USING AEM AND GMR METHODS FOR NON-INVASIVE, RAPID RECONNAISSANCE MAPPING AND CHARACTERISATION OF GROUNDWATER SYSTEMS IN THE KIMBERLEY REGION, NORTHERN AUSTRALIA

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The East Kimberley Region of north-western Australia has been identified as a priority for potential agricultural development. Within this region, the Ord Bonaparte Plain is remote, with limited access in an area of great cultural and environmental sensitivity. Initially, spatio-temporal mapping using remote sensing (and potential field) data, combined with data on the deeper basin geology was used to plan an airborne electromagnetics (AEM) survey. The relatively resistive nature of the basin sediments has enabled the AEM to map the hydrostratigraphy to depths of 300-500m, except in the coastal zone affected by seawater intrusion. Two overlying aquifers, separated by a faulted, 'leaky' aquitard, have been identified.

The AEM and remote sensing data were subsequently used to plan a ground magnetic resonance (GMR) survey. The latter has enabled a water table map to be constructed in an area with almost no drilling, while also enabling key aquifer properties to be determined. The target aquifer has a high free water content and high transmissivity. The GMR results have been validated by drilling, borehole Nuclear Magnetic Resonance (NMR), and induction logging.

Integration of AEM, GMR and temporal (Landsat) remote sensing data has enabled rapid mapping and characterisation of the groundwater system in a data-poor, culturally and environmentally sensitive area. These data have also revealed complex faulting within and bounding the aquifer system, delineated the sea-water intrusion interface, and mapped groundwater dependent ecosystems. These data have been used to target drilling and pump testing that will inform groundwater modelling, water allocations and development decisions.