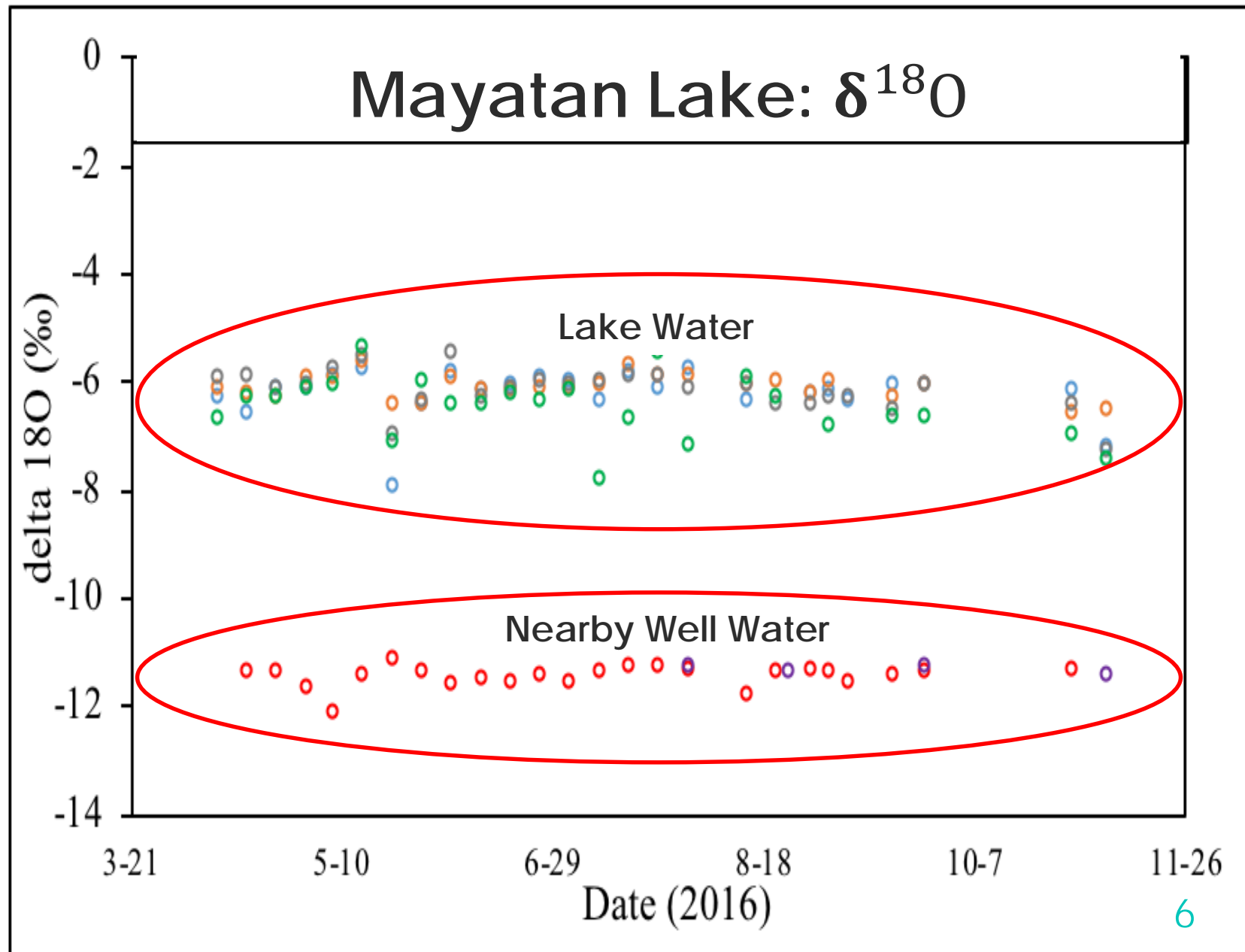
- Sampled over 2 years – Lakes and nearby wells
- Stable water isotopes
 - Time-series deuterium excess and $\delta^{18}\text{O}$ plots
 - Co-isotopes plots
- Inorganic chemistry
 - Piper Diagrams
 - Activity - activity plots
- Isotope Mass Balance Modelling



Example of sampling locations: Spring Lake

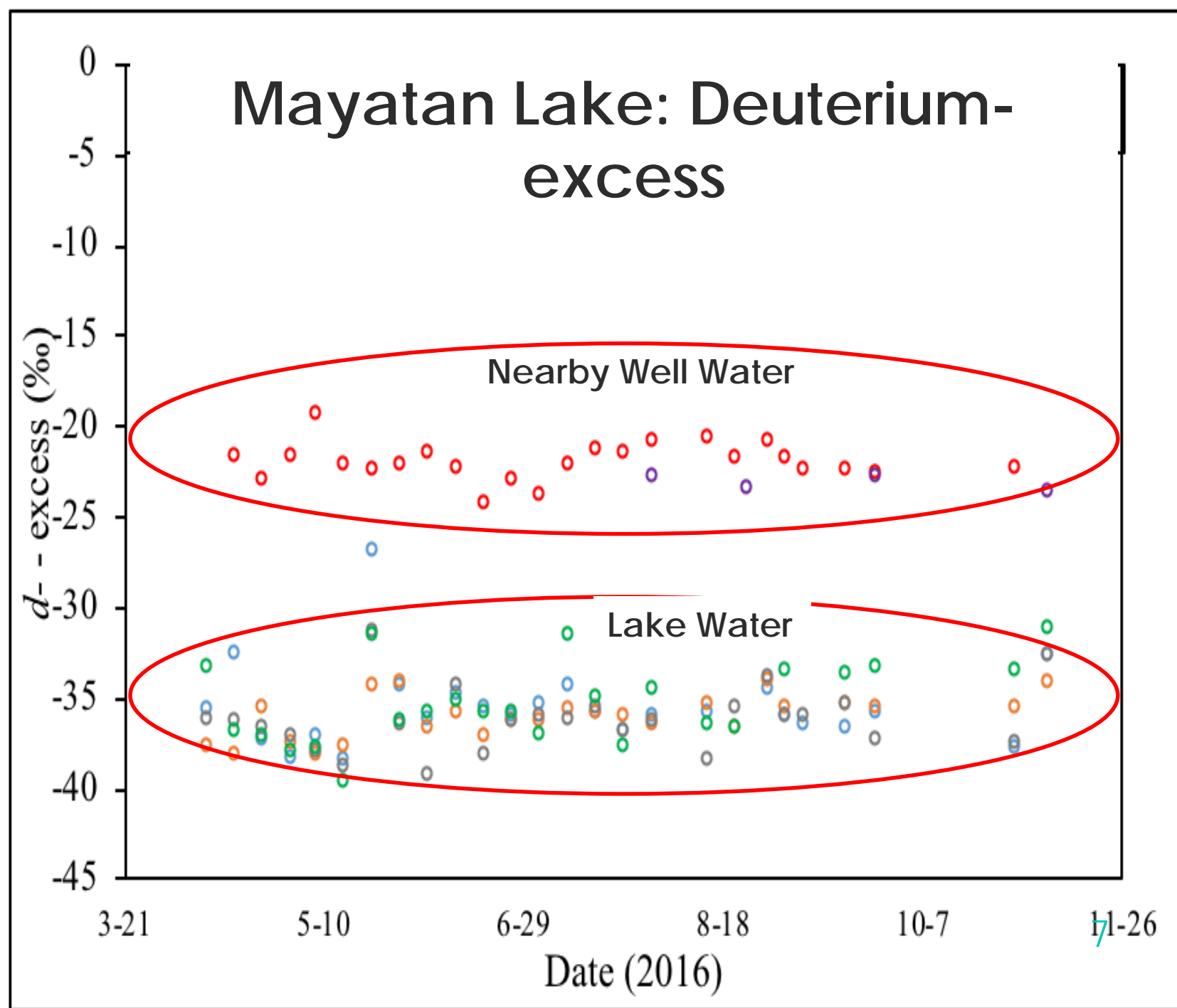
Results – Isotope Plots

- Low inter-annual variability indicates small groundwater input and extensive mixing within the lakes



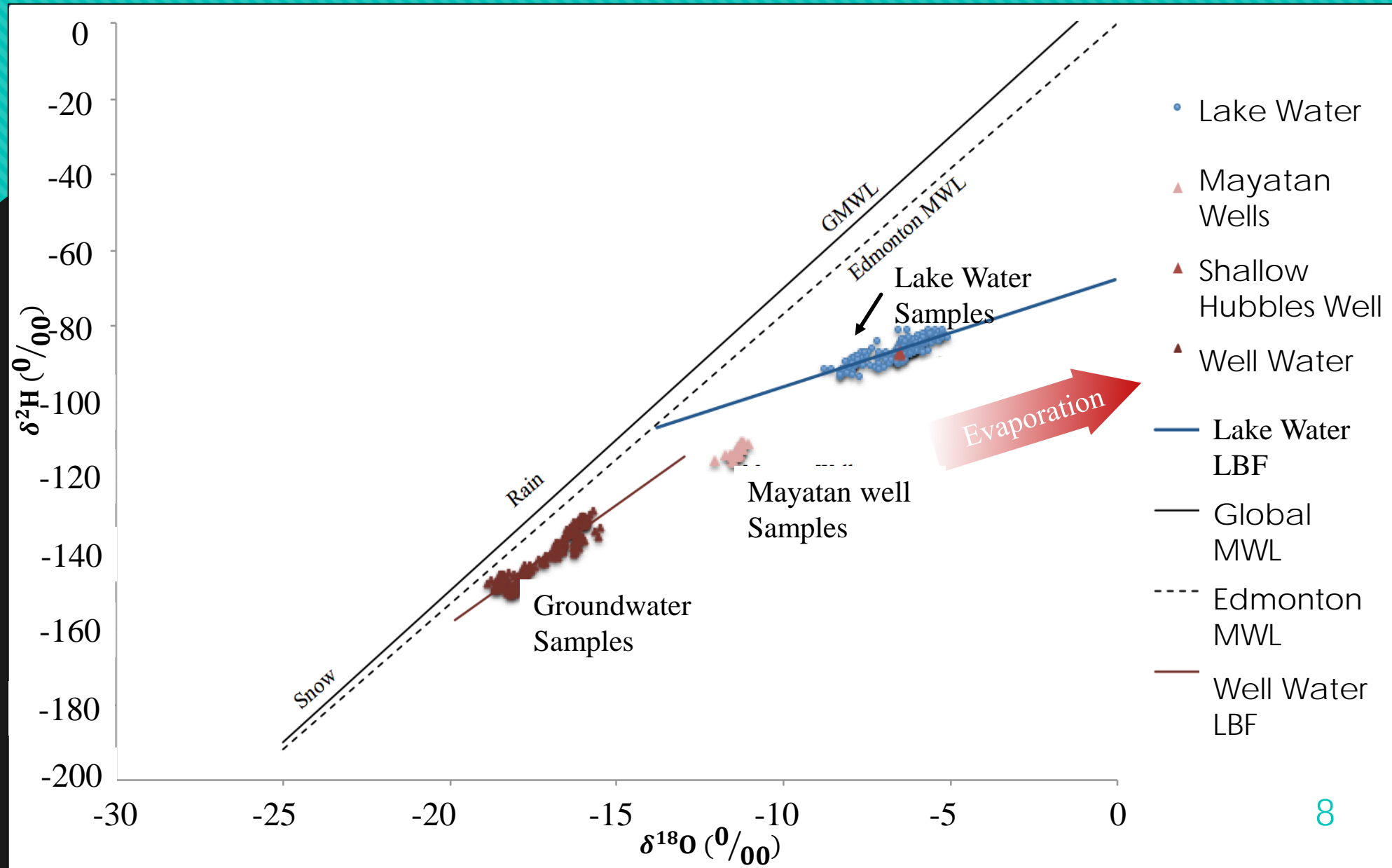
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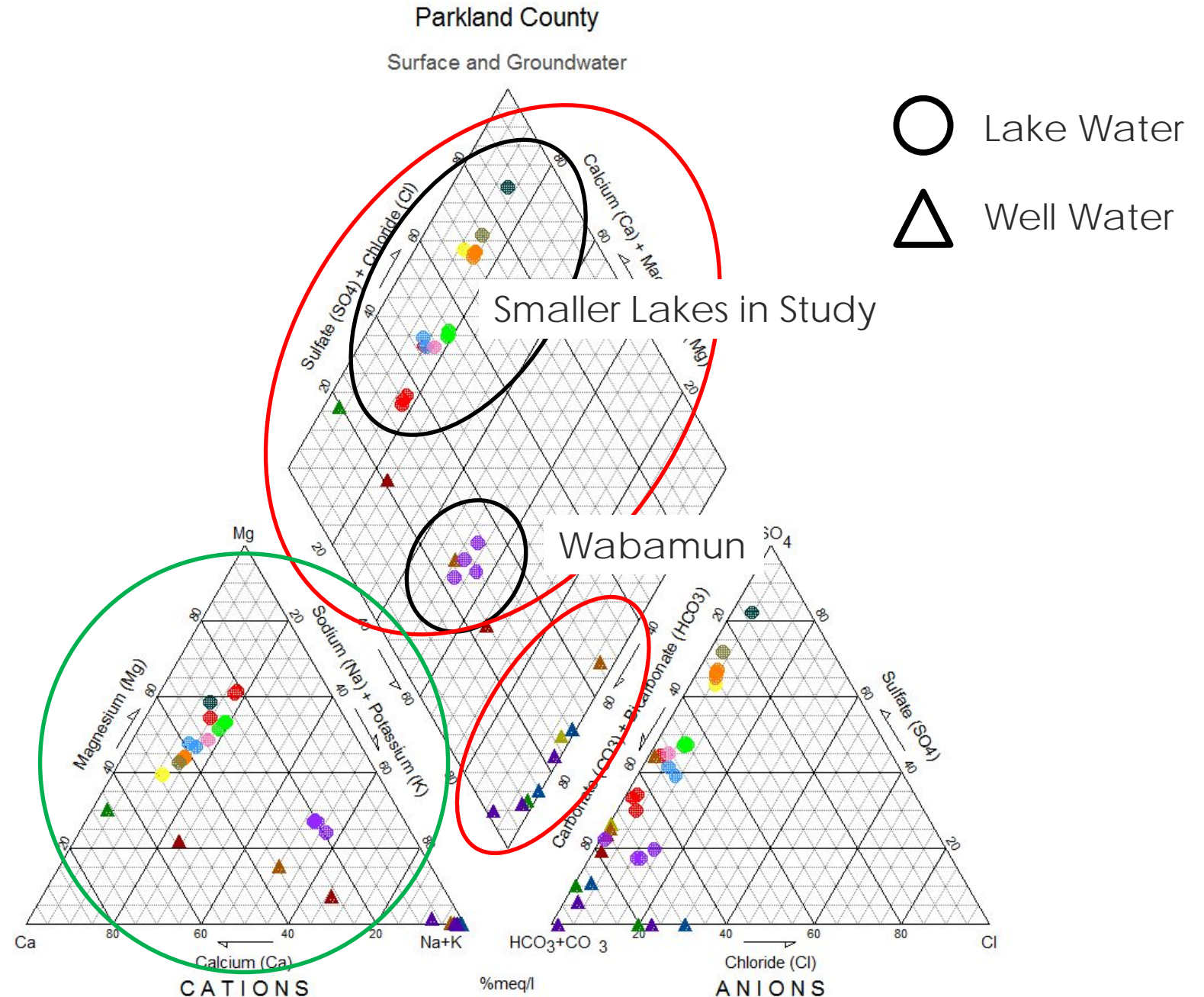
Results – Co-isotope Plot

- Strongly evaporatively enriched lake water indicating precipitation-evaporation relationships dominate

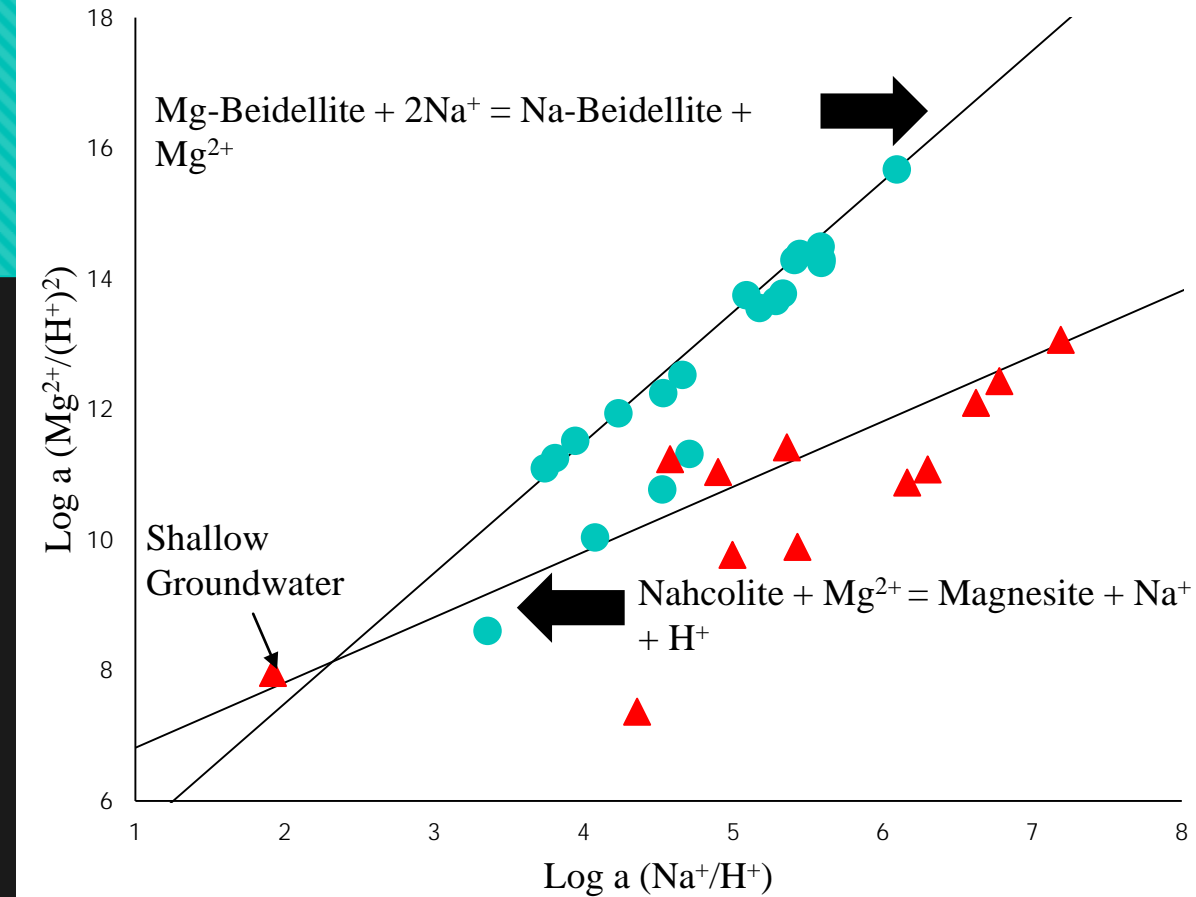
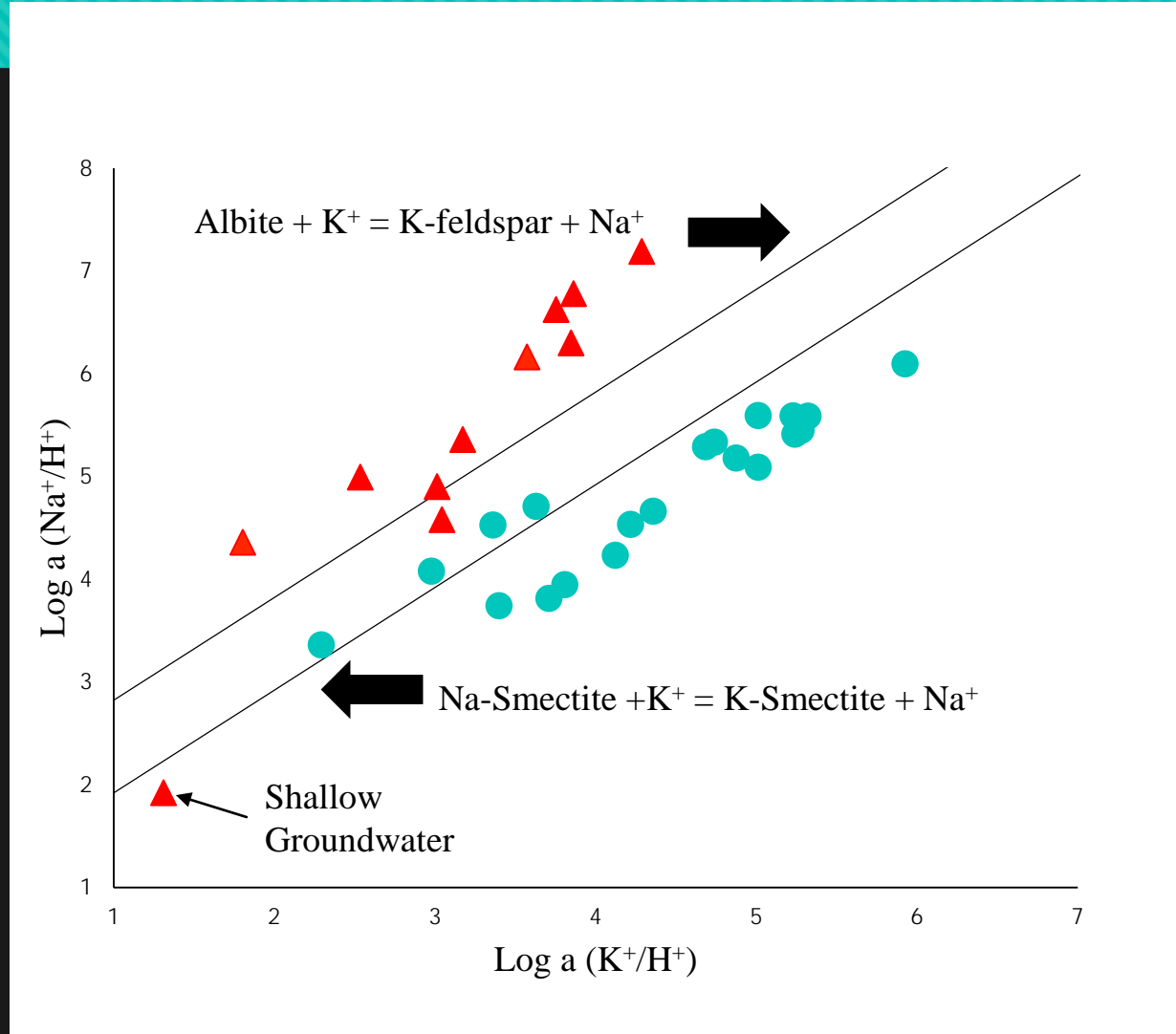


Results – Piper Diagrams

- Separation between lake and groundwater
- Separation between Wabamun and other lakes
- Overall trend reflected in cations and not anions



Results – Activity Plots



○ Groundwater input into the lakes is limited to only very shallow groundwater

Results – Isotope Mass Balance Modelling

- Short Residence times suggest groundwater input to lakes is small

Small, Shallow Lakes

Small Deep Lake

Large Shallow Lake

Lake	Residence Time (yrs)
Spring Lake	2.3
Jackfish Lake	3.6
Hasse Lake	4.1
Mayatan Lake	6.9
Hubbles Lake	11.4
Wabamun Lake	39.4

Conclusions

- Water levels of the lakes are mostly regulated by Precipitation (and Runoff) and Evaporation
- Groundwater input into the lakes is small and limited to only shallow groundwater
- Water is well mixed and spends multiple years in the Lake
- Recent declines in water levels possibly due to larger climatic events, and not anthropogenic influences from those living near the lakes

References and Acknowledgements

Acknowledgements

We acknowledge the contributions of the residents and volunteers of the Parkland County, North Saskatchewan Watershed Alliance (NSWA), and numerous colleagues without which this project would not have been a success. We would also like to thank Chi-Fan Shih at NAAR for evaporation data between 53° to 54°N and -114° to -115°W and NSERC for funding this project in the form of an undergraduate student research award (USRA) and Discovery Grants issued to Dr. Alessi and Dr. Froese.

References

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