



22<sup>nd</sup> August 2024

## GROUND PENETRATING RADAR GEOPHYSICAL INVESTIGATION TO IDENTIFY POTENTIAL UNMARKED BURIALS ON WADJEMUP (ROTTNEST ISLAND), WESTERN AUSTRALIA.

### (EXECUTIVE SUMMARY)

#### ACKNOWLEDGEMENT OF COUNTRY

McMullen Nolan Group (MNG) acknowledges the Traditional Owners and Custodians of the land on which these works are situated—the Whadjuk Noongar People. MNG pays respects to their Elders, both past and present, as well as those emerging. The known Wadjemup Aboriginal Burial Ground is of exceptional significance to not only the Whadjuk Noongar People, but many more Aboriginal nations across what is now known as Western Australia. Through these works, MNG is dedicated to taking a significant step towards recognition, reconciliation, and healing for Aboriginal people.

#### INTRODUCTION

The Wadjemup Project, led by the Rottnest Island Authority (RIA) engaged MNG SubSpatial (MNG) for a comprehensive geophysical investigation across designated areas, including the Wadjemup Aboriginal Burial Ground (WABG). The objective was to locate burial-like anomalies within these areas using modern archaeological geophysics techniques. This investigation aims to apply modern technology used in archaeological geophysics and advances in both equipment and software to reinvestigate the extent of the WABG and surrounding areas

#### PREVIOUS GPR SURVEYS

There have been two previous GPR surveys conducted on the Wadjemup Aboriginal Burial Ground. The first from 1991-93 and a second in 2004-05, both lead by Vernon Wilson of Curtin University and URS. These surveys were performed to the best practice with the technology available at the time. However, new more advanced GPR and software is available today.

#### GROUND PENETRATING RADAR (GPR) METHOD

Ground Penetrating Radar (GPR) is the most used technique to identify unmarked burials globally. A simple ground penetrating radar consists of a transmitting antenna and a receiving antenna. The transmitting antenna shoots a pulse of radar energy into the ground. The radar energy is reflected when there is a change in the electrical properties of the ground and the receiving antenna 'listens' to the response from the earth and records the reflections.

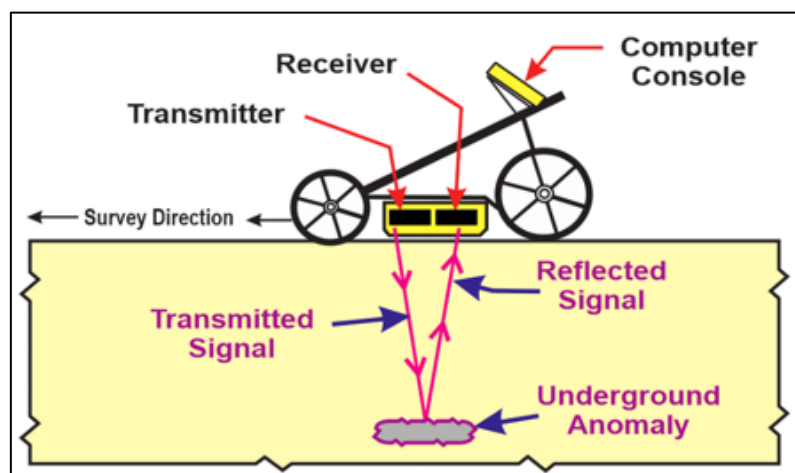


Figure 1: How Ground Penetrating Radar works.

There are a lot of things that can cause a change in the electrical properties and a reflection in GPR;

- foreign objects such as tree roots, utilities and buried remains
- Ground that has been disturbed by human activity
- The water table
- Boundary between sand and rock
- Natural cavities within the rock

As the operator pushes the GPR cart forward, a 2D scan of the subsurface is generated.

#### **NEW GPR EQUIPMENT – STREAM DP**

MNG used a high-tech GPR device called the IDS GeoRadar Stream DP to scan the ground. The Stream DP has a special antenna with 30 channels that can capture information in different directions, both along the path of movement and across it, almost like painting a picture of what's underground.

MNG collected the data by pushing the device by hand at a steady pace along paths that were 0.5 meter apart. A wheel attached to the device measured the distance we traveled to keep track of exactly where we were. A GPS was used to make sure we knew our exact location while collecting the data, which helped us map everything accurately.

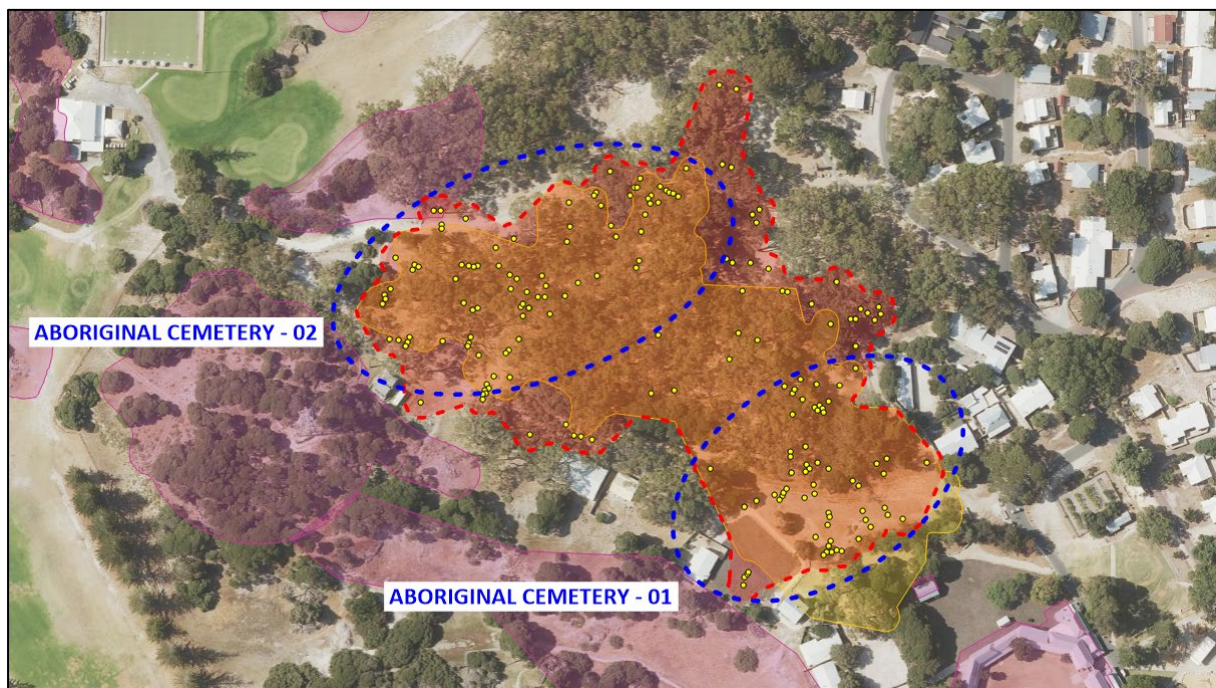
The Stream DP was released in July 2022 and is currently one of the most advanced ground radar systems available. Figure 2 illustrated the equipment onsite on the WABG.



**Figure 2: New advanced Ground Penetrating Radar (STREAM DP) at the Wadjemup Aboriginal Burial Ground.**

## NEW WABG RESULTS

- The geophysical survey was conducted from March to July 2024 by a team from MNG, including geophysicists, surveyors, utility locators, and field technicians.
- The work completed by MNG SubSpatial involved the following:
  - GPR Survey using current state of the art 3D multi-channel unit (StreamDP), linked with high precision GPS.
  - Quality Level B utility locating, using single-channel GPR and electro-magnetic induction locator.
  - Qualified surveyors used Total Station with multiple base station setups to maintain enhanced accuracy in relocating the GPR data and identified utilities.
- MNG used advanced GPR technology and accurate GPS, which helped us map burial-like features more precisely than before. Older surveys used less advanced equipment and simple tools like tape measures and compasses. This often resulted in unclear data, making it difficult to tell burials apart from other underground features like utility trenches or tree roots.
- It's important to understand that not everything detected by GPR is a burial. Tree roots or broken limestone can also show up. However, in the newly proposed area of the Wadjemup Aboriginal Burial Ground (WABG), MNG identified 188 spots that have burial-like anomalies. Some of these spots might have more than one burial, so we can't know the exact number of buried individuals.
- Some areas couldn't be scanned because of obstacles like trees planted after the burials, meaning there could be more burial-like features that we couldn't detect.
- Figure 3 illustrates the anomalies MNG has identified. One could conclude the two known Aboriginal cemeteries have been identified, outlined in blue. Anomalies have been identified outside these areas. However, the grouping matches the historical records, considering the second Aboriginal cemetery is approximately 200m north-west of the Quod.



**Figure 3: Identified burial-like anomalies (yellow) and potential historic Aboriginal cemeteries (blue).**

- The newly identified WABG extent, is based on the newly acquired and very accurate GPR data and the interpreted subsurface geology. It is likely no additional burials extend beyond the northern boundary. This is based upon the low water table evident in the GPR data in north-west section (golf course) and the near-surface limestone directly north of the current access road to the club house and across the oval to the northeast.
- MNG Subspatial has suggested a new boundary for the Wadjemup Aboriginal Burial Ground, adding a 5-meter buffer around each identified burial-like spot. We also respected the previously determined boundaries, even if they were outside the areas where we found features, because earlier findings couldn't be disproved. The only exception is the southern end of the burial ground, where features found in 1991 were related to utilities installed on the site, see Figure 4.



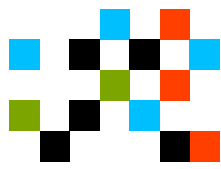
**Figure 4: Identified underground utilities across the WABG, overlaid with the 1991 and 2004 anomaly shape files (green).**

#### **AUTHORSHIP**

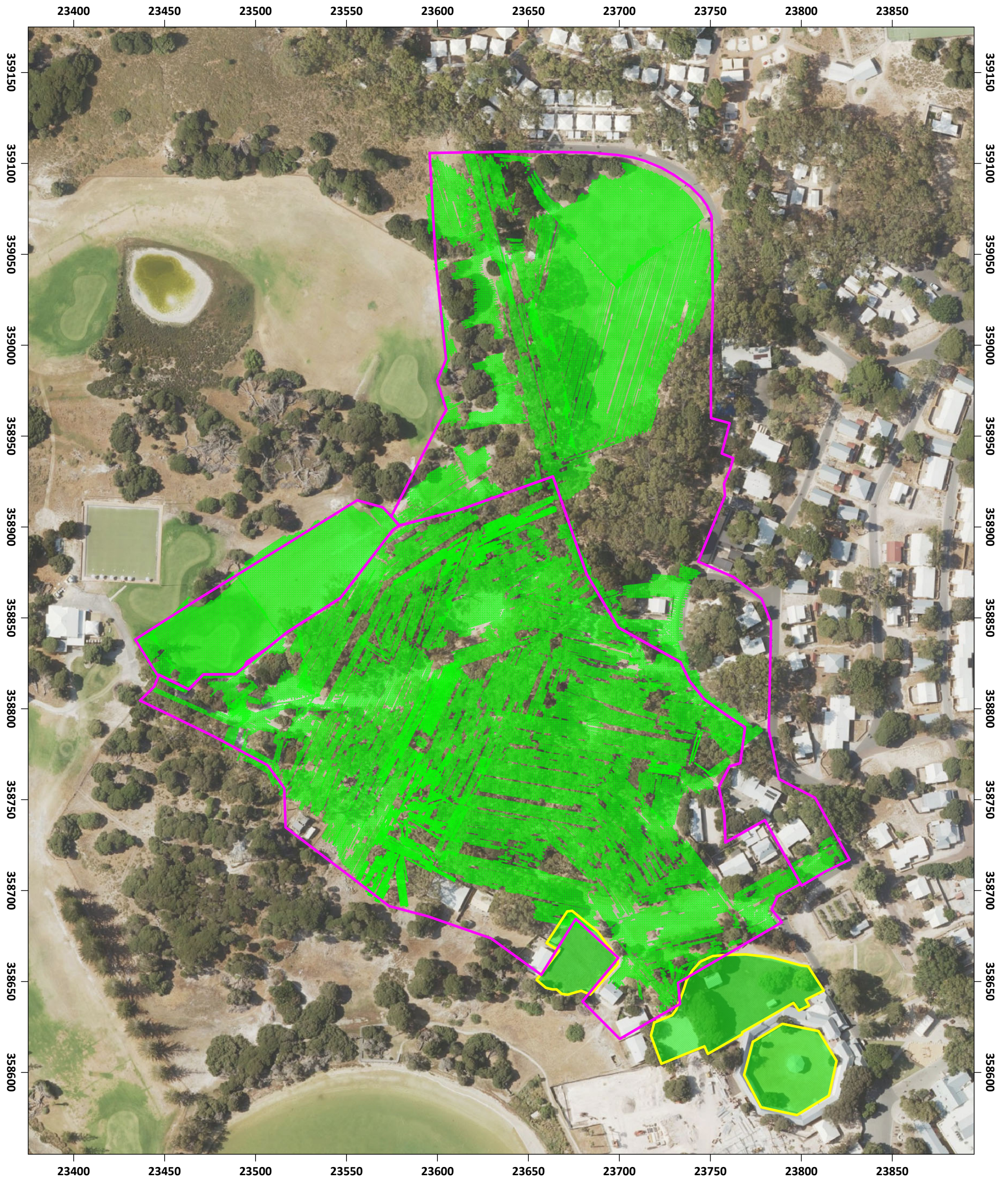
This report was written by Tavis Lavell on behalf of MNG Subspatial and reviewed by Dominic Howman.

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Dominic Howman (BSc Physics, Grad Dip Geophysics)  
*Geophysicist*



**GEOPHYSICAL INVESTIGATION - WADJEMUP**  
**SITE PLAN - GPR DATA ACQUISITION: SP1, SP2, & SP3**



Scale: 1:2,000  
**METRES (m)**  
 0 20 40 60 80 100  
 Paper Size: A3

**LEGEND:**

- GPR Data Coverage**  
 (Acquired by MNG, Mar-July 2024)
- RIA Survey Extent**  
 (Mar-July 2024)
- RIA Survey Extent**  
 (Jan 2024)



Drawing to be used in conjunction with Report 106233.  
 Image Source: MetroMap 01/12/2023

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Rev.	Description	Drawn	Date	Checked
A	Initial Issue	NWH	01/08/2024	TLA

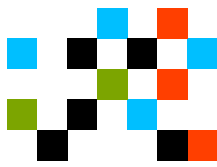
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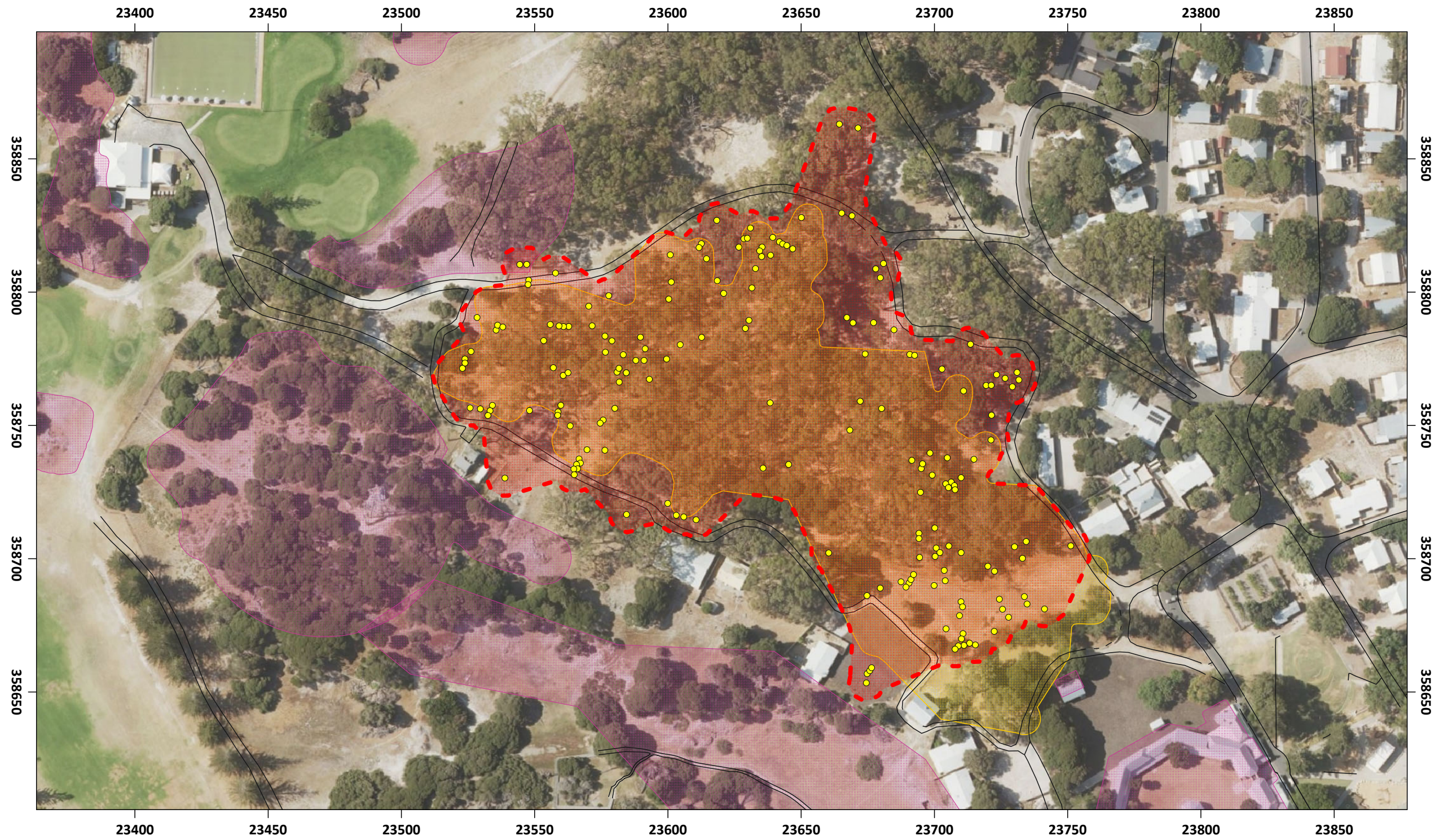
Offices in: Perth | Melbourne | Broome | Bunbury  
 ABN: 90 009 363 311

<b>Title:</b> GEOPHYSICAL INVESTIGATION TO IDENTIFY UNMARKED BURIALS AT WADJEMUP (ROTTNEST ISLAND) WA.			
<b>Client:</b> ROTTNEST ISLAND AUTHORITY	<b>Proj. Mngr.:</b> TLA	<b>Datum:</b> PCG2020 / AHD	<b>Drawing:</b> 106233-02



# GEOPHYSICAL INVESTIGATION - WADJEMUP

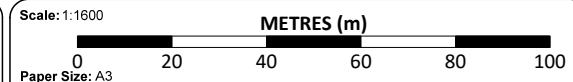
## IDENTIFIED GPR BURIAL-LIKE ANOMALIES



**LEGEND:**

- Identified GPR Anomalies (Potential Unmarked Burials) (2.2m in diameter)
- WABG Heritage Area - Current Extent
- WABG Heritage Area - Proposed New Extent
- Aboriginal Cultural Heritage Areas
- Access Tracks
- Walkways and Road

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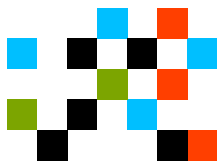
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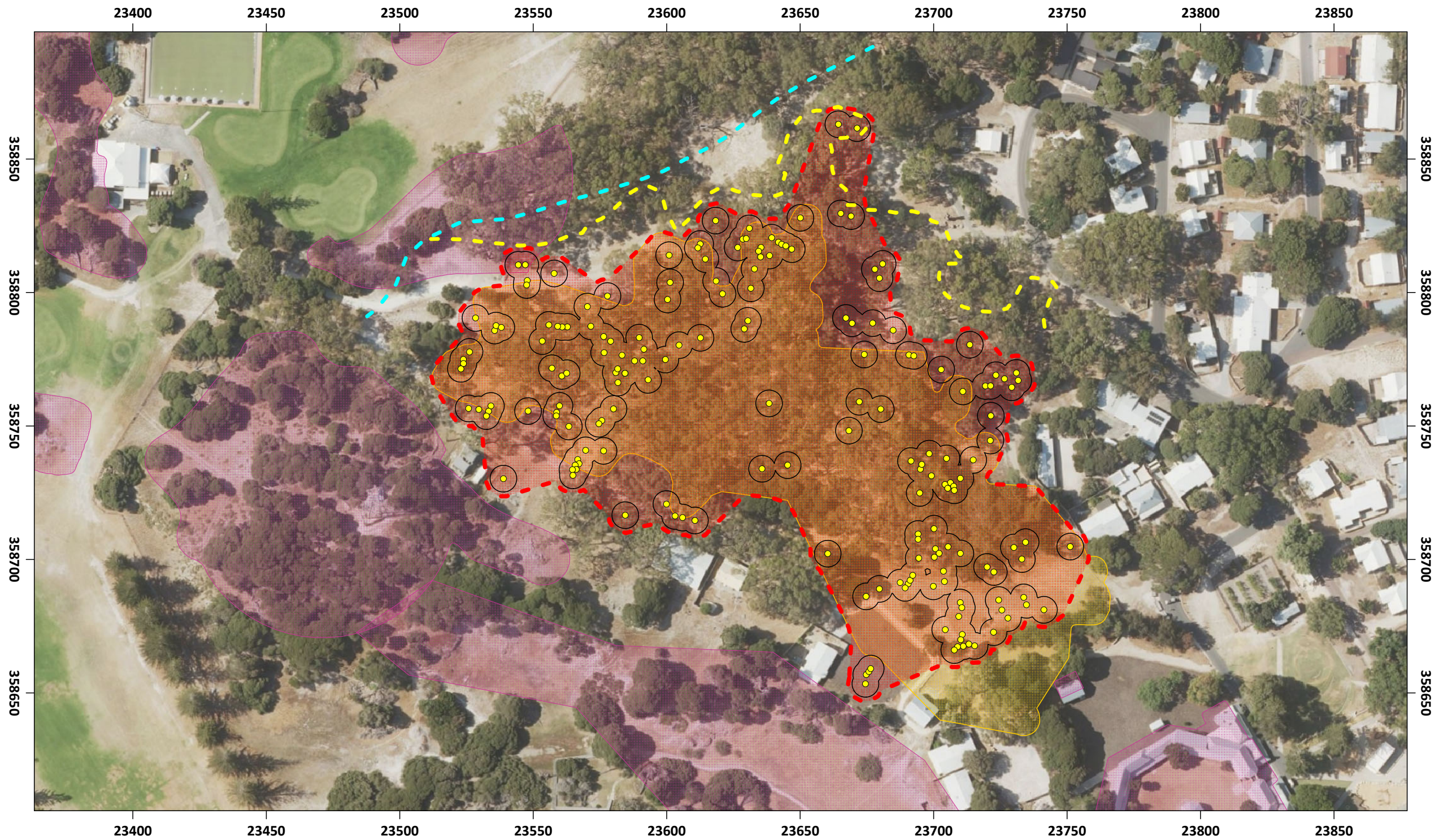
Proj. Mngr.	TLA	Datum	PCG2020 / AHD
Drawing:			<b>106233-04</b>

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A	Initial Issue	NWH	01/08/2024	TLA



# GEOPHYSICAL INVESTIGATION - WADJEMUP

## BOUNDARY DETERMINATION

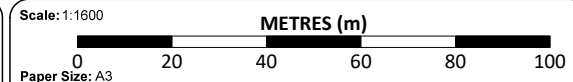


### LEGEND:

- Identified GPR Anomalies (Potential Unmarked Burials) (2.2m in diameter)
- 5m Radius Buffer
- WABG Heritage Area - Current Extent
- WABG Heritage Area - Proposed New Extent
- Aboriginal Cultural Heritage Areas
- Access Tracks
- Walkways and Road
- Approximate Boundary of Shallow Limestone Bedrock
- Approximate boundary of Shallow Water Table

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Rev.	Description	Drawn	Date	Checked
B	Revision B	NWH	20/08/2024	TLA
A	Initial Issue	NWH	01/08/2024	TLA



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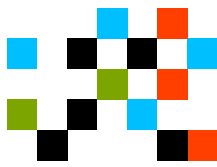
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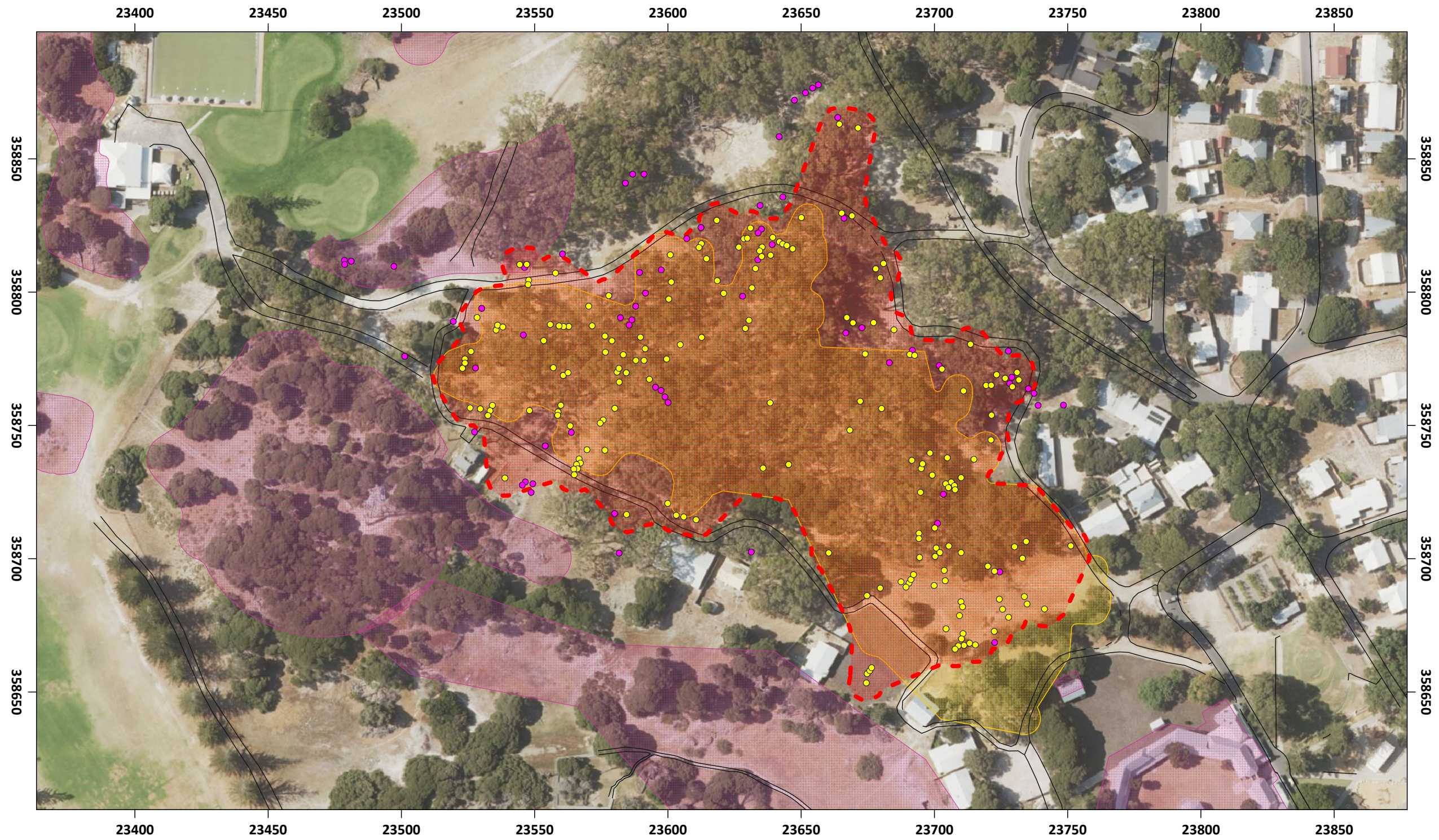
Proj. Mngr.	TLA	Datum	PCG2020 / AHD

Drawing: **106233-06**



# GEOPHYSICAL INVESTIGATION - WADJEMUP

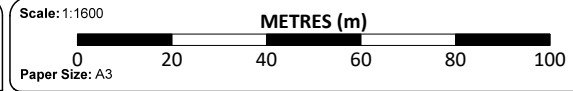
## ALL IDENTIFIED GPR ANOMALIES AND FEATURES OF INTEREST



**LEGEND:**

- Identified GPR Anomalies (Potential Unmarked Burials) (2.2m in diameter)
- Identified GPR Feature of Interest (NOT an Unmarked Burial) (2.2m in diameter)
- WABG Heritage Area - Current Extent
- WABG Heritage Area - Proposed New Extent
- Aboriginal Cultural Heritage Areas
- Access Tracks - Walkways and Road

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		<b>Drawing:</b> 106233-08	