Report on the 2007 Western Australian Museum, Department of Maritime Archaeology, *Batavia* National Heritage Listing Archaeological Fieldwork

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Report—Department of Maritime Archaeology, Western Australian Museum, No. 224
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2007

REPORT ON THE 2007 WESTERN AUSTRALIAN MUSEUM, DEPARTMENT OF MARITIME ARCHAEOLOGY, *BATAVIA* LAND SITES NATIONAL HERITAGE LISTING ARCHAEOLOGICAL SURVEY

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WESTERN AUSTRALIAN museum

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List of abbreviations

BAT	Wreck/Artefact prefix for *Batavia*
DIA	Department of Indigenous Affairs
EPA	Environmental Protection Authority
EPBCA	*Environmental Protection and Biodiversity Conservation Act 1999*
GPR	Ground Penetrating Radar
LI	Artefact prefix for objects from Long Island
WAM	Western Australian Museum
UWA	University of Western Australia
WWICS	West Wallabi Island Coastal Structure
WWIIS	West Wallabi Island Inland Structure

Summary

The Western Australian Museum's Department of Maritime Archaeology conducted archaeological surveys and excavation at selected sites in the Wallabi Group, Abrolhos Islands from 1–9 February 2007. This report is the preliminary results from this fieldwork which was funded through an Australian Government 'Gift to the Nation' to celebrate Heritage Places. The content of this report deals specifically with selected pre-settlement terrestrial sites associated with the *Batavia* shipwreck (1629) although the area is also renowned for sites associated with post-settlement or colonial shipwrecks and sites associated with maritime trade and industry. The purpose of this work was to accurately record the position and test the archaeological potential of selected sites on West Wallabi, Long, East Wallabi and Beacon islands. This information will then be used to formulate future research and management strategies for terrestrial archaeological sites in the Wallabi Group.

Recommendations

1. That the Western Australian Museum liaise with Fisheries WA and the Heritage Council of Western Australia to formulate a heritage management plan for the *Batavia* National Heritage List (NHL) area, including *Batavia* related sites that fall outside the NHL area (Dicks and Efast Wallabi Island). The plan should provide long-term recommendations for public access, site protection, interpretation, archaeological monitoring and research. An existing draft management plan (Green and Stanbury, 2001) was prepared with Coastcare funding. This plan' which includes the *Batavia* shipwreck and associated sites, exists in draft form only and was not formally agreed to by the major stakeholder, Fisheries WA at the time. It is proposed that this management plan is revised and updated to include new information obtained in archaeological surveys and excavations since 2001, and incorporate the Long Island tourism resort that is presently undergoing assessment under the EPBCA and EPA (state) planning provisions.
2. Sites which fall within the *Maritime Archaeology Act 1973* should be gazetted as per recommendations of Green & Stanbury (1988). These are summarised as follows:

Beacon Island. The whole of Beacon Island should be protected under sections 4.(1) (b) and 4.(1) (c) and as a protected zone under section 9. (1) of the *Act*.

Long Island. Long Island should be protected under sections 4.(1) (b) and 4.(1) (c). Maritime archaeological artefacts have been found at the north, central and southern ends of the island in the course of non-disturbance visual and metal detector surveys. This form of survey is considered selective and there is potential for non-metal or non-visible artefacts relating to the *Batavia* to also occur throughout the entire island. Of the area so far surveyed it is estimated that the survey has only covered 60% of the island due to vegetation rendering visual sighting or metal detection within 10cm from the ground surface impossible.

Traitors Island. This island together with all the small islands of the Morning Reef complex be protected under section 4. (1) (c).

West Wallabi Island. Slaughter Point, two limestone structures (WWICS & WWIIS). These should be protected under sections 4. (1) b and (c), each within a protected zone of 100 metres radius. [Any digging within these zones should be restricted to bon fide archaeological researchers with the permission of the Museum. Access to the site should be permitted, but suitable markers and notices should be erected in order to make known to the public the above recommendation.]

East Wallabi Island Wells. These should be protected under section 4.(1) (c) within a protected zone of 100 metres radius of each well.

3. Archaeological excavation of the 'nail site', located during the 2007 survey on Long Island, to be conducted as soon as feasible given its significance as a matching archaeological signature for the execution site of the *Batavia* mutineers. The potential impact to the site is high due to its proximity to the main island access landing. Any construction works for the proposed Long Island development will require equipment and materials storage and an influx of human activity, with a corresponding level of site disturbance and contamination over large areas of the island.
4. The visual and metal detector survey of Long Island to be completed as soon as feasible.
5. Fisheries WA officers involved in the management of Abrolhos and *Batavia* NHL site area to receive historic shipwreck inspector training under the Commonwealth *Historic Shipwrecks Act 1976*.
6. Archaeological monitoring is essential during the removal of any structures from Beacon Island, and no sub-surface remains must be removed. Any future removal of slabs and structures should be conducted separately following a complete ground penetrating radar survey and archaeological assessment.
7. The 2007 investigations have shown that the West Wallabi Island coastal structure (WWICS) does retain moderate archaeological potential and should be protected accordingly. There is potential for further work—remote sensing to survey the wider area surrounding the structure for potential outcamps or habitation sites and further archaeological test pitting.
8. The Western Australian Museum to be consulted for any future interpretation or installation of public signage or trails on *Batavia* NHL sites, or other Abrolhos Islands maritime archaeological sites

Project overview

Introduction

The Minister for Environment and Heritage approved 'Gifts for the Nation' to celebrate the National Heritage

Listing of the *Batavia* (1629) and Cape Inscription sites declared in 2006 to celebrate the European mapping of Australia's coast. Gifts to the Nation assist in the telling of stories of national heritage significance, of which these archaeological sites are an essential part – their heritage values include archaeological values in terms of the material culture they contain and their archaeological contexts. Archaeological data, synthesised and interpreted, provides additional information to the existing written record–whether supporting or challenging accepted stories–and obtains additional information about events not recorded in the written record.

The designated area of the *Batavia* National Heritage Listing (NHL) is shown in Figure 1. Some of the *Batavia* sites, requiring NHL protection, are outside of the declared area.

This report provides the background historical information to, and archaeological results from an expedition undertaken between 1–9 February 2007 by the Department of Maritime Archaeology, Western Australian Museum. The aims of the 2007 fieldwork were to gain a more complete understanding of the terrestrial archaeological sites that were created in the Wallabi Group of the Abrolhos Islands landscape by events following the *Batavia* shipwreck and subsequent mutiny.

The Western Australian Museum is the repository for all archaeological data and materials relating to all Western Australian shipwrecks, including the *Batavia*. The Chief Executive Officer of the Museum is also the Delegate for the Commonwealth Minister for Environment and Heritage (now Minister for Environment and Water Resources) who administers the *Historic Shipwrecks Act 1976* that protects the *Batavia* shipwreck site and associated artefacts. Additionally the Museum is the statutory authority for the administration of the *Western Australian Maritime Archaeology Act 1973*, that protects the survivor structures, human remains, graves and wells related to the *Batavia*.

Transport and accommodation to Beacon Island was coordinated with Fisheries WA, Geraldton Office. Personnel travelled to Geraldton by vehicle and air, and were transported to, from and around the Wallabi Group on the Fisheries WA vessel P.V. *Chalmers* for the duration of the project. Accommodation was the research hut on Beacon Island, provided by Fisheries WA.

Personnel

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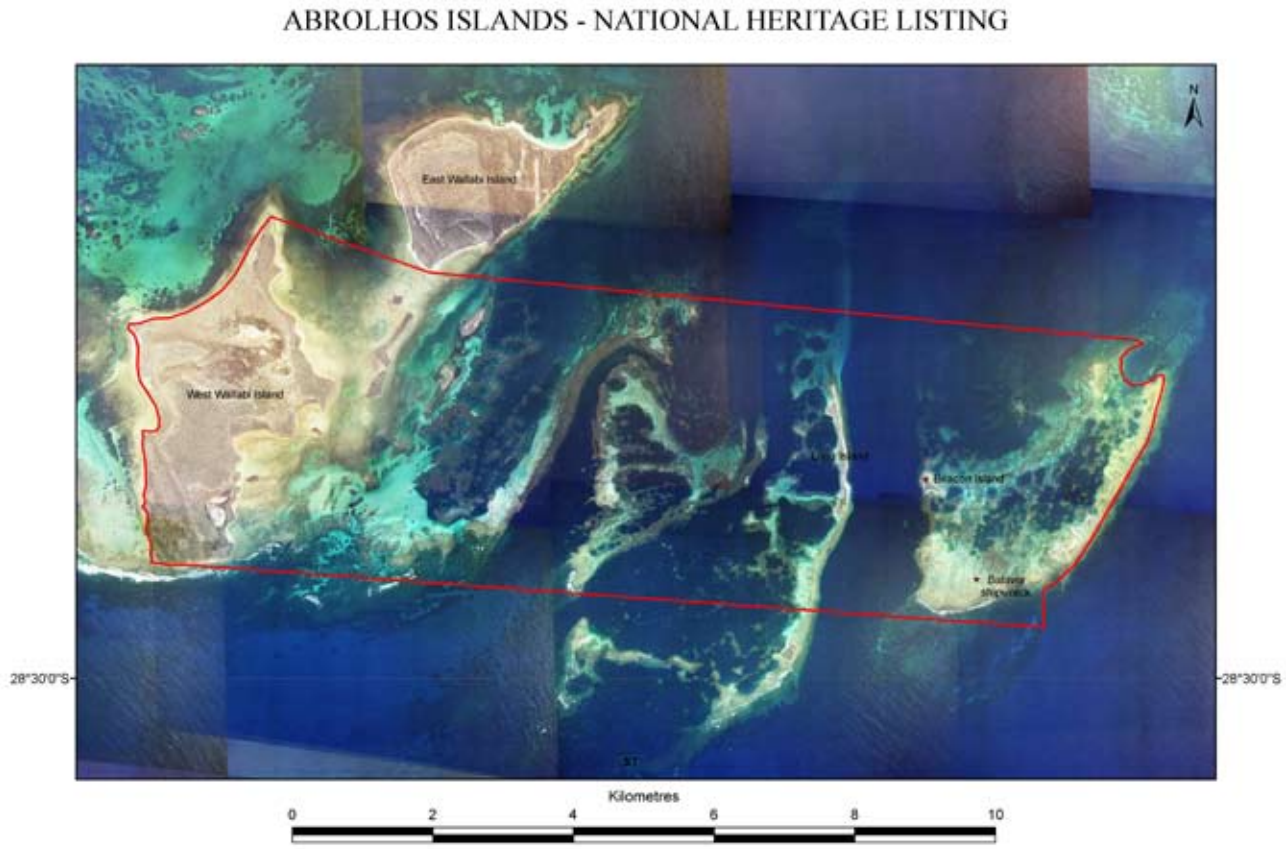

Figure 1. Map of *Batavia* National Heritage Listed area, Wallabi Group, Abrolhos Islands.

Historical background

The Dutch East India Company vessel *Batavia* was wrecked on Morning Reef in the Houtman Abrolhos archipelago in 1629. It was the first VOC ship to be lost off the coast of the Southland. Over 200 people survived the initial wreck, making their way to several small coral islands near to the wreck, the largest of these being *Batavia's* Graveyard, now known as Beacon Island. In the three and a half months before the arrival of the rescue vessel, the number of survivors was more than halved as a result of a particularly bloody mutiny by members of the crew, including a number of the officers. Since the re-discovery of the *Batavia* wreck in 1963, archaeological research has been focused on the marine sites and in particular the removal and conservation of the surviving structure of the wreck itself. The associated terrestrial sites, where most of the events described in the various historical reports took place, have been subject to targeted archaeological investigation by the Museum since 1992 (Gibbs, 1992, 1994; Stanbury, 2000; Paterson & Franklin, 2005; Souter, 2005) following the discovery of and/or interference with human remains.

Project aims and methodology

A number of projects in the *Batavia* NHL area identified by Department of Maritime Archaeology follow on from recommendations and conclusions from the 1999 and 2001 survey and excavation at Beacon, Seal and Long islands (Stanbury, 2000; Souter, 2005).

1. Complete a comprehensive archaeological investigation of the limestone structures referred to as 'forts' and other related structures (cairns, wells, fireplaces) used by the soldiers resisting the mutineers on West Wallabi Island. Work planned for West Wallabi Island involved test archaeological excavation of the coastal structure (WWICS), under the direction of Dr Alistair Paterson, UWA. Previous excavations were undertaken in 1964 and 1966 by staff and students from Aquinas College (O'Loughlin, 1964, 1966) and by the Western Australian Museum in 1967 and 1974 (Bevaqua, 1974). The Aquinas College and Museum investigations determined that WWICS related to the *Batavia* survivors, by the assemblage of artefacts found. Given the unscientific and poorly documented nature of past excavations, the 2007 investigations aimed to determine how thoroughly the area around WWICS had been previously excavated, and to investigate the potential for further archaeological deposits in unexcavated areas. The inland structure (WWIIS), wells and fireplaces were examined, though not excavated as it they are situated on limestone bedrock. The main aims related to the excavation of WWICS were:

to test the site to establish what archaeological material

Figure 2. 17th century engaving of *Batavia* and Wallabi Group from an illustration in the Jan Janz 1647 edition of Ongaluckige Voyagie (Drake-Brockman, 1963:183).

remains in (1) areas previously excavated and (2) areas outside the excavation zones;

to better interpret any similar material held in the museum

to provide contextual site-based information for archaeological interpretation and site management

From this, it would be possible to answer the question: Given the extensive excavations of previous years what is the archaeological value of the site? (i.e. potential to answer questions about European survivor occupation of West Wallabi Island and the events following the *Batavia* shipwreck; extent of remaining archaeological material, if any).

An additional aim of the 2007 survey and excavation program was to record the sites spatially using Differential Geographic Positioning System (DGPS) and Total station, to more accurately locate all of the *Batavia* terrestrial archaeological sites on West Wallabi Island.

2. A visual and metal detector survey of the southern portion of Long Island. A survey was initiated in 2001 to locate any potential archaeological sites related to *Batavia* mutiny including the execution of the perpetrators. A piece of lead sheathing moulded into a ball with the holes resulting from iron nails which would have originally protruded from it, possibly used as a weapon (*morning star*) and three iron fastenings were recovered by the Museum in 2001 as part of a metal detector survey which covered the northern third of the island (Souter, 2005:6). A subsequent survey was undertaken in 2005, on behalf of MBS Environmental and Humfrey Land Developments, for a proposed tourism operation (Souter, 2005). At the time of the 2007 survey, Long Island was undergoing EPBCA assessment for this tourism resort development. The aim of this latest survey was to cover the remaining portion of the island.
3. To conduct a ground penetrating radar (GPR) survey at selected sites on Beacon Island. GPR was first deployed on Beacon Island in October 1999 to identify and delineate archaeological sites, particularly human burials (O'Neill, 2000:1; Souter, 2000:21). A small-scale geophysical survey of Seal Island was also undertaken during this campaign. GPR was chosen because of its ability to map both the spatial and depth location of shallow, non-metallic targets at high resolution. This type of survey provides archaeologists with a non-intrusive and non-destructive indication of the archaeological resource. From previous discoveries and excavations, archaeological material was anticipated in the top 50cm of deposit. Remote sensing was used to obtain baseline data of the undisturbed sections of a mass gravesite excavated in 1999 by detecting soil profile changes and archaeological material, which were later confirmed by excavation. This data provided a calibrated signature of the cultural deposits that could then be compared with results from other survey areas selected on the island. The combination of a dry soil profile and collecting data at close spacings produced some promising targets. 'Time slices', which show the average reflection strength over various depth horizons, indicated the locations of possible burials and other cultural features. 2D sections and 3D views were then used to better confirm the nature and depth of these interpreted anomalies. In general, any coherant zone of high or low response and not just random noise was considered to be of interest (O'Neill, 2000:7). It was anticipated that technical advances in the field of GPR remote sensing since the 1999 survey would deliver improved detection rates and subsequently increase the potential for delineating new archaeological sites.
4. Identification and recording of inland fresh water well sites recorded to have been used by survivors and Pelsaert's rescue party East Wallabi Island. Using existing information as well as aerial photographs, a walking survey was undertaken to accurately record by GPS the position of related structures.

Background to 2007 archaeological fieldwork

Introduction

Planning and methodology for the fieldwork was based on existing knowledge of archaeological sites and places in the Wallabi Group, specifically the survivor camps, graves and sites related to the *Batavia* shipwreck located on Beacon Island. Overall, the project aimed to fill gaps in knowledge of the *Batavia* story by assessing identified as well as potential sites in the Wallabi Group, through targeted detailed recording. This data will assist in determining the current status and discrete location of the archaeological sites in the Wallabi Group and provide directions for future archaeological site location, management and research. Overall survivor camp issues such as subsistence (e.g. rationing, ship salvage, storage, economy, utilisation of shipboard and local sources of protein and water) and behaviour signatures (e.g. social hierarchies, power structures and social units/camps, cultural mores, killings, burials) have been, or have the potential to be, found in the archaeological record.

Previous detailed analysis has been conducted on early Dutch shipwreck and survivor campsites in the Abrolhos Islands notably Boranga's (1998) analysis and identification of social organisation in the *Zeewijk* survivor camps on Gun Island in the Pelsaert Group; Marwick's (1999) analysis of the faunal bone assemblage from Beacon and West Wallabi Islands; Hunneybun's (1995) analysis of skeletal remains from Beacon Island; and Franklin's (2001) bio-archaeological investigation of Beacon Island victims' skeletal remains. Gibbs (2003) has also more recently progressed archaeological theory related to specific issues concerning shipwreck survivor camps and survivor behaviour, based on his work on the site

There are no registered indigenous sites on the Western Australian Aboriginal Sites register on West Wallabi and the site has been subject to three previous excavations in which no indigenous material was identified. The Department of Indigenous Affairs (DIA) was informed of intended work and it was agreed that an application for a permit under Section 16 of the *Aboriginal Heritage Act 1972* was not required in order to undertake the work. The WA Museum, as a statuary body, gave written assurances that they would take the necessary steps to ensure compliance with the *Aboriginal Heritage Act 1972* should any indigenous material be found.

Other islands such as Traitor's Island, Seal Island, Dakin Island and Easter Island in the Morning Group have potential to contain artefacts and sites relating to the *Batavia* shipwreck, salvage and survivors' activities (Green & Stanbury, 1988) but, due to time constraints and priorities, were not investigated as part of the February 2007 fieldwork.

WEST WALLABI ISLAND

Background

The first recorded sighting of the West Wallabi limestone structures was by surveyor John Forrest who found them while undertaking an assessment of the islands' guano mining potential from the schooner *Moonlight* in 1879. He wrote that 'there are the remains of two old huts and a well of good water on this island (Forrest 1879:5). Visitation to the West Wallabi structures and other sites for the purpose of archaeological recording by Aquinas College occurred in 1964 and 1966 and by the Western Australian Museum in 1967 and 1974. Between 1879 and the present, an unknown amount of visitation and disturbance has occurred at the sites by guano miners, fishers, fossickers and other casual visitors.

O'Loughlin described the investigation of the two structures (WWICS and WWIIS) on West Wallabi Island in 1964 and 1966 including their trenching and sieving work to a depth of eight to ten inches. Their origin was found to date to *Batavia* history since both were identical in detail of construction with similar ones visited on Long Island and Beacon Island. In addition to constructional evidence, Dutch beardman jar pieces were found in the sand near the coastal structure at Slaughter Point. Similar pieces were found in 1963 on Beacon Island. Oyster shells, the burnt bones of tammar, seal and bird were also found near WWICS. We know from the Pelsaert Journals that survivors of the mutiny occupied West Wallabi for some time under the leadership of Wiebbe Hayes (O'Loughlin, 1966: 11). Low walls divide WWICS into two definite sections, the walls resembling foundation walls of a small two-roomed hut. The eastern and smaller room is not as well preserved as the other. It seems possible that this section was added as an afterthought to the original structure. All objects of interest were found outside the western end of the structure. This area yielded the most conclusive evidence of occupation (O'Loughlin, 1964: 35). Other finds included pieces of metal, regular pieces of sharp coral (possible weapons?) and two ship's nails. O'Loughlin also noted that the base of the stone structure extended an additional eight to ten inches below the level of their sieving operations (O'Loughlin, 1964: 36).

In 1966, Aquinas College returned to West Wallabi and conducted further work excavating and sieving the interior of WWICS to a similar depth of eight to ten inches, resulting in the finds of a crudely made lead ladle, more ceramic sherds, numerous iron fragments (some bent in the shape of fish hooks) and burnt bone, mainly tammar (Bevaqua, 1974:2). The Museum undertook its first visit to conduct excavations on West Wallabi Island in 1967, and later in 1974. Bevaqua was critical of the 1967 excavation which never had the results compiled into a report, although the artefact catalogue listed items of interest. These included another crudely made lead ladle and a small square lead piece similar to other lead pieces found on Beacon Island believed to have been used as weights for measuring small quantities on a balancing scale (Bevaqua, 1974:5). Bevaqua concluded that the use of the word 'fort' to describe the two structures, WWICS and WWIIS, was both misleading and inaccurate. The site is a 'roofless, unimposing hut built of limestone slabs. The structures do possess defensive capabilities but the defences are subtle and only become apparent after some scrutiny' (Bevaqua, 1974:4). Cultural disturbances to the West Wallabi sites in past years that have affected the archaeological record include guano mining and modern fossicking for souvenirs.

A general survey of all West Wallabi historic sites was carried out as part of an Abrolhos Project in December 1980. This survey documented guano-mining sites, wells, fireplaces and cairns as well as the inland and coastal structures. It noted modern contamination of sites such as by shotgun shells and bottle glass (Kirkham 1980).

Batavia artefacts, reportedly from terrestrial contexts in the Wallabi Group, were handed into the Western Australian Museum, Department of Maritime Archaeology during the *Historic Shipwrecks Act 1976* Amnesty held in 1993. These included musket balls, lead artefacts, copper, an iron needle, two homemade shoe buttons, uniform button, brass catch, barrel hoop iron and miscellaneous iron. The declaration of these artefacts is evidence of fossicking activities that also potentially resulted in the removal of a great deal more (undeclared) material.

Archaeological investigations of the WWIIS also located 19th century glass and ceramic artefacts. These are believed to be associated with guano miners' known occupation of the structure during guano mining operations at the Southwest field and Snake Flat field from around 1890s–1915 (Bevaqua, 1974:3). As such, it is uncertain whether the guano miners simply inhabited the existing structure (likely to have existed prior to guano mining activities if it is the same 'hut' noted by John Forrest in 1879) or built it themselves. Interestingly no 19th century material has been recorded at WWICS (Bevaqua, 1974:5).

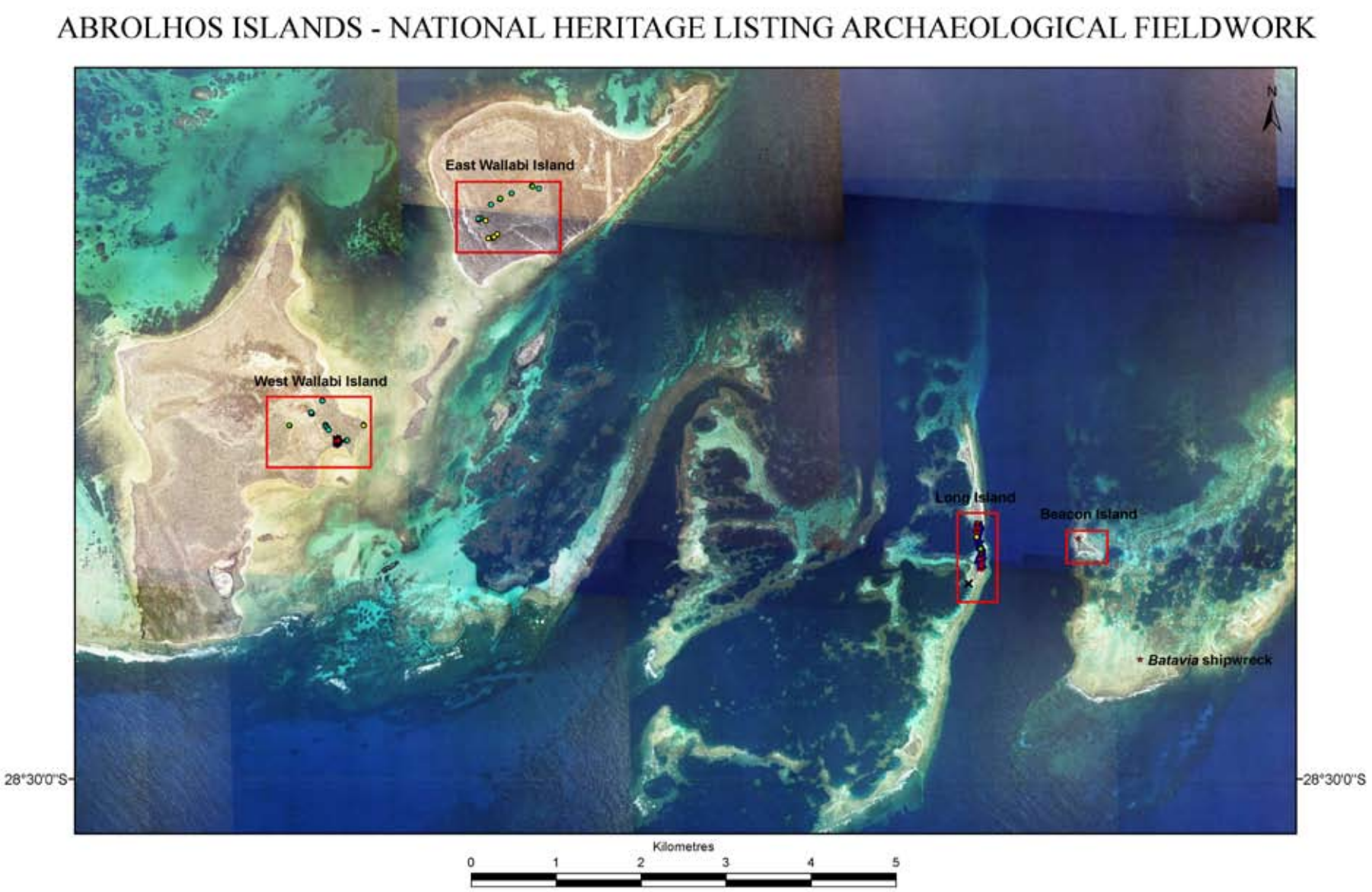

Figure 3. Map of. Wallabi Group, Abrolhos Islands showing 2007 survey and excavation areas.

Figure 4. WWICS (Photo: Alistair Paterson, WAM).

Survey and excavation of coastal structure on West Wallabi Island (WWICS)

Introduction

The 2007 field season surveyed several known, as well as new archaeological sites. The main emphasis was the excavation of WWICS (Figure 4). A photographic record complements the spatial mapping of features.

Figure 12 shows the excavation squares and the approximate location of previous excavations. As stated, the primary aims was to test the site to establish what archaeological material remains in (1) areas previously excavated and (2) areas outside the excavation zones, so to better understand what remains, what has been recorded, site taphonomy, and future management. Figure 6 shows the areas selected for test pitting in 2007.

Squares were located using baseline and offset from a NS line. One metre squares were excavated as samples in areas not indicated as previously excavated (although all areas may have been dug into, especially AA14 at the southern end of the structure.) The soil is a matrix of crushed shell, coral, bone, limestone, and vegetable matter, with little clear stratigraphy. As such, arbitrary units of 10 cm were excavated. The excavated material was sieved in 6 mm and 3 mm sieves. All artefactual material was collected, including bone. For each unit one bucket was sampled whereby all sieved material was kept (except first two units of Z27). Relative heights were recorded with the total station.

Square Descriptions

Square Z27 was located outside areas noted as previously excavated. Three units were excavated until limestone pavement was reached. Comparative heights of the pavement were surveyed for all the squares. Being closer to the main limestone shelf, the limestone was reached earlier in Square Z27 than other square.

Square AA14 was also set up outside area noted as previously excavated. The square was located at the SW edge of structure. Five units were excavated until limestone pavement was reached. Comparative heights of the pavement were surveyed.

Square ZZ22 was also located outside the area noted as previously excavated. Three units were excavated until limestone pavement was reached. This area had 5 metal detector targets, and some metal artefacts were collected.

Square BB17 was inside the stone structure in an area previously excavated. Three units were excavated, although the local pavement was not reached. Notable artefacts include metal clasp and points, possibly Dutch soldiers' equipment or uniform.

WWICS Artefact analysis

BAT 3949 Book clasp

Made of copper alloy this decorated book clasp can be positively identified as 15th–17th century Dutch in provenance. Similar artefacts have been found on the *Batavia*, *Zeewijk* and *Zuytdorp* wrecks (e.g. BAT 3380, BAT 3631) and in excavations in Amsterdam dating between the 15th–17th centuries (Baart *et al.* 1977:400-404).

The significance of this book clasp is that it is the first archaeologically provenanced find relating to the survivor camps that indicates books were carried ashore and between the islands. It is most probably from a bible. It indicates the type of possessions that were valued by the *Batavia* shipwreck survivors, even when undertaking small boat trips between the islands seeking the basic necessities of life. As this structure is associated with the soldiers/military occupation it indicates a level of literacy and education held by at least one person. Metal objects outlast the rest of the organic materials (paper, wooden book covers) comprising a book. It is said that of these book clasps that:

Ever since the Middle Ages book-bindings have had metal mountings and clasps to protect the corners and prevent dust and dirt penetrating the pages. After the 16th century it was not the printer but the vendor who was responsible for the binding and the manufacture of the mountings and clasps. Unfortunately these bindings are sometimes dated but are not marked and it is therefore difficult to ascribe them to a specific place or workshop (Baart *et al.* 1977:404).

BAT 3950 Lace tie end

This artefact can be positively identified as 16th–17th century Dutch in provenance. The artefact is a small, rolled, thin copper sheet, conical in shape, for use as a tie end on shoe or clothing lacing to stop fraying ends. Similar examples have been found on the *Batavia* wreck site (e.g. BAT 3074, BAT 3950, BAT 565, BAT 3872), and site of the *Scheurrak* T24 shipwreck a Dutch 17th century merchantmen (Holk, 1986:25), and in excavations in Amsterdam (Baart *et al.* 1977:159). This particular type of lace end is generally dated to the last quarter of the 16th and first half of the 17th century (Holk, 1986:25).

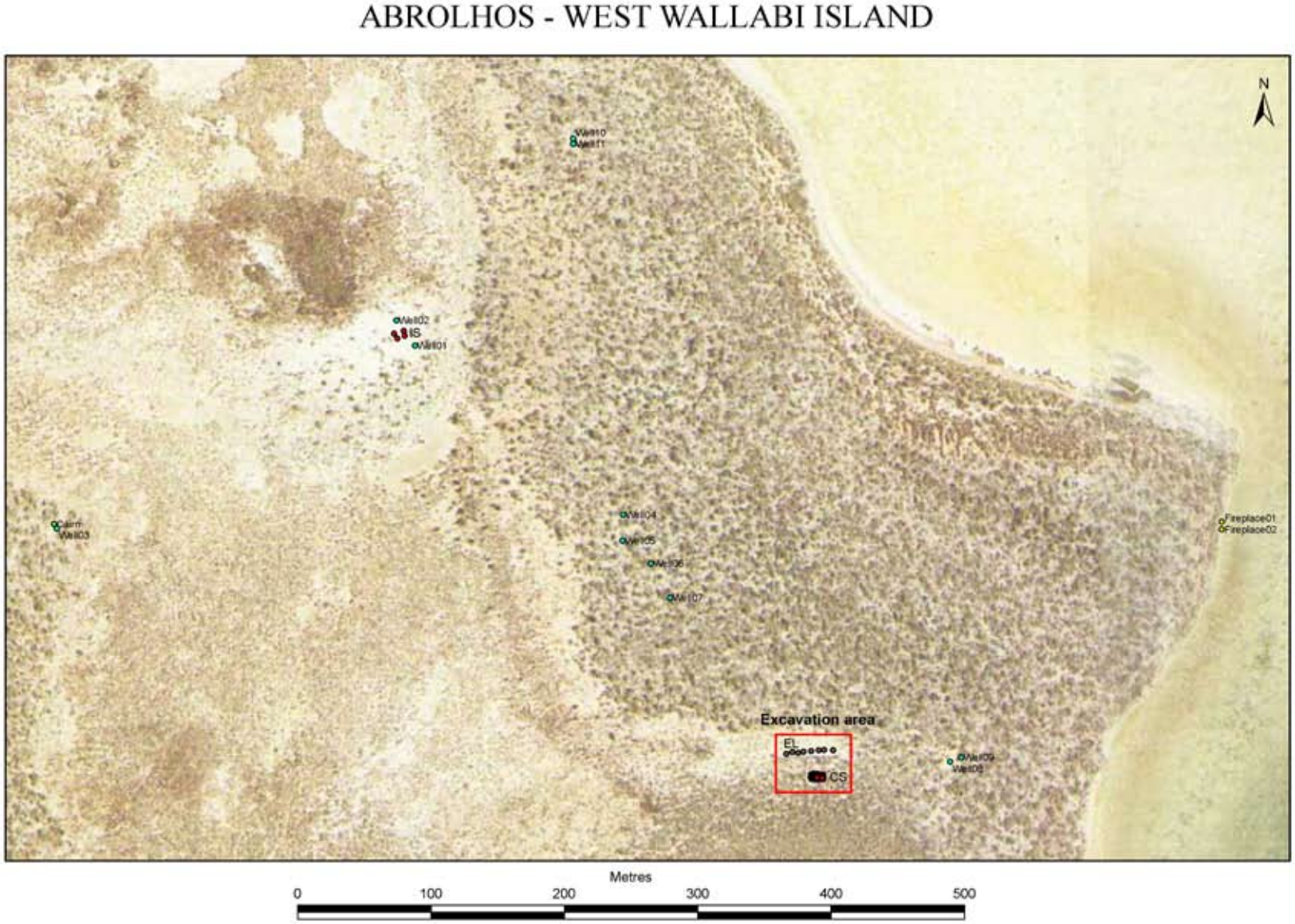

Figure 5. Map of West Wallabi Island, wells, cairns and structures.

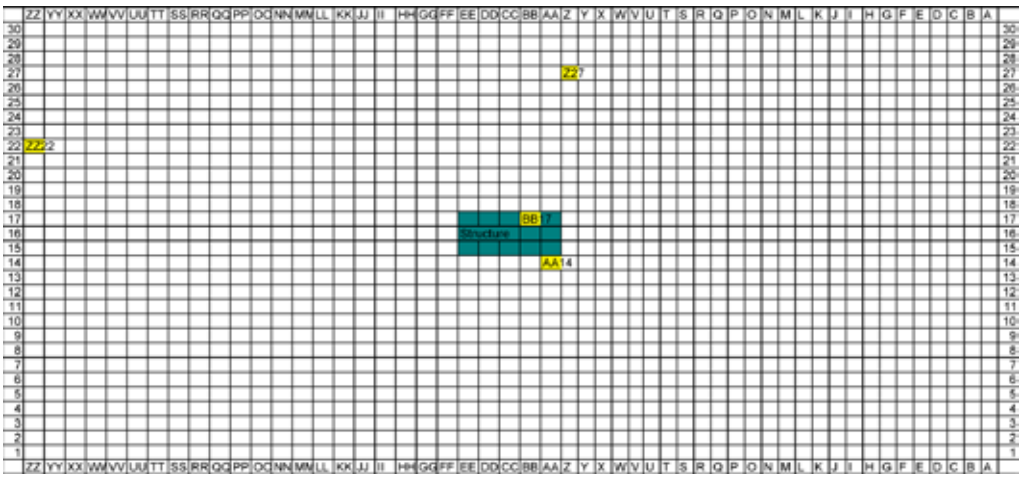

Figure 6. 2007 Excavation area detail (Paterson, 2007).

Figure 7. AA14 basal unit (Photo: Alistair Paterson, WAM).

Figure 9. ZZ22 basal unit (Photo: Alistair Paterson, WAM).

Figure 8. BB17 basal unit (Photo: Alistair Paterson, WAM).

Figure 10. Z27 basal unit (Photo: Alistair Paterson, WAM).

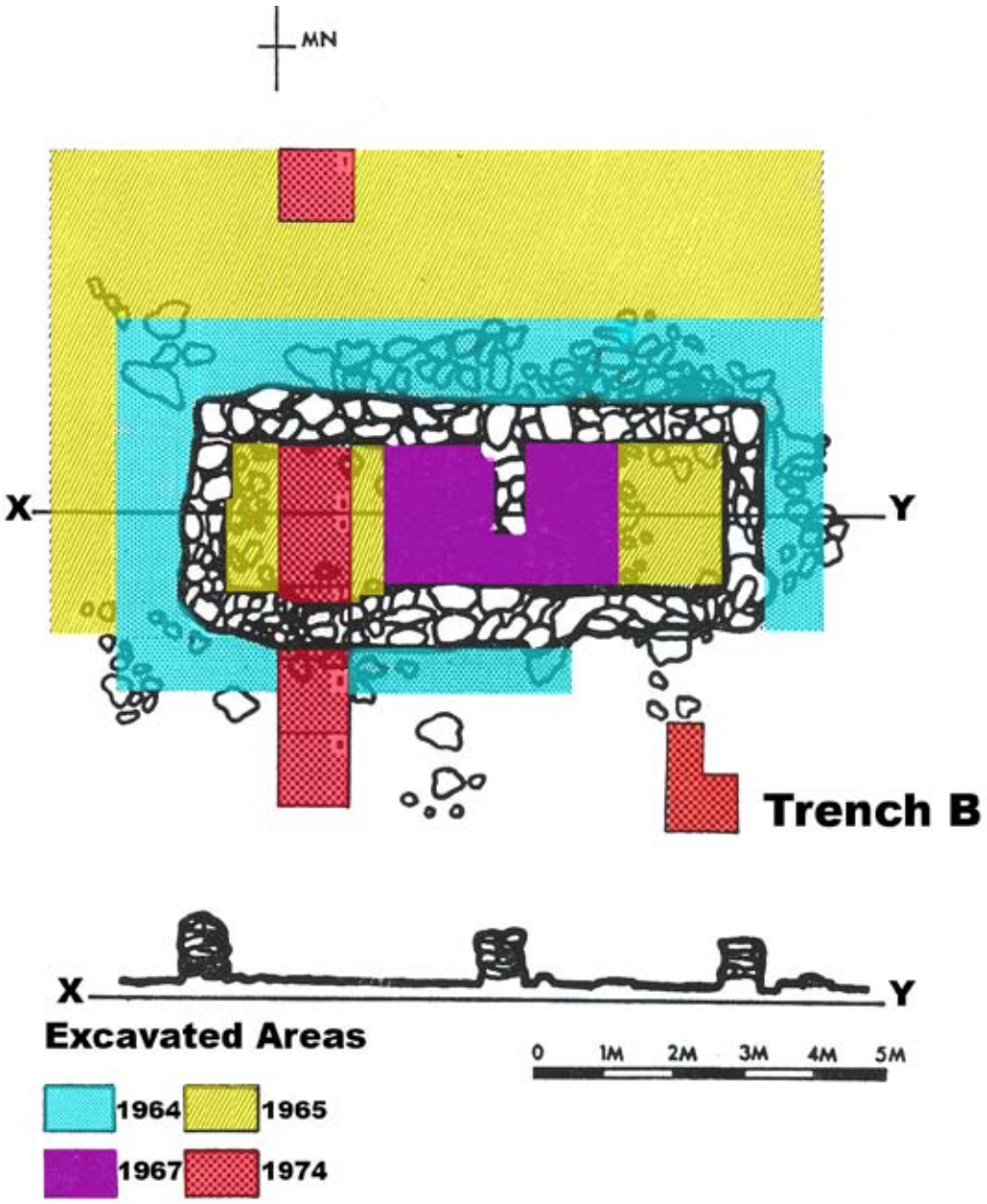

Figure 11. Site plan of previous excavations at WWICS (Kirkham 1980:4).

BAT 3948 Two square lead weights /money / tokens/ gaming pieces

These artefacts can be positively identified as 17th century Dutch in provenance and are similar to BAT 3327 (weight 9.0g, 18 x 18mm square) and BAT 7067 (25.9g, excavated from the *Batavia* wreck site. Their function is not certain, although they have been described and could be used, as weights (such as for measuring rations etc). An alternative explanation is that in Holland in the 17th and 18th centuries for 'special events lead attendance-coins were made and distributed in order to check who was present. Also made of lead are tokens with which the poor could get their most basic needs' (Baart *et al.* 1977:409). Similar small, square-shaped, lead objects have been identified as gaming pieces (Baart *et al.* 1977:460). Many of the identified examples have crosses scratched into them wheras these artefacts do not have any markings.

A small amount of burnt lead (BAT 3951), of unknown function, was also found.

BAT 4772 Glass fragments

Three small green coloured glass neck or rim fragments were found in Square AA14, Unit 2. These are too small and fragmentary for typological analysis or firm identification.

BAT 4768, BAT 4771, BAT 4798, BAT 4807 Faunal remains

Faunal remains included a variety of bones from tammar wallabies (*Macropus eugenii derbianus*) birds—probably wedge tailed shearwaters (*Puffinus pacificus*)—and fish. Some of the animal bones showed evidence of being burnt and cut (BAT 4768, BAT 4771, BAT 4798, BAT 4807) and therefore are clearly part of the cultural deposit.

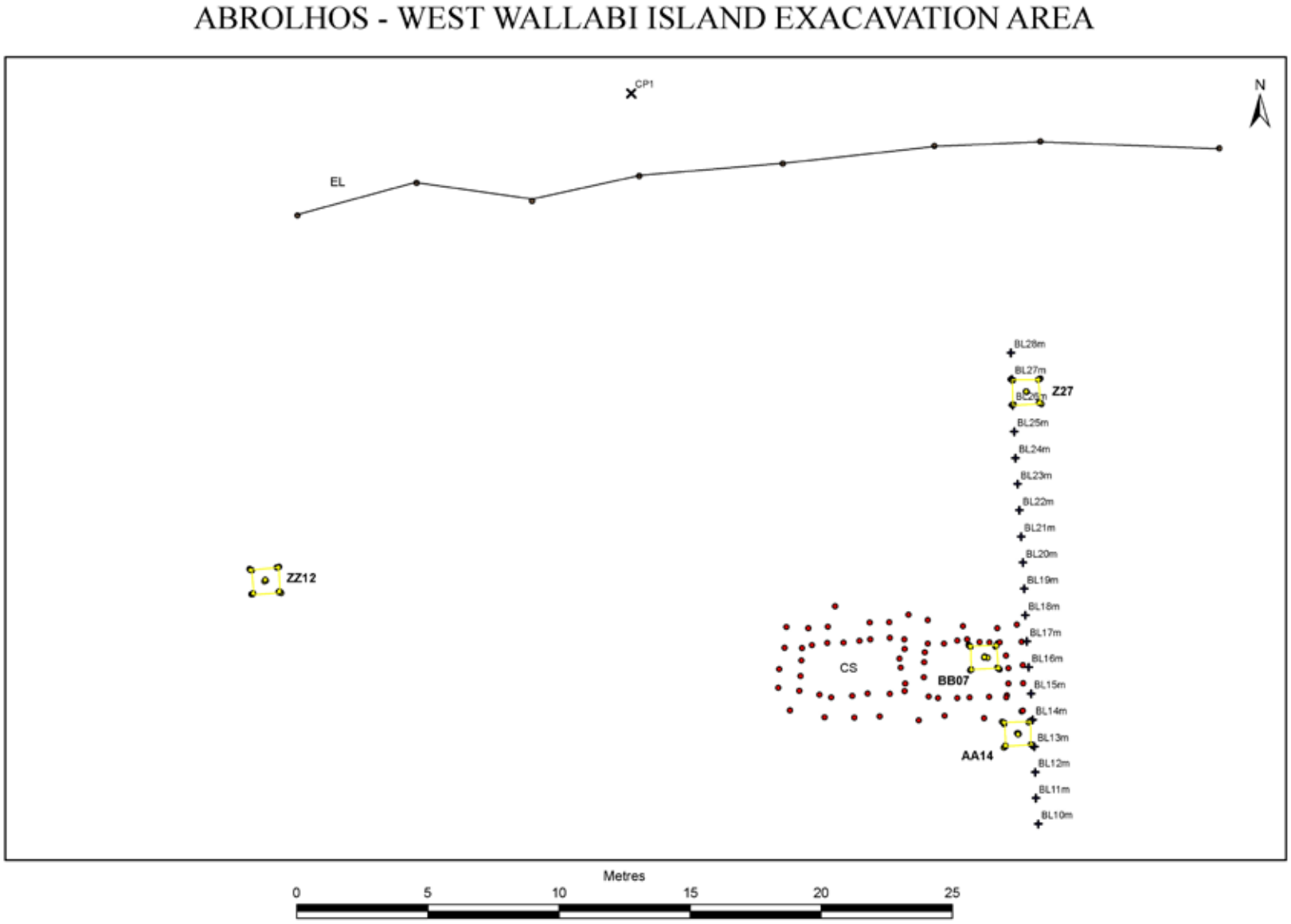

Figure 12. Map of West Wallabi Island, general excavation area near coastal structure

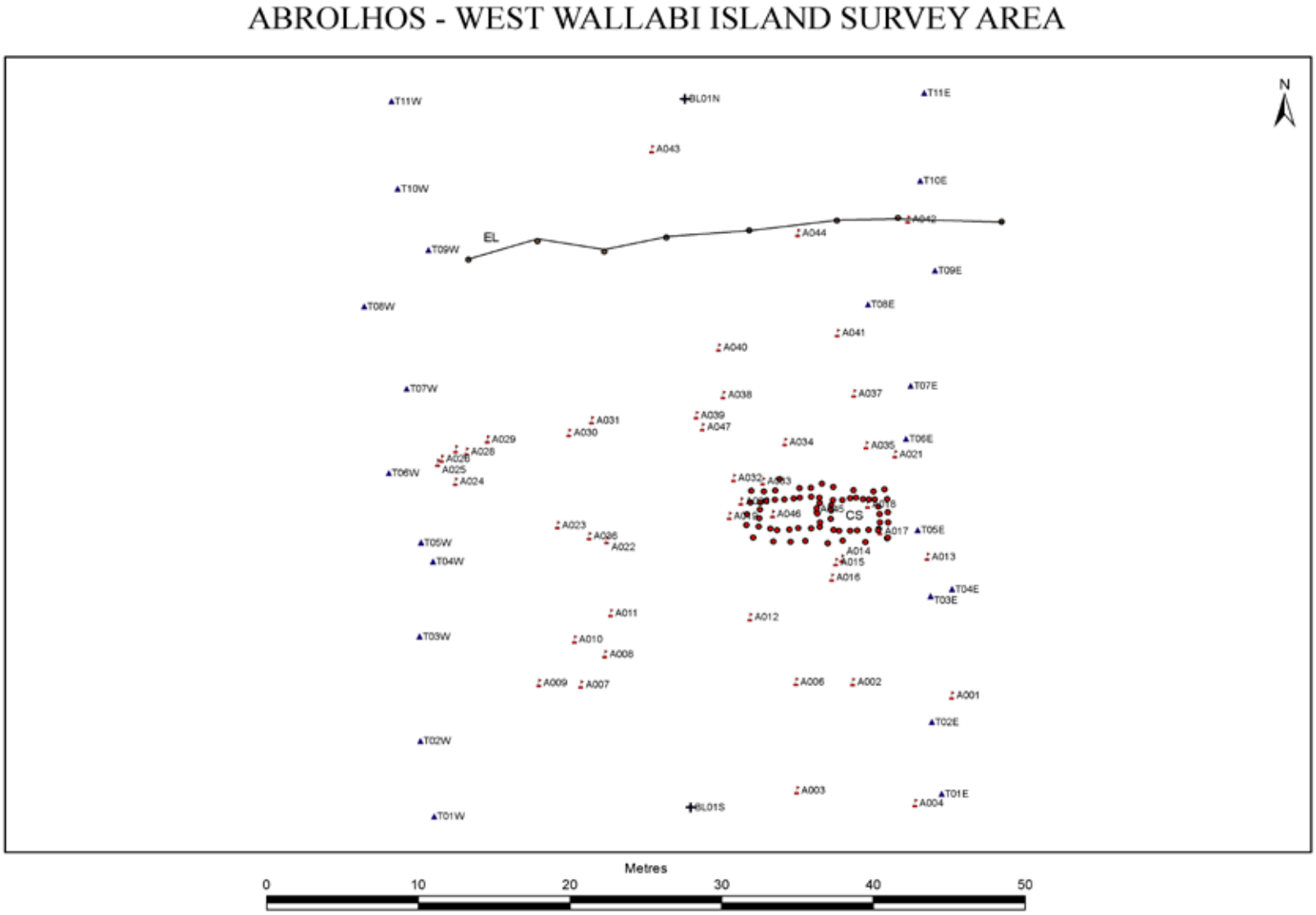

Figure 13. Map of West Wallabi Island, metal detecting area near coastal structure

Figure 14. BAT 3949 (Photo: Patrick Baker, WAM).

Figure 15. BAT 3950 (Photo: Patrick Baker, WAM).

Figure 16. BAT 3948 (Photo: Patrick Baker, WAM).

Sieved material was collected from 6 mm and 3 mm sieves that included marine shell and organics, mainly small sticks and root fibres. A large amount of small cockle-type, bivalve shells were collected that form the geographical strata of the site from when it was a low tidal beach and shallows during a time when sea levels were higher.

Overall, the archaeological recovery of Dutch material related to the *Batavia* shipwreck from the West Wallabi coastal structure shows that despite previous intensive excavations that involved sieving the ground surrounding and inside the structure, some Dutch material remains at this site. The preliminary identification and analysis presented here provides information on the type and amount of material collected, and its significance. The bulk of excavated material, notably the faunal bone analysis, awaits further analysis that is beyond the scope of this report. Such a detailed investigation is suitable for a post-graduate archaeology student Honours or Masters thesis, for which the *Batavia* NHL fieldwork archaeological data and material will be made available.

West Wallabi Island metal detection and field survey

A small survey was conducted on February 5, 2007, around WWICS on West Wallabi Island according the same method as the Long Island metal detecting survey. An area of 1500 m^2 was surveyed to determine the presence of unexcavated cultural remains relating to the *Batavia* period. As the area around WWICS has been excavated several times between 1964 to present, it was necessary to make an assessment of the current archaeological potential and value of this land site.

A 50 m baseline was laid in a north-south direction, west of WWICS. Perpendicular to this baseline, 30 m transect lines were laid down with tapes on a 5 m interval to provide a methodical metal detecting area. The baseline, transect lines and all metal targets were surveyed in with the Omnistar DGPS. The area south of WWICS and directly around it was surveyed with 44 targets located. Furthermore, in the area north of WWICS, where vegetation is scarce and the bottom rocky, only three metal anomalies were targeted. Approximately 20% of all 47 targets were surface finds; comprising modern material such as remnants of cans, bottle caps, and bullet cartridges. The remaining 80% comprise metal anomalies situated on or below the surface soil have not been recovered and remain *insitu*. These targets comprise historic cultural remains if found on the surface and may relate to the *Batavia* shipwrecking and the activities of Wiebbe Hayes and his men on West Wallabi Island. The remainder of metal targets are situated well below the surface and remain unidentified to date.

A walking survey utilising aerial photographs and previously recorded position of sites was also undertaken. All cultural features were mapped with an Omnistar DGPS courtesy of Fugro Australia Pty Ltd.

Positions of all cultural material mapped on West Wallabi Island are available at Appendix 1.

BAT 80547 - Silicate Inclusion

Acquisition Time:14:25:12 Date:16-May-2007

kV:30.00 Tilt: 0.00 Take-off:35.63 Tc:2.5
Detector Type :SUTW-Sapphire Resolution :160.70 Lsec :26

EDAX ZAF Quantification

Element Normalized
SEC
Table : User

Element	Wt %	At %	K-Ratio	Z	A	F
O K	8.01	19.9	0.0226	1.107	0.254	1.0032
MgK	0.71	1.16	0.0013	1.0665	0.1763	1.0025
AlK	1.44	2.12	0.0037	1.0361	0.2462	1.0051
SiK	9.63	13.63	0.0345	1.0671	0.3338	1.005
P K	7.71	9.89	0.0307	1.0326	0.3846	1.0043
S K	1.62	2.01	0.0077	1.06	0.447	1.0062
K K	1.09	1.11	0.0085	1.0269	0.7363	1.0277
CaK	1.79	1.78	0.0157	1.0502	0.8004	1.0403
MnK	0.6	0.43	0.0055	0.9445	0.9708	1
FeK	67.39	47.96	0.6397	0.9642	0.9844	1
Total	100	100				

Table 1. Silicate Inclusions Long Island Bolt (BAT 80547).

LONG ISLAND

Background

The Department of Maritime Archaeology has continued an on-going visual and metal detector survey of Long Island initiated in 2001, with the aim of locating evidence of habitation, including the execution site where the mutineers were tried and hanged according to 17th century Dutch conventions of justice. A research strategy and predictive model for the identification of a location for the gallows site was based on the likely construction (timber, iron fastenings, possible use of wreck timbers by ships' carpenters), anticipated site formation processes (collapse, partial burial) and possible clothing and human remains (buttons, textiles, teeth, bones) if the bodies were left to rot on the gallows or buried (Souter, 2005: 9). Between 45 and 60 survivors are known to have sheltered on 'Seals' Island (Long Island) with all but 'seven boys and some women' subsequently murdered (Drake-Brockman, 1963:159).

Previous finds have included a beardman jar sherd (LIWAM 67) found in 1967; a lead morning star weapon (BAT 3923) found in 2001; square head nails and a ship's fastening BAT 80531, BAT 80532, BAT 80533 and BAT 80534) found in 2005. A large copper alloy pintle (BAT 3918), was donated to the Museum during the Amnesty and is believed related to the Batavia Fort stone portico, used to support a large hinged wooden gate. This object was reportedly found in shallow water off the anchorage and landing place on the eastern side of Long Island. Given the discovery of several iron fastenings in 2007 in the vicinity of the anchorage and landing place, this object takes on a renewed significance as part of the Long Island assemblage of *Batavia* artefacts.

Long Island 2007 field survey

Introduction

Long Island has twice been subject to a visual and remote sensing survey using a metal detector by the Department of Maritime Archaeology, WAM (in 2001 and 2005) (Souter, 2005). In these two survey efforts, which mark the first systematic investigation to be conducted on the island, the northern half of the island was covered. After the discovery of material believed to be contemporary with the *Batavia* mutiny in both surveys, it has been recommended to continue the survey efforts in order to cover the entire Long Island area. In 2007, the Department of Maritime

Figure 17. BAT 3923 Morning Star (Photo: Patrick Baker, WAM).

Figure 18. BAT 3918 *Batavia* portico pintle (Photo: Patrick Baker, WAM).

Archaeology scheduled to include a continuation of the Long Island survey as part of its NHL program. Three days were planned to survey the southern premises of the island. Like previous survey efforts, the aim of this survey was to detect any surface artefacts or sites likely to be related to the *Batavia* massacre and subsequent executions of the *Batavia* mutineers. The 2005 departmental report on the Long Island archaeological investigation stated that:

> The archaeological signatures of these events are reasonably predicted to include small artefacts such as metal buttons or buckles from clothing and belts, lost or discarded weapons eg; morning stars, hatchets, knives, swords, spikes, and possibly iron fastenings from the gallows that are recorded to have been erected on Long Island. These artefacts could lie anywhere on the island (including submerged and below the low water mark) as isolated finds, or as a cluster of finds (Souter, 2005:9).

Although historical evidence from Pelsaert's journal does not indicate whether the mutineers were left on the gallows, it is unlikely that they were taken down and/or buried after their execution. According to Dutch practise of the period 'earth was not given or permitted' for those who were executed (Mak, 2001:136). The gallow fields of Amsterdam, for example, were well known for the decomposing bodies of criminals that were purposely left exposed to the elements. The research questions for this Long Island survey are identical to those of previous years and can be summarised as:

1. Are there any archaeological sites or artefacts of historical significance remaining on Long Island?
2. Is there any surface archaeological evidence of gallows structures remaining on Long Island?
3. If so, is there any archaeological evidence that mutineers were left hanging on the gallows?
4. Is there any archaeological evidence of burial sites on Long Island? (Souter, 2005)

It should be kept in mind, however, that neither visual survey nor the use of a metal detector will provide conclusive evidence to answer the questions listed above as both methods are not capable of detecting buried organic remains, such as wood or skeletal material. Therefore, possible burial sites on Long Island may remain undiscovered using the current exploration method. Furthermore, organic materials are unlikely to have survived if exposed to the elements on the surface.

Equipment

Minelab 'SP2200$_{v2}$ Multi-period Sensing Technology' metal detector with a Minelab '1100 MPS Technology 'Double D' coil.

Leica TCR305 total station.

Fugro OmniSTAR 8300HP Differential Global Positioning System (DGPS).

Survey Methodology

The survey methodology was to use a Fugro Omnistar 8300HP DGPS to fix all control, transect, and anomaly points with an accuracy of a few centimetres in horizontal plane. During the 2005 survey, information was provided by Barry Humfrey (Humfrey Land Developments) for existing survey marks on the island CPLI01 (Control Point Long Island 01) and CPLI02 (Control Point Long Island 02). These points were relocated for 2007 Long Island Survey and the total station was positioned on CPLI01—the northern-most survey mark. Survey point CPLI02 was used to orient the total station survey.

A 100 m fibreglass tape was used to lay the baseline down and two 30 m tapes were placed perpendicular to the baseline three to five metres apart. These tape transects marked the metal detecting survey 'lanes' and were set at right angle from the baseline with a compass. After each 100 m baseline area was surveyed, the baseline tape would be moved in line from north to south along the island. In total, five 100 m baselines (BL01-05) were laid down and surveyed. Endpoints of these baselines are referred to as 'BL01S' and BL01N (for 'Baseline 01 South Datum' and 'Baseline 01 North Datum'). Transect line endpoints were recorded as e.g.; T01W-T01E (Transect 01 West – Transect 01 East). Artefacts or anomalies were recorded as A001, A002 etc. Baseline, transect line and

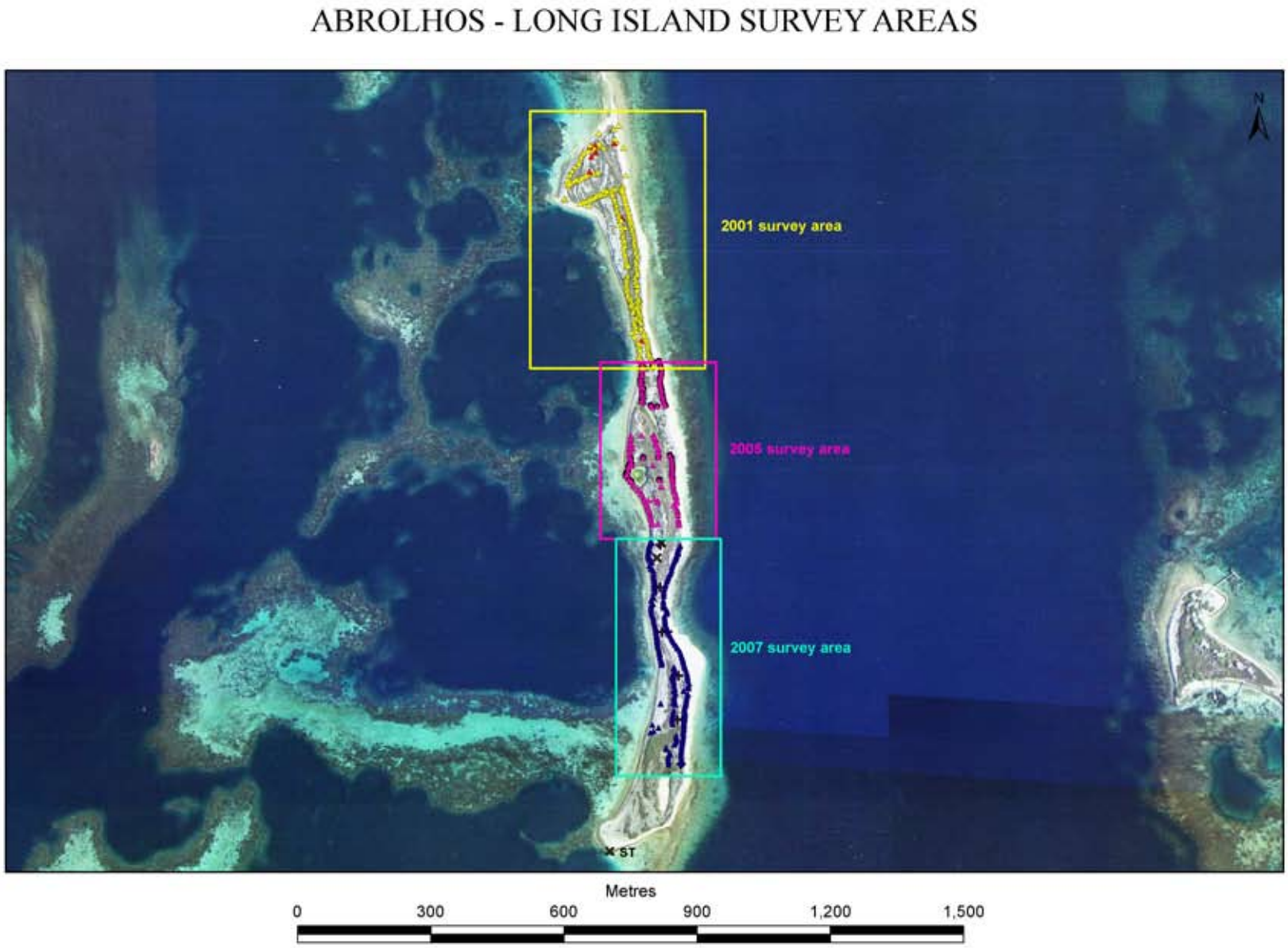

Figure 19. Map of Long Island, 2001, 2005 and 2007 survey areas

anomalies were fixed using the DGPS during the first three days and using the total station on the last day (as the DGPS antenna did not pick up enough satellites to provide accurate data.)

As in previous surveys of Long Island, one person acted as surveyor operating the DGPS to measure in the points of the baselines and transects, and to record the positions of any anomalies or artefacts found. Another person operated the metal detector to locate artefacts assisted by two persons who would help to locate targets, and move and offset tapes of transect and baselines as the detector moved along the island. Total station points were measured in by one of the metal detecting assistants and the surveyor. Communication between the operator of the total station and their assistant was facilitated by using hand-held UHF radios. According to survey instructions, the metal detector operator walked along either side of the transect lines moving the detector head coil from side to side to cover a 1.5 m transect lane swathe approximately 10 cm above the ground surface. This detection method and the previously described surveying method theoretically ensures a full coverage of the survey area, with an average 10 to 20 cm overlap between transects to guarantee full coverage. At the end of each day, the survey data was downloaded from the DGPS or total station and imported into Arcview GIS software.

Survey constraints

a) Environmental. Sandy sections along the high ridge of the island are occupied by nesting shearwaters. It was necessary to move the baselines and transect lines, and operate the metal detector very carefully through these highly sensitive areas in order to avoid treading on and collapsing burrows, thereby slowing the survey process. In addition, in some areas the island's vegetation was too high or dense, particularly in those areas along the highest ridge of Long Island. Here, the metal detector head coil could not be held at a distance of 10 cm or less from the ground. Coverage of these areas cannot be regarded as sufficient or accurate. Moreover, young chicks of nesting birds used these bushes as a hiding place at the time of survey. It was, therefore, decided not to include these areas in order to leave the flora and fauna of the island undisturbed. Furthermore, the sandy beach and deposition of coral rubble directly inshore from it were not included in the Long Island survey as this area is continuously disturbed by dynamic wave action and tidal changes. It is highly unlikely that any historic cultural remains would have been preserved in this area. The remaining areas of Long Island, particularly those consisting of non-vegetated coral rubble, were surveyed relatively quickly with 100% coverage.
b) Equipment. The metal detector used for the 2007 Long Island Survey is capable of detecting small, buried objects at a range of 10–30 cm. However, small isolated artefacts situated between the coral shingles or in soil at a depth greater than 30 cm, or below a bush greater than 30 cm height could not be detected.

Results

In total, five 100 m baselines were laid down and their associated transect areas covered in four days (February 1–3, and 8, 2007). This investigation was conducted within the limitations described above. Time restraints did not allow the completion of a systematic survey of the southern-most area of Long Island (approx. 250 m in length). This area remains un-investigated to date and it is recommended that the archaeological survey be completed in the near future. Artefact or anomalies detected during the survey were not recovered if below the surface soil (> 0.01 m depth, Total Station Point ID: A001-A015), and thus, remain unidentified to date. Metal artefacts representing historic archaeological material were recovered and registered in the museum's collection. One main concentration of wrought iron bolt and nail remnants was recovered from the southern end of Long Island near the only easily-accessible entrance/landing point to the island.

Positions of all cultural material mapped on Long Island are available at Appendix 1.

Long Island artefact analysis

BAT 80537—80547

A large concentration of wrought iron bolts and fastenings was found on Long Island in the course of the metal detector survey. Numerous remnants of iron nail heads and shafts, and three iron bolts were found in an area approximately 4 x 4 m. These fastenings are consistent with 17th–19th century ship construction; the nails having square-sectioned shafts and cylindrical iron bolts. The nails are poorly preserved and hardly have any diagnostic features. None of nail heads, for example, still has its original shape or dimensions, and none of the nail tips were found. The last stage of corrosion of metal fasteners is usually represented by remaining nail heads and their upper shafts as this part is the thickest and has the largest material density; this is exactly what is found in the Long Island fastening assembly.

The best-preserved remnant of a wrought iron bolt probably represents a clinch bolt with a thick washer (BAT 80547; pres. dia. 0.054; pres.th. 0.021), similar to those found in the *Vasa* ship (McCarthy, 2005:64, 70). The *Vasa* was built according to a Dutch bottom-based construction method and is contemporary to *Batavia*. The other two bolts found on Long Island are too poorly preserved; their heads and ends are missing (BAT 80540, BAT 80541). The preserved diameter, 0.033, of one of them (BAT 80541) is similar to the size of the bolts found on the *Batavia* ship's hull.

The site is consistent with the predicted remains of a gallows site, being a sufficiently large concentration of a range of iron fastenings used for fastening structural timber pieces and possibly decking.

Results of preliminary metallographic study of BAT 80547

A preliminary study of Long Island bolt (BAT 80547) found on Long Island was commenced after

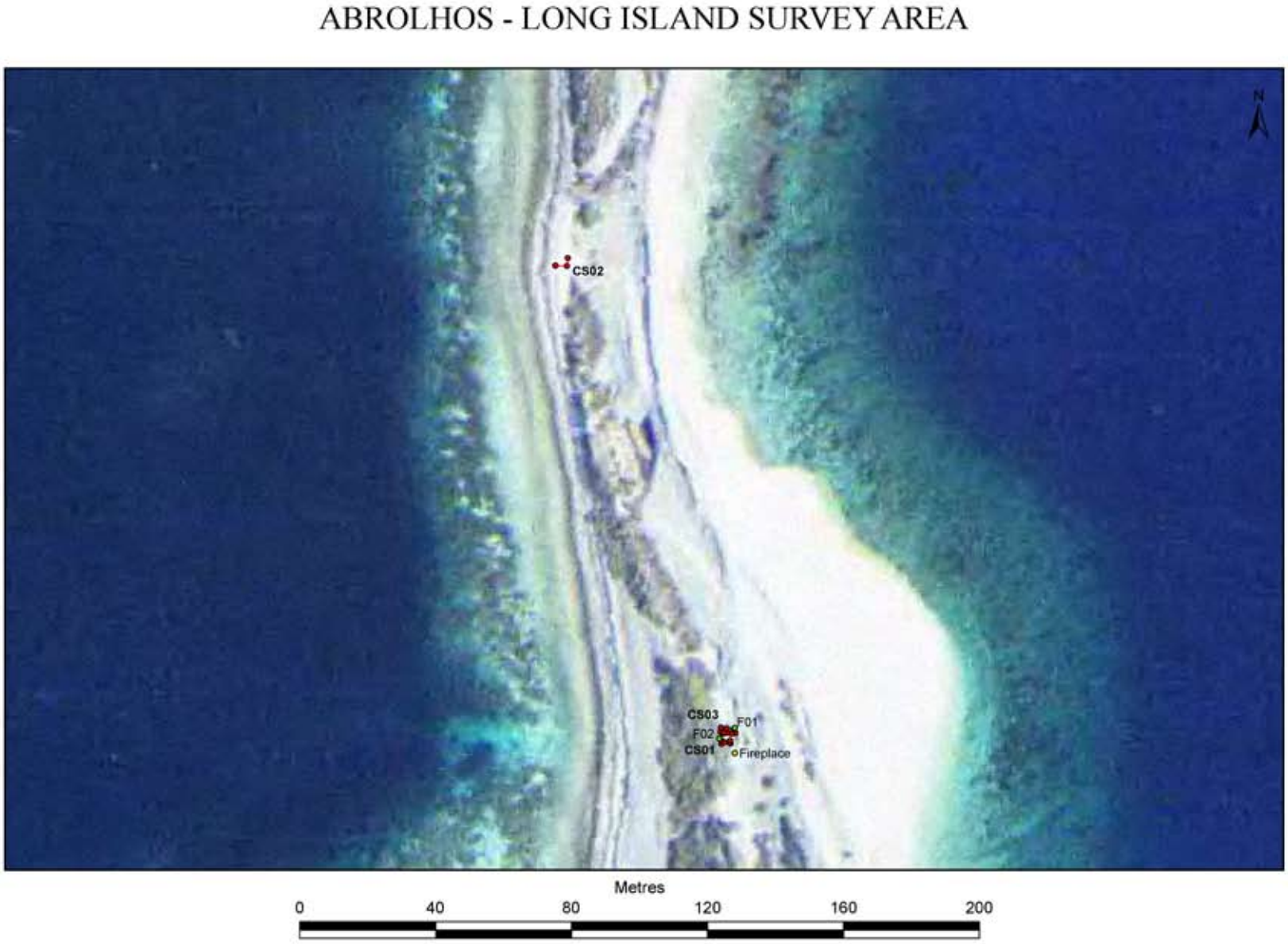

Figure 20. Map of Long Island 2007 survey area, showing structures, fireplace and unidentified features

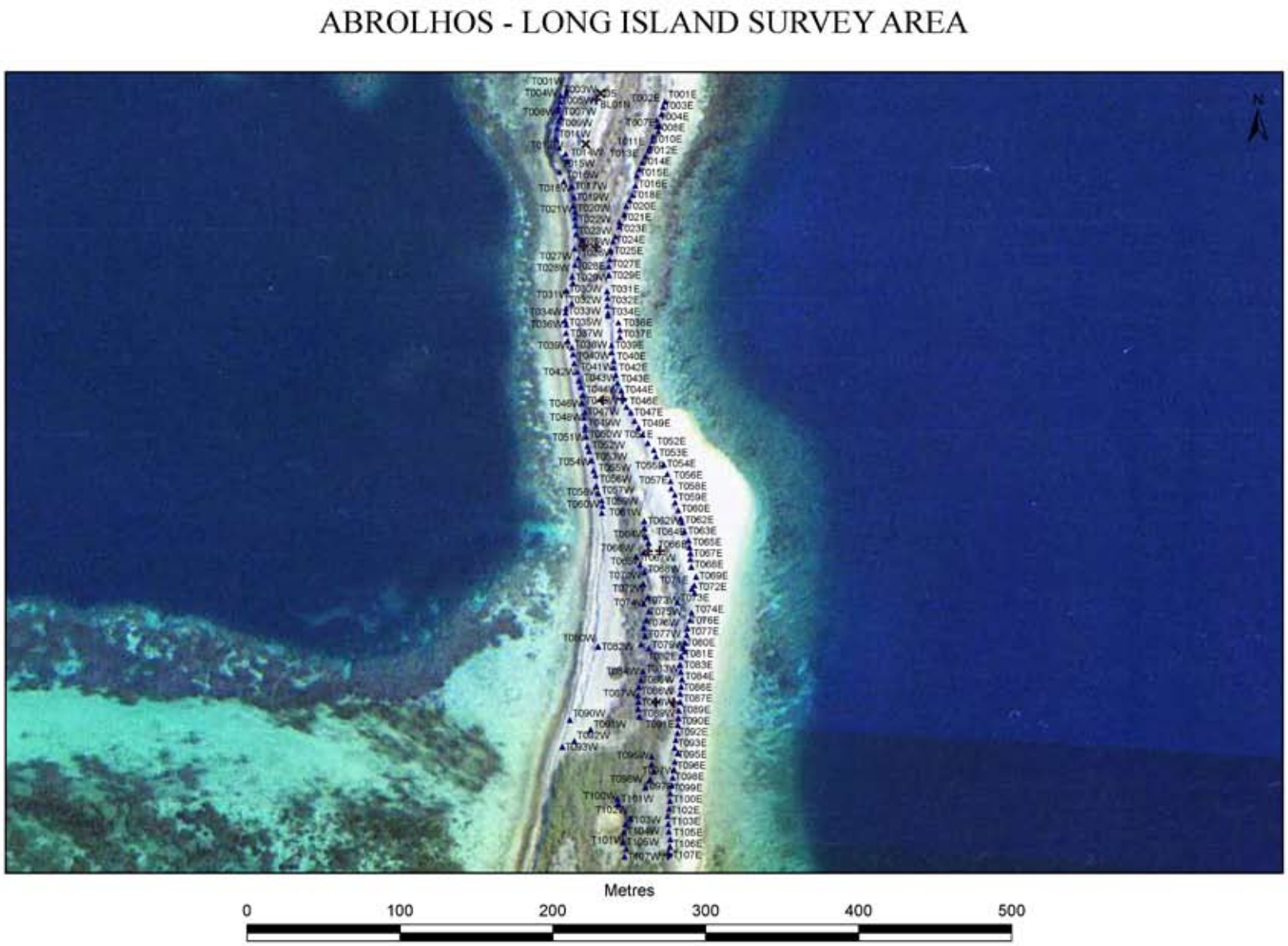

Figure 21. Map of Long Island 2007 survey area showing survey points, baselines and transects.

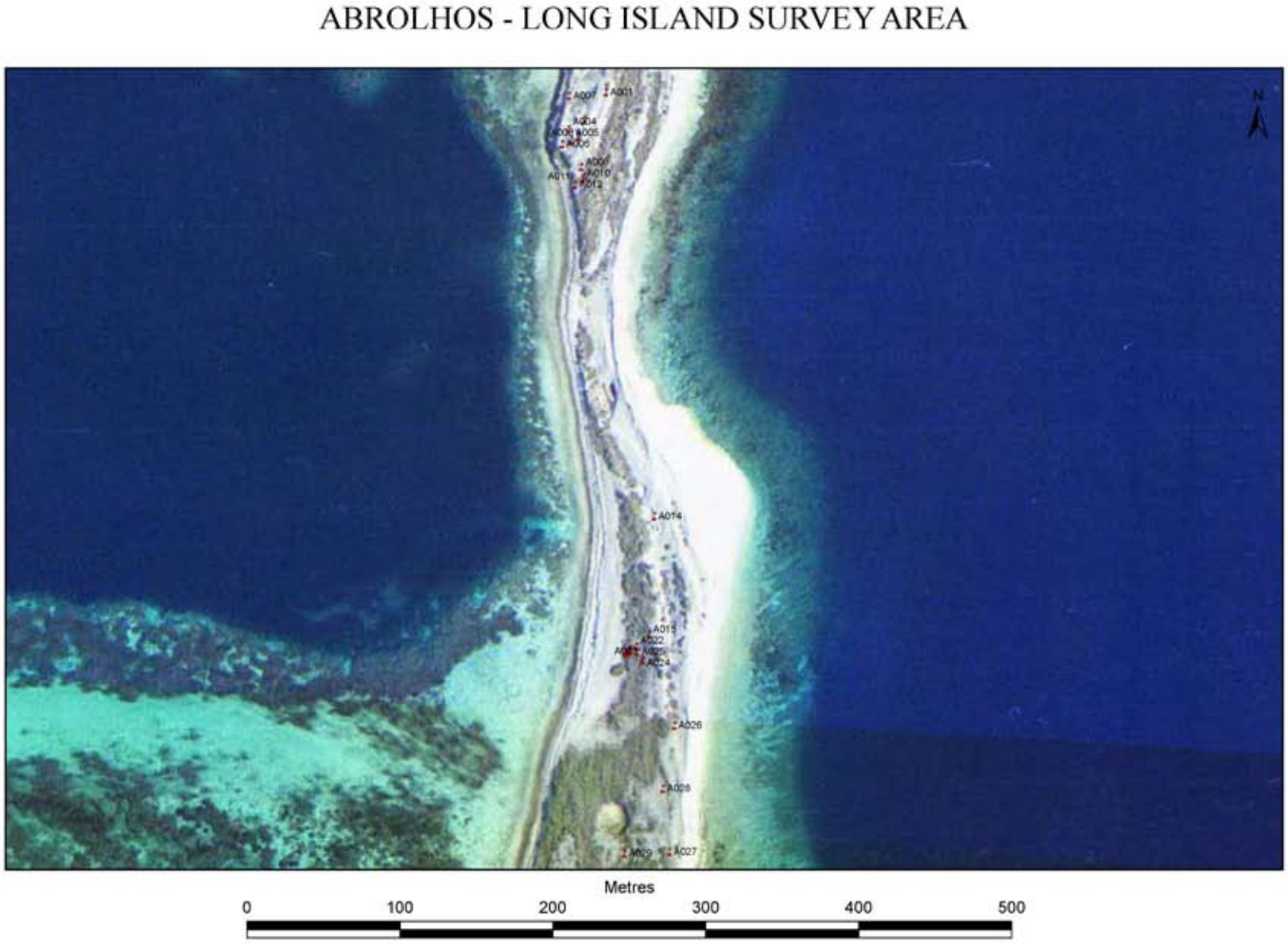

Figure 22. Map of Long Island 2007 survey area showing survey targets.

Figure 23. BAT 80547 clinch bolt (Photo: Patrick Baker, WAM).

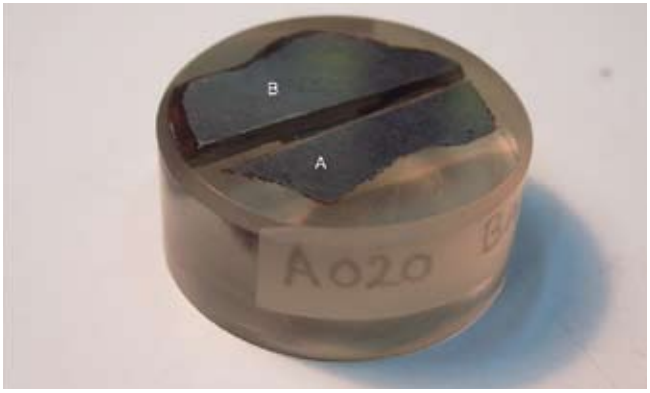

Figure 24. Embedded sample of Long Island bolt, with longitudinal (A) and transverse sections (B) (Photo: Patrick Baker, WAM).

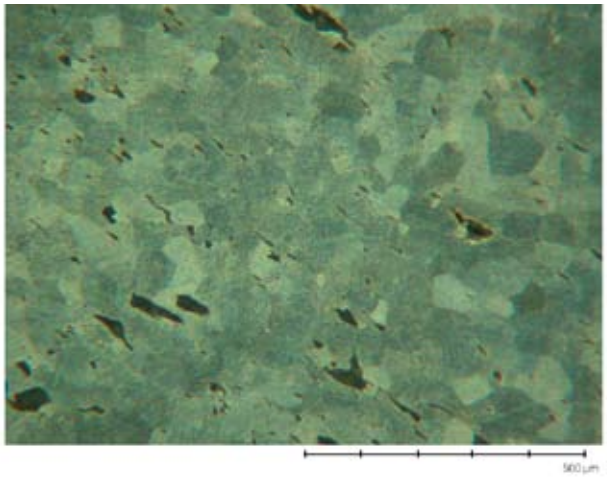

Figure 25. Equiaxed grain structure of Long Island bolt BAT 80547, Dissecting microscope (Micrograph: Wendy van Duivenvoorde, WAM).

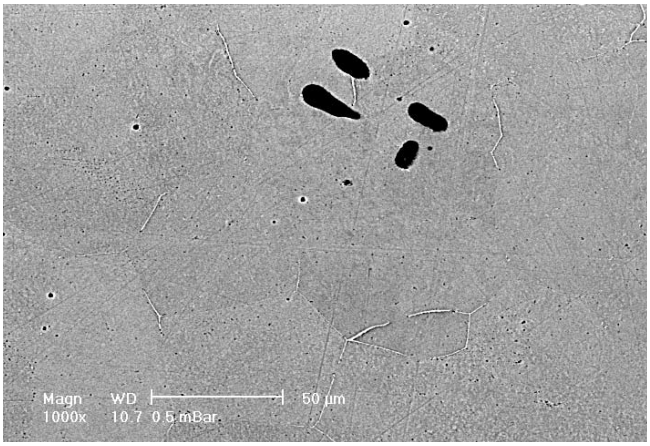

Figure 26. Silicate slag inclusion, Long Island bolt (BAT 80457). Scanning electron microscope. (Micrograph: Wendy van Duivenvoorde, WAM).

the fieldwork campaign in March 2007 by Wendy van Duivenvoorde, WAM and includes the chemical analysis and metallographic examination in order to possibly confirm its association with the *Batavia* shipwreck.

From the selected Long Island fastener, a small sample was sawn and subsequently embedded in resin showing a longitudinal and transverse section from the bolt's shank (Figure 24). The sample was cut in two sections with a 1 mm diamond by Derek Winchester of the CSIRO laboratories in Perth and then cleaned in an ultrasonic bath. The samples was dried at 40 degrees Celsius for a few hours and mounted in epoxy resin in a 30 mm plastic mould. Once the resin had set after 24 hours, it was removed from the mould and ground down on the front and back surface with a bench-top, diamond-grinding wheel. The front surface was ground to expose the sample from the resin for the polishing procedures. The rear is ground to neaten the sample and blunt the edges.

The surface of the sample was finally ground and sanded back with silicon carbide paper until smooth and flat and all major scratches removed. The sample was then cleaned in the ultrasonic bath again, and then polished to its final finish on a special polishing cloth with 1-3 micron diamond powder and light polishing oil. This took about one hour on a specialised polishing machine.

The sample was first etched for 80 seconds in $FeCl_3$ in ethanol and rinsed with ethanol and alcohol. It was then examined in the CSIRO laboratories, Perth, Western Australia, using a SEM with a SUTW-Sapphire detector. Spot testing with the detector is a semi-quantitative method of conducting chemical analysis. As this method of analysis is a localized testing method, it is not necessarily representative for the composition of the entire sample.

The following SEM settings were used during data acquisition: Kilovoltage: kV 30, EDAX ZAF Quantification, Element Normalized, SEC table: default, standardless, resolution: 159.80, tilt: 0.00, tc: 2.5. The time per sample analysis was set to about 30 seconds for each test.

The most common structure of wrought iron, according to North, Owens and Pearson, comprises a typical equiaxed grain structure with ferrite and slag inclusions (North et al. 1976:195). This structure is present in all historic and modern hot-worked iron (unless tempering has been applied). Some early wrought irons include localised areas with relatively high carbon content, in which a directional grain structure is present with pearlite inclusions (North *et al.* 1976:195; North & Pearson, 1975:1159-1160). This type of formation has

been observed in Dutch shipwreck material from the early 17th century and to the early eighteenth century. North, Owens and Pearson also found that pearlite inclusions or islands are no longer detected in material dating after 1840 (North *et al.* 1976:196). Pearlite is described in Scott's handbook on ancient and historic metals as 'The fine mixture of ferrite and cementite found in steels'. The eutectoid, pearlite, will be complete when the carbonate content reaches 8%. In most ancient steels, a mixture of ferrite and pearlite is common (Scott, 1991:142).

The Long Island sample was tested positive for trace elements which occur as natural impurities of iron, and the typical equiaxed grain structure with ferrite and slag inclusions (grey anomalies) were present (Figure 25). The results of the semi-quantitative chemical analysis of few grey-coloured slag inclusions, consisting of Fe silicates, can be found in Table 1 (Figure 26).

Variation in equiaxed grain size of the sample indicates different heats of iron. The elongated slag inclusions found in the longitudinal section of the iron bolt indicate intensive forging, which causes slag globules (natural impurities in iron ore) to become gradually elongated and string along the length of the object (Scott, 1991:7).

The pearlite regions typical for pre-1840 iron were observed in this sample by Ian McLeod, after re-etching with nital for few seconds (2% nitric acid in ethanol solution), using a reflected polarized light microscope. However, more metallurgical study on this sample needs to be conducted to provide conclusive evidence for its historic association.

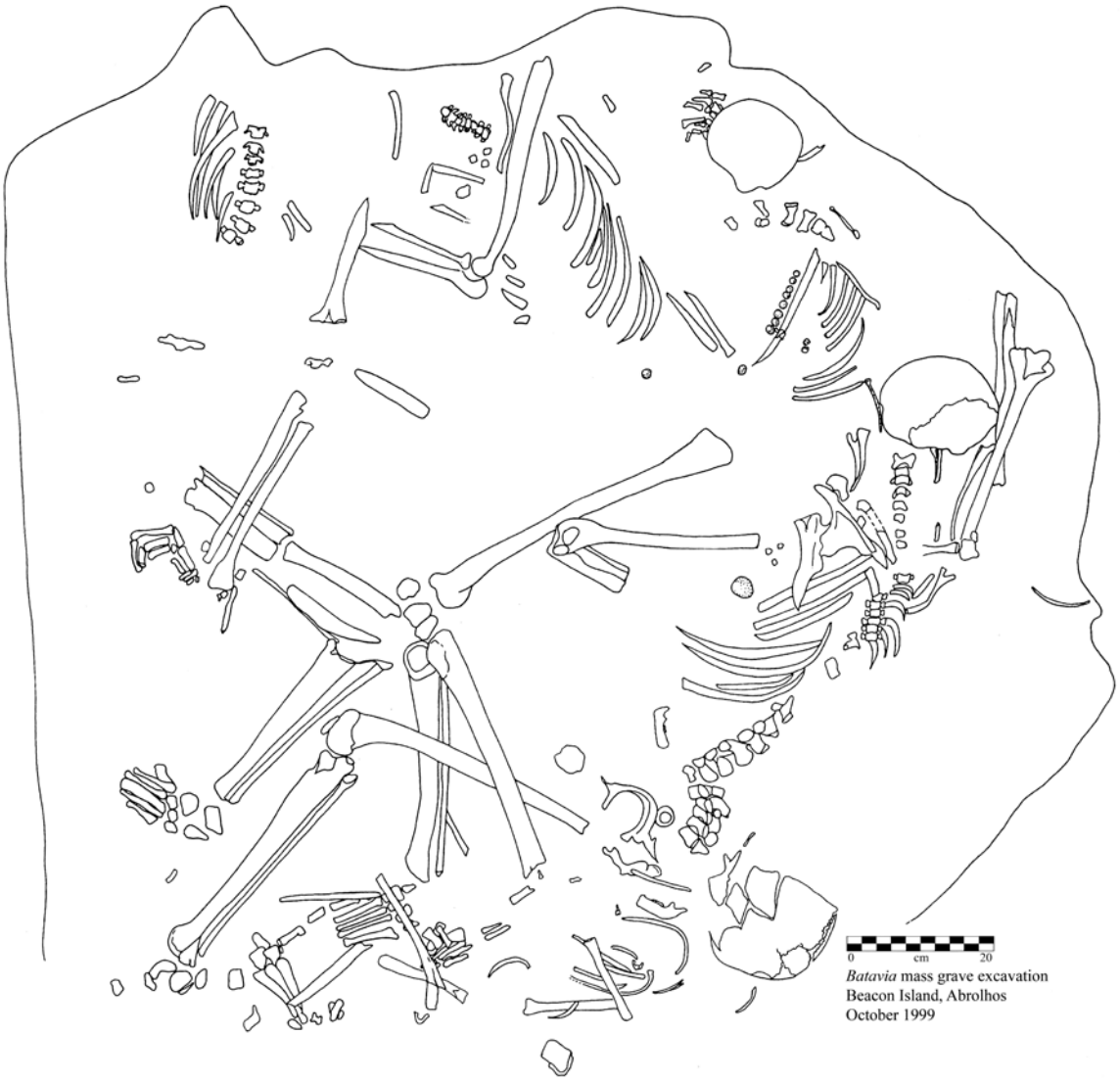

Figure 27. 1999 multiple burial excavation (Plan: Corioli Souter, WAM).

BEACON ISLAND

Background

The first discovery of a human skeleton and the discovery of the first datable Dutch artefact (an engraved trumpet garland) on Beacon Island was made by crayfisher Mr O. 'Pop' Marten around 1960. This led to Beacon Island being considered as the most likely location for '*Batavia's* Graveyard', and therefore the Wallabi Group as the most likely location for the wreck of the *Batavia*, previously thought by Stokes and Wickham to have wrecked in the Pelsaert Group (Stokes, 1846; Drake-Brockman, 1955:33 and 1963:278). Following the discovery of the *Batavia* wreck site in 1963, a frenzy of uncontrolled digging occurred both at the wreck site and on Beacon Island (Pasveer, 2000:5).

Human remains were located by crayfishers during (illegal) earthworks for a toilet leach drain in the early 1980s, though the Museum was not informed about the find until the Amnesty under the *Commonwealth Historic Shipwrecks Act* in 1993-94. A Museum team conducted a test excavation at the site and returned with skeletal remains belonging to at least two adults and one child (Gibbs, 1994; Hunneybun, 1995). The site was subject to a full excavation in 1999 (Pasveer, 1998, 2000; Pasveer *et al.* 1998). Although it was expected from the results of earlier test excavations, that three individuals (two adults and one child) would be present, the remains of five human skeletons were discovered—three adults, two children (SK7, SK8, SK9, SK10, SK11)—along with associated small artefacts. A dense, black deposit found in the middle of the grave, amongst the skeletons, was left *insitu* because of its uncertain nature and origin. In 2001, further excavation was undertaken to remove this dense soil feature from the mass grave site which was later carefully excavated in the Western Australian Museum Department of Materials Conservation laboratory

Figure 28. GPR acquisition system used on Beacon Island (Photo: Tristan Campbell, Geoforce).

(Paterson, 2005:74). Sixteen deciduous teeth and two permanent teeth were discovered in this organic deposit belonging to the sixth individual in the mass grave— an infant (SK12) (Franklin & Freedman 2005:81).

Zones of archaeological potential (the potent ial for burial of skeletons, mass graves, and other archaeological deposits) based on sand/soil depth on Beacon Island have been identified, and form a sound basis for further archaeological investigation and management of the island. The application of ground penetrating radar to further investigate this archaeological potential was considered the most appropriate survey technique post excavation work.

Beacon Island GPR Survey

Introduction

In February 2007, Tristan Campbell of Geoforce Pty Ltd conducted Ground Penetrating Radar (GPR) surveys for the Western Australian Museum on Beacon Island in the Abrolhos Island Group. The objective of the survey was to assess the potential for use of GPR in identifying archaeological targets for future archaeological investigations on the island. While on site, the possibility of assessing East Wallabi Island was also raised.

Previous GPR surveys had been conducted on Beacon Island but were primarily restricted to the vicinity of an excavation site as an initial assessment of the method (O'Neill, 2000). The method provided some additional information (such the boundary of a mass grave) but numerous GPR anomalies from later disturbances of the ground (particularly shearwater nests) precluded the extraction of further information from the GPR data.

The Ground Penetrating Radar (GPR) method

GPR is an electromagnetic version of marine echo sounding. A radio wave pulse is generated by a transmitter antenna and travels through the ground. Each time a boundary is encountered where there is a change in electrical properties (e.g. metal bar, cavity, change in rock type), part of the signal is reflected back. The reflected

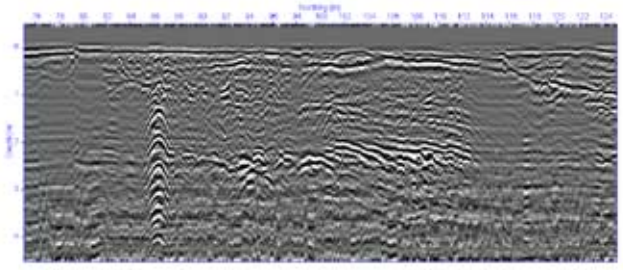

Figure 29. Example of GPR cross-section. (Image: Tristan Campbell, Geoforce).

signals (echoes) are sensed by a receiver antenna, which monitors return radio wave pulses as a function of time. The survey setup of Geoforce's GPR system is shown in Figure 28.

Since the echo time is proportional to the distance to the reflector, this indicates electrical boundaries as a function of depth at a specific point. By moving the antennas along the surface along a straight line and taking measurements at short intervals, a pseudo-2D cross-section of electrical boundaries is then built up, such as that shown in Figure 29.

The GPR mapping precision improves as the signal frequency is increased. However, as the frequency is increased, the signal penetration decreases. Therefore, there is a penetration/precision trade off which is regulated by the frequency used. A 500 MHz antenna was used in this survey to provide an optimum depth of investigation. The depth penetration of GPR also decreases with increasing electrical conductivity of the ground.

Note that the drain is depicted as a hyperbola. This is because the antenna detects the drain on approach and departure. The echo time is shortest when the antenna is directly above the drain and progressively longer as the antenna is further away from the drain. Note also that the drain reflections are repeated due to reverberations of the signal within the drain.

Capabilities and Limitations

GPR is a powerful technique. It is logistically straightforward to deploy and provides detailed mapping of targeted zones very rapidly. It can also map a wider range of features to a higher precision than any other geophysical approach. The restrictions of the technique should, however, be noted.

GPR investigates the subsurface immediately below the survey line and within a wedge up to about 45 degrees from the vertical plane containing the survey line;

The depth of investigation of GPR is strongly dependent on the ground conditions. *Conductive materials (such as clays) can severely limit the depth of investigation of GPR to the extent that GPR can be completely ineffective in some areas;*

GPR can image below the water table if the water is fresh. GPR will not image below the water table if the water

Figure 30. Location of GPR survey sites on Beacon Island. (Image: Tristan Campbell, Geoforce and Wendy van Duivenvoorde, WAM)).

is saline;

The method relies on a dielectric contrast between the layers to be imaged. *If there is insufficient dielectric contrast, no boundary will be detected*;

1. GPR will not detect gradational boundaries. A sharp contrast is required to produce a reflection;
2. There is a strong dielectric contrast between both rock and air, and rock and water;
3. There is often but not always a dielectric contrast between different soil and rock types;

GPR has very high resolution, both laterally and with depth. The resolution is typically slightly better than the length of the wavelength (2 m for 50 MHz antennas, as was used for this work);

GPR maps a wide range of features, both metallic and non metallic. To discriminate between these features, ground truthing is essential;

GPR surveying should always be used together with conventional mapping, drilling and any other available source of information. The more forms of information that are used in conjunction with GPR, the more accurately the origin of any GPR anomalies can be identified.

Surveying on closely spaced (0.25 m spacing) lines is recommended as this survey geometry allows for better classification of the anomalies through line-to-line correlation;

In some cases, GPR data can be contaminated by reflections from surface infrastructure. The effect of these can usually be minimized through processing and careful correlation of known surface infrastructure.

Survey methodology

The GPR survey conducted by Geoforce was to assess the potential of the method over a range of sites to determine which areas of Beacon Island may benefit from GPR investigations.

As previous surveys had used a different brand of GPR equipment, the first survey was done over the previous excavation/survey site (behind the Ashplant house) to compare the amount of information that could be interpreted from Geoforce's GPR data. Further survey sites were located in cleared areas around other structures, primarily in the zone of high archaeological importance', from information supplied by the Museum. A total of 10 sites were surveyed—see Figure 29 for details.

Surveys were not conducted on East Wallabi Island as a suitable anchorage could not be found to safely transport the equipment onto the island due to the strong prevailing winds during the survey campaign.

Data were acquired using a MALA GPR system, utilizing a CU2 control unit, 500 MHz antennas and a XVIII monitor for viewing and recording of data. A summary of the acquisition parameters is provided in Table. Due to

the proximity of the survey sites to buildings, the DGPS system brought to site was unable to achieve sufficient accuracies to locate the data. Therefore, local grids were marked out at each site sing measuring tapes and photos of the corner points photographed and labelled to allow anomalies from the GPR data to be located at a later date if required.

Data processing

Data was imported into Reflex to process and interpret the data. Reflex format files have been provided to the Museum as well as a more generic SEG2 format. A free viewing version of Reflex is available at www.sandmeir-geo.de that allows for viewing, but no processing of, Reflex format files.

Minimal processing was done to the data to ensure no subtle features would be removed. The processing steps consisted of:

1. 'Dewow' low frequency filtering to remove DC shift in data;
2. Subtracting average filter over 100 traces (over 2.5 m in length).

No amplitude filtering or gains were applied to the data.

One dataset (from Site 6) was processed into a 3D dataset as an example of how data can be viewed and interpreted in plan view images. Refer to the Results and Interpretation section for more details.

Results and interpretation

The 500 MHz GPR antenna achieved a 1.5 – 2.0 m depth of investigation across all survey areas. Most of the anomalies found were in the upper 0.70 m of the ground but some isolated features were found deeper than this. The areas surveyed on Beacon Island are at typically 1.5–2m above sea level over highly permeable sand and coral shingle. The saline groundwater under the Island is expected to be at an RL of 0 m and the GPR was not anticipated to penetrate below this depth.

Site 3 was surveyed over an un-reinforced concrete pad from a deconstructed building and similar quality data was acquired at this location to the other survey areas. It is therefore likely that GPR may be effective in investigating beneath un-reinforced concrete pads should other buildings on the island be removed. Note that it is unlikely that GPR will be an effective tool for investigating underneath reinforced concrete due to interference from the metallic reinforcing. GPR can typically only imaged objects of similar size and composition as 44-gallon drums or larger underneath reinforced concrete.

Examples of GPR data from sites 1, 3 and 6 are presented in Figures 31–33. These represent several different types of areas, namely:

1. Multiple, small reflections from highly disturbed ground (Site 1)
2. Sub-horizontal soil layers (Site 3)

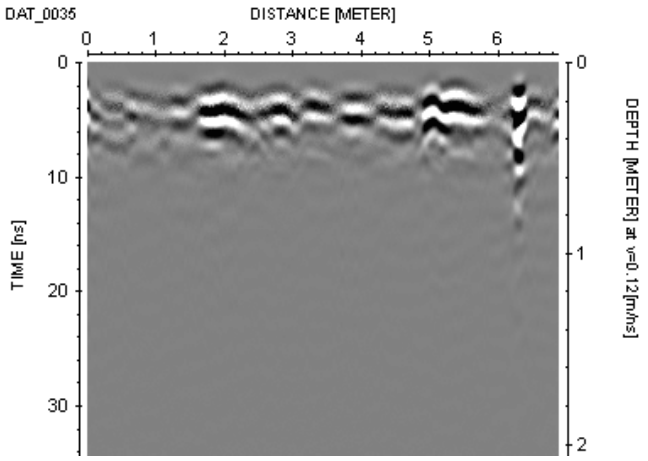

Figure 31. GPR data from Site 1 (previous excavation site) (Image: Tristan Campbell, Geoforce).

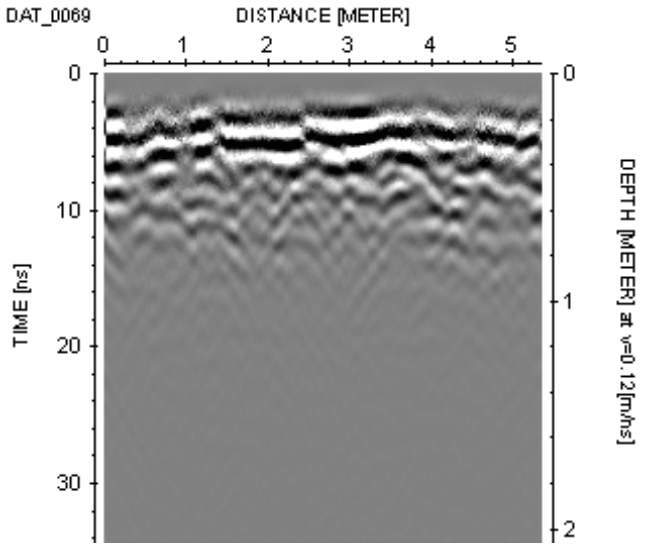

Figure 32. GPR data from Site 3 (un-reinforced concrete pad) (Image: Tristan Campbell, Geoforce).

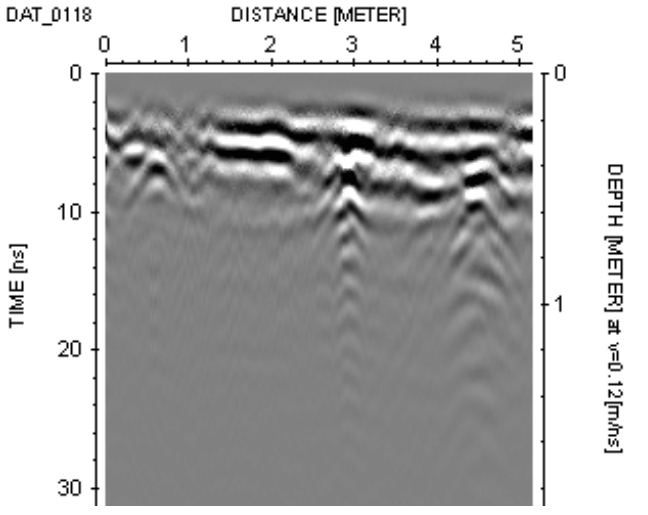

Figure 33. GPR data from Site 6 (Image: Tristan Campbell, Geoforce).

SYSTEM	Mala Ramac CUII with XVII monitor
ANTENNA	Mala 500MHz shielded antenna
SURVEY GRID	2.5 cm trace spacing, nominal 25cm line spacing
GPR MEASUREMENT PARAMETERS	209 samples at 1.94 ns increments (total 405ns measurement time)
PENETRATION DEPTH	1.5 - 2m
DATA POSITIONING	Local grid marked out at each site. Approximate locations annotated in Figure 21.

Table 2. Summary of GPR acquisition parameters of Beacon Island.

3. Reverberations from buried metallic objects (Site 6)

GPR anomalies are individually classified according to their characteristics. The 'total anomaly classification' is a summation of the characteristics of the anomaly, consisting of amplitude, strength of diffraction tails and reverberation and size. For some surveys, such as cavity investigations, a higher total classification equates to a higher priority but for archaeological surveys, even lower classification anomalies can be of importance. For these types of surveys, the classifications are used to define types of anomalies rather than prioritise them.

All sites contained numerous, low classification total anomalies. While the size of most of these can be estimated from the GPR data, their cause is impossible to ascertain without ground truthing in this area due to the number of potential reflectors (archaeological, rubbish, back-filled excavations for any reason, etc).

Most sites contained a few isolated metallic GPR anomalies. These are characterized by a very strong reverberation of the GPR signal (example in Figure 33). While the regular appearance of these across several lines can be indicative of buried services, isolated occurrences of occurrences over a few lines in an irregular arrangement are more indicative of smaller metallic features. Of particular interest is the small cluster of 3 metallic anomalies in Site 6 (refer to Figure 33

) that are high in amplitude, reverberation and occur across a couple of lines. This survey area is within 15 m of a single grave site found in previous archaeological work on the island. Some other isolated metallic anomalies were also identified in Site 6.

An additional feature that was visible at some sites was a change in the character of the data from fairly continuous, sub-horizontal layers to a 'broken' character, typically between 0.7–1.0 m depth. These types of character are generally associated with continuous, flat lying layers and heterogeneous material respectively. It is conjectured that this GPR interface may be from the sand/coral shingle interface but this has yet to be ground-truthed.

Data from Site 6 was processed into a 3D volume such that horizontal slices could be taken for plan-view interpretation of the data. This allows for a rapid spatial interpretation of anomalies from sites and a good comparison of the relative amplitudes of anomalies. Site 6 was processed as an example of the results of this process. Should more detailed investigations be conducted at the other sites, this process can be performed on other datasets as well.

Conclusions

The GPR survey successfully imaged a number of anomalies on Beacon Island across a range of terrains, including an un-reinforced concrete pad from a deconstructed building. GPR appears to be able to image the following features on Beacon Island;

Metallic objects, potentially smaller than 10 cm in horizontal extent;
Zones of localized disturbance (sometimes as small as 20 cm in horizontal extent);
Disturbances in soil layering, where clear layering is imaged;
Possibly the sand/coral shingle interface, but this has yet to be ground-truthed.

GPR is unable to image below the saline groundwater table and the anomalies from this survey were primarily located in the upper 0.7 m of the ground, despite data being recorded to 1.5–2.0 m depth.

The limitations on applying GPR on Beacon Island for archaeological investigations are:

Definitive interpretation of the cause of the GPR anomalies without ground truthing is not possible. This is due to the likely presence of recent disturbances and buried objects that will have the same GPR signature as archaeologically significant objects;
Areas of highly disturbed ground (especially where extensive mutton bird burrows are present) produce numerous GPR anomalies, most of which are unlikely to be archaeologically significant;
GPR will not be able to image anything smaller or of less electrical contrast that a 44-gallon drum underneath reinforced concrete due to interference from metallic reinforcing.

Figure 34. East Wallabi Well 2 (Photo: Ross Anderson, WAM).

Recommendations

GPR appears to be effective in identifying subsurface anomalies on Beacon Island but interpretation of these is difficult. Geoforce recommends the excavation of two different locations, to be decided upon with consultation between Geoforce and the Museum, to assess the nature of the source of the observed GPR reflections.

EAST WALLABI ISLAND

Introduction

Fresh water wells on East Wallabi Island are known to have been used by Pelsaert (who named it 'High Island') and later Stokes for filling their ships' water stores and tanks (Green and Stanbury, 1988:17). Wiebbe Hayes' men located two wells on High Island and lit fires to signal their success but were later forced to defend themselves on West Wallabi Island. East Wallabi Island is recorded to have been burnt under Pelsaert's orders in order to reduce vegetation to enable them to catch 'cats' (tammar wallabies) and find wells, and at least one murder occurred, that being of the upper barber, Frans Jansz, by Cornelisz' men. Pelsaert's crew found three wells of which only one had good water, the opening of which they enlarged with pick axes and crowbars, and subsequently obtained enough water to replenish the ship's supplies (Green and Stanbury, 1988:17). Guano miners and pastoralists probably would have used the wells in later years. There has been no comprehensive study of structures on East Wallabi Island and the current location information was considered out-of-date.

East Wallabi Island 2007 Survey

The museum had existing GPS positions for only two of the wells. On Sunday 4 February a compass traverse field survey, using a magnetic compass and handheld Garmin GPS (datum WGS84) of East Wallabi Island, was undertaken to attempt to relocate all four wells so far recorded on the island, As the earlier two GPS positions were obtained pre-Selective Availability (when positions can be up to 200 m out) the original unreliable GPS positions of the wells along with earlier survey maps were used to find the approximate areas in which the wells are known to be, namely two in the centre of the island and two on the western coastal end. Time allocated for the survey was limited to three hours due to boat pick up and drop off requirements.

After being dropped off at the airstrip jetty the traverse commenced due west of the airstrip wind-sock. Generally speaking most of the central and south-western area of East Wallabi Island consists of a large expanse of cracked limestone pavement with numerous fissures and holes, and all of the well sites are contained within this area. Some of the deeper and accessible rock sinkholes and fissures were recorded as 'sinkholes' if they were large and deep enough to have potential to retain water following rainfall. Visibility was hindered by waist to head high vegetation and small trees, dense in some areas but mostly passable.

Of the four known wells only three were located due to time constraints, these have now had their positions fixed and updated. After checking with the previous GPS positions and survey maps it appears the northernmost coastal well was not relocated during this survey.

East Wallabi Island Site Descriptions

1. East Wallabi hole 1. Sinkhole with no water.

2. East Wallabi cairn and well 2. Large sinkhole with water. Of the two mid-island wells with cairns this has the smaller cairn made out of limestone. Three exfoliating, weathered glass fragments were surface collected for comparison with 17th century Dutch material (BAT 4767). Other broken glass left insitu included a double-collared, dark-olive coloured glass lip and base fragments that had previously been collected by unknown visitors and placed at the base of the cairn. It is possible that the rock surface in the region of this well has been worked to increase its opening, as it has a 'step' leading into it.
3. East Wallabi sinkhole 3. Large deep sinkhole with no water, tree growing out of it.
4. East Wallabi cairn and well 4. Good well with fresh water and large well-built cairn nearby (the largest rock cairn of all the wells here described). A sinkhole lies on the northern side (East Wallabi sinkhole 5). It is possible that the rock surface in the region of this well has been worked to increase its opening.
5. East Wallabi sinkhole 5. Sinkhole to the north of East Wallabi mid well 4, no water.
6. East Wallabi sinkhole 6. Sinkhole, no water.
7. East Wallabi coastal cairns and well 7. Three small limestone rock cairns surround a well on the western coast of the island. The well lies just inland from the coastal sand dune. The well was covered with flat rock slabs and contained a good and apparently deep reserve of fresh water. The well and cairns are surrounded by extensive glass scatters of mainly 19th century bottle fragments.
8. East Wallabi sinkholes 1, 2, 3, 4, 5. Dry sinkholes south and south-east of East Wallabi cairns and well 7 that possibly collect and contain rainwater in winter months.

Artefacts recovered

BAT 4767 GLASS FRAGMENTS

Three exfoliating and iridescent clear or green glass fragments were collected for comparison with Dutch material from East Wallabi well and cairn #2. Other 19th century material was located in the vicinity of the East Wallabi wells predominantly black/green glass bottle fragments and bases, probably related to the island's occupation or visitation during its guano mining phase.

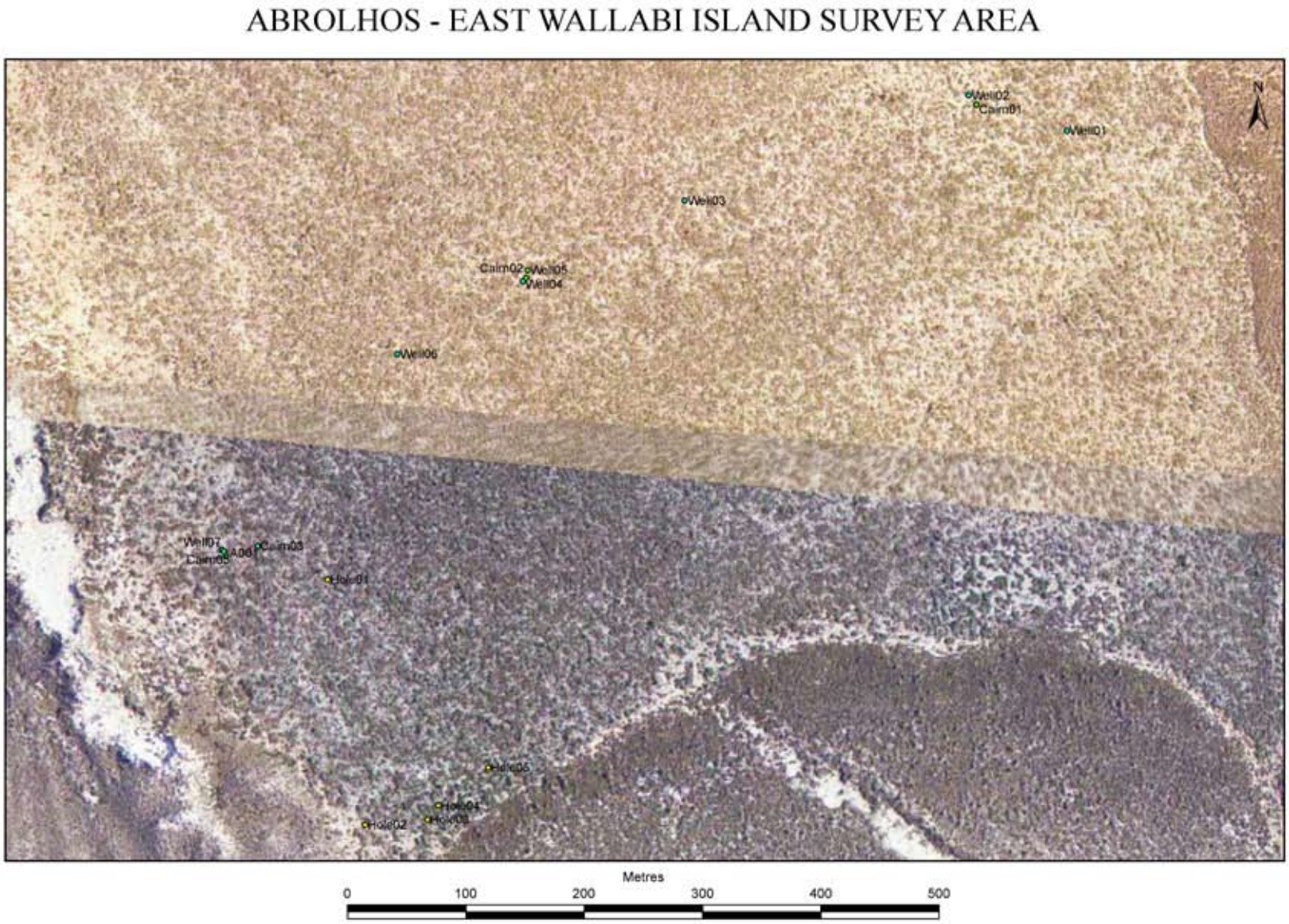

Figure 35. Map of East Wallabi Island, survey area.

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APPENDICES

Appendix 1. Survey Data

Total Station and DGPS Survey Data of Long Island, and West Wallabi and East Wallabi Islands

LONG	LAT	EASTING	NORTHING	HEIGHT	ID	LOCATION	DESCRIPTION
West Wallabi Island - Excavation							
113.70681619	-28.46411317	765046.190	6848398.330	0.000	CP1	WWI	WWICP1
113.70695577	-28.46436371	765059.237	6848370.246	-0.485	BL10m	WWI	Baseline 10m
113.70695503	-28.46435488	765059.187	6848371.229	-0.459	BL11m	WWI	Baseline 11m
113.70695480	-28.46434595	765059.187	6848372.218	-0.426	BL12m	WWI	Baseline 12m
113.70695446	-28.46433721	765059.175	6848373.192	-0.425	BL13m	WWI	Baseline 13m
113.70695380	-28.46432802	765059.134	6848374.208	-0.438	BL14m	WWI	Baseline 14m
113.70695329	-28.46431901	765059.106	6848375.206	-0.400	BL15m	WWI	Baseline 15m
113.70695248	-28.46431000	765059.049	6848376.205	-0.447	BL16m	WWI	Baseline 16m
113.70695184	-28.46430109	765059.009	6848377.196	-0.365	BL17m	WWI	Baseline 17m
113.70695139	-28.46429216	765058.987	6848378.190	-0.463	BL18m	WWI	Baseline 18m
113.70695098	-28.46428306	765058.970	6848379.200	-0.444	BL19m	WWI	Baseline 19m
113.70695053	-28.46427405	765058.948	6848380.198	-0.406	BL20m	WWI	Baseline 20m
113.70694994	-28.46426513	765058.913	6848381.193	-0.440	BL21m	WWI	Baseline 21m
113.70694935	-28.46425612	765058.877	6848382.189	-0.455	BL22m	WWI	Baseline 22m
113.70694866	-28.46424711	765058.832	6848383.188	-0.461	BL23m	WWI	Baseline 23m
113.70694801	-28.46423820	765058.791	6848384.184	-0.439	BL24m	WWI	Baseline 24m
113.70694751	-28.46422918	765058.764	6848385.184	-0.436	BL25m	WWI	Baseline 25m
113.70694700	-28.46422008	765058.737	6848386.188	-0.489	BL26m	WWI	Baseline 26m
113.70694671	-28.46421116	765058.731	6848387.177	-0.505	BL27m	WWI	Baseline 27m
113.70694640	-28.46420214	765058.723	6848388.182	-0.401	BL28m	WWI	Baseline 28m
113.70694408	-28.46433760	765058.157	6848373.170	-0.456	AA14.S.SW	WWI	CS AA14 Surface SW
113.70694343	-28.46432877	765058.116	6848374.153	-0.417	AA14.S.NW	WWI	CS AA14 Surface NW
113.70695354	-28.46432821	765059.108	6848374.193	-0.438	AA14.S.NE	WWI	CS AA14 Surface NE
113.70695401	-28.46433722	765059.131	6848373.193	-0.428	AA14.S.SE	WWI	CS AA14 Surface SE
113.70694858	-28.46433264	765058.611	6848373.707	-0.423	AA14.S.C	WWI	CS AA14 Surface Centre
113.70694451	-28.46433714	765058.201	6848373.218	-0.528	AA14.1.B.SW	WWI	CS AA14 Unit 1 Basal SW
113.70694410	-28.46432957	765058.179	6848374.063	-0.518	AA14.1.B.NW	WWI	CS AA14 Unit 1 Basal NW
113.70695248	-28.46432895	765059.002	6848374.113	-0.516	AA14.1.B.NE	WWI	CS AA14 Unit 1 Basal NE
113.70695329	-28.46433651	765059.062	6848373.271	-0.525	AA14.1.B.SE	WWI	CS AA14 Unit 1 Basal SE
113.70694876	-28.46433272	765058.628	6848373.697	-0.522	AA14.1.B.C	WWI	CS AA14 Unit 1 Basal Centre
113.70694453	-28.46433723	765058.202	6848373.211	-0.582	AA14.2.B.SW	WWI	CS AA14 Unit 2 Basal SW
113.70694391	-28.46432894	765058.162	6848374.132	-0.562	AA14.2.B.NW	WWI	CS AA14 Unit 2 Basal NW
113.70695329	-28.46432848	765059.082	6848374.163	-0.593	AA14.2.B.NE	WWI	CS AA14 Unit 2 Basal NE
113.70695387	-28.46433677	765059.119	6848373.243	-0.568	AA14.2.B.SE	WWI	CS AA14 Unit 2 Basal SE
113.70694876	-28.46433290	765058.628	6848373.679	-0.594	AA14.2.B.C	WWI	CS AA14 Unit 2 Basal Centre
113.70694451	-28.46433696	765058.201	6848373.241	-0.695	AA14.3.B.SW	WWI	CS AA14 Unit 3 Basal SW
113.70694394	-28.46432912	765058.165	6848374.113	-0.685	AA14.3.B.NW	WWI	CS AA14 Unit 3 Basal NW
113.70695318	-28.46432830	765059.072	6848374.182	-0.661	AA14.3.B.NE	WWI	CS AA14 Unit 3 Basal NE
113.70695385	-28.46433668	765059.117	6848373.253	-0.694	AA14.3.B.SE	WWI	CS AA14 Unit 3 Basal SE
113.70694898	-28.46433272	765058.650	6848373.698	-0.695	AA14.3.B.C	WWI	CS AA14 Unit 3 Basal Centre
113.70694468	-28.46433713	765058.217	6848373.224	-0.795	AA14.4.B.SW	WWI	CS AA14 Unit 4 Basal SW
113.70694396	-28.46432903	765058.167	6848374.122	-0.788	AA14.4.B.NW	WWI	CS AA14 Unit 4 Basal NW
113.70695319	-28.46432830	765059.073	6848374.177	-0.765	AA14.4.B.NE	WWI	CS AA14 Unit 4 Basal NE
113.70695379	-28.46433668	765059.111	6848373.246	-0.782	AA14.4.B.SE	WWI	CS AA14 Unit 4 Basal SE
113.70694909	-28.46433299	765058.660	6848373.675	-0.799	AA14.4.B.C	WWI	CS AA14 Unit 4 Basal Centre

LONG	LAT	EASTING	NORTHING	HEIGHT	ID	LOCATION	DESCRIPTION
113.70694457	-28.46433696	765058.207	6848373.237	-0.859	AA14.5.B.SW	WWI	CS AA14 Unit 5 Basal SW
113.70694399	-28.46432894	765058.170	6848374.127	-0.869	AA14.5.B.NW	WWI	CS AA14 Unit 5 Basal NW
113.70695302	-28.46432849	765059.056	6848374.160	-0.891	AA14.5.B.NE	WWI	CS AA14 Unit 5 Basal NE
113.70695371	-28.46433677	765059.103	6848373.243	-0.897	AA14.5.B.SE	WWI	CS AA14 Unit 5 Basal SE
113.70694888	-28.46433308	765058.639	6848373.659	-0.912	AA14.5.B.C	WWI	CS AA14 Unit 5 Basal Centre
113.70693247	-28.46431112	765057.086	6848376.126	-0.456	BB07.S.SW	WWI	CS BB07 Surface SW
113.70693201	-28.46430229	765057.063	6848377.105	-0.487	BB07.S.NW	WWI	CS BB07 Surface NW
113.70694183	-28.46430183	765058.026	6848377.139	-0.364	BB07.S.NE	WWI	CS BB07 Surface NE
113.70694261	-28.46431083	765058.080	6848376.143	-0.432	BB07.S.SE	WWI	CS BB07 Surface SE
113.70693741	-28.46430634	765057.582	6848376.653	-0.447	BB07.S.C	WWI	CS BB07 Surface Centre
113.70693274	-28.46431094	765057.113	6848376.147	-0.535	BB07.1.B.SW	WWI	CS BB07 Unit 1 Basal SW
113.70693210	-28.46430265	765057.071	6848377.074	-0.542	BB07.1.B.NW	WWI	CS BB07 Unit 1 Basal NW
113.70694143	-28.46430256	765057.985	6848377.060	-0.528	BB07.1.B.NE	WWI	CS BB07 Unit 1 Basal NE
113.70694232	-28.46431066	765058.052	6848376.161	-0.563	BB07.1.B.SE	WWI	CS BB07 Unit 1 Basal SE
113.70693718	-28.46430670	765057.559	6848376.613	-0.547	BB07.1.B.C	WWI	CS BB07 Unit 1 Basal Centre
113.70693279	-28.46431067	765057.119	6848376.179	-0.619	BB07.2.B.SW	WWI	CS BB07 Unit 2 Basal SW
113.70693256	-28.46430309	765057.115	6848377.021	-0.625	BB07.2.B.NW	WWI	CS BB07 Unit 2 Basal NW
113.70694113	-28.46430292	765057.955	6848377.018	-0.602	BB07.2.B.NE	WWI	CS BB07 Unit 2 Basal NE
113.70694173	-28.46431022	765057.996	6848376.207	-0.588	BB07.2.B.SE	WWI	CS BB07 Unit 2 Basal SE
113.70693851	-28.46430676	765057.689	6848376.600	-0.620	BB07.2.B.C	WWI	CS BB07 Unit 2 Basal Centre
113.70693290	-28.46431085	765057.129	6848376.164	-0.724	BB07.3.B.SW	WWI	CS BB07 Unit 3 Basal SW
113.70693248	-28.46430283	765057.108	6848377.049	-0.724	BB07.3.B.NW	WWI	CS BB07 Unit 3 Basal NW
113.70694150	-28.46430256	765057.992	6848377.064	-0.695	BB07.3.B.NE	WWI	CS BB07 Unit 3 Basal NE
113.70694223	-28.46431039	765058.044	6848376.194	-0.701	BB07.3.B.SE	WWI	CS BB07 Unit 3 Basal SE
113.70693730	-28.46430661	765057.571	6848376.617	-0.722	BB07.3.B.C	WWI	CS BB07 Unit 3 Basal Centre
113.70668591	-28.46428500	765032.999	6848379.570	-0.472	ZZ12.S.SW	WWI	CS ZZ12 Surface SW
113.70668526	-28.46427635	765032.957	6848380.533	-0.419	ZZ12.S.NW	WWI	CS ZZ12 Surface NW
113.70669536	-28.46427561	765033.948	6848380.585	-0.422	ZZ12.S.NE	WWI	CS ZZ12 Surface NE
113.70669612	-28.46428462	765034.000	6848379.588	-0.443	ZZ12.S.SE	WWI	CS ZZ12 Surface SE
113.70669045	-28.46428049	765033.455	6848380.059	-0.473	ZZ12.S.C	WWI	CS ZZ12 Surface Centre
113.70668642	-28.46428490	765033.049	6848379.576	-0.614	ZZ12.1.B.SW	WWI	CS ZZ12 Unit 1 Basal SW
113.70668610	-28.46427679	765033.038	6848380.476	-0.542	ZZ12.1.B.NW	WWI	CS ZZ12 Unit 1 Basal NW
113.70669459	-28.46427581	765033.872	6848380.565	-0.550	ZZ12.1.B.NE	WWI	CS ZZ12 Unit 1 Basal NE
113.70669516	-28.46428428	765033.907	6848379.631	-0.580	ZZ12.1.B.SE	WWI	CS ZZ12 Unit 1 Basal SE
113.70669086	-28.46428030	765033.496	6848380.082	-0.576	ZZ12.1.B.C	WWI	CS ZZ12 Unit 1 Basal Centre
113.70668625	-28.46428481	765033.033	6848379.587	-0.666	ZZ12.2.B.SW	WWI	CS ZZ12 Unit 2 Basal SW
113.70668539	-28.46427653	765032.969	6848380.512	-0.630	ZZ12.2.B.NW	WWI	CS ZZ12 Unit 2 Basal NW
113.70669488	-28.46427580	765033.901	6848380.569	-0.662	ZZ12.2.B.NE	WWI	CS ZZ12 Unit 2 Basal NE
113.70669574	-28.46428408	765033.964	6848379.648	-0.664	ZZ12.2.B.SE	WWI	CS ZZ12 Unit 2 Basal SE
113.70669037	-28.46428058	765033.447	6848380.048	-0.696	ZZ12.2.B.C	WWI	CS ZZ12 Unit 2 Basal Centre
113.70668649	-28.46428472	765033.057	6848379.604	-0.818	ZZ12.3.B.SW	WWI	CS ZZ12 Unit 3 Basal SW
113.70668559	-28.46427671	765032.988	6848380.490	-0.752	ZZ12.3.B.NW	WWI	CS ZZ12 Unit 3 Basal NW
113.70669509	-28.46427580	765033.921	6848380.571	-0.734	ZZ12.3.B.NE	WWI	CS ZZ12 Unit 3 Basal NE
113.70669544	-28.46428400	765033.935	6848379.657	-0.784	ZZ12.3.B.SE	WWI	CS ZZ12 Unit 3 Basal SE
113.70669063	-28.46428004	765033.474	6848380.105	-0.796	ZZ12.3.B.C	WWI	CS ZZ12 Unit 3 Basal Centre
113.70694681	-28.46422009	765058.718	6848386.192	-0.438	Z27.S.SW	WWI	CS Z27 SW Cnr Ground
113.70695695	-28.46421979	765059.712	6848386.201	-0.441	Z27.S.SE	WWI	CS Z27 SE Cnr Ground
113.70695654	-28.46421096	765059.694	6848387.181	-0.428	Z27.S.NE	WWI	CS Z27 NE Cnr Ground
113.70694644	-28.46421125	765058.704	6848387.175	-0.431	Z27.S.NW	WWI	CS Z27 NW Cnr Ground
113.70695185	-28.46421566	765059.223	6848386.669	-0.422	Z27.S.C	WWI	CS Z27 Centre Ground
113.70694715	-28.46421999	765058.752	6848386.201	-0.521	Z27.1.B.SW	WWI	CS Z27 Unit 1 Basal SW
113.70694681	-28.46421143	765058.740	6848387.154	-0.506	Z27.1.B.NW	WWI	CS Z27 Unit 1 Basal NW

LONG	LAT	EASTING	NORTHING	HEIGHT	ID	LOCATION	DESCRIPTION
113.70695636	-28.46421124	765059.676	6848387.152	-0.513	Z27.1.B.NE	WWI	CS Z27 Unit 1 Basal NE
113.70695682	-28.46421953	765059.700	6848386.233	-0.527	Z27.1.B.SE	WWI	CS Z27 Unit 1 Basal SE
113.70695157	-28.46421539	765059.196	6848386.699	-0.543	Z27.1.B.C	WWI	CS Z27 Unit 1 Basal Centre
113.70694731	-28.46421990	765058.768	6848386.211	-0.623	Z27.2.B.SW	WWI	CS Z27 Unit 2 Basal SW
113.70694710	-28.46421160	765058.768	6848387.135	-0.619	Z27.2.B.NW	WWI	CS Z27 Unit 2 Basal NW
113.70695611	-28.46421133	765059.651	6848387.144	-0.621	Z27.2.B.NE	WWI	CS Z27 Unit 2 Basal NE
113.70695612	-28.46421918	765059.633	6848386.268	-0.632	Z27.2.B.SE	WWI	CS Z27 Unit 2 Basal SE
113.70695175	-28.46421539	765059.214	6848386.701	-0.656	Z27.2.B.C	WWI	CS Z27 Unit 2 Basal Centre
113.70694704	-28.46421981	765058.742	6848386.222	-0.672	Z27.3.B.SW	WWI	CS Z27 Unit 3 Basal SW
113.70694677	-28.46421125	765058.737	6848387.165	-0.634	Z27.3.B.NW	WWI	CS Z27 Unit 3 Basal NW
113.70695583	-28.46421143	765059.624	6848387.128	-0.688	Z27.3.B.NE	WWI	CS Z27 Unit 3 Basal NE
113.70695612	-28.46421936	765059.632	6848386.250	-0.671	Z27.3.B.SE	WWI	CS Z27 Unit 3 Basal SE
113.70695167	-28.46421539	765059.206	6848386.702	-0.707	Z27.3.B.C	WWI	CS Z27 Unit 3 Basal Centre
West Wallabi Island - Survey							
113.70683001	-28.46405678	765047.685	6848404.554	6.566	BL01N	WWI	Baseline 01N
113.70683350	-28.46448946	765046.947	6848356.579	6.347	BL01S	WWI	Baseline 01S
113.70698233	-28.46448117	765061.546	6848357.172	6.298	T01E	WWI	Transect 01E
113.70668129	-28.46449492	765032.022	6848356.310	6.109	T01W	WWI	Transect 01W
113.70667308	-28.46444890	765031.333	6848361.426	6.101	T02W	WWI	Transect 02W
113.70697653	-28.46443735	765061.087	6848362.043	6.291	T02E	WWI	Transect 02E
113.70697569	-28.46436042	765061.197	6848370.567	3.471	T03E	WWI	Transect 03E
113.70667264	-28.46438513	765031.449	6848368.496	1.321	T03W	WWI	Transect 03W
113.70668058	-28.46433932	765032.341	6848373.561	0.876	T04W	WWI	Transect 04W
113.70698848	-28.46435620	765062.460	6848371.013	2.663	T04E	WWI	Transect 04E
113.70696815	-28.46432007	765060.559	6848375.060	6.870	T05E	WWI	Transect 05E
113.70667346	-28.46432774	765031.673	6848374.856	7.613	T05W	WWI	Transect 05W
113.70696123	-28.46426436	765060.020	6848381.247	7.971	T06E	WWI	Transect 06E
113.70665436	-28.46428527	765029.908	6848379.607	7.773	T06W	WWI	Transect 06W
113.70696394	-28.46423210	765060.366	6848384.818	8.959	T07E	WWI	Transect 07E
113.70666498	-28.46423391	765031.076	6848385.277	8.116	T07W	WWI	Transect 07W
113.70693851	-28.46418236	765058.000	6848390.395	8.706	T08E	WWI	Transect 08E
113.70697831	-28.46416163	765061.950	6848392.596	8.689	T09E	WWI	Transect 09E
113.70663978	-28.46418371	765028.733	6848390.900	8.428	T08W	WWI	Transect 08W
113.70667787	-28.46414903	765032.551	6848394.658	8.902	T09W	WWI	Transect 09W
113.70696951	-28.46410678	765061.225	6848398.700	9.177	T10E	WWI	Transect 10E
113.70665969	-28.46411178	765030.863	6848398.828	9.321	T10W	WWI	Transect 10W
113.70697196	-28.46405323	765061.599	6848404.627	9.152	T11E	WWI	Transect 11E
113.70665601	-28.46405826	765030.636	6848404.768	8.910	T11W	WWI	Transect 11W
113.70698849	-28.46442106	765062.299	6848363.824	4.212	A001	WWI	Unidentified metal target (not recovered)
113.70692972	-28.46441285	765056.563	6848364.856	3.729	A002	WWI	Unidentified metal target (not recovered)
113.70689649	-28.46447900	765053.142	6848357.597	4.637	A003	WWI	Unidentified metal target (not recovered)
113.70696660	-28.46448681	765059.991	6848356.579	4.669	A004	WWI	Unidentified metal target (not recovered)
113.70681257	-28.46452722	765044.801	6848352.437	4.883	A005	WWI	Unidentified metal target (not recovered)
113.70689595	-28.46441280	765053.255	6848364.940	2.664	A006	WWI	Unidentified metal target (not recovered)
113.70676871	-28.46441443	765040.787	6848365.041	2.573	A007	WWI	Unidentified metal target (not recovered)
113.70678280	-28.46439584	765042.213	6848367.074	4.900	A008	WWI	Unidentified metal target (not recovered)

LONG	LAT	EASTING	NORTHING	HEIGHT	ID	LOCATION	DESCRIPTION
113.70674371	-28.46441339	765038.340	6848365.210	4.857	A009	WWI	Unidentified metal target (not recovered)
113.70676474	-28.46438681	765040.467	6848368.113	3.905	A010	WWI	Fragment of copper-alloy bullet (not recovered)
113.70678605	-28.46437069	765042.595	6848369.853	6.026	A011	WWI	Aluminium bottle cap (not recovered)
113.70686877	-28.46437320	765050.691	6848369.386	5.895	A012	WWI	Unidentified metal target (not recovered)
113.70697381	-28.46433637	765061.073	6848373.241	3.867	A013	WWI	Modern nail (not recovered)
113.70692330	-28.46433738	765056.122	6848373.244	4.531	A014	WWI	Unidentified metal target (not recovered)
113.70691976	-28.46433961	765055.771	6848372.995	3.474	A015	WWI	Unidentified metal target (not recovered)
113.70691727	-28.46434896	765055.503	6848371.968	3.957	A016	WWI	Unidentified metal target (not recovered)
113.70694592	-28.46432069	765058.380	6848375.039	6.645	A017	WWI	Unidentified metal target (not recovered)
113.70693853	-28.46430442	765057.697	6848376.856	6.438	A018	WWI	Fragments of rusted can (not recovered)
113.70685651	-28.46431146	765049.645	6848376.264	3.536	A019	WWI	Unidentified metal target (not recovered)
113.70686346	-28.46430240	765050.348	6848377.248	4.313	A020	WWI	Unidentified metal target (not recovered)
113.70695480	-28.46427378	765059.367	6848380.224	8.184	A021	WWI	Unidentified metal target (not recovered)
113.70678387	-28.46432608	765042.492	6848374.795	6.492	A022	WWI	Unidentified metal target (not recovered)
113.70675482	-28.46431710	765039.669	6848375.859	6.600	A023	WWI	Unidentified metal target (not recovered)
113.70669413	-28.46429043	765033.791	6848378.950	6.548	A024	WWI	Unidentified metal target (not recovered)
113.70668361	-28.46427891	765032.789	6848380.245	6.610	A025	WWI	Unidentified metal target (not recovered)
113.70668595	-28.46427643	765033.024	6848380.521	6.779	A026	WWI	Unidentified metal target (not recovered)
113.70669437	-28.46427058	765033.864	6848381.147	7.078	A027	WWI	Unidentified metal target (not recovered)
113.70670076	-28.46427208	765034.486	6848380.975	7.376	A028	WWI	Unidentified metal target (not recovered)
113.70671309	-28.46426470	765035.712	6848381.755	7.628	A029	WWI	Unidentified metal target (not recovered)
113.70676161	-28.46426076	765040.475	6848382.087	7.877	A030	WWI	Unidentified metal target (not recovered)
113.70677505	-28.46425319	765041.810	6848382.898	8.074	A031	WWI	Unidentified metal target (not recovered)
113.70685904	-28.46428823	765049.950	6848378.835	8.143	A032	WWI	Fragment of cartridge (not recovered)
113.70687636	-28.46429023	765051.642	6848378.574	8.120	A033	WWI	Unidentified metal target (not recovered)
113.70688947	-28.46426624	765052.986	6848381.199	8.785	A034	WWI	Unidentified metal target (not recovered)
113.70693771	-28.46426826	765057.707	6848380.871	8.952	A035	WWI	Unidentified metal target (not recovered)
113.70677356	-28.46432367	765041.488	6848375.088	9.183	A036	WWI	Unidentified metal target (not recovered)
113.70693033	-28.46423683	765057.062	6848384.368	8.336	A037	WWI	Unidentified metal target (not recovered)
113.70685293	-28.46423765	765049.478	6848384.451	6.645	A038	WWI	Copper lace tie end (not recovered)
113.70683686	-28.46425006	765048.215	6848382.297	6.323	A039	WWI	Unidentified metal target (not recovered)
113.70685022	-28.46420866	765047.873	6848383.114	6.568	A040	WWI	Unidentified metal target (not recovered)
113.70692063	-28.46419977	765049.285	6848387.672	8.671	A041	WWI	Unidentified metal target (not recovered)

LONG	LAT	EASTING	NORTHING	HEIGHT	ID	LOCATION	DESCRIPTION
113.70696237	-28.46413047	765056.205	6848388.499	9.645	A042	WWI	Unidentified metal target (not recovered)
113.70681046	-28.46408748	765060.467	6848396.086	8.952	A043	WWI	Unidentified metal target (not recovered)
113.70689706	-28.46413871	765045.693	6848401.192	9.316	A044	WWI	Bottom of cartridge (not recovered)
113.70690781	-28.46430720	765054.048	6848395.324	10.014	A045	WWI	Fragment of soda can (not recovered)
113.70688215	-28.46431023	765054.681	6848376.618	6.655	A046	WWI	Unidentified metal target (not recovered)
113.70684054	-28.46425730	765052.159	6848376.344	6.314	A047	WWI	Unidentified metal target (not recovered)
West Wallabi Island - Features							
113.70695015	-28.46432512	765058.783	6848374.544	-0.410	CS	WWI	CS SE Cnr Exterior
113.70693721	-28.46432754	765057.510	6848374.304	-0.410	CS	WWI	CS S Wall Exterior
113.70692367	-28.46432673	765056.185	6848374.421	-0.454	CS	WWI	CS S Wall Exterior
113.70691481	-28.46432826	765055.314	6848374.266	-0.510	CS	WWI	CS S Wall Exterior
113.70690141	-28.46432690	765054.004	6848374.446	-0.490	CS	WWI	CS S Wall Exterior
113.70689275	-28.46432734	765053.155	6848374.418	-0.470	CS	WWI	CS S Wall Exterior
113.70688253	-28.46432718	765052.154	6848374.455	-0.398	CS	WWI	CS S Wall Exterior
113.70687063	-28.46432481	765050.994	6848374.748	-0.458	CS	WWI	CS SW Cnr Exterior
113.70686661	-28.46431713	765050.620	6848375.611	-0.465	CS	WWI	CS W Wall Exterior
113.70686693	-28.46431072	765050.667	6848376.315	-0.499	CS	WWI	CS W Wall Exterior
113.70686884	-28.46430337	765050.873	6848377.126	-0.507	CS	WWI	CS W Wall Exterior
113.70686945	-28.46429623	765050.950	6848377.921	-0.452	CS	WWI	CS NW Cnr Exterior
113.70687693	-28.46429662	765051.682	6848377.857	-0.498	CS	WWI	CS N Wall Exterior
113.70688362	-28.46429613	765052.339	6848377.899	-0.455	CS	WWI	CS N Wall Exterior
113.70688615	-28.46428913	765052.604	6848378.666	-0.428	CS	WWI	CS N Wall Exterior
113.70689797	-28.46429467	765053.748	6848378.031	-0.482	CS	WWI	CS N Wall Exterior
113.70690468	-28.46429454	765054.405	6848378.031	-0.420	CS	WWI	CS N Wall Exterior
113.70691128	-28.46429197	765055.058	6848378.296	-0.387	CS	WWI	CS N Wall Exterior
113.70691797	-28.46429391	765055.709	6848378.071	-0.372	CS	WWI	CS N Wall Exterior
113.70693000	-28.46429593	765056.882	6848377.824	-0.329	CS	WWI	CS N Wall Exterior
113.70694180	-28.46429669	765058.036	6848377.709	-0.405	CS	WWI	CS N Wall Exterior
113.70694847	-28.46429538	765058.693	6848377.844	-0.455	CS	WWI	CS NE Cnr Exterior
113.70695013	-28.46430130	765058.841	6848377.183	-0.417	CS	WWI	CS E Wall Exterior
113.70695049	-28.46430932	765058.856	6848376.285	-0.446	CS	WWI	CS E Wall Exterior
113.70695060	-28.46431555	765058.851	6848375.600	-0.417	CS	WWI	CS E Wall Exterior
113.70695051	-28.46432493	765058.819	6848374.559	-0.412	CS	WWI	CS E Wall Exterior
113.70694502	-28.46431963	765058.294	6848375.155	-0.447	CS	WWI	CS SE Cnr Interior Room 1
113.70693902	-28.46432020	765057.705	6848375.106	-0.417	CS	WWI	CS S Wall Interior Room 1
113.70693228	-28.46432042	765057.044	6848375.100	-0.417	CS	WWI	CS S Wall Interior Room 1
113.70692809	-28.46432059	765056.634	6848375.090	-0.366	CS	WWI	CS S Wall Interior Room 1
113.70692147	-28.46432064	765055.985	6848375.096	-0.412	CS	WWI	CS S Wall Interior Room 1
113.70691820	-28.46432007	765055.666	6848375.174	-0.387	CS	WWI	CS SW Cnr Interior Room 1
113.70691661	-28.46431343	765055.527	6848375.907	-0.483	CS	WWI	CS W Wall Interior Room 1
113.70691670	-28.46430837	765055.548	6848376.467	-0.503	CS	WWI	CS W Wall Interior Room 1
113.70691693	-28.46430494	765055.579	6848376.848	-0.456	CS	WWI	CS W Wall Interior Room 1
113.70691789	-28.46430194	765055.681	6848377.185	-0.503	CS	WWI	CS NW Cnr Interior Room 1
113.70692348	-28.46430192	765056.229	6848377.169	-0.461	CS	WWI	CS N Wall Interior Room 1
113.70692802	-28.46430084	765056.676	6848377.278	-0.447	CS	WWI	CS N Wall Interior Room 1
113.70693141	-28.46430050	765057.009	6848377.306	-0.427	CS	WWI	CS N Wall Interior Room 1
113.70693566	-28.46430141	765057.423	6848377.203	-0.401	CS	WWI	CS N Wall Interior Room 1
113.70693908	-28.46430152	765057.758	6848377.176	-0.413	CS	WWI	CS N Wall Interior Room 1

LONG	LAT	EASTING	NORTHING	HEIGHT	ID	LOCATION	DESCRIPTION
113.70694257	-28.46430154	765058.100	6848377.169	-0.364	CS	WWI	CS N Wall Interior Room 1
113.70694476	-28.46430601	765058.303	6848376.666	-0.378	CS	WWI	CS NE Cnr Interior Room 1
113.70694560	-28.46431041	765058.374	6848376.182	-0.376	CS	WWI	CS E Wall Interior Room 1
113.70694562	-28.46431564	765058.363	6848375.603	-0.392	CS	WWI	CS E Wall Interior Room 1
113.70694483	-28.46432044	765058.274	6848375.066	-0.435	CS	WWI	CS SE Cnr Interior Room 1
113.70690998	-28.46431825	765054.865	6848375.391	-0.481	CS	WWI	CS SE Cnr Interior Room 2
113.70690497	-28.46431916	765054.372	6848375.303	-0.501	CS	WWI	CS S Wall Interior Room 2
113.70689728	-28.46431904	765053.619	6848375.325	-0.530	CS	WWI	CS S Wall Interior Room 2
113.70689201	-28.46431987	765053.101	6848375.245	-0.505	CS	WWI	CS S Wall Interior Room 2
113.70688479	-28.46432037	765052.393	6848375.211	-0.511	CS	WWI	CS S Wall Interior Room 2
113.70688074	-28.46431946	765051.998	6848375.319	-0.503	CS	WWI	CS S Wall Interior Room 2
113.70687387	-28.46431816	765051.328	6848375.482	-0.495	CS	WWI	CS SW Cnr Interior Room 2
113.70687425	-28.46431310	765051.378	6848376.045	-0.503	CS	WWI	CS W Wall Interior Room 2
113.70687461	-28.46430768	765051.427	6848376.639	-0.553	CS	WWI	CS W Wall Interior Room 2
113.70687475	-28.46430343	765051.451	6848377.113	-0.528	CS	WWI	CS NW Cnr Interior Room 2
113.70687817	-28.46430246	765051.789	6848377.209	-0.489	CS	WWI	CS N Wall Interior Room 2
113.70688341	-28.46430173	765052.304	6848377.279	-0.559	CS	WWI	CS N Wall Interior Room 2
113.70688904	-28.46430162	765052.856	6848377.278	-0.589	CS	WWI	CS N Wall Interior Room 2
113.70689449	-28.46430097	765053.391	6848377.340	-0.561	CS	WWI	CS N Wall Interior Room 2
113.70689818	-28.46430044	765053.754	6848377.394	-0.554	CS	WWI	CS N Wall Interior Room 2
113.70690495	-28.46429995	765054.418	6848377.434	-0.533	CS	WWI	CS N Wall Interior Room 2
113.70690986	-28.46430048	765054.898	6848377.361	-0.524	CS	WWI	CS NE Cnr Interior Room 2
113.70691001	-28.46430381	765054.904	6848376.994	-0.511	CS	WWI	CS E Wall Interior Room 2
113.70690825	-28.46430710	765054.724	6848376.634	-0.528	CS	WWI	CS E Wall Interior Room 2
113.70690859	-28.46431016	765054.749	6848376.294	-0.530	CS	WWI	CS E Wall Interior Room 2
113.70691019	-28.46431563	765054.893	6848375.678	-0.484	CS	WWI	CS E Wall Interior Room 2
113.70692018	-28.46413122	765056.332	6848396.100	-0.502	EL	WWI	Edge of Limestone
113.70686813	-28.46413731	765051.218	6848395.543	-0.506	EL	WWI	Edge of Limestone
113.70681896	-28.46414153	765046.391	6848395.185	-0.454	EL	WWI	Edge of Limestone
113.70678224	-28.46415011	765042.772	6848394.311	-0.439	EL	WWI	Edge of Limestone
113.70674253	-28.46414387	765038.898	6848395.095	-0.392	EL	WWI	Edge of Limestone
113.70670165	-28.46415505	765034.865	6848393.940	-0.368	EL	WWI	Edge of Limestone
113.70695649	-28.46412968	765059.892	6848396.187	-0.441	EL	WWI	Edge of Limestone
113.70701798	-28.46413198	765065.910	6848395.803	-0.497	EL	WWI	Edge of Limestone
113.70419780	-28.46140255	764796.463	6848704.577	3.024	Well01	WWI	Well 01
113.70412180	-28.46130303	764789.261	6848715.784	3.021	IS	WWI	Inland Structure NE Cnr
113.70412900	-28.46133644	764789.885	6848712.058	2.991	IS	WWI	Inland Structure SE Cnr
113.70407930	-28.46135376	764784.970	6848710.253	2.992	IS	WWI	Inland Structure SW Cnr
113.70405790	-28.46132135	764782.958	6848713.888	3.010	IS	WWI	Inland Structure NW Cnr
113.70407410	-28.46123262	764784.767	6848723.690	3.066	Well02	WWI	Well 02
113.70178290	-28.46263613	764556.822	6848573.158	3.659	Well03	WWI	Well 03
113.70176270	-28.46260622	764554.917	6848576.521	3.966	Cairn	WWI	Cairn
113.70560230	-28.46254240	764931.198	6848575.125	5.424	Well04	WWI	Well 04
113.70559660	-28.46271761	764930.203	6848555.720	5.727	Well05	WWI	Well 05
113.70578800	-28.46287149	764948.569	6848538.244	5.338	Well06	WWI	Well 06
113.70591890	-28.46310335	764960.813	6848512.255	5.346	Well07	WWI	Well 07
113.70780750	-28.46420926	765143.053	6848385.487	5.229	Well08	WWI	Well 08
113.70788270	-28.46417998	765150.496	6848388.575	5.590	Well09	WWI	Well 09
113.70963950	-28.46259198	765326.557	6848560.722	6.005	Fireplace01	WWI	Fireplace 01
113.70963910	-28.46264205	765326.397	6848555.168	5.888	Fireplace02	WWI	Fireplace 02
113.70526560	-28.46000685	764904.544	6848856.942	9.978	Well10	WWI	Well 10
113.70526580	-28.46004229	764904.483	6848853.012	10.389	Well11	WWI	Well 11

LONG	LAT	EASTING	NORTHING	HEIGHT	ID	LOCATION	DESCRIPTION
East Wallabi Island - Survey							
113.72817944	-28.43756106	767205.723	6851294.329	-	Well01	EWI	Well 01
113.72743356	-28.43729302	767133.313	6851325.705	-	Well02	EWI	Well 02
113.72749297	-28.43736373	767138.956	6851317.727	-	Cairn01	EWI	Cairn 01
113.72527580	-28.43809215	766919.879	6851241.914	-	Well03	EWI	Well 03
113.72404298	-28.43870547	766797.543	6851176.660	-	Well04	EWI	Well 04
113.72406881	-28.43867880	766800.141	6851179.558	-	Cairn02	EWI	Cairn 02
113.72407953	-28.43862139	766801.336	6851185.902	-	Well05	EWI	Cairn 03
113.72308988	-28.43925861	766702.767	6851117.459	-	Well06	EWI	Well 06
113.72255996	-28.44097367	766646.539	6850928.524	-	Hole01	EWI	Hole 01
113.72202905	-28.44071871	766595.162	6850957.956	-	Cairn03	EWI	Cairn 03
113.72178557	-28.44077031	766571.175	6850952.777	-	A001	EWI	Glass Scatter
113.72178765	-28.44079165	766571.325	6850950.409	-	Cairn04	EWI	Cairn 04
113.72175832	-28.44074750	766568.562	6850955.374	-	Cairn05	EWI	Cairn 05
113.72177038	-28.44075988	766569.713	6850953.965	-	Well07	EWI	Well 07
113.72284450	-28.44283705	766669.741	6850721.333	-	Hole02	EWI	Hole 02
113.72331910	-28.44279859	766716.337	6850724.537	-	Hole03	EWI	Hole 03
113.72340175	-28.44269238	766724.702	6850736.128	-	Hole04	EWI	Hole 04
113.72378027	-28.44240362	766762.515	6850767.299	-	Hole05	EWI	Hole 05
Long Island - Survey							
113.77457859	-28.47339951	771660.387	6847217.455	8.119	CPLI01	LI	Survey Point
113.77466699	-28.47310210	771669.808	6847250.219	8.324	D5	LI	Survey Point
113.77362312	-28.47934518	771551.571	6846560.509	-2.325	ST	LI	Southern Tip Island
113.77464158	-28.47313662	771667.230	6847246.454	8.370	BL01N	LI	Baseline 01N
113.77456635	-28.47399956	771657.651	6847150.964	5.977	BL01S	LI	Baseline 01S
113.77464145	-28.47400308	771664.998	6847150.396	5.033	BL02N	LI	Baseline 02N
113.77467981	-28.47490528	771666.445	6847050.301	3.771	BL02S	LI	Baseline 02S
113.77479686	-28.47489884	771677.926	6847050.748	6.144	BL03N	LI	Baseline 03N
113.77494721	-28.47579388	771690.360	6846951.192	6.105	BL03S	LI	Baseline 03S
113.77501520	-28.47579213	771697.025	6846951.233	4.831	BL04N	LI	Baseline 04N
113.77509664	-28.47668371	771702.717	6846852.212	4.608	BL04S	LI	Baseline 04S
113.77499199	-28.47668125	771692.473	6846852.717	-1.082	BL05N	LI	Baseline 05N
113.77506423	-28.47758060	771697.245	6846752.858	-1.526	BL05S	LI	Baseline 05S
113.77504566	-28.47314903	771706.779	6847244.161	6.097	T001E	LI	Transect 001E
113.77446743	-28.47307974	771650.319	6847253.152	6.763	T001W	LI	Transect 001W
113.77503457	-28.47317903	771705.616	6847240.862	6.444	T002E	LI	Transect 002E
113.77446591	-28.47309754	771650.123	6847251.176	6.504	T002W	LI	Transect 002W
113.77502414	-28.47322308	771704.482	6847236.001	6.409	T003E	LI	Transect 003E
113.77443250	-28.47311383	771646.809	6847249.447	5.392	T003W	LI	Transect 003W
113.77499734	-28.47325764	771701.768	6847232.231	7.433	T004E	LI	Transect 004E
113.77442919	-28.47314890	771646.395	6847245.572	7.661	T004W	LI	Transect 004W
113.77499944	-28.47329431	771701.880	6847228.162	7.321	T005E	LI	Transect 005E
113.77441886	-28.47317888	771645.306	6847242.273	8.398	T005W	LI	Transect 005W
113.77501337	-28.47329177	771703.251	6847228.406	6.200	T006E	LI	Transect 006E
113.77441576	-28.47320023	771644.948	6847239.907	6.443	T006W	LI	Transect 006W
113.77500600	-28.47332485	771702.444	6847224.764	5.966	T007E	LI	Transect 007E
113.77443368	-28.47324154	771646.597	6847235.293	6.891	T007W	LI	Transect 007W
113.77497476	-28.47335227	771699.314	6847221.795	5.739	T008E	LI	Transect 008E
113.77441896	-28.47326250	771645.102	6847232.997	7.235	T008W	LI	Transect 008W
113.77497119	-28.47337806	771698.898	6847218.935	5.910	T009E	LI	Transect 009E

LONG	LAT	EASTING	NORTHING	HEIGHT	ID	LOCATION	DESCRIPTION
113.77440967	-28.47330509	771644.083	6847228.302	7.676	T009W	LI	Transect 009W
113.77495752	-28.47341631	771697.461	6847214.729	7.486	T010E	LI	Transect 010E
113.77494846	-28.47343490	771696.526	6847212.688	7.391	T011E	LI	Transect 011E
113.77440579	-28.47336840	771643.540	6847221.285	9.240	T011W	LI	Transect 011W
113.77493131	-28.47347079	771694.755	6847208.751	7.794	T012E	LI	Transect 012E
113.77442317	-28.47342073	771645.109	6847215.451	11.793	T012W	LI	Transect 012W
113.77491050	-28.47350550	771692.627	6847204.951	7.703	T013E	LI	Transect 013E
113.77446198	-28.47345656	771648.819	6847211.389	9.493	T013W	LI	Transect 013W
113.77489318	-28.47354699	771690.824	6847200.386	7.089	T014E	LI	Transect 014E
113.77447369	-28.47349764	771649.860	6847206.805	8.847	T014W	LI	Transect 014W
113.77487919	-28.47358345	771689.360	6847196.381	7.106	T015E	LI	Transect 015E
113.77442539	-28.47356024	771644.969	6847199.977	6.828	T015W	LI	Transect 015W
113.77487258	-28.47364330	771688.560	6847189.764	4.483	T016E	LI	Transect 016E
113.77444997	-28.47361810	771647.228	6847193.510	4.364	T016W	LI	Transect 016W
113.77485439	-28.47369780	771686.638	6847183.757	5.992	T017E	LI	Transect 017E
113.77449945	-28.47365317	771651.985	6847189.506	6.724	T017W	LI	Transect 017W
113.77483713	-28.47372792	771684.870	6847180.462	6.158	T018E	LI	Transect 018E
113.77450991	-28.47371033	771652.863	6847183.154	7.063	T018W	LI	Transect 018W
113.77481820	-28.47376412	771682.923	6847176.486	4.820	T019E	LI	Transect 019E
113.77450680	-28.47376127	771652.429	6847177.505	4.966	T019W	LI	Transect 019W
113.77480599	-28.47381380	771681.600	6847171.007	4.562	T020E	LI	Transect 020E
113.77451529	-28.47379745	771653.167	6847173.484	4.784	T020W	LI	Transect 020W
113.77477673	-28.47385752	771678.622	6847166.228	2.963	T021E	LI	Transect 021E
113.77451647	-28.47383261	771653.193	6847169.583	3.434	T021W	LI	Transect 021W
113.77477593	-28.47388333	771678.478	6847163.369	3.275	T022E	LI	Transect 022E
113.77452007	-28.47387665	771653.433	6847164.695	2.571	T022W	LI	Transect 022W
113.77475469	-28.47394222	771676.246	6847156.894	2.085	T023E	LI	Transect 023E
113.77452238	-28.47392703	771653.530	6847159.099	1.062	T023W	LI	Transect 023W
113.77474004	-28.47397094	771674.738	6847153.739	4.263	T024E	LI	Transect 024E
113.77456435	-28.47396253	771657.550	6847155.065	5.351	T024W	LI	Transect 024W
113.77472840	-28.47402737	771673.453	6847147.505	5.110	T025E	LI	Transect 025E
113.77451449	-28.47401460	771652.533	6847149.410	4.191	T025W	LI	Transect 025W
113.77472015	-28.47407842	771672.514	6847141.875	6.235	T026E	LI	Transect 026E
113.77453497	-28.47407120	771654.394	6847143.087	7.306	T026W	LI	Transect 026W
113.77471455	-28.47411895	771671.862	6847137.395	6.332	T027E	LI	Transect 027E
113.77451786	-28.47411015	771652.618	6847138.811	5.862	T027W	LI	Transect 027W
113.77471589	-28.47416709	771671.870	6847132.045	6.010	T028E	LI	Transect 028E
113.77450046	-28.47417790	771650.740	6847131.339	5.219	T028W	LI	Transect 028W
113.77471450	-28.47417163	771671.722	6847131.553	6.289	T029E	LI	Transect 029E
113.77450515	-28.47421704	771651.099	6847126.995	6.019	T029W	LI	Transect 029W
113.77470435	-28.47426493	771670.489	6847121.227	6.605	T030E	LI	Transect 030E
113.77446448	-28.47426099	771647.003	6847122.210	5.432	T030W	LI	Transect 030W
113.77470863	-28.47430328	771670.810	6847116.967	6.474	T031E	LI	Transect 031E
113.77449833	-28.47433653	771650.125	6847113.763	6.888	T031W	LI	Transect 031W
113.77470636	-28.47434996	771670.468	6847111.797	6.828	T032E	LI	Transect 032E
113.77446296	-28.47436575	771646.586	6847110.603	5.719	T032W	LI	Transect 032W
113.77470968	-28.47439445	771670.679	6847106.861	6.836	T033E	LI	Transect 033E
113.77446041	-28.47439269	771646.267	6847107.621	5.804	T033W	LI	Transect 033W
113.77470982	-28.47441060	771670.651	6847105.072	5.394	T034E	LI	Transect 034E
113.77445684	-28.47443741	771645.803	6847102.672	4.875	T034W	LI	Transect 034W
113.77477266	-28.47444946	771676.707	6847100.619	4.804	T035E	LI	Transect 035E
113.77446504	-28.47446142	771646.545	6847099.988	4.380	T035W	LI	Transect 035W

LONG	LAT	EASTING	NORTHING	HEIGHT	ID	LOCATION	DESCRIPTION
113.77478146	-28.47449321	771677.457	6847095.747	4.859	T036E	LI	Transect 036E
113.77446288	-28.47451063	771646.207	6847094.541	4.458	T036W	LI	Transect 036W
113.77478011	-28.47453311	771677.223	6847091.334	4.672	T037E	LI	Transect 037E
113.77447290	-28.47455553	771647.073	6847089.535	3.886	T037W	LI	Transect 037W
113.77473069	-28.47458337	771672.253	6847085.868	4.806	T038E	LI	Transect 038E
113.77449781	-28.47459471	771649.413	6847085.141	3.868	T038W	LI	Transect 038W
113.77473239	-28.47462493	771672.314	6847081.265	5.061	T039E	LI	Transect 039E
113.77450528	-28.47463561	771650.040	6847080.594	4.279	T039W	LI	Transect 039W
113.77474280	-28.47467550	771673.203	6847075.626	5.371	T040E	LI	Transect 040E
113.77451318	-28.47468885	771650.677	6847074.671	4.973	T040W	LI	Transect 040W
113.77474367	-28.47471553	771673.186	6847071.187	5.634	T041E	LI	Transect 041E
113.77453069	-28.47473928	771652.263	6847069.040	5.470	T041W	LI	Transect 041W
113.77475613	-28.47475759	771674.299	6847066.498	5.806	T042E	LI	Transect 042E
113.77453904	-28.47479206	771652.946	6847063.170	5.487	T042W	LI	Transect 042W
113.77476624	-28.47480573	771675.166	6847061.138	5.765	T043E	LI	Transect 043E
113.77455056	-28.47482637	771653.987	6847059.339	5.727	T043W	LI	Transect 043W
113.77478904	-28.47484983	771677.286	6847056.204	5.925	T044E	LI	Transect 044E
113.77456193	-28.47487630	771654.972	6847053.783	5.947	T044W	LI	Transect 044W
113.77480273	-28.47489727	771678.505	6847050.914	6.254	T045E	LI	Transect 045E
113.77455979	-28.47492325	771654.643	6847048.577	5.875	T045W	LI	Transect 045W
113.77482009	-28.47494527	771680.084	6847045.551	5.616	T046E	LI	Transect 046E
113.77457367	-28.47497745	771655.863	6847042.538	5.753	T046W	LI	Transect 046W
113.77484544	-28.47497894	771682.480	6847041.759	5.823	T047E	LI	Transect 047E
113.77456943	-28.47500785	771655.370	6847039.177	5.655	T047W	LI	Transect 047W
113.77486703	-28.47502793	771684.469	6847036.281	5.261	T048E	LI	Transect 048E
113.77457601	-28.47505742	771655.889	6847033.667	4.827	T048W	LI	Transect 048W
113.77489046	-28.47506634	771686.666	6847031.966	5.787	T049E	LI	Transect 049E
113.77457440	-28.47508055	771655.671	6847031.112	5.485	T049W	LI	Transect 049W
113.77491482	-28.47510887	771688.943	6847027.196	5.732	T050E	LI	Transect 050E
113.77458238	-28.47512224	771656.346	6847026.472	5.445	T050W	LI	Transect 050W
113.77494409	-28.47515906	771691.681	6847021.566	8.753	T051E	LI	Transect 051E
113.77459045	-28.47517674	771656.996	6847020.405	8.298	T051W	LI	Transect 051W
113.77497958	-28.47519875	771695.056	6847017.093	8.987	T052E	LI	Transect 052E
113.77459865	-28.47520670	771657.723	6847017.072	8.267	T052W	LI	Transect 052W
113.77499223	-28.47523800	771696.194	6847012.714	9.344	T053E	LI	Transect 053E
113.77461389	-28.47526142	771659.076	6847010.965	9.604	T053W	LI	Transect 053W
113.77503804	-28.47528641	771700.557	6847007.241	8.029	T054E	LI	Transect 054E
113.77462461	-28.47531857	771659.979	6847004.613	7.963	T054W	LI	Transect 054W
113.77506001	-28.47533981	771702.573	6847001.267	7.304	T055E	LI	Transect 055E
113.77463695	-28.47534854	771661.111	6847001.255	8.029	T055W	LI	Transect 055W
113.77507833	-28.47538202	771704.260	6846996.551	7.537	T056E	LI	Transect 056E
113.77464105	-28.47541097	771661.353	6846994.333	7.246	T056W	LI	Transect 056W
113.77508259	-28.47542667	771704.562	6846991.586	7.239	T057E	LI	Transect 057E
113.77465338	-28.47545528	771662.447	6846989.385	7.014	T057W	LI	Transect 057W
113.77510428	-28.47546150	771706.597	6846987.677	6.561	T058E	LI	Transect 058E
113.77467404	-28.47549609	771664.366	6846984.816	6.466	T058W	LI	Transect 058W
113.77510622	-28.47550855	771706.667	6846982.464	6.694	T059E	LI	Transect 059E
113.77467858	-28.47552847	771664.728	6846981.222	6.446	T059W	LI	Transect 059W
113.77512347	-28.47555403	771708.240	6846977.384	4.938	T060E	LI	Transect 060E
113.77467521	-28.47556886	771664.294	6846976.750	4.704	T060W	LI	Transect 060W
113.77513879	-28.47560225	771709.617	6846972.001	3.513	T061E	LI	Transect 061E
113.77492332	-28.47561630	771688.475	6846970.926	4.178	T061W	LI	Transect 061W

LONG	LAT	EASTING	NORTHING	HEIGHT	ID	LOCATION	DESCRIPTION
113.77514387	-28.47562496	771710.056	6846969.469	3.995	T062E	LI	Transect 062E
113.77492556	-28.47565820	771688.587	6846966.282	3.485	T062W	LI	Transect 062W
113.77516114	-28.47567783	771711.612	6846963.572	5.412	T063E	LI	Transect 063E
113.77493425	-28.47570971	771689.307	6846960.553	5.034	T063W	LI	Transect 063W
113.77518550	-28.47573011	771713.864	6846957.719	5.291	T064E	LI	Transect 064E
113.77494865	-28.47574406	771690.629	6846956.711	4.590	T064W	LI	Transect 064W
113.77519007	-28.47576998	771714.210	6846953.292	5.036	T065E	LI	Transect 065E
113.77491989	-28.47580301	771687.661	6846950.240	5.276	T065W	LI	Transect 065W
113.77519541	-28.47580442	771714.645	6846949.464	4.018	T066E	LI	Transect 066E
113.77487607	-28.47582510	771683.312	6846947.893	4.693	T066W	LI	Transect 066W
113.77519558	-28.47583942	771714.572	6846945.583	4.135	T067E	LI	Transect 067E
113.77489686	-28.47587429	771685.223	6846942.386	4.966	T067W	LI	Transect 067W
113.77520108	-28.47588549	771714.992	6846940.461	4.349	T068E	LI	Transect 068E
113.77492586	-28.47591583	771687.957	6846937.718	5.172	T068W	LI	Transect 068W
113.77522899	-28.47594338	771717.578	6846933.982	5.533	T069E	LI	Transect 069E
113.77491643	-28.47598602	771686.853	6846929.962	5.522	T069W	LI	Transect 069W
113.77521783	-28.47599313	771716.357	6846928.486	4.948	T070E	LI	Transect 070E
113.77492103	-28.47598575	771687.305	6846929.984	5.351	T070W	LI	Transect 070W
113.77520366	-28.47601435	771714.915	6846926.169	4.338	T071E	LI	Transect 071E
113.77521969	-28.47603991	771716.420	6846923.302	4.244	T072E	LI	Transect 072E
113.77494473	-28.47606501	771689.423	6846921.144	5.028	T072W	LI	Transect 072W
113.77511839	-28.47609439	771706.358	6846917.491	5.382	T073E	LI	Transect 073E
113.77491932	-28.47610324	771686.836	6846916.961	5.978	T073W	LI	Transect 073W
113.77520231	-28.47615645	771714.419	6846910.418	5.279	T074E	LI	Transect 074E
113.77495217	-28.47614686	771689.942	6846912.047	5.898	T074W	LI	Transect 074W
113.77519410	-28.47619857	771713.507	6846905.771	5.702	T075E	LI	Transect 075E
113.77493597	-28.47619924	771688.221	6846906.277	5.756	T075W	LI	Transect 075W
113.77517809	-28.47624806	771711.812	6846900.323	6.626	T076E	LI	Transect 076E
113.77492025	-28.47624376	771686.568	6846901.377	6.846	T076W	LI	Transect 076W
113.77517486	-28.47628619	771711.397	6846896.104	6.798	T077E	LI	Transect 077E
113.77492932	-28.47629211	771687.332	6846895.997	6.895	T077W	LI	Transect 077W
113.77516756	-28.47633514	771710.557	6846890.693	7.130	T078E	LI	Transect 078E
113.77490496	-28.47634159	771684.819	6846890.569	6.144	T078W	LI	Transect 078W
113.77516240	-28.47638189	771709.932	6846885.518	6.559	T079E	LI	Transect 079E
113.77495024	-28.47636646	771689.190	6846887.714	6.756	T079W	LI	Transect 079W
113.77515326	-28.47636322	771709.084	6846887.614	-1.117	T080E	LI	Transect 080E
113.77465226	-28.47635559	771660.031	6846889.595	-1.808	T080W	LI	Transect 080W
113.77514171	-28.47641506	771707.820	6846881.890	-1.214	T081E	LI	Transect 081E
113.77513500	-28.47646246	771707.042	6846876.651	-1.226	T082E	LI	Transect 082E
113.77465387	-28.47635565	771660.189	6846889.583	-1.568	T082W	LI	Transect 082W
113.77513898	-28.47650361	771707.326	6846872.084	-1.264	T083E	LI	Transect 083E
113.77491666	-28.47649976	771685.560	6846873.009	-1.497	T083W	LI	Transect 083W
113.77514672	-28.47654792	771707.971	6846867.149	-1.425	T084E	LI	Transect 084E
113.77490490	-28.47655087	771684.277	6846867.374	-1.593	T084W	LI	Transect 084W
113.77514158	-28.47659286	771707.352	6846862.176	-1.532	T085E	LI	Transect 085E
113.77489248	-28.47659416	771682.949	6846862.600	-1.705	T085W	LI	Transect 085W
113.77513581	-28.47663294	771706.684	6846857.747	-1.530	T086E	LI	Transect 086E
113.77488716	-28.47664415	771682.300	6846857.070	-1.801	T086W	LI	Transect 086W
113.77513513	-28.47668167	771706.493	6846852.353	-1.382	T087E	LI	Transect 087E
113.77489025	-28.47668017	771682.511	6846853.070	-1.813	T087W	LI	Transect 087W
113.77512730	-28.47673081	771705.600	6846846.916	-1.428	T088E	LI	Transect 088E
113.77488910	-28.47672304	771682.288	6846848.321	-1.993	T088W	LI	Transect 088W

LONG	LAT	EASTING	NORTHING	HEIGHT	ID	LOCATION	DESCRIPTION
113.77512482	-28.47677587	771705.241	6846841.931	-1.620	T089E	LI	Transect 089E
113.77489486	-28.47676821	771682.737	6846843.304	-1.915	T089W	LI	Transect 089W
113.77512167	-28.47681563	771704.831	6846837.529	-1.880	T090E	LI	Transect 090E
113.77448620	-28.47678657	771642.662	6846842.190	-1.979	T090W	LI	Transect 090W
113.77512033	-28.47686437	771704.575	6846832.129	-2.189	T091E	LI	Transect 091E
113.77460757	-28.47684417	771654.402	6846835.532	-1.810	T091W	LI	Transect 091W
113.77510972	-28.47690455	771703.433	6846827.695	-1.891	T092E	LI	Transect 092E
113.77451272	-28.47691205	771644.938	6846828.218	-1.738	T092W	LI	Transect 092W
113.77510282	-28.47695052	771702.639	6846822.623	-2.052	T093E	LI	Transect 093E
113.77444255	-28.47694505	771637.980	6846824.724	-2.015	T093W	LI	Transect 093W
113.77512103	-28.47698253	771704.341	6846819.031	-2.100	T094E	LI	Transect 094E
113.77496769	-28.47700091	771689.274	6846817.339	-1.469	T094W	LI	Transect 094W
113.77510352	-28.47703259	771702.497	6846813.518	-1.724	T095E	LI	Transect 095E
113.77496760	-28.47704664	771689.148	6846812.272	-1.441	T095W	LI	Transect 095W
113.77509838	-28.47708024	771701.872	6846808.247	-1.452	T096E	LI	Transect 096E
113.77497991	-28.47708978	771690.243	6846807.465	-1.275	T096W	LI	Transect 096W
113.77509132	-28.47712621	771701.063	6846803.165	-1.162	T097E	LI	Transect 097E
113.77495776	-28.47713579	771687.956	6846802.412	-1.620	T097W	LI	Transect 097W
113.77508701	-28.47717131	771700.525	6846798.179	-1.082	T098E	LI	Transect 098E
113.77492969	-28.47718580	771685.078	6846796.926	-1.760	T098W	LI	Transect 098W
113.77507677	-28.47721888	771699.400	6846792.931	-1.460	T099E	LI	Transect 099E
113.77476535	-28.47725095	771668.815	6846790.084	-2.355	T099W	LI	Transect 099W
113.77507526	-28.47726338	771699.138	6846788.002	-1.591	T100E	LI	Transect 100E
113.77477325	-28.47728398	771669.504	6846786.404	-2.335	T100W	LI	Transect 100W
113.77507033	-28.47730958	771698.537	6846782.888	-2.068	T101E	LI	Transect 101E
113.77481844	-28.47754502	771673.261	6846757.356	-2.799	T101W	LI	Transect 101W
113.77476838	-28.47728453	771669.025	6846786.352	-2.375	T101W	LI	Transect 101W
113.77506191	-28.47735197	771697.603	6846778.213	-1.880	T102E	LI	Transect 102E
113.77484378	-28.47736761	771676.198	6846776.969	-2.269	T102W	LI	Transect 102W
113.77506540	-28.47739962	771697.823	6846772.921	-2.158	T103E	LI	Transect 103E
113.77481238	-28.47740054	771673.038	6846773.393	-2.486	T103W	LI	Transect 103W
113.77506907	-28.47744293	771698.072	6846768.112	-1.978	T104E	LI	Transect 104E
113.77480427	-28.47744762	771672.123	6846768.189	-2.553	T104W	LI	Transect 104W
113.77507730	-28.47748859	771698.761	6846763.030	-2.142	T105E	LI	Transect 105E
113.77480088	-28.47750596	771671.641	6846761.731	-2.611	T105W	LI	Transect 105W
113.77507511	-28.47753383	771698.430	6846758.021	-1.786	T106E	LI	Transect 106E
113.77507235	-28.47758106	771698.039	6846752.790	-1.670	T107E	LI	Transect 107E
113.77480800	-28.47759200	771677.320	6846752.464	-2.520	T107W	LI	Transect 107W

Long Island - Artefacts

113.77469879	-28.47311588	771672.887	6847248.619	10.342	A001	LI	Unidentified metal target (not recovered)
113.77457239	-28.47327804	771660.091	6847230.927	10.145	A002	LI	Unidentified metal target (not recovered)
113.77453742	-28.47337519	771656.417	6847220.242	13.334	A003	LI	Unidentified metal target (not recovered)
113.77448202	-28.47333482	771651.093	6847224.840	8.598	A004	LI	Unidentified metal target (not recovered)
113.77449820	-28.47339944	771652.513	6847217.645	8.717	A005	LI	Unidentified metal target (not recovered)
113.77444349	-28.47342049	771647.100	6847215.431	9.207	A006	LI	Unidentified metal target (not recovered)
113.77448259	-28.47313761	771651.654	6847246.700	9.034	A007	LI	Unidentified metal target (not recovered)

LONG	LAT	EASTING	NORTHING	HEIGHT	ID	LOCATION	DESCRIPTION
113.77455562	-28.47355460	771657.740	6847200.308	6.544	A008	LI	Unidentified metal target (not recovered)
113.77457505	-28.47361031	771659.500	6847194.092	7.173	A009	LI	Unidentified metal target (not recovered)
113.77456300	-28.47362662	771658.279	6847192.314	6.688	A010	LI	Unidentified metal target (not recovered)
113.77451773	-28.47365866	771653.762	6847188.856	6.078	A011	LI	Unidentified metal target (not recovered)
113.77451844	-28.47365838	771653.832	6847188.889	6.019	A012	LI	Unidentified metal target (not recovered)
113.77498385	-28.47560676	771694.429	6846971.854	3.577	A014	LI	Unidentified metal target (not recovered)
113.77495194	-28.47630247	771689.522	6846894.803	6.672	A015	LI	Unidentified metal target (not recovered)
113.77483411	-28.47639184	771677.750	6846885.162	-1.847	A016	LI	Iron fastener fragments (BAT80537)
113.77484158	-28.47639764	771678.467	6846884.498	-1.805	A017	LI	Iron fastener fragments (BAT80538)
113.77483606	-28.47640461	771677.909	6846883.739	-1.898	A018	LI	Iron fastener fragments (BAT80539)
113.77481166	-28.47641395	771675.495	6846882.763	-2.057	A019	LI	Iron bolt and fastener fragments (BAT80540)
113.77482383	-28.47640522	771676.709	6846883.702	-1.941	A020	LI	Iron bolt (BAT80547)
113.77482758	-28.47641209	771677.059	6846882.935	-1.923	A021	LI	Iron bolt and fastener fragments (BAT80541)
113.77487763	-28.47637336	771682.061	6846887.112	-1.743	A022	LI	Iron fastener (BAT80542)
113.77491241	-28.47645104	771685.268	6846878.424	-1.548	A023	LI	Iron fastener fragments (BAT80543)
113.77491499	-28.47645820	771685.503	6846877.621	-1.523	A024	LI	Iron fastener fragments (BAT80544)
113.77488432	-28.47640452	771682.636	6846883.636	-1.662	A025	LI	Iron fastener (BAT80545)
113.77510195	-28.47683849	771702.841	6846835.044	-1.877	A026	LI	Iron fastener (BAT80546)
113.77507235	-28.47758106	771698.039	6846752.790	-1.670	A027	LI	Fragments of copper and iron
113.77503435	-28.47720919	771695.270	6846794.101	-1.588	A028	LI	Unidentified iron fragments (BAT80549)
113.77480800	-28.47759200	771677.320	6846752.464	-2.520	A029	LI	Iron concretions and fasteners (BAT80548)
Long Island - Features							
113.77493493	-28.47568922	771689.426	6846962.817	-2.428	S01	LI	Structure 01 W Corner Exterior
113.77493286	-28.47565760	771689.304	6846966.329	-2.827	S01	LI	Structure 01 NW Corner Exterior
113.77497251	-28.47566031	771693.181	6846965.937	-2.248	S01	LI	Structure 01 NE Corner Exterior
113.77495994	-28.47568790	771691.879	6846962.905	-2.288	S01	LI	Structure 01 SE Corner Exterior
113.77494277	-28.47568545	771690.203	6846963.218	-2.721	S01	LI	Structure 01 SW Corner Interior
113.77494001	-28.47566187	771689.993	6846965.835	-2.981	S01	LI	Structure 01 NW Corner Interior
113.77496180	-28.47566188	771692.128	6846965.794	-2.949	S01	LI	Structure 01 NE Corner Interior
113.77495672	-28.47568598	771691.568	6846963.129	-2.875	S01	LI	Structure 01 SE Corner Interior
113.77495120	-28.47565975	771691.095	6846966.052	-2.954	S01	LI	Structure 01 Entrance E
113.77494096	-28.47566005	771690.091	6846966.039	-2.994	S01	LI	Structure 01 Entrance W
113.77497057	-28.47571339	771692.855	6846960.056	4.580	Fireplace	LI	Fireplace
113.77452916	-28.47440455	771652.971	6847106.152	4.473	S02	LI	Structure 02 NE Corner
113.77452681	-28.47442516	771652.688	6847103.869	4.556	S02	LI	Structure 02 SE Corner
113.77449667	-28.47442478	771649.737	6847103.980	4.522	S02	LI	Structure 02 SW Corner
113.77495043	-28.47564822	771691.049	6846967.328	4.243	S03	LI	Structure 03 Door E

LONG	LAT	EASTING	NORTHING	HEIGHT	ID	LOCATION	DESCRIPTION
113.77496850	-28.47564974	771692.816	6846967.115	4.874	S03	LI	Structure 03 NE Corner
113.77493431	-28.47564620	771689.475	6846967.588	4.248	S03	LI	Structure 03 NW Corner
113.77495817	-28.47568045	771691.725	6846963.740	4.933	S03	LI	Structure 03 SE Corner
113.77493414	-28.47567985	771689.372	6846963.859	4.740	S03	LI	Structure 03 SW Corner
113.77497079	-28.47564735	771693.045	6846967.380	3.916	F01	LI	Feature 01 Unidentified
113.77492927	-28.47567553	771688.906	6846964.348	4.507	F02	LI	Feature 02 Unidentified

Appendix 2 Artefact Register

Catalogue of Long Island, and West Wallabi and East Wallabi Islands (BAT)

Reg. No.	Date		Description	Code	Location
BAT	**East Wallabi Island**				
4767	2.4.07	3	Glass sherds, light green, clear, iridescent exfoliation.	44	Surface collection, survey. Near well and cairn 02.
BAT	**West Wallabi Island**				
3948	2.6.07	2	Lead weights or gaming pieces, square (?, x2). Pres.l. 0.024, pres.w. 0.022; pres.th. 0.004 (weight: 19g); pres.l. 0.021; pres.w. 0.020; pres.th. 0.002 (weight: 7g).	34	Trench AA14, Unit 2
3949	2.7.07	1	Copper-alloy book clasp, decorative. Pres.l. 0.033; pres.w. 0.015; pres.th. 0.002.	32	Trench BB17, Unit 2
3950	2.7.07	1	Copper lace tie end for clothing or shoelace, conical (tapers to a point). Pres.l. 0.028; max.pres.dia. 0.003.	32	Trench BB17, Unit 2
3951	2.7.07	1	Lead, burnt (?)	34	Trench ZZ12, Unit 2
4768	2.5.07	21	Bone fragments, bird (x17, 1 burnt), tammar (vertebrae, leg? x2), UNID concretion (x1), animal skull fragment (?, x1)	41	Trench AA14, Unit 1
4769	2.5.07	1	Sieve sample (6mm), sticks, marine shell	48	Trench AA14, Unit 1
4770	2.5.07	1	Sieve sample (3mm), sticks, marine shell	48	Trench AA14, Unit 1
4771	2.5.07	58	Bone, skull fragments (x8), leg (x50), vertebrae, teeth fragments (x2, burnt)	41	Trench AA14, Unit 2
4772	2.5.07	3	Glass sherds, neck or rim fragments, green	44	Trench AA14, Unit 2
4773	2.5.07	1	Sieve sample (6mm), sticks, marine shell	48	Trench AA14, Unit 2
4774	2.5.07	1	Sieve sample (3mm), sticks, marine shell	48	Trench AA14, Unit 2
4775	2.5.07	32	Bone fragments, bird and tammar	41	Trench AA14, Unit 3
4776	2.5.07	1	Sieve sample (6mm), sticks, marine shell	48	Trench AA14, Unit 3
4777	2.5.07	1	Sieve sample (3mm), sticks, marine shell	48	Trench AA14, Unit 3
4778	2.5.07	50	Bone fragments (x48), bird skull and beak fragments (x2)	48	Trench AA14, Unit 4
4779	2.5.07	1	Sieve sample (6mm), sticks, marine shell	48	Trench AA14, Unit 4
4780	2.5.07	1	Sieve sample (3mm), sticks, marine shell	48	Trench AA14, Unit 4
4781	2.5.07	39	Bone fragments (x38), bird skull fragments (x3)	41	Trench AA14, Unit 5
4782	2.5.07	1	Sieve sample (6mm), sticks, marine shell	48	Trench AA14, Unit 5
4783	2.5.07	1	Sieve sample (3mm), sticks, marine shell	48	Trench AA14, Unit 5
4784	2.7.07	1	Bone fragments, small (weight: 30g)	41	Trench BB17, Unit 1
4785	2.7.07	1	Sieve sample (6mm), marine shell	48	Trench BB17, Unit 1
4786	2.7.07	1	Sieve sample (3mm), marine shell	48	Trench BB17, Unit 1
4787	2.7.07	1	Bone fragments, small, including teeth, some burnt and cut (weight: 30g)	41	Trench BB17, Unit 2
4788	2.7.07	2	Fish vertebrae	48	Trench BB17, Unit 2
4789	2.7.07	1	Sieve sample (6mm), marine shell	48	Trench BB17, Unit 2
4790	2.7.07	1	Sieve sample (3mm), marine shell	48	Trench BB17, Unit 2
4791	2.7.07	1	Bone fragments, small (weight: 21g)	41	Trench BB17, Unit 3
4792	2.7.07	1	Sieve sample (6mm), marine shell	48	Trench BB17, Unit 3
4793	2.7.07	1	Sieve sample (3mm), marine shell	48	Trench BB17, Unit 3
4794	2.7.07	1	Bone fragments, small, including animal skull fragments (weight: 18g)	41	Trench ZZ12, Unit 1
4795	2.7.07	1	Shell fragment, Baler	48	Trench ZZ12, Unit 1
4796	2.7.07	1	Sieve sample (6mm), marine shell	48	Trench ZZ12, Unit 1
4797	2.7.07	1	Sieve sample (3mm), marine shell	48	Trench ZZ12, Unit 1
4798	2.7.07	1	Bone fragments, small, including teeth, some burnt (weight: 23g)	41	Trench ZZ12, Unit 2
4799	2.7.07	3	Shell fragments, Baler	48	Trench ZZ12, Unit 2
4800	2.7.07	1	Sieve sample (6mm), marine shell	48	Trench ZZ12, Unit 2
4801	2.7.07	1	Sieve sample (3mm), marine shell	48	Trench ZZ12, Unit 2

Reg. No.	Date		Description	Code	Location
4802	2.7.07	1	Bone fragments, small (weight: 26g)	41	Trench ZZ12, Unit 3
4803	2.7.07	1	Marine shell	48	Trench ZZ12, Unit 3
4804	2.7.07	1	Sieve sample (6mm), marine shell	48	Trench ZZ12, Unit 3
4805	2.7.07	1	Sieve sample (3mm), marine shell	48	Trench ZZ12, Unit 3
4806	2.5.07	1	Marine shell (weight: 41g)	48	Trench ZZ27, Unit 1
4807	2.5.07	1	Bone fragments, some burnt (weight: 10g)	41	Trench ZZ27, Unit 1
4808	2.5.07	1	Sieve sample (6mm), marine shell	48	Trench ZZ27, Unit 1
4809	2.5.07	1	Bone fragments, small (weight: 21g)	41	Trench ZZ27, Unit 2
4810	2.5.07	1	Sieve sample (6mm), marine shell	48	Trench ZZ27, Unit 2
4811	2.5.07	1	Bone fragments (weight: 7g)	41	Trench ZZ27, Unit 3
4812	2.5.07	1	Sieve sample (6mm), marine shell	48	Trench ZZ27, Unit 3
4813	2.5.07	1	Sieve sample (3mm), marine shell	48	Trench ZZ27, Unit 3
80550	2.6.07	14	Iron, corroded flakes or fragments	8	Trench AA14, Unit 1
80551	2.6.07	17	Iron, corroded flakes or fragments (x16) plus iron nail remnant.	8	Trench AA14, Unit 2
80552	2.6.07	6	Iron, corroded flakes or fragments	8	Trench AA14, Unit 3
80553	2.6.07	2	Iron, corroded flakes	8	Trench AA14, Unit 4
80554	2.6.07	40	Iron, corroded fragments	8	Trench BB17, Unit 1
80555	2.6.07	40	Iron, corroded fragments (weight: 66g)	8	Trench BB17, Unit 2
80556	2.6.07	30	Iron, corroded fragments (weight: 12g)	8	Trench BB17, Unit 3
80557	2.6.07	30	Iron, corroded fragments, including nail head remnant (weight: 34g)	8	Trench ZZ12, Unit 1
80558	2.6.07	20	Iron, corroded fragments (weight: 7g)	8	Trench ZZ12, Unit 2
80559	2.6.07	20	Iron, corroded fragments (weight: 18g)	8	Trench ZZ27, Unit 1
BAT	**Long Island**				
3946	2.8.07	1	Lead fragment, flake	34	Long Island
3947	2.3.07	3	Lead fragments, molten	34	Long Island
80537	2.8.07	66	Wrought iron nail remnants, no original surface. Nail head and upper part of shafts (x15). Shaft square in section. Head shape not diagnostic. Tip not preserved. Max.pres.l. 0.058; pres. head dia. 0.012; max.pres. x-section shaft 0.005. Nail head fragments (x10). Shaft and tip not preserved. Head shape not diagnostic. Max.pres.l. 0.018; max.pres. head dia. 0.018. Nail shaft remnants (x7). Square in section. Max.pres.l. 0.032; max.pres. x-section shaft 0.008. Plus non-diagnostic flakes from these fasteners (x34). No measurements taken.	8	TSP; A016. Surface collection, metal detection survey.
80538	2.8.07	56	Wrought iron nail remnants, no original surface. Nail head and upper part of shafts (x7). Shaft square in section. Head shape not diagnostic. Tip not preserved. One is bend (pres.l. 0.062, pres. head dia. 0.013; pres. x-section shaft 0.006). Nail head fragments (x6). Shaft and tip not preserved. Head shape not diagnostic. Nail shaft remnant (x3). One square in section. Max. pres.l. 0.067; max.pres. x-section shaft 0.010. Plus non-diagnostic flakes or exfoliated fragments from these fasteners (x40). No measurements taken.	8	TSP; A017. Surface collection, metal detection survey.
80539	2.8.07	11	Wrought iron nail remnants, no original surface. Fragment of bend nail shaft (x1), plus associated corroded fragments and flakes. Nail shaft: head and tip not preserved. Pres.l. 0.135; max.pres. x-section shaft 0.014.	8	TSP; A018. Surface collection, metal detection survey.
80540	2.8.07	21	Wrought iron bolt, shaft remnant, and associated corroded flaked fragments (x20+); no original surface. Bolt: only upper shaft directly below head. Head and tip not preserved. Pres.l. 0.117; max.pres. shaft dia. 0.033.	8	TSP; A019. Surface collection, metal detection survey.
80541	2.8.07	13	Wrought iron bolt, shaft remnants (x11) and associated flaked fragments (weight: 4g), no original surface.	8	TSP; A021. Surface collection, metal detection survey.
80542	2.8.07	1	Wrought iron nail remnant, no original surface. Nail head and upper part of shaft preserved. Head shape not diagnostic. Tip not preserved. Pres.l. 0.039; max.pres. head dia. 0.018; pres. x-section shaft 0.009.	8	TSP; A022. Surface collection, metal detection survey.
80543	2.8.07	4	Wrought iron nail remnant, and associated flakes (x3); no original surface. Nail head preserved. Head shape not diagnostic. Shaft and tip not preserved. No measurements taken.	8	TSP; A023. Surface collection, metal detection survey.

Reg. No.	Date		Description	Code	Location
80544	2.8.07	1	Wrought iron nail remnant, no original surface. Nail head and upper part of shaft preserved. Shaft square in section. Head shape not diagnostic. Tip not preserved. Pres.l. 0.040; pres. head dia. 0.011; max. pres. x-section shaft 0.005.	8	TSP; A024. Surface collection, metal detection survey.
80545	2.8.07	1	Wrought iron nail remnant, no original surface. Nail head and upper part of shaft preserved. Shaft square in section. Head shape not diagnostic. Tip not preserved. Pres.l. 0.027; pres. head dia. 0.012; max. pres. x-section shaft 0.004.	8	TSP; A025. Surface collection, metal detection survey.
80546	2.8.07	1	Wrought iron nail remnant, no original surface. Nail head and upper part of shaft preserved. Shaft square in section. Head shape not diagnostic. Tip not preserved. Pres.l. 0.022; max.pres. head dia. 0.0153; pres. x-section shaft 0.005.	8	TSP; A026. Surface collection, metal detection survey.
80547	2.8.07	1	Wrought iron bolt, peened head, possibly clinch bolt with thick washer. Head and upper part shaft preserved; lower shaft and tip missing. Pres.l. 0.180; pres. head/washer dia. 0.054; pres. shaft dia. 0.028; pres.th. possible washer 0.021.	8	TSP; A020. Surface collection, metal detection survey.
80548	2.8.07	5	Iron concretions, small fragments (x4), and possible nail remnant. Not diagnostic.	86	TSP; A029. Surface collection, metal detection survey. Located along edge of salt water pond, south end
80549	2.8.07	2	Metal fragments or concretion. Not diagnostic. Copper corrosion stains on surface.	86	TSP; A028. Surface collection, metal detection survey. Located along edge of salt water pond, south end