THE UNIVERSITY OF QUEENSLAND
AUSTRALIA

Emerging Complexity of the GAB Aquifer Systems in the Surat Basin

For: The Condamine District Irrigators

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Acknowledgements: Sam Guiton and QGC for data and analysis and Alexandra Wolhuter and CWiMI:UQ for data analysis

Disclaimer & Disclosure

Disclaimer

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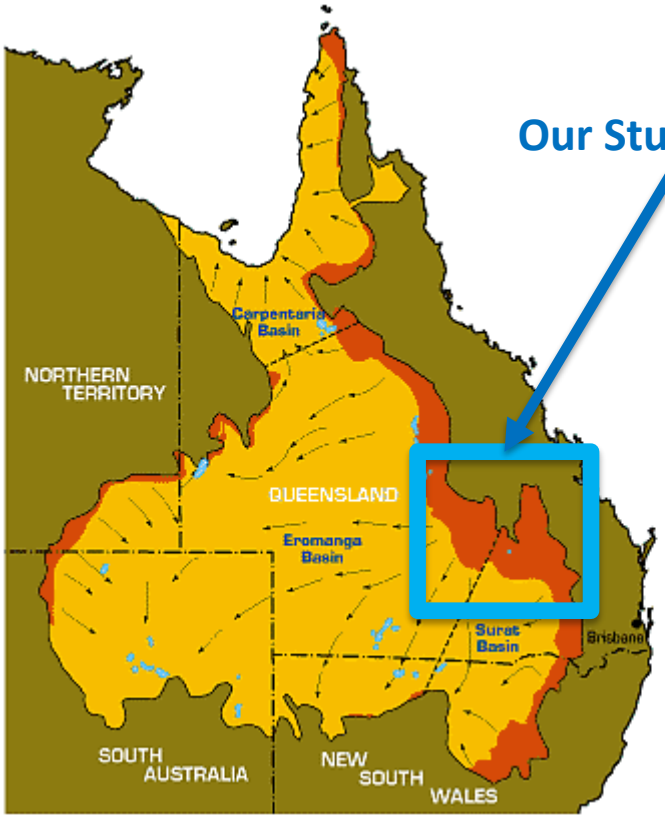
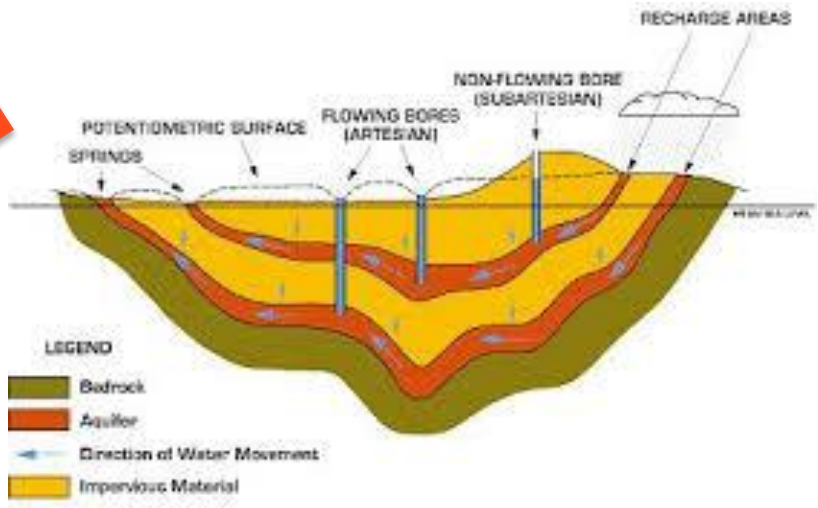
Great Artesian Basin (a simple view)

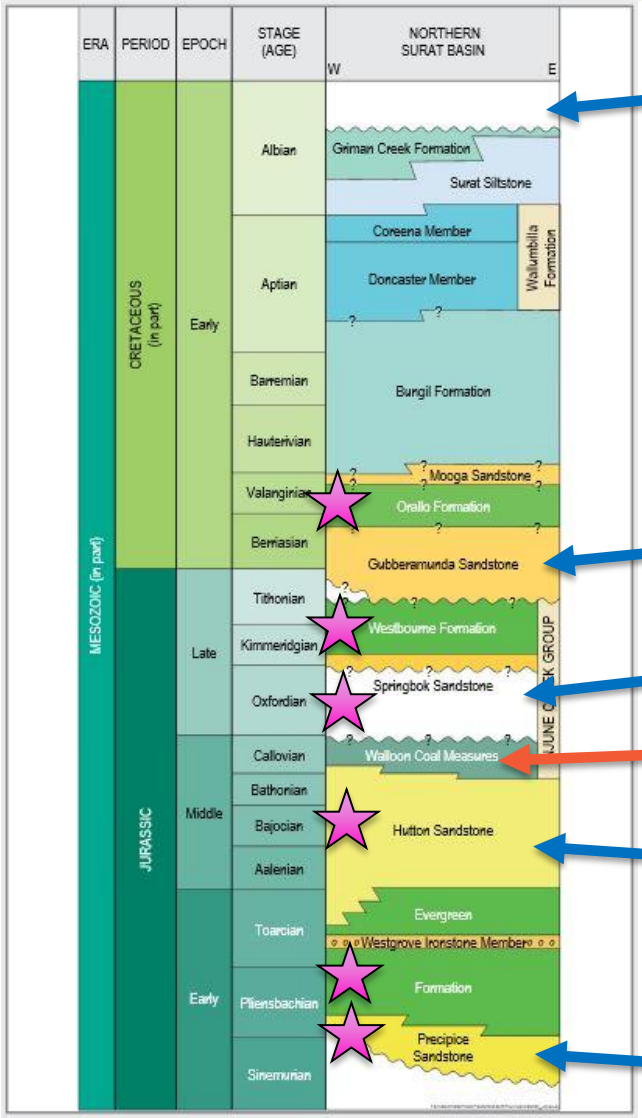




After Habermehl 1980 and friends

http://www.travelling-australia.info/Infsheets/Greatartesianbasin.html

With a complex Surat basin geology



Alluvial Aquifers (cotton irrigation)

Minor coal

Gubberamunda Aquifer (irrigation & town)

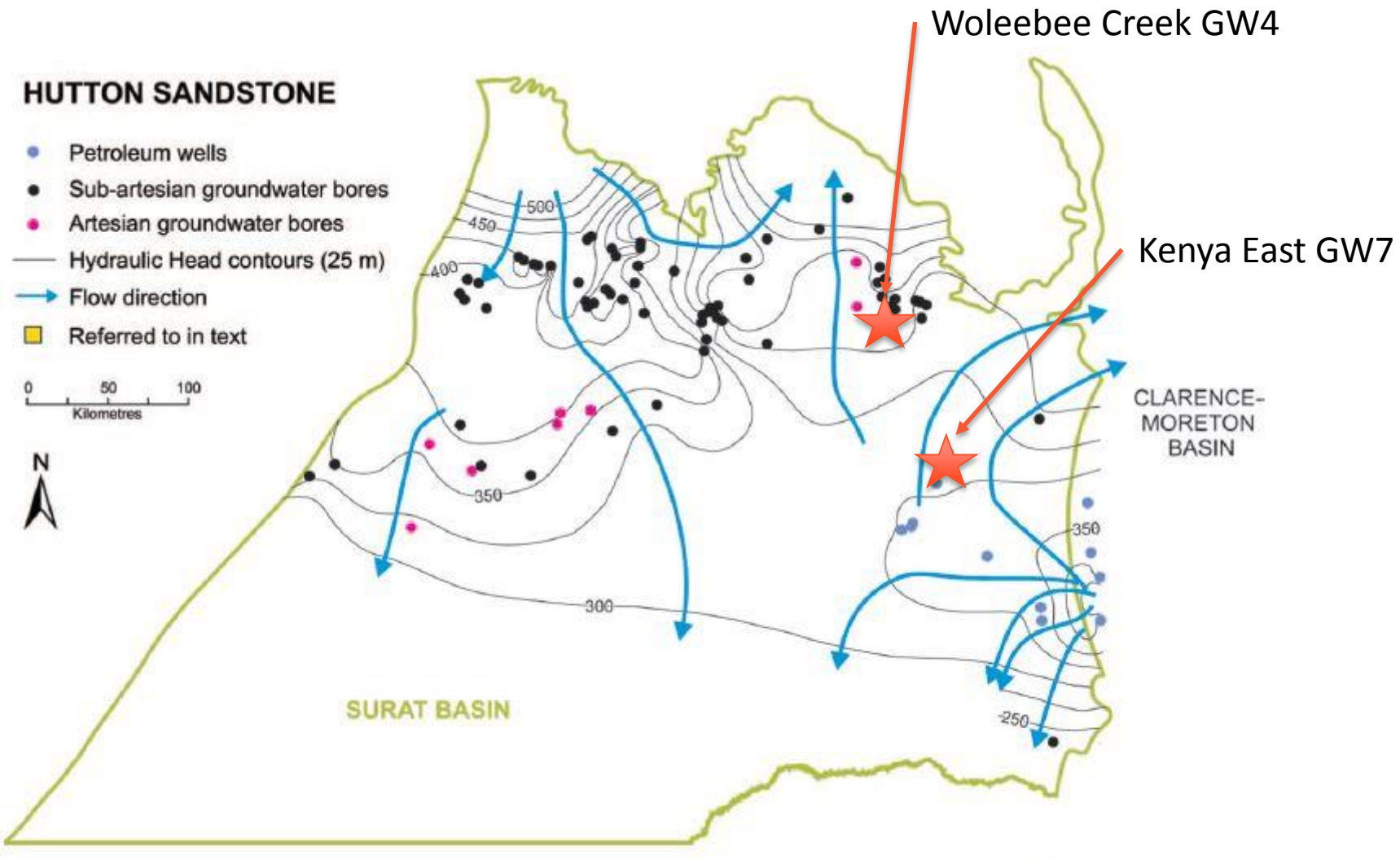
Springbok Aquifer (stock and domestic)

Commercial coal seam methane (Walloons)

Hutton Aquifer (stock and domestic)

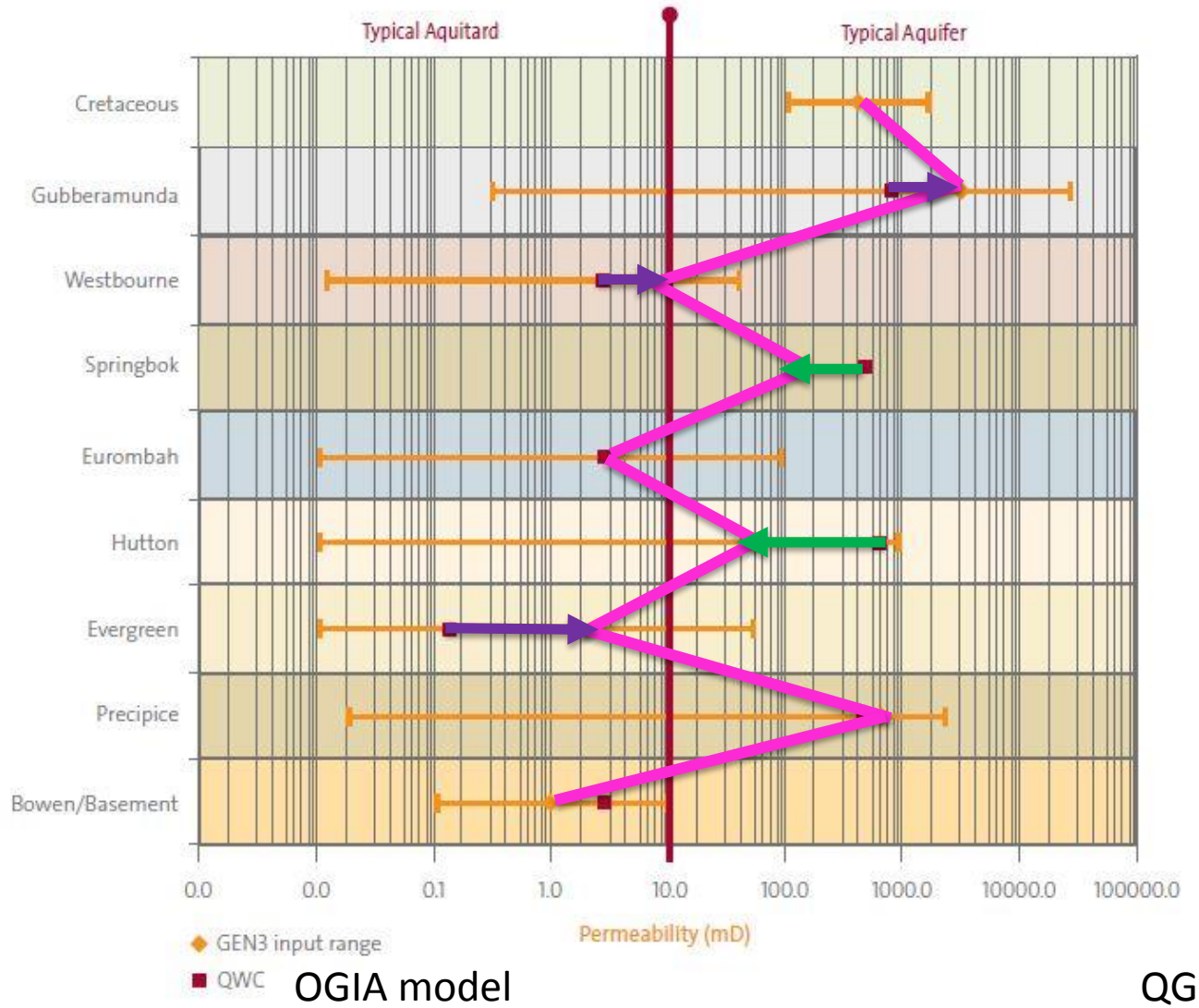
Precipice Aquifer

Hodgkinson, Hortle and friends say: “wait a minute……..”



Hodgkinson & Grigorescu (2012) AJES

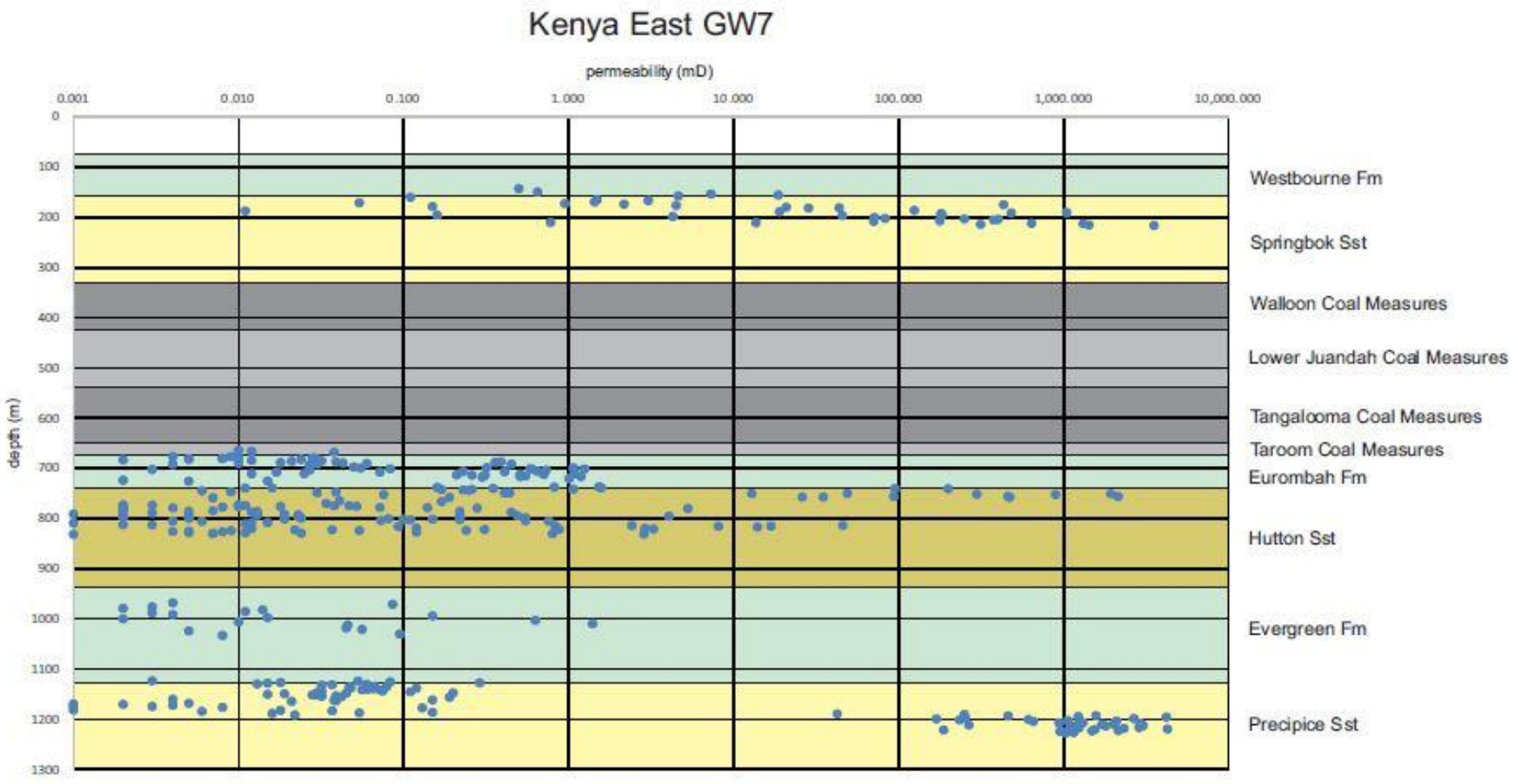
Developing knowledge of aquifer permeability



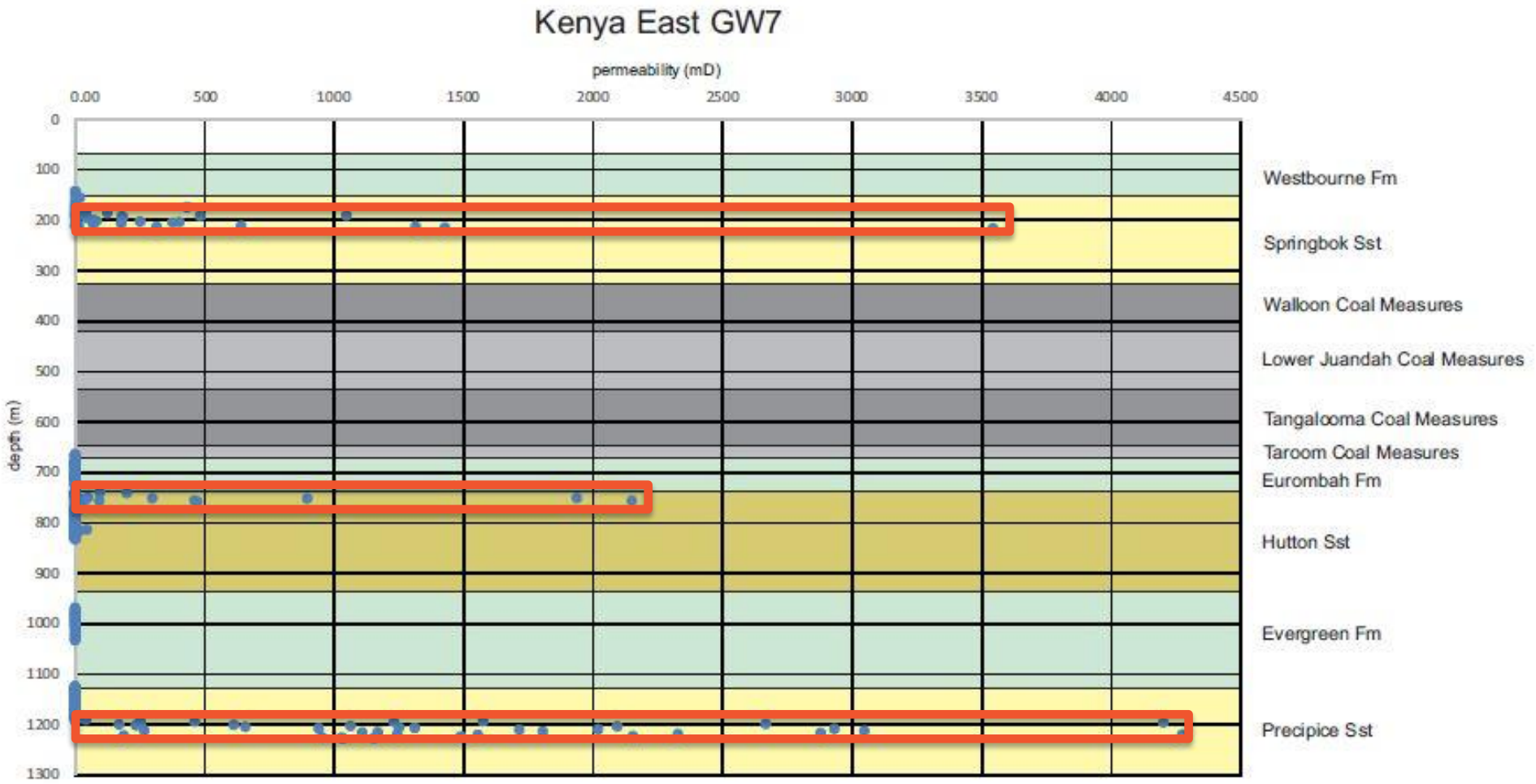
OGIA model

QGC: GEN3 model

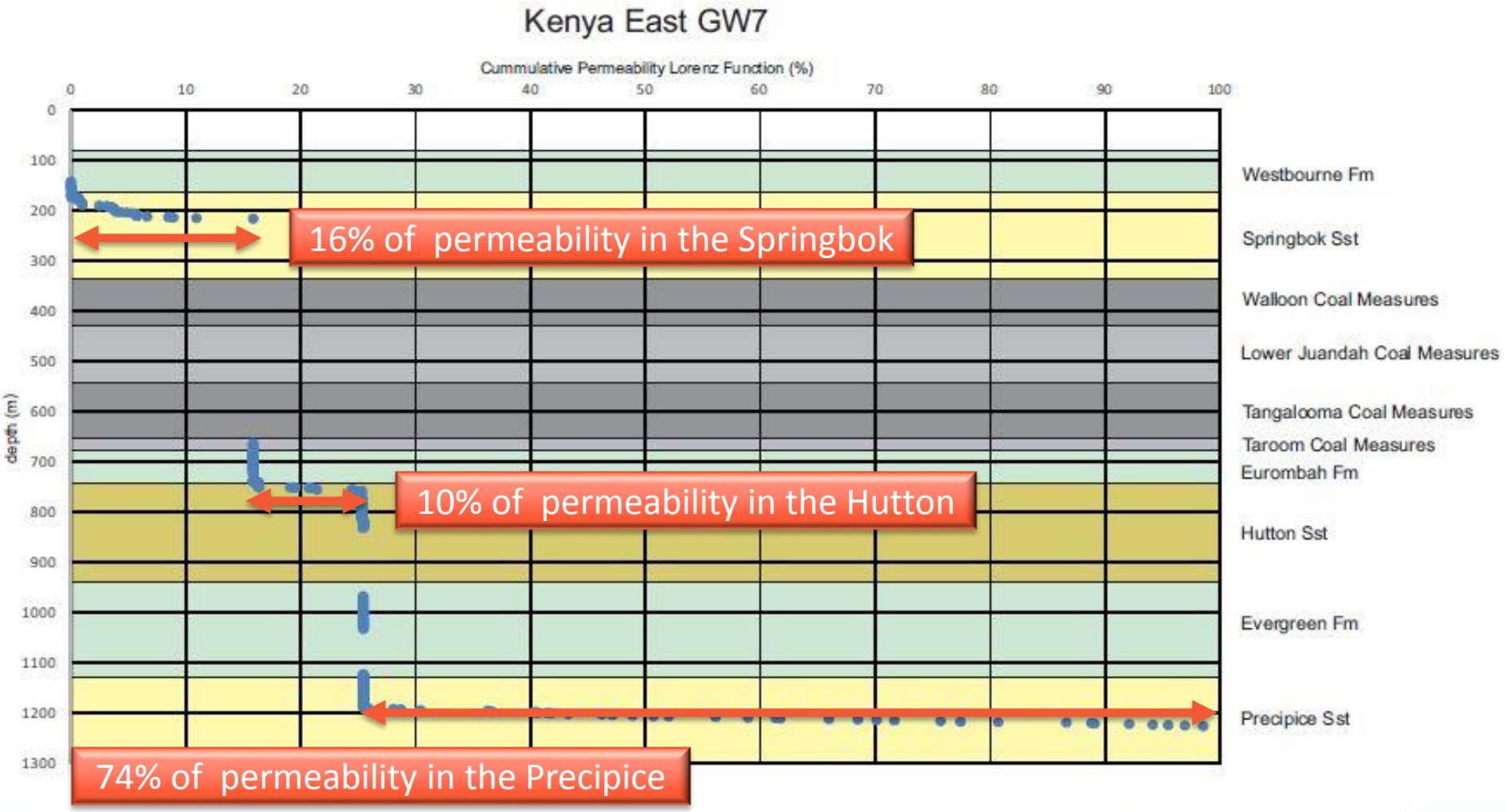
Vertical Permeability Distribution on a Logarithmic-Scale



Vertical Permeability Distribution on a Normal-Scale



Vertical Permeability Distribution on a Cumulative-Scale



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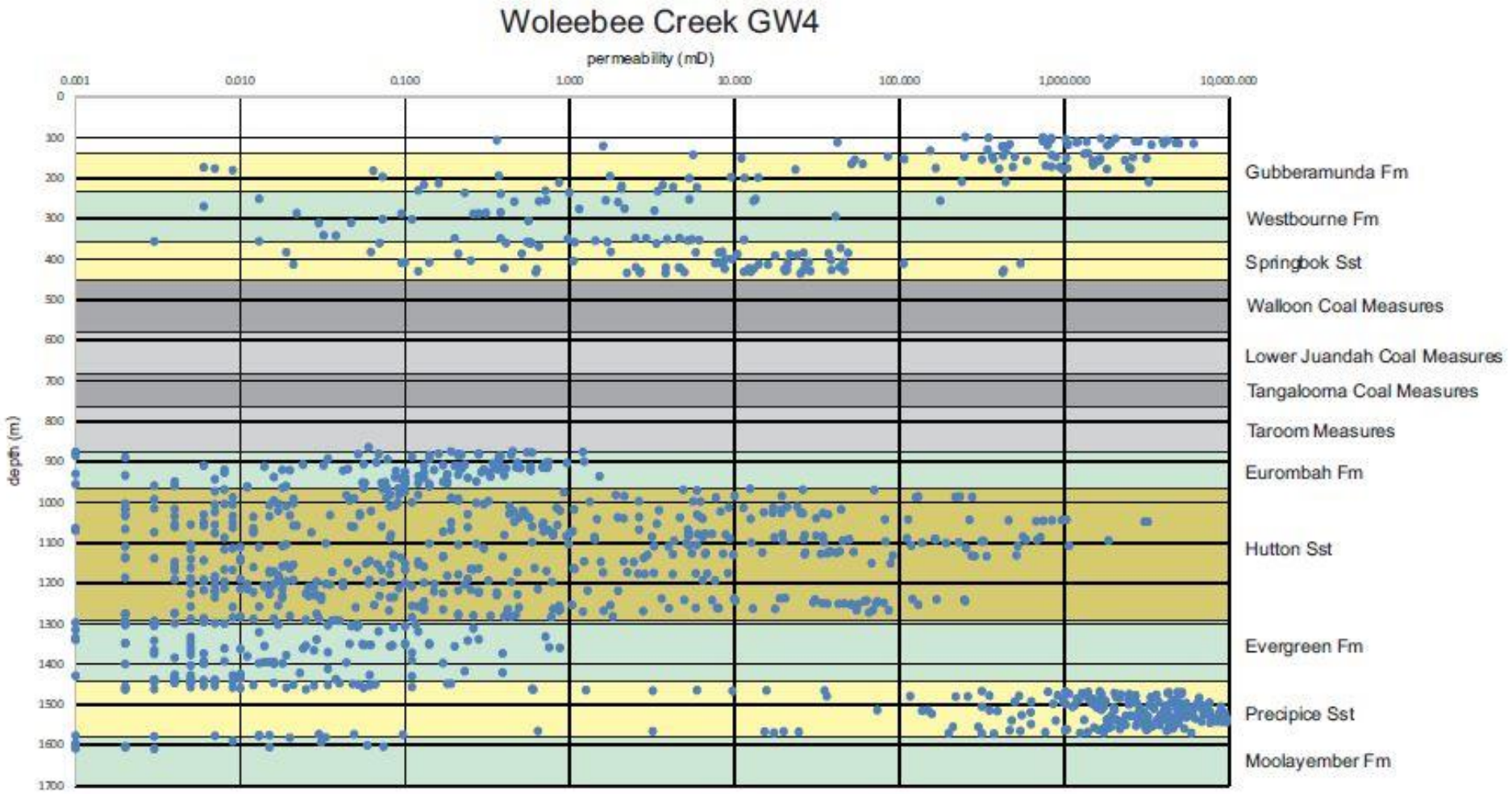

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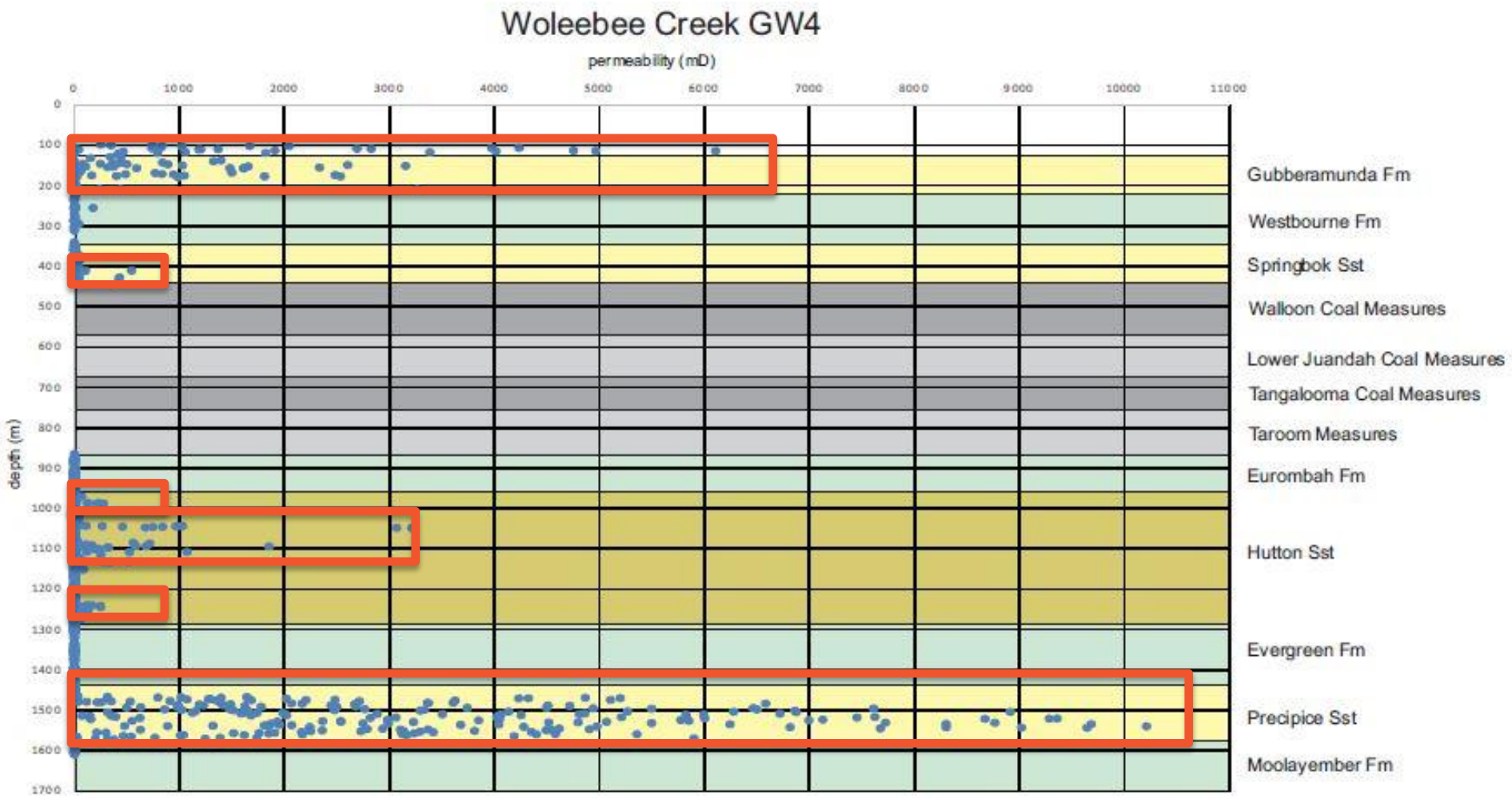
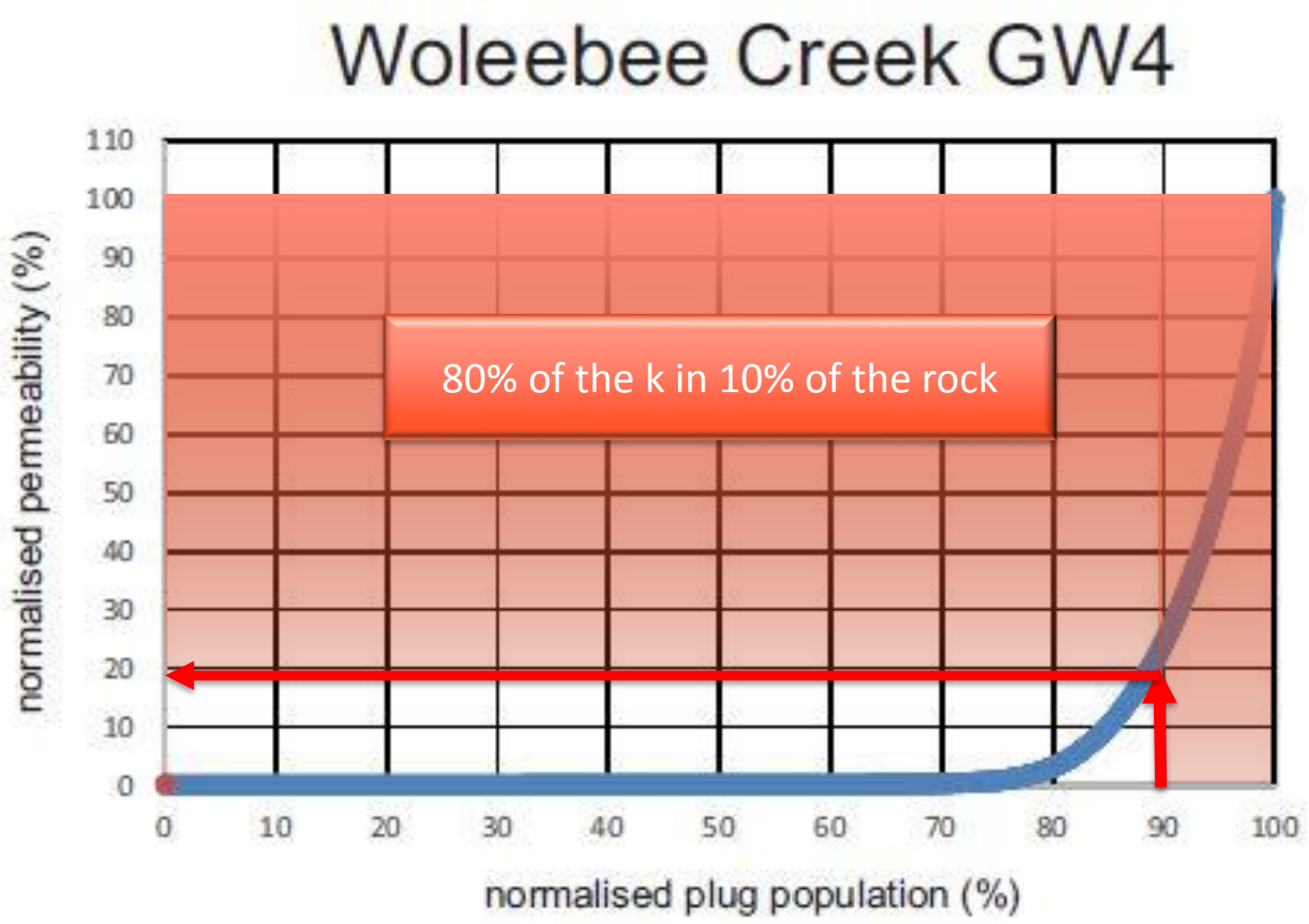


Permeability Distribution on a Lorenz Function Plot



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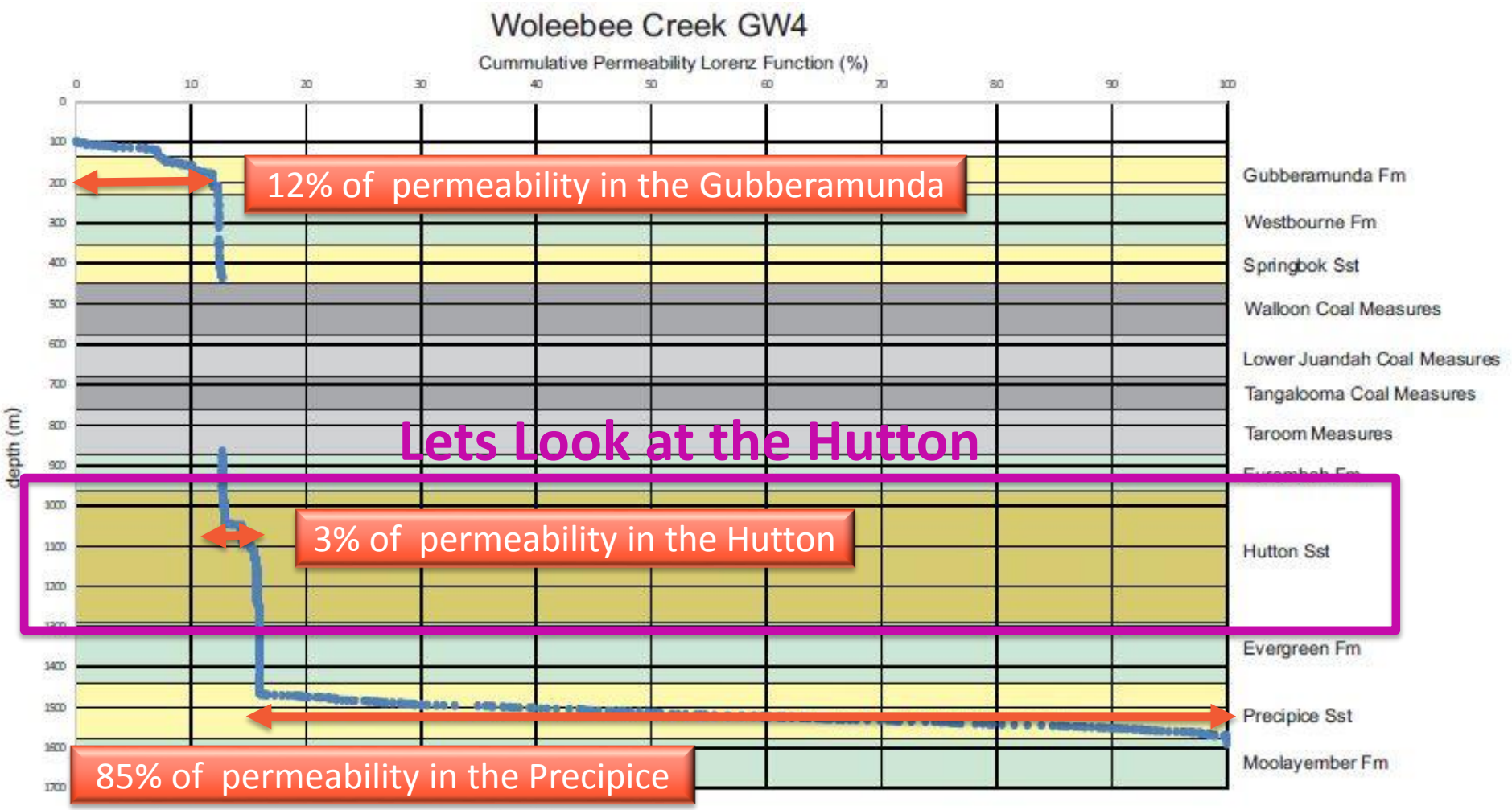
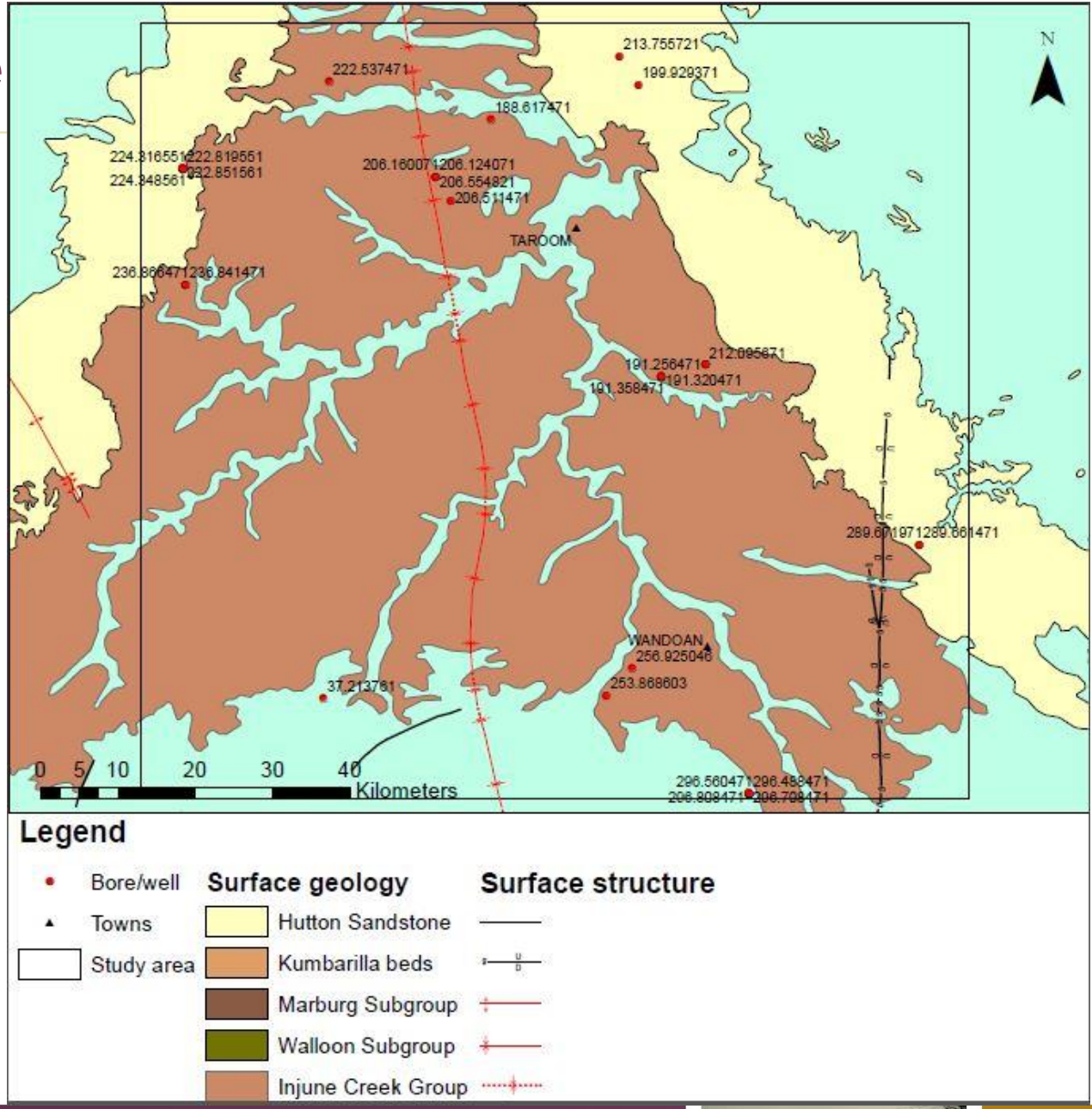
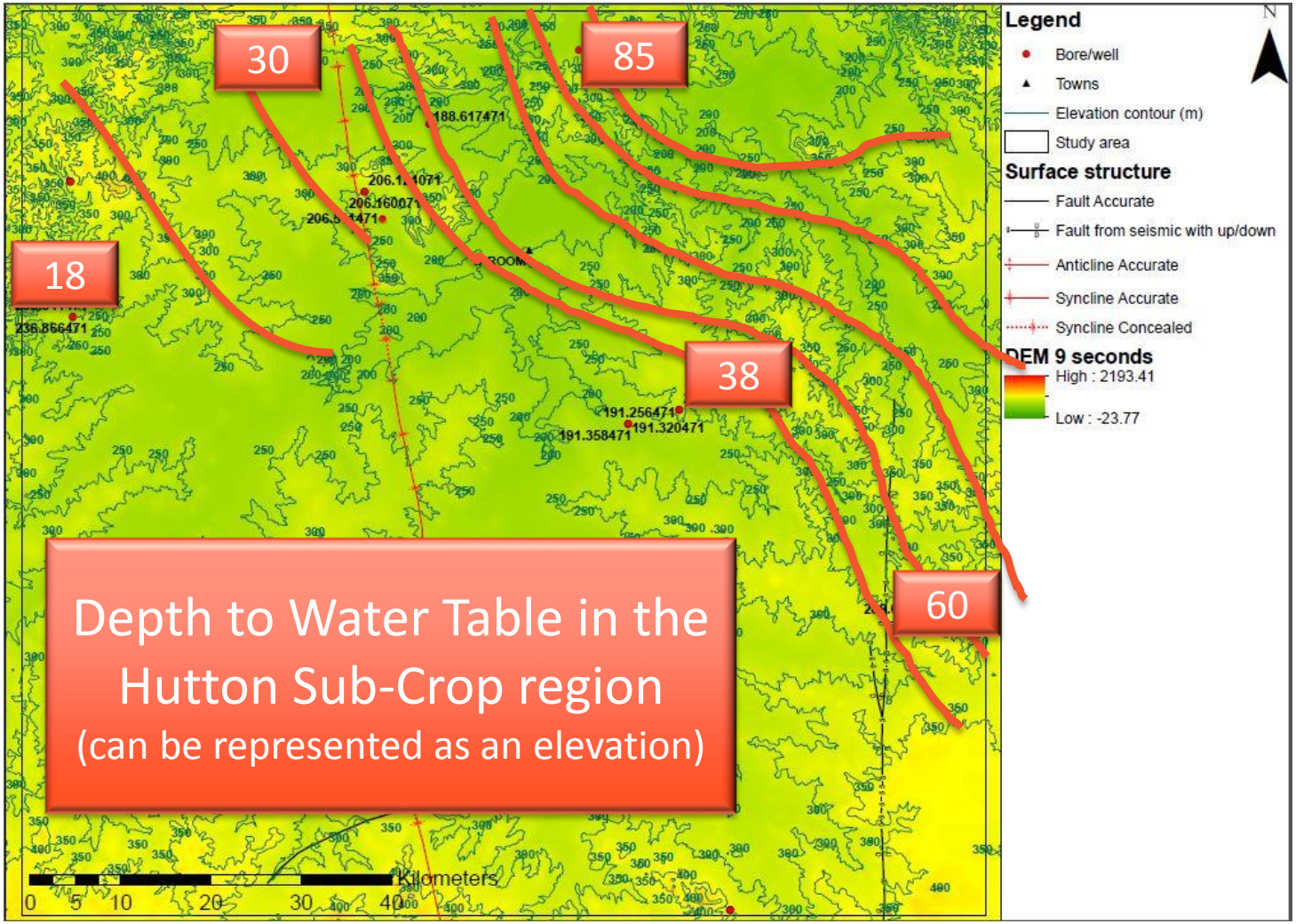


Corrected Pressure

- GW Bores
- O&G wells
- Corrected and Converted to Fresh Water Hydraulic Head

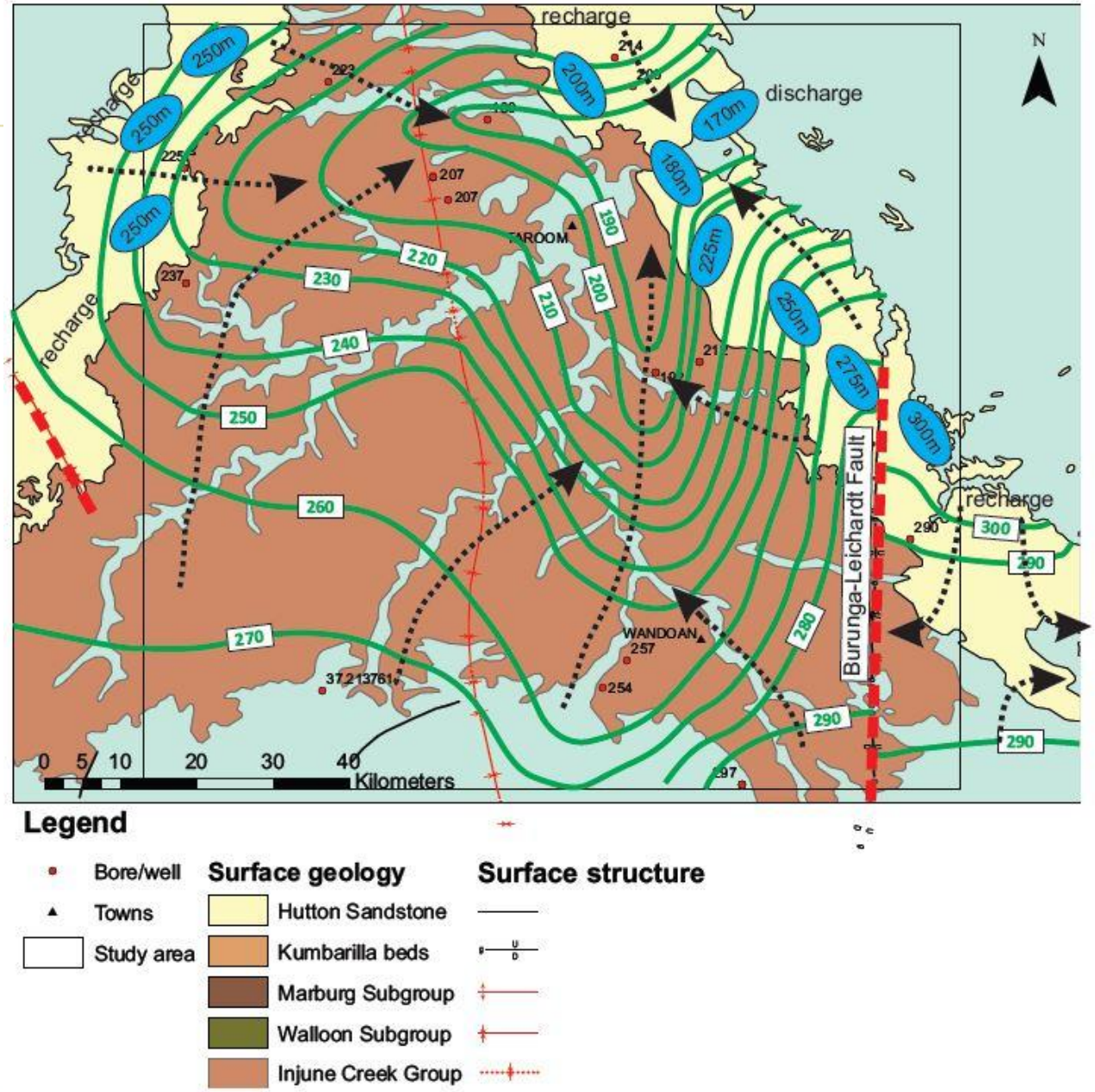


Surface Elevation – Hutton Head in Sub-Crop Region



Hutton FW Head

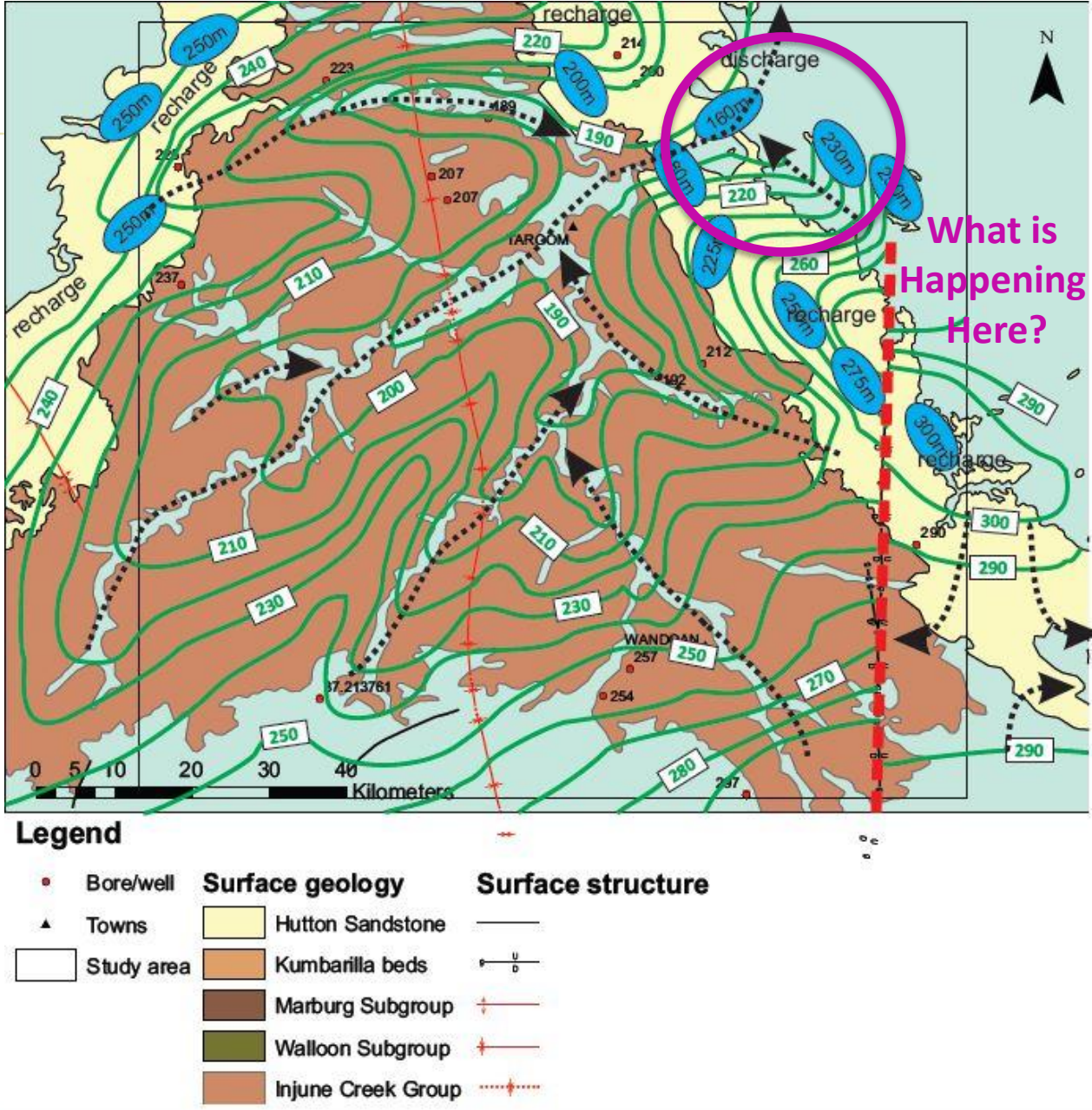
- Uses water table elevation control in the sub-crop region
- There is a physical discharge point to water table in NE at <180m elevation
- Note the influence of the fault



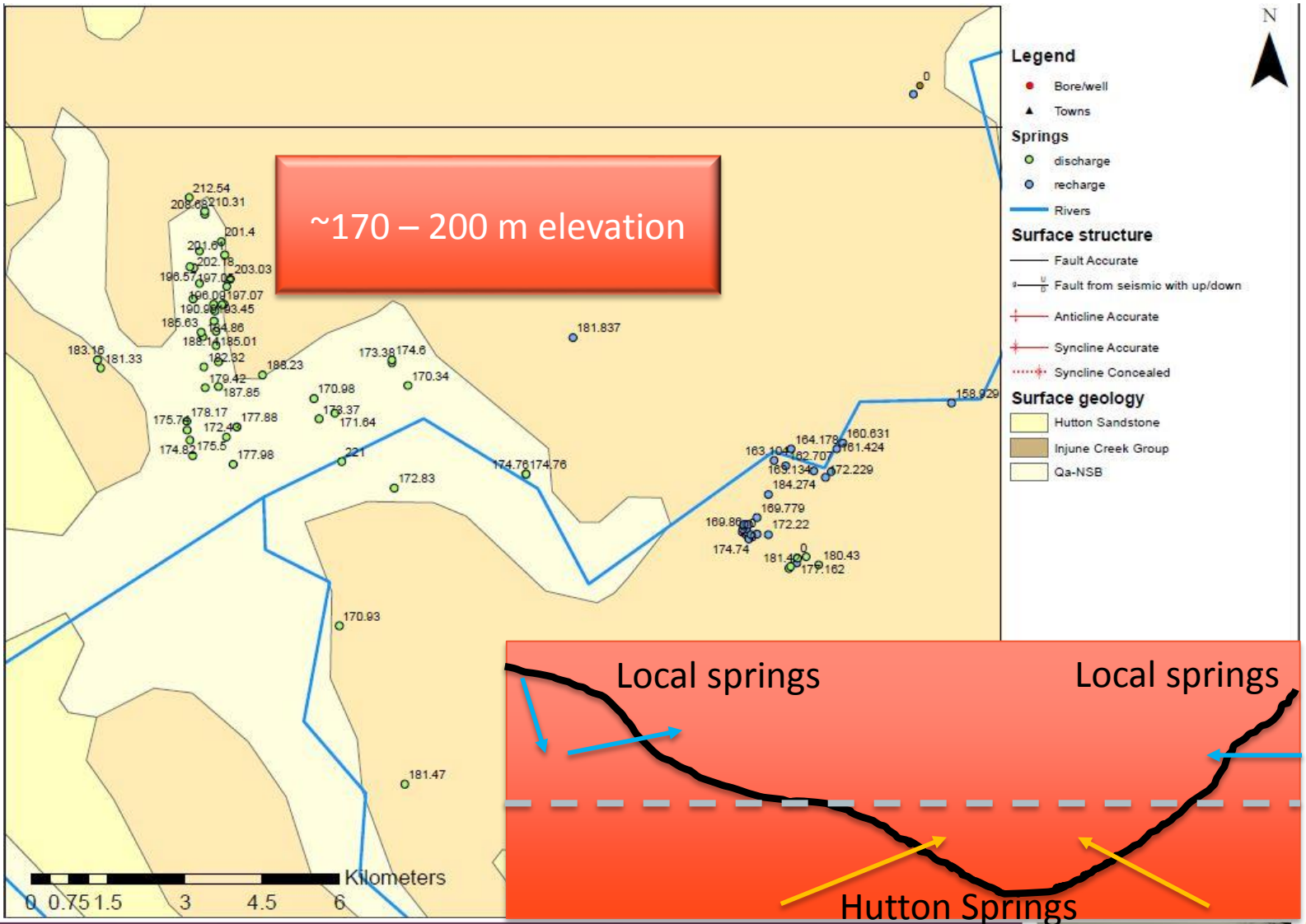
Hutton FW Head

- Uses a stronger influence of the topography

- Heterogeneity
- 80% of flux through 10% of the rock volume?
- Regions connected linearly through lows of hydraulic head
- Discharge to subcrop



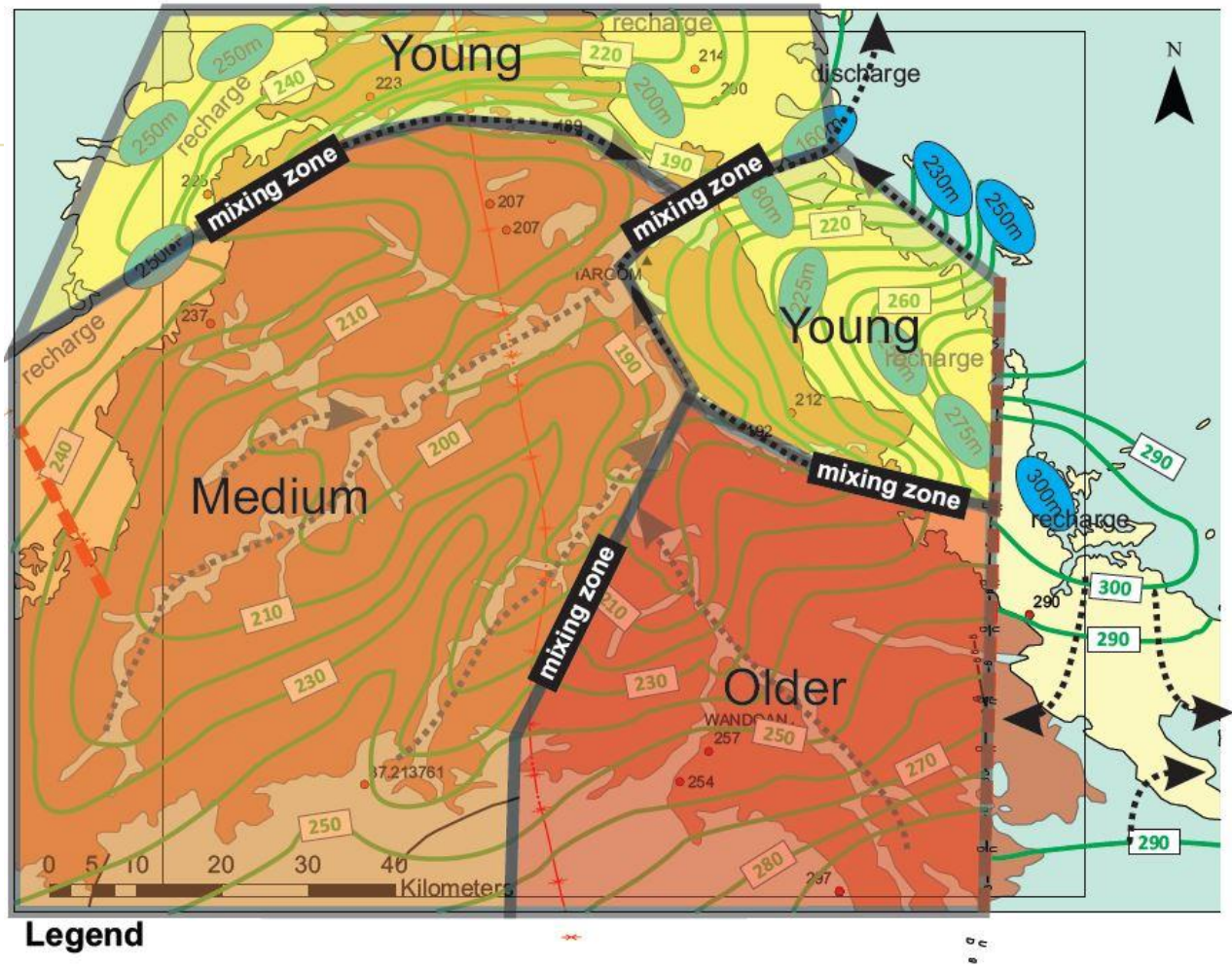
Springs data: pins the discharge area



Hutton FW Head

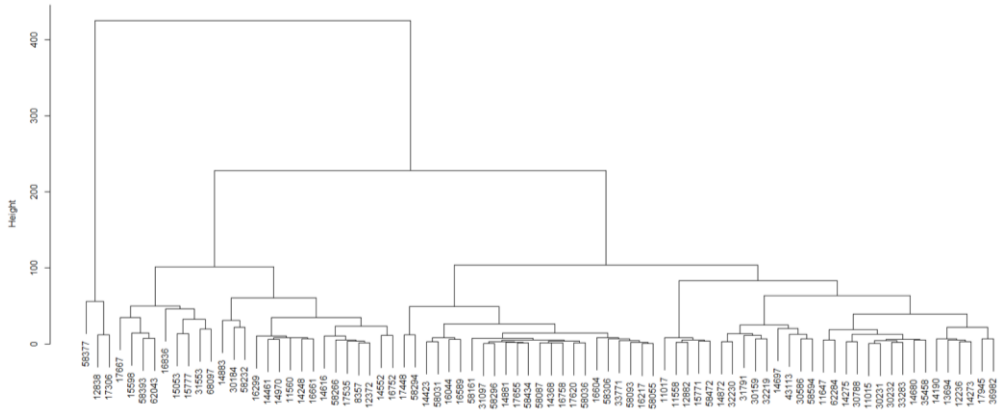
- Regions of various GW systems

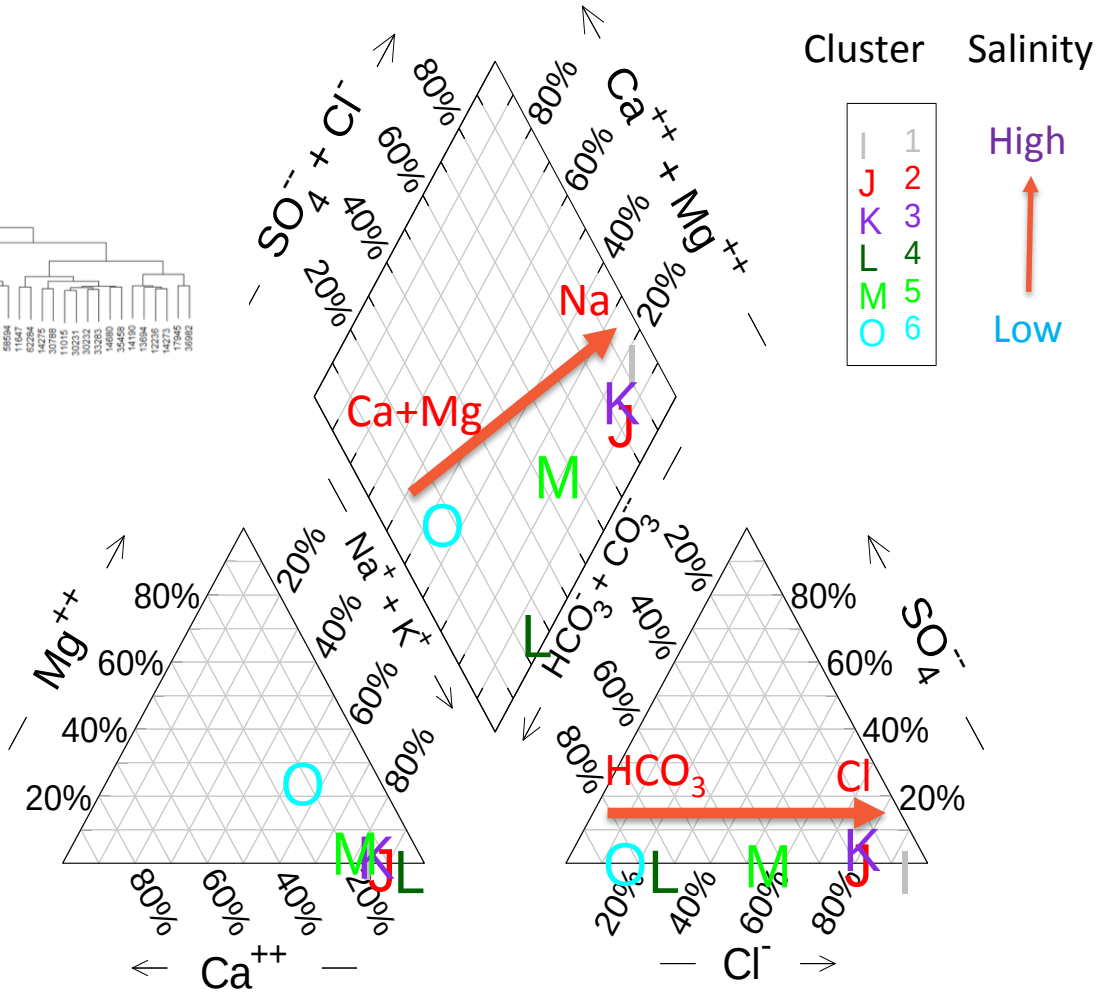
- Yellow: recharge captured by high flux to local discharge
- Orange: separated from recharge but draining toward high flux local discharge
- Red: sheltered from recharge but draining toward high flux local discharge
- Boundaries are mixing zones



Virtually none of the recharge is heading to the regional GAB

Chemistry: Hierarchical Cluster Analysis on 6 clusters

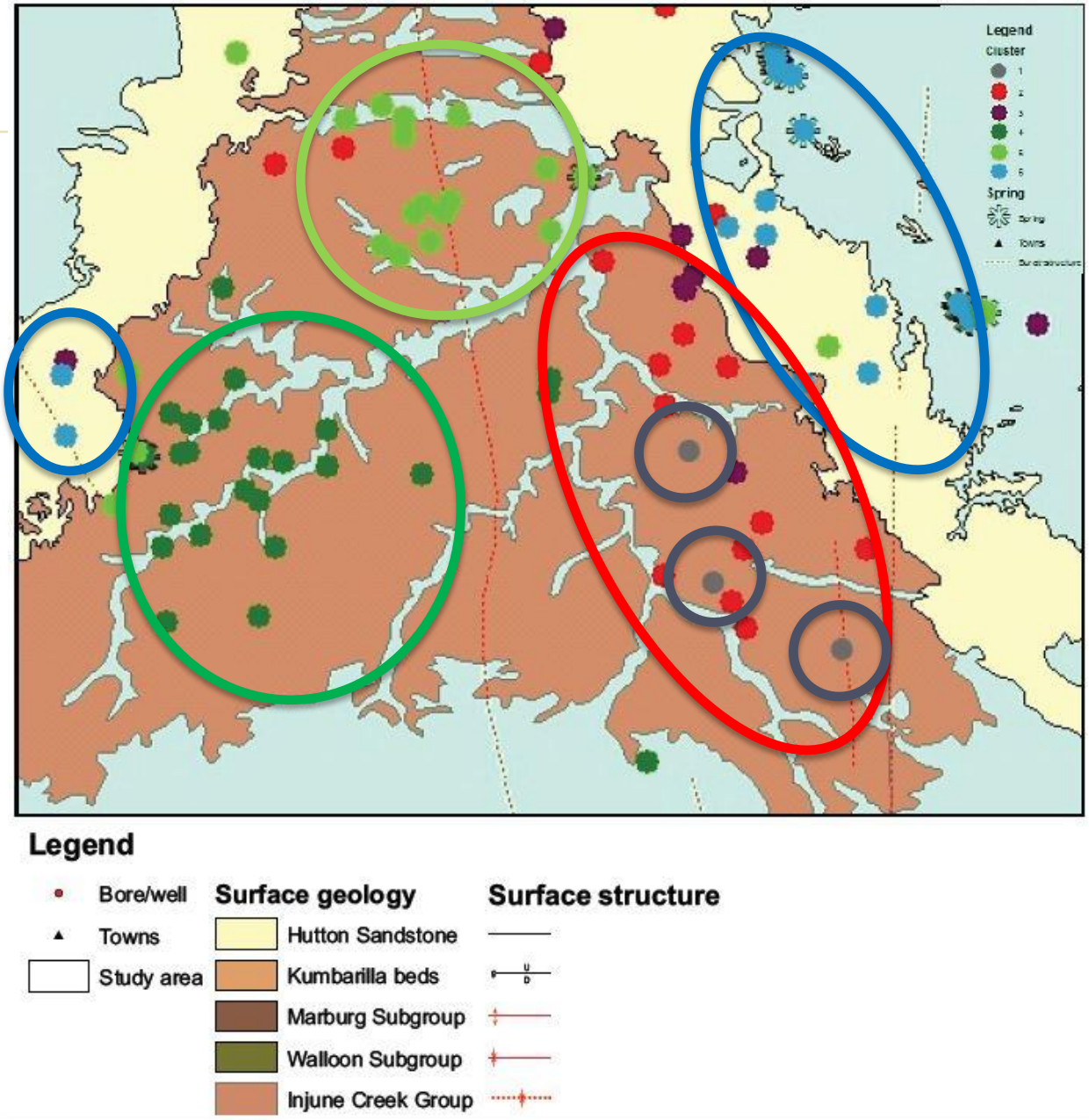




- Recharge = Fresh, HCO_3 > Cl & high Mg, Ca
- Trending to higher EC NaCl dominant

Water Chemistry

- Cluster 6: Fresh & higher HCO_3 , Ca, & Mg
- Cluster 5:
- Cluster 4:
- Cluster 3 & 2:
- Cluster 1: More saline & NaCl dominated has signature of coal?



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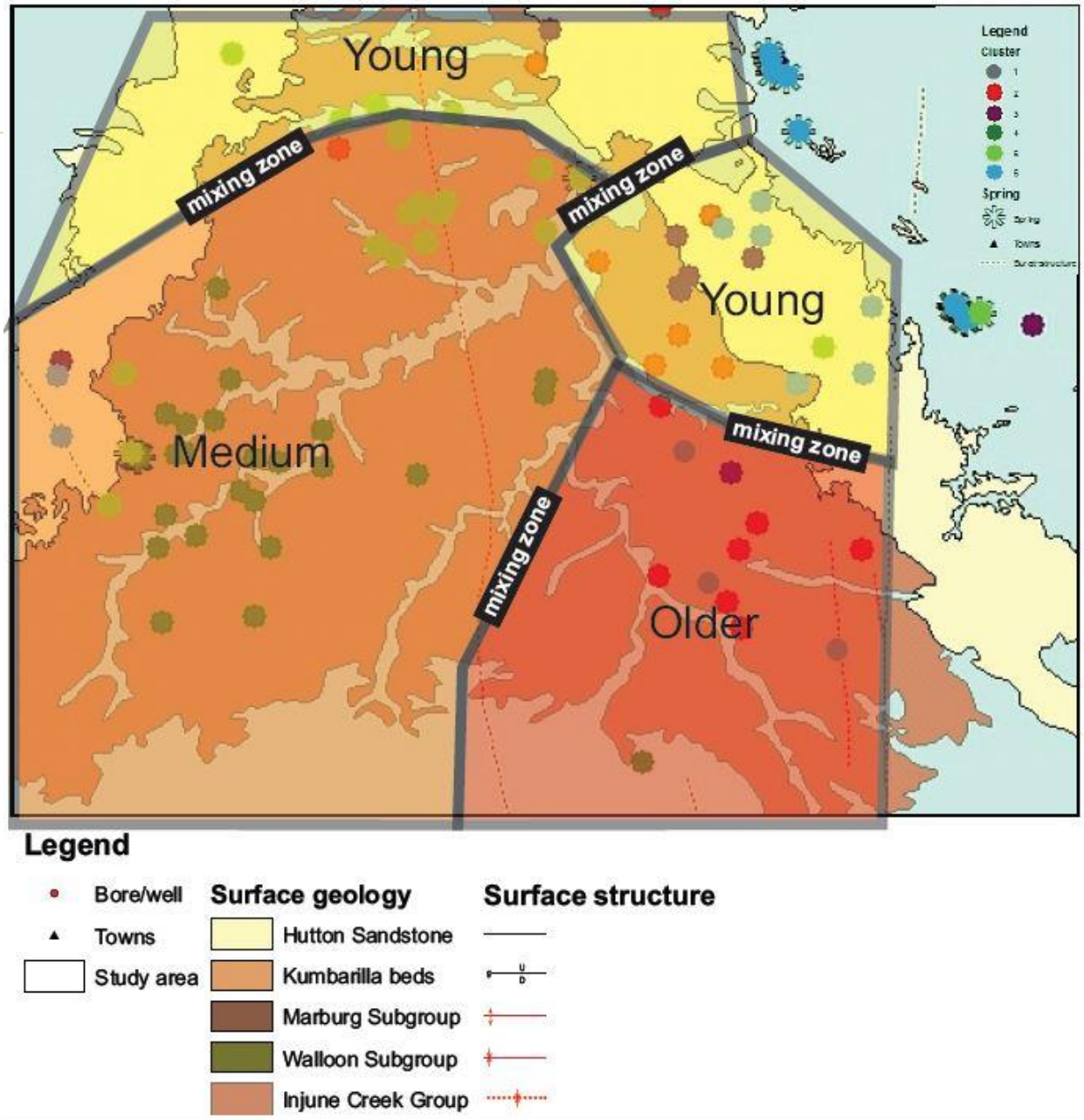

Conclusions

- Gubberamunda and Precipice represent the bulk of the available permeability and thus flux of formation water in the Study Area
- Springbok and Hutton have some permeability but this is highly localised both stratigraphically and geographically
- The heterogeneity drives very complicated flow systems (Pressure and Chemistry and Springs)
- Little (if any) local recharge to the Hutton in this area contributes to the broader GAB
- ~80-90% of the flux goes through 10-20% of the rock

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THANK YOU

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