

# Appendix J Technical Paper: Statement of Heritage Impact (maritime)

**Statement of Heritage Impact**  
**Barangaroo Ferry Hub, East Darling Harbour**  
Report for Transport for NSW



18 September 2014

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## Definitions

**Adaptation** means changing a place to suit the existing use or a proposed use.

**Bathymetry** is the measurement of the depths of oceans, seas or other large bodies of water, typically using narrow swath acoustic (sonar) systems.

**Environmental heritage** (heritage) means those places, buildings, works, relics, infrastructure, movable objects, landscapes and precincts of State or local heritage significance.

**Conservation** means all the processes of looking after a place so as to retain its cultural significance.

**Cultural significance** means aesthetic, historic, scientific, social or spiritual value for past, present or future generations. Cultural significance is embodied in the place itself, its fabric, setting, use, associations, meanings, records, related places and related objects. Places may have a range of values for different individuals or groups.

**Desktop study** or desk-based assessment is a programme of study of the historic environment within a specified area or site on land, the inter-tidal zone or underwater that addresses agreed research and/or conservation objectives. It consists of an analysis of existing written, graphic, photographic and electronic information in order to identify likely heritage assets, their interests and significance and the character of the study area, including appropriate consideration of the settings of heritage assets and the nature, extent and quality of the known or potential archaeological, historic, architectural and artistic interest. Significance is to be judged in a local, regional, national or international context as appropriate.

**Fabric** means all the physical material of the place including elements, fixtures, contents and objects.

**Ground-truthing** is the process by which information received from remote-sensing equipment, such as data from multi-beam sonar, is compared with what is there in reality so as to verify the data. This usually involves divers undertaking a visual inspection of the site, seabed anomalies and/or sonar targets.

**Interpretation** means all the ways of presenting the significance of an item or place.

**Interpretation plan** is a document that provides the policies, strategies and detailed advice for interpreting a heritage item. It is based on research, analysis and plans to communicate the significance of the item, both during a conservation project and in the ongoing life of the item. The plan identifies key themes, storylines and audiences and provides recommendations about interpretation media. It includes practical and specific advice about how to implement the plan.

**Maintenance** means the continuous protective care of a place and its setting. Maintenance is to be distinguished from repair, which involves restoration or reconstruction.

**Meanings** denote what an item signifies, indicates, evokes or expresses. Meanings can be subjective and can vary from one individual or community to the next.

**Multi-beam sonar** is a device typically used by hydrographic surveyors to determine the depth of water and the nature of the seabed. Most modern systems work by transmitting broad acoustic fan shaped pulse (multiple acoustic beams) from a specially designed transducer. A two way travel time of the acoustic pulse is then established utilizing a bottom detection algorithm. If the speed of sound in water is known for

the full water column profile, the depth and position of the return signal can be determined from the receive angle and the two-way travel time. In this context it is used to produce maps detailed of the seabed, which can be used to identify anomalies or targets on the seabed that may be historically significant.

**Place** is a geographically defined area, either on land or underwater. It may include elements, objects, spaces and views. Place may have tangible and intangible dimensions.

**Preservation** means maintaining a place in its existing state and retarding deterioration.

**Restoration** means returning a place to a known earlier state by removing accretions or by reassembling existing elements without the introduction of new material.

**Reconstruction** means returning a place to a known earlier state and is distinguished from restoration by the introduction of new material.

**Side-scan sonar** is a geophysical instrument similar in operation to a multi-beam sonar, but having two fan-shaped beams (rather than multiple beams) that are projected either side of the instrument (towfish). A two way travel time of the acoustic pulse is then established utilizing a bottom detection algorithm.

**Sonar** is an acronym for sound navigation and ranging, the principal of which involves bouncing acoustic waves off objects (e.g. a shipwreck or the seabed) to determine their distances by measuring the time for the echoes to return (see multi-beam sonar and side-scan sonar).

**Sonar target (target)** is an object, which reflects a sufficient amount of a sonar signal to produce a detectable echo signal at the sonar equipment.

**Towfish** is an instrument, such as a side-scan sonar, towed behind a vessel, its shape resembling that of a fish.

**Use** means the functions of a place, including the activities and traditional and customary practices that may occur at the place or are dependent on the place.

## Executive Summary

ArchaeoMar Australasia has been engaged by Transport for NSW to prepare a Statement of Heritage Impact (SoHI) for the proposed Barangaroo Ferry Hub (BFH) early works. The early works will include a geotechnical investigation designed to inform the BFH development, planned for the eastern shore of Darling Harbour adjoining Barangaroo South. Major transport infrastructure will be required to service Barangaroo once the Barangaroo redevelopments are complete. The BFH will be one major element of the planned transport network.

The purpose of the desktop study and SoHI is to gain an understanding of the submerged historic environment in order to:

- determine the potential for heritage items to survive within the study area;
- assess the significance of known or predicted heritage items within the study area;
- provide strategies for further evaluation where the nature, extent or significance of the cultural resource is not sufficiently well defined;
- assess the potential impact of the proposed development on the identified or predicted heritage items; and
- identify any requirement for further archaeological investigation.

This SoHI was carried out in accordance with NSW Heritage Office guidelines (2002) and includes an Aboriginal cultural heritage due diligence assessment completed in accordance with the NSW Office of Environment and Heritage (OEH) requirements (DECCW 2010).

The human history of eastern Darling Harbour includes at least 6,000 thousand years of Aboriginal occupation (Attenbrow 2002: 3) and almost 200 years of European modification. Historical research undertaken by McLeod and McCarthy (2010) and Casey (2012) indicates that European settlers realised the potential of this resource-rich maritime location as early as 1820, when merchants and ship builders leased or took possession of large waterfront allotments and began to build private wharves and warehouses.

Subsequent development of the landscape adjoining the study area included shipbuilding, maritime infrastructure, maritime-related industry, manufacturing, commerce facilities and residential accommodation. Quarrying and reclamation for the construction of buildings, wharves and roads has been an ongoing process. The resultant structural remains and large-scale topographic alterations now dominate the landscape.

A number of phases of maritime infrastructure development and foreshore modification have been identified adjacent to the study area, as evidenced by the recent archaeological excavations at Barangaroo North (McLeod and McCarthy 2010) and Barangaroo South (Casey 2010). The nature and extent of extant waterlogged remains particularly at Barangaroo South indicates a high potential for early European archaeological features and deposits to survive underwater.

Aboriginal Heritage Information Management System (AHIMS) searches were undertaken on 29 July 2014. The basic searches indicate 14 Aboriginal sites recorded within one kilometre of the study area. Although the shores and seabed of eastern Darling Harbour would have provided ideal conditions for year-round Aboriginal occupation, European development of the harbour is understood to have destroyed sites, which may have previously existed. As the proposed works will have no impact on any known Aboriginal

site, object or place of Aboriginal heritage significance, an Aboriginal Heritage Impact Permit (AHIP) is not required.

Historic heritage searches were undertaken on 29 July 2014. The searches revealed that there are no items of European heritage within the study area recorded on the World Heritage List, National Heritage Register, Register of the National Estate, Commonwealth Heritage List, State Heritage Register, or the Port Authority of NSW (Sydney Ports), Roads and Maritime Services or Sydney Harbour Foreshore Authority Section 170 State Government Agency Heritage and Conservation Register.

The searches further indicate that there are no items within the study area subject to an Interim or Authorised Interim Heritage Order, no items of environmental heritage listed on the *Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005* and no items within the study area identified as being of local or State heritage significance.

Historic shipwreck searches were also undertaken. The searches confirm that no historic shipwrecks have previously been reported as located within the study area. The searches did indicate the potential for four - as yet unlocated - historic shipwrecks to be present within the area. The four ships foundered in Darling Harbour, however no position for the sinking or the location of the resultant shipwreck, is available.

Eastern Darling Harbour has been the subject of maritime, industrial and infrastructure developments from 1820 to present day and was inhabited by Indigenous Australians for some 6,000 years prior to European arrival. The resultant historical and archaeological record implies that the study area has a moderate to high archaeological potential.

As such, marine geophysical survey data was obtained from the Sydney Ports and the Australian Defense Science and Technology Organisation (DSTO). Multi-beam sonar data collected by Sydney Ports in November 2013 revealed at least 30 seabed anomalies (sonar targets) within the study area. This was verified by high quality side-scan sonar data gathered by DSTO in August 2014. The DSTO data indicated at least 30 targets within the impact area of the early works, with more in the broader study area.

A diver-based visual inspection was undertaken to ground-truth the sonar data in order to determine the nature, extent and (where possible) identity of the sonar targets. The visual inspection confirmed the targets to be a variety of geological features, modern navigation and construction aids (some still in use) and modern debris and detritus. No items of Aboriginal or European heritage significance were identified during the visual inspection. The visual inspection revealed that the parts of the study area have been dredged to bedrock level. It is therefore considered that no items of Aboriginal or European heritage significance will be impacted during the proposed early works.

In accordance with *The Burra Charter* procedures for undertaking studies and reports (AICOMOS 2013), the following recommendations have been formulated in consideration of all available information.

### **Recommendation 1**

The proposed early works are appropriate on heritage grounds and should proceed, provided Recommendations 2-5 are followed.

## **Recommendation 2**

All relevant staff, contractors and subcontractors should be made aware of their statutory obligations for heritage under NSW *National Parks and Wildlife Act 1974*, NSW *Heritage Act 1977* and best practice outlined in *The Burra Charter 2013*. This may be implemented as a heritage induction.

## **Recommendation 3**

If any Aboriginal sites, objects or places of Aboriginal heritage significance are identified during the proposed works, all works in the area should cease. The area should be cordoned off (this can be achieved through the use of ropes and buoys) and contact made with the Heritage Division, Office of Environment and Heritage, NSW Department of Planning and Environment (131 555), a suitably qualified archaeologist and the relevant Aboriginal stakeholders, so that the Aboriginal heritage can be adequately assessed and managed.

## **Recommendation 4**

In the highly unlikely event that skeletal remains are identified during the proposed works, work in the vicinity of the remains must cease immediately. The area must be cordoned off (this can be achieved through the use of ropes and buoys). The NSW Police Coroner must be contacted in order to determine if the material is of Aboriginal origin. If determined to be of Aboriginal origin, the Client must contact the Heritage Division, Office of Environment and Heritage, NSW Department of Planning and Environment (131 555), along with a suitably qualified archaeologist and the relevant Aboriginal stakeholders, so that the remains can be adequately assessed and managed.

## **Recommendation 5**

If, during the proposed works, suspected archaeological relics, as defined by the *Heritage Act 1977* are identified, the Heritage Division, Office of Environment and Heritage, NSW Department of Planning and Environment (131 555) should be notified, a research design developed and works only recommence when relevant permits and an appropriate and approved management strategy instigated.

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## 1.0 Introduction

ArchaeoMar Australasia has been engaged by Transport for NSW to prepare a Statement of Heritage Impact (SoHI) for the proposed Barangaroo Ferry Hub (BFH) early works. The early works will include a geotechnical investigation designed to inform the BFH development, planned for the eastern shore of Darling Harbour adjoining Barangaroo South. Major transport infrastructure will be required to service Barangaroo once the Barangaroo redevelopments are complete. The BFH will be one major element of the planned transport network.

The purpose of the desktop study and SoHI is to gain an understanding of the submerged historic environment in order to:

- determine the potential for heritage items to survive within the study area;
- assess the significance of known or predicted heritage items within the study area;
- provide strategies for further evaluation where the nature, extent or significance of the cultural resource is not sufficiently well defined;
- assess the potential impact of the proposed development on the identified or predicted heritage items; and
- identify any requirement for further archaeological investigation.

This SoHI was carried out in accordance with NSW Heritage Office guidelines (2002) and includes an Aboriginal cultural heritage due diligence assessment completed in accordance with the NSW Office of Environment and Heritage (OEH) requirements (DECCW 2010).

### 1.1 Study Area

The study area is located adjacent to the Barangaroo redevelopment, on the eastern shore of Darling Harbour approximately one kilometre from the Sydney General Post Office at 1 Martin Place (Figure 1).

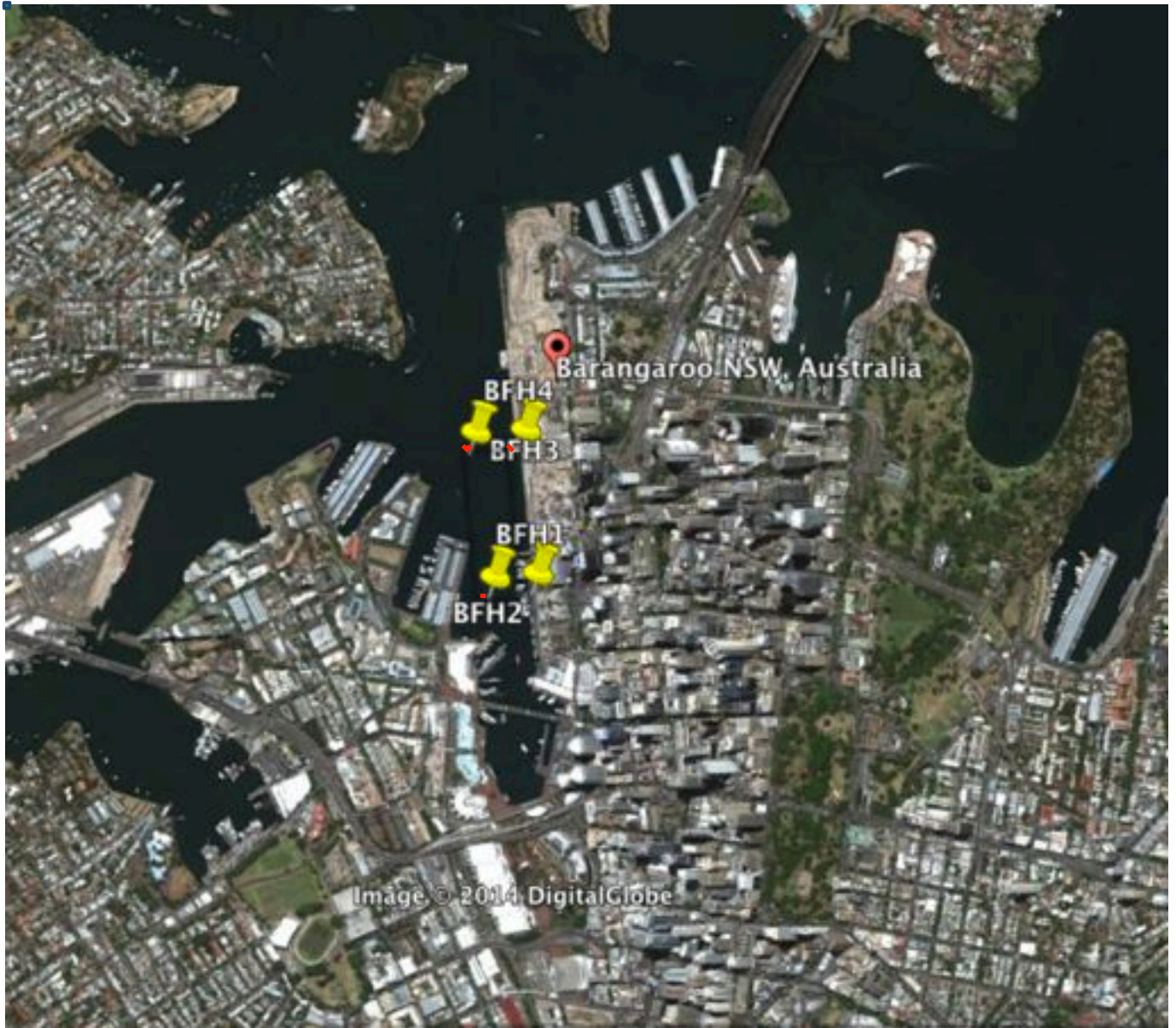
Rectangular in shape, the study area is approximately 500 metres long by 175 metres wide and bounded by the coordinates in Table 1. King Street Wharf (Johnsons Bay) is located along the southern perimeter of the study area, whilst Barangaroo South (managed by the NSW Government Barangaroo Delivery Authority (BDA) forms the eastern boundary. The remainder of Darling Harbour is to the west and north.

**Table 1: Boundary Coordinates of the Study Area**

Coordinate Name	Positing (Eastings)	Positing (Northings)
BFH1	333614.00 m E	6251124.00 m S
BFH2	333471.00 m E	6251101.00 m S
BFH3	333398.00 m E	6251580.00 m S
BFH4	333565.00 m E	6251591.00 m S

(Source: ArchaeoMar Australasia)

It is understood that the proposed BFH development would not utilise the entire study area. The study area has been chosen to be sufficiently large that the proposed development can be designed to fit within its perimeter, allowing for a range of design options. The overly large study area, should also provide a significant 'heritage buffer' around the proposed development.



**Figure 1:** Map of central Sydney showing Darling Harbour, Barangaroo and the study area in red. The yellow pins illustrate the study area boundary coordinates (BF1-BF4). Image courtesy: Google Earth / Digital Globe 2014.

## 1.2 Proposed Works

The proposal is to develop a new ferry terminal, the Barangaroo Ferry Hub (BFH), at Barangaroo South as outlined in the Barangaroo Integrated Transport Plan (TfNSW 2012). It is envisaged that the BFH would enable growth in the ferry mode of transport and provide convenient access to the western CBD for ferry passengers, whilst relieving pressure from Circular Quay.

Although the design has yet to be finalised, the proposed works are expected to involve the construction of two new wharves, with an option for a third. Each wharf would have an entry platform, shelter, gangway and floating pontoon supported by a number of piles driven into the seabed. The seabed and adjoining shore face would also be impacted by the machinery and equipment used to install the wharves and ancillary facilities.

As part of the Lend Lease Barangaroo South development, services (including power, communications, sewerage and water) would be installed to the harbour edge and made available for connection to the BFH. Ancillary facilities such as ticket vending machines and wayfinding signage are likely to be installed, as well a temporary construction compound.

Early investigation works (early works) are planned ahead of the main construction of the BFH to provide information for design development. These involve geotechnical and contamination investigations on the seabed comprising:

- five boreholes of 122 millimetre diameter (including the casing) drilled into the seabed to sample soils and bedrock, at the locations specified in Table 2;
- cone penetrometer testing (CPT) undertaken adjacent to completed borehole locations, which involves hydraulically pushing an instrumented cone through the soil stratum at a controlled rate (This will only be undertaken if required. At each location this will be determined depending on the initial borehole results. This will be determined on site at the time); and
- use of a jack-up barge for the drilling and CPT work.

**Table 2: Borehole Locations**

Borehole Name	Position (Eastings)	Position (Northings)
BH-A5	333539.40 m E	6251404.10 m S
BH-A4	333578.60 m E	6251389.30 m S
BH-A3	333547.10 m E	6251332.40 m S
BH-A2	333586.30 m E	6251317.50 m S
BH-A1	333553.90 m E	6251270.50 m S

(Source: Transport for NSW 2014)

A circular area of 30-metre radius will be assessed around each borehole location. This represents the largest area that would potentially be impacted during borehole drilling and includes impacts arising from the borehole itself and the footprint of the jack-up barge used for drilling. Table 3 shows the extent of both the diving area and the impact area as a result of the proposed early works. This was designed to provide a buffer for the safety of divers undertaking the investigation whilst providing a clear boundary within the study area for the containment of early works.

**Table 3: Extent of Diving Zone/Borehole Impact Area (UTM Zone 56)**

Coordinate Name	Position (Eastings)	Position (Northings)
DZ-01	333609.00 m E	6251242.00 m S
DZ-02	333523.00 m E	6251233.00 m S
DZ-03	333499.00 m E	6251423.00 m S
DZ-04	333590.00 m E	6251430.00 m S

(Source: ArchaeoMar Australasia 2014)

### 1.3 Limitations

The report has not been unduly constrained by any timing or budgetary constraints, relative to its purpose and the questions being asked. It must be emphasized that, apart from analysis of historic graphics and existing archeological/technical reports, no detailed site-specific historical research has been undertaken. As is always the case with historical research, it is possible that further investigation will reveal relevant information not presented in this report.

### 1.4 Terminology

The terms relating to heritage conservation are consistent with the definitions contained in *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 2013* and *Heritage Terms and Abbreviations* (NSW Heritage Office 1996). For ease of reading several of these definitions are provided in the prefix to this report.

### 1.5 Report Structure

The report is structured as follows:

- Section 2 reviews the legislative and regulatory regime under which this study was carried out;
- Section 3 presents historical details pertinent to understanding the significance of the study area;
- Section 4 outlines the archaeological and environmental framework within which the results of the SoHI desktop study can be interpreted;
- Section 5 provides the heritage context within which the study area can be considered;
- Section 6 presents the significance assessment using the NSW Heritage Office (2002) criteria;
- Section 7 investigates the potential heritage impacts of the proposal, presents design and construction considerations;
- Section 8 draws conclusions, provides measures to mitigate any heritage impacts and provides recommended management responses;
- Section 9 provides references; and is followed by the appendices.

### 1.6 Authorship and Acknowledgements

This report was prepared by ArchaeoMar Principal Consultant and Maritime Archaeologist Sarah Ward and reviewed by Quality Manager Andrew Stanton. The ArchaeoMar team gratefully acknowledges the assistance of the following individuals and organisations nominated in Table 4.

**Table 4: Acknowledgements**

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Mr Chris Menin	Transport for NSW
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Dr Stuart Anstee	Defense Science and Technology Organisation
Mr Alan McLennan	McLennan Diving Services
Mr Tim Stone	Tim Stone Pty Ltd

(Source: ArchaeoMar Australasia 2014)

## 2.0 Legislative Context

Together with best practice principles outlined in documents such as *The Burra Charter* (AICOMOS 2013), the following legislative and regulatory context forms basis of the framework within which heritage items and potential heritage items are managed in NSW. It should be noted that titles to the beds of all tidal waters (land below the Mean High Water Mark), unless specifically vested in another authority or the subject of a Crown Grant, are vested in the Crown. In accordance with the NSW Land and Property Information Registrar General's Directions, NSW Roads and Maritime Services is the proprietor of the bed of Port Jackson (Certificate of Title Volume 5018 Folio 1), which includes the study area.

### 2.1 *Environmental Planning and Assessment Act 1979*

The *Environmental Planning and Assessment Act 1979* (EP&A Act) regulates a system of environmental planning and assessment for NSW. Land use planning requires that environmental impacts, including impacts on environmental heritage, be considered. The EP&A Act is supported by the EP&A Regulations 2000 (Regulations) and provides the framework for establishment of a range of environmental planning instruments (EPIs) to regulate land use and guide development. EPIs relevant to this assessment include the following:

- *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP);
- *Sydney Regional Environmental Plan (Sydney Harbour Catchment)* (SREP); and
- *Sydney Harbour Foreshores and Waterways Area Development Control Plan* (SDCP).

Assessment documents prepared to meet the requirements of the EP&A Act and supporting EPIs include Statements of Environmental Effects (SEE), Reviews of Environmental Factors (REF), Environmental Impact Statements (EIS) and Environmental Impact Assessments (EIA). All should address European and Aboriginal cultural heritage.

#### 2.1.1 *State Environmental Planning Policy (Infrastructure) 2007*

The aim of the Infrastructure SEPP is to facilitate the effective delivery of infrastructure across the State by:

- a) improving regulatory certainty and efficiency through a consistent planning regime for infrastructure and the provision of services;
- b) providing greater flexibility in the location of infrastructure and service facilities;
- c) allowing for the efficient development, redevelopment or disposal of surplus government owned land;
- d) identifying the environmental assessment category into which different types of infrastructure and services development fall (including identifying certain development of minimal environmental impact as exempt development);
- e) identifying matters to be considered in the assessment of development adjacent to particular types of infrastructure development; and
- f) providing for consultation with relevant public authorities about certain development during the assessment process or prior to development commencing.

Part 2, Division 1, Clause 14 (2)(a) of the SEPP requires an impact assessment if the assessment is likely to have an impact that is not minor or inconsequential on a local heritage item (other than a local heritage item that is also a State heritage item) or a heritage conservation area.

### 2.1.2 Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005

The intention of the SREP is to provide a set of clear planning principles for submerged land within the Sydney Harbour Catchment. From 1 July 2009 this plan is taken to be a State Environmental Planning Policy (see clause 120 of Schedule 6 to the EP&A Act). With respect to the Sydney Harbour Catchment, the SREP aims to:

- a) ensure that the catchment, foreshores, waterways and islands of Sydney Harbour are recognised, protected, enhanced and maintained;
- b) ensure a healthy, sustainable environment on land and water;
- c) achieve a high quality and ecologically sustainable urban environment;
- d) ensure a prosperous working harbour and an effective transport corridor;
- e) encourage a culturally rich and vibrant place for people;
- f) ensure accessibility to and along Sydney Harbour and its foreshores;
- g) ensure the protection, maintenance and rehabilitation of watercourses, wetlands, riparian lands, remnant vegetation and ecological connectivity; and
- h) provide a consolidated, simplified and updated legislative framework for future planning.

The SREP zones the waterways into nine different zones to suit the differing environmental characteristics and land uses of the harbour and its tributaries. The waterway which contains the study area is zoned W1 'Maritime Waters' (refer Part 3, Division 1, Clause 16(1)). The objectives of this zone are to:

- a) give preference to and protect waters required for the effective and efficient movement of commercial shipping, public water transport and maritime industrial operations generally;
- b) allow development only where it is demonstrated that it is compatible with, and will not adversely affect the effective and efficient movement of, commercial shipping, public water transport (the purpose of this study) and maritime industry operations; and
- c) promote equitable use of the waterway, including use by passive recreation craft.

It is permissible to carry out the development of 'public water transport facilities' in this zone (W1) only with development consent (refer Part 3 Division 1 Clause 18(1)(b)).

With regard to heritage, the SREP (Part 5 Division 1 Clause 53(1)) promotes the conservation of environmental heritage (53(1)(a)), heritage significance (53(1)(b)), archaeological sites and places of Aboriginal heritage significance (53(1)(c)) and places which have the potential to have heritage significance but are not identified as heritage items (53(1)(d)).

With development consent, the SREP allows for: the demolition, destruction or alteration of a heritage item (Part 5 Division 1 Clause 55(1)(a)(b)); the disturbance of, or damage to, an Aboriginal heritage place or object of Aboriginal heritage significance (55(1)(c)); and the erection of a building or structure on land on which a heritage item is located (55(1)(d)). Note that the SREP Heritage Map indicates no known heritage items within the study area (refer Part 5 Division 1 Clause 54).

Development consent for the early works will be sought under Part 5 of the EP&A Act. Approval for the BHF construction will then sought from DP&E under Part 5.1 of the EP&A act. Part 5.1 specifies that for approved State Significant Infrastructure (SSI) authorisations under Part 4, or an excavation permit under s139, of the Heritage Act are not required (s115ZG(1)(c)), an Aboriginal heritage impact permit under section 90 of the NPW Act, is not required (s115ZG(1)(d)) and under (s115ZG(2)) Part 6 Division 8 of the

Heritage Act does not apply. Development approval under Part 5.1 of the EP&A Act effectively switches off the Heritage Act.

### **2.1.3 Sydney Harbour Foreshores and Waterways Area Development Control Plan 2005**

The SDCP has been prepared to support the SREP and provides detailed design guidelines for development and criteria for natural resource protection for the area identified as Foreshores and Waterways area.

The SDCP needs to be taken into consideration by landowners, developers and consent authorities when preparing or assessing development applications within the Foreshores and Waterways Area of the SREP. It provides design guidelines for water-based and land/water interface developments including public water transport facilities such as the proposed BFH.

The SDCP does not specifically address heritage considerations such as Aboriginal or historic archaeology, or the need for a SoHI or CMP (s55(5), 57, 58). Instead, the SDCP refers readers to the relevant Local Environmental Plans (LEPs), the SREP and relevant information prepared by the NSW Heritage Office.

## **2.2 Heritage Act 1977**

The *Heritage Act 1977* (Heritage Act) administered by the Heritage Division, OEH, NSW Department of Planning and Environment (DP&E), protects the cultural and natural history of NSW with emphasis on historic heritage items (such as place, building, works, relic, moveable object, precinct, historic shipwreck or archaeological site) of State or local significance, through protection provisions and the establishment of a Heritage Council and State Heritage Register (SHR).

Division 9 of the Heritage Act is titled 'Protection of certain relics' and Section 139 also refers to an excavation permit being required in certain cases to 'disturb or excavate land'. A 'relic' is defined under s4(1), as being 'any deposit, artefact, object or material evidence that (a) relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement and (b) is of State or local heritage significance'.

Section 139(1) states that a person must not disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed, unless the disturbance or excavation is carried out in accordance with an excavation permit, whilst s139(2) states a person must not disturb or excavate any land on which the person has discovered or exposed a relic, except in accordance with an excavation permit.

Such permits are issued under Part 4 Division 3 s60 and s63 Part 6 Division 9 s140 and s141 of the Act, or under of the Act, in cases where 'relics' are situated within sites or places listed on the SHR. It should be noted that under these conditions, an excavation permit is required for any excavation (such as an excavation for geotechnical investigation), not solely archaeology excavations. Approval under Part 5.1 of the EP&A Act, authorisations' under Part 4 and/or an excavation permit under s139, of the Heritage Act are not required.

Where the development is being undertaken under a Division 4.1 State Significant Development or Part 5.1 State Significant Infrastructure process there is no requirement to apply for an s140 approval but there

is an expectation that the required archaeological work will conform to best practice established by the Heritage Council and their various guidelines. The Heritage Division will be required to review relevant documentation and provide advice as to whether it is acceptable.

State government agencies have particular responsibilities under s170 of the Heritage Act. Section 170 requires agencies to identify, conserve and manage heritage assets owned, occupied or managed by that agency and in doing so, keep a publically accessible register of these heritage items. The register is called a *Heritage and Conservation Register* or more commonly, the s170 Register.

The Heritage Act also protects historic shipwrecks (Part 3C) and associated relics that have been situated in State Waters for 75 years or more, along with historic relics not associated with an historic shipwrecks (Part 6), but that may be submerged.

Although Aboriginal heritage is primarily protected by the *National Parks and Wildlife Act 1974* (NPW Act), if an Aboriginal site, object or place is of State significance, it may be protected by an interim heritage order or by virtue of listing on the SHR. Penalties of up to \$1.1 million are in place for breaches of the Heritage Act and its Regulations. The Heritage Act is effectively 'turned off' by Division 4.1 State Significant Development and Part 5.1 State Significant Infrastructure of the EP&A Act.

### **2.3 National Parks and Wildlife Act 1974**

Aboriginal heritage within NSW is predominantly protected by the NPW Act, also administered by DP&E. The object of the NPW Act is to consolidate and amend the law relating to the establishment, preservation and management of national parks, historic sites (and certain other areas) and the protection of certain fauna, native plants and Aboriginal objects. Significant measures have been put in place to deter Aboriginal Heritage offences:

- penalties of up to \$1.1 million apply in the case of companies who do not comply with the legislation;
- strict liability offences ensure companies or individuals cannot claim 'no knowledge' in cases of serious harm to Aboriginal heritage places and objects;
- remediation provisions ensure those who illegally harm significant Aboriginal sites are forced to repair the damage, without need for a court order;
- unification of Aboriginal heritage permits into a single, more flexible permit, the Aboriginal Heritage Impact Permit (AHIP); and
- offences around breaches of AHIP conditions have been strengthened.

The NPW Act provides defences, applicable where a person harms an Aboriginal object without knowing what it was and without a permit from DP&E. One of these defences is the 'due diligence' defence (s87 (2)). This states that if a person or company has exercised due diligence to ascertain that no Aboriginal object was likely to be harmed as a result of the activities proposed for the site, then liability from prosecution under the NPW Act will be removed, or mitigated, if it transpires that an object was harmed.

The NPW Act also provides a generic code of practice to explain what due diligence means. Carefully following this code of practice, which is adopted by the Regulation made under the NPW Act, would be regarded as 'due diligence'. This code sets out the reasonable and practicable steps to: identify whether or not Aboriginal objects are, or are likely to be, present in an area; determine whether or not their activities are likely to harm Aboriginal objects (if present); and determine whether an AHIP is required.

The steps to identify whether or not Aboriginal objects are, or are likely to be, present in an area, have been undertaken in preparing this SoHI and are as follows:

- carrying out of a search of the Aboriginal Heritage Information Management System (AHIMS) database to ensure there are no registered sites within the project area;
- undertaking a review of previous archaeological investigations in the project area; and
- making an assessment of the relevant landscape features and visual inspection to determine whether there are Aboriginal objects present within the project area or that they are likely.

One of the benefits of the due diligence provisions are that they provide a simplified process for investigating the Aboriginal archaeological context of an area without the need for intrusive investigation and an AHIP.

Aboriginal consultation is not required for an investigation under due diligence. However, if the due diligence investigation reveals that the activities proposed for the area are likely to harm objects or likely objects within the landscape, then an AHIP will be required with full consultation.

The due diligence assessment contained within this report does not conclude that Aboriginal objects are likely to be harmed, thus the AHIP procedures have not been triggered and full Aboriginal consultation following the *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (ACHCR) (DECCW 2010) is not required.

## **2.4 Aboriginal Land Rights Act 1983**

The purpose of the *Aboriginal Land Rights Act 1983* (ALR Act) is to provide land rights for Aboriginal people within NSW and to establish Local Aboriginal Land Councils (LALCs).

The land able to be claimed by Aboriginal Land Councils on behalf of Aboriginal people is certain Crown land that (s36): is able to be lawfully sold, leased, reserved or dedicated; is not lawfully used or occupied; will not, or not likely, in the opinion of the Crown Lands minister, be needed for residential purposes; will not, or not likely, be needed for public purposes; does not comprise land under determination by a claim for native title; and is not the subject of an approved determination under native title.

Even though the land is submerged, the study area is considered to be land required for a public purpose (water transport) and has been previously lawfully occupied (by Sydney Ports et al), it is deemed that no claim under this act would apply.

## **2.5 Native Title Act 1993**

The Commonwealth Government enacted the *Native Title Act 1993* (NT Act) to formally recognise and protect native title rights in Australia following the decision of the High Court of Australia in *Mabo & Ors v Queensland* (No. 2) (1992) 175 CLR 1.

Although there is a presumption of native title in any area where an Aboriginal community or group can establish a traditional or customary connection with that area, there are a number of ways in which native title is taken to be extinguished. For example, land that was designated as having freehold title prior to 1 January 1994 extinguishes native title, as does any commercial, agricultural, pastoral or residential lease.

Land that has been utilised for the construction or establishment of public works also extinguishes any native title rights and interests for as long as they are used for that purpose. Other land tenure, such as mining leases, may be subject to native title, depending on when the lease was granted. Native title is taken to have been extinguished within the study area.

## 2.6 International Convention and Soft Law

### 2.6.1 UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001

The UNESCO *Convention on the Protection of the Underwater Cultural Heritage 2001* (the 'convention'), entered into force on 2 January 2009. The convention is designed to protect 'underwater cultural heritage' defined as 'all traces of human existence having a cultural, historical or archaeological character which have been partially or totally under water, periodically or continuously, for at least 100 years such as:

- a) sites, structures, buildings, artefacts and human remains, together with their archaeological and natural context;
- b) vessels, aircraft, other vehicles or any part thereof, their cargo or other contents, together with their archaeological and natural context; and
- c) objects of prehistoric character (UNESCO 2001: 2; O'Keefe and Prott: 2011: 135).

At the time of writing, Australia has not ratified the convention. Australia has however indicated that it is actively considering ratification. As a result of this consideration, a review of the Commonwealth *Historic Shipwrecks Act 1976* has been undertaken (this legislation does not apply to inland waterways which are the jurisdiction of the States) and the Commonwealth has implemented an Inter-Governmental Agreement (IGA) between the States and the Commonwealth.

The intent of this IGA is to clarify the roles and responsibilities the Commonwealth, States and the Northern Territory jurisdictions in relation to the management of Australia's underwater cultural heritage and meet international best practice management of Australia's underwater cultural heritage as outlined in the Rules in the Annex to the convention (Commonwealth of Australia 2010:2). A whole-of-government response was obtained from NSW and it acceded to the agreement on 5 July 2010.

Although Australia is not a state party to the convention, NSW (by acceding to the IGA) has agreed to the terms of the convention and the rules contained in its Annex. On 2 August 2006, the Heritage Council of NSW endorsed the Annex to the convention (UNESCO 2001: 16-21; O'Keefe and Prott: 2011:143-146) as a doctrine best practice, recognising and endorsing the general principles of the convention as a key policy document that underpins its own policies for the conservation of underwater cultural heritage items in NSW (Heritage Council 2006: 5).

In short, this means that any matters directed at, or incidentally affecting shipwrecks and underwater cultural heritage and which require heritage council approval, must be carried out in accordance with the 'rules' concerning activities directed at underwater cultural heritage, as referred to in Article 33 of the convention (refer Article 1(9)) (UNESCO 2001: 3,15,16-21, O'Keefe and Prott: 2011:136, 143-146).

Article 5 of the convention 'activities incidentally affecting underwater cultural heritage' stipulates that each state party to the convention is required to use the 'best practicable means at its disposal' to prevent or mitigate any adverse effects that might arise from activities under its jurisdiction (i.e. under its control) and incidentally affect underwater cultural heritage (UNESCO 2001: 4; O'Keefe and Prott: 2011:136) and Rule 12 states that 'where unexpected discoveries are made or circumstances change, the project design shall

be reviewed and amended with the approval of the competent authorities' (UNESCO 2001: 18; O'Keefe and Prott: 2011:144). NSW has agreed to abide by these rules.

It should be noted that - even if they have been *in situ* underwater for 100 years or more - pipelines and cables placed on the seabed shall not be considered as underwater cultural heritage. Likewise, installations other than pipelines and cables, placed on the seabed and still in use shall not be considered as underwater cultural heritage (UNESCO 200: 2; O'Keefe and Prott: 2011: 135). Submerged historic maritime infrastructure, such as that potentially within the study area, does fall within in the remit of the convention, its annexe and NSW's IGA commitments.

## 3.0 Historical Context

Until the development of the first scientific dating techniques around the beginning of the century, the dating of built heritage depended almost entirely on historical methods, that is, by using a documented historical chronology. The historical period in NSW begins with European land settlement in 1788 when Governor Philip claimed possession of the land now known as Australia, on behalf of the British Government. The documentary evidence relating to this period helps us to better understand the patterning of European settlement and to contextualize its material remains.

### 3.1 Indigenous Occupation of Darling Harbour

Prior to the European occupation of Sydney, the landscape was characterized by sandstone ridges and plateaus cut by streams and rivers forming bays and estuaries that provided a wide range of resources for the exploitation by Indigenous inhabitants. Eucalypt forest in the protected gullies gave way to open woodland on the slopes and coastal plains and inter-tidal rock platforms, beaches or mangrove mudflats on or near the shore (Attenbrow 2002: 40).

The traditional owners of the Sydney region are the Cadigal (Gadigal) people of the Darug language group (McLeod and McCarthy 2010: 11). Their country extended across the southern shore of Port Jackson (Sydney Harbour) from South Head to Darling Harbour and to Petersham in the south and people readily moved about the landscape in order to access the resources they needed.

The first written records of Aboriginal history come from the colonial diarists, who recorded fish and shellfish as the staple Indigenous diet (McLeod and McCarthy 2010: 11). The shores of Darling Harbour proved to be an important source of cockles (*Anadara trapezia*), rock oyster (*Saccostrea commercialis*) and mud oyster (*Ostrea angasi*), not only for Indigenous Australians but for the settlers as well. Diets were supplemented with an intake of vegetables, grubs, birds, reptiles, possums, wombats and kangaroos, particularly in the winter (Attenbrow 2002: 41).

Archaeological evidence indicates (Attenbrow 2002 et al; Appendix 1) campsites were usually located close to shore. Women caught fish either from canoes or from the shore using fishing line made from bark and shellfish hooks, whilst men fished from shore using spears.

The result of the AHIMS searches (Appendix 1) confirm that the varied landscape, combined with a mild annual climate, provided an ideal environment for the Aboriginal people. Fourteen Aboriginal sites were recorded within one kilometre of the study area, with all sites located within 200 metres of the harbour which was less than one metre deep at that time of European arrival (Hunter 1788; Figure 2). The AHIMS search results are discussed in greater detail in section 4.2.3).

### 3.2 European Development of Darling Harbour

Discouraged by the rugged topography of what is now Millers Point and Darling Harbour, the 1788 settlement centred around Sydney Cove (now Circular Quay) and the Tank Stream, a fresh water tributary that flowed into the cove. The colony, however, grew quickly and within a few years, the European settlement had spread to the western ridge overlooking, what is now Darling Harbour.

By 1792, four clearly delineated settlement areas are evident on the eastern shore of Darling Harbour (Philip 1792; Figure 3). It is not until Lesueur's plan of 1802, however that this part of the colony is



**Figure 2:** Extract from John Hunter's Chart of Port Jackson as surveyed in 1788. Image shows the shoreline and depth of water in Darling Harbour including the study area. Image courtesy: State Library of NSW (Z/M2 811.15/1788/1).

well represented (Figure 4). The eastern shore, now Barangaroo, is shown to have rocky cliffs with steep gradients and a protracted intertidal zone. Together with the number of creeks meandering through the head of Darling Harbour and the type of vegetation depicted, this area can be taken to have been predominantly swamp or marshland; fertile hunting ground for Indigenous Australians, but much less inviting for the settlers.

Charles Grimes, Surveyor General and James Meehan, Assistant Surveyor of Lands, both prepared plans of Sydney in 1807 (Figure 4; Figure 5). These plans show a rapid increase in development of the land to the east of Darling Harbour. Two long thin rows of buildings visible to the southwest of the government windmill are thought to be allotments and houses. Readily identifiable by their orientation at an angle to the continuation of Soldiers' Back Row (renamed Kent Street in 1810), these appear more clearly in later plans and surveys (Casey 2010:17; Sydney Gazette 6 October 1810). Few of the early maps give a true impression of the topography of Sydney Harbour and it is only the location and orientation of the earliest buildings that help to identify the realities of the shoreline contours.

Soon after the Meehan and Grimes maps, in 1809, the Sydney Gazette announced the construction - in Cockle Bay - of a vessel of 60 tons for James and William Jenkins, the aptly named *Brothers*. This is the first record of the development of shipbuilding and maritime infrastructure in Darling Harbour, although the shipyard location is not known.

It's not until John Septimus Roe's plan of August 1822, that maritime infrastructure is first depicted at what is now Barangaroo. Roe's plan clearly shows Arthurs Wharf protruding from shore into the waters of eastern Darling Harbour. Development of the area continued apace until its peak and ultimate decline between 1870 and 1901.

Both McLeod and McCarthy (2010: 11-35) and Casey (2012: 4-11) have produced lengthy overviews of the historic development of eastern Darling Harbour and it is for this reason that it will not be reproduced here. Both reports provide detailed accounts of which merchants and shipbuilders occupied which land are supported by a plethora of historical photographs.

These reports indicate that the Barangaroo headland and eastern Darling Harbour generally, was a hubbub of industry. Over time, it housed several shipyards and engineering facilities including Henry Bass' shipyard (occupied 1832-1854), Girard's Quarry and Flour Mill (1832-1841), Breillat and Sydney Flour Company (1841-1878) and Grafton Wharf which was occupied by Smith and Challis (1854-1880) and Watson and Evans (1880-1900) (Casey 2012: 5-11) prior to its resumption, repair and renewal (McLeod and McCarthy 2010: 35-45; Casey 2012: 9-11).

It wasn't just the foreshore being developed. References to the dredging of Darling Harbour appear in the local Sydney newspapers as early as 1875 (Anon. 1875a; 1875b) and continue throughout to the 1880s (Anon 1878; 1879; 1881; 1883; 1888:1889). One article in the Evening News (Anon. 1888) makes reference to annual dredging with in excess of 240,000 tonnes of sediment removed by one of the three dredgers in that year alone. Historic photographs, such as that in Plate 1, show dredging taking place around the wharf infrastructure adjacent to the study area.



**Plate 1:** Historic dredging between the wharves of Darling Harbour within the study area at the foot of Margaret Street. Image courtesy: Government Printing Office/State Library of NSW (d1\_47746).

### 3.2 Darling Harbour today

Today Barangaroo is undergoing major urban renewal and development due for completion in approximately 2023. Plans for the 22-hectare site include half business and residential developments and areas reserved for open public space. The state government of NSW declared plans for Globe Street, a street designed to become Australia and Asia Pacific's centre for corporate trade (styled on New York's "Wall Street" district), along with a new International Convention Centre Sydney (to replace the Exhibition Centre).

Until recently, eastern Darling Harbour was one of the few remaining working areas in Sydney Harbour, with a number of maritime businesses, including Sydney Ports and Patrick Stevedores still operational. These are vestiges of the industrial and maritime use of Darling Harbour - and its significance - over the past 225 years.



**Figure 3:** A survey of the settlement of New South Wales, New Holland 1792. Engraved by A. Dulon and L. Poates. Image courtesy: National Library of Australia (nla.map-f306v).



**Figure 4:** Plan de la ville de Sydney: Capitale des colonies Anglaises, aux terres Australes. Engraved by Charles Alexandre Lesueur 1802. Image courtesy: National Library of Australia (nla.map-f307v).



**Figure 5:** 1807 plan of its environs prepared by Charles Grimes, Surveyor General. Plan indicates a rocky foreshore. The approximate location of the Barangaroo South redevelopment, adjacent to the study area, is shown in red. Image Courtesy: The National Archives (UK) (CO 700/NewSouthWales18). Image reproduced from Casey (2010: 19).

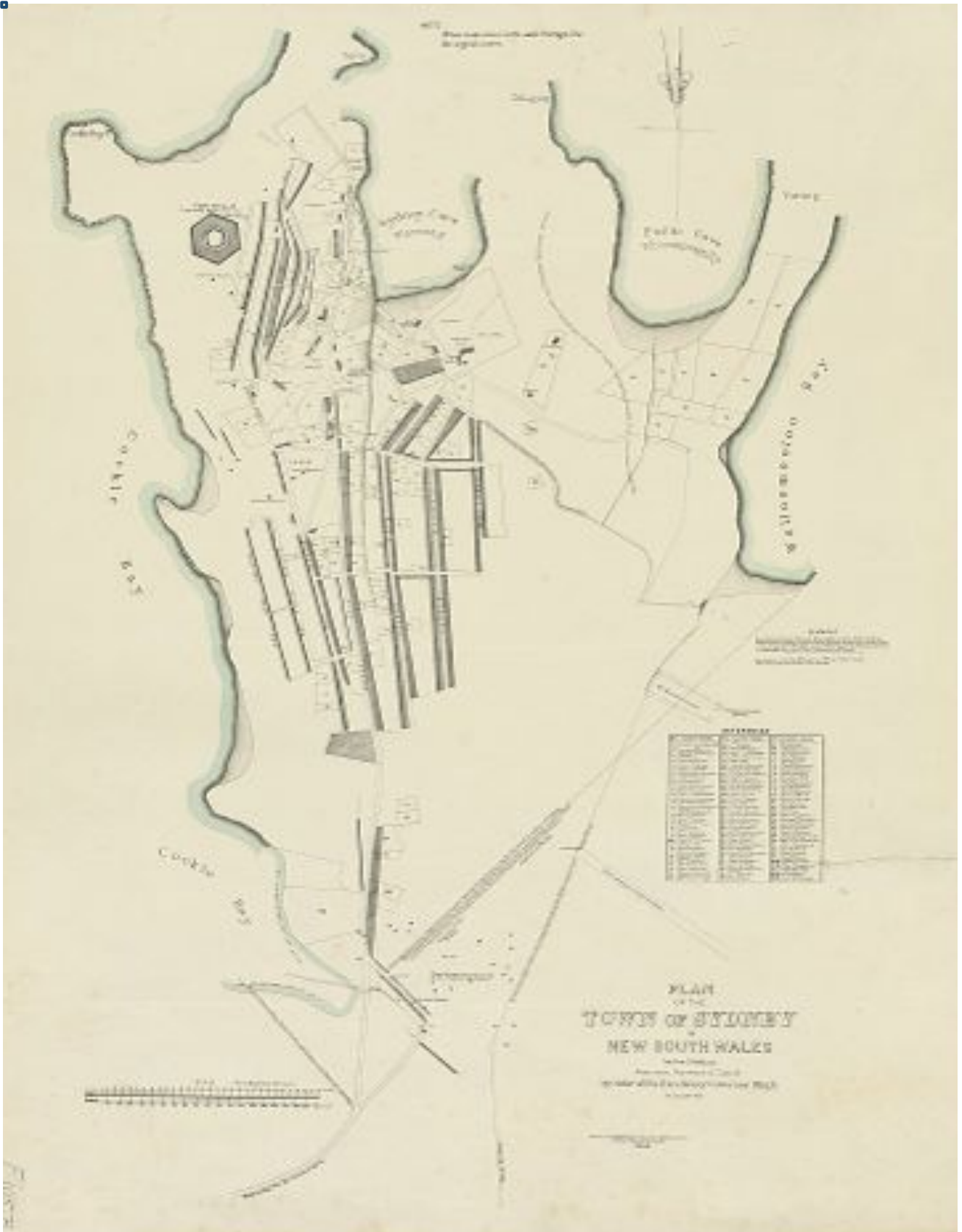
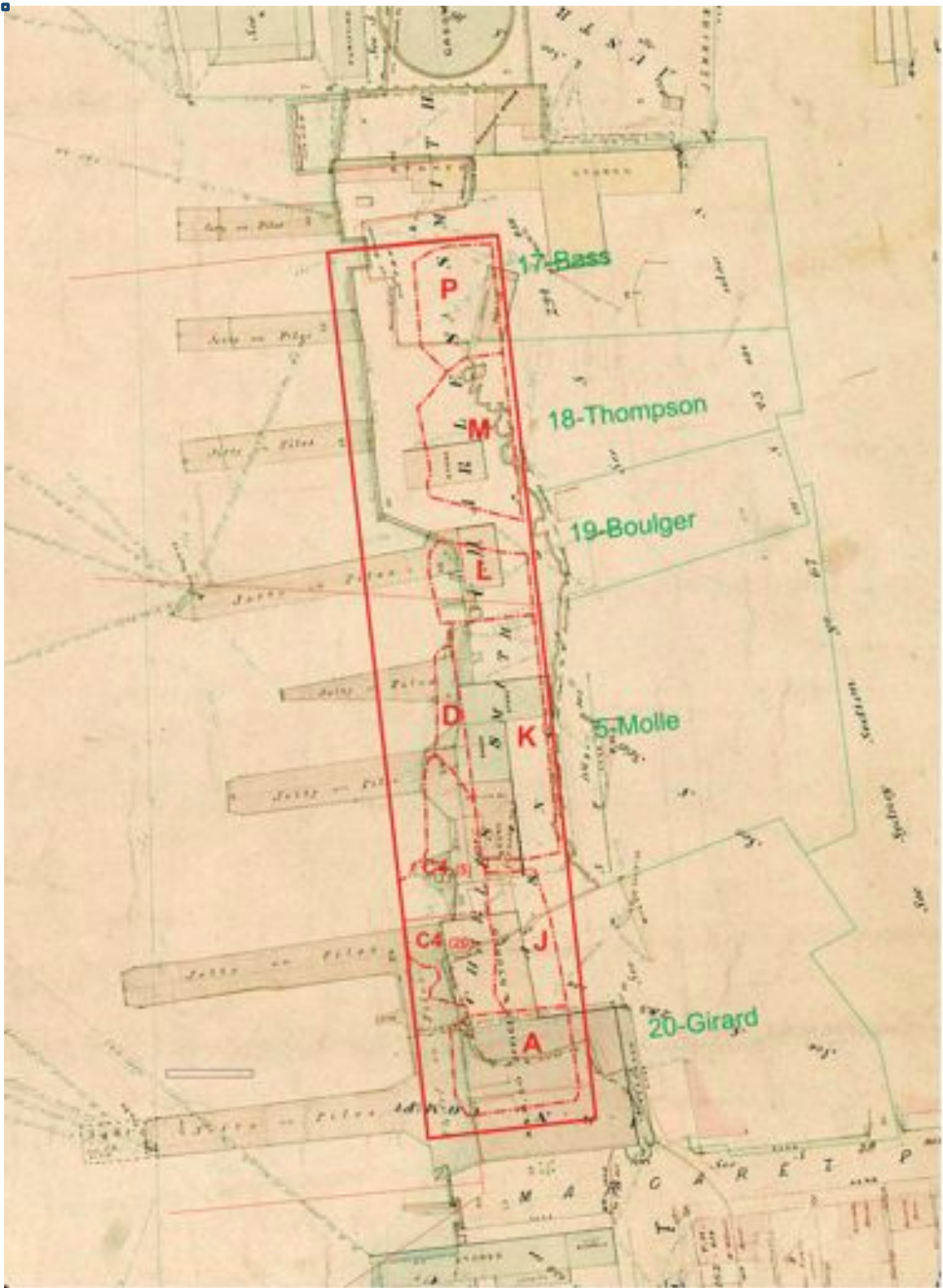


Figure 6: James Meehan's 1870 Plan of Sydney. Image courtesy: National Library of Australia (nla.map-f105b-e).



**Figure 7:** John Roe's Plan of Sydney dated 1822. Image shows modification of eastern Darling Harbour as a result of the development of maritime infrastructure (Arthur's Wharf). Image courtesy: State Library of Victoria (H24501).



**Figure 8:** The Barangaroo South redevelopment area overlain on plans showing maritime infrastructure development and land tenure in 1875. Note the wharves appear to extend into the current study area. Crown Plan P.26.574. Image courtesy of Casey (2012: 13), overlay by A. Cryerhall.

## 4.0 Archaeological Framework

This section includes searches related to both Aboriginal and European archaeological heritage, however more detailed information on the historical context within which European heritage exists is available in Section 3.0.

### 4.1 Environmental Overview

An understanding of environmental context is important for understanding both the historical development pattern of European settlement and for the predictive modelling of Aboriginal sites. The nature of Aboriginal occupation and resource procurement is intimately related to the local environment and it therefore needs to be considered as part of the cultural heritage assessment process. Stone, for example, was used for manufacturing tools, animals and plants provided food and medicines, from wood and bark, shields, spears, canoes, bowls, shelters and other implements were created and the topography and geography of the landscape provided areas for camping and other traditional activities.

Although European land use practices have heavily disturbed Darling Harbour, the reporting of environmental context is required by DP&E as specified in the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010). Understanding environmental context also helps us to better understand European development patterning.

#### 4.1.1 Climate

During the last glacial maximum (approximately 30,000-19,000 years ago), large ice sheets covered high latitude Europe and North America and the Antarctic ice sheet was more extensive than today. Sea levels stood some 120-130 metres lower than today (Lambeck, Yokoyama et al. 2002: 343) and the earth's climate was distinctly different from that of the present interglacial conditions. As the ice began to melt climatic conditions began to alter (Lambeck, Yokoyama et al. 2002: 343). This affected the movement and behaviour of past populations within their environs. Sea levels started to rise and there was a corresponding increase in rainfall and temperature. Short's (2000: 19-21) research suggests the change in climatic conditions reached its peak about 6,000 years ago. Up until 1,500 years ago, temperatures decreased slightly and then stabilised about 1,000 years ago, which is similar to the temperatures currently experienced. Consequently, the climate of the project area for the past 1,000 years would probably have been much the same as present day, providing a year round habitable environment. Historic mapping (Hunter 1788) indicates that Darling Harbour was less than one metre deep at the time of European settlement.

#### 4.1.2 Geology and Soils

According to the NSW Department of Natural Resources (1983), the study area is underlain by man-made fill, dredged estuarine sand and mud, demolition rubble, household and industrial waste, atop Hawkesbury sandstone of the Wianamatta Group. Hawkesbury sandstone is described as a medium to coarse grained quartz sandstone with very minor shale and laminate lenses. Samples of the sediment obtained during the visual inspection confirm this the presence of sandstone in across the study area.

Chapman and Murphy (2009) described the adjacent landform (Barangaroo) as a 'disturbed landscape' and this description is interpreted to extend to the study area as the literature review reveals that as a result of infrastructure development and repeated dredging dating back to 1878 (Anon. 1878).

Prior to European occupation the study area would likely have been comprised of salty to peaty quartz sand, silt and clay with ferruginous and humic cementation in places and common shell layers with a water depth (as identified within the Darling Walk excavations) of 4-5 feet (approximately 1-2 metres) (Hunter 1788). Today the water depth is between 10-14 metres.

#### 4.1.3 Topography and Hydrology

The topography of the Barangaroo landform was - until the commencement of recent redevelopment works - relatively flat, as a result of being cut, filled and leveled. The resulting geology is man-made fill overlying Hawkesbury Sandstone of the Wianamatta Group

Recent data obtained from TfNSW indicates that the seabed is also generally flat with seabed leveling range from -10m CD at the southern end of Darling Harbour down to -14m at the northern end of the Harbour (Whitely: 11). This bathymetry and continuous seismic profiling (CSP) mirrors the 2011 data obtained from NSW Maritime (Gordon 2011: 1) and the 2013 multi-beam data obtained from Sydney Ports (Figure 10, Figure 11).

The CSP data revealed a steeply varying bedrock level. A shallow rock feature (approximately -15m CD) at the southern end of the survey area deepens rapidly in a northerly direction, until it levels out at approximately -35m CD. A similar sandstone feature was identified at the location of borehole BH-A2 which corresponds to the anomaly identified as seabed target ST-25 (Table 12). It appears to form part of a deep paleochannel (drowned riverbed) which trends approximately north south, approximately 15 metres west of the King Street Wharf. This interpreted rock again shallows on the western side of the Coffey Geotechnics survey area to approximately -16m CD.

#### 4.1.4 Flora and Fauna

As a result of widespread clearance of natural vegetation on the foreshore adjoining the study area, seabed and contaminants in the water immersing the study area, there is little evidence of fauna and flora present on site today. Only two fish were identified on site during the diving operations.

The dominant ecological community prior to European contact was low dry sclerophyll open-woodland which would have dominated the ridges and upper slopes, with species commonly present including Red Bloodwood *Eucalyptus gummifera*, Scribbly Gum *Eucalyptus haemastoma*, Brown Stringybark *Eucalyptus capitellata* and Old Man Banksia *Banksia serrata*. More sheltered slopes would have commonly supported Black Ash *Eucalyptus sieberi*, Sydney Peppermint *Eucalyptus piperita* and Sydney Red Gum *Angophora costata*. The understorey of these plant communities would have consisted of shrubs from the families *Ericaceae*, *Myrtaceae*, *Fabaceae* and *Proteaceae* (City of Sydney undated: online).

Typical animals that would have inhabited this vegetation community include *Macrodidae* (Kangaroos and wallabies), sugar gliders, possums, echidnas, a variety of lizards and snakes, birds, as well as rats and mice. The bones of these animals have been recovered from Aboriginal sites in the Sydney region suggesting that they were sources of food (Attenbrow 2002: 70-76), although the hides, bones and teeth of some of the larger mammals may have been used for Aboriginal clothing, ornamentation, or other implements. A variety of fish and shellfish (previously described) would have been prevalent within the harbour.

#### 4.1.5 Previous land use and disturbance

Barangaroo and the submerged landforms of the study area have been substantially impacted by prior land use practices. This is a highly disturbed landscape. Since the earliest period of European settlement, Darling Harbour has been used for commerce, and industry, with the presence of flour mills, brick works, manufacturing plants, heavy industry and for shipbuilding present as early as the early 1820s.

#### 4.1.6 Environmental Context and Cultural Heritage

A review of the environmental data shows that the East Darling Harbour was abundantly suitable for Aboriginal occupation. Ample food sources in the form of fish, shellfish and game were present, as was reliable water from the waterholes, stream, river and harbour. This is borne out by the AHIMS data. The fact that only 14 sites are present is interpreted to be the result of the highly disturbed nature of the project area and adjacent lands due to its European occupation and long industrial usage.

### 4.2 Review of Heritage Registers

Items considered being of heritage significance in Australia and NSW may be included on registers or schedules at the national, State, or local level. The type/level of listing reflects the level of significance of that heritage item, with National Heritage Places (Matters of National Environmental Significance under the EPBC Act) recorded on the National Heritage List, items of State significance to the people of NSW listed on the SHR and items of local heritage significance recorded on schedules within the Local Environmental Plans of local government. These registers are not static with sites recorded and removed as deemed necessary.

Searches of the Australian Heritage Database with reference to the World Heritage List, National Heritage List, Register of the National Estate archive and Commonwealth Heritage List were made on 29 July 2014. No items on any of these lists were identified as being within the study area.

#### 4.2.1 State Heritage Register

Archaeological sites and heritage items in NSW may be registered as important at the State or local level. The Heritage Council has developed a set of seven criteria (refer 6.1) to help determine whether a heritage item is of State or local significance to the people of NSW. If deemed eligible for listing i.e. of State significance, they are referred to the Minister for Heritage for Listing on the SHR, a statutory register of heritage items created by the Heritage Act.

**Table 5: Items of State Significance listed under the NSW Heritage Act - Darling Harbour**

Item	Address	Heritage Listing
Darling Harbour Woodward Water Feature	Harbour Promenade, Darling Harbour	State Heritage Register
Pymont Bridge	Darling Harbour, Sydney	State Heritage Register (and Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register)

(Source: OEH 2014)

A search of the SHR on 25 July 2014 revealed no items of State Heritage significance within of Barangaroo. Instead, a search of the SHR with reference to Darling Harbour returned two items of State Heritage Significance (Table 5) listed in Darling Harbour - Pymont Bridge (SHR#01618) and Darling Harbour Woodward Water Feature (SHR#01933). Neither of these items is within the study area or its vicinity. The SHR was searched again on 25 July 201, this time with reference to the unincorporated

waters of Sydney and Middle Harbour. The search revealed four items of State Heritage Significance in Sydney Harbour listed on the SHR (Table 6). None of these items are within the study area or its vicinity.

**Table 6: Items of State Significance listed under the NSW Heritage Act - Unincorporated Waters**

Item	Address	Significance	Heritage Listing
Fort Denison (Mattewanye)	Port Jackson, Sydney Harbour	State	State Heritage Register
Goat Island	Port Jackson, Sydney Harbour	State	State Heritage Register
SS <i>South Steyne</i>	Port Jackson, Sydney Harbour	State	State Heritage Register
Sydney Harbour Bridge, approaches and viaducts (road and rail)	Milsons Point/Dawes Point/Sydney Harbour	State	State Heritage Register and Roads and Transport Authority s170 State Agency Heritage and Conservation Register

(Source: OEH 2014)

#### 4.2.2 State Heritage Inventory

Some heritage places and items that do not reach the threshold for listing on the SHR may be of local heritage significance. These items may be afforded statutory protection, listed by local councils under their LEP, or if a State agency asset, on the s170 State Agency Heritage and Conservation Register and contained in the SHI maintained by OEH, DP&E.

A search of the SHI on 25 July 2014 revealed no items of local heritage significance in Barangaroo. The searches did reveal 18 items of local heritage significance in Darling Harbour (Table 7). The NSW State Government owns all of these 18 items; in this case the Sydney Harbour Foreshore Authority (part of the NSW DP&E) and all are listed on the Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register. Of these 18 items, no items are located within or near to the study area.

Although regularly updated, the SHI is not comprehensive and for that reason additional searches were undertaken. Separate searches of the Sydney Harbour Foreshore Authority s170 State Agency Heritage Register were undertaken. These searches revealed the same 18 local heritage items listed on the register and confirmed that although it is of State significance, Pyrmont Bridge is also a State heritage asset listed on the Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register.

Further searches of the SHI were undertaken on 25 July 2014 with reference to the unincorporated waters of Sydney and Middle Harbour. The searches revealed 27 local heritage items within Sydney Harbour (Port Jackson), 16 of which are listed on either the NSW Maritime or Sydney Ports s170 Registers (Table 7). The remaining 11 items are items of local heritage significance listed on the Heritage Map of the SREP (Table 9).

Whilst undertaking the SHI searches, several anomalous listings became apparent. The search revealed that the SHI contains several items of local heritage significance (including Andersons Couch, Barneys Cut, Barracks (former), Cooperage (former), Harbour Master's Residence (former), Kitchen (former), Laboratory (former), Lime Kiln, Ordinance Magazine (former), Pathway from Magazine Precinct to Water Police Station Precinct and the Water Police Station (former)) which were listed under The Sydney Regional Environmental Plan No. 23 – Sydney and Middle Harbour, which is repealed legislation. These items have been excluded from this assessment and the Heritage Division, OEH DP&E has been advised (Gary Escort pers. comm. 29 July 2014).

**Table 7: Items of Local Significance listed under the NSW Heritage Act - Darling Harbour**

Item	Address	Significance	Heritage Listing
Archaeological Collections (Darling Harbour sites) includes items from Little Pier and Paddys Market excavations)	No longer <i>in situ</i> – removed by SHFA and placed in offsite storage	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register
Barkers Mill - Stone Walls	No longer <i>in situ</i> – removed by SHFA and placed in offsite storage	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register
Cockle Bay Precinct Archaeological Remains	East Side of Darling Harbour, West Of Sussex Street, North of Pier St, NSW	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register
Darling Harbour Rail Corridor	West Side of Darling Harbour To Pyrmont	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register
Dundee Arms Hotel	171 Sussex Street, Darling Harbour, NSW	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register
The Corn Exchange	173-185 Sussex Street, Darling Harbour, NW	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register
Chinese Garden of Friendship	Day Street and Pier Street, Darling Harbour, NSW	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register
Exhibition Centre Precinct - Archaeological Remains - Iron Wharf	Directly East of The Exhibition Centre, Darling Harbour, NSW	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register
Hunter River Steamship Navigation Company Office (former)	147-149 Sussex Street, Sydney, Darling Harbour, NSW	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register
Hydraulic Pumping Station No. 1 (former)	Pier Street, Darling Harbour, NSW	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register
Market City (façade- former Paddy's Markets)	Haymarket, Darling Harbour, NSW	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register
Pier St Precinct - Archaeological Remains - includes Dickson's Mill remains (reburied)	Bounded By Hay, Harbour, Pier Streets and Merino Boulevard, Darling Harbour, NSW	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register
Shelbourne Hotel	200 Sussex Street, Darling Harbour, NSW	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register
Shops/Warehouses	121-127 Sussex Street, Darling Harbour, NSW	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register
Shops/Warehouses	151-153 Sussex Street, Darling Harbour, NSW	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register
Shops/Warehouses	139-145 Sussex Street, Darling Harbour, NSW	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register
The Carousel	Concourse Under Western Distributor, Darling Harbour, NSW	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register
Water Cooling System and Manifold	Powerhouse To Murray Street To Waters Edge, Darling Harbour, NSW	Local	Sydney Harbour Foreshore Authority s170 State Agency Heritage and Conservation Register

(Source: OEH 2014)

Again as the SHI can be unreliable, additional searches of the SREP confirmed that there are 85 heritage items identified in Sydney and Middle Harbour areas, 11 of which are assessed to be of State significance. The remaining 74 are of local heritage significance. The 85 included all of those listed on the SHI and outlined in Table 8 and Table 9. The search confirmed that none of these items are within Darling Harbour or the study area. There are no items within the study area of either State or local heritage significance and no items listed on any of the s170 Registers, the SREP or the SHI or SHR. Searches of the SREP also revealed that the study area is not located within a Heritage Conservation Area, likewise there are no items within the study area subject to an Interim, or authorized Interim Heritage Order.

**Table 8: Items of Local Significance listed under the NSW Heritage Act - Unincorporated Waters**

Item	Address	Significance	Heritage Listing
Eastern Channel Buoy No. 5	Port Jackson (Sydney Harbour)	Local	NSW Maritime s170 State Agency Heritage and Conservation Register
Eastern Channel Lighthouse	South End Eastern Channel, Sydney Harbour, NSW	Local	Sydney Ports Corporation s170 State Agency Heritage and Conservation Register
Eastern Channel Pile Beacon	South End Eastern Channel, Sydney Harbour, NSW	Local	NSW Maritime s170 State Agency Heritage and Conservation Register
Lady Bay Buoy	Lady Bay, Sydney Harbour, NSW	Local	NSW Maritime s170 State Agency Heritage and Conservation Register
Middle Head Buoy No. 2	Middle Head, Sydney Harbour, NSW	Local	NSW Maritime s170 State Agency Heritage and Conservation Register
Obelisk Bay Buoy No. 4	Obelisk Bay, Sydney Harbour, NSW	Local	NSW Maritime s170 State Agency Heritage and Conservation Register
Outer Junction Buoy No. 1	Junction of Eastern and Western Channels, Sydney Harbour, NSW	Local	NSW Maritime s170 State Agency Heritage and Conservation Register
Port Botany Old Government Wharf Remains	Port Botany	Local	Sydney Ports Corporation s170 State Agency Heritage and Conservation Register
Shark Island Light	off Shark Island, Sydney Harbour	Local	NSW Maritime s170 State Agency Heritage and Conservation Register
Shark Island Lighthouse	Off Northern End of Shark Island, Sydney Harbour, NSW	Local	Sydney Ports Corporation s170 State Agency Heritage and Conservation Register
Sow and Pigs Shoal	between Eastern and Western Channels, Sydney Harbour, NSW	Local	NSW Maritime s170 State Agency Heritage and Conservation Register
Submarine Minefield Installation	Western Chanel, Sydney Harbour, NSW	Local	NSW Maritime s170 State Agency Heritage and Conservation Register
Sydney Harbour and Tributaries including Curtilage	Port Jackson Parramatta River and tributaries, Sydney Harbour, NSW	Local	NSW Maritime s170 State Agency Heritage and Conservation Register
Western Channel Pile Beacon	South End Western Channel, Sydney Harbour, NSW	Local	NSW Maritime s170 State Agency Heritage and Conservation Register
Western Channel Lighthouse	Southwest End Western Channel, Sydney Harbour, NSW	Local	Sydney Ports Corporation s170 State Agency Heritage and Conservation Register
Western Channel Buoy No. 3	Sydney Harbour, NSW	Local	NSW Maritime s170 State Agency Heritage and Conservation Register

(Source: OEH 2014)

### 4.2.3 Historic Shipwrecks

Historic shipwrecks more than 75 years of age are protected in NSW by the Shipwreck provisions of the *Heritage Act 1977*. A search of the OEH maritime heritage online (2014: Online) - the statutory database of Historic Shipwrecks in NSW - revealed four historic shipwrecks known to have been lost in Darling Harbour (Table 10), but which have not yet been located. This result contradicts the McLeod and McCarthy (2010) report, which states that ‘there are no shipwrecks directly off the shore of the Barangaroo site’ – this has yet to be proven.

In addition to the shipwrecks recorded in Table 10, several other shipwrecks are known to be in Sydney Harbour and remain unlocated. These shipwrecks include the *Siesta* (1942), *Nereus* (1942), *Silver Cloud* (1942), *Marlean* (1944), *Sea Nymph* (1882), *Cadet* (1912), *Rodney* (1938), *Robert Saywers* (1854), *Native* (1850), *Gem* (1880) and *Esther* (1920). The number in brackets is the year that the shipwreck was recorded as lost.

**Table 9: Items of Local Significance listed on the SHI - Unincorporated Waters**

Item	Address	Significance	Heritage Listing
Clark Island	Port Jackson, Sydney Harbour	Local	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
Hopper Barge	150 metres east of Clark Island, Sydney Harbour	Local	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
Navigation light tower	Near Shark Island, Sydney Harbour	Local	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
Navigation Light Tower eastern Channel (Bottle and Glass Rocks)	Port Jackson, Sydney Harbour	Local	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
Shark Island	Port Jackson, Sydney Harbour	Local	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
Wreck of Maritime Services Board Hopper Barge	Berrys Bay, Sydney Harbour, NSW	Local	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
Wreck of the <i>Centennial</i>	Taylor's Bay, Sydney Harbour	Local	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
Wreck of the <i>Centurion</i>	Cannae Point North Head, Sydney Harbour	Local	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
Wreck of the <i>Currajong</i>	Bradleys Head (off), Sydney Harbour, NSW	Local	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
Wreck of the <i>Edward Lombe</i>	Middle Harbour, NSW	Local	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
Wreck of the <i>Itata</i> and wrecks of other unnamed vessels	Salt Pan Creek, Middle Harbour, NSW	Local	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005

As Darling Harbour was a well-known body of water, it is unlikely that these wrecks foundered in Darling Harbour without records indicating so. Although the visual inspection indicates that Darling Harbour has been dredged to bedrock level in many places and the presence of shipwrecks and relics is unlikely as a result, without sub-bottom profiling data or archaeological testing there is no way of knowing whether or not these wrecks are contained in the study area. If any historic material is identified during the site inspection, it will be analysed to determine if it is remnant wharfage, or could be related an historic shipwreck.

**Table 10: Historic Shipwrecks listed under the Heritage Act**

Item	Where Lost	When	Heritage Listing
<i>Omeo</i>	Darling Harbour near Bathurst St	1899	Heritage Act
<i>Orphan Girl</i>	Darling Harbour	1880	Heritage Act
<i>Sterling</i>	Darling Harbour near Federal Wharf	1919	Heritage Act
<i>William Woolley</i>	Darling Harbour	1854	Heritage Act

#### 4.2.4 Aboriginal Heritage Information Management System

A basic search of the DP&E Aboriginal Heritage Information Management System (AHIMS) was undertaken on 29 July 2014 in accordance with the Due Diligence Code (DECCW 2010:11). The searches were conducted for the study area, an area of seabed approximately 500 metres long by 175 metres wide and delineated by the coordinates below (Table 11). Note all coordinates are GDA Zone 56.

**Table 11: Boundary Coordinates of AHIMS Search Area (Study Area)**

Coordinate Name	Position (Eastings)	Position (Northings)
BFH1	333614.00 m E	6251124.00 m S
BFH2	333471.00 m E	6251101.00 m S
BFH3	333398.00 m E	6251580.00 m S
BFH4	333565.00 m E	6251591.00 m S

The searches indicate that 14 Aboriginal sites are recorded within one kilometer of the study area (Appendix 1). These sites are marked with red pins in Figure 8.

A 1994 excavation of Cumberland Street on the ridge overlooking The Rocks uncovered an Aboriginal campfire containing the remains of a meal. Although not recorded in AHIMS, the site was radiocarbon dated to 1500 AD (McLeod and McCarthy 2010: 12), almost 300 years before European occupation. Likewise, excavations at Moores Wharf (Lampart and Truscott 1980: Appendix 1) on the northern edge of the Barangaroo redevelopment area, revealed an Aboriginal campsite (AHIMS #45-6-0519) beneath the rubble floor of the Bond Store. No radiocarbon date has been obtained for this site, although it is suggested that the camp predates European occupation of the site.

Further evidence of Aboriginal occupation in the vicinity has been obtained from excavations at the KENS Site 1 (AHIMS #45-6-2647) and Darling Quarter (formerly Darling Walk), a redevelopment site to the south of Barangaroo. Approximately 952 Aboriginal artefacts were recovered from the KENS site, whilst Darling Walk produced ten artefacts excavated from a shell deposit, but not recorded in AHIMS. The site was interpreted as a midden re-deposited by estuarine tidal movements and disturbed by later Colonial reclamation activities (Casey and Lowe 2009: 7; Comber 2012: 21, 32). Although no radiocarbon date has been obtained for either site, the shell deposit at Darling Walk was located adjacent to natural (pre-European) shoreline suggesting it pre-dated European occupation of the area.

Archaeological investigation of the former banks of the Tank Stream under Angel Place (AHIMS # 45-6-2581) recovered Aboriginal artefacts, pollen and botanic remains of eucalypt rainforest (Godden McKay 1998), which would have provided a resource rich environment in which Indigenous Australians thrived.

As the sites at Cumberland Street and at Darling Quarter (formerly Darling Walk) do not appear in the AHIMS data and therefore no coordinate for either site has been provided, the positions have been approximated on the basis of the data contained in the aforementioned reports report (pink pins, Figure 2). One site (AHIMS#45-6-0519), the previously described Moores Wharf campsite is located within the Barangaroo North redevelopment area, approximately 620 metres from the north-eastern boundary of the study area; the closest site (AHIMS 45-6-2647) is the closest KENS Site 1 is approximately 360 metres from the south-eastern boundary of the study area.



**Figure 9:** Map of central Sydney showing Darling Harbour, Barangaroo and the study area in red. The yellow pins illustrate the study area boundary coordinates (BF1-BF4), the red pins indicate Aboriginal sites previously recorded in AHIMS (Appendix 1) and the pink pins provide approximate locations for two Aboriginal sites mentioned in the literature, but not recorded in AHIMS i.e. the Cumberland Street campsite and the Darling Walk shell deposit. Image courtesy: Google Earth / Digital Globe 2014.

## 4.3 Reviews and Assessment of Marine Geophysical Survey Data

### 4.3.1 Multi-beam Sonar Data

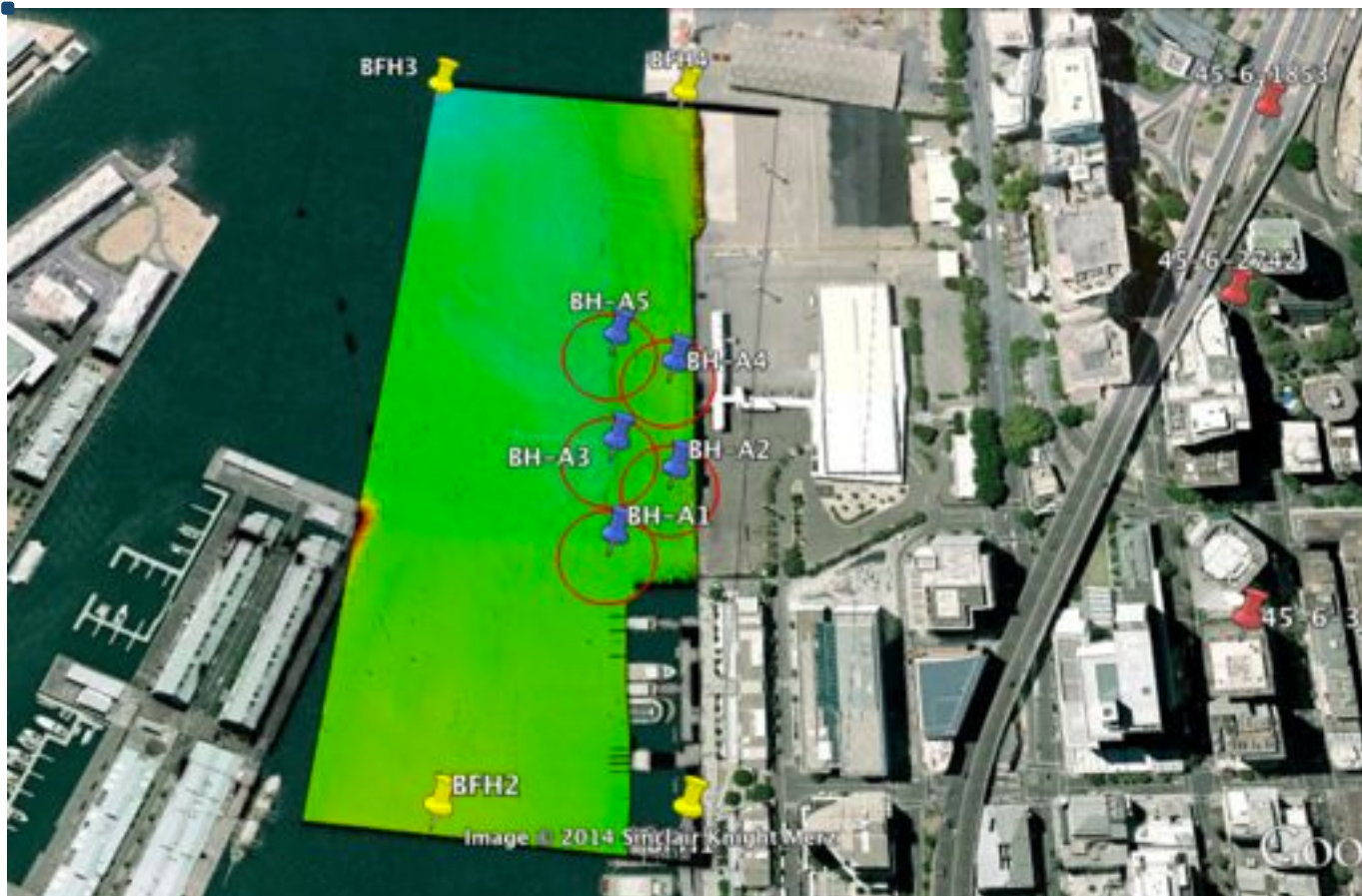
An assessment of multi-beam sonar data gathered by Sydney Ports (now Port Authority of NSW), in November 2013 was undertaken. The method of collection and the type of instrument used to gather this data is unknown. This data set does cover the entire project area and as a result eliminated the need for a separate marine geophysical or diver-based maritime archaeological survey as any items of potential heritage significance on the seabed would, by their very nature have been *in situ* prior to the 2013 survey. The data reveals at least 30 anomalies (sonar targets) on the seabed within the study area, however it is not possible to identify the true nature and extent of the anomalies, from the data set, only their presence on the seabed at the time of the survey.

When the proposed locations are overlaid on the multi-beam data and a circular buffer of approximately 30 metres placed around each borehole location (indicating the impact area), it is clear that each borehole will impact a number of these anomalies. Figure 10 shows the location of the five boreholes within the study area. Figure 11 provides a close-up of the area around boreholes BH-A4 and BH-A5. The blue pins identify each of the borehole locations, whilst the red circles show the extent of the 30-metre impact area. The 30-metres radius has been selected to account for both the impact of the borehole itself, as well as the impact from the footprint of the jack-up barge used to drill the boreholes (Appendix 2).

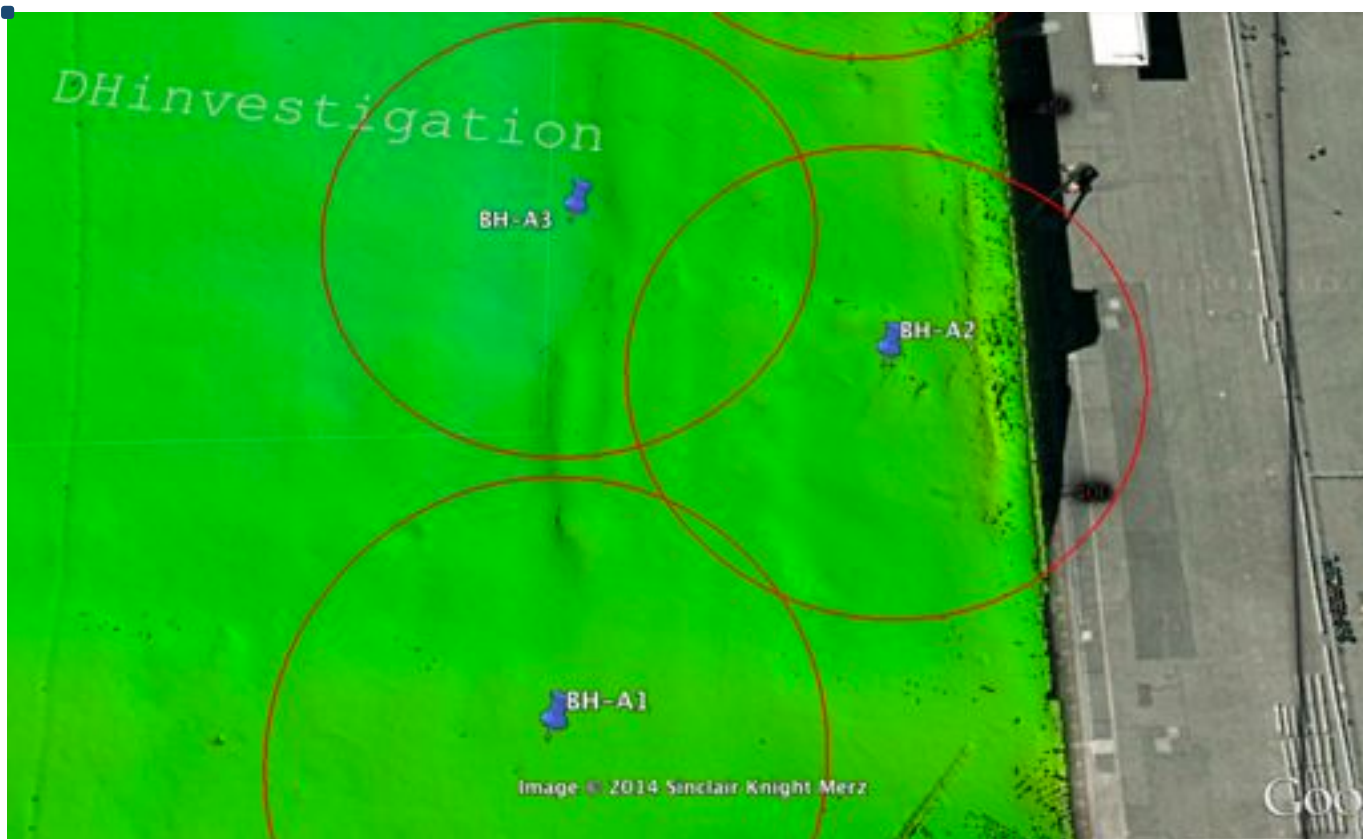
### 4.3.2 Side-scan Sonar Data

In addition to the Sydney Ports multi-beam data, side-scan sonar data for the study area was obtained from the Australian Government's Defense Science and Technology Organisation (DSTO). The DSTO survey was undertaken in August 2014 (whilst this study was underway), using a Sonardyne Solstice 3000 (Appendix 3) side-scan sonar operating at 750 kHz.

The sonar was rigidly mounted on the bow of an old workboat (Anstee 2014, pers. comm.) and integrated with a Novatel OEM-4 SPAN GPS – inertial motion sensing system. The Solstice is known to produce the highest quality imagery available from a conventional (non-SAS) sonar.



**Figure 10, Figure 11:** Map of the study area with the multi-beam data boreholes overlaid (Figure 10 above) with a close up of boreholes BH-A4 and BH-A5 (Figure 11 below). At least 30 individual anomalies have been identified on the seabed. The borehole locations (blue pins) and 30-metre buffer (red circle) will impact several of these anomalies. Image courtesy: Google Earth / Sinclair Knight Merz / Sydney Ports 2013-4.



The DSTO side-scan data verifies the multi-beam data gathered by Sydney Ports in 2013 and provides a more detailed image of the seabed in the study area, than was previously available. Within the BH-A1 buffer, for example, the side-scan data shows a rectangular anomaly that was not visible in the multi-beam data. The side-scan data provides confirmation that seabed anomalies present in November 2013 are still present today (Figure 12, Figure 13). This could be interpreted in one of three ways, that is, that the targets are:

- mobile, yet are of a size, weight and composition that limits seabed mobility;
- mobile, yet partly buried/embedded in the sediments of the harbour floor; and
- immobile for example, natural reflective geological features, shipwrecks or intact wharf infrastructure.

The DSTO data was of such high quality that it provided a better understanding of the size and scope of the targets identified in 2013 and it also identified several additional targets that were not visible in the 2013 data. A complete list of targets identified within the side-scan and multi-beam data is provided in Table 12.

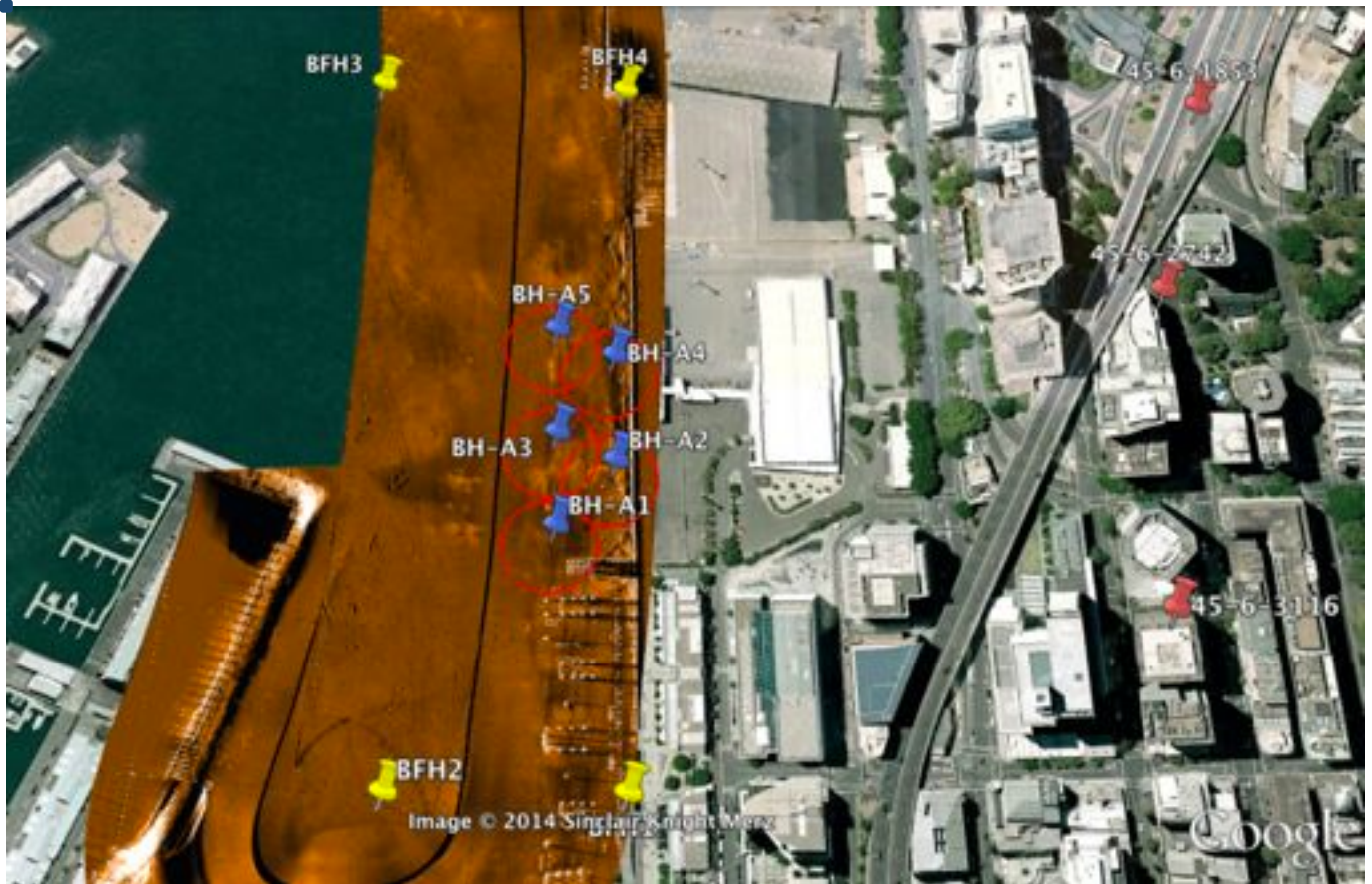
As it is considered that the seabed anomalies identified on the sonar data and within the borehole impact will be destroyed as a result of the early works, it was recommended that a diver-based visual inspection be undertaken to ground-truth the geophysical survey data. This inspection allowed the targets to be located, inspected, identified and the potential heritage status of each assessed. The results of the ground-truthing are presented in Section 4.3.3 below.

#### **4.3.3 Ground-Truthing Sonar Targets**

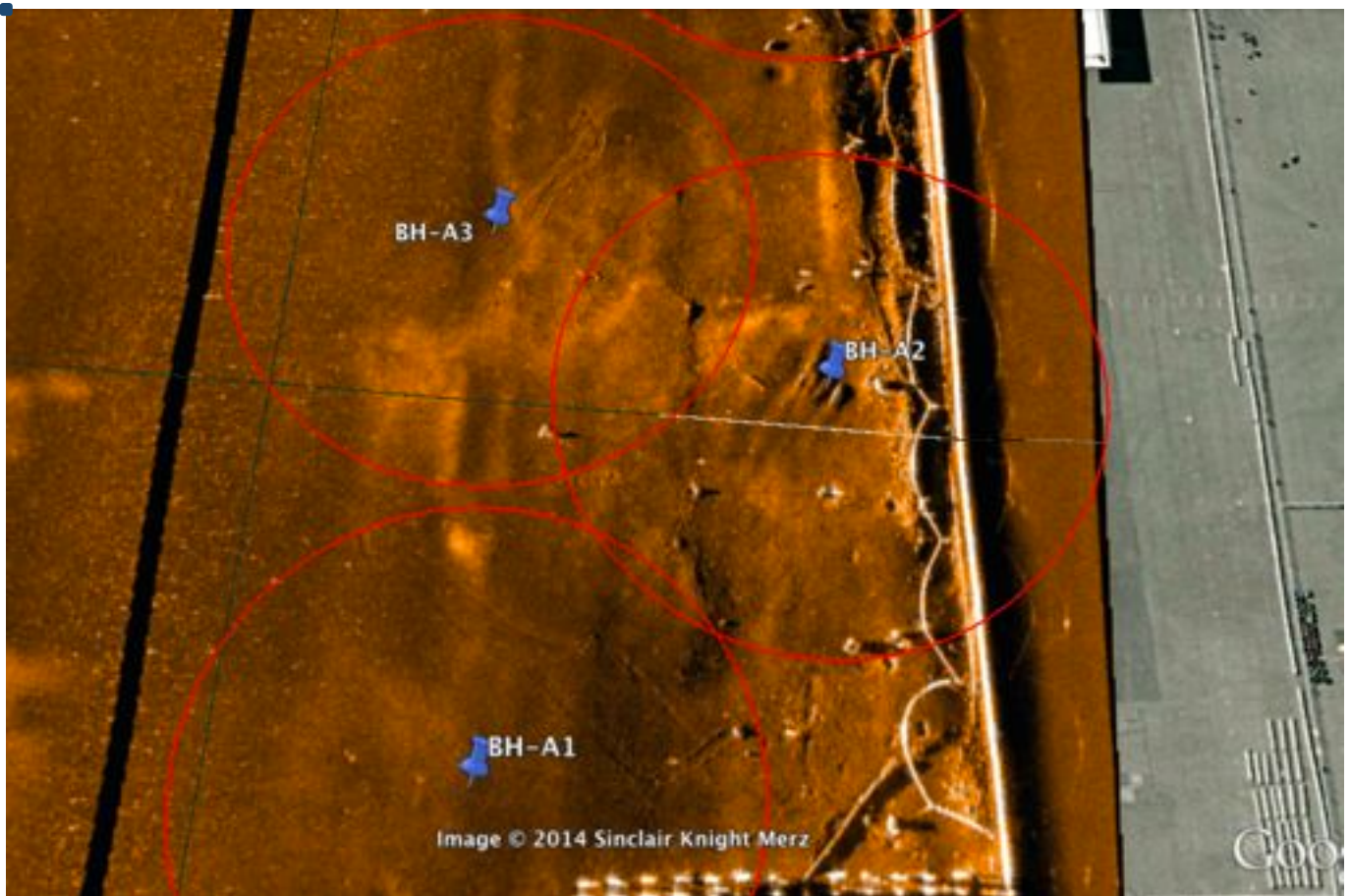
On Thursday 11 September 2014, diving operations were carried out in order to ground-truth the sonar data and visually inspect the located targets. The purpose of this activity was three-fold: to confirm the presence of the targets on the seabed; to identify whether the targets are potential heritage items; and if heritage items, to assess their significance. The methodology employed to ground-truth the data, inspect the anomalies and identify the targets, was a combination of expanding circular search patterns and individual target inspection.

An expanding circular search is a procedure conducted by a diver swimming at a series of distances (radii) around a fixed reference point (in this case, the borehole location). In practice, each borehole location was identified using a handheld differential global positioning system (dGPS) operated from the diving boat. Once the borehole location was identified at the surface, a weighted buoy was lowered into position. When leaving surface the diver would then travel down the buoy line to the seabed. Starting from the borehole location, the diver would start the search by swimming the circumference of a circle where the radius is defined by a search line anchored at that central point (the weighted buoy). The radius of the each circle depended on visibility. At the commencement of diving operations, the visibility was approximately one metre, so the circles were expanded in one-metre increments. As visibility deteriorated throughout the day, the radii were adjusted accordingly so that after each circle had been completed, the next radius was adjusted by an amount, which allowed the diver to either see or feel an overlap between the current arc and the previous arc.

Where known targets (Table 12) were not located during an expanding circular search (e.g. ST-12) and/or where known targets were beyond the limits of a circular search, either as a result of interference



**Figure 12, Figure 13:** Map of the study area with the side-scan data, borehole locations (blue pins) and borehole impact areas overlaid (red circle) (above) with close ups of BH-A4 and BH-A5 (below). At least 30 individual seabed anomalies have been identified, with at least three anomalies per borehole impacted. Note the additional clarity provided by the side-scan data. Image courtesy: Google Earth / Sinclair Knight Merz / DSTO 2013-14.



from the timber jetty piles associated with the wash wall, or because the diver was at the end of his/her tether (e.g. ST-26), a different method of individual target inspection was employed.

In this situation, the dGPS was used to locate the position of each individual target. Once the position was identified at the surface, a weighted buoy was lowered into the water at that position. As with the circular search, the diver would descend down the buoy line to the seabed to the target position. The target was usually visible on arrival at the seabed, being within one metre of the position identified on the sonar. With the exception of one target (Target ST-12), which was unable to be located using either method, all targets identified on the sonar were located and inspected.

The results of the ground-truthing are presented in Table 13. The inspection also a number of items of modern debris - a shoe, a mobile phone, a skateboard, several cups and plastic containers - which were not identified on either sonar due to the small size and mobility on the seabed. Due to their nature and insignificance, these items were not recorded as individual targets in Table 12.

As evidenced in Table 13, the majority of targets (18 / 35) were modern debris including discarded silt curtain, anchor chain, timber piles, chairs and plastic containers. The remaining targets were either components of modern construction infrastructure, including silt curtain currently in use (3 / 35), navigational aids in use (5 / 35), or natural geological features (8 / 35 targets). One target (ST-12) was unable to be located and is no longer at the identified position. This target was not identified else in the borehole area during the visual inspection.

Figure 15 demonstrates how, by considering the environment topside (i.e. how the harbor is being used within the study area), that it was possible to tie many of the sonar targets to features topside. Importantly, no items of Aboriginal or European heritage significance were identified during the visual inspection. As a result it is considered that no items of Aboriginal or European heritage significance will be impacted during the proposed early works and that the works can proceed in accordance with the recommendations contained in Section 8.

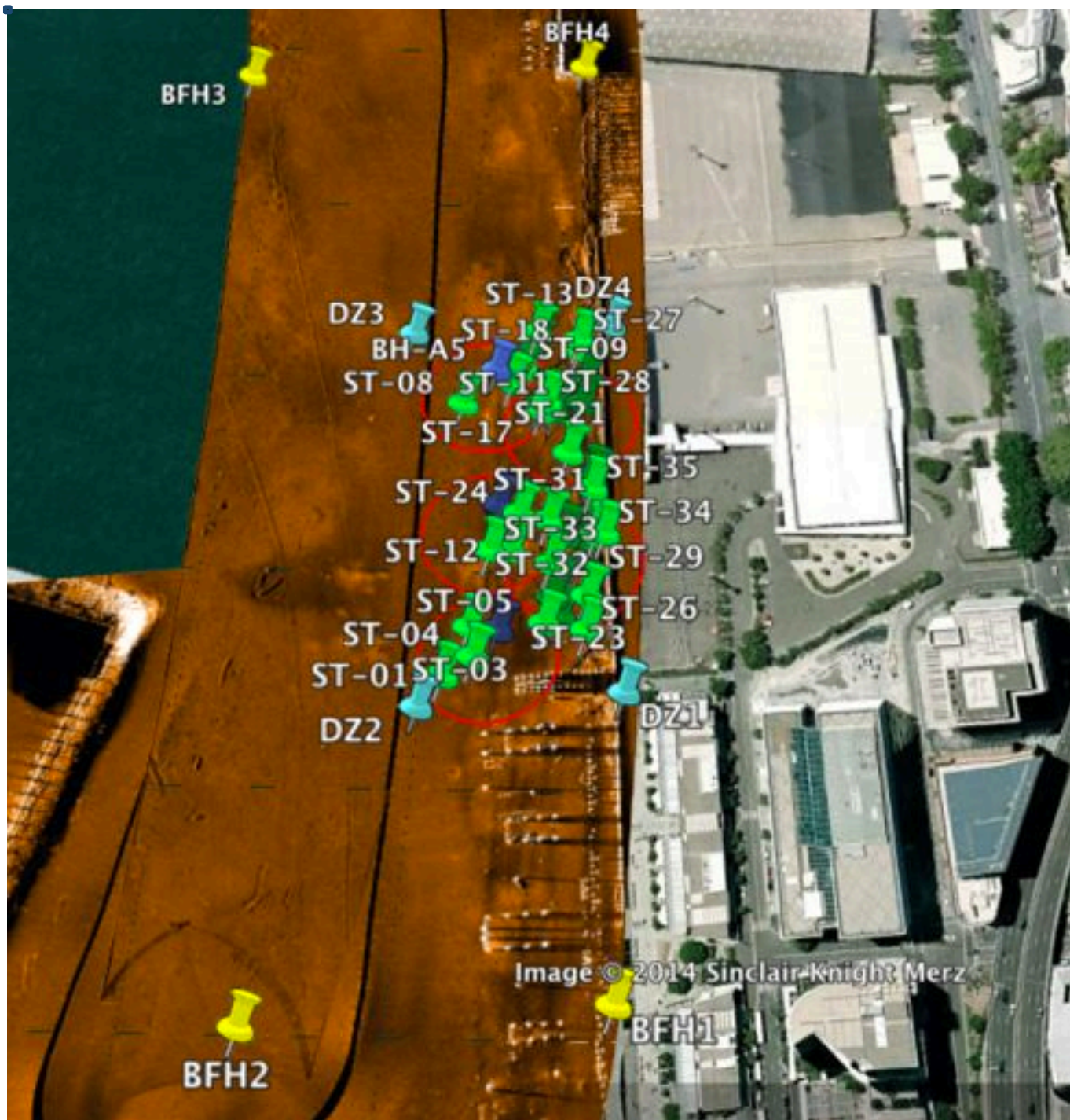
#### 4.4 Synthesis of Archaeological Context

The archaeological evidence presented about suggests that Darling Harbour and its neighbouring terrestrial environment, with its Eucalypt forest and sandstone beds would have provided important resources for Aboriginal people, prior to and following the European occupation of Sydney. The lowering of seabed level since European occupation suggests that even if there were Aboriginal heritage sites submerged in Darling Harbour, they would have been destroyed as a result of land reclamation, coastal infrastructure development and dredging and the visual inspection confirms this.

Previous land disturbances arising from Darling Harbour's European industrial, maritime and residential development have impacted heavily on the potential for Aboriginal sites or objects to be present within, or near to, the study area. As no Aboriginal sites were observed during the visual inspection (and the area has been dredged to bedrock in some places e.g. around BH-A2 and ST-25) there is considered to be no potential for *in situ* Aboriginal material to be present within the study area and an extremely low to nil chance of causing harm to Aboriginal archaeological objects and places as a result of the proposed works. An AHIP is therefore not required for the proposed early works.

Likewise the visual inspection indicates that there are no European potential heritage items (of State or local significance) and no historic shipwrecks or associated relics visible within the impact area. It is

considered that the potential for European heritage to be present within the impact area is an extremely low to nil and as such permits under the Heritage Act or Historic Shipwrecks Act are not required for the proposed early works.



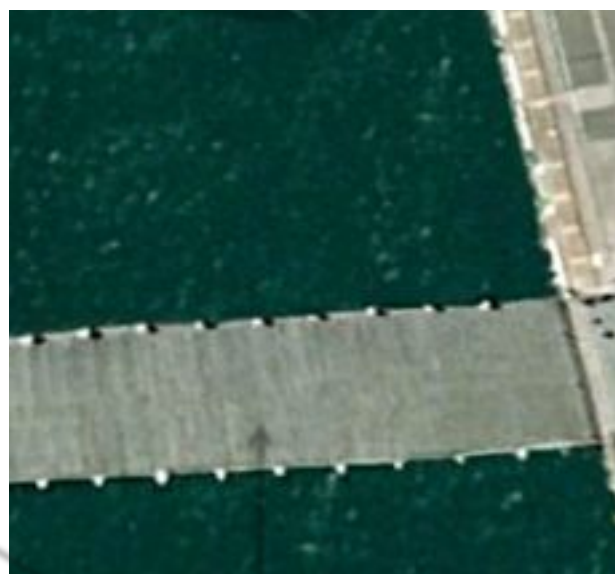
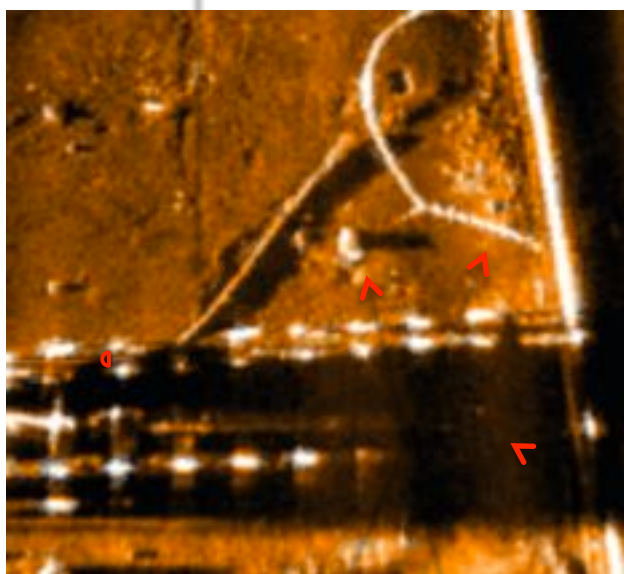
**Figure 14:** Map of the study area with sonar targets (green pins) overlaid. The side-scan data, boreholes (blue pins), borehole impact areas (red circles) are visible. Note a diving zone (light blue pins) has been created around the borehole impact areas to delineate to define the perimeter of the visual survey area and to separate this from the overall study area. Image courtesy: Google Earth / Sinclair Knight Merz / DSTO / ArchaeoMar Australasia 2013-4.

**Table 12: Sonar Targets Identified within the Geophysical Survey Data**

Sonar Target #	Approx. Dimensions L x B x H (metres)	Position (Eastings)	Position (Northings)	Within Impact Area of Borehole	Distance from Borehole (Metres)	Bearing from Borehole (Degrees )	Data set
ST-01	1 x 1 x 1	333532.00 m E	6251248.00 m S	BH-A1	30	225	SS
ST-02	1 x 0.75 x 0.5	333579.00 m E	6251278.00 m S	BH-A1	27	74	SS
ST-03	1.35 x 1 x 0.5	333541.00 m E	6251271.00 m S	BH-A1	12	277	SS
ST-04	2 x 2 x 0.5	333544.00 m E	6251257.00 m S	BH-A1	18	34.3	SS
ST-05	3.75 x 3.2 x 0	333573.00 m E	6251274.00 m S	BH-A3	37	180	SS
ST-06	40 x 10 x 1.5	333575.00 m E	6251287.00 m S	BH-A1	28	53	SS
ST-07	2.75 x 1.45 x 0	333586.00 m E	6251304.00 m S	BH-A2	13	180	SS
ST-08	2.14 x 1 x 0.5	333526.00 m E	6251385.00 m S	BH-A5	23	215	SS
ST-09	3.5 x 0.5 x 0.5	333552.00 m E	6251405.00 m S	BH-A5	13	86	SS
ST-10	4.5 x 0.5 x 0.5	333556.00 m E	6251418.00 m S	BH-A5	22	51	SS
ST-11	1.2 x 0.3 x 0.2	333547.00 m E	6251397.00 m S	BH-A5	10.5	133	SS
ST-12	3 x 1.5 x 2	333555.00 m E	6251309.00 m S	BH-A3	25	162	SS
ST-13	1 x 1 x 0.8	333556.00 m E	6251426.00 m S	BH-A5	28	38	SS
ST-14	3 x 0.5 x 0.2	333561.00 m E	6251386.00 m S	BH-A4	17.4	260	SS
ST-15	5.6 x 0.5 x 0.5	333567.00 m E	6251388.00 m S	BH-A4	11.1	265	SS
ST-16	100 x 0.5 x 0.5	333568.00 m E	6251382.00 m S	BH-A4	12	237	SS
ST-17	1 x 0.5 x 0.2	333562.00 m E	6251382.00 m S	BH-A4	17.5	248	SS
ST-18	30 x 0.5 x 0.5	333576.00 m E	6251416.00 m S	BH-A5	<b>38.7</b>	<b>73</b>	SS
ST-19	2.5 x 1.4 x 0.2	333581.00 m E	6251401.00 m S	BH-A4	12.3	14	SS
ST-20	16 x n/a x 0.3	333580.00 m E	6251387.00 m S	BH-A4	2.8	134	SS
ST-21	2.25 x 0.5 x 0.5	333576.00 m E	6251360.00 m S	BH-A4	29	185	SS
ST-22	2 x 0.5 x 0.4	333587.00 m E	6251348.00 m S	BH-A2	30	2	SS
ST-23	2 x 2 x 1.5	333590.00 m E	6251288.00 m S	BH-A2	29	173	SS
ST-24	2.3 x 0.8 x 0.2	333557.00 m E	6251328.00 m S	BH-A2	31	291.5	SS
ST-25	16 x 6 x 1	333587.00 m E	6251316.00 m S	BH-A2	1.3	142	SS
ST-26	15 x 0.6 x 0.6	333591.00 m E	6251271.00 m S	BH-A1	38	90	SS
ST-27	2 x 1.5 x 1.5	333576.00 m E	6251422.00 m S	BH-A5	41	65	SS
ST-28	0.3 x 0.3 x 0.1	333564.00 m E	6251387.00 m S	BH-A4	14.25	263	SS
ST-29	1 x 1 x 1	333591.00 m E	6251318.00 m S	BH-A2	5	80	SS
ST-30	2.6 x 0.4 x 0.4	333578.00 m E	6251317.00 m S	BH-A2	8	272	SS
ST-31	4 x 4 x .75	333570.00 m E	6251325.00 m S	BH-A2	18	297	SS
ST-32	1 x 1 x 1	333573.00 m E	6251303.00 m S	BH-A2	21.6	220	SS
ST-33	13 x 3 x 1	333546.00 m E	6251309.00 m S	BH-A2	23	183.5	SS
ST-34	200 x 0.3 x 0.3	333595.00 m E	6251319.00 m S	BH-A2	9	80	SS
ST-35	50 x 0.5 x 0.5	333588.00 m E	6251342.00 m S	BH-A2	25	5	SS

(Source: ArchaeoMar Australasia 2014)

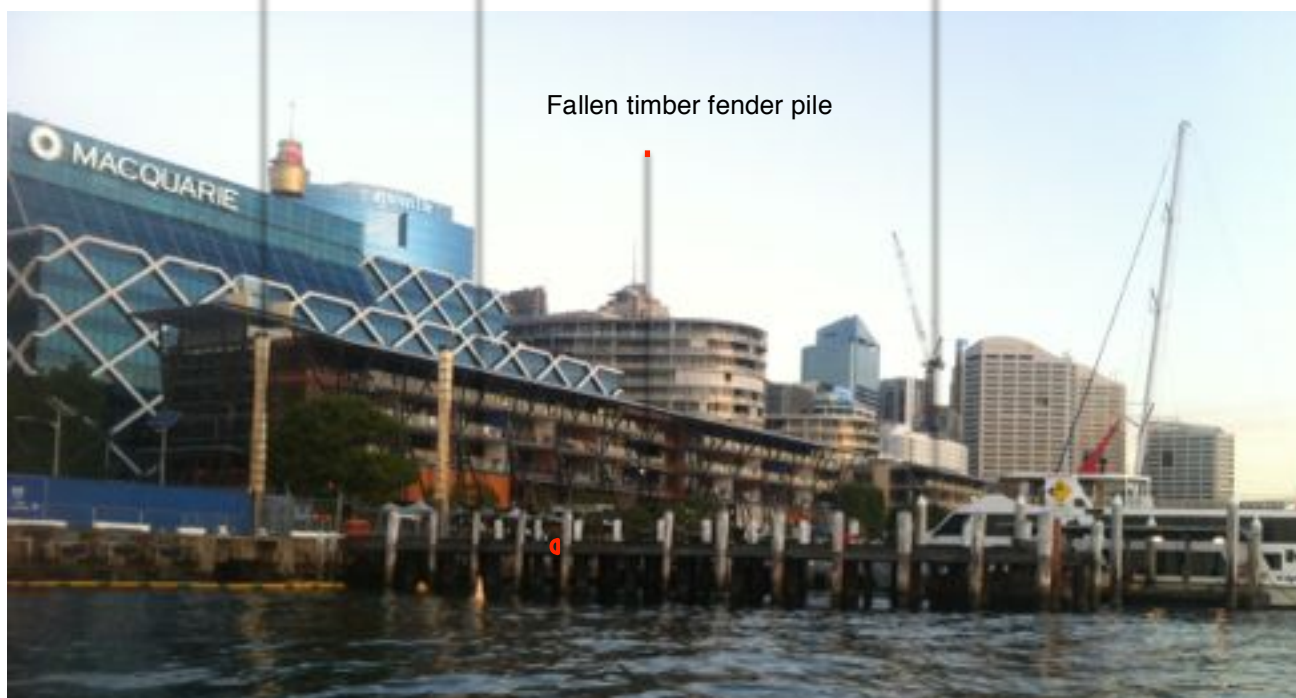
Fallen timber fender pile (ST-26)



Silt Curtain

Mooring Block

Timber jetty encapsulating a wash wall



Fallen timber fender pile

**Figure 15:** Sonar targets in context. An outline of the timber jetty encapsulating the wash wall is visible in the 2014 side-scan image (top left), as is target ST-26 (the fallen timber fender pile), a section of the silt curtain and the navigation buoy mooring block. The timber jetty, with pile in place, is visible in the 2009 aerial (top right). The silt curtain and navigation buoy are not. The photo (bottom) was taken during the 2014 visual inspection. This shows the silt curtain, yellow navigation buoy, timber jetty and gap from where the fender pile has fallen. Images courtesy: DSTO/Google Earth - Sinclair Knight Merz.

**Table 13: Sonar Targets Identified by Visual Inspection**

Sonar Target #	Target Description	Material Type	Historic Material	Potential Heritage Item	Heritage Significance	Observations
ST-01	Metal framed chair	Cultural	No	No	Nil	Modern debris
ST-02	Mooring block associated with yellow instructional buoy	Cultural	No	No	No	Modern navigation equipment (in use)
ST-03	Cluster of modern containers and a chair	Cultural	No	No	No	Modern debris
ST-04	Geology presenting as crumbling iron-rich sandstone, probably drowned red/yellow podzolic soil profiles (or remnants thereof)	Natural	No	No	No	Same geology identified at ST-05.
ST-05	Geology presenting as crumbling iron-rich sandstone, probably drowned red and yellow podzolic soil profiles (or remnants thereof). Adjacent to this were two small loose timbers that appear to have been washed in (modern)	Natural Cultural	No	No	No	Same geology as identified at ST-04.
ST-06	Linear anomaly presenting on as a ridgeline on seabed. Diver probe suggests a sandstone overlain with clay/mud	Natural	No	No	No	Geology
ST-07	Mooring block associated with yellow instructional buoy	Cultural	No	No	No	Modern navigation equipment (in use)
ST-08	Piece metal, possibly steel, with rolled edges attached to a metal strap 0.5m from one end	Cultural	No	No	No	Modern debris
ST-09	Timber pile with toe/point at one end, degraded at other	Cultural	No	No	No	Remnant modern maritime infrastructure
ST-10	Timber pile, rounded, with toe at one end, tyre located nearby	Cultural	No	No	No	Remnant maritime infrastructure/modern debris
ST-11	Rubber tyre	Cultural	No	No	No	Modern debris
ST-12	N/a	N/a	N/a	N/a	N/a	No identified anomaly at this position. Suspected mooring block that may have been moved
ST-13	Wicker chair	Cultural	No	No	No	Modern debris
ST-14	Timber fender pile	Cultural	No	No	No	Remnant modern maritime infrastructure
ST-15	Timber pile with metal bolt attached at southern end, with man's shoe alongside	Cultural	No	No	No	Remnant maritime infrastructure/modern debris
ST-16	Old fabric silt curtain associated and same as that at ST-18	Cultural	No	No	No	Modern debris
ST-17	Timber pile driven into seabed, cut off above seabed level and with metal anchor screw protruding	Cultural	No	No	No	Remnant modern maritime infrastructure
ST-18	Old fabric silt curtain with rope attached skateboard lying alongside. Same as that at ST-16.	Cultural	No	No	No	Remnant maritime infrastructure/modern debris
ST-19	Timber pile with toe next to 'school' chair	Cultural	No	No	No	Remnant maritime infrastructure/modern debris

ST-20	Linear anomaly presents as a ridgeline on seabed. Diver probe suggests a Hawkesbury sandstone overlain with clay/mud	Natural	No	No	No	Geology
ST-21	Snapped pile head - appears to be a new and recent deposit	Cultural	No	No	No	Remnant maritime infrastructure/modern debris
ST-22	Mooring block associated with old silt curtain ST-27	Cultural	No	No	No	Remnant maritime infrastructure/modern debris
ST-23	Mooring block associated with yellow instructional buoy	Cultural	No	No	No	Modern navigation equipment (in use)
ST-24	Outcrop of crumbling iron-rich sandstone, probably drowned red and yellow podzolic soil profiles (or remnants thereof).	Natural	No	No	No	Geology
ST-25	Yellow Hawkesbury sandstone bedrock outcrop (natural)	Natural	No	No	No	Geology
ST-26	Fallen timber fender pile from the jetty encapsulating the wash wall	Cultural	No	No	No	Remnant modern maritime infrastructure
ST-27	Mooring block for yellow instructional marker buoy	Cultural	No	No	No	Modern navigation equipment (in use)
ST-28	Loose section of anchor chain	Cultural	No	No	No	Modern debris
ST-29	Mooring block for beehive buoy used to move current silt curtain	Cultural	No	No	No	Modern maritime infrastructure (in use)
ST-30	Loose timber pile	Cultural	No	No	No	Remnant modern maritime infrastructure
ST-31	High point on and forms part of bedrock/base clay ridge described as linear anomaly ST-32 (natural)	Natural	No	No	No	Geology
ST-32	Mooring buoy sits on ridge described in AF and of which ST-32 is the highpoint	Cultural	No	No	No	Modern navigation equipment (in use)
ST-33	Outcrop of crumbling iron-rich sandstone, probably drowned red and yellow podzolic soil profiles (or remnants thereof)	Natural	No	No	No	Same geology as present at ST-05
ST-34	New silt curtain currently in use	Cultural	No	No	No	Modern maritime infrastructure (in use)
ST-35	Old fabric silt curtain	Cultural	No	No	No	Remnant maritime infrastructure/modern debris

(Source: ArchaeoMar Australasia 2014)

## 5.0 Comparative Analysis

### 5.1 Comparative Summary

A brief desktop assessment was made of the early works for similar seabed developments within Sydney Harbour (Table 14). This data has been used to inform the following significance assessment and provides a predictive model of the likeliness of heritage material to be identified following a SoHI in which it was deemed acceptable on heritage grounds to proceed with the proposed works.

**Table 14: Comparative Summary of Seabed Developments**

Name	Address	Date	Significance	Description	Comment
Thames Street Commuter Wharf Upgrade	Mort Bay, adjoining Thames Street, Balmain	2013	Local	The wharf shelter was locally significant and the adjoining Mort Bay Park of State Significance; the wharf was significantly upgraded in 2013.	No submerged heritage was impacted by the removal of the wharf and installation of new larger wharf.
Huntleys Point Commuter Wharf Upgrade	Parramatta River, adjoining Huntleys Point Road, Gladesville	2013	Local	The wharf was of local significance but not for its fabric; the wharf was upgraded in 2013.	No submerged heritage identified during or impacted by the removal of the wharf and installation of new larger wharf.
Milsons Point Commuter Wharf Upgrade	Sydney Harbour adjoin Milsons Point, North Sydney	2010	Local	The original wharf was demolished and replaced with a new wharf, which was completed in November 2010.	No submerged heritage identified during or impacted by the removal of the wharf and installation of new larger wharf.
Yeend Street Wharf Upgrade	Mort Bay, adjoining Yeend Street, Birchgrove	2013	Nil	The wharf was upgraded ahead of the Thames Street upgrade so it could be used as an alternative during the Thames Street wharf upgrade.	No submerged heritage identified during or impacted by the removal of the wharf and installation of new larger wharf.
King Street Wharf	Johstons Bay, Darling Harbour	2009	Local	The 5ha site in southern Darling Harbour (Johnstons Bay) was redeveloped in 2009, including the installation of a new ferry wharf.	No submerged heritage identified during or impacted by the removal of the wharf and installation of new larger wharf.
Pymont Wharf	Blackwattle Bay, Pymont	2013	Local	This locally significant wharf was on RMS s.170 and was being considered for removal and replacement, as it was not fit for purpose.	No submerged heritage identified during or impacted by the removal of the wharf and installation of new larger wharf.

(Source: ArchaeoMar Australasia 2014)

### 5.2 Discussion

Several of the original wharves mentioned above date to the late 1800's, the time when the Darling Harbour maritime expansion was at its peak and maritime trade and exchange was at its peak in Sydney's working harbour. Although several of the heritage impact assessments are cursory and the risk of impacting submerged heritage was not flagged in all instances, there were no reported, or recorded, submerged heritage identified during these developments and no unexpected archaeological finds were identified. The visual inspection suggests that the potential for the remains of submerged maritime infrastructure to exist within the study area was similar to that in these six cases and it is highly unlikely i.e. a low to extremely low potential to discover unexpected heritage items or submerged archaeological relics during the proposed works.

## 6.0 Significance Assessment

Before making decisions about the future of a heritage item it is first necessary to understand its heritage significance and the values it embodies. The aim of this particular significance assessment is to explain the heritage values embodied by the study area to enable an understanding of the likely heritage impact of the proposed development.

### 6.1 Basis for the Assessment

The *NSW Heritage Manual*, published by the then NSW Heritage Office and Department of Urban Affairs and Planning (1996), sets out a detailed process for conducting assessments of heritage significance. The Manual provides a set of specific criteria for assessing the significance of an item, including guidelines for inclusion and exclusion. The following assessment has been prepared in accordance with these guidelines.

The Heritage Council of NSW has adopted specific criteria for significance assessment, which have been gazette pertinent to the Heritage Act. The seven criteria upon which the following significance assessment has been prepared are as follows:

- Criterion (a) an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area);*
- Criterion (b) an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local area);*
- Criterion (c) an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area);*
- Criterion (d) an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons;*
- Criterion (e) an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area);*
- Criterion (f) an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area); and*
- Criterion (g) an item is important in demonstrating the principal characteristics of a class of NSW's cultural or natural places, or cultural or natural environments.*

As the criteria for *The Burra Charter* are very similar to the Heritage Manual, they have not been considered separately.

### 6.2 Historical Themes in Evidence

National and state-level patterns of historical development are useful in determining the historical value of a site. Nine historical themes have been developed and adopted by NSW Heritage Council. They are derived from the Australian historical themes prepared by the Australian Heritage Commission. The following table notes the NSW historical themes considered to be in evidence within the study area.

**Table 15: Identification of Historical Themes related to East Darling Harbour**

Australian Theme	NSW Theme	Relevance to Study Area
Tracing the evolution of the Australian Environment	Environment - naturally evolved	East Darling Harbour is a feature occurring naturally in the physical environment which has significance independent of human intervention. It has however been shaped and influenced by human life and cultures, not least the maritime and industrial development of the adjacent foreshore through land reclamation, infrastructure development and dredging of the seabed to facilitate a working harbour.
Peopling Australia	Aboriginal cultures and interactions with other cultures	East Darling Harbour has a long association with Aboriginal Australians, their cultural identities and practises, past and present, their distinctive ways of life and interactions with the first European arrivals. It is also significant for its role in the development of Colonial Sydney and Australia as a maritime nation.
Developing local, regional and national economies	Commerce Environment - cultural landscape Industry Technology Transport	East Darling Harbour was the centre of shipbuilding, maritime commerce, trade and exchange in early Sydney. Activities associated with the interactions between humans, human societies and the shaping of their physical surroundings is also evident as Darling Harbour is a highly modified cultural landscape shaped to enhance the colony's ability to manufacture, produce, distribute and transport goods.
Building settlements, towns and cities	Towns, villages and suburbs Land tenure Accommodation	Darling Harbour is associated with activities and processes for identifying forms of ownership and occupancy of land and water, both Aboriginal and non-Aboriginal. It is significant for its early development as a town/suburb, that's planning and its industrial character shaped accommodation. This significance does not however extend to the seabed within the study area.
Working	Labour	Due to its historic development as a hub for painters dockers and waterside workers, the area is significance for its association with organised labour and trade unionism, however this does not extend to the seabed within the study area.
Educating	Education	Not applicable
Governing	Government and administration	Not applicable
Developing Australia's cultural life	Domestic life	In more recent years East Darling Harbour is associated with cultural activities and is socially significant for modern Australians, however this significance does not extend to the seabed within the study area.
Marking the phases of life	Birth and death	Not applicable

(Source: ArchaeoMar Australasia 2014)

## **6.3 Significance Assessment**

### **6.3.1 Criterion A (Historical Significance)**

East Darling Harbour is historically significant as a key industrial and maritime area in the development of Sydney from colonial times to the present day. The site has been in continuous use (albeit under different owners) from 1820 until 2010, however the historical significance is not vested in the submerged fabric of the place, of which there are no visible remains.

### **6.3.2 Criterion B (Associative Significance)**

East Darling Harbour is associated with the historical figures John Hunter (later Governor Hunter), the first person to survey Sydney Harbour, from HMS *Sirius*, in 1788. The study area is also associated with Prosper de Mestre who was one of the first people to undertake land reclamation in the area and Francois Girard whose flourmill occupied the reclamation adjoining the study area. The site is further associated with Henry Bass, colonial shipbuilder, along with Smith and Challis and Watson and Evans whom occupied Grafton Wharf, between 1854 and 1900 and in more recent times Patrick Stevedores and the Port of Sydney, the only port in Australia to have two dedicated passenger terminals, of which this was one. Associative significance is not vested in the submerged fabric of the place, which appears to have been previously destroyed.

### **6.3.3 Criterion C (Aesthetic Significance)**

The study area is not assessed to be significant under this criterion.

### **6.3.4 Criterion D (Social Significance)**

East Darling Harbour has both social and cultural significance as a maritime cultural landscape and is subject to a high level of Indigenous and European community esteem, most notably in recent years as a tourist destination and as a result of its use as a passenger and goods terminal.

### **6.3.5 Criterion E (Research Potential)**

The research potential of the submerged lands of eastern Darling Harbour is considered low. It is considered highly unlikely that the study contains any evidence of pre or post contact Aboriginal occupation of the area. The remains of any places of Aboriginal cultural heritage significance, which may have previously existed, are likely to have been destroyed by later construction activities. These later construction activities appear to have also removed any potential for the area to contain any remnant European historic or maritime heritage. The visual inspection revealed that this part of the harbour has been dredged to bedrock level in several places and as a result no traces of Aboriginal or European cultural heritage as identified during the diving operations.

### **6.3.6 Criterion F (Rarity)**

As no material remains were identified within the study area during the visual inspection, it is assessed to have low to nil potential to provide rare examples of early maritime and industrial infrastructure. The study area is therefore not considered to be significant under this criterion.

### 6.3.7 Criterion G (Representativeness)

As no heritage material was identified within the study area during the visual inspection, the study area is not assessed to be significant under this criterion.

## 6.4 Summary Statement of Significance

The submerged lands of eastern Darling Harbour are of local heritage significance for its role in the early development of Sydney and Australia as a maritime nation. The study area is assessed to be of local significance for its association with historical figures John Hunter, the first person to survey the harbour in 1788 (and who went on to become Governor), Prosper de Mestre, who was one of the first people to undertake land reclamation in the area and Francois Girard whose flourmill occupied the reclamation. It is also of historical value for its association with Henry Bass, colonial shipbuilder, along with Smith and Challis and Watson and Evans whom occupied Grafton Wharf between 1854 and 1900 and for the value of its location and its social significance, although this significance is not vested in material remains as no physical evidence demonstrating the use history remains submerged today.

## 7.0 Assessment of Heritage Impacts

This Statement of Heritage Impact has been prepared in accordance with the criteria developed in the New South Wales Heritage Office (now the Heritage Division, OEH) guidelines, *Altering Heritage Assets* and *Statements of Heritage Impact*, originally published in the NSW Heritage Manual.

### 7.1 Proposed Changes to the Study Area

If the proposed early works are to proceed, there will be minimal impact to the seabed within the diving zone as a result of the proposed early works. The geotechnical investigation will involve the removal of a proportionally small amount of material from the seabed via the five boreholes.

In accordance with best practice, physical changes to heritage item that are considered to have high or exceptional heritage value should be avoided. These items, or components, contribute the most to maintaining the heritage significance of an area. Similarly any justified physical changes to components that have moderate or low heritage value should be considered with care and be sympathetic to original form, scale and location. Changes to intrusive components are generally considered to be acceptable, especially when the removal of such components can restore the original form of the heritage item.

As no heritage items of Aboriginal or European origin have been identified within the impact area, there will be no change to any items of exceptional, high, moderate or low heritage significance. As the modern debris identified within the study area (Table 12) is intrusive in nature, it is considered acceptable for those to be impacted as a result of the proposed works.

### 7.2 Potential Heritage Impacts

Although it may be considered socially, historically and associatively significant in the broader context, the study area is not rare. It is considered to have no representative values, is not technically or aesthetically significant and has low research potential.

Given that no items of European or Aboriginal heritage significance were identified within the study area during the visual inspection, it is considered that the proposed early works are acceptable on heritage grounds. The proposed works are assessed to have no heritage impact, notably as the significance associated with the place is considered to be intangible and not vested in heritage fabric.

## 8.0 Conclusions and Recommendations

The NSW Heritage Council Guidelines (2002) require that a SoHI desktop study, together with supporting information, address what measures are proposed to mitigate the negative impacts of the proposal.

In accordance with *The Burra Charter* procedures for undertaking studies and reports (AICOMOS 2013) the following recommendations have been formulated in consideration of all available information and have been prepared in accordance with the relevant legislation.

### Recommendation 1

The proposed early works at are appropriate on heritage grounds and should proceed, provided Recommendations 2-5 are followed.

### Recommendation 2

All relevant staff, contractors and subcontractors should be made aware of their statutory obligations for heritage under NSW *National Parks and Wildlife Act 1974*, NSW *Heritage Act 1977* and best practice outlined in *The Burra Charter 2013*. This may be implemented as a heritage induction.

### Recommendation 3

If any Aboriginal sites, objects or places of Aboriginal heritage significance are identified during the proposed works, all works in the area should cease. The area should be cordoned off (this can be achieved through the use of ropes and buoys) and contact made with the Heritage Division, Office of Environment and Heritage, NSW Department of Planning and Environment (131 555), a suitably qualified archaeologist and the relevant Aboriginal stakeholders, so that the Aboriginal heritage can be adequately assessed and managed.

### Recommendation 4

In the highly unlikely event that skeletal remains are identified during the proposed works, work in the vicinity of the remains must cease immediately. The area must be cordoned off (this can be achieved through the use of ropes and buoys). The NSW Police Coroner must be contacted in order to determine if the material is of Aboriginal origin. If determined to be of Aboriginal origin, the Client must contact the Heritage Division, Office of Environment and Heritage, NSW Department of Planning and Environment (131 555), along with a suitably qualified archaeologist and the relevant Aboriginal stakeholders, so that the remains can be adequately assessed and managed.

### Recommendation 5

If, during the proposed works, suspected archaeological relics, as defined by the *Heritage Act 1977* are identified, the Heritage Division, Office of Environment and Heritage, NSW Department of Planning and Environment (131 555) should be notified, a research design developed and works only recommence when relevant permits and an appropriate and approved management strategy instigated.

## 9.0 References

- Anon., (1875a), 'Darling Harbour', *Evening News* (Sydney, NSW: 1869 - 1931), Thursday 4 November, p. 5.
- Anon., (1875b), 'Removal of Silt and Sewerage from Darling Harbour', *The Sydney Morning Herald* (NSW: 1842 - 1954), Friday 5 November, p. 5.
- Anon., (1878a), 'Dredging of Darling Harbour', *The Sydney Morning Herald* (NSW: 1842 - 1954), Saturday 16 March, p. 5.
- Anon., (1878b), 'Deputations: Dredging of Darling Harbour', *The Sydney Morning Herald* (NSW: 1842 - 1954), Saturday 12 January, p. 3.
- Anon., (1879), 'The Dredging of Darling Harbour', *The Sydney Morning Herald* (NSW: 1842 - 1954), Friday 24 October, p. 5).
- Anon., (1881), 'Dredging in Darling Harbour', *Evening News* (Sydney, NS : 1869 - 1931), Wednesday 12 October, p. 3.
- Anon., (1883), 'Dredging Operations', *The Sydney Morning Herald* (NSW: 1842 - 1954), Tuesday 3 July, p. 5).
- Anon., (1889a), 'Dredging in 1888', *Evening News* (Sydney, NSW: 1869 - 1931), Friday 21 June, p.3.
- Anon., (1889b), 'Dredging Operations Annual Report' *Newcastle Morning Herald and Miners' Advocate* (NSW: 1876 - 1954) , Thursday 20 June, p. 6.
- Attenbrow, V. (2002) *Sydney's Aboriginal past: investigating the archaeological and historical records*. UNSW Press: Sydney.
- Australia International Council on Monuments and Sites (AICOMOS) (2013) *The Burra Charter. The Australia ICOMOS Charter for Places of Cultural Significance*, [Online], Available: <http://australia.icomos.org/wp-content/uploads/The-Burra-Charter-2013-Adopted-31.10.2013.pdf>, [Accessed 25 July 2014].
- Australia International Council on Monuments and Sites (AICOMOS) (1988) *Procedures for Undertaking Studies and Reports* [Online], Available: [http://australia.icomos.org/wp-content/uploads/Guidelines-to-the-Burra-Charter\\_-Procedures.pdf](http://australia.icomos.org/wp-content/uploads/Guidelines-to-the-Burra-Charter_-Procedures.pdf), [Accessed 25 July 2014].
- Australian Bureau of Meteorology (BOM) (2014) *Weather Observations for New South Wales*, [Online], Available: <http://www.bom.gov.au/nsw/observations/nswall.shtml?ref=hdr>, [Accessed: 25 July 2014].
- Australian Government (2014) Australian Heritage Database, [Online], Available: <http://www.environment.gov.au/heritage/ahdb/>, [Accessed: 25 July 2014].
- Australian Heritage Commission (2001) *Australian Historic Themes: a framework for use in heritage*

*assessment and management*. Commonwealth of Australia: Canberra.

Australian Heritage Commission (2001) *Australian Historic Themes Framework: key*. Commonwealth of Australia: Canberra.

Benson, D. and Howell, J. (1995) *Taken for Granted: the Bush land of Sydney and its Suburbs*, Royal Botanic Gardens: Sydney.

Birch, G. F. (2007) 'A short geological and environmental history of the Sydney estuary, Australia', pp. 217-246 In: *Water, Wind, Art and Debate*. Ed. G. F. Birch, Sydney University Press, The Sydney University, Australia, [Online], Available: <http://ses.library.usyd.edu.au/bitstream/2123/2102/1/WaterWindCh7Birch.pdf>, [Accessed 30 May 2014].

Casey, M. (2013), Darling Quarter (formerly Darling Walk), Darling Harbour, Sydney Volume 1.1: Main Report. Report to Lend Lease Development December 2013, Casey and Lowe: Leichhardt.

Casey, M. (2010), Non-Indigenous Archaeological Assessment Barangaroo Stage 1 (Barangaroo South) Report to Lend Lease (Millers Point) Pty Ltd July 2010, 29 July, Casey and Lowe Pty Ltd: Marrickville.

Casey, M. (2009), Darling Walk Archaeological Excavation 2008/2009 Preliminary Results Report to Lend Lease Development, June, Casey and Lowe: Marrickville.

Casey, M. (2008), FINAL Non-Indigenous Archaeological Assessment Darling Walk, Darling Harbour. Report to Lend Lease Development June 2008, Casey and Lowe: Marrickville.

Chapman, G.A. and Murphy, C.L. (2009), Sydney Soil Landscapes Series – Sheet 9130 (Fourth Edition), The Department of Environment, Climate Change and Water: Sydney.

Coller, M. (2007), *SahulTime*, Monash University: Melbourne.

Comber, J. (2012), Darling Quarter (formerly Darling Walk), Darling Harbour Aboriginal Archaeological Excavation Report. Report to Casey and Lowe on behalf of Lend Lease. August, Comber Consultants: Croydon.

Commonwealth of Australia (2010), *Australian Underwater Cultural heritage Intergovernmental Agreement*, 31 May [Online], Available: <http://www.environment.gov.au/resource/australian-underwater-cultural-heritage-intergovernmental-agreement>, [Accessed 27 July 2014].

Doherty, K. (2014), *Borehole / vibracore locations*, email to Sarah Ward on Thursday, 7 August 2014 1:09 pm.

ERM (2007), Environmental Site Assessment: East Darling Harbour, Sydney, and NSW. Final Report – Revision 1. Sydney Harbour Foreshore Authority 21 June, [Online], Available: <http://www.epa.nsw.gov.au/resources/barangaroo/BRRP03.pdf>, [Accessed 25 July 2014].

Flannery, T. (2009), Watkin Tench's 1788: *A Narrative of the Expedition to Botany Bay (1789) and An Account of the Settlement at Port Jackson (1793)*, 2<sup>nd</sup> edn. Penguin Books: Sydney.

Gordon, A. (2011), Custom Plan: Barangaroo. 15 June, NSW Maritime: Rozelle.

Herbert, C. and Helby, R. (eds) (1980) *A Guide to the Sydney Basin*, Bulletin no. 26, Department of Mineral Resources, Geological Survey of NSW: Sydney.

Heritage Council of NSW (2006), *Heritage Council of New South Wales Minutes of Ordinary Meeting: Meeting Number 325*, Liverpool, 2 August, [Online], Available: <http://www.environment.nsw.gov.au/resources/heritagebranch/heritage/heritagecouncil/hcminutes2006august.pdf>, [Accessed 27 July 2014].

Heritage Council of NSW (2001) *New South Wales Historical Themes: table showing correlation of national, state and local themes, with annotations and examples*, [Online], Available: <http://www.environment.nsw.gov.au/resources/heritagebranch/heritage/themes2006.pdf>, [Accessed 30 May 2014].

Higginbotham, E., Kass, T. and Walker, M. (1991a), *The Rocks and Millers Point Archaeological Management Plan. Volume 1. Management Plan*. 21 November, Edward Higginbotham and Associates: Sydney.

McLeod, K. and McCarthy, J. (2010) *Barangaroo Archaeological Assessment and Management Plan: Final Report prepared by Austral Archaeology Pty Ltd Archaeological and Cultural Heritage Consultants for Barangaroo Delivery Authority*, June, Austral Archaeology: Sydney.

Mulvaney, J., Kamminga, J. and Bowman, D. (1999), *Prehistory of Australia*, University of Chicago Press: Chicago.

Norrington, B. (2003), Union leaders walk The Hungry Mile, Sydney Morning Herald, 4 June [Online], Available: <http://www.smh.com.au/articles/2003/06/03/1054406193082.html>, [Accessed 28 July 2014].

NSW Department of Environment, Climate, Change and Water (DECCW) (2010) *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales*, [Online], Available: <http://www.environment.nsw.gov.au/resources/cultureheritage/ddcop/10798ddcop.pdf>, [Accessed 24 July 2014].

NSW Department of Environment, Climate, Change and Water (DECCW) (2010) *Aboriginal Heritage Consultation Requirements for Proponents*, [Online], Available: <http://www.environment.nsw.gov.au/resources/cultureheritage/commconsultation/09781ACHconsultreq.pdf>, [Accessed: 24 July 2014].

NSW Department of Natural Resources (1983), 1:100 000 Geological Survey of NSW (Sydney), Geological Series Sheet 9130 (Edition 1) [Online], Available: [http://www.resourcesandenergy.nsw.gov.au/\\_\\_data/assets/image/0006/343527/Sydney\\_100K\\_Geological\\_Sheet\\_9130\\_1st\\_edition\\_1983.jpg](http://www.resourcesandenergy.nsw.gov.au/__data/assets/image/0006/343527/Sydney_100K_Geological_Sheet_9130_1st_edition_1983.jpg), [Accessed 20 July 2014].

NSW Government (2014) *Environmental Planning and Assessment Act 1979*, [Online], Available: [http://www.austlii.edu.au/au/legis/nsw/consol\\_act/epaaa1979389/](http://www.austlii.edu.au/au/legis/nsw/consol_act/epaaa1979389/), [Accessed 30 May 2014].

NSW Government (2014) *Environmental Planning and Assessment Regulations 2000 under the Environmental Planning and Assessment Act 1979*, [Online], Available: <http://www.legislation.nsw.gov.au/inforcepdf/2000-557.pdf?id=9d376d33-da45-c796-d869-86fe6d73c9c1>, [Accessed 30 May 2014].

- NSW Government (2014) *Heritage Act 1977*, [Online], Available: [http://www.austlii.edu.au/au/legis/nsw/consol\\_act/ha197786/](http://www.austlii.edu.au/au/legis/nsw/consol_act/ha197786/), [Accessed 29 May 2014].
- NSW Government (2014) *National Parks and Wildlife Act 1974*, [Online], Available: [http://www.austlii.edu.au/au/legis/nsw/consol\\_act/npawa1974247/](http://www.austlii.edu.au/au/legis/nsw/consol_act/npawa1974247/), [Accessed 29 May 2014].
- [http://www.austlii.edu.au/au/legis/nsw/num\\_epi/llep20132013758304.pdf](http://www.austlii.edu.au/au/legis/nsw/num_epi/llep20132013758304.pdf), [Accessed 30 May 2014].
- NSW Government (1994) *Native Title Act (New South Wales) 1994*, [Online], Available: [http://www.austlii.edu.au/au/legis/nsw/consol\\_act/ntswa1994319/](http://www.austlii.edu.au/au/legis/nsw/consol_act/ntswa1994319/), [Accessed 30 May 2014].
- NSW Government (1983) *Aboriginal Land Rights Act 1983*, [Online], Available: [http://www.austlii.edu.au/au/legis/nsw/consol\\_act/alra1983201/](http://www.austlii.edu.au/au/legis/nsw/consol_act/alra1983201/), [Accessed 30 May 2014].
- NSW Heritage Office (2002) *Altering Heritage Assets*, Heritage Council Policy No. 2, [Online], Available: <http://www.environment.nsw.gov.au/resources/heritagebranch/heritage/hmaltering.pdf>, [Accessed 30 May 2014].
- NSW Heritage Office (2002) *Heritage Terms and Abbreviations*, Heritage Information Series, [Online], Available: <http://www.environment.nsw.gov.au/resources/heritagebranch/heritage/hmtermsabbreviations.pdf>, [Accessed 30 May 2014].
- NSW Heritage Office (2002) *Interpreting Heritage Places and Items Guidelines*, Heritage Information Series, [Online], Available: <http://www.environment.nsw.gov.au/resources/heritagebranch/heritage/infointerpreting.pdf>, [Accessed 30 May 2014].
- NSW Heritage Office (2002) *Statements of Heritage Impact*, [Online], Available: <http://www.environment.nsw.gov.au/resources/heritagebranch/heritage/hmstatementsofhi.pdf>, [Accessed 30 May 2014].
- O’Keefe, P. J and Prott, L. V. (2011), *Cultural Heritage Conventions and Other Instruments: a compendium with commentaries*, Institute of Art and Law: Built Wells.
- Transport for New South Wales (2012), *Barangaroo Integrated Transport Plan* 30 August, NSW Government: Haymarket.
- UNESCO (2001), *Convention on the Protection of the Underwater Cultural Heritage*, Paris, 2 November, [Online], Available: <http://unesdoc.unesco.org/images/0012/001260/126065e.pdf>, [Accessed 27 July 2014].
- Ward, S. (2012a) *Commuter Wharf Upgrade Statement of Heritage Impact Balmain Thames Street Wharf*, NSW 14 August, RPS Group: Sydney.
- Ward, S. (2012b) *Commuter Wharf Upgrade Statement of Heritage Impact Huntleys Point Wharf*, NSW, 10 October, RPS Group: Sydney.
- Whiteley, B. (2008), *North West Metro, Contract 140 – Technical Advisor Geophysical Site Investigation*, 23 December, Coffey Geotechnics: Lane Cove West.

# Appendix 1

## AHIMS Search



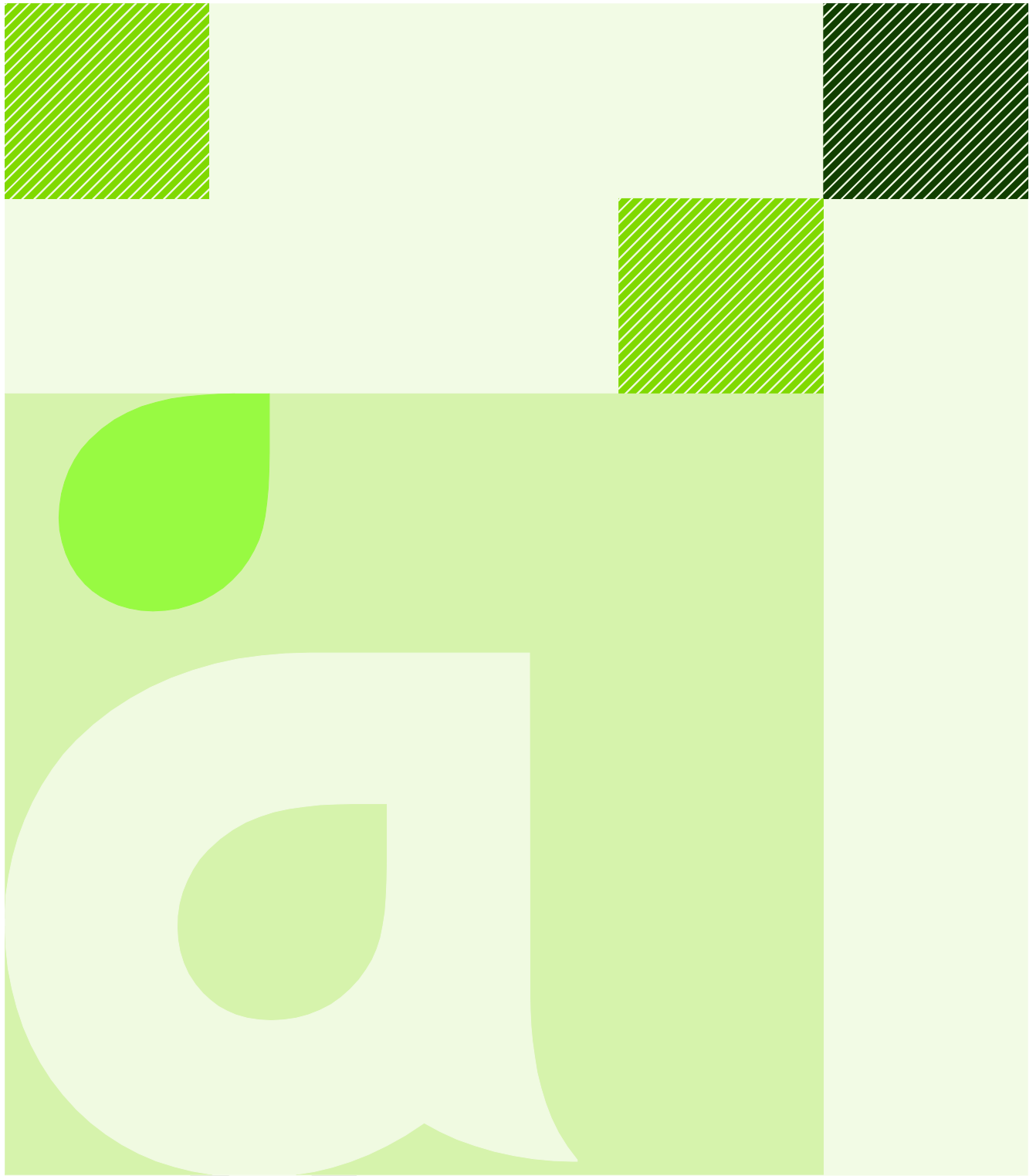
SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-6-3081	200 George Street	AGD	56	334237	6251637	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	<b>Contact</b>			<b>Recorders</b>	Ms.Sally MacLennan			<b>Permits</b>	3577	
45-6-2796	320-328 George St PAD	AGD	56	334100	6251050	Open site	Valid	Potential Archaeological Deposit (PAD) :-		102494,10276 3,102765
	<b>Contact</b>			<b>Recorders</b>	Mr.Dominic Steele			<b>Permits</b>	2415	
45-6-3116	Wynyard Walk PAD	GDA	56	333931	6251252	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	<b>Contact</b>			<b>Recorders</b>	Godden Mackay Logan Heritage Consultants			<b>Permits</b>	3670	

Report generated by AHIMS Web Service on 29/07/2014 for Sarah Ward for the following area at Datum :GDA, Zone : 56, Eastings : 333398 - 333614, Northings : 6251101 - 6251591 with a Buffer of 1000 meters. Additional Info : For Due Diligence Assessment. Number of Aboriginal sites and Aboriginal objects found is 14

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## **Appendix 2**

# **Geotechnical Methodology**



**TPD-14-3721 Barangaroo Ferry Hub  
Technical Advisor**

**Geotechnical Investigation Project Plan  
Methodology and Safe Work Method  
Statement**

**Transport for New South Wales  
(TfNSW)**

**12 August 2014**

**Revision: 0**

**Reference: 243260**

# Document control record

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Approval			
<b>Author signature</b>		<b>Approver signature</b>	
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Date 12 August 2014  
Reference 243260  
Revision 0

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Jack Up Barge and Water Craft Specification Sheets

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Indicative Investigation Locations

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# 1 Introduction

This Geotechnical Investigation Plan ('GIP') has been produced based upon the conforming geotechnical investigation scope contained within Aurecon's tender submission in response to the RFT prepared by TfNSW for the Barangaroo Ferry Hub ('BFH') project (reference TPD-14-3721 dated 12 June 2014).

This plan describes the methodology and equipment we intend to use to complete the investigation fieldwork.

The investigation includes the following works:

- Five over-water boreholes at the indicative locations shown in Appendix B. As part of the borehole drilling, Standard Penetration Testing along with thin-walled U63 tube sampling will be undertaken within soils. Boreholes will be advanced into rock by PQ sized coring until a minimum 5m of continuous high strength sandstone is encountered. We have estimated a total drilling depth of the order of 20m below seabed surface at each test location;
- Five over-water cone penetration tests (CPTs) close to the borehole locations shown indicatively in Figure 2 presented in Appendix B. CPT will likely refuse at the top of rock. We have therefore allowed an average depth of 8m below seabed surface at each test location.

## 2 Investigation Scope

Table 1 summarises the proposed investigation scope.

**Table 1 Investigation Scope**

<b>Investigation Element</b>	<b>Number Scheduled</b>	<b>Estimated Drilling Depth (m below seabed level)</b>	<b>Investigation Purposes</b>
Overwater borehole drilling from a jack-up barge	5	20	To provide information on soils and rock and depth to bedrock. To assess soil consistency and rock quality. To inform design of ferry hub foundations. To obtain undisturbed samples for laboratory testing.
Cone Penetration Testing, from a jack-up barge	5	8 or shallower, if practical refusal is encountered	To assess soil consistency and compressibility characteristics.

Note: Approximate water depth is 12m.

# 3 Geotechnical Investigation Methodology

## 3.1 Preliminaries

Prior to undertaking the fieldwork, planning will need to address the regulatory and statutory requirements applicable to works in Sydney Harbour waters under the Environmental Protection Act and related legislation, including the Contaminated Land Management Act 1997 and the Fisheries Management Act 1994. These requirements together with likely impacts and mitigation strategies are documented in an Environmental Management Plan (EMP) which also incorporates Environmental Work Method Statement and Environmental Control Map. The field related activities will be conducted in accordance with the management requirements and guidelines within the approved EMP.

All Aurecon field staff, sub-contractors, and any visitors, will attend the EMP and safety site inductions prior to the commencement of works. Internal audits will then be regularly undertaken during the course of the fieldwork to ensure compliance with the EMP.

Prior to commencement on site, a “Dial-Before-You-Dig” inquiry and consultation with Harbour Master will be undertaken to determine existence and location of any potential conflicting buried services where exploratory holes are to be located. Test locations will be positioned away from any buried services for a minimum clearance of 10m.

## 3.2 Vessels

### 3.2.1 Jack-Up Barge, Drilling and Testing Equipment

Aurecon proposes to engage Hagstrom Drilling (Hagstrom) as the drilling and testing sub-contractor and considers the use of a jack-up barge for the borehole drilling and cone penetration testing. The jack-up barge provides a fixed-level working platform that is not affected by sea level changes due to tides, wave action and wash effects from Harbour boat traffic. The barge we propose to employ is a “Sea Lift 6” supplied by Australian Barge Hire (ABH), who has extensive experience in using this barge in the harbour area for over-water investigations. The barge will be equipped with a UDR 100 Drill Rig, a CPT Rig, portable toilet, generator, Office/crib room, and workshop sea container for the storage of drilling consumables. Appendix A contains a specification sheet for the barge.

### 3.2.2 Marine Spread

Hagstrom will utilise the ABH vessel “Sea Cat/Sea Punt” to undertake the tow of “Sea Lift 6” between test locations. The vessel will be also be utilised to carry out the crew transfers from shore (White Bay) to sea and will be on standby with the jack up barge during operational hours in case of emergency. Appendix A contains a specification sheet for the Sea Cat.

### 3.2.3 Survey and Test Location Positioning

A HP DGPS System will be utilised to determine the easting, northing and elevation of the test location with an accuracy of  $\pm 0.3\text{m}$  in the vertical and  $\pm 3\text{m}$  in the horizontal. The DGPS will be set up with the antenna on the mast of the drilling rig. The distance from the antenna to the drill deck and drill deck to

the seabed will be deducted from the DGPS recorded elevation to provide the elevation of the seabed. The easting, northing and antenna elevation will be recorded on the driller's borehole log.

The drill rig on the jack-up shall be positioned within 10m of the proposed location or as close as agreed by the Client's Representative.

Before the start of the positioning operation, the Barge Master will carry out a risk assessment. This risk assessment shall take into account weather, speed, stability limitations of the plant involved and also navigational requirements. The best result of this risk assessment should be a location specific positioning procedure, which will be decided after discussion between all personnel involved in the positioning activities before the positioning begins. Once on location, the surveyor will confirm this to the Client's Representative on board the jack-up barge, who will then give permission to the Barge Master to commence jacking down operations.

The jack-up barge will remain at each test location, after positioning, until testing is completed at each location. The barge will remain in place, unattended, at the test location overnight (and over weekend, if required). The barge will be towed into place for each test set-up, and will only leave the Barangaroo Ferry Hub test area once all the fieldworks are completed.

### **3.2.4 Crews**

The drilling crew will consist of 1 x Driller/CPT Operator and 1 x assistant and 1 x Barge Master. We propose that the crew operates 12 hours shifts inclusive of travel from accommodation and to accommodation. The marine vessel crew will consist of a vessel master.

## **3.3 Borehole Drilling**

The boreholes will be drilled through the "moon hole" of the jack-up barge. Each borehole will be drilled to a maximum depth of 20m below seabed level. The available geophysical survey near shore suggests that a soil thickness in the range of 8m to 9m. A further rock coring of 10m is anticipated.

All boreholes will be cased from the barge through the water column to the soil/rock interface to ensure retrieval of samples and the re-circulation of drilling fluids. PQ sized coring technique will be adopted to advance the borehole drilling through soils and the underlying rock. Standard Penetration Tests will be undertaken at 1.5m intervals. U63 diameter thin-walled tube samples will be taken at selected depths as determined by our experienced field personnel or as required in suitable ground conditions. Hand shear vane testing would be carried out on the ends of recovered tube samples.

Core drilling would be commenced within 0.5m of encountering stiff soil or soil/rock interface. Recovered rock cores will be boxed on site and photographed as soon as possible. Selected sections of core will be wrapped in plastic film and preserved for strength testing. Core transfers will be conducted on an ad-hoc basis.

Our field-based geotechnical engineers will be on site on a full-time basis during drilling to log the encountered subsurface profile and direct in-situ testing and sampling. The soil and rock logging will be carried out according to Australian Standard, AS1726-1993.

## **3.4 Cone Penetrometer Testing**

Cone penetrometer testing will be undertaken adjacent to each borehole location. The cone penetrometer test involves hydraulically pushing an instrumented cone through the soil stratum at a controlled rate. The cone is affixed to the end of rods that are supported by the weight of soil, thus minimising the risk of buckling. However, in over-water work and in view of the 13m water depth within the test area, a steel casing will be employed to support the CPT rods through the water column to reduce the risk of buckling. Dissipation testing may be undertaken at selected locations to assess time rate of settlement parameters.

### 3.5 Laboratory Testing

Laboratory testing of recovered soil and rock samples will be carried out at NATA-accredited laboratories. The Brief does not provide test quantities, however, we have allowed for a nominal quantity of the specified tests as shown in Table 2.

**Table 2 Scope for Laboratory Testing**

Laboratory Test	Test Method	Estimated Quantity
Field Moisture Content	AS1289.2.1.1	10
Size Grading (sieve)	AS1289.2.1.1	10
Hydrometer Grading	AS1289.2.1.1	5
Atterberg Limits and Linear Shrinkage	AS1289.2.1.1	5
Undrained Triaxial Strength	AS1289.2.1.1	3
Emerson Crumb Dispersion	AS1289.2.1.1	3
1D Consolidation	AS1289.2.1.1	2
Compaction and CBR	AS1289.2.1.1	2
Aggressivity Suite (pH, Cl and SO <sub>4</sub> contents)	USEPA 9045; APHA 4500-Cl; APHA 4110	4
Rock UCS Strength	AS4133.4.2-1993	5
Point Load Index test	AS41334.1	10

## 4 Subcontractors

Table 3 lists our nominated sub-contractors for the project.

Sub-contractor name	Expertise
Hagstrom Drilling	Over-water drilling and testing
Australian Barge Hire	Supplier of jack-up barge and marine vessels

# 5 Occupational health and safety

Aurecon has developed an Occupational Health and Safety Management System which meets the requirements of AS/NZS 4801 and was first accredited by an independent third party provider, DLIQ Certification Services, in 2002. We are one of the few consulting engineering companies to maintain this five star achievement.

Our established safety management system is practical in approach and is built around risk management principles to ensure safe systems of work are established and maintained.

OH&S management will be incorporated into delivery of the services for the project through the implementation of OH&S Procedures. This will include a Safety Risk Assessment in accordance with the guidelines at various stages of the project. The aim of these progressive assessments is to ensure that field investigations are carried out in a safe manner and that safety awareness is implemented throughout the duration of the fieldwork.

In undertaking the field works, it is understood that we will be responsible for site safety at every investigation location. This responsibility extends to all people who may be affected by the works. To address our safety responsibilities we will:

- Undertake work in accordance with our Ground Investigation Plan and our Safe Work Method Statement (presented in Appendix C).
- Comply with OH&S Act (2000).
- Develop safe methods of work and detail these in Safe Work Method Statement.
- Undertake Safety Risk Assessments for all work activities.
- Conduct project-specific Safety Inductions for all team members including all sub-contractors engaged by us, and TFNSW staff who are required to enter our work sites.
- Conduct regular audits for our site works and update/revise our safety control plans as required.

In particular, our field investigations will be undertaken by appropriately trained and certified personnel with approved equipment. As part of the OH&S induction all personnel will be required to show valid NSW General Construction Induction card and tickets/certificates required for the operation of equipment.

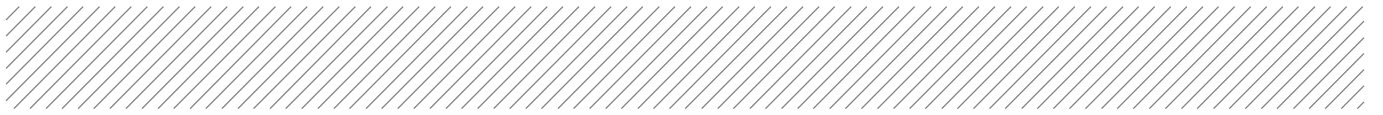


## 6 Programme

We have assumed that the investigations can be undertaken Monday to Friday, between the hours of 07:30hrs and 17:30hrs.

We aim to start the fieldwork on 4 September 2014. We anticipate that the fieldwork will take 9 days to complete.

DRAFT



# Appendix A

## Jack Up Barge and Water Craft Specification Sheets

DRAFT

Australian Barge Hire  
Work Boat  
Sea Cat  
Information Sheet  
May 2010



"MV SEA CAT"



MV Sea Cat on Station Darwin Harbour

"SEA CAT"	
Specifications	
Type of vessel	Work Boat
Operator	Australian Barge Hire Pty Ltd
Survey	NSW Maritime 2C
Built	2004
Construction	Fibreglass
Measured length	7.47 m
Moulded breadth	2.40 m
Moulded Depth	0.70 m
Engines	Twin 175 hp Mercury Optimax Outboards
Fuel Capacity	300 litres
Service Speed	20 knots
Road Transport	Drop Deck Semi Trailer

Australian Barge Hire  
[www.sealift.com.au](http://www.sealift.com.au)  
2D 1-3 Endeavour Road Caringbah NSW 2229  
Phone +612 9531 2900





## Sea Lift 6



### Sea Lift 6

#### Basic Information

<b>LOA</b>	19.51m
<b>Beam</b>	14.50m
<b>Draft</b>	0.91m
<b>Lift capacity</b>	Up to 80 tonnes
<b>Operational depth</b>	Leg length 27.30 m



#### Operation

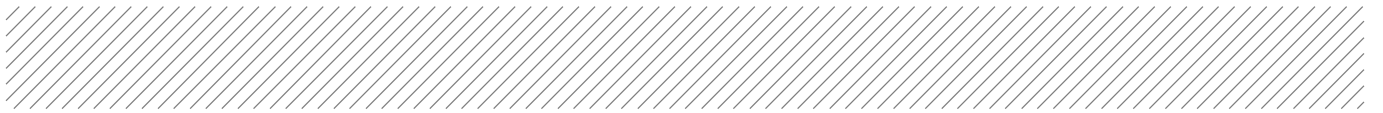
Sea Lift 6 Series 5-Contfloat jack up barge is ideal for a variety of near shore marine operations including geotechnical investigations, piling, boring and jacking of piles, dolphins installation and servicing, wharf rehabilitation, diver support, drilling and blasting for dredging, offshore mineral exploration and gas pipeline installations.

Sea Lift 6 is modular and can be disassembled and road transported across the country minimising mobilization costs.

Sea Lift 6 was built in 2008 and has a deck loading of approximately 80 tonnes capacity. She is in survey with AMSA to USL 2C and Germanischer Lloyd 100AS R5A (70).

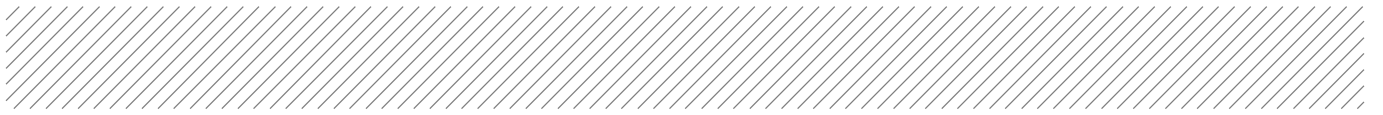
#### Features

- Clear Deck
- Road Transportable
- Fully Documented Safety Management System including risk assessed safe work procedures
- Safety inductions
- Drills and procedures
- Trained experienced operators
- Optional support vessels
- Environmental protection equipment



### Specifications

<b>Type of Vessel</b>	Jack Up Barge
<b>Road Transport</b>	7 axel trailers
<b>Operator</b>	Australian Barge Hire Pty Ltd
<b>Survey</b>	AMS&A US, Class DC and Germanischer Lloyd 100AS RSA (D1)
<b>Built In</b>	Stalco
<b>Construction</b>	Steel
<b>Length Overall</b>	19.81 m
<b>Beam</b>	14.50 m
<b>Draft</b>	0.90m
<b>Displacement</b>	202.68 tonnes bare
<b>Working Area</b>	18.30m x 12.20m
<b>Load Lift Capacity</b>	Up to 80 tonnes
<b>Spud Length</b>	17.3 - 26.3m
<b>Jacking System</b>	Electric Over Hydraulic



# Appendix B

## Indicative Investigation Locations

DRAFT



**Legend**

- Proposed**
- ★ Proposed borehole/CPTs  
20 per RTT trial
- Historical**
- ★ Existing borehole locations  
(Coffey 2008)
- Site boundary
- ▨ Existing echo sounding /  
seismic reflection profiling  
(Coffey 2008)
- ▨ Proposed wharf location

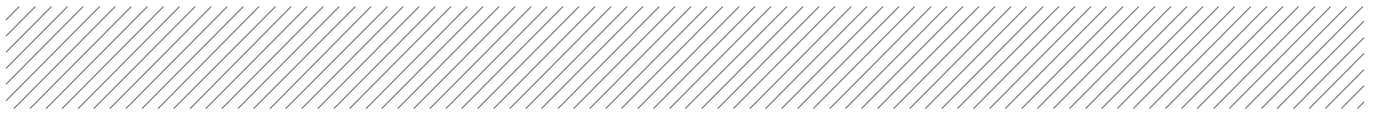
Source: Aurecon, Coffey, Newsmap



Projection: GDA 1984 MGA Zone 56

**Barangaroo Ferry Wharf Geotechnical Assessment**

FIGURE 2: Proposed Investigation (Conforming)



# Appendix C

## Safe Work Method Statement

DRAFT

## Safe work method statement (SWMS)

### Administration Section

Project name: Barangaroo Ferry Hub Technical Advisor		Job / Project no: 243260	SWMS no: 243260-G-01	Version no: 1
Activity / Task assessed: Geotechnical Over-water Site Investigations including borehole drilling and CPT			Date of assessment: 11 August 2014	
Prepared by: C. Chow		Approved by: R. Rohleder		
Reviewed at first use by: M. Merry	Review date 11 August 2014	Controls effective Yes	12 Month review date : 11 August 2015	

### Work method assessment (Must be task specific only, no generic or motherhood statements will be accepted)

Step	Task Describe the task: What is being done, by whom, how, where and with what items/materials? (be specific, one task per line)	Hazard Exactly what could cause injury or illness? (one hazard per line)	Consequences What could happen if hazard were not controlled?	Risk Score Before control	Controls Describe how the hazard will be eliminated or what actions must be taken to make the task safe	Control hierarchy List the hierarchy s used	Risk score After control
1	<b>Driving to and from site</b>	Driver fatigue	Road accident and serious injury	Extreme	<ul style="list-style-type: none"> <li>Ensure driver is well rested;</li> <li>Ensure regular stop breaks for rest if necessary; and</li> <li>Plan ahead, and allow sufficient travel time in the working day; and</li> <li>Stay near site if necessary.</li> </ul>	Administrate	Low
		Defective Vehicle	Road accident and serious injury	Extreme	<ul style="list-style-type: none"> <li>Ensure vehicle has undergone recent inspections and is roadworthy;</li> <li>Check that First Aid kit is in the vehicle</li> <li>Hired vehicles must be supplied by an Aurecon – approved vehicle hire firm; and</li> <li>Inspect external condition of vehicle (particularly tyres, wipers, lights) before setting off.</li> </ul>	Administrate	Low

### Safe work method statement (SWMS)

		Unrestrained Equipment in Vehicle	Road accident and serious injury	Extreme	<ul style="list-style-type: none"> <li>• Ensure equipment checklist is completed; and</li> <li>• Check all equipment transported in (or attached to) vehicle is properly secured.</li> </ul>	Administrative	Low
		Poor weather and/or road conditions	Road accident and serious injury	Extreme	<ul style="list-style-type: none"> <li>• Always drive to suit prevailing weather and/or road conditions; and</li> <li>• In severe conditions, postpone journey if possible.</li> </ul>	Administrative	Low
		Drugs and alcohol	Road accident and serious injury	Extreme	<ul style="list-style-type: none"> <li>• Do not drive if under the influence of drugs and/or alcohol; and</li> <li>• All staff to comply with Aurecon zero tolerance policy to Drugs and Alcohol.</li> </ul>	Administrative	Low

**Safe work method statement (SWMS)**

<p>2</p>	<p><b>Accessing site (either by vehicle or on foot)</b></p>	<p>Difficult access including uneven ground, slippery or wet conditions, steep terrain, transfer from land to a barge over-water etc.</p>	<p>Injury, fatality</p>	<p>Extreme</p>	<ul style="list-style-type: none"> <li>• Wear suitable footwear, i.e. steel capped, fully laced boots;</li> <li>• Conduct site walkover with plant operator prior to entering site with equipment. Plant operators are to be aware of test location(s) and are to be given the opportunity to inspect the location(s) and access prior to mobilising at the test location;</li> <li>• Consult with the barge operator for access arrangements;</li> <li>• If there are concerns regarding the access, then consider relocating test location and/or mobilising alternate equipment;</li> <li>• Keep to any existing access tracks/roads; and</li> <li>• Only park in designated areas and do not block any roads/access tracks.</li> </ul>	<p>Engineer / Isolate</p>	<p>Moderate</p>
		<p>Lack of knowledge/ awareness about the site and site activities</p>	<p>Injury, fatality, accident</p>	<p>Extreme</p>	<ul style="list-style-type: none"> <li>• All Aurecon staff (including Aurecon sub-contractors) to sign on to this SWMS and be briefed about it;</li> <li>• All Aurecon staff (including Aurecon sub-contractors) to sign on to and abide by OH&amp;S procedures set by the project principal;</li> <li>• Conduct a "Take 5" safety check each day prior to commencing work on site; and</li> <li>• Review site TMP (Traffic Plan) to confirm permitted access routes.</li> </ul>	<p>Administrative</p>	<p>Moderate</p>

### Safe work method statement (SWMS)

		Hit by passing vehicles/plant	Disabling injury or illness, i.e. amputation and/or permanent loss of bodily function, or any kind of permanent health impact	Extreme	<ul style="list-style-type: none"> <li>Wear high visibility PPE;</li> <li>Be alert when crossing any roadways;</li> <li>Do not walk around when talking on a mobile phone; and</li> <li>Use TC (Traffic control) if required.</li> </ul>	Administrative	Moderate
		Tripping/slipping and falling	Injury, fatality	High	<ul style="list-style-type: none"> <li>Wear PPE;</li> <li>Be aware of changing ground conditions in the wet;</li> <li>Inspect site prior to set up or use of plant/equipment for any steep slopes and/or loose ground; and</li> <li>Assess condition of ground surface</li> </ul>	Personal Protective Equipment (PPE)	Moderate
<b>3</b>	<b>Drilling over-water</b>						
<b>3.1</b>	<b>Working over water (including travel by boat to barge)</b>	Barge unseaworthy	Accident	High	<ul style="list-style-type: none"> <li>Barge log to be sited. Barge condition to be assessed.</li> </ul>	Administrative	Moderate
		Barge hits high ground or other in water obstacles	Accident	High	<ul style="list-style-type: none"> <li>Must use experienced barge operators familiar with the area</li> <li>Must use barge operators with "Master 5" licenses by Waterways</li> </ul>	Administrative	Moderate
		Rig movement or instability on barge	Accident	High	<ul style="list-style-type: none"> <li>Rig must be securely fixed to the barge by chains or other appropriate mechanism to prevent sliding or toppling movements, prior to barge leaving anchorage</li> </ul>	Administrative	Moderate

### Safe work method statement (SWMS)

		<ul style="list-style-type: none"> <li>• Fall in water. Drown.</li> <li>• Hit by other water vessels</li> </ul>	Accident, injury, fatality	High	<ul style="list-style-type: none"> <li>• All staff must be able to swim, comfortable with moderate heights, and be physically fit enough to climb a rope ladder if required, to be allowed to work on an overwater drilling program.</li> <li>• Must wear life vest within 3m of water edge or in boat</li> <li>• Must never work/travel alone.</li> <li>• Must use barge operators with "Master 5" licenses by Waterways</li> <li>• Check boat capacity (max number of people on the boat)</li> <li>• Obey all barge contractor instructions</li> <li>• Check weather conditions-avoid working during rough sea.</li> <li>• Competent and experienced swimmers only to undertake work</li> <li>• At least one member of the working team to be a First Aider</li> <li>• Suitable egress sites to be established prior to commencement of work.</li> </ul>	Administrative PPE	Moderate
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### Safe work method statement (SWMS)

		Working near operating drill rig on confined barge	Injury, fatality	Extreme	<ul style="list-style-type: none"> <li>• Maintain safe distance from drill rig operations when moving around barge</li> <li>• Stay clear of machinery at all times</li> <li>• Where PPE (high visibility, etc) at all times,</li> <li>• Give way to plant and equipment,</li> <li>• Make contact with operator (via radio, eye, etc.) prior to moving near or around any plant and equipment,</li> <li>• Use only designated roads and access paths,</li> <li>• Do not walk around while talking on mobile phone.</li> </ul>	Administrative PPE	Moderate
		Jacking up and down on barge under tow	Injury, fatality	High	<ul style="list-style-type: none"> <li>• Find safe position agreed with by barge master for supervisors to stay during tow / jack up / down operations</li> <li>• Stay clear of jacking rams</li> <li>• Stay clear of drilling crew</li> <li>• Never stand directly behind towline while undertow.</li> </ul>	Administrative	Low

### Safe work method statement (SWMS)

		Accessing Jack-up Barge	Injury	High	<ul style="list-style-type: none"> <li>All Aurecon staff will be properly inducted and trained on proper boarding and disembarking procedures for the barge and support vessel.</li> <li>Stay alert and follow the directions of the barge master regarding when and how to board and exit the barge safely.</li> <li>Three points of contact should always be used during boarding and exiting of the jack up barge. Under certain weather and sea state conditions staff may be required to access the barge using the rope ladder. All staff will be trained in this procedure during the induction process.</li> </ul>	Administrative	Low
		Accessing transfer vessel from the wharf or barge	Injury, fatality	High	<ul style="list-style-type: none"> <li>All Aurecon staff will be fully inducted on the proper procedure for boarding the transfer vessel. Three points of contact should always be used during boarding and exiting of the transfer vessel.</li> </ul>	Administrative	Low
3.2	<b>Drilling/Augering/CPT</b>	Unsuitable plant/equipment and/or operator not competent	Injury, fatality	Extreme	<ul style="list-style-type: none"> <li>All Contractors to be Aurecon approved by OHS manager (on approved list)</li> </ul>	Administrative	Low

**Safe work method statement (SWMS)**

		Site security (unauthorized access)	Injury, fatality	Extreme	<ul style="list-style-type: none"> <li>Establish worksite areas by erecting plastic bollards, barrier tape, signage or combination of these;</li> <li>Only authorized, inducted persons to enter worksite area; and</li> <li>Site vehicles to be fitted with flashing lights, which must be on at works location.</li> </ul>	Administrative	Moderate
		Contact with underground services	Damages to underground services, serious injury and potential for fatality	Extreme	<ul style="list-style-type: none"> <li>Review DBYD drawings before commencing with any breaking of the ground;</li> <li>Employ a service locator to clear locations prior to breaking ground if necessary and where required;</li> <li>Observe marked services prior to drilling</li> <li>If services are problematic, consider relocating test location.</li> </ul>	Administrative	Moderate
		Contact with Contaminated Soils/Groundwater	Noxiousness, Serious illness, carcinogens from dermal contact, ingestion or inhalation, cross-contamination, risk to environment	Moderate	<ul style="list-style-type: none"> <li>Use PPE as appropriate, including gloves (if required)</li> <li>Wash hands and face thoroughly before leaving site</li> <li>Be aware of unusual coloured soils, and/or any odours – report these to Works Supervisor</li> </ul>	Administrative PPE	Low

**Safe work method statement (SWMS)**

		Encountering buried Asbestos or ACM (Asbestos Containing Materials)	Serious toxicity ; long-term health consequences	Moderate	<ul style="list-style-type: none"> <li>• Check if site has been previously identified as ACM contaminated – refer to project site Asbestos Management Plan (where on exists)</li> <li>• Use PPE as appropriate, including facemask and gloves (if required). Minimum P2-rated dust mask to be worn at all times at high risk locations</li> <li>• Wash hands and face thoroughly before leaving site</li> <li>• If asbestos is encountered or suspected, stop work and report it to the Works Supervisor/Project Manager</li> <li>• Do not replace contaminated spoil back into excavations – consult with Works Supervisor</li> </ul>	Administrative PPE	Low
		Injury from rotating/moving mechanical parts of plant	Disabling injury or illness, i.e. amputation and/or permanent loss of bodily function, or any kind of permanent health impact	Extreme	<ul style="list-style-type: none"> <li>• Wear PPE: Hearing protection, safety glasses, hard hat;</li> <li>• Keep suitable distance away from moving parts/machinery;</li> <li>• Make sure you are always seen by the machine/plant operator;</li> <li>• Identify all operations of vehicles, machinery/ plant/ equipment &amp; sequence of operations in the work area; and</li> <li>• Identify pinch points on plant and keep hands well away.</li> </ul>	Personal Protective Equipment	Moderate

### Safe work method statement (SWMS)

		Noise	Short term or permanent hearing loss	Extreme	<ul style="list-style-type: none"> <li>Wear suitable PPE. Hearing protection; and</li> <li>Turn off drill rig when not in use.</li> </ul>	Eliminate	Low
		Contact with overhead power lines/cables	Serious injury, fatality	High	<ul style="list-style-type: none"> <li>Maintain minimum clearance of 6m from power lines/overhead wires; and</li> <li>If overhead power lines are causing problems, then consider relocating borehole or finding an alternate access route.</li> <li>Establish the site owner's procedures for working on or near both high and low voltage electrical equipment</li> </ul>	Engineer / Isolate	Moderate
		Loss of concentration	Injury, fatality	Extreme	<ul style="list-style-type: none"> <li>Always be alert and aware of surroundings;</li> <li>Do not move around whilst talking on a mobile phone. Operating a mobile phone whilst spotting or operating equipment not permitted;</li> <li>Keep an eye out for fellow workers and what they are doing; and</li> <li>Take 5 minute breaks every hour or so to rest and refresh.</li> </ul>	Administrate	Low
		Chemical spills	Injury requiring medical treatment	Low	<ul style="list-style-type: none"> <li>All plant to have necessary spill kits available (near machine and when refuelling);</li> <li>Wear PPE (boots, gloves, safety glasses)</li> <li>Applicable MSDS to be kept on site (in vehicle)</li> </ul>	PPE	Low

### Safe work method statement (SWMS)

		Fire or explosion from handling & storage of machinery fuels	Serious Injury, fatality	High	<ul style="list-style-type: none"> <li>• Store fuels securely i.e. in approved containers, cool surrounds, etc;</li> <li>• Use appropriate PPE when handling fuels; and</li> <li>• Do not expose fuels to sparks or naked flames.</li> </ul>	Eliminate	Moderate
		Working on or near roadway, hit by passing vehicle	Serious Injury	Moderate	<ul style="list-style-type: none"> <li>• High visibility clothing to be worn at all times.</li> <li>• Be aware of vehicle thoroughfares</li> </ul>	Administrate PPE	Low
		Uncontrolled dispersion of spoil materials	Potential adverse environmental consequences	Moderate	<ul style="list-style-type: none"> <li>• Ensure spoil is stockpiled on reasonably clear level ground</li> <li>• Cover spoil if necessary (inclement weather)</li> <li>• Follow procedures in Erosion and Sediment Control Plan (ESCP) as appropriate</li> </ul>	Administrate	Low
3.4	<b>Outdoor Physical Hazards</b>	Uneven ground	Injury from falling, potential for fatality	Moderate	<ul style="list-style-type: none"> <li>• Suitable foot wear (PPE);</li> <li>• Watch your step;</li> <li>• Don't take unnecessary risks;</li> </ul>	Eliminate	Low

**Safe work method statement (SWMS)**

		Manual Handling, carrying equipment	Back injury	Extreme	<ul style="list-style-type: none"> <li>• Deliver material (by vehicle) as close as possible to work area;</li> <li>• Warm up prior to heavy physical activity;</li> <li>• Analyse the work to be done;</li> <li>• Ask for help with heavy work (2 person lift) – use mechanical means to lift where possible</li> <li>• Distribute weight to be carried as evenly as possible;</li> <li>• Keep objects to be carried close to your body;</li> <li>• Tighten abdominal muscles, time and coordinate lift;</li> <li>• Lift with your legs not your back; and</li> <li>• When turning, pivot with feet and avoid twisting body.</li> </ul>	Administrative	Moderate
3.5	<b>Outdoor Environmental Hazards</b>	<ul style="list-style-type: none"> <li>• Thermal/sun</li> <li>• Wind</li> <li>• Storms</li> <li>• Electrical Storms</li> <li>• Heat</li> <li>• Cold</li> </ul>	<ul style="list-style-type: none"> <li>• Sunburn skin cancer;</li> <li>• Debris/dust may enter eye;</li> <li>• wet underfoot slippery;</li> <li>• Dehydration;</li> <li>• Hypothermia</li> </ul>	High	<ul style="list-style-type: none"> <li>• Wear long sleeve clothing;</li> <li>• Use sunscreen;</li> <li>• If caught in open lightning storm crouch down with your feet together and do not lie down;</li> <li>• Take and drink plenty of potable water;</li> <li>• Cease work during extreme weather; and</li> <li>• Wear suitably warm clothes in cold conditions.</li> </ul>	Administrative	Moderate
4	<b>Unidentified Hazard not listed on this SWMS</b>	<ul style="list-style-type: none"> <li>• Unforeseen</li> </ul>	<ul style="list-style-type: none"> <li>• Unspecified</li> </ul>	High	<ul style="list-style-type: none"> <li>• Revise SWMS and consult with work staff</li> <li>• Task observations to be completed</li> </ul>	Administrative	Moderate

## Safe work method statement (SWMS)

### Personal protective equipment (P.P.E) required

List Requirements for the Job Site "Check"

<input type="checkbox"/> Fall arrest equipment	<input checked="" type="checkbox"/> Steel capped boots	<input checked="" type="checkbox"/> Hard hat	<input checked="" type="checkbox"/> Safety glasses	<input checked="" type="checkbox"/> Sun screen	<input type="checkbox"/> Hearing protection	<input type="checkbox"/> P2 face mask	<input checked="" type="checkbox"/> Gloves	<input type="checkbox"/> Disposable coveralls with booties and hood	<input checked="" type="checkbox"/> Hi Visibility Vest
<input checked="" type="checkbox"/> Personal Floating Device (PFD) Type 3 min									

Description of the specific PPE that is to be used:

Other PPE, Please List

- Hearing protection and / or Gloves required when appropriate
- Long sleeve shirts and long trousers to be worn at all times whilst on site
- PFD while on barge

### Training required

List Mandatory Training Requirements for the Job Site / Job Activity "Check"

<input checked="" type="checkbox"/> AURECON induction	<input checked="" type="checkbox"/> Site Induction	<input checked="" type="checkbox"/> Industry Induction Card	<input type="checkbox"/> RISI Card (only if entering Rail corridor)
---	--	---	---

Other Training, Please List:

- All site staff to have completed Aurecon Project Site Safety Induction
- All staff to have completed LORAC OH&S and Site Inductions

### Permits required

List Permits required for the Job Site prior to commencing work "Check"

<input type="checkbox"/> Isolation & lockout permit	<input checked="" type="checkbox"/> Excavation permit	<input type="checkbox"/> Confined space permit	<input type="checkbox"/> Hot work permit	<input type="checkbox"/> Permit to work	<input type="checkbox"/> Road Closure permit	<input type="checkbox"/> Other	Specify:
---	---	--	--	---	--	--------------------------------	----------

### Legislation / Standards / Codes

List any H&S legislation / standards / codes of practice etc applicable to the work

NSW OH&S Act 2000 ; NSW OH&S Regulation 2001 ; WorkCover NSW Code of Practice (Excavation Work) ;



### Safe work method statement (SWMS)

#### Induction and sign off

Project leader to induct all people performing this work into the SWMS and ensure sign off (this includes all Aurecon sub contractors)

**Project leader name: As per specific Project – for sign off SMWS refer to Project-specific or Task-specific SWMS**

Induction register (attach additional pages if necessary)					Induction register (attach additional pages if necessary)				
No	Name	Signature	Company	Date	No	Name	Signature	Company	Date
1					16				
2					17				
3					18				
4					19				
5					20				
6					21				
7					22				
8					23				
9					24				
10					25				
11					26				
12					27				
13					28				
14					29				
15					30				

Risk Rating Matrix					
Most Likely Consequence	Likelihood				
	Very likely will occur	Good chance to occur	Likely to occur	Unlikely to occur	Very unlikely to occur
Disastrous	Extreme	Extreme	Extreme	Extreme	High
Critical	Extreme	Extreme	Extreme	High	High
Serious	Extreme	High	High	Moderate	Moderate
Significant	High	High	Moderate	Low	Low
Minor	Moderate	Moderate	Low	Low	Low

Consequence	Example	Likelihood	Example
Disastrous	Single or multiple fatality	Very likely to occur	Is expected to occur in most circumstances i.e. could occur once per week
Critical	Disabling injury or illness i.e. amputation and/or permanent loss of bodily function, or any kind of permanent health impact	Good chance to occur	Will probably occur in most circumstances i.e. could occur once per month
Serious	Any lost time injury (LTI) resulting in one or more complete days off work or Any (RII) resulting in more than 1 week off normal duties	Likely to occur	Might occur at some time i.e. could occur once per year
Significant	A medical treatment injury (MTI) or A restricted work injury (RWI) i.e. any injury resulting in less than 1 week on alternate duties	Unlikely to occur	Could occur at some time i.e. could occur once in 10 years
Minor	Minor First Aid injury or an injury not requiring treatment	Very unlikely to occur	May occur only in exceptional circumstances i.e. could occur once in 100 years

Risk Category	
Rating	Response
Extreme Risk	Cease the work immediately and notify the most senior line manager responsible for the work. Immediate action required, do not proceed with any work until confirmed safe to do so and re-commencement has been authorised the senior line manager or appropriately qualified and competent person.
High Risk	Cease the work immediately and notify the most senior line manager responsible for the work. Immediate action required, do not proceed with any work until confirmed safe to do so and re-commencement has been authorised the senior line manager or appropriately qualified and competent person.
Moderate Risk	Notify Project Leader or Manager and identify control actions and action dates, proceed with work only if confirmed safe to do so.
Low Risk	Manage by routine procedures.

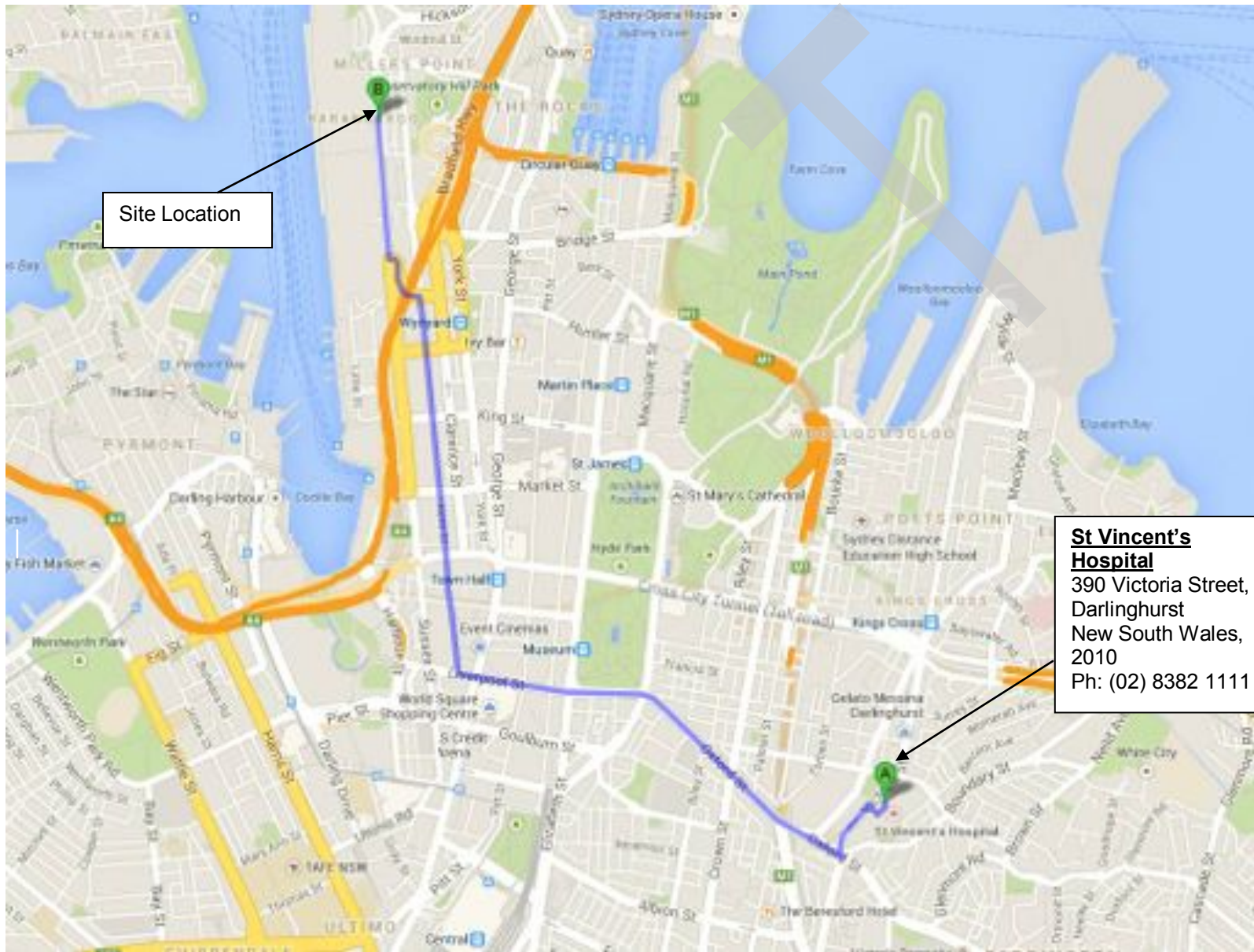
Hierarchy of Control		
You should attempt remove or control the hazard in the following order: If the hazard cannot be eliminated completely then apply any one or a combination controls 2 – 5 in descending order until the work can be done safely.		
Option 1	1. Eliminate	Eliminate the hazard at its source i.e. complete removal or termination of whatever is generating the hazard, could be a process, work method, equipment, material or substance etc.etc.
Option 2 (Control the hazard through 1 or a combination of these controls)	2. Substitute	Replace whatever is generating the hazard with a non-hazardous or less hazardous process, work method, equipment, material or substance etc.
	3. Engineer / isolate	Redesign or modify whatever is generating the hazard to control the effects of the hazard or prevent people from coming into contact with it, this includes isolating the hazard to prevent access. Engineer & re-design includes the use of barriers, guards, enclosures, engineering control systems and protective devices, re-designed layouts and work processes, design of new equipment to handle the hazardous source, etc.
	4. Administrative	Administrative controls include the use of procedures, training and information, signage, hours of work etc.
	5. Personal Protective Equipment (PPE)	Use appropriately designed and properly fitting personal protective equipment where other controls are not practicable (This is not a primary control it is a back up control and should be considered only as a support to the other controls)

<b>Motor Vehicle Accident</b>	Contact Police, Ambulance 000	<b>Damage to Underground Services</b>	Poisons Information:	13 11 26
<b>Serious Accident or Dangerous occurrence</b>	Contact WorkCover on 131 050 for non-disturbance incident	Sydney Water 13 20 90 Gas Agility 13 19 09		
<b>Police</b>	Police Station Phone: 000	Jemena Gas 131 909	Neutral Bay Office Phone	02 9465 5599
		Energy Australia 13 13 88 or 02 4951 0899	Geotechnical Project Manager: Rolf Rohleder	02 9465 5404 0403 549 123
<b>Fire</b>	Fire Brigade 000	Telstra 132203	Aurecon Field Engineer: TBC	
<b>Fuel or Oil spill</b>	If cannot be contained, Contact Fire Brigade 000 If necessary contact EPA on 131 555 (Pollution Line)	Optus 1800 505 777	OH&S Manager: Adam Martin	02 9465 5185
			Environmental Manager:	

**Additional Emergency Response Information**

Nearest Hospital: St. Vincent's Hospital  
390 Victoria Street, Darlinghurst  
New South Wales, 2010  
(02) 8382 1111

# Hospital Route Map





**Aurecon Australasia Pty Ltd**

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**W** [aurecongroup.com](http://aurecongroup.com)

**Aurecon offices are located in:**

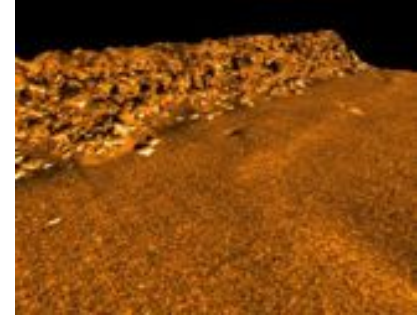
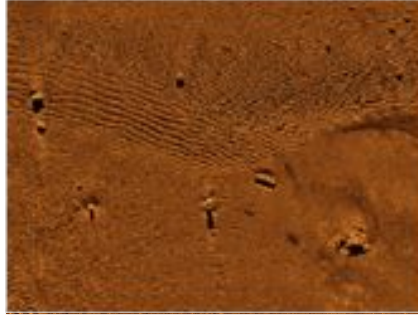
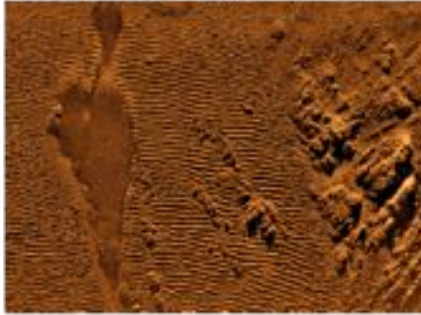
Angola, Australia, Botswana, Chile, China,  
Ethiopia, Ghana, Hong Kong, Indonesia,  
Lesotho, Libya, Malawi, Mozambique,  
Namibia, New Zealand, Nigeria,  
Philippines, Qatar, Singapore, South Africa,  
Swaziland, Tanzania, Thailand, Uganda,  
United Arab Emirates, Vietnam.

## Appendix 3

# Side-scan Sonar Specifications

# Datasheet

## Solstice Side-scan Sonar



### Description

Solstice is a new generation of search and classify side-scan sonar with integrated swath bathymetry.

Whilst the sonar has been designed specifically for operation on AUVs it also has a real-time mode for use on tethered vehicles, submersibles and USVs. It increases the operational envelope of a vehicle significantly by providing wide swath coverage at high resolution whilst consuming less than 12 Watts of power. The low power and wide swath results in long AUV endurance and high area coverage rates.

Solstice's onboard processing produces geo-coded side-scan imagery which is available for onboard automatic target recognition and post-mission analysis.

The imagery produced by Solstice is designed to be of the highest quality possible from a conventional (non-SAS) sonar. It is designed to produce wide swath coverage ( $\pm 100$  m), with image quality suitable for simultaneous search and classification. To achieve this, the system uses a number of innovative techniques.

Most conventional side-scan sonars have a fixed focus; Solstice provides a high-fidelity image by using a

back-projection beamforming technique to focus at every single pixel in the image.

Imagery from conventional side-scans is distorted due to non-linear platform motion, and may have gaps in coverage due to platform roll, pitch and yaw. Solstice uses knowledge of the platform motion to eliminate the effects of platform motion, producing undistorted imagery with 100% ground coverage.

Accurate imaging demands highly linear element alignment, which cannot easily be achieved mechanically. Real-time array calibration is therefore used to dynamically re-calibrate each individual hydrophone element several times a second to compensate for any dynamical strains causing array non-linearity.

Conventional side-scans are designed for operation in deep water. When required to operate in the littorals, noise from multi-path reverberation severely reduces the contrast of the imagery. Solstice has been designed to produce high-contrast imagery even in very shallow water. It employs a unique array technology which allows a wide swath coverage normally associated with wide vertical

beamwidth, whilst providing the shadow contrast associated with very narrow vertical beams.

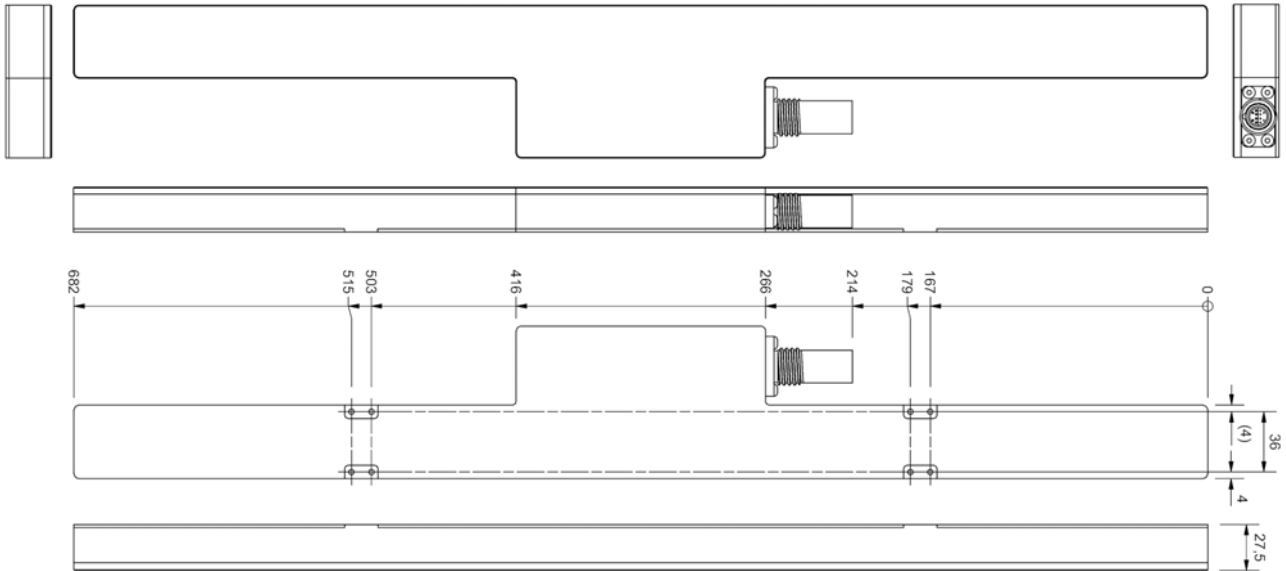
Solstice produces high quality bathymetry data from a vertical hydrophone array on each flank. The bathy data is co-registered onto the same pixel grid as the side-scan imagery, and therefore can produce stunning digital terrain maps, with the side-scan imagery accurately draped over the bottom topography.

### Key Features

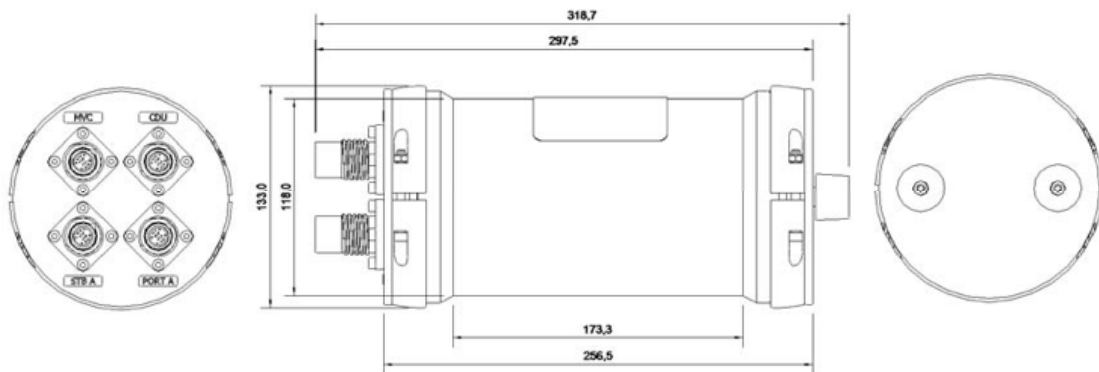
- Increases the operational envelope of existing sensor platform systems by 200%.
- <12 W power consumption for both sides – Solstice 1000
- Enables onboard computer-aided detection and classification
- Co-registered side-scan imagery with swath bathymetry
- Unique algorithms eliminate distortion at long ranges
- Multipath suppression array technology
- Real time auto-calibration
- Within the Solstice family variants are available with standard or double length aperture for even greater resolution

# Specifications

## Solstice Side-scan Sonar



Solstice 3000 shown



Optional Payload Pressure Vessel (PPV) Shown

Feature	Solstice 1000	Solstice 2000	Solstice 3000	Solstice 4000
Hydrophone Array Length	672 mm	672 mm	672 mm	1344 mm
Bathymetry	No	No	Yes	Yes
Number of Receiver Channels	2 x 8	2 x 32	2 x (32+4)	2 x (64+4)
Number of Transmitter Channels	32	32	32	32
Azimuth Beam-Width	0.15°	0.15°	0.15°	0.075°
Projector Array Length	416 mm	416 mm	416 mm	416 mm
Frequency Band	725 to 775 kHz	725 to 775 kHz	725 to 775 kHz	725 to 775 kHz
Source Level	220 dBµPa @ 1 m	220 dBµPa @ 1 m	220 dBµPa @ 1 m	220 dBµPa @ 1 m
Swath	200 m	200 m	200 m	200 m
Operational Depth Rating	200 metres	200 metres	200 metres	200 metres