Masters of Science (Hydrogeology)

Current and a pre-clearing reconstruction of the water and salt balance of a wetland system using Chloride, Bromide, and stable isotopes.

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Acknowledgements:
DEC Sciences scholarship in memory of Dr George Malajczuk
Dr Ryan Vogwill (DEC and UWA)
Dr Matt Forbes (DEC)
Staff from DEC Midwest region, Geraldton WA
Landholders and volunteers from the BMNDRC

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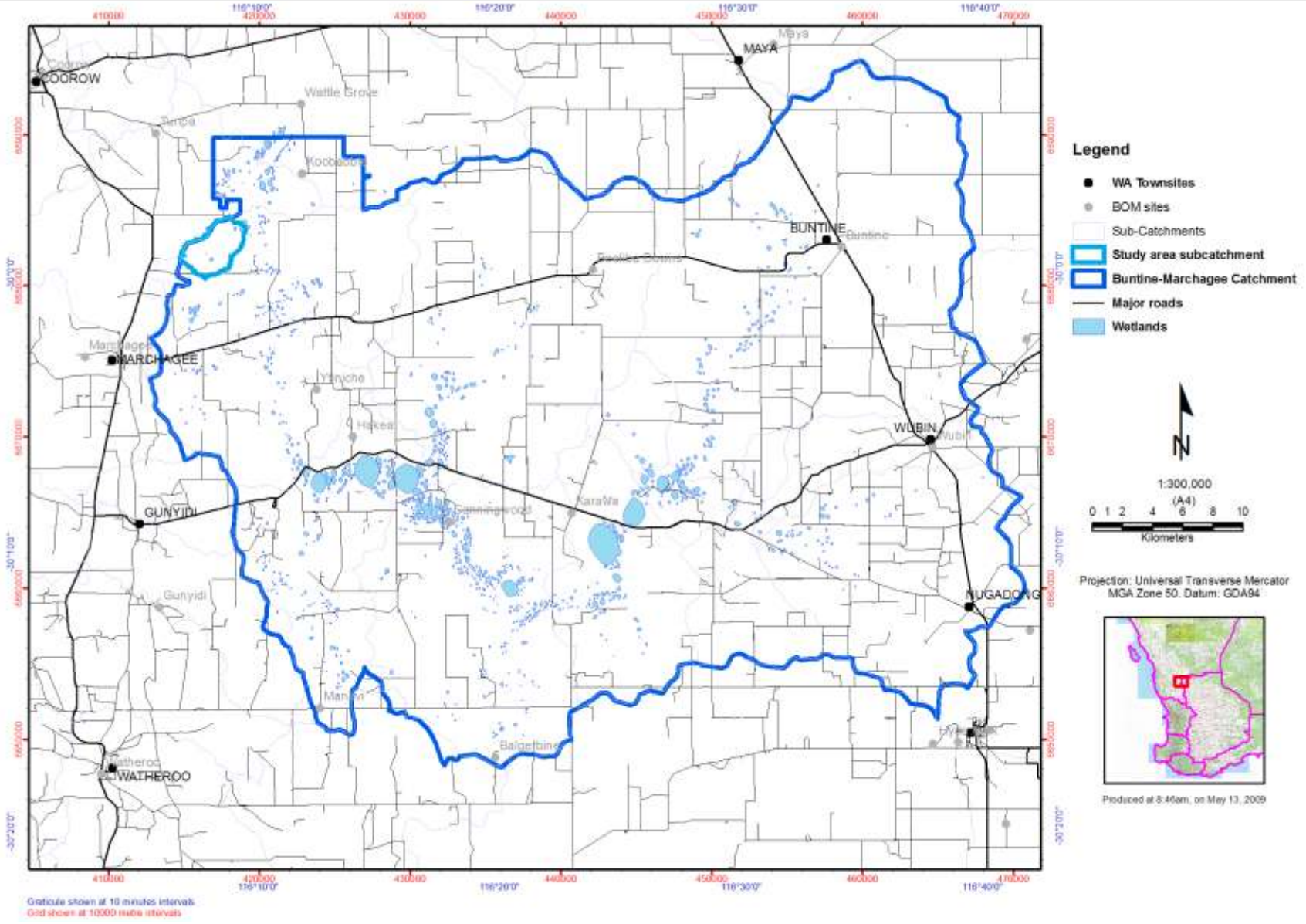
Buntine Marchagee Catchment

The University of Western Australia

Buntine-Marchagee Natural Diversity Recovery Catchment



Why undertake this study?

- High biodiversity values threatened by altered hydrology
- River red gum community at its southern most distribution
- Other known communities decimated by altered hydrology (water logging, salinity, altered hydroperiod)

Impacts of altered hydrology

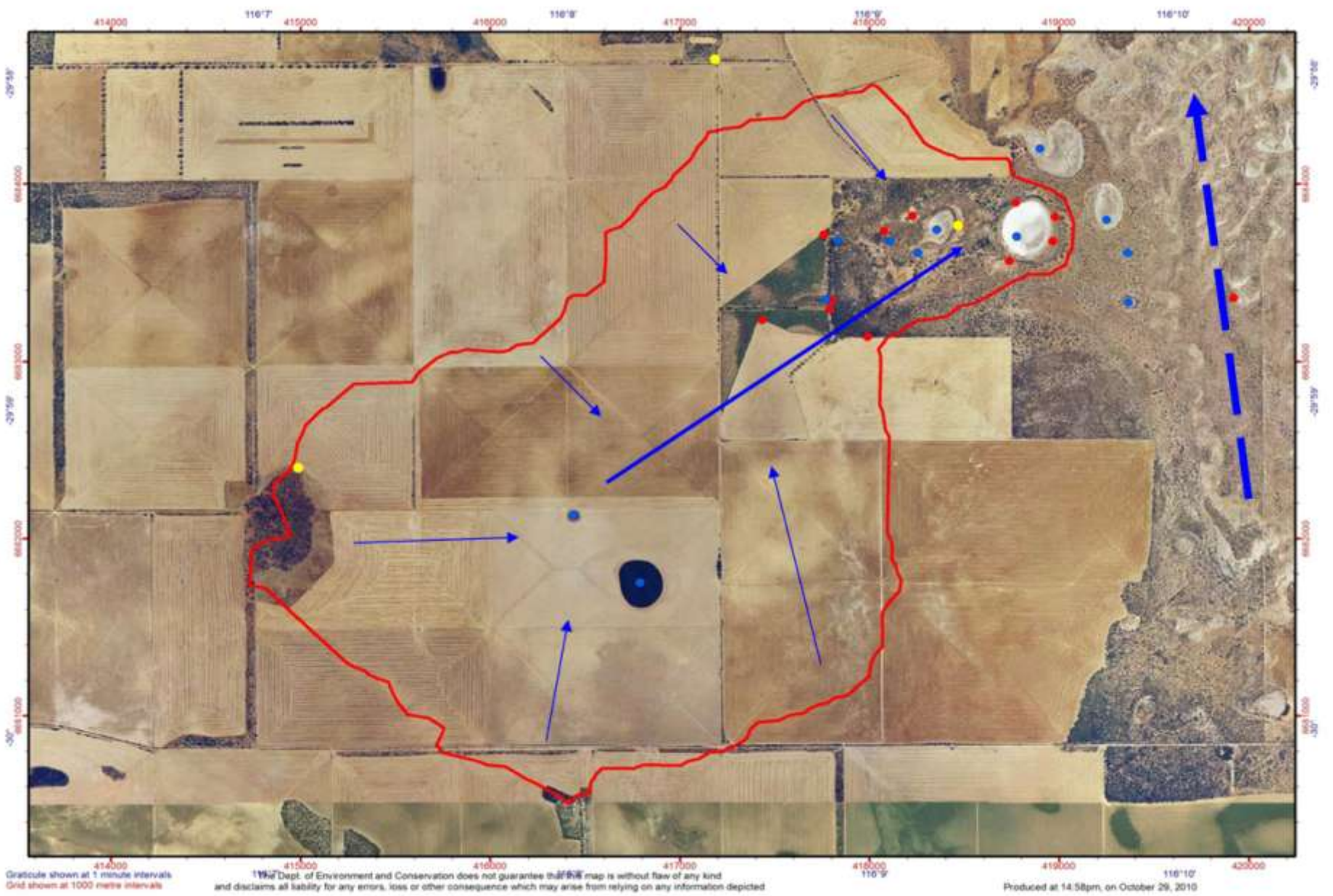
- Significant change has already occurred
- Degradation continues
- Biological decline exacerbated by extended drought

Aims

- Understanding of the hydrological function of subcatchment and its wetlands
- Apply a multidisciplinary approach
  - Hydrogeology
  - Hydrochemistry
  - Aqueous stable isotopes ($\delta^{2}H$ and $\delta^{18}O$)
- Science applied to future management decisions




The study area



Study area wetlands

Fresh → Brackish

Brackish → Hypersaline

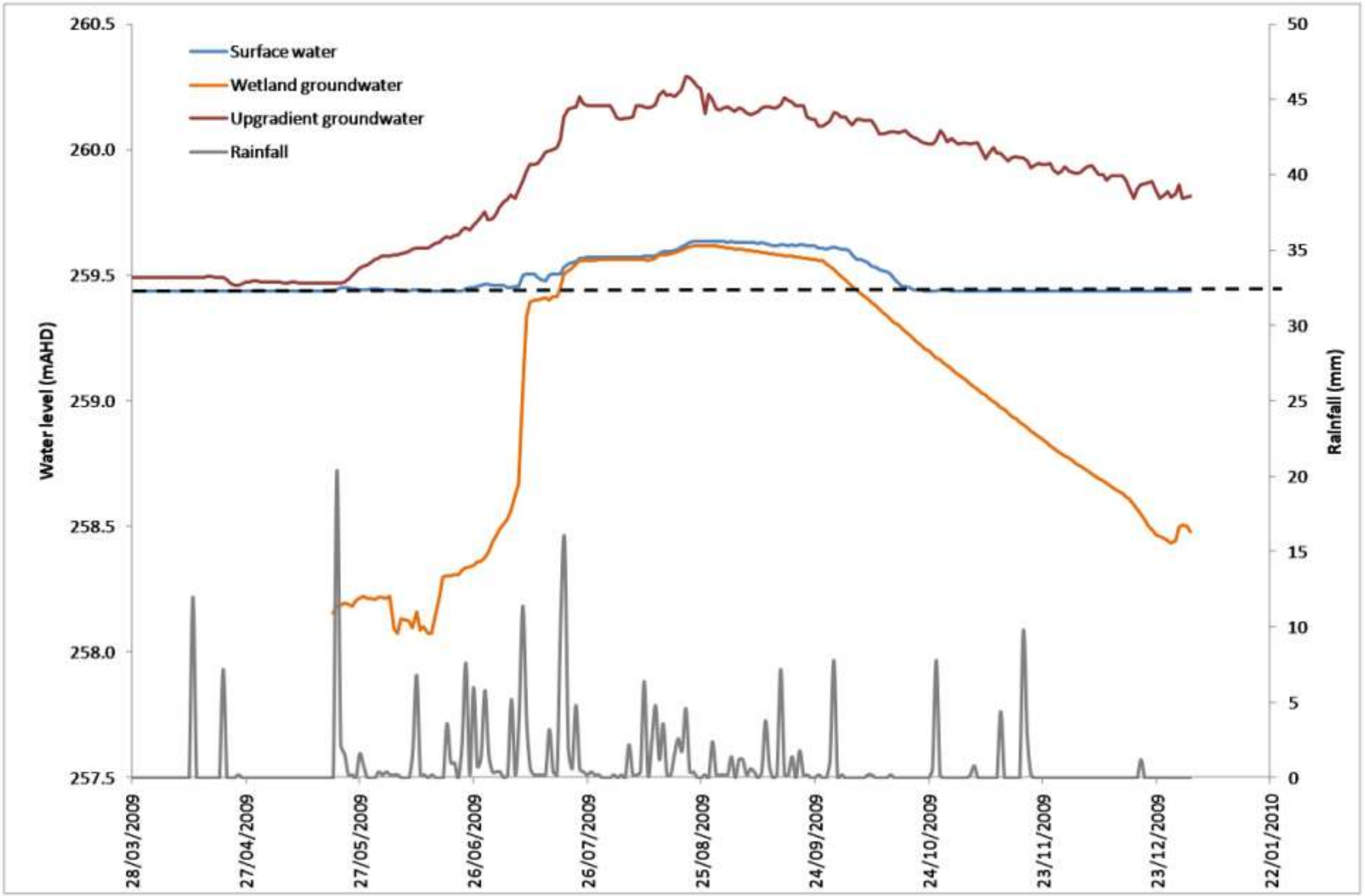
Monitoring sites

Sampling program

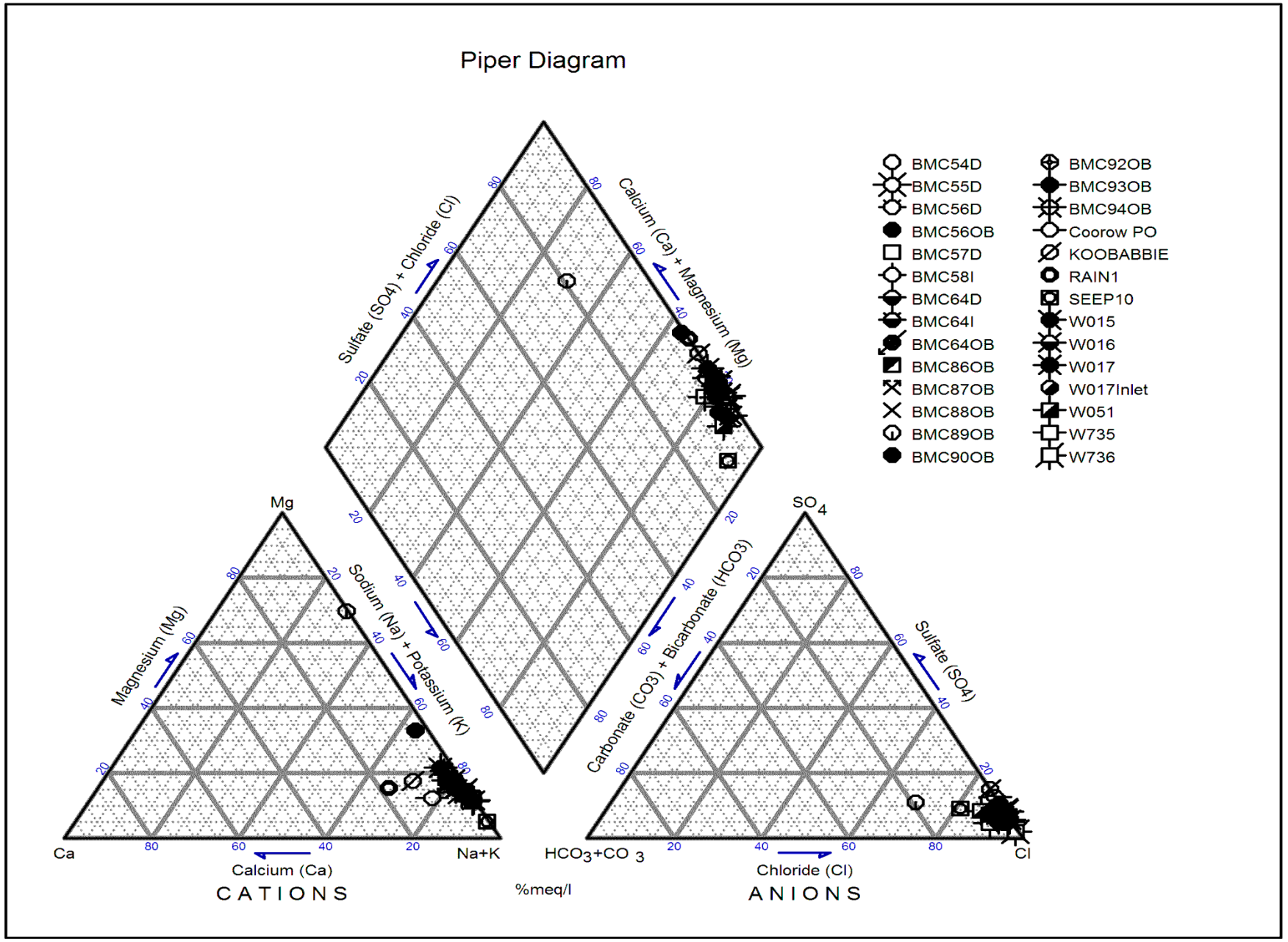
a) Monthly groundwater and surface water sampling, April to November 2009
   a) Stable isotopes $\delta^{2}H$ and $\delta^{18}O$
   b) Major ions including Br^{-}
b) Rainfall
   a) Event-based rainfall sampling for stable isotopes ^{2}H and ^{18}O (2 x sites)
   b) Composite samples for analysis of major ions and Br^{-} (3 x sites)
c) High resolution surface water and groundwater levels recorded with data loggers (2006 to 2010)

Results and discussion

Groundwater-surface water interactions

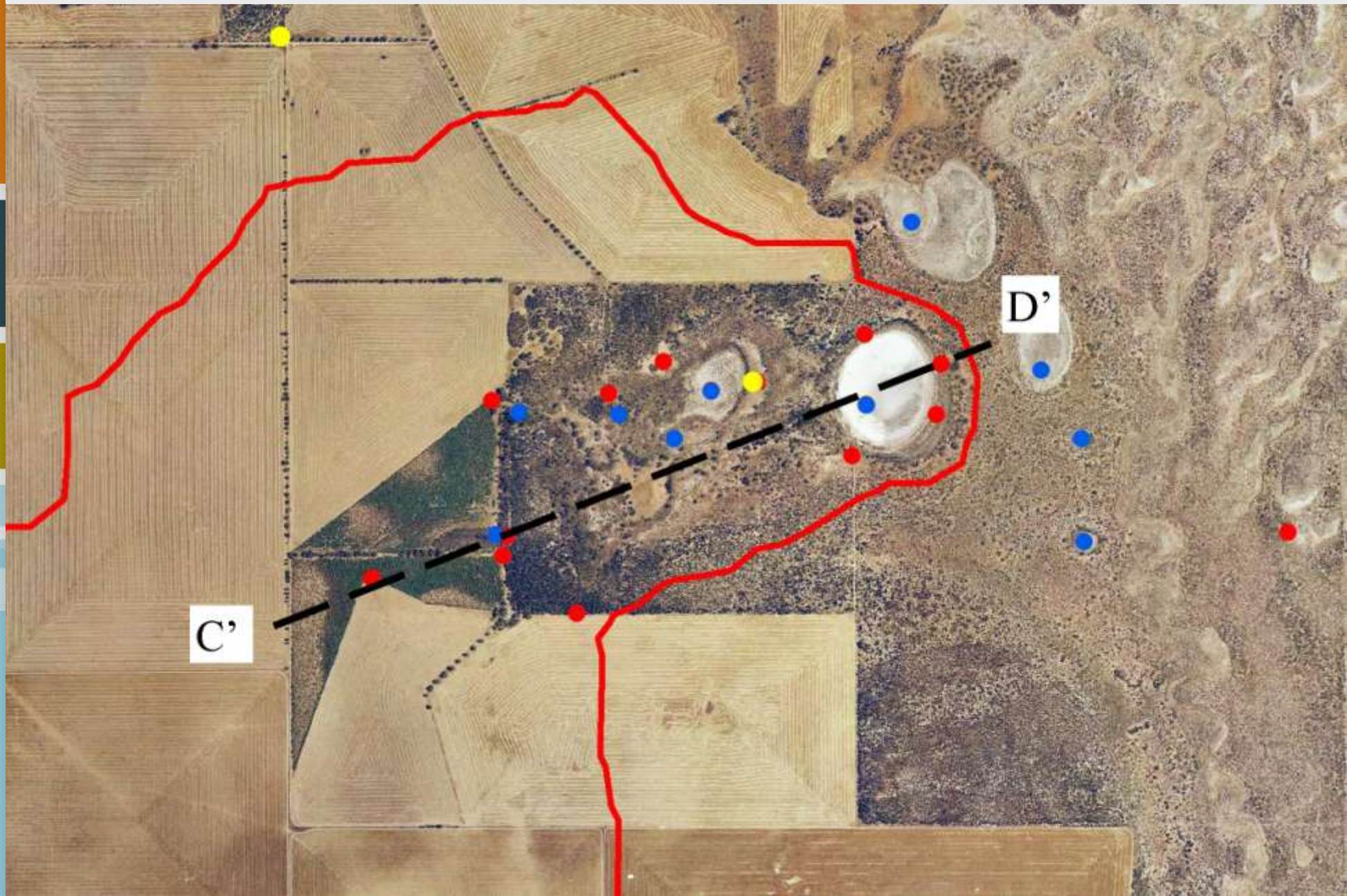


Hydrochemistry

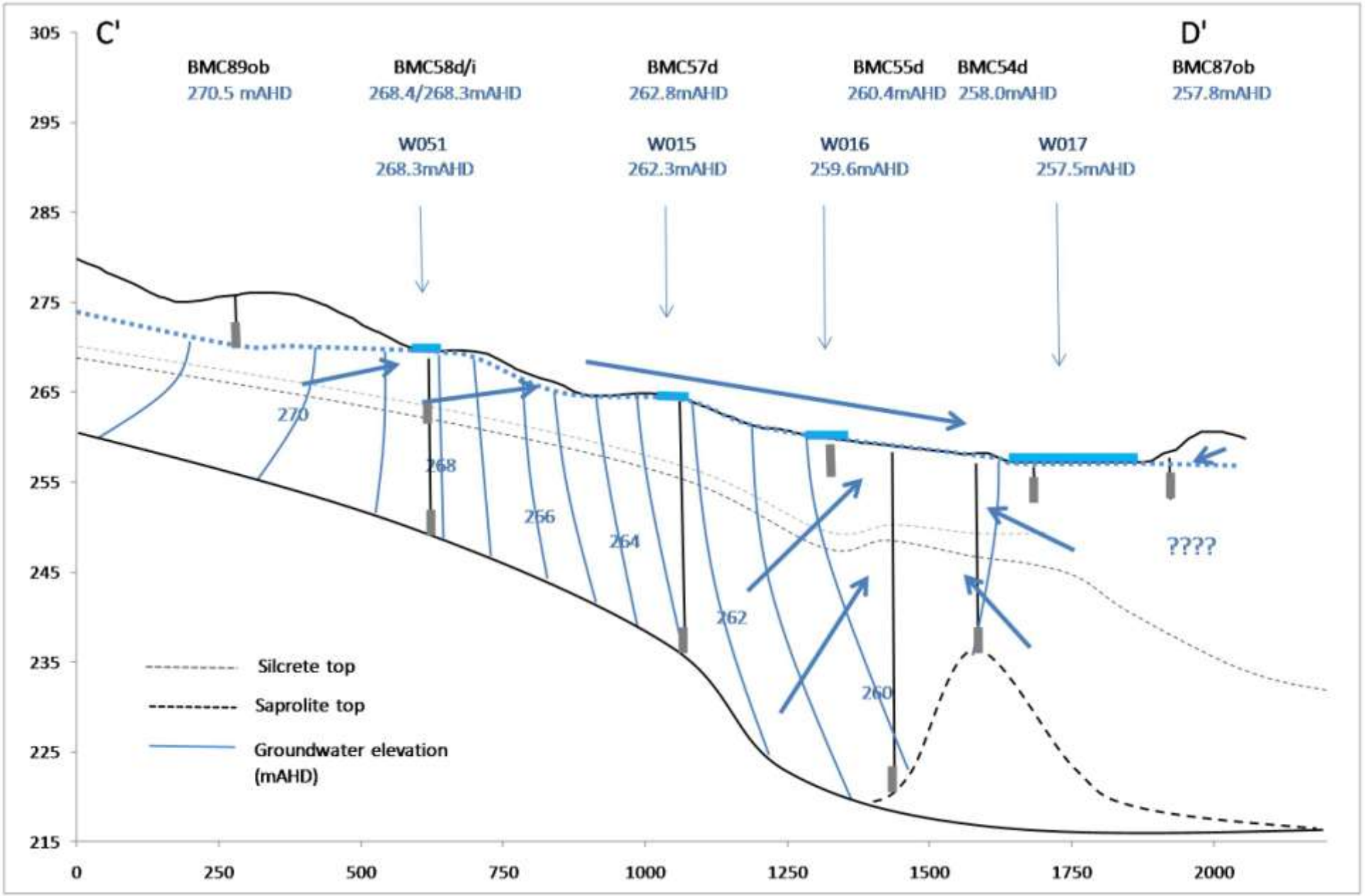


Water table (mbgl)- May 09

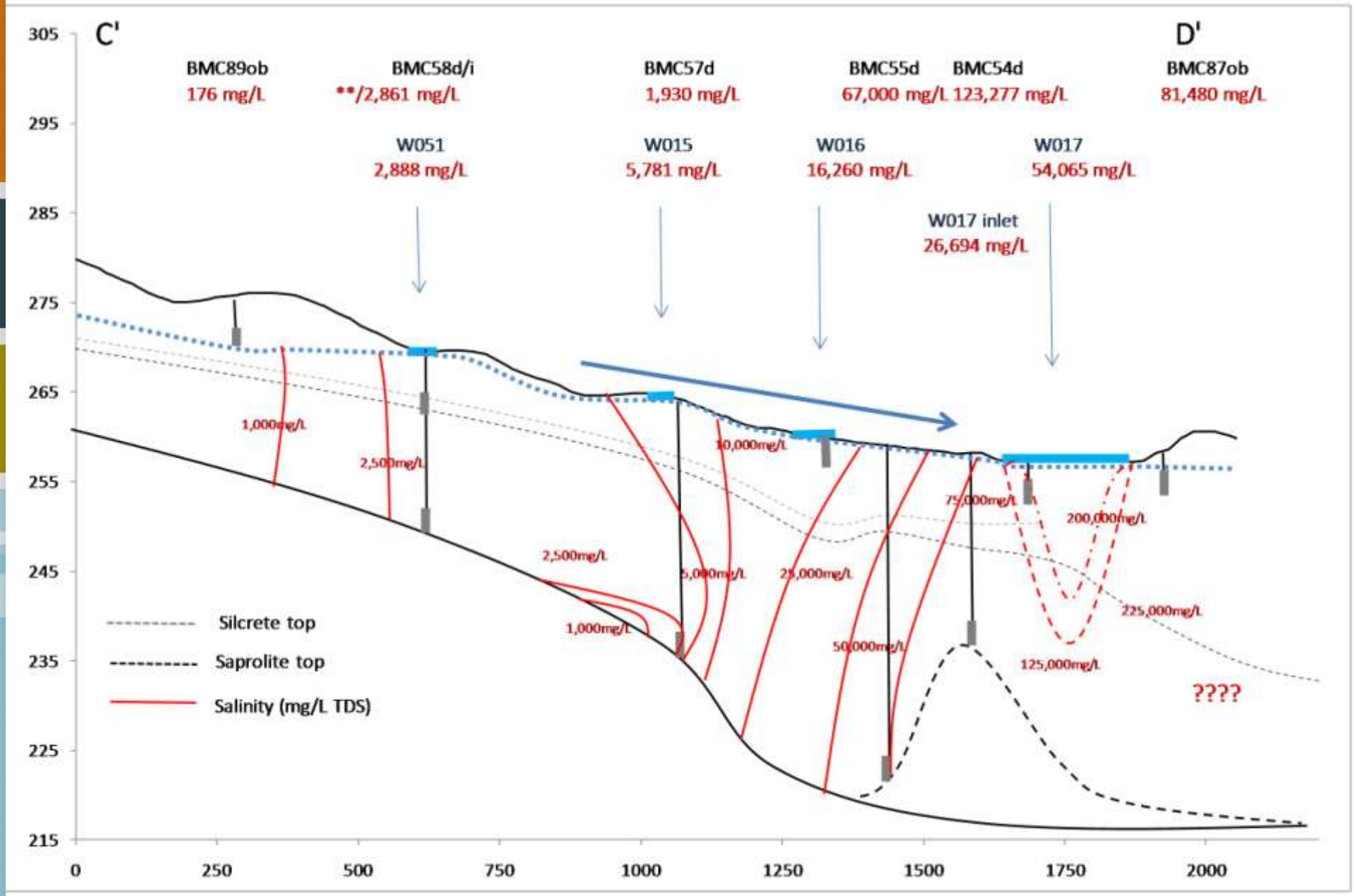
Cross-section C’ to D’



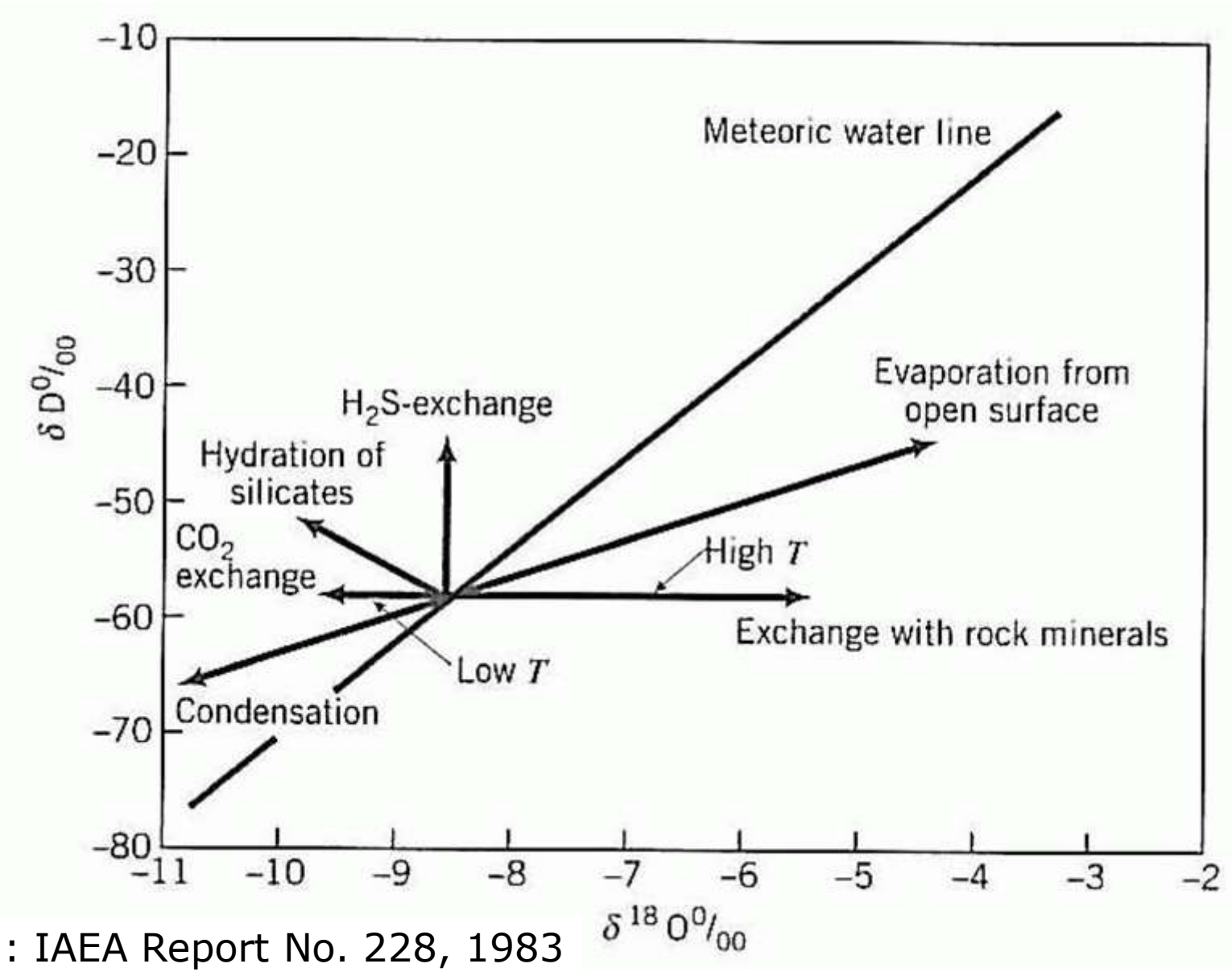
Water table (mAHD) – August 09



TDS (mg/L)- August 09

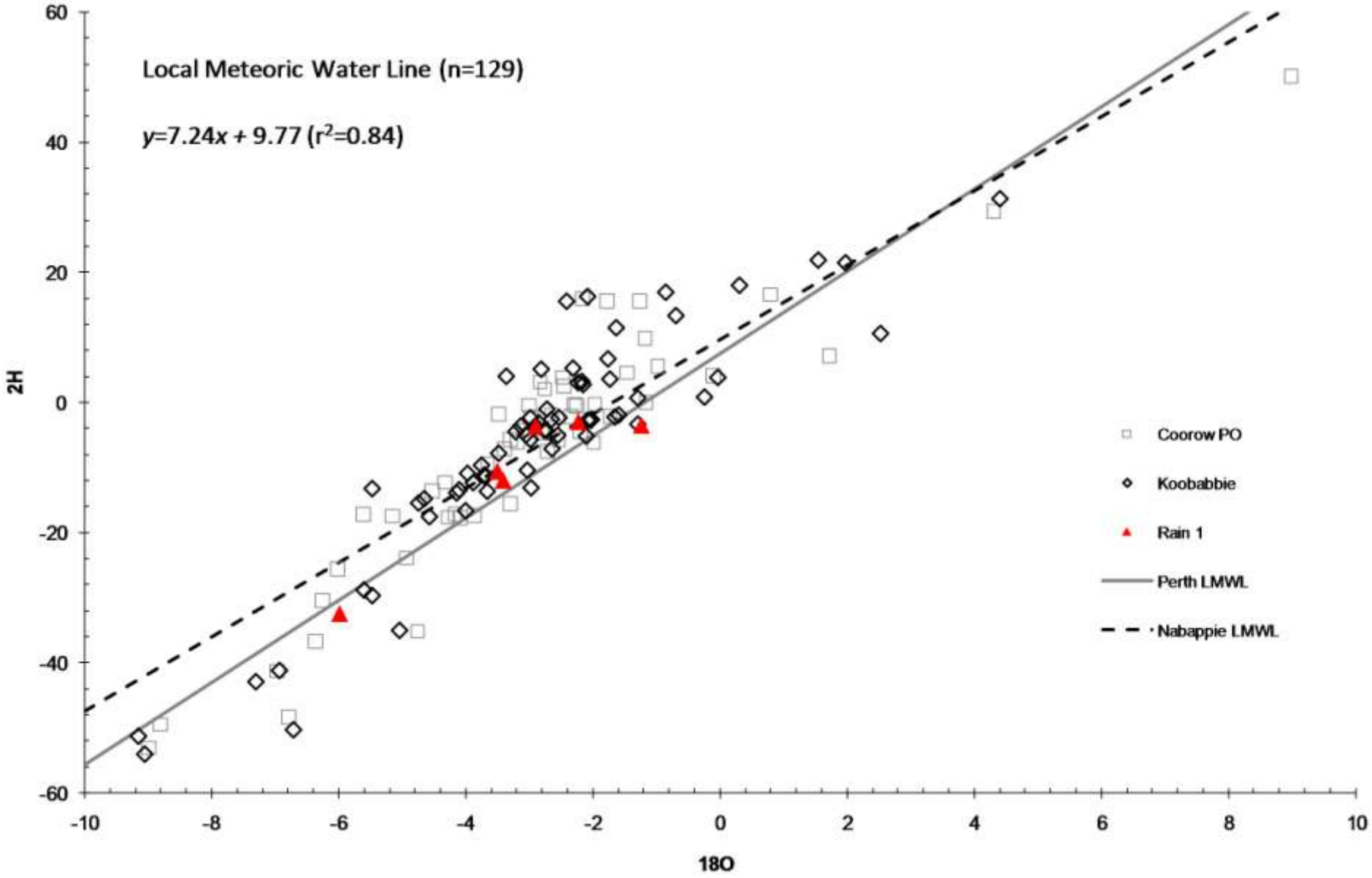


Stable isotopes – δ^2H and $\delta^{18}O$

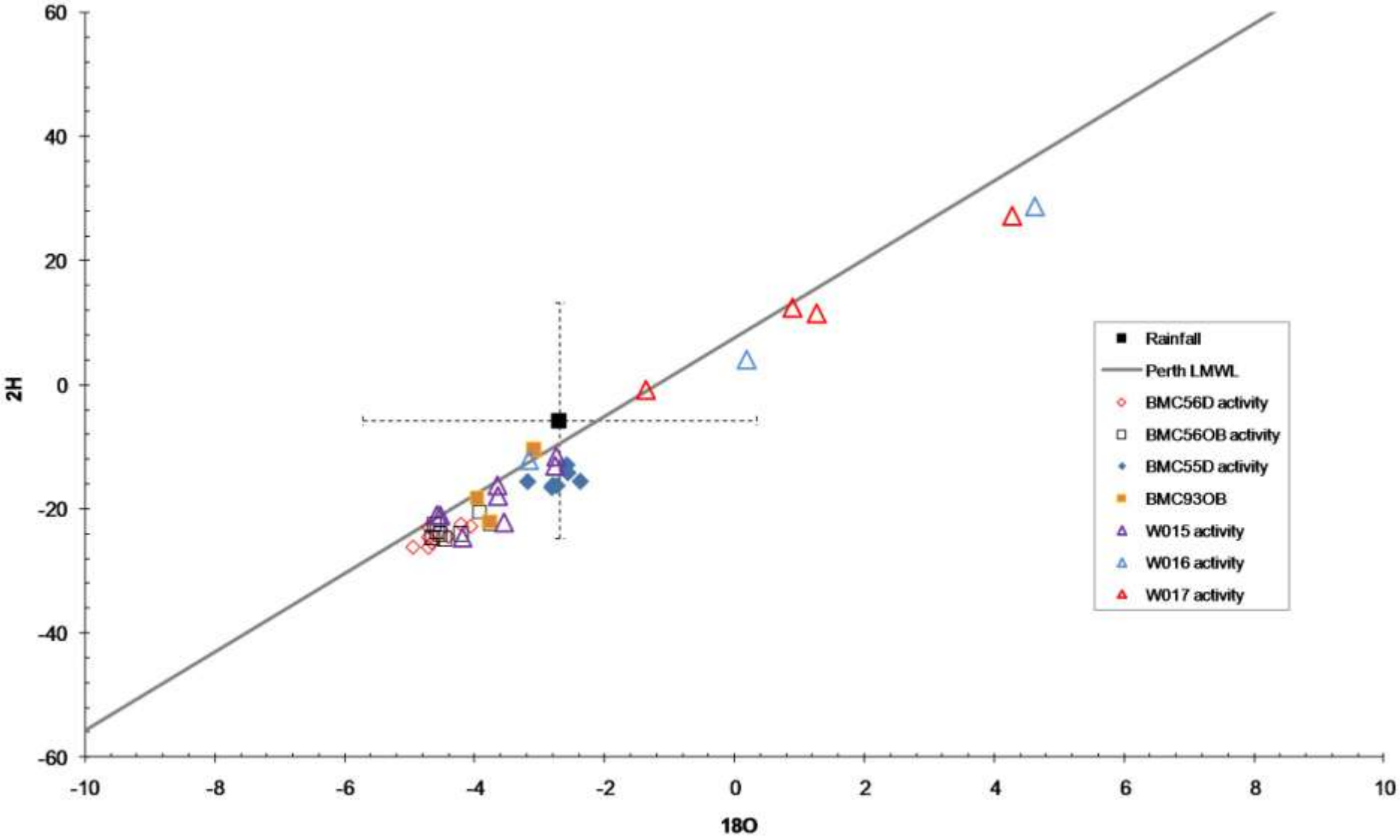


Source : IAEA Report No. 228, 1983

Stable isotopes - LMWL

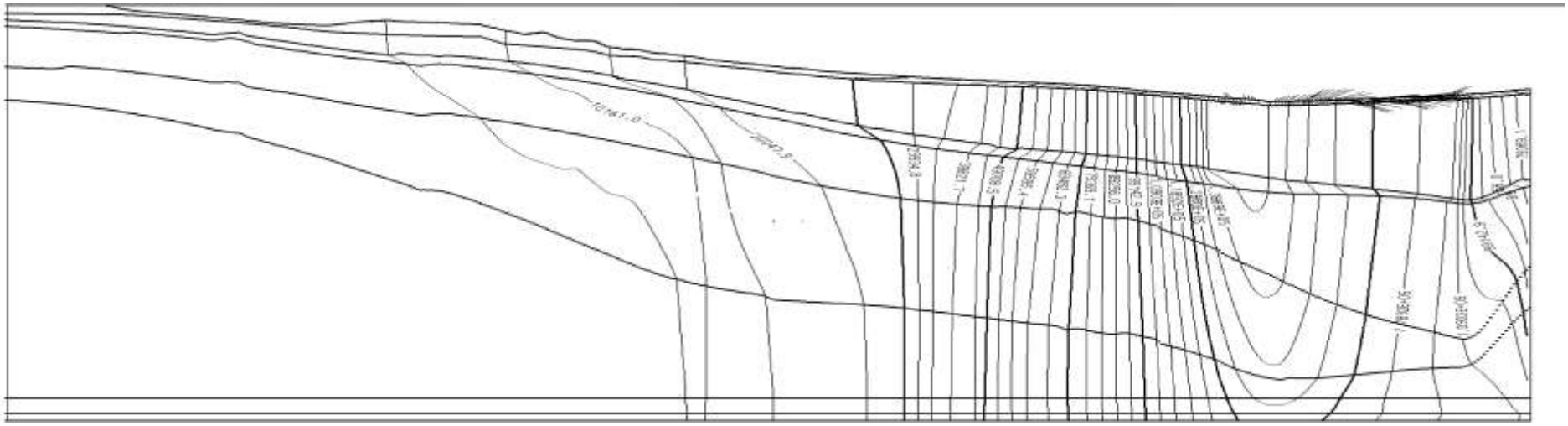


Stable isotopes - Evaporative enrichment



Density coupled model

- FEFLOW model
  - Most appropriate model for density coupled flow
  - Model built
  - Calibration near completion
- Predictive modelling
  - Climate scenarios
  - Management scenarios



Summary

a) The threat from altered hydrology continues to impact on biodiversity values

b) Complex interaction between distinctly different aquifers and water fluxes

c) A multidisciplinary approach is ideally suited to the study area

d) Evaporation is the key driver of water chemistry

e) Management actions to be assessed using results from this study and future FEFLOW modelling

References:

Horita, J. (1989). Analytical aspects of stable isotopes in brines. *Chemical Geology: Isotope Geoscience section, 79(2), 107.*

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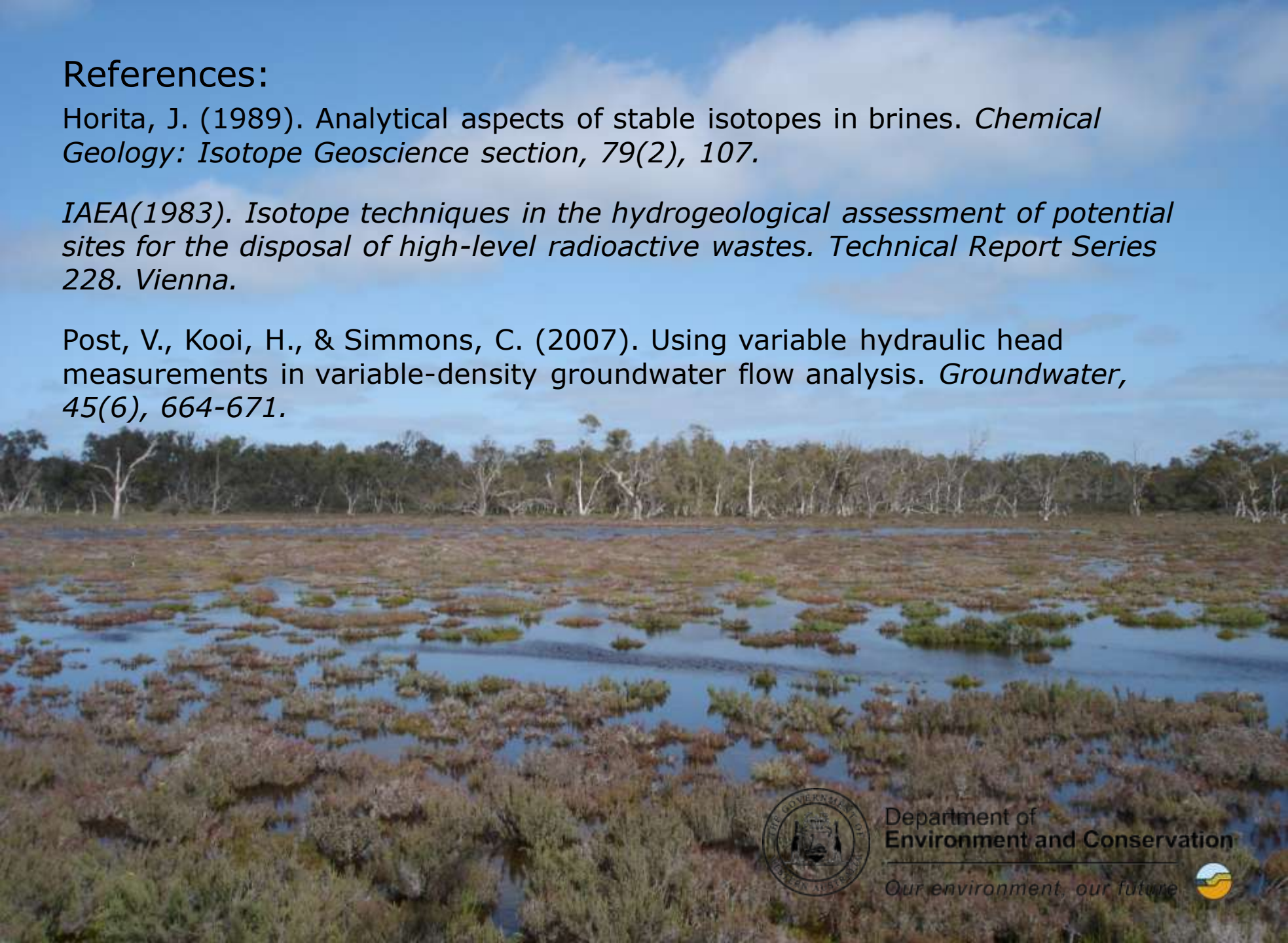
Post, V., Kooi, H., & Simmons, C. (2007). Using variable hydraulic head measurements in variable-density groundwater flow analysis. *Groundwater, 45(6), 664-671.*



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