

Airborne electromagnetic mapping – geophysics

An activity within the Flinders and Gilbert Agricultural Resource Assessment, which is part of the North Queensland Irrigated Agriculture Strategy

The Flinders and Gilbert Agricultural Resource Assessment will use an airborne electromagnetic geophysical method to map soil salinity and groundwater quality at the regional scale in the Flinders and Gilbert catchments.

Thousands of hectares of soil are potentially suitable for irrigated agriculture across northern Australia but access to sufficient water is a constraint to development.

In recognition of these challenges and opportunities facing northern communities and primary producers, the North Queensland Irrigated Agriculture Strategy (NQIAS) commenced in January 2012.

The \$10 million NQIAS is a collaborative initiative, funded by the Australian Government Office of Northern Australia and the Queensland Government.

CSIRO is conducting one component of the NQIAS, the Flinders and Gilbert Agricultural Resource Assessment. This two-year, \$6.8 million project will be completed by December 2013. Key parts of the Assessment will be undertaken by the Queensland Government and TropWATER (James Cook University).

in soil salinity and to investigate surface water-groundwater interactions in remote areas.

This technology will be used to help assess the suitability of land proposed for irrigation, and along with other groundwater sampling methods will help understand the connectivity between surface water and groundwater in the region.

What is AEM?

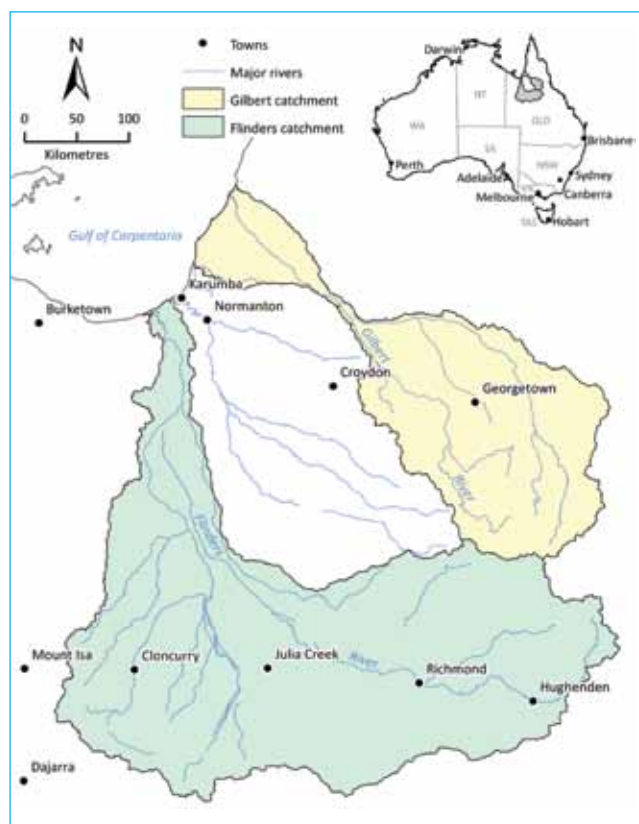
An AEM system is carried by an aircraft, often a helicopter, and measures the changes in conductivity of the ground. It is now routinely employed as an investigative technology for mapping groundwater quality and the characteristics of aquifer systems, and for soil salinity mapping.

A helicopter AEM system is a quick and cost-effective method to map key parts of the Flinders and Gilbert catchments, as it can provide detailed information near to the surface as well as to depths greater than 100 m.

How do helicopter AEM systems work?

Helicopter AEM systems carry transmitter and receiver coils mounted in a frame slung beneath the helicopter.

An electrical current is pulsed through the transmitter coil which produces a primary magnetic field. This field induces eddy currents in the ground, which then create their own secondary magnetic fields. The strength of the secondary field fluctuates with varying ground conductivity which may be



The Assessment will provide a comprehensive and integrated evaluation of the feasibility, economic viability and sustainability of water resource development. The Assessment involves 13 different activities. This factsheet explains one of these activities – airborne geophysics.

Airborne Geophysics

This activity will use advanced airborne electromagnetic (AEM) techniques developed specifically for land and groundwater assessment, to understand spatial patterns

The Assessment will focus on the catchments of the Flinders and Gilbert rivers in north-west Queensland.

influenced by changes in soil salinity or changes in the quality of groundwater.

The decay of the secondary field is measured by the receiver coil located beneath the helicopter and the response can be used to tell us about ground conductivity as it varies with depth. These fields last only a few milliseconds.

Is AEM safe?

Yes. There is no risk of electric shock from the AEM system while in operation. Electromagnetic (EM) fields from the AEM system are tiny compared to

EM fields generated by household wiring or radio, mobile phone and TV antennas; and the currents generated in the ground are of the order of micro to nanoAmps. The aircraft altitude and speed also limits exposure.

AEM is used around the world. It is operated by specialist contractors who have many decades of experience in a range of environments. AEM technologies have been used over various regions across northern Australia including the Ord irrigation district. It has also been used in the

wheatbelt of south-western Australia and in the Murray Basin to collect data on salinity, groundwater and geology.

The technology causes no ill effect to livestock, but because low flying aircraft are involved it has the potential to cause some annoyance or alarm to cattle and horses. To minimise this we ask landholders to advise us of any situation or circumstance that may require careful scheduling. No surveys are flown directly over houses or towns at anytime, although the helicopter may pass nearby at times.

Flying the survey

The helicopter flies at a height

of approximately 60m and tows the circular frame approximately 30m above the ground surface. For this project it will fly along carefully selected lines to maximise information that tells us about the subsurface soil and groundwater conditions in key areas that may be developed for irrigation.

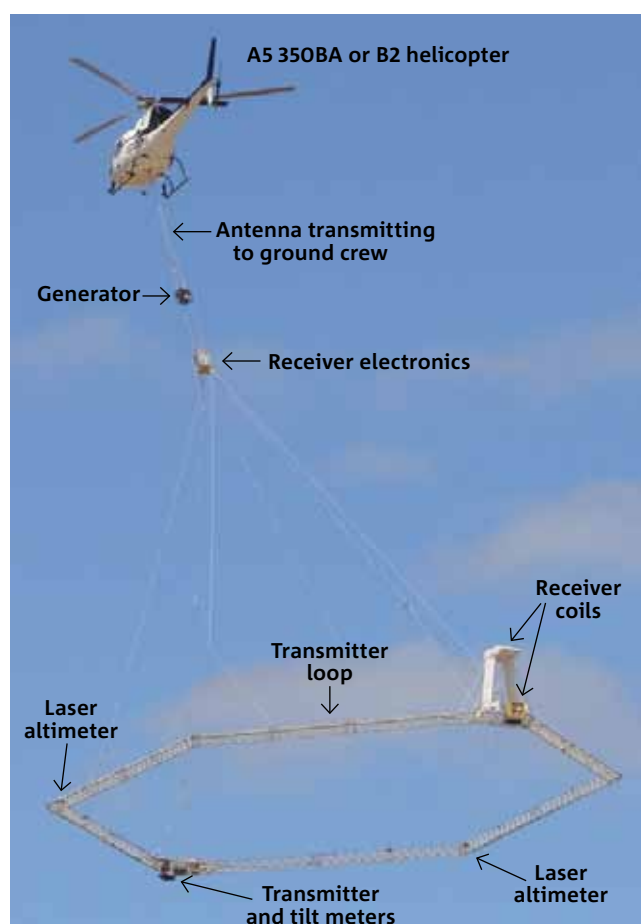
We will also fly along tracts of the river systems in the Flinders and Gilbert catchments, and use AEM information along with that collected as part of the groundwater component of the Assessment to help understand groundwater quality variations along important segments of the river systems.

Data will be processed by CSIRO to generate maps and cross-sections showing how ground conductivity varies with depth. This information may also help understand the connection between deeper aquifers and the alluvial aquifer system.

Project outcomes

The results from the AEM survey will contribute to the understanding of land suitability and water availability for irrigation development in key parts of the Flinders and Gilbert catchments.

The Flinders and Gilbert Agricultural Resource Assessment is being conducted for the Office of Northern Australia in the Australian Government Department of Regional Australia, Local Government, Arts and Sport under the North Queensland Irrigated Agriculture Strategy <http://www.regional.gov.au/regional/ona/nqis.aspx> The Strategy is a collaborative initiative of the Office of Northern Australia and the Queensland Government. One part of the Strategy is the Flinders and Gilbert Agricultural Resource Assessment, which is led by CSIRO.



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CONTACT US

t 1300 363 400
+61 3 9545 2176
e enquiries@csiro.au
w www.csiro.au

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FOR FURTHER INFORMATION

Tim Munday
CSIRO Perth
t +61 8 6436 8634
m +61 418 221 311
f +61 7 3833 5504
e tim.munday@csiro.au