



CASE STUDY TEMORA PROPERTIES - NSW, AUSTRALIA

ADVANCED METHODS IN GROUNDWATER EXPLORATION LOCATING PREVIOUSLY UNDETECTED WATER SOURCES FOR DROUGHT PRONE REGIONS

Written and Compiled by the Lawrence Anthony Earth Organization Technical Staff

INTRODUCTION

Australia is Earth's driest inhabited continent and characterized by highly variable rainfall patterns. As a result, drought has been a critical issue for farmers and other agricultural producers since the time of Australia's European colonization (Howden 2014, Tench 1793).

The town of Temora (study area) is located in the Riverina-Murray region of New South Whales (NSW). This district is part of the large Murray-Darling River Basin and characterized by extensive irrigated agriculture (Bishop-Taylor et al 2018). For this reason it is one of Australia's most productive agribusiness regions.

The majority of Riverina is attributed with a warm, persistently dry, semi-arid climate (Stern et al., 2000). Though rainfall is relatively uniform year-round, it is still prone to drought events (BOM 2016). This is evidenced by the effects of the Millennium Drought (1996-2009) and the current drought, which been affecting the Murray-Darling Basin since 2017, severely limiting water resources throughout the region (BOM 2019).



Figure 1. Location of Riverina-Murray Region (NSW Govt. 2018)



Figure 2. Riverina Regional Landuse (Bishop-Taylor 2018)

ROLE OF GIS ANALYTICS (GISA) COMPANY GROUP*

GISA aims to help farmers and rural communities combat drought by identifying additional groundwater resources and appropriate soil and land cover management. This is accomplished via specialized, proprietary techniques to detect previously unknown sources of groundwater and soil property analysis and rehabilitation interventions. Through the identification and proper management of these resources, GISA strives to strengthen drought resilience.

*GISA Company Group founded by The Lawrence Anthony Earth Organization consists of entities operating in Australia, USA, Middle East and South Africa with a mission to implement effective water security solutions





Mr. H PROPERTIES, TEMORA, NSW

Mr. H, a farmer located near Temora, NSW, was at the tail end of the Millennial Drought, the most extreme hydroclimatic events on record for southeastern Australia at the time, when he reached out to a senior member of the GISA Company Group for assistance in locating groundwater on his properties.

His hope was to safeguard his properties from the dramatic effects of drought that had been plaguing the region. Through GISA's technical mapping and field-surveying techniques, three bores were sited and successfully drilled between 2009 – 2010, one on each of Mr. H's properties (Appendices 1-3).



Figure 3. One of Mr. H's properties near Temora

METHODS

The GISA team collected both raw and processed datasets from available sources including satellite imagery, digital elevation models, soils, geology, geophysical, and morphology data, etc.

Next, GISA used proprietary techniques to process the acquired data so that it could be displayed and interpreted by its technical experts. After the completion of a remote assessment and identification of potential groundwater targets, GISA conducted a field survey for verification of initial findings. Based on the field survey, two sites were recommended to the client as having high probability for groundwater resources.









RESULTS

A remote assessment was carried out for the first property. Based on remote findings, a field survey was then conducted at the request of the owner. Senior GISA Company Group member identified several sites for exploratory well drilling.

Given the recommendations and other accompanying data, the client pursued a well on his first property. The drilling occurred on 1 December 2009 to a depth of 240 m and a flow rate of 2'300 gallons per hour was successfully attained.

After having success on his first property, Mr. H requested remote assessments and subsequent field surveys on two additional properties.

The drillings occurred on 6 September and 6 October 2010. The drill depths were 198 and 178 m and attained flow rates were 1,980 and 792 gallons per hour, respectively.

Name	Depth (m)	Flow Rate (I/hr)	Flow Rate (UK Gal / hr)	Date Drilled
Property 1	240	10,440	2,300	December 1, 2009
Property 2	198	9,000	1,980	September 6, 2010
Property 3	178	3,600	792	October 6, 2010

Table 1. GIS Analytics bore sites identified on the three Temora properties

"In each case the bores were successful and the information supplied was accurate in regards to location, water quality and depth."

- Mr. H, Landowner

ONGOING PROJECT

Due to the high success rate of the previous three projects, Mr. H has engaged the GISA Company Group to locate groundwater resources on a newly acquired property.

In March of 2019, GISA started work on this project, producing maps, executing the remote assessment, and conducting the field survey. Both the remote analysis and field assessment indicated a high probability for groundwater resources on the property, and therefore an ability to increase drought resilience.

Several potential bore sites have been identified, and drilling is planned for the near future.

REFERENCES

Bishop-Taylor, Robbi, Mirela G. Tulbure, and Mark Broich. "Impact of hydroclimatic variability on regional-scale landscape connectivity across a dynamic dryland region." *Ecological indicators* 94 (2018): 142-150.
 Bureau of Meteorology. "Rainfall Variability." *Australian Climate Averages - Rainfall Variability (Climatology 1961-1990)*, of Meteorology, (2016), www.bom.gov.au/jsp/ncc/climate_averages/rainfall-variability/index.jsp.
 Bureau of Meteorology, Commonwealth of Australia (BOM). "Drought Rainfall Deficiencies and Water Availability." *Monthly Drought Statement*, Australian Government - Bureau of Meteorology (2019), <u>www.bom.gov.au/climate/drought/#tabs2=Rainfall-deficiencies</u>.
 Howden, Mark, et al. "The changing roles of science in managing Australian droughts: An agricultural perspective." *Weather and Climate Extremes* 3 (2014): 80-89.
 NSW Government. "Riverina-Murray." *NSW Regional Investment*, Department of Premier and Cabinet, 2018, www.investregional.nsw.gov.au/regions/riverina-murray/.
 Tench, Watkin. A Complete Account of the Settlement at Port Jackson, in New South Wales: Including an Accurate Description of the Situation of the Colony, of the Natives, and of Its Natural Productions. Cambridge University Press, 2011.





APPENDIX 1. DRILLER REPORT, PROPERTY 1

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APPENDIX 2. DRILLER REPORT, PROPERTY 2

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APPENDIX 3. DRILLER REPORT, PROPERTY 3

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APPENDIX 4. LETTER FROM CLIENT Mr. H

To whom it may concer	n
Robert Gourlay has may the bores were success quality and depth. His s	pped and sited three individual bores on three of our properties. In each case ful and the information supplied was accurate in regards to location, water ervice was excellent in all regards
The bores are on the fo	llowing properties.
Bellandale, Booths Lane	r, Temora 2666
Location – 5557398E, 6	196857N
Lillianfells, Narruburra,	Temora 2666
Location – 341650385, 3	147384393E
Bogan Villa, Trungley Ha	all Temora 2666
Location – 555719E, 620	09012N
Please find attached all	necessary documentation.
Regards	