CASE STUDY
MINAKI PROPERTY – ORANGE, 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

Drought is a common, recurring climatic hazard in virtually all regions of the earth, affecting more people than any other natural hazard (Hagman 1984). The effects of drought can be far reaching, and have implications on water resources, ecosystems, agriculture, economy, and society in the affected areas. (Wilhite 2000).

Australia is Earth's driest inhabited continent and characterized by highly variable rainfall patterns. Drought has been a critical issue for farmers and other agricultural producers since the time of Australia's European colonization (Howden 2014, Tench 1793). Despite the extensive history of drought on the continent, it continues to create profound societal effects, including increased suicide rate for farmers and farm workers (Hanigan et al 2012, Page et al 2002). Subsequently, Australian farmers continue to look for and evolve effective methods to manage and mitigate the effects of drought on their lands (Howden 2014, Meinke and Stone 2005, Stone et al 2003).

ROLE OF GIS Analytics (GISA) Company Group

The GISA Company Group aims to help farmers and rural communities combat drought by identifying groundwater resources. This is accomplished via specialized, proprietary techniques to detect previously unknown sources of groundwater. Through the identification and proper management of these resources, GISA strives to strengthen drought resilience.

MINAKI PROPERTY, ORANGE NSW

Charles Smith, a farmer located near Orange NSW, was in the midst of a drought in 2019 when he reached out to the GISA Group for groundwater locating services. The NSW government had the entire surrounding region categorized as either drought affected (intensifying) or in drought. Smith had "six (6) wells dug over twenty years on [his] property, and they all came up with dust and no water".

METHODS

The GISA team collected both raw and processed geospatial datasets from available sources including satellite imagery, digital elevation, radiometrics, geology, geophysical, etc.

Next, the GISA team used proprietary techniques and algorithms 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.

Figure 1. Process model of groundwater detection methodology

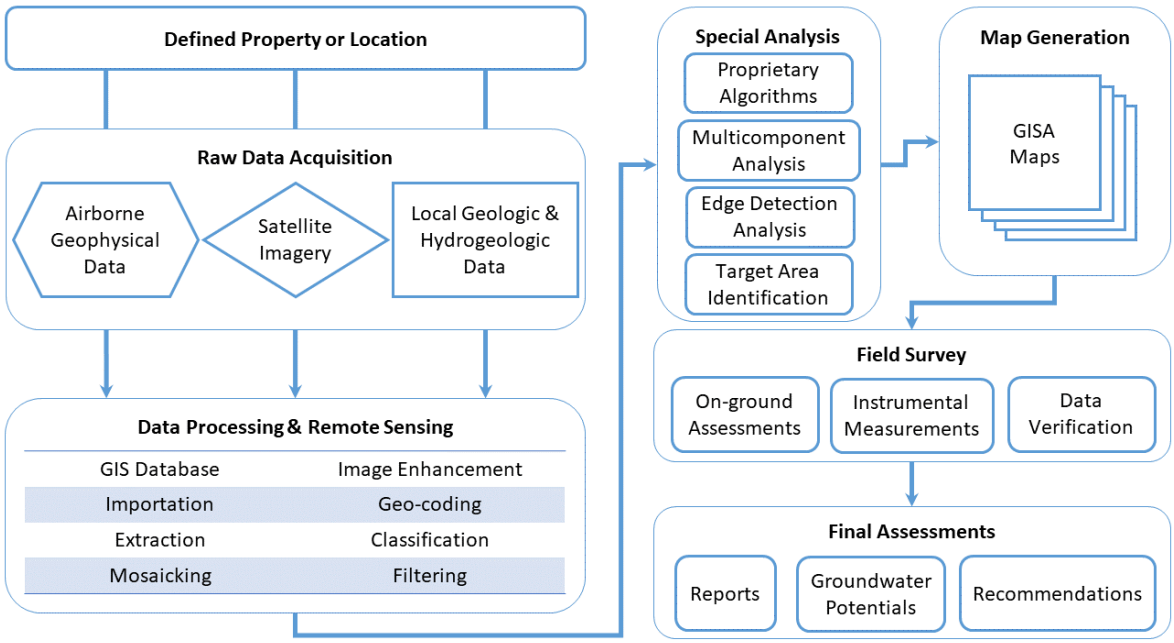
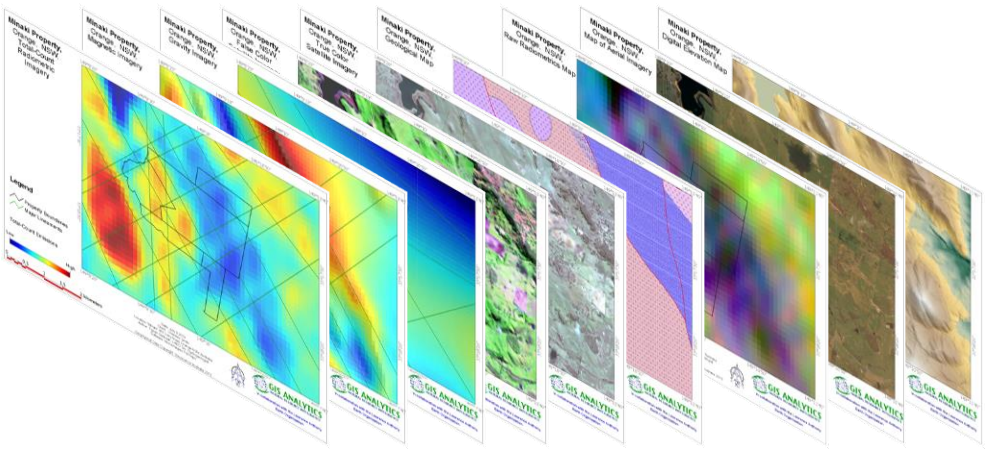


Figure 2. Specialized Maps created for Minaki Property



RESULTS

Based on the remote study using its advanced geospatial analysis techniques and subsequent a field survey, GISA recommended two sites for exploratory well drilling (Figure 3).

As part of its ground assessment, GISA advised a bore depth between 120-280 meters and estimated a flow rate of 2'900 gal/hour at 120 m depth.

Given the recommendations and other accompanying data, the client pursued a well at the first site. The drilling occurred on 14 August 2019 to a depth of 131 m and a flow rate of 3'000 gallons per hour was successfully attained.

While it was advised that Smith could keep drilling for larger flow volumes, the 3'000 gallons per hour met his needs, and he chose to terminate the drilling at that point.

"It was a wonderful relief to find good water after 6 dusty dry holes."
- Charles Smith, Landowner

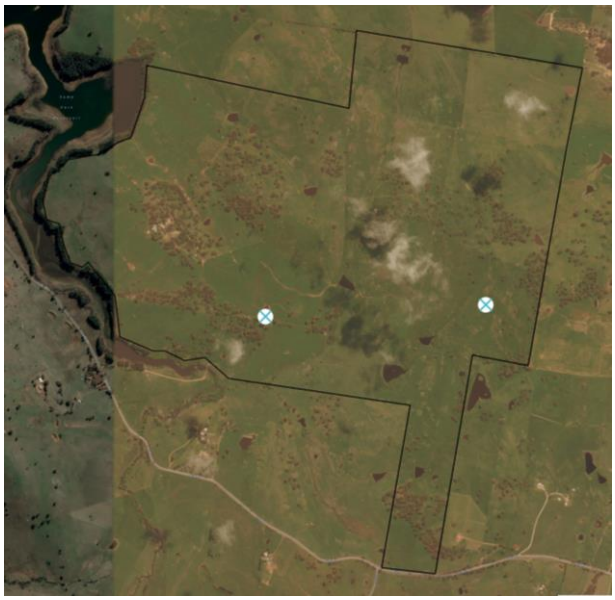


Figure 3. Recommended potential bore sites on Minaki Property

Figure 4. Drill rig drilling western potential bore site on Minaki Property, 14 Aug 2019.

REFERENCES

1. Hanigan, Ivan C., et al. "Suicide and drought in new South Wales, Australia, 1970–2007." *Proceedings of the National Academy of Sciences* 109.35 (2012): 13950-13955. **2.** Howden, Mark, et al. "The changing roles of science in managing Australian droughts: An agricultural perspective." *Weather and Climate Extremes* 3 (2014): 80-89. **3.** Meinke, Holger, and Roger C. Stone. "Seasonal and inter-annual climate forecasting: the new tool for increasing preparedness to climate variability and change in agricultural planning and operations." *Climatic change* 70.1-2 (2005): 221-253. **4.** Page, Andrew, S. Morrell, and R. Taylor. "Suicide and political regime in New South Wales and Australia during the 20th century." *Journal of Epidemiology & Community Health* 56.10 (2002): 766-772. **5.** Stone, G., et al. "Preventing the 9th degradation episode in Australia's grazing lands." *Science for Drought, Proceedings of the National Drought Forum'.(Eds R. Stone and I. Partridge.) pp*. 2003. **6.** 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. **7.** Wilhite, Donald A. "Drought as a natural hazard: concepts and definitions." (2000).

APPENDIX 1. DRILLER REPORT

Central West Water Bores

ABN: 623445741
Orange NSW 2800
Phone – 0402 980 000

Description of Drilling

Name:	Charlie Smith.	Date:	14-8-19
Address:	457 Icely Road. Orange	Bore License:	
		Drillers License:	2330

From	To	Description
0	1	Top soil.
1	17	brown clay
17	23	decomposed basalt.
23	131	basalt with quartz bands.

Water Cuts	28 - 42	70-72	95-96	108-114	124-125
Thickness	4	2	1	6	1
Supply	920	300	200	400	1200

Total Water Supply	3,000 g.p.h.
Recommended Depth of Pump	

GPS Coordinates	

Static Water Level	5 M
Casing Size	150 MM.
Cased to	131 M
Casing Above Ground	.5 M
Fixing Casing in Hole:	Cement Clamped On Bottom ✓ In Rock
Casing Slotted	33-42, 48-54, 66-72, 90-96, 108-114, 120-129.

Please note that water supply on airlift test only. Pump test should be completed to confirm continuous water supply.

Notes:

flow rate at different depths. 30M = 720 gph — 36M = 900 gph. 42M = 1000 gph. 54M = 1200 gph. 60M = 1400 gph. 78M = 1800 gph. 96M = 2400 gph. 120M = 3000 gph.

Prepared By: [signature]