HISTORICAL ARCHAEOLOGICAL ASSESSMENT

WINX STAND - LEGER LAWN, ROYAL RANDWICK RACECOURSE

3 FEBRUARY 2020
P0005973
FINAL
PREPARED FOR THE AUSTRALIAN TURF CLUB

URBIS

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EXECUTIVE SUMMARY

Urbis have been commissioned by the Australian Turf Club (ATC) to prepare a Historical Archaeological Assessment (HAA) for the proposed Winx Stand at the Leger Lawn, in the north western section of the Royal Randwick Racecourse Lot 2009 DP 116904 (hereafter referred to as 'the subject area') Figure 1 and Figure 2). The subject area is within the bounds of Randwick Council Local Government Area (LGA) and encompasses the proposed development with a reasonable buffer to ensure that this HAA provides adequate assessment of proposed impacts. The subject area is approximately 4.5km south east of the Sydney CBD and covers an area of approximately 8,000 square metres (m^2).

The current environment of the subject area consists of cleared and levelled lawn area, bound by the Paddock Stand and the race circuit from east and south, and a temporary race stall and permanent multi-level carpark from the west and north.

This HAA was prepared to investigate whether the proposed activities will harm relics as identified under the *Heritage Act 1977 No 136* (Heritage Act) that may exist within the subject area.

This HAA has been informed by the existing CMP:

- Godden Mackay Logan, 2006. *Royal Randwick Racecourse Conservation Management Plan.* Report for AJC.

This HAA has assessed the historical archaeological potential of the subject area. Aboriginal archaeological and cultural heritage investigations were carried out under an Aboriginal Cultural Heritage Assessment (ACHA) and provided as a separate document for ATC. The ACHA has concluded that there are moderate to high potential for aboriginal objects and archaeological resources within the subject area and therefore recommended staged salvage excavation to be carried out as part of further investigation of those resources.

The subject area has seen multiple stages of continuous activity since the area was first reserved to be used for a racecourse in 1832. The subject area has been the part of the Spectator Precinct of the racecourse and included various previous structures including three stages of the St Leger Stand, the Queen's Stand and a scratching tower existed between the 1910's and the 1970's. There is low potential that subsurface remains of those structures are still present within the subject area.

The HAA concluded that:

- The subject area is located within the Spectator Precinct of the Royal Randwick Racecourse.
- The subject area does not have any surface archaeological potential due to the placement of approximately 1 m imported fill on the location.
- The south-western section of the subject area has low potential for the subsurface remains of the three stages of the St Leger Stand. The last stand was demolished in 1986.
- The centre section of the subject area has low potential for the subsurface remains of a scratching tower that was operational between the 1910's and 1970's.
- The north-east section of the subject area low potential for the subsurface remains of the Queen's Stand built in 1910 and demolished in 1998.
- The HAA found that the subsurface remains have no archaeological potential due to the high level of disturbance resulted in low structural integrity caused by the demolition of the structures.
- The HAA found that there is no potential for relics associated with the subsurface remains of the previous structures and consequently there is no historical archaeology of significance at the Leger Lawn.

Based on the above conclusions, we recommend the following:

1. The proposed construction of the Winx Stand will not have impact on historical archaeological resources and the development can proceed with the Chance Find Procedure outlined below.
2. In the event of uncovering any archaeological resources including relics, the following Chance Find Procedure must be implemented:

- Stop work and demarcate affected area.
- Contact a suitably qualified archaeologist or heritage consultant to provide advice and assess the finds.
- Notify the Heritage Council of NSW under Section 146 of the *NSW Heritage Act 1977* if the finds are assessed as relics under the *NSW Heritage Act 1977*.
- Provide an appropriate archaeological management plan to manage the identified relics.
- Resume work only when the proposed management plan has been applied and written clearance is provided.

1. INTRODUCTION

1.1. AUTHOR IDENTIFICATION

This document has been prepared by, Meggan Walker (Urbis Heritage Consultant and Archaeologist) and reviewed by Balazs Hansel (Urbis Associate Director/Archaeologist).

1.2. SITE LOCATION AND DESCRIPTION

The proposed development is located within the Randwick Racecourse on the Leger Lawn, in the north western section of Lot 2009 DP 116904 (hereafter referred to as 'the subject area') (Figure 1 and Figure 2). The subject area is within the bounds of Randwick Council Local Government Area (LGA). The subject area is approximately 4.5km south east of the Sydney CBD and covers an area of approximately 8,000 square metres (m^2).

The current environment of the subject area consists of cleared and levelled lawn area, bound by the Paddock Stand and the race circuit from east and south, and a temporary race stall and permanent multi-level carpark from the west and north.

1.3. PROPOSED DEVELOPMENT

The proposed works will involve the construction of a new public, multipurpose facility, will be known as the Winx Stand at the site. The construction of the new facility will involve the construction of pylons that will penetrate the existing ground surface to the depth of 10 m, excavation and site preparation works, construction of facilities and associated utilities, landscaping and terrace planting (Figure 3). Overall, the proposed Winx Stand development is summarised as:

- Construction of a two-storey multi-purpose facility comprising:
    - An approximate 3,546sqm footprint and maximum building height of 19.8m.
    - An approximate total 5,043sqmGFA (Ground level – 3,255sqmGFA, Upper level – 1,788sqmGFA).
    - Upper level outdoor terrace and balcony space.
    - Maximum internal capacity for up to 7,500 patrons in Race Day mode (the proposed will cater for existing patronage and does not increase the overall approved maximum capacity of the racecourse).
    - Food and beverage facilities.
    - Entry foyer and Back-of-house facilities.
    - The Laneway.
    - Link bridge connecting to the QEII Grandstand.
- Demolition of the existing Temporary Day Stalls, minor earthworks and site preparation works.
- Associated landscaping and planting.
- Use of the facility on race days and minor non-race day events (consistent with conditions approved under MP10_0097_MOD 2)..

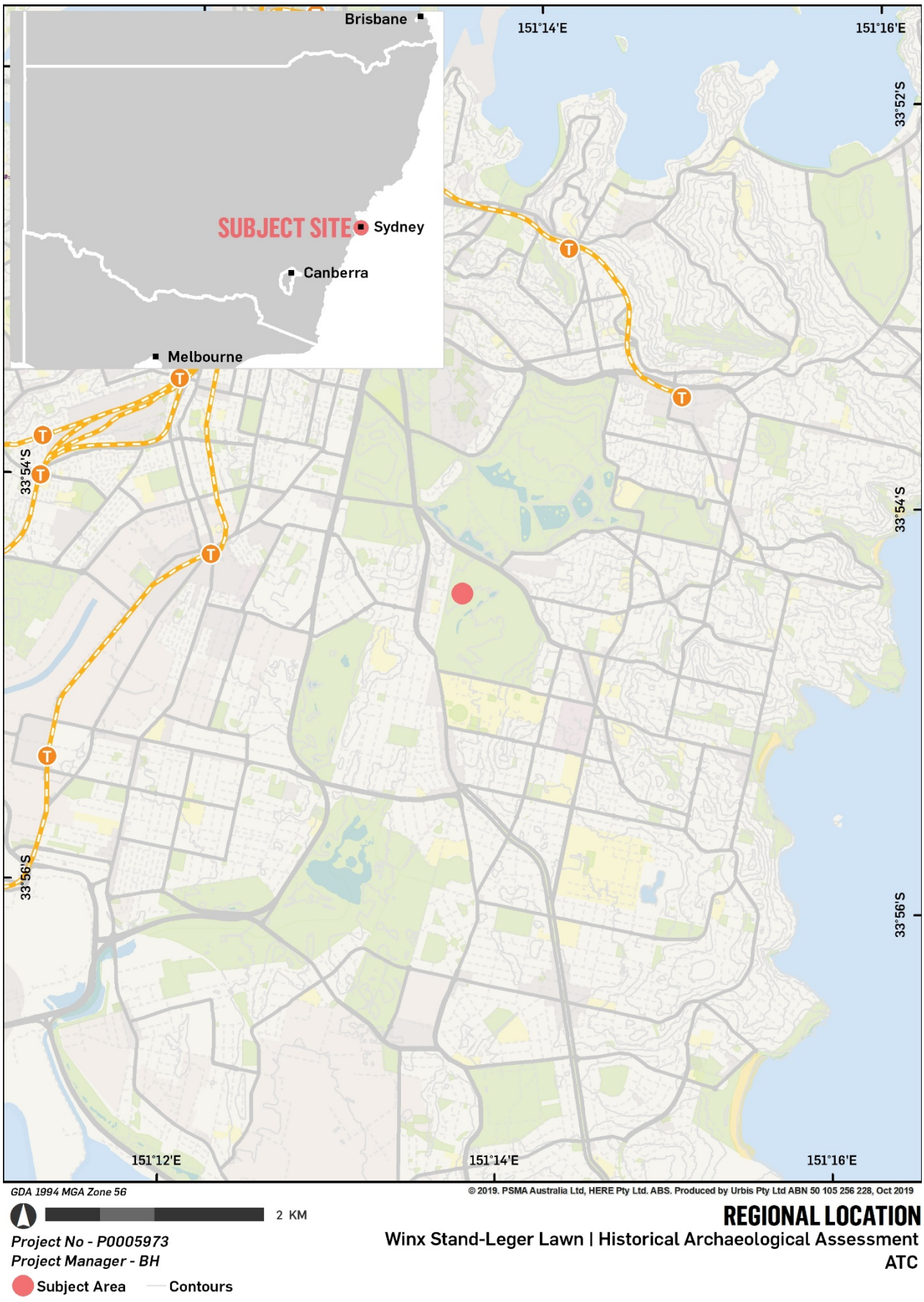

Figure 1 – Regional location

Figure 2 – Location of the subject area

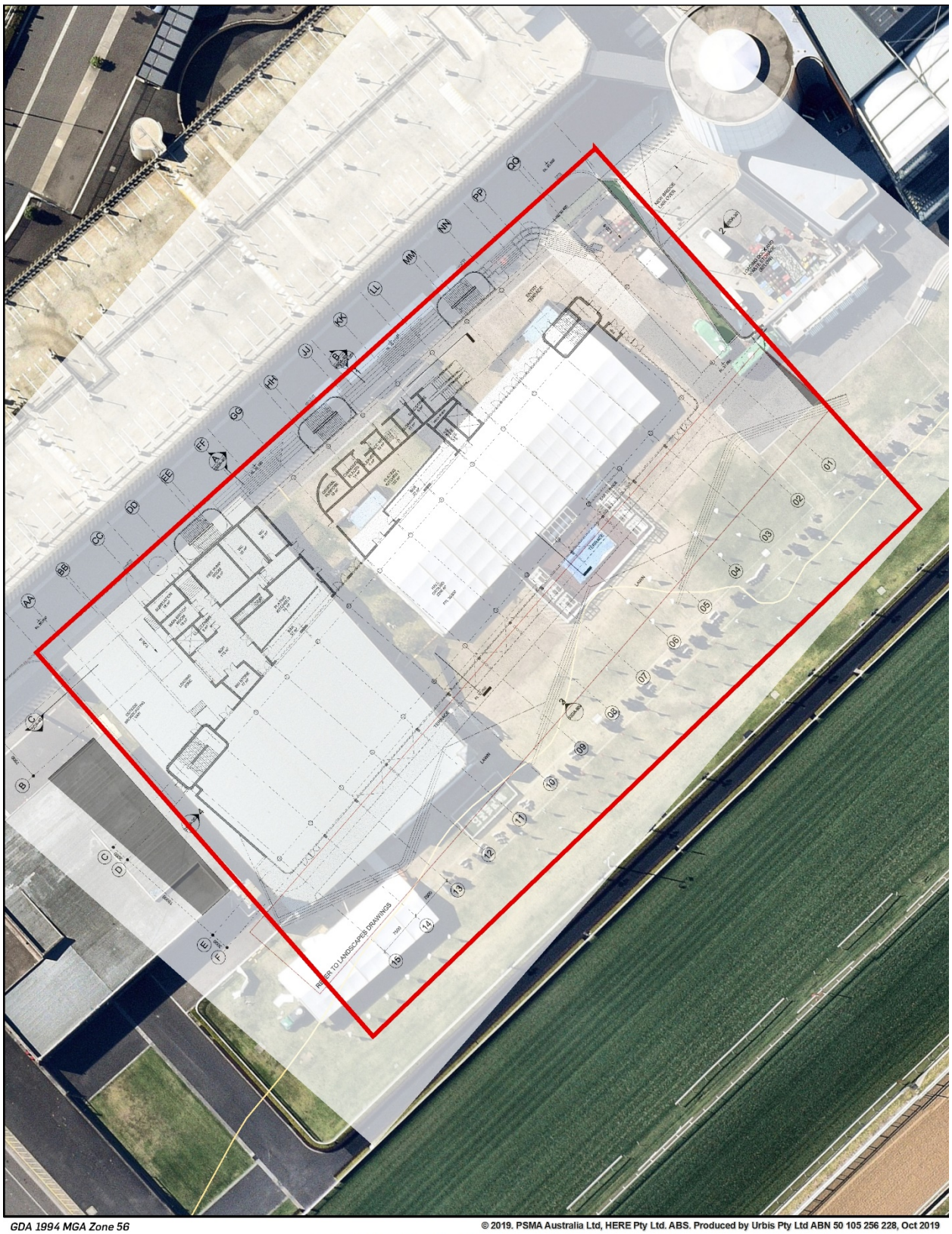

Figure 3 – Location of subject area and proposed development

2. STATUTORY FRAMEWORK

2.1.1. Heritage Act 1977 No 136

The Heritage Act is the primary State legislative instrument affording protection to items of environmental heritage (natural and cultural) in NSW. The Heritage Act is designed to protect both listed heritage items, such as standing structures, and potential archaeological remains or relics.

Under the Heritage Act, items of 'environmental heritage' include places, buildings, works, relics, moveable objects and precincts identified as significant based on historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic values. State significant items are listed on the NSW State Heritage Register (SHR) and are given automatic protection under the Heritage Act against any activities that may damage or affect their heritage significance. The SHR was established under Section 22 of the Heritage Act and is a statutory list of places and objects of importance to the people of NSW, including archaeological sites.

Under the Heritage Act (as amended), an application needs to be made to the Heritage Council in the event that it is proposed to disturb or excavate any land in NSW that is likely to contain archaeological remains.

Archaeological features and deposits are afforded statutory protection by the 'relics provision'. Section 4(1) of the Heritage Act (as amended 2009) defines 'relic' as follows:

> *any deposit, artefact, object or material evidence that:*
>
> *(a) relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and*
>
> *(b) is of State or local heritage significance.*

Section 139 to 146 of the Heritage Act require that excavation or disturbance of land that is likely to contain, or is believed may contain, archaeological relics is undertaken in accordance with an excavation permit issued by the Heritage Council (or in accordance with a gazetted exception under Section 139(4) of the Heritage Act). In addition, Section 139[1] of the Act states that:

> *A person must not disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed unless the disturbance or excavation is carried out in accordance with an excavation permit.*

In such cases, an excavation permit under section 140 is required. The Heritage Council can, under Section 139(4) of the Heritage Act, also grant an exception in certain circumstances from the need for a permit. Note that no formal listing is required for archaeological relics; they are automatically protected if they are of local or state significance.

A s146 Notification is required when a person has discovered or located a relic, even when a permit has already been issued.

2.1.2. Randwick Local Environmental Plan 2012

The Randwick City Council Local Environmental Plan 2012 (Randwick LEP) is relevant in relation to the control of development with regards to heritage within the subject area and surrounds. In relation to heritage, the LEP's objectives are to conserve the heritage of the Randwick area through the protection of the significance of heritage items, conservation areas, archaeological sites and Aboriginal places of significance. Schedule 5 of the LEP identifies places of heritage significance within the Randwick City Council LGA.

3. HERITAGE ENTRIES

This section outlines the results of the statutory and non-statutory heritage listings for the subject area and its surroundings. Figure 4 shows the location of the items and areas discussed below.

3.1. RANDWICK CITY COUNCIL LOCAL ENVIRONMENTAL PLAN (LEP) 2012

The Randwick City Council Local Environmental Plan (LEP) 2012 identifies heritage items and archaeological sites of local heritage significance.

A search of the Randwick LEP 2012 was completed on 28th August 2019. The subject area was identified as within the Randwick Racecourse Heritage Conservation Area (Item no. C13).

3.2. RANDWICK DEVELOPMENT CONTROL PLAN (DCP) 2013

A review of the Randwick Development Control Plan (DCP) 2013 was completed on 28th August 2019. Heritage is addressed in Section B2, which identifies the Objectives as:

> *"To clarify the consent requirements for the conservation of Aboriginal objects, Aboriginal places of heritage significance and archaeological sites [and] To provide detailed guidelines for change to heritage items and properties within heritage conservation areas, which will allow their heritage significance to be retained."*

Section B -1.2 addresses archaeological sites and identifies the need for development consent for disturbing or excavating an archaeological site whilst knowing or suspecting that it may result in the identification of relics being exposed, moved, damaged or destroyed.

Section B2- 4.12 discusses the Randwick Racecourse Heritage Conservation Area in particular. This section identifies the significance of the precinct, with specific reference to aesthetic, historical and social significance. While the subject area is not specifically mentioned as contributing to these areas of significance, the precinct is considered as a whole to be of importance (Randwick City Council, 2013).

3.3. NSW STATE HERITAGE REGISTER (SHR)

The State Heritage Register (SHR) lists items that have been assessed as being of State heritage significance to New South Wales. Items appearing on the SHR are granted protection under s.60 of the Heritage Act.

A search of the SHR was completed on 28th August 2019. There are no listed items located within the subject area.

3.4. STATE HERITAGE AND CONSERVATION (S.170) REGISTERS

Section 170 of the Heritage Act requires that State Government Agencies establish and maintain a Heritage Conservation Register for heritage items located on land under their control or ownership. Items listed on the s.170 Register are listed on the State Heritage Inventory (SHI) and bound by the regulations of the Heritage Act.

A search of the SHI was completed on 28th August 2019. No heritage items are listed on the register are located within the subject area.

3.5. AUSTRALIAN HERITAGE DATABASE

The Australian Heritage Database contains information about more than 20,000 natural, historic and Indigenous places including: places in the World Heritage List, Places in the National Heritage List, places in the Commonwealth Heritage list; and places in the Register of the National Estate (non-statutory). The list also includes places under consideration, or that may have been considered for any one of these lists.

A search of the Australian Heritage Database was completed on 28th August 2019. No places recorded on any of these lists were identified within the subject area. There were two sites within the racecourse precinct identified on these lists – these are the Queen's Stand (Place ID 100460), and the Member's Stand (Place ID

1752). The Queen's Stand, formerly known as the Ladies Stand, is no longer present having been demolished in 1998.

3.6. SUMMARY OF HERITAGE ENTRIES

The search of the Statutory and non-statutory heritage entries confirmed the following:

- The subject area is located within the Randwick Racecourse Heritage Conservation area, as listed on the LEP.
- No items were identified on any of the heritage lists as within the subject area.

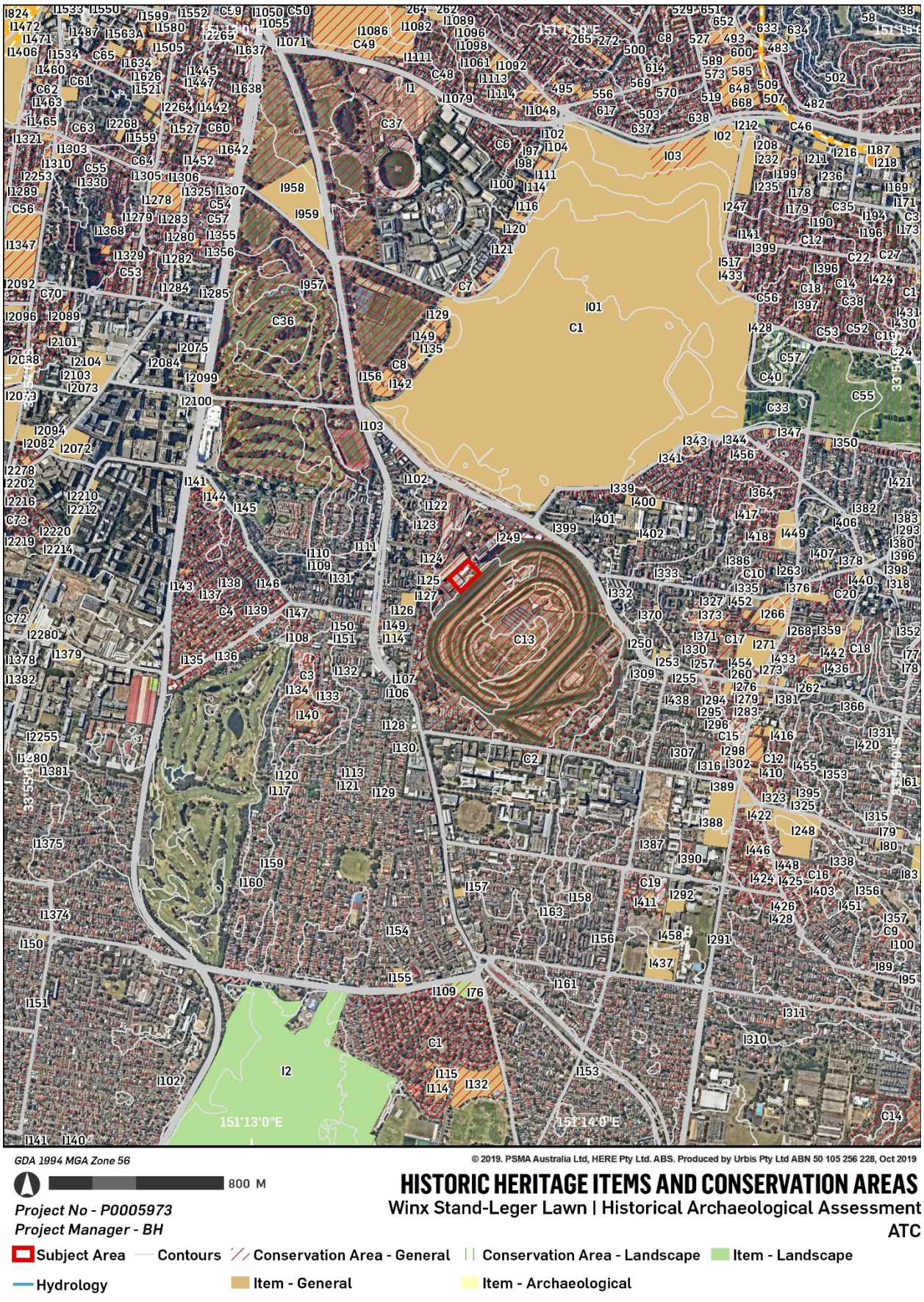

Figure 4 – Historic heritage items and conservation areas

4. HISTORICAL OVERVIEW

The history of the subject area from the creation of the racecourse has been extracted primarily from the Randwick Racecourse Conservation Management Plan prepared by Godden Mackay Logan (GML) in 2006 (GML 2006). Aboriginal cultural heritage and archaeological values are addressed in the Aboriginal Cultural Heritage Assessment (ACHA) (Urbis 2019).

4.1.1. Prior to the 1830's

European settlement within and to the east of the Lachlan Swamps was sparse in the early years of the colony due to the low-lying swampy conditions. By approximately 1817 the first roads in the area had been constructed to enable access from the Sydney settlement to the watchtower at Botany Bay. This early colonial road (now established as Frenchmans Road and Anzac Parade) is assumed to have followed an established Aboriginal route through the swamplands.

4.1.2. The Sandy Course and its abandonment 1832-1858

In 1832 a Committee was formed to oversee the establishment of a formal racecourse under the direction of the Surveyor General Major Thomas Mitchell and assistant surveyor Mortimer Lewis. The site chosen for the racecourse, at an unknown date, had previously been cleared and improved as a training track. The earliest plan of the Randwick Racecourse (Figure 5) shows a convict constructed oval course with associated early structure. The particulars of this early structure are not known and the plan itself was produced by later colonial architect Mortimer Lewis in 1832. From the location of the structure in the 1832 plan it would appear that it was located within or in the close vicinity of the current subject area.

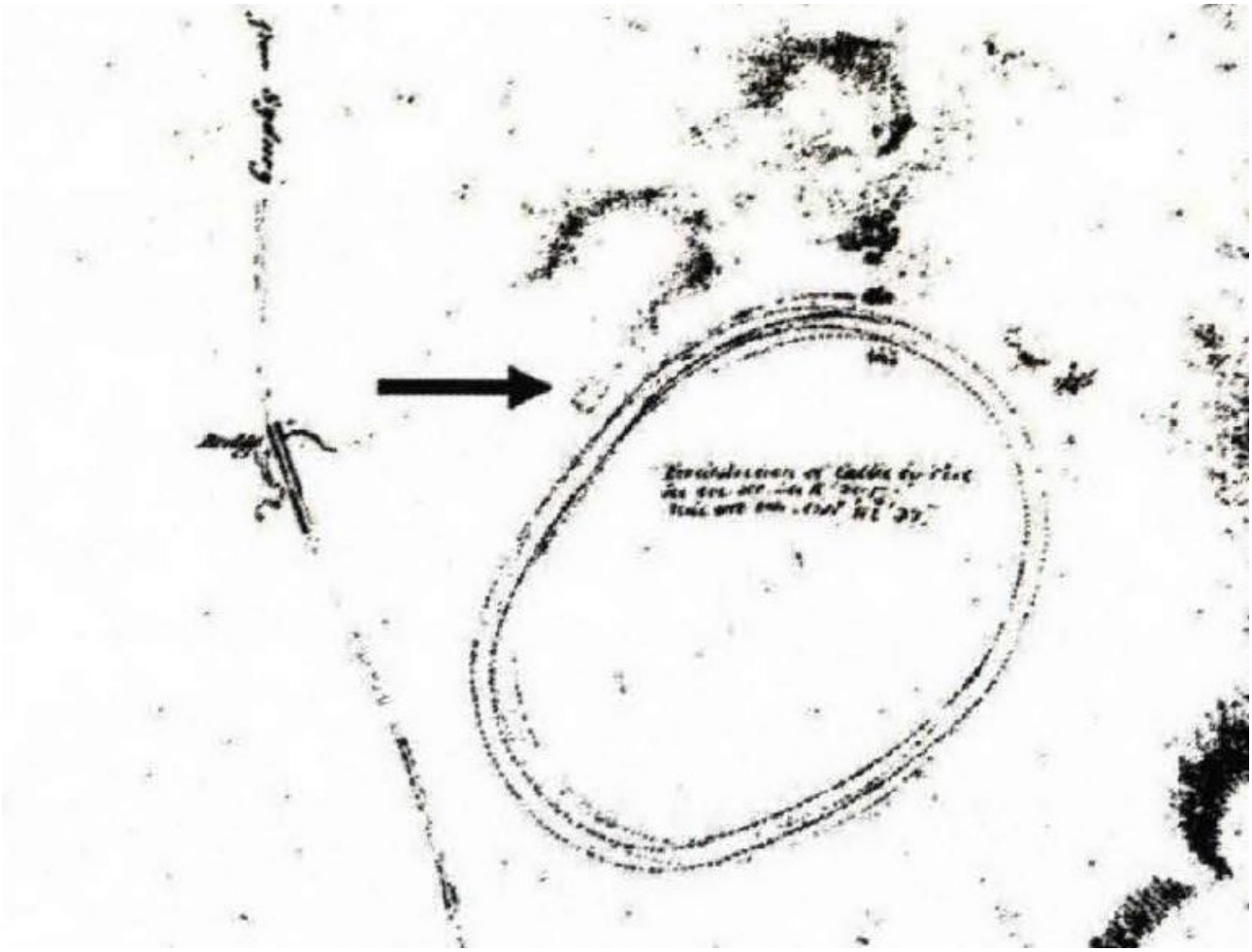

Figure 5 – Plan of oval racecourse and early structure.

Source: Plan by later colonial architect Mortimer Lewis, 1832, State Records Map No. 5538

The ‘sandy course’ was not conducive to racing and quickly fell into disrepair. The track was abandoned by 1838 due to the inability to maintain a good quality racing on the sandy, deteriorating track. Randwick Racecourse remained unutilised and in disrepair until refurbishment and further development commenced in the 1850s.

During the period of the Sandy Course, no structures are known to have existed within the subject area.

4.1.3. The revitalisation period 1858-1899

In the second half of the 1800s, the racecourse underwent a transformation. Growth of interest in horse racing in the colony led to the establishment of better facilities at Randwick, with further land grants in 1863 allowing the Australian Jockey Club (AJC) to feel secure in their tenure. This resulted in the formalising of the track and construction of spectator facilities including grandstands, amenities, refreshment rooms and bars. This had a cyclical affect, with improved facilities increasing interest in racing in the colony and increased interest leading to more security and thus the establishment of further facilities. In 1873, the AJC was given permission to charge admission to the racecourse, resulting in the construction of perimeter fences, walls and gates.

Overall, this was a period of widespread development for the entire racecourse. Within the subject area, this period saw the construction of the original St Leger Stands, both of which were built out of wood (Figure 6). The first stand was constructed in 1867 and demolished in 1882 to make way for the second St Leger Stand (Figure 7), which survived until 1910. These stands were made of wood and there is a low potential for any remaining parts within the subject area due to later development such as the construction of the last St Leger Lawn in 1911. Figure 8 shows the northern section of the St Leger Stand within the subject area and Figure 9 confirms that with additional structures are also included within the subject area including the Grand Stand and a small building in between the two stands.

This period of development at the racecourse not only established its supremacy in the colony as a recreational facility, but also opened up the areas of Randwick and Kensington, with improved roads and transport including the original steam tram required for transporting race-goers to and from the racecourse, and racing specific industry popping up within these area.

Figure 6 - View of the racecourse, before commencement of construction works in the mid-1870s. The St Leger Stand is at far left (demolished 1882); the 1860 Hilly Grandstand at centre (demolished 1875); and the Derby Stand at right (demolished 1880)

Source: State Library of New South Wales

Figure 7 – The second St Leger Stand in 1882. Note the substantial structural change compared to the first stand and landscaping in the foreground.

Source: AJC Library Collection

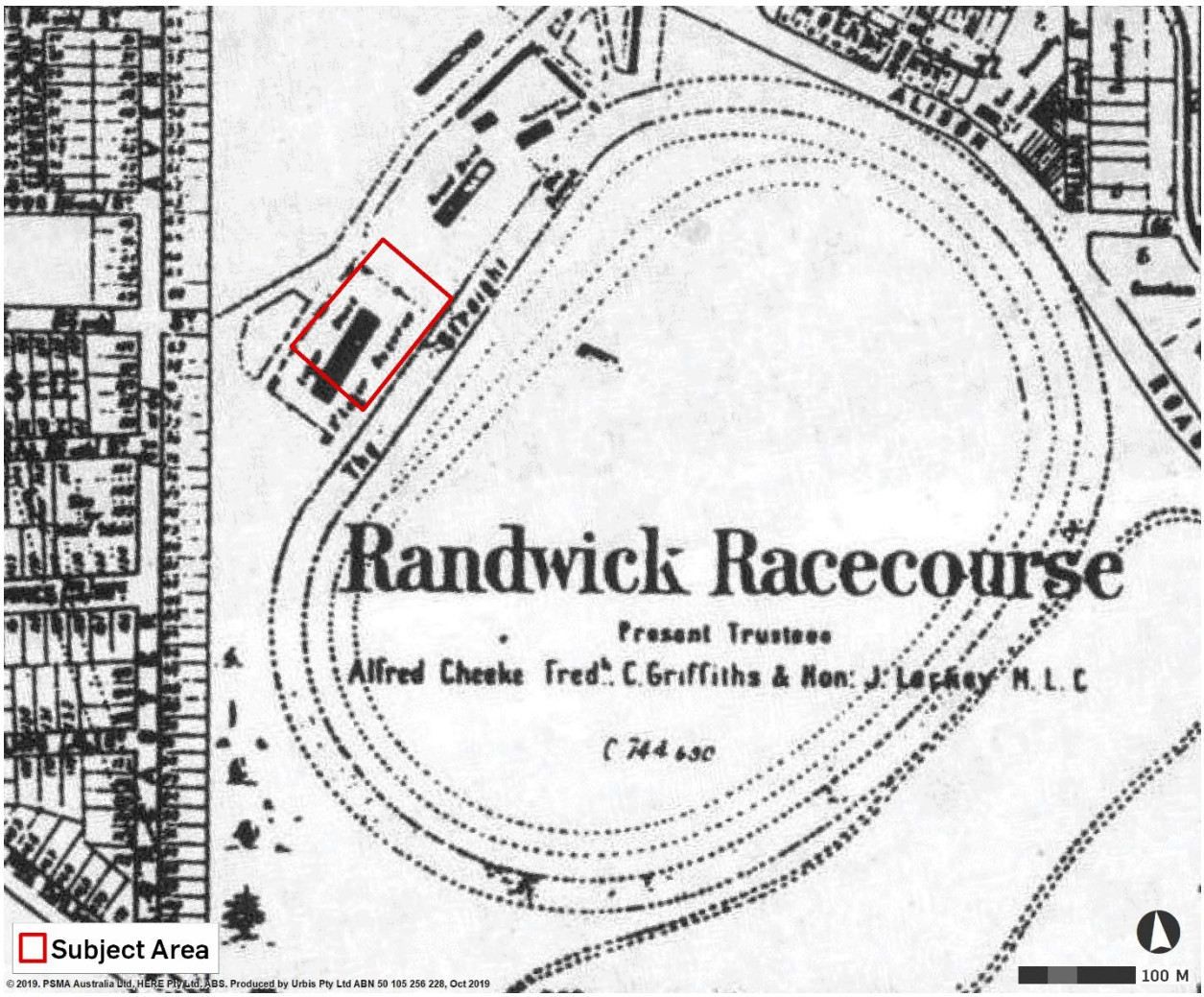

Figure 8 - Plan of the Randwick Racecourse, 1892, with the three stands (St Leger, Grandstand, and Official Stand) clearly identifiable in the north-western quadrant of the racecourse site. The St Leger Stand featured a fenced perimeter, creating the St Leger Reserve. Note that the subject area is at an approximate location.

Source State Library of New South Wales:

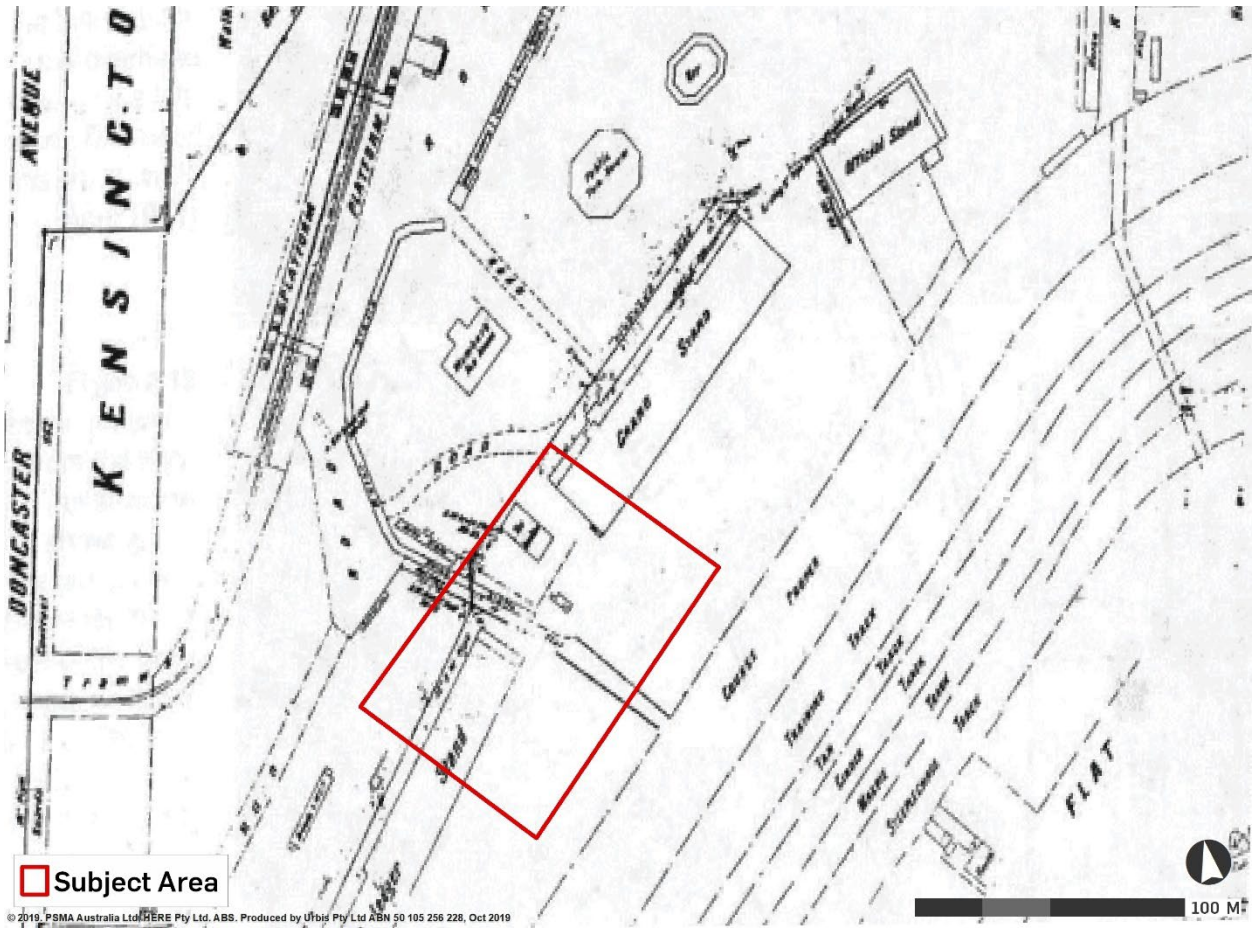

Figure 9 - Detail of Sydney Water Board survey of the racecourse, 1907. Note that apart form the St Leger Stand, part of the Grand Stand and a small building are also included within the subject area.

Source: Sydney Water

4.1.4. Consolidation and renovation, 1900-1930

The 1900s saw further development at Randwick Racecourse, and consolidation of existing structures and facilities. In 1902, the grandstands including those in the subject area underwent renovations to include sewers, allowing for the establishment of bathrooms facilities. It is not clear from the historical record where privies may have been located prior to the establishment of the sewer line. The refurbishment program created uniformity across the various grandstand and spectator facilities, and by 1920 Randwick Racecourse was capable of accommodating crowds of up to 70,000. The sewer works could have significant impact on the sub-surface archaeological potential around structures impacted by the works, such as the St Leger Stand.

The subject area underwent significant transformation in this period. In 1911 the third and final St Leger Stand was constructed, this time from brick and steel to accommodate 11,500 spectators. The St Leger Stand embankment was also increased in the 1920s, with capacity to accommodate another 7,000 people. Also constructed within the subject area in this period was a scratching tower for the recording of race results (Figure 10). These construction activities might have involved cut and fill method that created the slope down to the track from the Stand.

Figure 10 – Race day in 1914. Note the Scratching Tower on the right side of the photo.

Source: ATC Archives

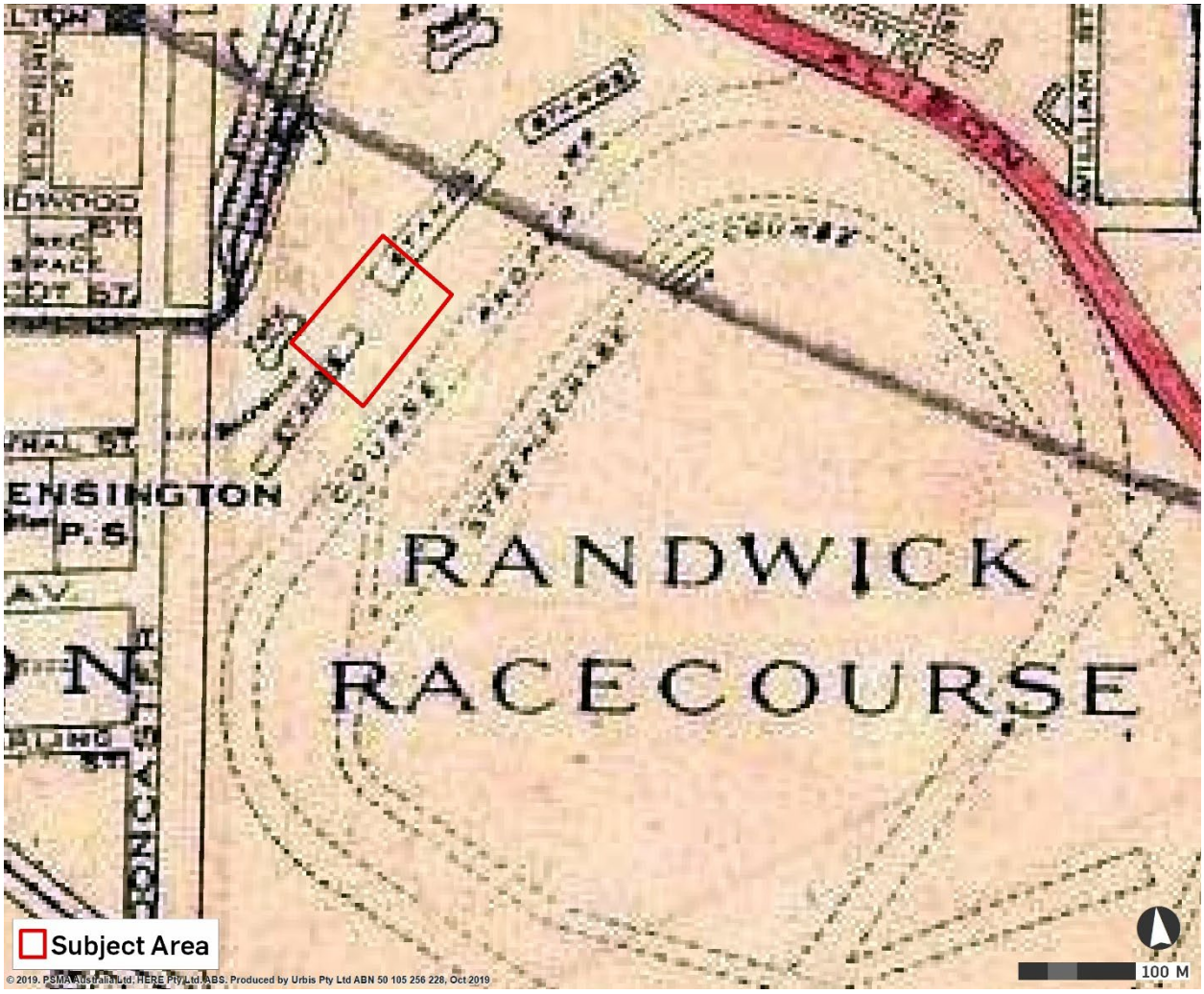

Figure 11 – Post 1917 map showing the three stands on site. Note that the subject area encompasses both part of the St Leger Stand as well as the Queen's Stand.

Source: New South Wales Land and Property Information

4.1.5. War and repercussions at the Royal Randwick Racecourse, 1930-1960s

The Great Depression and World War 2 had significant impacts on the economy of the racing industry in Sydney. Several competing Racecourses were shutdown, with land resumed by the military for training and operations. Randwick Racecourse was also resumed but remained operational although the racing schedule was reduced.

The subject area experienced no documented changes during this period. The first historical aerial photograph from 1930 shows the subject area encompassing the north-east end of the St Leger Stand, the entire Scratching Tower and the south-west section of the Queen's Stand.

4.1.6. The Leger Lawn, 1970s-present

The Leger Stand was last renovated in the 1970s, at a cost of $99,000. This included the renovation of the interior of the stand and the two liquor bars within it. In 1984, discussions commenced regarding the demolition of the Leger Stand, which had by this point fallen into disrepair.

The demolition of the St Leger Stand has potential implications for the level of disturbance within the subject area. The St Leger Stand was demolished in the 1980s, using unclear methods. A variety of proposed methodologies were submitted to the then Australian Jockey Club (AJC) from 1984-1987. In April 1986, G & H Todd Pty Ltd provided a letter to the AJC general manager regarding the demolition, stating:

> *"G & H Todd Pty Ltd are prepared to demolish the Ledger Stand at Randwick Racecourse, at no cost to the ALC provided that all waste materials in the form of rubble can be buried in a prepared hole in front of the Stand" (G & H Todd Pty Ltd, 1986a)*

This has concerning implications for disturbance within the subject area. If this proposal was accepted, as a further letter from July 1986 suggests (G & H Todd Pty Ltd, 1986b), then this will have involved the complete excavation of sands in front of the stand to water table depth and then the filling of this hole with rubble and waste materials, resulting in high levels of disturbance across large portions of the subject area. However, subsequent quotes provided by G & H Todd Pty Ltd to the AJC in 1987 for further demolition works suggest that rubble was removed and disposed of in a pit at High Street Hill (G & H Todd Pty Ltd, 1987). There is also a letter provided to AJC by G & H Todd Pty Ltd in 1988 which discusses the works carried out in Stages 2 and 3. This letter suggests materials were removed to a 'waster area' (presumably High Street Hill). It also suggests that the footings of the Ledger Stand were removed, with voids up to 2m deep around the footings excavated and filled with imported sands to level the area (G & H Todd Pty Ltd, 1988). There is ambiguity surrounding whether this activity actually took place, and if not then the footings may still be present within the subject area. In 2016, CLAH undertook an historic archaeological assessment to identify if the footings of the Leger Stand remained. This study identified evidence for footings and a concrete ground slab 150mm below bulk fill. They thus recommended excavation in the area cease and subsurface activities raised to avoid impacts to these items (CLAH, 2016).

The above surface section of the stand was completely removed and it is safe to assume that most of the sub-surface structures were also partially removed due to the agreement for the demolition company to be able to sell all recovered material. No visible evidence of the stand exists within the subject area. The subject area was subsequently landscaped, and temporary race day structures erected, with the turfed area used for spectators and temporary race stalls.

In 1998 the Queen's Stand was also demolished and similarly, no visible signs of the structure left.

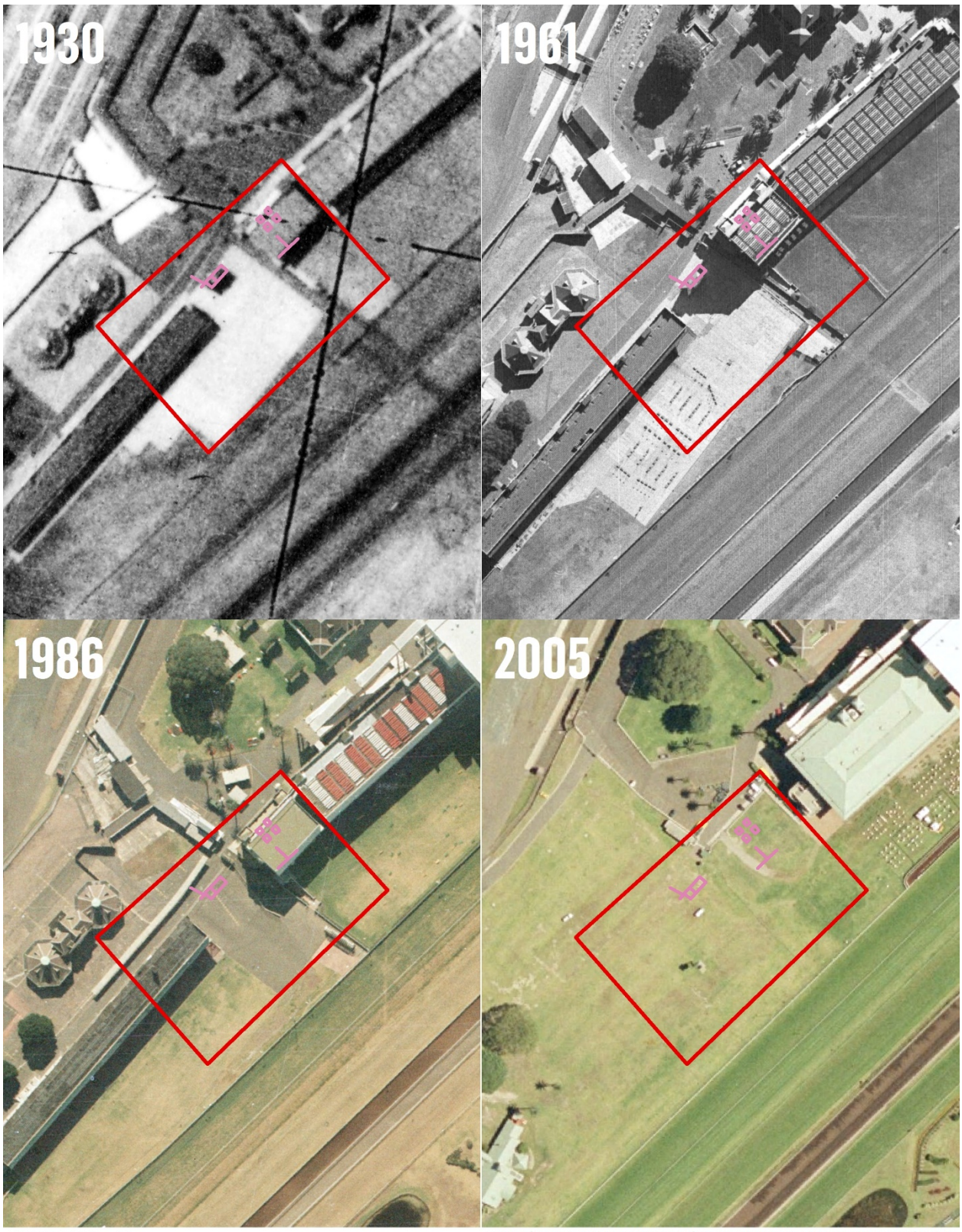

Figure 12 – Historical aerial photographs

4.2. FIELD INSPECTION

Field inspection was carried out on 2 May 2019 with highly limited ground surface visibility (GSV) as a result of the landscaping of the subject area. The subject area comprises a turfed, and partially paved area, just south-west of the Paddock Stand (Figure 13, Figure 14, Figure 15 and Figure 16). The entire are is covered by turf and imported fill. Based on the geotechnical investigation, there are has a minimum of 1 m imported fill on top of the original sand dune landscape. No visible signs of previously constructed structures of the St Leger Lawn, the Queen's Stand or the Scratching Tower were found. No invasive archaeological investigation has been undertaken to inform this HAA.

Figure 13 – subject area looking towards the Paddock Stand. Aspect NE.

Source: Urbis

Figure 14 – Subject area looking towards the multi-level carpark. Aspect N.

Source: Urbis

Figure 15 – Subject area looking towards the multi-level carpark and the temporary race stalls. Aspect NW.

Source: Urbis

Figure 16 – Subject area looking towards the multi-level carpark. Aspect W.

Source: Urbis

5. CURRENT ENVIRONMENT

The subject area is located within the bounds of the Randwick Racecourse and situated on the Botany Lowlands sand dune system that is part of the Aeolian Tuggerah Soil Landscapes. Part of the subject area is situated on 'Disturbed Terrain' (DTxx) (Figure 17). The current environment includes landscaped lawns, paved and concreted areas, and a temporary stall situated on imported fill that covers the original landscape units.

The Tuggerah Soil Landscape is a dune system that exists upon the Botany Lowlands and the coastline of the north eastern suburbs of Sydney. Soils are described as deep (>200 cm) podzols (Uc2.31, Uc2.32, Uc2.34) on dunes and podzols/humus podzol intergrades (Uc2.23, Uc2.21, Uc2.3, Uc4.33) on swales. Dominant soil materials include loose speckled grey-brown loamy sand, bleached loose sand, grey-brown mottled sand, black soft sandy organic pan, brown soft sandy iron pan and yellow massive sand. The geotechnical analysis confirmed soil depths in the subject area up to15 m. There was no indication from the geotechnical analysis that major disturbance or the complete removal of soils has taken place, with disturbance existing exclusively in the first 3m. This suggests that the proposed demolition works as discussed in Section 4.1.6 did not take place, as disturbance would likely be at a deeper level.

The demolition of the Leger Stand has implications for levels of disturbance within the subject area. If the 1986 Letter with proposed methodologies (G & H Todd, 1986) is to be believed, then extensive disturbance works have been undertaken involving the complete removal of materials in front of the sand and replacement with demolition waste. However, subsequent letters contradict this statement of events. The letters between G & H Todd and the AJC also suggest that the footings of the Leger Stand were removed, with voids up to 2m deep dug around the footings which were then removed. However, subsequent works have identified the potential footings of the Leger Stand, with evidence for footings and a concrete ground slab belonging to the old St Leger Stand encountered 150mm below bulk fill (CLAH, 2016). Further analysis is required to determine whether the footings are present.

5.1. GEOPHYSICAL SURVEY

A geophysical (Ground Penetrating Radar - GPR) investigation was undertaken on 2 July 2019 by MALA (MALA, 2019). The investigation was limited by the temporary stalls located within the south-western section of the subject area. The investigation identified signals from subsurface structures that have the potential for marking the remains of underground parts of previous structures within the subject area (Figure 12). These include what is assumed to be footings of the Queen's Stand and possibly the Scratching Tower. The results were overlayed by the historical aerial photographs to investigate the context with previous structures within the area. Further subsurface archaeological analysis is required to determine the exact nature of the identified areas of interest from the GPR, and also to examine disturbance and integrity of any potential archaeological remains. The MALA report is included in Appendix A.

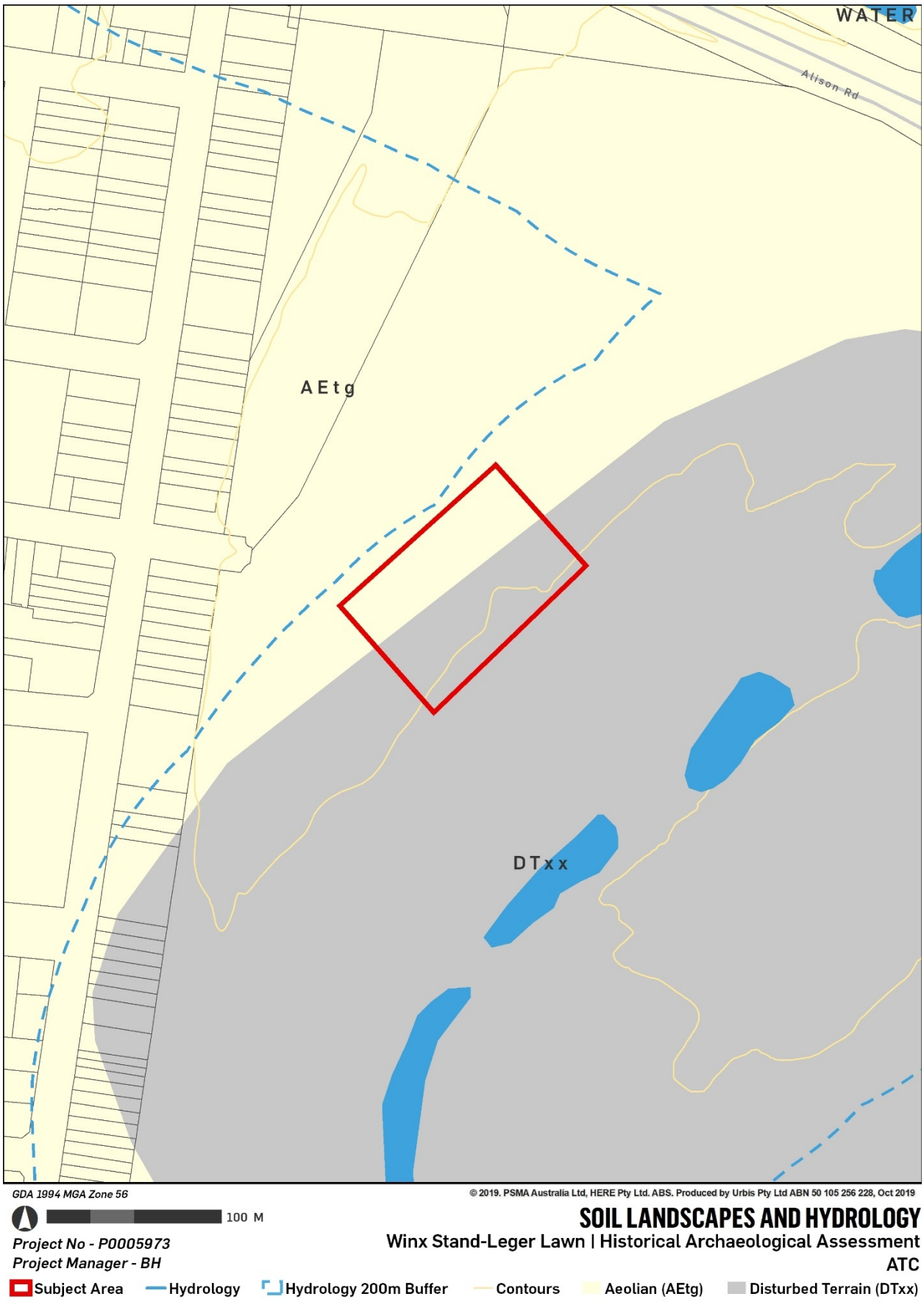

Figure 17 – Soil landscapes and hydrology

6. ARCHAEOLOGICAL POTENTIAL

This section presents an assessment of the potential for archaeological resources to be present within the subject area. Archaeological resources may generally exist 'in-situ' or in a disturbed context below or above ground, and also within the cavities of existing structures. Such resources have the potential to provide insight into the use and occupation of the site that is not identifiable through other resources.

6.1. ASSESSMENT OF ARCHAEOLOGICAL POTENTIAL

Historical archaeological potential is defined as:

The degree of physical evidence present on an archaeological site, usually assessed on the basis of physical evaluation and historical research. (Department of Urban Affairs and Planning 1996)

Archaeological research potential of a site is the extent to which further study of relics likely to be found is expected to contribute to improved knowledge about NSW history which is not demonstrated by other sites, archaeological resources or available historical evidence. The archaeological potential of the subject area is assessed based on the background information presented earlier in the report, and graded as per:

- **Nil Potential**: the land use history demonstrates that high levels of ground disturbance have occurred that would have completely destroyed any archaeological remains. Alternatively, archaeological excavation has already occurred, and removed any potential resource.
- **Low Potential**: the land use history suggests limited development or use, or there is likely to be quite high impacts in these areas, however deeper sub-surface features such as wells, cesspits and their artefact-bearing deposits may survive.
- **Moderate Potential**: the land use history suggests limited phases of low-moderate development intensity, or that there are impacts in this area. A variety of archaeological remains is likely to survive, including building footings and shallower remains, as well as deeper sub-surface features.
- **High Potential**: substantially intact archaeological deposits could survive in these areas.

The potential for archaeological relics to survive in a particular place is significantly affected by land use activities that may have caused ground disturbance. These processes include the physical development of the site (for example, phases of building construction) and the activities that occurred there. The following definitions are used to consider levels of disturbance:

- **Low Disturbance**: the area or feature has been subject to activities that may have had a minor effect on the integrity and survival of archaeological remains.
- **Moderate Disturbance**: the area or feature has been subject to activities that may have affected the integrity and survival of archaeological remains. Archaeological evidence may be present; however it may be disturbed.
- **High Disturbance**: the area or feature has been subject to activities that would have had a major effect on the integrity and survival or archaeological remains. Archaeological evidence may be greatly disturbed or destroyed.

Table 1 – Assessment of the potential archaeological resource and likelihood of survival at the subject site

Phase and Date	Potential Archaeological Resource	Integrity of Archaeological Evidence	Archaeological Potential
Pre-European occupation	Aboriginal archaeological resources have high potential to occur within the subject area. Potential and	Integrity of Aboriginal archaeological resources are unknown and need to be addressed by sub-surface archaeological testing. There is a high possibility that the integrity of the archaeological record is high due to the fact that imported fill	Moderate to high.

	significance have been assessed under an ACHA by Urbis.	capped the original soil profile and protected the unconsolidated sand body from erosion.	
The Sandy Course and Abandonment, 1832-1838	General discard items associated with early, un-developed horse racing including post holes, general items discarded by spectators.	This phase saw the establishment of the original track. There were no structures present in the subject area during this phase, and archaeological potential is considered to be low. There is limited chance that materials representative of general discard from spectators may be present, but this is diminished by the activities associated with subsequent phases of development.	Low.
The Revitalisation Period, 1852-1892	Remains of the first and second St Leger Stand, including subsurface structural remains, post holes and demolition material, waste materials (privies, rubbish dumps)	This phase saw the establishment of built structures within the subject area, specifically the first and second St Leger Stands, built from timber. These stands are unlikely to survive owing to disturbance relating to other phases of development and landscaping, but deeper subsurface structural remains including post holes have moderate potential to be identified. The Leger Stand did not have sewers installed until 1902, so it is also possible that privies and general rubbish dumps associated with this phase of occupation may occur below subsequent disturbance within the subject area. If they do occur, they are likely to be highly disturbed. Consequent development and construction of the third St Leger Stand might have had significant impact on the integrity of the earlier phases.	Low.
Consolidation and Renovation, 1900-1930	Remains of the third St Leger Stand, the Queen's Stand and Scratching Tower, including structural elements such as steel and timber posts and beams, concrete slabs and footings, brick elements, waste materials and sewer and other utilities.	The renovation of structures at the racecourse during this period resulted in great changes to the subject area, with the installation of plumbing, the demolition of the second and construction of the third St Leger Stand, the Queen's Stand and the construction of the Scratching Tower. The potential archaeological resource will be disturbed and there is a low potential that footings and some standing structural elements of the two stand and the scratching tower survived covered by the imported fill. This has been confirmed by the geotechnical survey as well that provided strong signals at the location of the Queen's Stand and the Scratching Tower.	Low.

Great Depression and wartime 1930-1951	Nil	This period saw a halt to development at Randwick, resulting from the impacts of the Great Depression and the Wars. There is no evidence of new structures or renovations in the subject area during this period, and in general the popularity of racing decreased, and less people were present. Archaeological evidence of this period is not anticipated to occur.	Low
The Leger Lawn, 1980s - present	Demolition waste, structural remains	The St Leger Stand was demolished in 1986 by uncertain methods, resulting in the creation of the Leger Lawn as it stands today. The Scratching Tower was removed some time before and the Queen's Stand was demolished in 1998. As per the above information, there is a high potential that subsurface archaeological resources survived from the three St Leger Stands, the Queen's Stand and the Scratching Tower and protected by the imported fil land landscaping within the current Leger Lawn.	Low to Moderate.

6.2. SUMMARY OF ARCHAEOLOGICAL POTENTIAL

Overall, the subject area has a long history of use associated with the establishment of the racing industry in Sydney. The subject area has been utilised as a spectator precinct for the Royal Randwick Racecourse since the early 19th century. There is the potential for evidence of this use to remain within the subject area in the form of footings, post holes, privies and rubbish dumps. There is also the possibility that waste from the demolition of the Leger Stand was dumped within the subject area. The GPR analysis demonstrates that there are subsurface features within the subject area, although further analysis is necessary to confirm the exact nature of these features.

In general, the subject area is determined to have low to moderate archaeological potential for subsurface archaeological materials relating to the previous structures but low to nil potential for relics under the *NSW Heritage Act 1977*.

7. SIGNIFICANCE ASSESSMENT

7.1.1. Introduction

Archaeological significance has long been accepted as linked directly to archaeological (or scientific) research potential: a site or resource is said to be scientifically significant when its further study may be expected to help answer research questions. The following questions (Bickford and Sullivan1984 pp 23–24) can be used as a guide for assessing the research potential of an archaeological site within a relative framework:

1. Can the site contribute knowledge that no other resource can?

2. Can the site contribute knowledge that no other site can?

3. Is this knowledge relevant to general questions about human history or other substantive questions relating to Australian history, or does it contribute to other major research questions?

7.1.2. Can the site contribute knowledge that no other resource can?

The research carried out by this HAA and the most recent HIS (Urbis, 2019) identified that there is a substantial body of information and knowledge about the Leger Lawn and in generally of the Royal Randwick Racecourse and its various elements. The potential subsurface remains of the previously erected and demolished structures would only confirm the detail of information on the historical St Leger Stands, rather than contribute to new information.

The subject area would not potentially provide new information or knowledge that is not already known from existing historical records.

7.1.3. Can the site contribute knowledge that no other site can?

The history and development of the Royal Randwick Racecourse is well documented and there is a large volume of information available for the various stages of use of the Leger Lawn. The occupation and historic development of the subject area is well documented. The subsurface remains of the previous standing structures would not provide new knowledge that is not known from the historic research.

The subsurface remains of previous buildings in the subject area would not contribute to new knowledge in relation to the history of the site.

7.1.4. Is this knowledge relevant to general questions about human history or other substantive questions relating to Australian history, or does it contribute to other major research questions?

The potential archaeological resource would only confirm statements and already known information for the subject area and would not contribute to further research questions.

8. CONCLUSION AND RECOMMENDATIONS

This HAA has assessed the historical archaeological potential of the subject area. Aboriginal archaeological and cultural heritage investigations were carried out under an Aboriginal Cultural Heritage Assessment (ACHA) and provided as a separate document for ATC. The ACHA has concluded that there are moderate to high potential for aboriginal objects and archaeological resources within the subject area and therefore recommended staged salvage excavation to be carried out as part of further investigation of those resources.

The subject area has seen multiple stages of continuous activity since the area was first reserved to be used for a racecourse in 1832. The subject area has been the part of the Spectator Precinct of the racecourse and included various previous structures including three stages of the St Leger Stand, the Queen's Stand and a scratching tower existed between the 1910's and the 1970's. There is a high potential that subsurface remains of those structures are still present within the subject area.

The HAA concluded that:

- The subject area is located within the Spectator Precinct of the Royal Randwick Racecourse.
- The subject area does not have any surface archaeological potential due to the placement of approximately 1 m imported fill on the location.
- The south-western section of the subject area has low potential for the subsurface remains of the three stages of the St Leger Stand. The last stand was demolished in 1986.
- The centre section of the subject area has low potential for the subsurface remains of a scratching tower that was operational between the 1910's and 1970's.
- The north-east section of the subject area low potential for the subsurface remains of the Queen's Stand built in 1910 and demolished in 1998.
- The HAA found that the subsurface remains have no archaeological potential due to the high level of disturbance resulted in low structural integrity caused by the demolition of the structures.
- The HAA found that there is no potential for relics associated with the subsurface remains of the previous structures and consequently there is no historical archaeology of significance at the Leger Lawn.

Based on the above conclusions, we recommend the following:

1. The proposed construction of the Winx Stand will not have impact on historical archaeological resources and the development can proceed with the Chance Find Procedure outlined below.
2. In the event of uncovering any archaeological resources including relics, the following Chance Find Procedure must be implemented:
    - Stop work and demarcate affected area.
    - Contact a suitably qualified archaeologist or heritage consultant to provide advice and assess the finds.
    - Notify the Heritage Council of NSW under Section 146 of the *NSW Heritage Act 1977* if the finds are assessed as relics under the *NSW Heritage Act 1977*.
    - Provide an appropriate archaeological management plan to manage the identified relics.
    - Resume work only when the proposed management plan has been applied and written clearance is provided.

9. BIBLIOGRAPHY AND REFERENCES

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APPENDIX A GEOTECHNICAL SURVEY REPORT

Geophysical Survey
Royal Randwick Racecourse, Sydney NSW

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JOB SITE	Leger Lawn Royal Randwick Racecourse		
PROJECT ID #	GNX19254		
ONSITE CONTACT	Hayden Kegg		
SURVEY DATE	02 July, 2019	**METHODS**	[x] 3D GPR
REPORT DATE	15 July, 2019		

COMPILED BY

James Meintjes (B.Sci)
Geophysicist

REVIEWED BY

William Barber (B.Sci)
Geophysicist

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SPECIFICATIONS and SURVEY AREA

The undertaking of a geophysical survey over a dedicated area of grounds located within Royal Randwick Race Course. The survey area is known as the 'Leger Lawn'. The geophysical method utilised was 400Mhz 3D Ground Penetrating Radar (GPR), a method that was requested by the client.

The survey primarily aims to identify areas containing subsurface footings or foundations (up to 2.5m depth) to understand their approximate depth and orientation. Identification of individual anomalies and utilities/redundant utilities was not in the scope of work. A 400Mhz 3D GPR was used in order to achieve maximum depth penetration and resolution to easily identify the survey targets.

The survey was conducted on the morning of July 02, 2019. The 3D GPR instrument was manouvered on a John Deere ride-on utility vehicle. The Leger Lawn area is approximately 4000 sqm. One third of the area contains an existing dwelling with the remainder of the area open for survey. The area was grassed, relatively level and completely open and unobstructed (with the exception of a tree line bordering the survey area and existing dwelling. Survey lines were conducted with an approach to achieve the maximum level of data coverage possible. Survey lines were run parallel to the roadway/racetrack between the existing dwelling and large grandstand. This direction of collection was completed in anticipation of crossing any existing subsurface linear footings at a perpendicular angle to achieve maximum potential for results. GPR lines were run in one direction only (away from the main grandstand) to eliminate potential for GPS offsets within the data that may occur from a bidirectional survey.

The site characterisation information and detail which aims to contribute to existing site plans; thereby providing a safer working environment and detail for informed decision making. The survey provides a .dxf file displaying identified features which can be used as a layer overlay in CAD.

Figure 1: Approximate survey area (outlined in red) within the Legder Lawn area.

GROUND PENETRATING RADAR (GPR)

Ground penetrating radar (GPR) is a geophysical method that uses radar pulses to image the subsurface (figure 2). GPR uses transmitting and receiving antennas. The transmitting antenna radiates short pulses of high-frequency radio waves into the ground/material. When the wave hits a buried object or a boundary with different dielectric constants, the receiving antenna records variations in the reflected return signal. The depth range of GPR is limited by the electrical conductivity of the ground. As ground conductivity increases, the signal penetration depth decreases. This is caused when the electromagnetic pulse emitted by a GPR transmitter is more quickly dissipated into heat, causing a loss in signal strength at depth.

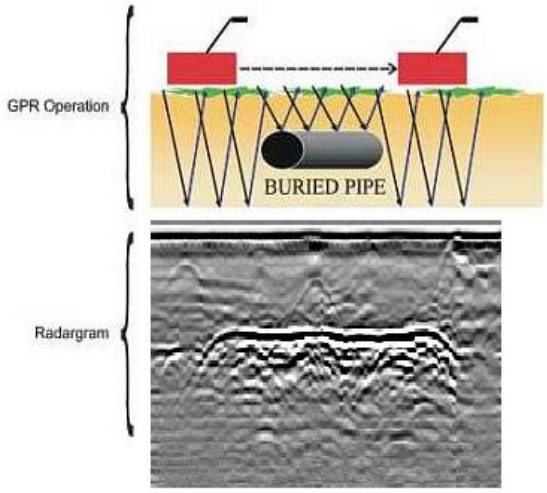

Figure 2: GPR operation and the reflection profile across the length of a buried pipe. A similar anomaly would be presented due to a subsurface footing/foundation.

INSTRUMENTS USED

The area was surveyed using the following systems

- MALA 400Mhz 3D MIRA system - 16 Channel
- MALA Widerange HDR 670/160MHz

MALA GPR Imaging Radar Array (MIRA) is the most technically advanced GPR system on the market. It is the only system of its kind that integrates acquisition, processing, QA/QC, positioning data, interpretation and export of ground penetrating radar data (figure 3).

The MIRA instrument has the ability to quickly and easily gather full 3D data in broad paths, called "swats" using 16 channels. This allows for data collection in one pass (i.e. a swat needs to be covered only once, in singular direction) as opposed to single channel systems which require multiple passes in multiple directions. The MIRA system is an efficient and effective solution for large scale ground penetrating radar mapping and subsurface object identification. Results are processed in 3D depth slices and are displayed and interpreted through a dedicated software package (rSlicer) and then exported into suitable GIS or CAD data formats (.dxf).

A 2D GPR was tested over the site however depth penetration did not exceed that achieved from the 3D GPR, therefore data was not acquired for the investigation.

Figure 3: MALA 400MHz 3D MIRA acquiring data on site.

POSITIONING

Positioning information for the MIRA 3D GPR system was tracked using high accuracy RTK GPS (Hemisphere s321 rover) which aimed to offer ~100mm horizontal accuracy by using a rover antenna (mounted above the GPR antenna) being tracked by GNSS correction satellites. A Hemisphere s321 rover was used.

In order to obtain high accuracy positioning, clear vision to the sky/open satellites was a requirement and therefore areas with tree/building cover limited the survey area. All of the survey area obtained an RTK fix to allow for very favourable GPS positioning.

Survey line positioning/spacing was controlled using spray chalk paint marks on the ground to aid GPR navigation. Horizontal chainage was calculated by the use of an optical distance encoder wheel mounted to the front wheel of the John Deere acquisition vehicle.

No local survey markers were provided to MALA GPR therefore fixed objects within the survey area and surrounds (manhole pit covers) were surveyed into the project to allow for repositioning if required. The coordinate system used in conjunction with the survey was UTM WGS84 Zone 56s.

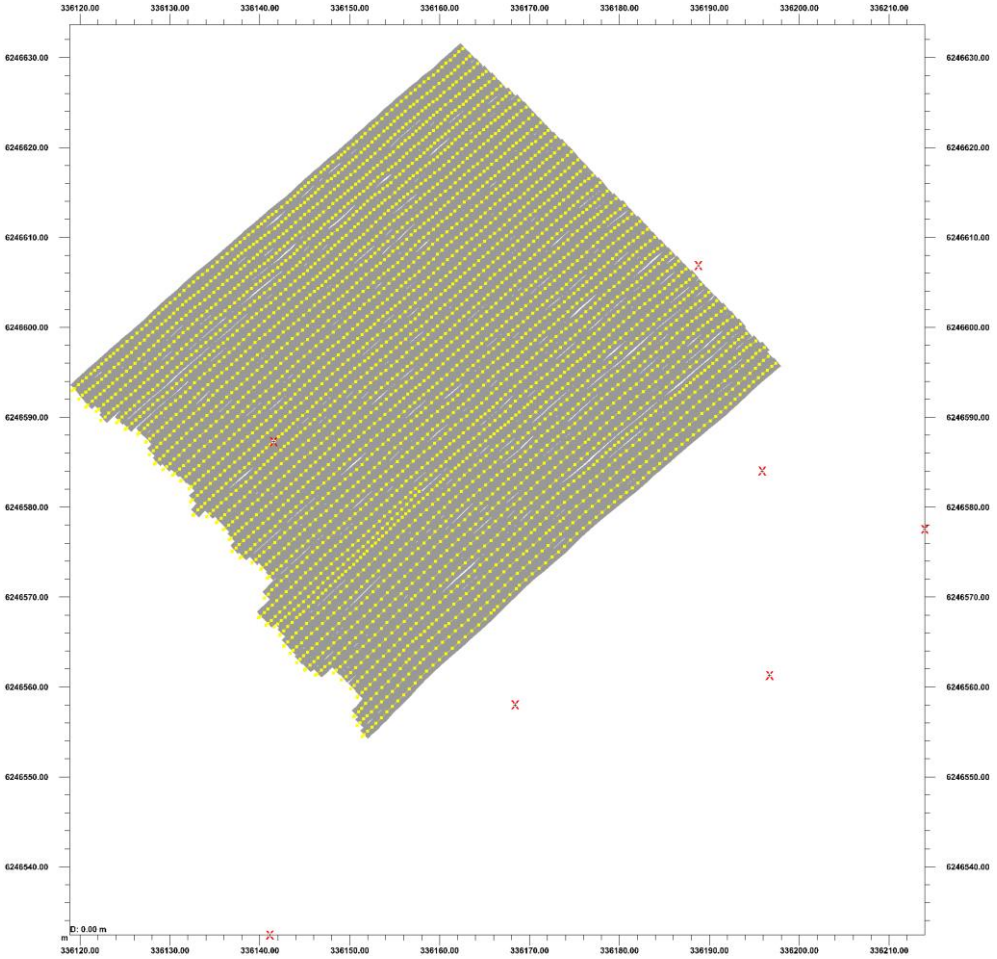

Figure 4: Yellow dots and lines indicate Individual GPS points and GPR lines conducted, respectively. The survey achieved 100% site coverage. Red 'X' markers indicate manhole pit covers that were surveyed into the dataset.

STAFFING

The data acquisitioning was performed by Geophysicist James Meintjes (B.Sci) and Senior Geophysicist Mads Toft (M.Geo) of MALA GPR Australia. Data processing and reporting was performed by James Meintjes and reviewed by William Barber.

SURVEY PARAMETERS

Data was collected using the MALA MIRA 400Mhz antenna array Data sampling was triggered with an encoder wheel connected to the John Deere rear wheel. The table below outlines the collection parameters used for the survey.

Collection Parameters	400Mhz MIRA Array
Samples per trace	408
Trace Sampling Frequency	4096.55 MHz
Frequency Steps	116
Distance Interval	0.066 m
Antennas	400MHz Shielded
Antenna Separation	0.28 m
Time Window	99.59 ns
Stacks	4

DATA PROCESSING

The data processing strategy deployed for the targets was as follows:

First the data was imported into our proprietary 3D processing package rSlicer. In that process the time-zero level is established, adjusted for the antenna separation and the DC filter is applies in order to normalise the individual GPR traces.

After the data was successfully imported minor adjustments were made to the array geometry in which bad GPS points were deleted. GPS was very good therefore minimal geometry adjustments were made. Upon saving the survey geometry the pre-processing routine was deployed. The following filters were used in the pre-processing step:

Amplitude Muting: Traces with abnormal amplitudes are removed from further processing in order to reduce striping in the data.

Amplitude Correction: A Spherical Divergence Correction and a centered 29ns Automatic Gain Control window was applied to the data.

Predictive Deconvolution is an algorithm-based process used to reverse the effects of convolution on recorded data. The concept of deconvolution is widely used in the techniques of signal processing and image processing. For GPR data it is used to recover as much ground signal as possible by separating it from the transmitted signal.

Antenna Ringdown Removal is applied to the data in order to reduce the ringing of the signal. It is effectively a trailing subtraction of the average trace over a certain distance, in this case 500 traces.

Band Pass Filtering is applied to reduce signal noise outside our transmitted frequency spectrum. The parameters used in this case were:
Low Cut: 76MHz
Low Pass: 203MHz
High Pass: 609MHz
High Cut: 1218MHz

After the pre-processing is complete the data is Chunked, interpolated at 80mm, and x1 slice averaging is applied. These steps are applied in order to facilitate for a more manageable dataset which can be loaded fully into RAM on the processing station.

Data Migration is the process by which GPR targets are geometrically re-located in either space or time to the real position of the target rather than the location that it was recorded at the surface, thereby creating a more accurate image of the subsurface. Migration moves dipping reflectors to their true subsurface positions and collapses diffractions, resulting in a migrated image that typically has an increased spatial resolution and resolves areas of complex structure much better than non-migrated images. The migration velocity used for the dataset was 10cm/µs and subsequently this velocity was used for the time-depth transformation of the data.

Amplitude Envelope is a parameter-less filter used to highlight high amplitude features within a dataset. It is particular useful in 3D GPR data sets in plan view.

RESULT OF SURVEY

Initial observations made from the data were those regarding data quality and depth penetration. The MIRA survey achieved 100% coverage of the open survey area with the exception of a strip of grass behind and between the tree line near the existing dwelling. Data quality appeared favourable and clear as there were high contrast anomalies present, mainly those representing linear features. Depth penetration was also very acceptable and was noted to reach a maximum depth of ~ 2500mm (considering a soil velocity of 10cm/µs). With the 400MHz frequency antenna used this depth penetration that was achieved is indicative of a suitable subsurface material for GPR technology. The subsurface material was described by MostynCopper as being of sand composition, this being evident through the quality of the data and depth penetration achieved.

Many anomalies were evident within the processed dataset, mainly those of linear nature. For each anomaly detected, interpretation markers (polylines) were inserted into the dataset at different depths. Different interpretation colours represent different interpreted targets and are discussed further in detail below Figure 5 below displays all interpretations mads within the dataset. Note all plots within the report are North facing.

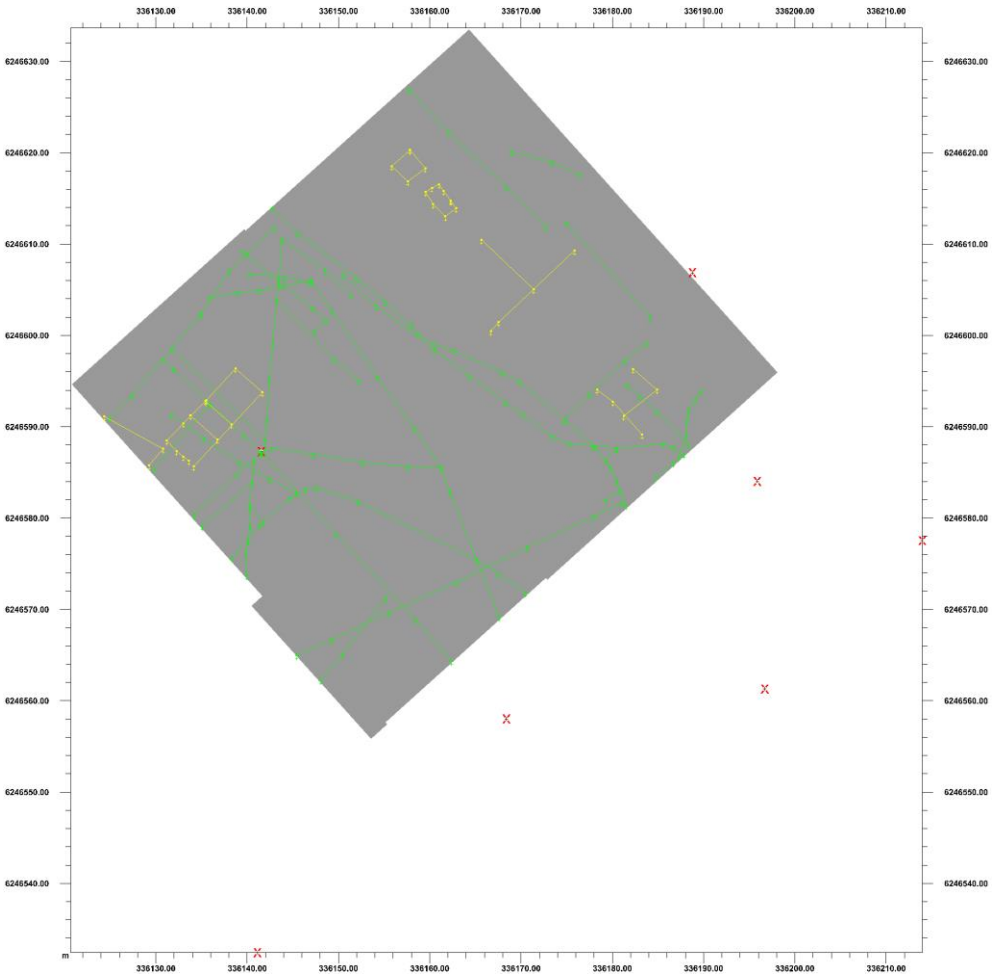

Figure 5: Plan view displaying every interpretation marker inserted into the dataset. (Green = Potential service/redundant service; Yellow = Potential footing/foundation).

YELLOW Interpretation Marker – Interpreted Footing/Foundation

The target for the survey focuses on linear anomalies that could represent subsurface foundations or footings. Such linear anomalies evident in the dataset contained high contrast resolution and appeared of a larger relative size to other anomalies detected, that may represent services and utilities (pipes, cables, etc). These anomalies appear to display a distinct pattern, such as square/rectangular orientations, in line with existing buildings and dwellings. Figure 6 below shows ALL anomalies interpreted as potential subsurface footings/foundations.

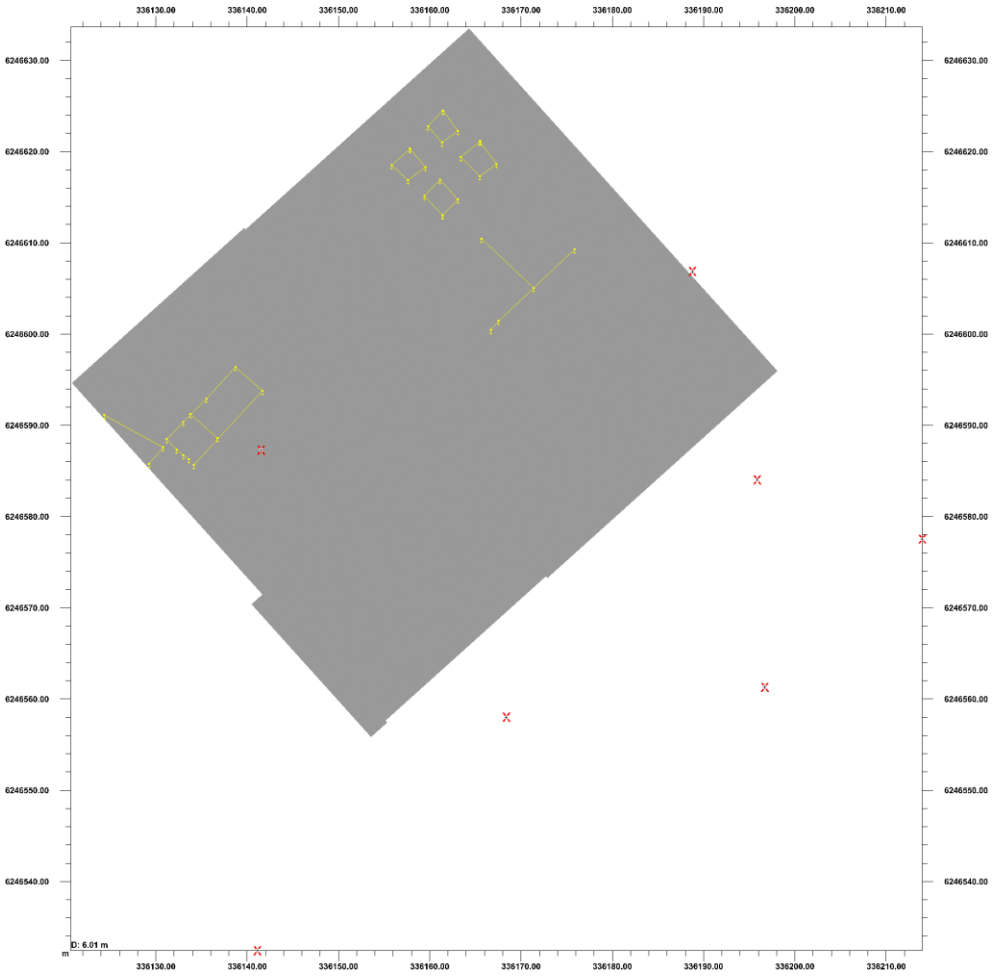

Figure 6: Yellow polylines indicated areas where subsurface anomalies were detected that were interpreted as potential subsurface footings/foundations. Note the anomalies occur at different depths and this plan view is an overall visual only.

There were three zones within the survey area that displayed anomalies/features indicating those of potential subsurface footings or foundations. They will be discussed further in detail individually below. Each figure below displays two images, with the top image containing yellow interpretation polylines over the detected anomaly and the bottom image containing migrated processed GPR data. This is for reference to the reader/viewer to comfortably visualise the anomaly being discussed.

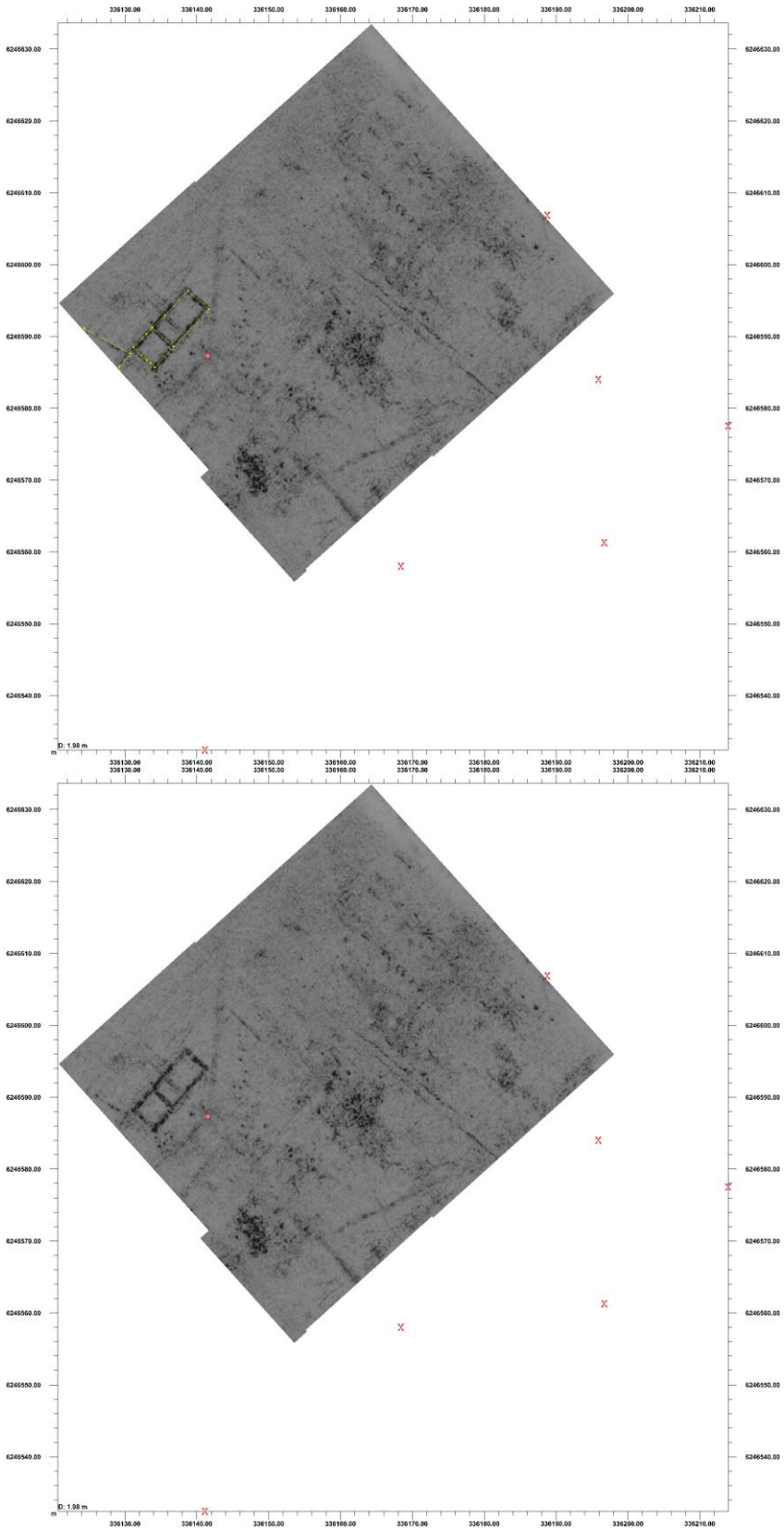

Figure 7: Zone 1 anomaly; Both images displaying a depth slice of migrated data at ~1.98m depth.

Figure 7 above displays an anomaly detected at ~1.98m depth. The anomaly is of extremely high contrast and takes the pattern of a foundation (rectangular feature). The relative size of the anomaly differs greatly to surrounding linear anomalies that may represent services and utilities. This anomaly has high confidence from the interpreter towards being a foundation/footing feature.

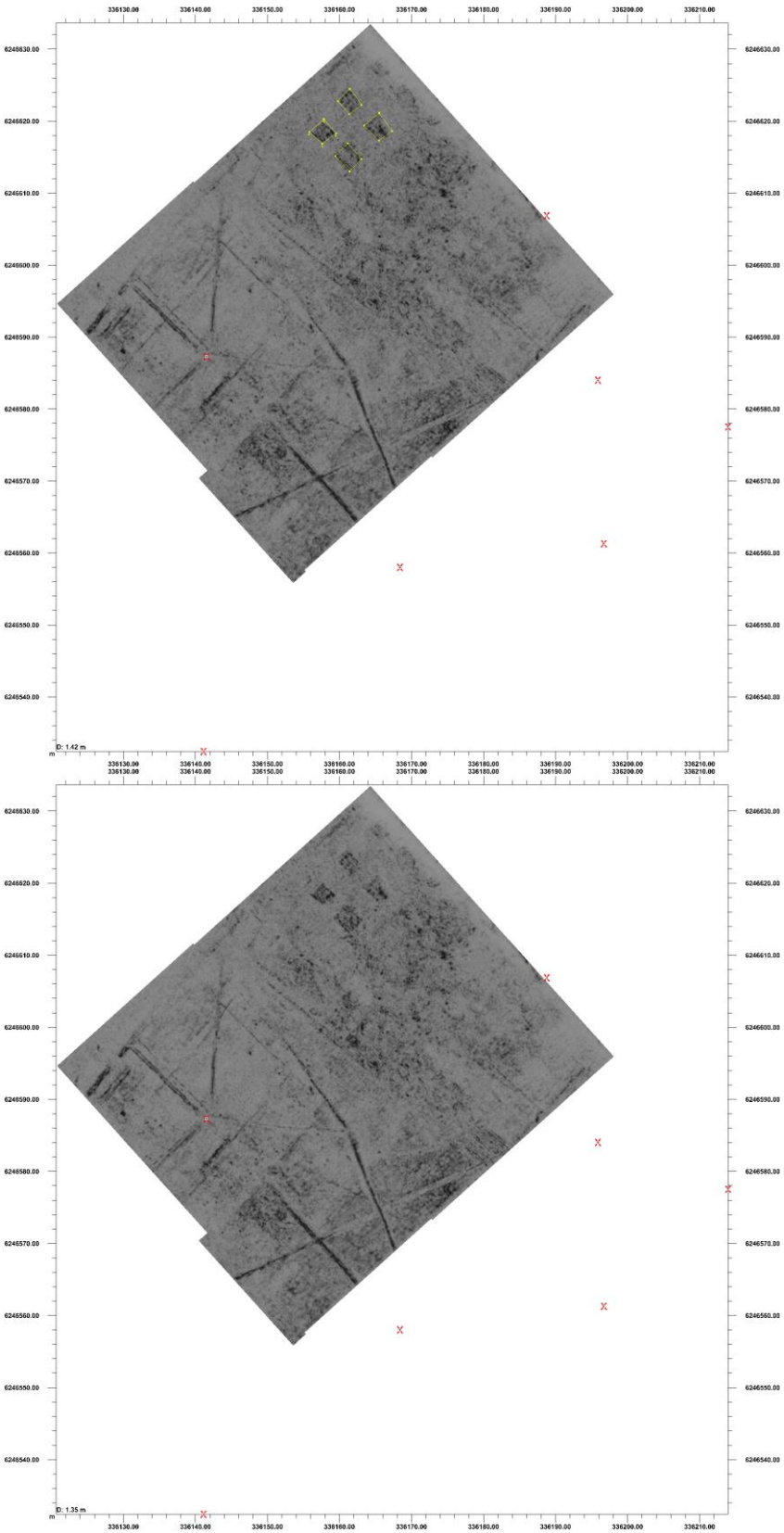

Figure 8: Zone 2 anomaly; Both images displaying a depth slice of migrated data at ~1.42m depth.

Figure 8 above displays four anomalies at ~1.42m depth. The anomalies are of different nature to that discussed in Zone 1, being of lower contrast and more of a localised shape, not a linear anomaly. They do however occur in a 'group' with some form of pattern visible. This anomaly has medium confidence from the interpreter towards being a foundation/footing feature.

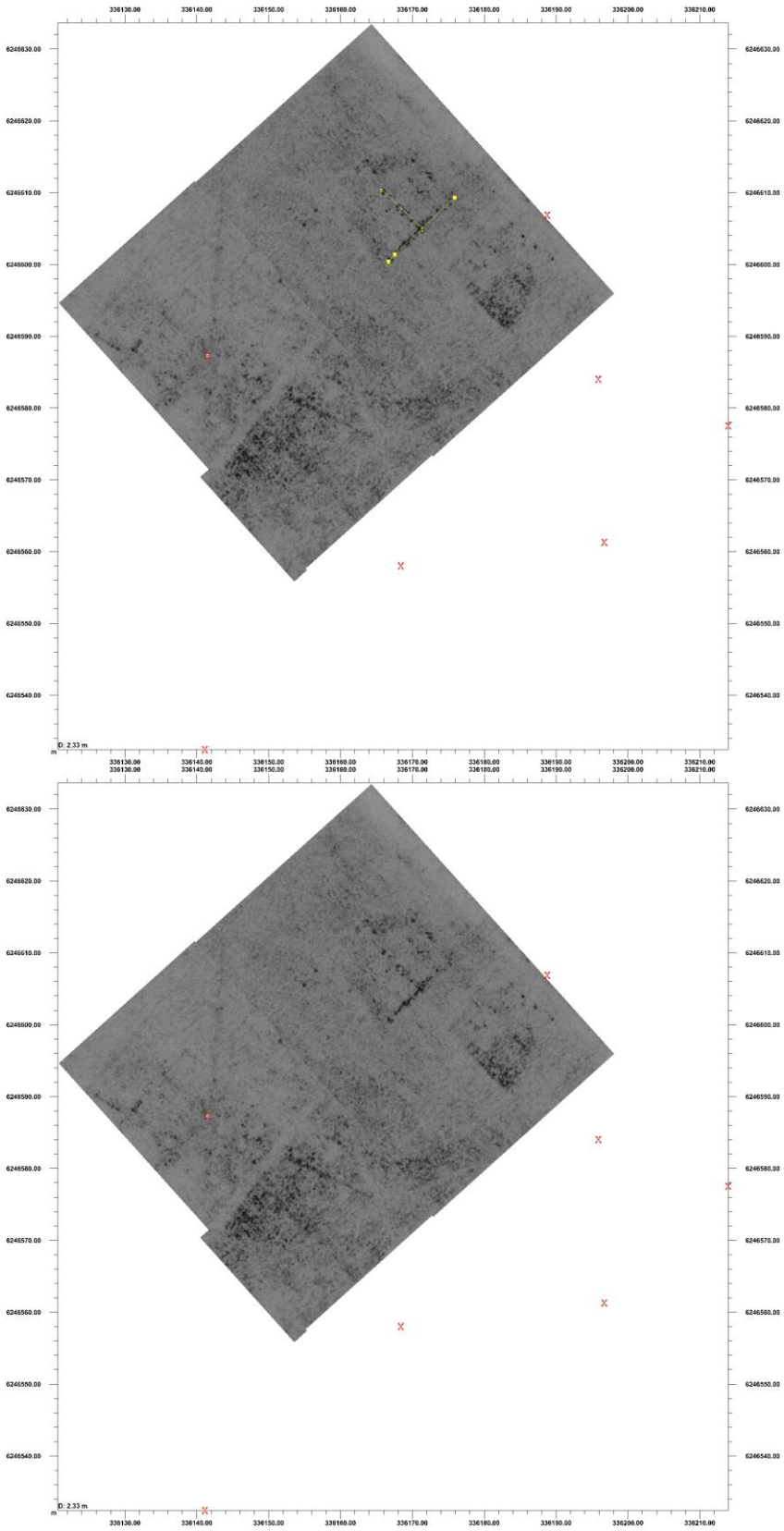

Figure 9: Zone 3 anomaly; Both images displaying a depth slice of migrated data at ~2.33m depth.

Figure 9 above displays an anomaly detected at ~2.33m depth. The anomaly is of low contrast (most likely due to the depth encountered). Two relatively large linear lines are seen to create a feature that has potential to be a subsurface footing. The orientation of the anomalies lines up with existing dwellings. This anomaly has medium confidence from the interpreter towards being a foundation and it is recommended it is investigated further for confirmation.

GREEN Interpretation Marker – Interpreted Utility/Redundant Service

Many anomalies were detected throughout the dataset that were interpreted as potential active/redundant services. A number of these had pattern while others had no pattern. Mostly all the anomalies were able to be delineated through the dataset which allows further inference towards them occurring as subsurface utilities and/or redundant services. Additionally, a number of these anomalies ran towards manhole pits (as marked within the dataset, further supporting their interpretation as utilities.

Figure 10 below displays all interpretations made towards potential live/redundant services. Note; these interpretations were made so due to the nature of the anomalies, being depth, contrast and orientation. It is possible that these anomalies could in fact represent subsurface footings however have been interpreted differently.

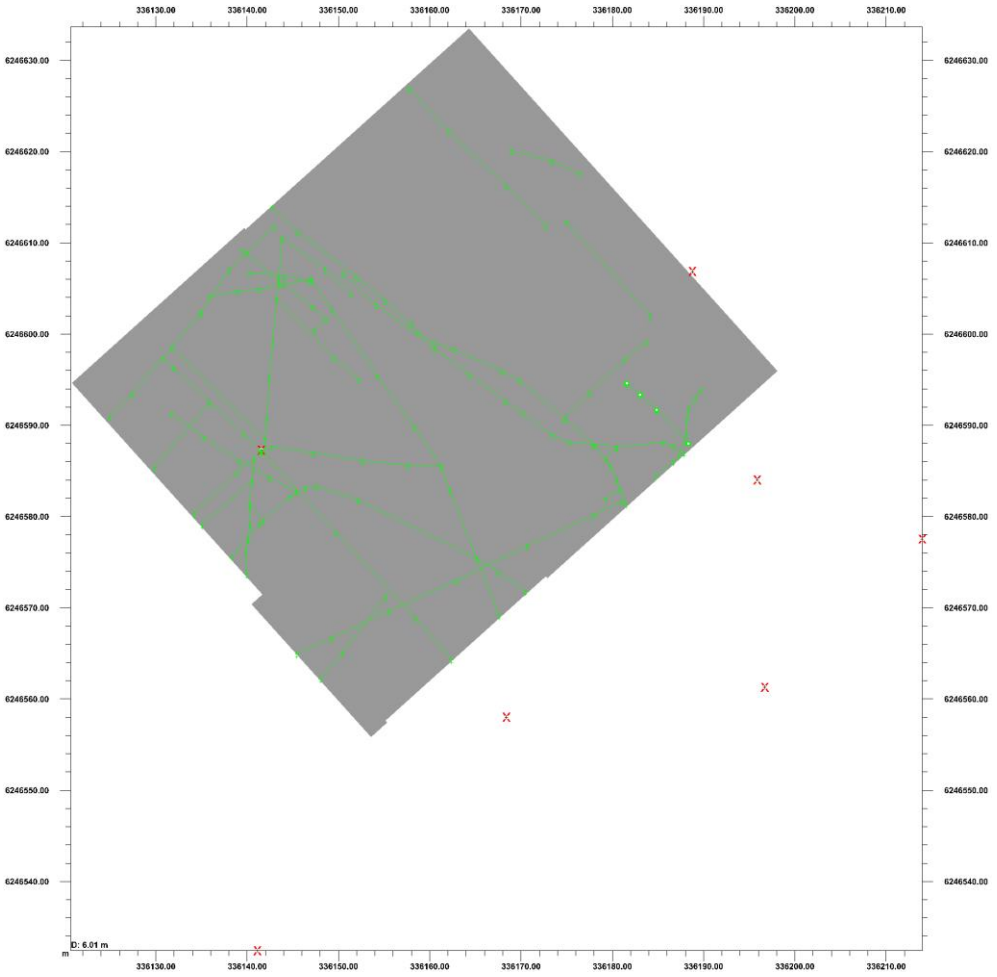

Figure 10: Green polylines indicated areas where subsurface anomalies were detected that were interpreted as potential subsurface live/redundant services. Note the anomalies occur at different depths and this plan view is an overall visual only.

Discussions will not be held regarding interpreted potential services. All interpretation markers (both interpreted footings and services) are included within the accompanied .dxf file. These markers have a GPS position (x,y) and depth (z) value associated with them. The file can be imported into AutoCAD or similar for GIS manipulation and mapping.

CONCLUSION

Overall, data coverage was excellent over the Leger Lawn with complete GPR coverage of the area. GPS was excellent and allowed for high accuracy positioning of the dataset, aiding further informative interpretations. Areas between and behind the tree line were not surveyed. GPR data quality was above average with excellent depth penetration. Up to 2.5m depth penetration was achieved using the 400Mhz 3D array, a depth indicating favourable subsurface materials. The soil velocity used 10cm/µs was determined through hyperbola fitting and migration techniques and through analysis of 2D cross sectional profiles picked from the 3D dataset.

Many anomalies were evident in the data set which included mainly linear features that have in turn been interpreted as both potential subsurface utilities (both active and redundant) and potential footings/foundations. Interpretations on individual anomalies have been made as a result of the anomaly contrast and orientation. Interpretations have been made at the first sign of an anomaly within the depth slice (at the shallowest detected anomaly depth). These associated depths are based on the set soil velocity of 10cm/µs. The interpreted depths may vary and as a result, caution should be exercised during further invasive investigations.

Interpretations made towards those of subsurface footings are both of high and medium levels of confidence. Zone 1 for instance (figure 7) displays a very high contrast, large/wide, rectangular anomaly. This anomaly takes the pattern of a subsurface footing/foundation. It should be noted that this shape can also be seen imprinted onto the grass in satellite imagery (visible in Figure 1). Zone 2 displays lower contrast, less intense anomalies, however a pattern is still visible in the anomalies, displaying a 'group' of four rectangular features, relatively evenly spaced between each other. Zone 3 displays anomalies that could take the shape of a large subsurface footing however the limitation here is the depth it was detected, allowing for lost contrast and anomaly shape. Another 500mm of depth penetration would've aided this interpretation and associated confidence of interpretation.

There is high possibility that not all survey targets were detected. There are certain factors which may limit the GPR data resolution towards identifying utilities and other associated anomalies, including material of target, host material, and levels of saturation. The electrical contrast between the pipe/cable and the surroundings must be significant enough to accurately tell the difference between the two materials. For example, a steel pipe within a dry sand would create a strong contrast whereas an asbestos/clay pipe within a surrounding clay would create a lower density contrast. In this investigation, concrete (most presumably) footings within sandy soils should create a reasonable dielectric contrast however success is not always achievable to factors of signal attenuation, conductivity and associated dielectrics.

It is recommended that further invasive investigations are conducted. These will help to correlate with non-destructive GPR results and findings.

Please contact the author if relocation issues occur. Raw GPR data can be provided upon request. A .dxf file with all interpretations will accompany this report.

DISCLAIMER It should be noted that the attached results are the result of an interpretation of the collected data. Whilst state-of-the-art instrumentation and qualified personnel have been utilised for this survey there are circumstances under which the interpreted result can differ from the actual sub surface strata.

The author accepts no responsibility for actions or decisions made on the basis of the presented result. The results are presented for the clients' review only and should not form the sole basis of any decision or action made in relation to this project.

This report has been prepared for the use of the client as listed on page 1 in accordance with general accepted consulting practice. No other warranty, expressed or implied, is made as to the professional advice included in this report.

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If it is found that the actual locations differ from the interpreted result the author should be contacted immediately.

URBIS