

WALSH BAY ARTS AND CULTURAL PRECINCT

STATE SIGNIFICANT DEVELOPMENT APPLICATION

SSDA 8671

APPENDIX 23:

PHASE 2 ENVIRONMENTAL SITE ASSESSMENT



Phase 2 Environmental Site Assessment

Infrastructure NSW
Proposed Walsh Bay Arts and Cultural Precinct
Redevelopment

Walsh Bay Wharves
Dawes Point

19 September 2017
52304/105953 Rev 5
JBS&G Australia Pty Ltd

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Infrastructure NSW
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Abbreviations

A list of the common abbreviations used throughout this report is provided below.

AST	Aboveground Storage Tank
bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
COPC	Chemicals of Potential Concern
DME	Department of Minerals and Energy
DNR	Department of Natural Resources
DQI	Data Quality Indicator
DQO	Data Quality Objective
EPA	Environment Protection Authority
LNAPL	Light Non-Aqueous Phase Liquid
NSW	New South Wales
PAHs	Polycyclic Aromatic Hydrocarbons
PID	Photo-ionisation Detector
PPE	Personal Protective Equipment
PSH	Phase Separated Hydrocarbon
QA/QC	Quality Assurance/Quality Control
SAQP	Sampling, Analysis and Quality Plan
TPH	Total Petroleum Hydrocarbons
UCL	Upper Confidence Level
UST	Underground Storage Tank

Executive Summary

Introduction and Background

JBS&G (NSW & WA) Pty Ltd (JBS&G) was engaged by Infrastructure NSW (INSW, the client) to prepare a Phase 2 Environmental Site Assessment (ESA) of the area of the proposed Walsh Bay Arts and Cultural Precinct (WBACP). The Walsh Bay Arts and Cultural Precinct, herein defined as 'the site' is legally defined as:

- Pier 2/3 – Lot 11 in DP 1138931; and
- Wharf 4/5 (Pier 4/5 and its shore sheds) – Lot 65 in DP 1048377.

The objectives of this Phase 2 ESA are to characterise potential contamination at the site through:

- documenting the history of the site to identify areas of potential environmental concern (AECs) and contaminants of potential concern (COPC) associated with the current and former landuses;
- conducting a detailed inspection of current site conditions and surrounding land uses to identify potential on and off-site sources of site contamination;
- completing of a program of soil sampling to assess whether further works, or management plans, are required to address potential site impacts; and
- preparing a report on the results of the investigation in accordance with the requirements of OEH (2011) and DEC (2006) which draws conclusions regarding the likely suitability of the site for the proposed land use, or makes recommendations to enable such conclusions to be drawn.

The investigation was conducted in general accordance with relevant guidelines made or endorsed by the NSW Environment Protection Authority (NSW EPA). This report addresses the Secretary's Environmental Assessment Requirements (SEARs) condition Number 11 as issued for the WBACP by NSW Government Planning & Environment (the Department) which states that the Contamination Assessment Works, or ESAs must:

- *Demonstrate compliance with the requirements of SEPP 55.*
- *If remediation works are required, the EIS must include a Remedial Action Plan (RAP). The RAP must be prepared in accordance with the contaminated land planning guidelines under section 145C of the Environmental Planning and Assessment Act 1979 and relevant guidelines produced or approved under section 105 of the Contaminated Land Management Act 1997.*
- *The RAP must be- accompanied by a Site Audit Statement prepared by a NSW EPA accredited site auditor certifying that the site can be made suitable for the proposed use(s).'*

Summary of Findings

- The site is located within the Walsh Bay Conservation Zone, with a surrounding locality comprised of residential, commercial and public domain land uses.
- The site, which comprises the Walsh Bay Pier 2/3 and Wharf 4/5 structures, the adjacent Shore Shed buildings and associated wharf aprons, is estimated to have an approximate area of 2 hectares.
- Historical information indicates that the existing Pier 2/3, Wharf 4/5 and shore shed buildings were constructed circa 1910, however the alignment of the existing built structures

and seawall are consistent with earlier versions of the Walsh Bay wharves in operation as early as 1890.

- At the time of the site inspection and sampling completed the entire site surface comprised a concrete ground slab. The site was being used as a commercial performing arts centre with public foreshore access external to the existing buildings. The existing Pier 2/3 and Wharf 4/5 buildings were observed to be fully suspended structures founded on timber piles driven into the seabed. Based on observations made during the inspection it would appear that more than 50% of the shore shed buildings are similarly founded on timber piles driven in the seabed. Less than 50% of the existing shore shed buildings are founded on a seawall and possible backfill material.
- Whilst current use of the site is considered to have negligible potential for contamination of land and sea, the site was previously used as part of the Walsh Bay Wharves shipping facility. This former use, in combination with the location of the site in the central inner city suggested that heavy metals, organochlorine pesticides (OCPs), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH) and asbestos were contaminants of potential concern in soil and sediments underlying the site. The proximity of the WBACP to the former Millers Point Gasworks has also led to the inclusion of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) as potential contaminants of concern for the site.
- The installation of six boreholes was attempted across the site to assess the potential for these contaminants to be present. One or more concrete slabs at the ground surface at each location, with sandstone bedrock was encountered at all completed locations within 100mm of the slab bases. No evidence of aesthetic issues such as significant anthropogenic inclusions, odours or staining were observed during sampling.
- Representative soil samples from three of the installed boreholes were successfully collected and analysed for contaminants of potential concern (COPCs) identified at the site. Reported concentrations of the COPCs were below the adopted NEPC (2013) human health criteria for standard commercial land use. Based on the analytical results for the COPCs, no unacceptable risk to future on-site human or ecological receptors have been identified within site soils sampled during this investigation. Results of the current investigation did not identify any impacts that indicate widespread or gross contamination of the land. This was also confirmed by the results of analytical testing on one sub-slab vapour sample collected in proximity of bore JBBH06.

Conclusions

Based on the findings of this investigation and subject to the limitations presented in **Section 11**, JBS&G concludes that the site is suitable for the continued commercial land use as proposed by the State Significant Development Application (SSDA) for the WBACP. Standard unexpected find protocols should be implemented during any future development

Additionally, available information suggests that potential contaminants in sediment and seawater at the site do not appear to represent a potential human health risk for continued commercial use of the site and the associated arts/cultural use.

The WBACP SSDA SEARs Condition Number 11, requires the Contamination Assessment Works, or ESAs:

- *Demonstrate compliance with the requirements of SEPP 55.*
- *If remediation works are required, the EIS must include a Remedial Action Plan (RAP). The RAP must be prepared in accordance with the contaminated land planning guidelines under section 145C of the Environmental Planning and Assessment Act 1979 and relevant*

guidelines produced or approved under section 105 of the Contaminated Land Management Act 1997.

•The RAP must be- accompanied by a Site Audit Statement prepared by a NSW EPA accredited site auditor certifying that the site can be made suitable for the proposed use(s).'

In response to this condition, the results of this ESA conclude that a RAP is not required for the uses proposed under the WBACP SSDA. Rather, collectively the results of this ESA indicate that the site is suitable for the uses proposed under the WBACP SSDA without the need for further investigation or remediation.

1. Introduction

1.1 Introduction

JBS&G Australia Pty Ltd (JBS&G) was engaged by Infrastructure NSW (INSW, the client) to prepare a Phase 2 Environmental Site Assessment (ESA) of the area of a proposed public arts and cultural precinct at Walsh Bay.

The precinct, herein defined as 'the site' is legally defined as:

- Pier 2/3 – Lot 11 in DP 1138931; and
- Wharf 4/5 (Pier 4/5 and its shore sheds) – Lot 65 in DP 1048377.

1.2 The Project

The NSW Government is committed to development of a public arts and cultural precinct at Walsh Bay. Infrastructure NSW is acting on behalf of the client, Arts, Screen and Culture Division, in preparing this State Significant Development Application (SSDA) for the Walsh Bay project.

This SSDA will seek approval for the construction and operation of Pier 2/3 and Wharf 4/5 for arts and cultural uses with complementary commercial and retail offerings to activate the precinct.

The site generally comprises Pier 2/3, Wharf 4/5, and Wharf 4/5 Shore Sheds. The site has a street frontage to Hickson Road as shown in Figure 1. The site is part of the Walsh Bay area, which is located adjacent to Sydney Harbour within the suburb of Dawes Point. **Figure 1** presents the location of the site and **Figure 2** shows the extent of the site boundaries and current layout.

It is understood that the scope of the Project is as follows:

Pier 2/3:

- The adaptive re-use providing for new arts facilities including performance venues for the Australian Chamber Orchestra, Bell Shakespeare and Australian Theatre for Young People;
- Retaining a large heritage commercial events/art space for events such as Sydney Writers Festival, Biennale of Sydney and a wide range of commercial and artistic events;
- A series of stairs, external lift and balconies designed as a contemporary interpretation of the original gantries reflecting the precinct's former industrial heritage; and
- Modifications to the roof

Wharf 4/5 (including Shore Sheds)

- Refurbishment of the ground floor arts facilities and its associated Shore Sheds for Bangarra Dance Theatre, Sydney Dance Company, Sydney Philharmonia, Gondwana and Song Company;
- New commercial retail opportunities;
- A series of stairs, external lifts and balconies designed as a contemporary interpretation of the original gantries reflecting the precinct's former industrial heritage; and
- Modifications to the roof.

1.3 Objectives

The objectives of this Phase 2 ESA are to characterise potential contamination at the site through:

- documenting the history of the site to identify areas of potential environmental concern (AECs) and contaminants of potential concern (COPC) associated with the current and former landuses;
- conducting a detailed inspection of current site conditions and surrounding land uses to identify potential on and off-site sources of site contamination;
- completing of a program of soil sampling to assess whether further works, or management plans, are required to address potential site impacts; and
- preparing a report on the results of the investigation in accordance with the requirements of OEH (2011) and DEC (2006) which draws conclusions regarding the likely suitability of the site for the proposed land use, or makes recommendations to enable such conclusions to be drawn.

The investigation was conducted in general accordance with relevant guidelines made or endorsed by the NSW Environment Protection Authority (NSW EPA).

1.4 Report Structure

The structure of this report is as follows:

- Section 1 – Introduction, project background and objectives of the ESA;
- Section 2 – Site condition and surrounding environment. This section provides the context, as determined by site inspection and desktop information review, of the area subject to this environmental site assessment;
- Section 3 – Site history. This section summarises the findings of previous investigations completed at the site that were made readily available to JBS&G, and that relate to the contamination status of soil and groundwater underlying the site;
- Section 4 – Conceptual site model. This section summarises the expected status of contamination at the site as based on the desktop review of site conditions and history;
- Section 5 – Sampling and analysis plan. This section documents the sampling plan completed at the site to characterise subsurface conditions at the site and inform the ESA conclusions;
- Section 6 - Assessment criteria. This section identifies the criteria used to assess environmental data collected from the site;
- Section 7 – Quality Assurance / Quality Control (QA/QC) – This section assesses the QA/QC of the environmental data collected for the site and addresses;
- Section 8 - Results. This section summarises the field observations made and sampling results collected from the site;
- Section 9 – Site characterisation. This section provides a detailed discussion of the status of the site with respect to exposure of future site users to contamination;
- Section 10 – Conclusions and recommendations made with respect to suitability of the site for the proposed use; and
- Section 11 – Limitations. This statement should be read in conjunction with the ESA report.

2. Site Condition & Surrounding Environment

2.1 Site Identification

The location of the site is shown on **Figure 1**. The available site details are summarised in **Table 2.1** and described in detail in the following sections.

The Walsh Bay Arts and Cultural Precinct (WBACP) (the “site”) generally comprises Pier 2/3, Pier 4/5 and its shore sheds which make up Wharf 4/5, as well as the adjoining waterway. The site has a street frontage to Hickson Road. The site is part of the Walsh Bay area which is located adjacent to Sydney Harbour within the suburb of Dawes Point. The site is located within the City of Sydney Local Government Area.

Walsh Bay is strategically located to the north of Sydney’s CBD in the vicinity of major tourist destinations including the Sydney Harbour Bridge, the historic areas of Millers Point and The Rocks, Circular Quay and the Sydney Opera House. The Barangaroo redevelopment precinct is located immediately to the south-west.

Table 2.1: Summary Site Details

Lot/DP	Lot 11 DP 1138931 and Lot 65 in DP 1048377
Address	Hickson Road, Dawes Point, NSW 2000
Local Government Authority	City of Sydney Council
Site Zoning	Lot 11 DP 1138931: Zone 1-Walsh Bay Conservative Zone and Zone 2-Walsh Bay Waterway Zone in Sydney Regional Environmental Plan No 16. Lot 65 DP 1048377: Zone 1-Walsh Bay Conservative Zone-Sydney Regional Environmental Plan 16.
Approximate co-ordinates of the centre of the site (MGA 56)	Easting: 334091.675 Northing: 6252401.537
Current Use	Owned by Roads and Maritime Services (RMS) and occupied by Arts NSW and Department of Justice under various lease arrangements primarily for arts and cultural uses
Previous Use	Berths for international and inter-state shipping
Site Area	Approximately 18,090 m ²

Pier 2/3 is legally described as Lot 11 in DP 1138931 and Wharf 4/5 is legally described as Lot 65 in DP 1048377. The total area for these lots is 18,090m².

2.2 Site Description

The site forms part of the Walsh Bay Wharves (**Figure 1**) which are located adjacent to Sydney Harbour. The current formation of the Walsh Bay Wharves comprises ten berths constructed between 1908 and 1922 for international and inter-state shipping, as follows:

- Pier 1 currently occupied by the Sebel Pier One Sydney Hotel;
- Pier 2/3 the last remaining undeveloped pier (has previously received approval for cultural uses, temporary arts events and some commercial events);
- Wharf 4/5 which is occupied by the Sydney Theatre Company (STC), the Australian Theatre for Youth Program (ATYP), Sydney Dance Company (SDC), Bangarra Dance Theatre and the choirs comprising Gondwana, the Song Company and Sydney Philharmonia;
- Pier 6/7 which has been redeveloped for residential apartments and associated boat marina;
- Pier 8/9 which has been redeveloped for office uses; and
- Shore sheds aligning Hickson Road which contain a range of commercial activities, including restaurants, bars, shops and offices.

The recent redevelopment works mentioned above are understood to have occurred between 1997 and 2004 by the NSW Government in conjunction with the Walsh Bay Partnership. The areas of recently development at the Walsh Bay Wharves are external to the boundaries of the site.

A detailed inspection of the site was conducted by JBS&G on 19 February 2014 which included inspection of the nearby surrounding infrastructure. The site layout is shown on **Figure 2**. Entry to Pier 2/3 (and associated shore sheds) and Wharf 4/5 was through vehicle driveways and pedestrian access points (i.e. breezeways) along Hickson Road. Wharf 4/5 was occupied by a large rectangular four storey timber building, extending from the landward end at Hickson Road, to the northern end of the wharf. Pier 2/3 consisted of a wharf occupied by a vacant heritage-listed two-storey warehouse building. Shore sheds, comprising two storey warehouse buildings, were present at the landward end of Pier 2/3, currently occupied by a café/restaurant and small performing arts studio. Land between these buildings and extending to the edges of the Piers comprised a concrete apron which provided public access to the foreshore.

Additionally, visible sections of the seawall were present at the southeastern end of the site. Access stairs to sea level between Pier 2/3 and Wharf 4/5 allowed for observation of foundations underlying the Shore Shed buildings. Timber piles were visible under the concrete apron of the wharf and parts of the Shore Sheds. **Figure 3** shows the approximate position of the seawall under the site based on these locations. Based on this position it is considered that part of the shore shed buildings are supported on timber footings. The client's representative, present during the site inspection, confirmed that only the southern end of the Shore Sheds is founded on land.

Anecdotal information provided during the site inspection from the client's representative indicated that Pier 2/3 is the last wharf structure within the Walsh Bay Wharves remaining in its original state. The following features were observed upon inspection of the Pier 2/3 building:

- structural columns present throughout the building;
- a stairway located towards the central portion of the warehouse building, providing access from the ground floor to the second storey level;
- an elevator lift noted within proximity of the stairway;
- several sections of the building were barricaded, including a small section on the ground level in the western portion of building, and on the second storey towards the central to northern portion of the upper building area was barricaded. These barricaded areas contained several heritage items, including construction material and metal works owned by RMS; and
- basic utility services were present in the building comprising electricity mains and sewer system located on the ground level and storm water conduits located on top of the roof. Observations were also made of new roof insulation installed through the warehouse building.

Anecdotal information provided by the client's representative indicated that several columns will be removed (replaced by steel trusses) to facilitate the proposed arts and cultural development plans. Additionally, it was indicated that the heritage materials observed in the building may potentially be incorporated into the Design.

The Shore Sheds were observed to consist of a row of double-storey (double brick and timber) warehouse sheds, located at the landward end of Pier 2/3. Observations of the Shore Sheds noted that they are currently occupied by commercial tenancies (ground level) and arts and cultural organisations (performing arts studios). Due the current occupancy of the Shore Sheds, a detailed site inspection was unable to be completed within these buildings. The client's representative confirmed that the general structure of the Shore Sheds will be retained as part of the SSDA, with any upgrade works restricted to internal refurbishment.

The Wharf 4/5 building was occupied by the STC, ATYP, BDT and other arts organisations at the time of the inspection. A café/restaurant was also located at the southern end of the Wharf 4/5 building. The third level of the building (towards the central to southern portion of the building) consisted of the stage design/prop workshop. According to Arts NSW, no change was proposed to the workshop as part of the Stage 2 DA works. Observations noted that various painting and oil chemicals were used in the workshop in the construction of stage performance props. A staff member from the Sydney Theatre Company confirmed that an oil and waste recycling drainage system was installed the building. Furthermore, air filtration systems were installed within the workshop area to reduce inhalation exposure to chemicals for employees.

During the 2014 inspection of Wharf 4/5, JBS&G field staff were informed that the rooftop of the building is installed with 'green' pipework which collects rainwater as part of the 'Greening the Wharf' project for the City of Sydney Council, a harvesting, storage and reticulation system which supplies non-potable water for all Pier 4/5 amenities. It is also understood that solar panels were also installed to the rooftop of the building on Wharf 4/5 as part of the 'Greening the Wharf' project.

A more recent inspection of the site was completed on 25 August 2017 by JBS&G and site conditions were consistent observed during the 2014 inspection. No significant changes with respect to land use or potentially contaminating activities were observed.

2.3 Surrounding Landuse

The current landuse of adjacent properties or properties across adjacent roads is summarised below.

- North – immediately north is Sydney Harbour.
- East – to the east is Pier One (Sebel) Hotel Sydney Harbour Bridge, The Rocks, Circular Quay and Sydney Opera House.
- South – to the south are a series of smaller property lots which appear to be used for either residential or commercial purposes. South of the site is Sydney's CBD.
- West – to the west are Walsh Bay wharves (Piers 6/7 and Piers 8/9), Millers Point and Sydney Harbour. South-west of the site is the Barangaroo redevelopment precinct.

Inspection of the surrounding properties was beyond the scope of this Phase 1 ESA, however based only on the external viewing of these areas and review of aerial photography, there did not currently appear to be any significant potential offsite contamination sources located in the properties around the site.

2.4 Topography

Survey plans provided indicate that the area of the site is flat and present at a relative level of 2.5m above Australian Height Datum (m AHD) which is level with the adjacent Hickson Road. Site observations noted large sandstone rockfaces are present opposite the site at the southern end of Hickson Road, and that the site is some 10 to 20m below the ground level along Pottinger Street and areas located further south.

2.5 Hydrology

The site is adjacent to, and is in part suspended above, Walsh Bay which forms part of Sydney Harbour. The site is predominantly sealed, covered in concrete footpaths, over which surface water generated by heavy or prolonged rainfall is likely to be run directly into the harbour.

2.6 Geology

Review of the regional geological map (DMR 1983) indicated the site is located in an area of Middle Triassic Hawkesbury Sandstone, part of the Wianamatta Group. The Wianamatta Group comprises medium to coarse-grained quartz sandstone, very minor shale and laminite lenses.

Review of the regional soil map (SCS NSW 1989) indicated that the site is located on the Gymea residual soil landscape group. The typical Gymea landscape is characterised by undulating to rolling rises and low hills on Hawkesbury Sandstone. Gymea soils are shallow to moderately deep Yellow Earths and Earthy Sands on crests and inside of benches; shallow Siliceous Sands on leading edges and benches; localised Gleyed Podzolic Soils and Yellow Podzolic Soils on shale lenses; shallow to moderately deep Siliceous Sands and Leached Sands along drainage lines. Limitations of soils in the Gymea group are localised steep slopes, high soil erosion hazard, rock outcrop, shallow highly permeable soil, very low soil fertility.

Review of the Natural Resource Atlas (DNR website) indicated that the site is located in an area of potential acid sulphate soils (ASS).

2.7 Hydrogeology

Registered groundwater bore information obtained from the Natural Resources Atlas database identified 36 groundwater bores within one km of the site. Details registered for these bores is included in **Appendix A** and summarised in **Table 2.2** below.

All bores on the database within 1km of the site have been registered for use as monitoring wells. The monitoring wells are installed to depths of between 3 and 17 m, with standing water levels reported for only two wells at depths of approximately 2.5m below ground level (m bgl).

Where the geology encountered was reported, it consisted of clay, silty sand or gravel fill.

It is anticipated that groundwater in the vicinity of the site would migrate in a northerly direction towards Walsh Bay. As such, and noting that the site borders Walsh Bay, it is considered that the monitoring wells listed in **Table 2.2** would not be influenced by activities at the site.

Table 2.2: Groundwater Bores Summary Details

Bore ID	Location (approximate)	Intended Purpose	Drilled Depth (m bgl)	Standing Water Level (m bgl)
GW109085	660 m west of site, property of Sydney water	Monitoring	5.68	N/A
GW109086	661 m west of site, property of Sydney water	Monitoring	5.68	N/A
GW109087	662 m west of site, property of Sydney water	Monitoring	8.50	N/A
GW111570	201 m west of site, within Barangaroo Headland	Monitoring	6.00	2.72
GW111571	200 m west of site, within Barangaroo Headland	Monitoring	6.00	2.65
GW112871	520 m south east of site, within Sydney Opera House premises	Monitoring	20.00	N/A
GW112872	510 m south east of site, within Sydney Opera House premises	Monitoring	20.12	N/A
GW112873	510 m south east of site, within Sydney Opera House premises	Monitoring	15.10	N/A
GW113553	260 m west of site, within Barangaroo Headland	Monitoring	5.20	N/A
GW113554	310 m west of site, within Barangaroo Headland	Monitoring	5.00	N/A
GW113555	351 m south west of site, within Barangaroo Headland	Monitoring	14.00	N/A
GW113556	350 m south west of site, within Barangaroo Headland	Monitoring	14.00	N/A
GW113557	400m south west of site, within Barangaroo Headland	Monitoring	12.00	N/A
GW113558	410 m south west of site, within Barangaroo Headland	Monitoring	14.00	N/A
GW113559	450 m south west of site, within Barangaroo Headland	Monitoring	4.00	N/A
GW113560	460 m south west of site, within Barangaroo Headland	Monitoring	3.60	N/A
GW113561	480 m south west of site, within Barangaroo Headland	Monitoring	4.50	N/A
GW113562	500 m south west of site, within Barangaroo Headland	Monitoring	10.70	N/A
GW113563	530 m south south-west of site, within Barangaroo Headland	Monitoring	11.70	N/A
GW113564	550 m south south-west of site, within Barangaroo Headland	Monitoring	7.00	N/A
GW113565	540 m south south-west of site, within Barangaroo Headland	Monitoring	4.00	N/A
GW113566	530 m south south-west of site, within Barangaroo	Monitoring	3.00	N/A

	Headland			
GW113596	510 m west of site, within Barangaroo Headland	Monitoring	14.10	N/A
GW113597	510 m west of site, within Barangaroo Headland	Monitoring	9.50	N/A
GW113598	520 m west of site, within Barangaroo Headland	Monitoring	13.20	N/A
GW113599	560 m west of site, within Barangaroo Headland	Monitoring	13.50	N/A
GW113602	550 m west of site, within Barangaroo Headland	Monitoring	17.00	N/A
GW113603	555 m west of site, within Barangaroo Headland	Monitoring	14.50	N/A
GW113604	540 m west of site, within Barangaroo Headland	Monitoring	8.20	N/A
GW113605	535 m west of site, within Barangaroo Headland	Monitoring	3.00	N/A
GW113606	545 m west of site, within Barangaroo Headland	Monitoring	13.00	N/A
GW113607	530 m west of site, within Barangaroo Headland	Monitoring	7.20	N/A
GW113608	520 m west of site, within Barangaroo Headland	Monitoring	13.00	N/A
GW113610	525 m west of site, within Barangaroo Headland	Monitoring	12.20	N/A
GW113611	550 m west of site, within Barangaroo Headland	Monitoring	7.50	N/A
GW113612	520 m west of site, within Barangaroo Headland	Monitoring	13.00	N/A

2.8 Detailed Consideration of Proposed Redevelopment

A summary of the works associated with the development as provided by the client is presented in **Table 2.3** along with the anticipated built form and landscape modifications required.

Table 2.3: Summary of Works Required for Redevelopment

Proposed Change in Land Use	Anticipated Built Form or Landscape Change
The transformation of Pier 2/3 building to accommodate the Australian Chamber Orchestra, Bell Shakespeare and Australian Theatre for Young People. The retention of a large 'raw' space in Pier 2/3 for events, festivals and functions.	Removal of internal columns within the Pier 2/3 building
A major upgrade of ground floor facilities at Wharf 4/5, allowing Bangarra to confirm its place as the premier Indigenous performing arts company and maximise new tourist and engagement opportunities	Removal of internal columns within the Wharf 4/5 building, repair of the external Wharf 4/5 building walls
The expansion of creative and commercial activities along the shore sheds offering cafes, restaurants, retail and commercial activities to further enhance the visitor experience	New tenancies to be established in Pier 2/3 and Wharf 4/5 shore shed buildings but no changes of note to building structures

The works described in **Table 2.3** will be completed within, or will connect to, the original Walsh Bay commercial wharves which are close to 100 years old. JBS&G has been provided with '*Walsh Bay Arts Precinct, Conceptual Structural Design Report*' prepared by Taylor Thomas Whiting and dated February 2014 (TTW 2014) for the proposed works. A copy of TTW (2014) including copies of the proposed redevelopment footprint is provided as **Appendix B**. In assessing the current condition of structures at the site TTW (2014) confirmed that Pier 2/3 and Wharf 4/5 are all timber wharves comprising turpentine timber piles with hardwood pile caps, beams and decking. Some of the exposed apron decks were reportedly replaced with thin concrete slabs in the 1930s.

The wharves were reported to be present in typically 6 to 15 metres depth of water, but the seabed was considered to be extremely soft, with the depth to founding materials in excess of 20m below seabed level at some locations. Apron deck levels were reported to be typically between 4 and 6m AHD.

It was also reported that the supporting structure for the proposed WBAP will be constructed with reinforced concrete headstocks and beams with hardwood timber bearers supporting the deck planks. All concrete would be reinforced with V-rod reinforcing (glass fibre reinforced deformed plastic) to avoid chloride attack on steel reinforcing.

Provision of advice by INSW has confirmed that screw pile construction will be utilised to spirally wind steel tube piles to foundation levels below the deep marine muds. The seabed between Piers 3 and 4 was considered to comprise deep, very soft overburdens overlying Hawkesbury Sandstone, which in turn is typically characterised by a number of buried "cliffs".

TTW (2014) reported that the original timber piles at Walsh Bay are set out on a 10ft by 10ft grid in the Piers. In the previous upgrades and repairs carried out on the Piers, many of the piles were regarded as redundant and not repaired as the live load for the recent use was considered to be much less than the original design loads as part of a cargo wharf. It was considered that for the proposed SSDA use, the opportunity exists to add jack-up piles in these redundant pile locations to provide extra footing capacity to support the additional loads intended for Pier 2/3, should it be required.

It was also noted that routine rehabilitation of existing piles under Pier 2/3 and Wharf 4/5 has been occurring over the last decade, understood to comprise the replacement of between 5 and 10 piles per year based on the severity of degradation. It is understood that the routine maintenance works replace the existing timber piles with 'jack-up' piles or pile segments through exposing the existing timber pile, cutting (or splicing) the pile to the sound timber stump, cleaning of the stump, inserting a steel collar at the stump and insert a new pile segment through the collar.

3. Site History

3.1 Aerial Photographs

Copies of aerial photographs were obtained from the Department of Land and Property Information, with copies provided in **Appendix C**. Additional aerial photographic imagery from the period from 2011 to September 2016 was reviewed online using NearMap Imagery. Relevant information from the aerial photograph review is summarised below.

- 1930: The quality of the 1930 image is poor which prevented a detailed viewing of the site area. Wharf structures consistent with the current (i.e. 2014) configuration are visible at Pier 2/3 and Wharfs 4/5. Smaller buildings are visible between Pier 2/3 and Wharf 4/5 and the southern end and to the southwest of Wharf 4/5 consistent with the current (i.e. 2014) configuration of the shore sheds. Large shipping vessels are visible adjacent to Piers 2 and 3, consistent with use of this area ship berthing, associated activities and other commercial operations.
- At the eastern end of the site Pier 1 is visible, and the western end of the site Piers 6/7 and 8/9 are visible, also with large shipping vessels adjacent to each structure.
- 1951: The site and surrounding areas appear generally similar to the previous aerial image. Shipping vessels are visible in Darling Harbour adjacent to all piers and wharfs forming the Walsh Bay Wharves. Large buildings are also clearly visible on the 1951 image adjacent to all piers and wharfs forming the Walsh Bay Wharves.
- The road network visible in the area to the south of the Walsh Bay Wharves appears to have undergone significant redevelopment since the previous image.
- 1961: The site appears generally similar to the previous aerial image. The road network visible in the area to the south of the Walsh Bay Wharves appears to have undergone significant redevelopment since the previous image.
- 1970: The site and surrounding areas appear to be generally similar to the previous aerial image.
- 1986: The site and surrounding areas appear to be generally similar to the previous aerial image.
- 1999: The roofing material on the Wharf 4/5 building and the shore sheds on the site appear to have been upgraded, however the shape and nature of these buildings appears to be unchanged. Apart from this minor difference, the site and surrounding areas appear to be generally similar to the previous aerial image.
- 2011: The roofing material on the all buildings on the site appears to have been changed since the 1999 image, however the shape and nature of these buildings appears to be unchanged. Apart from this minor difference, the site and surrounding areas appear to be generally similar to the previous aerial image.
- 2014-2016: The site and surrounding areas remained unchanged in comparison to the 2011 image.

3.2 EPA Records

A search of the EPA's public register under the Protection of the Environment Operations Act 1997 was undertaken (**Appendix D**). The search identified that, for the site, there were:

- No prevention, clean-up or prohibition notices;

- No transfer, variation, suspension, surrender or revocation of an environment protection licence.

A search was also undertaken through the EPA's public contaminated land register (**Appendix D**). The search identified that there have been no notices issued under the Contaminated Land Management Act 1997 (CLM Act) for the site.

The site has not been notified to the EPA as containing significant contamination. It is noted that the nearby site of the former Millers Point gasworks on Hickson Road was subject to several notices (2 current and 2 former) in which the EPA states the former gasworks may be contaminated with the following substances: polycyclic aromatic hydrocarbons (PAHs); benzene, toluene, ethylbenzene and xylene (BTEX); copper; cyanide; lead; and phenol. The latest entry with respect to the former gasworks indicates that the notice has been lifted by the EPA and the former gasworks is no longer subject to regulation by the EPA.

The site is considered not to have been impacted by the former Millers Point gasworks.

3.3 Title Details

A historical title search was conducted for Pier 2/3 (Lot 11 in DP 1138931), and Wharf 4/5 (Lot 65 in DP 1048377). Copies of title records are included in **Appendix E**.

The property lots which comprise the site are incorporated within the Sydney Harbour and foreshores title. Numerous leases and easements have been registered over the subject land, however detailed investigation of this complex title is beyond the current scope of works. In lieu of this detailed analysis of title the following information was obtained from the basic historical title search:

- The site is currently registered to the Maritime Authority of New South Wales, and has been in the ownership of the Maritime Authority of New South Wales (currently Roads and Maritime Services) or its predecessors since around 1900; and
- Both Pier 2/3 and Wharf 4/5 are occupied under various leases with the NSW Minister for the Arts including leases registered for Lot 65 in DP 1048377 for the Bangarra Dance company, Australian Dance Council, Australian Theatre for Young People.

3.4 Council Records

The zoning certificate for the site was obtained from Sydney City Council, and is included in **Appendix F**. Relevant information for the site (Lot 11 in DP 1138931 and Lot 65 in DP 1048377) is summarised below:

- Pier 2/3 (Lot 11 DP 1138931) is zoned in Zone 1-Walsh Bay Conservative Zone-Sydney Regional Environment Plan 16 and Zone 2-Walsh Bay Waterway Zone-Sydney Regional Environmental Plan No 16.
- Wharf 4/5 (Lot 65 DP 1048377) is zoned in Zone 1-Walsh Bay Conservative Zone-Sydney Regional Environmental Plan 16.
- The land does not include or comprise critical habitat. The property has been identified within a Heritage Conservation Area and has been identified of state heritage significance, and entered on the State Heritage Register.
- The land has been identified as being on an Acid Sulphate Soils Map as being Class 1 or Class 2.
- The land is not a declared investigation area or remediation site, or the subject of an investigation order or remediation order under the CLM Act 1997. The land is not the subject

of a voluntary investigation or remediation proposal or a site audit statement within the meaning of the CLM Act 1997.

3.5 WorkCover Dangerous Goods Licence Database

A search of the NSW WorkCover Stored Chemical Information Database (SCID) was conducted, and the results are included in **Appendix G**. WorkCover records show that a licence for the storage of up to 250L of flammable goods has been obtained by the Sydney Theatre Company as part of their operations on Wharf 4/5. The flammable goods registered for the site are ethylmethyl ketone, isopropanol and turpentine substitute and have been listed as being required for production of live performances. Sketches of the storage submitted as part of the licence show these items stored within a flammable gas cupboard within the ground floor props workshop and also within a roofed store. The last renewal of this licence was dated 2006 and is understood to be current.

3.6 Heritage Listings

A heritage assessment of the proposed development was undertaken on the site was documented in the report *'Walsh Bay Arts Precinct; Heritage Assessment Report'*, Design 5 Architects, dated February 2014, (Design 5, 2014).

Design 5 (2014) included an assessment of items of national, state and local heritage significance that may be present at the site. It was noted that the entire Walsh Bay Wharves Precinct is listed on the State Heritage Register (SHR).

With respect to history of the Walsh Bay Precinct the following was noted:

- Upon colonisation, the first industry in the area included windmills and quarrying.
- As import/export trades prospered, this increased the value of waterfront areas for merchants and private wharves were constructed in the area. Continued wealth from the Gold Rush during the 1850s boosted Sydney's local economy and the larger sailing vessels of the 1860s and 1870s prompted the expansion of private wharves, and the building of jetties and wharves. By 1900 there were fourteen finger wharves in Walsh Bay (**Figure 4**). The original shoreline through some areas of Walsh Bay was extended through land reclamation, and the building of parallel wharves to reach out to the deep waters where large vessels berthing commenced.
- Private ownership of the wharves prior to 1900 reportedly resulted in makeshift developments and poor conditions. The outbreak of the Bubonic Plague in 1900 acted as a catalyst for the creation of the Sydney Harbour Trust and the resumption of the wharves by the Government. The construction of the present configuration of wharves in Walsh Bay was made possible at that time.
- Sydney Harbour Trust oversaw development of the current timber-pile wharves, two longshore wharves, shore sheds, a low level roadway and an upper level road. Renewal projects commenced in 1909 with the construction of the low-level Hickson Road. This progress was critical to the redevelopment of the area, providing shoreline access to the wharves as well as connectivity to the railway yards at Darling Harbour and the wharves at the Pyrmont peninsula.
- In 1910, as a response to the general panic prompted by the plague, the Sydney Harbour Trust developed an innovative rat-proof sea wall constructed of reinforced concrete, spanning from the head of Darling Harbour to Millers Point. Construction of overhead bridges connecting the Walsh Bay Wharves to Pottinger Street commenced in 1913.
- Pier 2/3 was reportedly commenced in 1912, completed in 1922 and leased to the Adelaide Steamship Company. Pier 2/3 was also reportedly used as a general cargo wharf for overseas vessels from 1925 to the 1970s.

- Wharf 4/5 was reportedly commenced in 1913, completed in 1923, and leased to the Maritime Services Board until 1928;
- By the 1960s Pier 2/3 was reported to be in a deteriorating state and required repairs, including the replacement of the timber apron with concrete, and the renewal of the piles and deck in 1974. By the 1970s the Walsh Bay wharves, unable to accommodate container freight, ceased functioning as commercial wharfage. By the early 1980s the wharves were reported to be severely neglected, and faced 'the very real danger of collapse'; and
- In the 1980s Pier 4/5 was secured by the Sydney Theatre Company which marked the transition of the area into a cultural use space.

3.7 Previous Investigations

3.7.1 Soil and Groundwater Investigations

JBS&G has been provided with a copy of '*Initial Contamination Assessment, Walsh Bay Redevelopment Project, Sydney NSW*' Prepared by HLA-Envirosciences Pty Limited and dated August 1996 (HLA 1996). HLA (1996) documents a historical review and limited soil sampling program undertaken across the Walsh Bay Wharves including Hickson Road, but excluding Wharf 4/5. Nine soil bores were drilled in areas considered likely to be underlain by fill and/or in areas likely to require excavation as part of any future Walsh Bay upgrade.

Of relevance to the site, was the drilling of one location, BH-7, which was placed at the southern end of Pier 2/3 and just inside the sea wall. The profile encountered at this location comprised concrete to 0.4m, overlying brown silty sand fill to 1.7m and then weathered sandstone. Refusal in BH-7 was encountered on competent sandstone at 2.5m below ground level. A sample of the fill material at 1 to 1.5 metres from BH-7 was submitted for analysis. While the full set of laboratory results was not summarised in the copy of HLA (1996) provided for review, the tabulated results for this location reported a total polycyclic aromatic hydrocarbons (PAHs) concentration of 23 mg/kg, a concentration of mercury, cadmium and all total petroleum hydrocarbons (TPH) fractions less than the laboratory detection limit and arsenic, lead, copper and zinc concentrations less than 50mg/kg.

While HLA (1996) did not provide detailed assessment or discussion of these results, the report generally concluded that the investigation came across some areas of soil and groundwater contamination that should be considered in the planning of Walsh Bay. However, it was considered that none of the identified contamination was significant enough to affect the feasibility of proposed Walsh Bay redevelopment.

As part of the report review JBS&G has compared the results reported in HLA (1996) to the Health based Investigation Levels (HILs), outlined in NEPC 2013¹, for commercial/industrial land use (HIL-D) and public open space use (HIL-C). Concentrations in the BH-7 1-1.5m sample were all less than the current HIL-C and HIL-D criteria applicable to the site. This indicates that fill material under the site, if present, is not likely to be grossly impacted.

3.7.2 Marine Impact Assessment

JBS&G has been provided with a copy of '*Walsh Bay Redevelopment, Master Plan Development Application Marine Report*' prepared by Patterson Britton Pty Limited dated 1996 (PB 1996). The report summarises the marine environment at Walsh Bay and assessment of how the marine environment would be affected by the 1996 Master Plan.

In characterising the marine environment at Walsh Bay, PB (1996) noted that:

¹ National Environment Protection (Assessment of Site Contamination) Measure 1999 (April 2013), NEPC 2013, Canberra.

- the piers associated with the existing Walsh Bay Wharves encroach some 40m into Port Jackson;
- water depths ranged between 6m (in shore areas) to 15m moving west across the wharves;
- the top of the seabed floor under Walsh Bay ranges from RL-3m to RL -15m. Recently deposited surficial silts and clayey silts overlay older marine sediments consisting of interbedded clays, sands and clayey sands. The profile near the seawall is extremely shallow consisting of several metres of recently deposited silts overlying sandstone. The profile towards the ends of the wharves typically consists of up to 8m of recently deposited very soft silts and clayey silts overlying approximately 15 m of loose to medium dense sands and clayey sands, approximately 20m of soft marine clay and then sandstone; and
- the top of the sandstone bedrock under Walsh Bay ranges from RL-5m near the seawall end to RL -51m at the end of the wharves. Sandstone bedrock ranges from extremely weathered to very strong and fresh;

With respect to the effects of the development on the marine environment PB (1996) concluded that:

- repairs or replacement of piles will cause no material disturbance of the seabed while divers are cutting off the top of the pile just above the seabed in order to insert a jacket over the top of the timber stub. It was also noted that such pile replacements works are carried out on a continuous basis at Walsh Bay, and that the completion of such works even in areas of high contamination of seabed material is considered not to cause any deleterious effects due to the localised areas of works and the short time period required for the seabed to subsequently stabilise and recover.
- installation of new piles by driving tubular steel piles were considered to have an almost imperceptible disturbance of seabed materials or re-suspension of sediments during these operations.

Prior to the completion of Cardno (2016), as summarised in **Section 3.7.4**, and in the absence of any readily available documentation regarding sediment quality at the site, JBS&G undertook a review of sediment quality data available for the general Port Jackson area including sediments within Darling Harbour and adjacent to the nearby Barangaroo development site, with the following noted:

- a study of sediment toxicity in the 50km² area of the Sydney Harbour (Birch et al. 2008) reported that sediments collected from the central embayment of Sydney Harbour, which includes Walsh Bay, were contaminated with heavy metals, polychlorinated aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs). While sources of these impacts were not discussed in detail they were generally attributed to urban runoff and discharges.
- With respect to Darling Harbour and the vicinity of Barangaroo, sediments in these areas have also been reported as impacted with heavy metals, PAHs, OCPs and PCBs in addition to petroleum hydrocarbons. The source of these impacts has been reported to be the dumping of fuel and waste from ships and shipping associated operations, discharges from former gasworks, and other commercial operations, directly into the local stormwater network, leaching of antifouling paints, and other land based discharges into Darling Harbour and other areas of Port Jackson.

3.7.3 Building Assessments

JBS&G has been provided with a copy of *'Hazardous Materials Re-Assessment, Wharf 4-5 Hickson Road Walsh Bay NSW'* Prepared by Prensa Pty Limited and dated September 2012 (Prensa 2012). Prensa (2012) documented and inspection of the interior and exterior of the Wharf building during

which bonded asbestos, lead containing paint, synthetic mineral fibres and polychlorinated biphenyls were all identified as present within the fabric of the current structure. Prensa (2012) included recommendations for management of these items during the proposed redevelopment including nominating conditions which would trigger the need for an Occupational Hygienist to be present during redevelopment works to ensure appropriate management of identified/suspected hazardous materials as may be disturbed during site works.

3.7.4 Sediment Investigation

JBS&G has been provided with a copy of *'Walsh Bay Redevelopment Preliminary Sediment Investigation'* prepared by Cardno (NSW/ACT) Pty Ltd and dated 7 November 2016 (Cardno 2016). Cardno (2016) documents a historical review and a sediment sampling program undertaken to characterise the marine sediments in the vicinity of the Walsh Bay Wharves. Sediment samples were collected from seven sites (S1-S7) within the proposed waterfront square between Pier 2/3 and Wharf 4/5, with additional samples collected from two reference sites (S8-S9) between Wharf 4/5 and Wharf 6/7.

Sediment samples were collected using handheld corers (7 cm diameter and 40 cm length) by divers at a water depth of approximately 10-12 m. The top and bottom 20 cm of the core was separated, mixed and placed in different containers. Samples from S1, S2, S4, S6 and two reference samples were submitted for laboratory analysis. The 95% upper confidence limit (UCL) values calculated were used to assess data using screening levels adopted from National Guidelines for Dredging (Commonwealth of Australia 2009) and Interim Sediment Quality Guidelines (ISQGs) in ANZECC/ARMCANZ (2000), revised as Sediment Quality Guideline Values (SQGV) in Simpson et al (2013).

While laboratory certificates of analysis for sediment samples were not included in Cardno (2016), tabulated analytical results were provided in the report. The 95% UCL calculated for arsenic and chromium marginally exceeded SQGV (low) value in top and bottom sediment, whilst copper was reported several times above this level. The 95% UCL calculated for lead, silver and zinc exceeded SQGV (low) and SQGV (high) values in top and bottom sediment. 95% UCL for total PAHs and OCP compound DDD in bottom sediment and OCP compound DDE in top sediment marginally exceeded SQGV (low) values. All detected TPHs were below adopted assessment criteria, while BTEX was reported below laboratory limit of reporting.

Cardno (2016) considered that contaminant concentrations were generally comparable between top and bottom sediments with the exception of OCP compound HCB detected at low concentrations in the S6 bottom sediment. Additionally, it was considered that the contaminant concentrations reported within the site were also comparable with the reference samples. It was noted that heavy metals, PAHs and OCPs concentrations reported exceeding assessment criteria were considered indicative of historical industrial practices in the wider Sydney Harbour area, with reported concentration comparable with or less than historical data from other locations in Sydney Harbour. As such, further assessment of bioavailability and toxicity of sediment bound contaminants to determine possible ecosystem risk was not considered to be necessary.

3.7.5 Environmental, Construction and Site Management Plan

JBS&G has been provided with a copy of Draft *'Environmental, Construction and Site Management Plan'* prepared by Cadence Australia Pty Ltd dated September 2017 (Cadence 2017). Cadence (2017) documents provisions for occupational health and safety measures; identification of hazardous materials; unexpected finds relating to contamination; remediation of identified hazardous materials; handling of hazardous substances; sediment and water discharge/management; dust control and waste management during the proposed construction and fitout works associated with the WBAP.

Sediment and water discharge management measures were provided as follows:

- Existing stormwater discharge provisions will need to be maintained during construction, however, protective measures may include use of filter fabric, hay bales and temporary diversion gutters and drains. Risk mitigating measures to prevent any concrete entering the harbour during placement may include use of local silt fences along the edge of the pier, temporary hay bales to catch any cement slurry runoff and temporary plastic sheeting to catch any concrete spills. The contractor should have within its standard procedures, the requirement to use spill kits for hazardous materials also including environmental audits that review the usage and storage of hazardous materials onsite.
- Construction zones will need to be kept clean to ensure trucks/vehicles exit the site in same condition as entering.
- Water quality parameters (primarily turbidity) should be monitored to validate effectiveness of control measures. Monitoring can include visual inspection of water turbidity and sediment plumes; and monitoring of metal contaminants that had been recorded in the sediments. A suitable approach to monitoring of water quality would include sampling of turbidity immediately inside and outside of the silt curtain; and baseline monitoring of water quality in the immediate vicinity of Walsh Bay to provide data for comparison with that measured during construction.

The implementation of above controls was considered to be sufficient to reduce residual impacts to the marine environment due to the project to acceptable levels.

4. Conceptual Site Model

4.1 Potential Areas of Environmental Concern

Based on the history review and observations of the site, areas of environmental concern (AECs) and associated COPCs have been identified and are presented in **Table 4.1**. AECs in **Table 4.1** are based only on the known historical activities undertaken at the site.

Table 4.1 Areas of Environmental Concern and Associated Contaminants of Potential Concern

Area of Environmental Concern	Nature of Environmental Concern	Contaminants of Potential Concern
AEC 1: Shore shed building southern end 3m strip of fill/soil inside seawall –	Use of potentially contaminated imported material as fill	Heavy metals, TPH, BTEX, PAHs, OCP/OPPs, PCBs, asbestos, VOCs, SVOCs
AEC 2: All site area except for the land based portion of site (mentioned above)	Potential contaminants in seabed sediments	Heavy metals, TPH, BTEX, PAHs, OCP/OPPs, PCBs, asbestos
AEC 3: Areas of potential access to seawater -	Potential contaminants in seawater	Heavy metals, TPH, BTEX, PAHs, OCP/OPPs, viruses/bacteria/pathogens
AEC 4: Pier 2/3, Wharf 4/5 and Shore Shed building exteriors and interiors	Use of hazardous materials in building construction	Asbestos, lead based paint, SMF, PCBs

Notes: BTEX = Benzene, Toluene, Ethylbenzene and Xylene

Heavy metals = 8 priority heavy metals (arsenic, cadmium, chromium, copper, lead, nickel, mercury and zinc)

OCPs = organochlorine pesticides

OPPs = organophosphorus pesticides

PAHs = polycyclic aromatic hydrocarbons

PCBs = polychlorinated biphenyls

TPH = Total Petroleum Hydrocarbons

VOCs = volatile organic compounds

SVOCs = semi-volatile organic compounds

In addition to the specific AECs, wide-scale filling has previously occurred in land to the south of Hickson Road, and as noted in **Section 3.2**, the Millers Point gasworks was operational in the general vicinity of the site between 1841 and 1921. As such it is likely that impacted fill from the surrounding area has been historically used in neighbouring land to the south of the site. This may include fill material as sourced from the gasworks. However, noting that development of Walsh Bay occurred as part of the shipping use of the area and the alignment of the initial wharves suggest that limited filling was required as part of the wharf construction, it is considered that use of imported fill near the site, if at all, was likely to have been highly localised. It is also considered unlikely that gasworks waste or significant volumes of other fill materials were imported onto the site. Should small volumes of imported fill have been used on the site then the range of contaminants potentially present would be consistent with those listed in **Table 4.1**.

4.2 Potentially Contaminated Media

Potentially contaminated media present at the site were listed in **Table 4.1** and comprised:

- Potential fill materials present in the small land based area of the site inside the seawall. This was included in **Table 4.1** for completeness, however based on consideration of the HLA (1996) results relevant to the site, it is considered that the potential for fill under the site to be contaminated is very low.
- Hazardous materials present in the building fabric and that have the potential to be released during the proposed building upgrades. It is however considered that if the works on the building are completed (and validated) in accordance with the recommendations of the hazardous materials assessment (Prensa 2012), then these exposure pathways will be rendered incomplete for future users of the site. Hazardous materials are therefore no longer considered a significant AEC for the site.

- Seabed sediments impacted by urban runoff and other emissions from the surrounding foreshore area.

Cardno (2016), as summarised in **Section 3.7.3**, provides an initial assessment of the condition of sediments in proximity of the WBAP. Impacts to sediment, if any are influenced by the dynamic tidal system and not readily quantifiable. As such while this media have been identified as potentially contaminated, their effect on suitability of the proposed redevelopment of the site has been assessed based on whether the pathways to these potentially contaminated media are complete.

Table 4.2 summarises the potential exposure pathways associated with the identified AECs.

Table 4.2: Potential Exposure Pathways for Long Term Users Following Redevelopment of the site

AEC	Population	Exposure Pathways Post Construction During Long Term Use (Complete or Not Complete?)			
		Inhalation - Particulates	Inhalation – Vapour	Oral	Dermal
1 – potentially impacted sediment seabased portion of site	Commercial Site worker	N	C	N	N
	Subsurface Maintenance Worker	C	C	C	C
	Site Patron	N	C	N	N
2 – potential contaminated seawater	Commercial Site worker	N	N	N	N
	Site Patron	N	N	N	N
3 – Potentially impacted fill material present beneath the land based portion of the site	Commercial Site worker	N	C	N	N
	Site Patron	N	C	N	N

Notes:

C = potentially complete exposure pathway

N = exposure pathway incomplete

- = exposure pathway not applicable for user group

Review of **Table 4.2** indicates that:

- at least one potentially complete exposure pathway exists for future above ground users of the WBAP, i.e. inhalation of vapours, if any, as originating from subsurface materials present below the existing ground slab; and
- multiple exposure pathways also exist for any future subsurface excavation workers on the land-based portion of the WBAP.

On this basis it is considered that while the potential for impacted fill material to be present on site is low, impacted fill material will require investigation to provide an assessment of site suitability.

While seabed sediment underlying the site may be contaminated, review of **Table 4.2** confirms that future users will have no complete exposure pathways to this material. Sediments will remain below a minimum depth of 6 m of water.

In addition to the receptors listed in **Table 4.2**, it is considered that completion of the proposed redevelopment works may provide the opportunity for construction site personnel to be exposed to fill, sediment and seawater at the site. However, it is considered that implementation of the construction management plan measures as documented in Cadence (2017) and summarised in **Section 3.7.3**, should adequately manage risks to the health and safety of the construction site staff and the surrounding marine environment.

5. Sampling and Analysis Plan

5.1 Data Quality Objectives

Data quality objectives (DQOs) were developed for the investigation, as discussed in the following sections.

5.1.1 State the Problem

A SSDA will be submitted to the Department of Planning for the Project at Walsh Bay. The site area has been subject to several previous uses (including uses associated with wharfage and commercial / industrial activities) and potential historical filling activities. Given the historical use of the area as wharfage and other commercial activities, an assessment of potential contamination is required to support the SSDA application, identifying whether the WBAP site is suitable, from a contamination perspective, for the proposed use.

5.1.2 Identify the Decision

Based on the decision making process for assessing urban redevelopment site detailed in DEC (2006), modified to meet the specific project objectives, the following decisions must be made:

- Are there any unacceptable risks to likely future onsite receptors from soil?
- Are there any issues relating to the local area background soil concentrations that exceed appropriate soil criteria?
- Are there any impacts of chemical mixtures?
- Are there any aesthetic issues?
- Is there any evidence of, or potential for, migration of contaminants from the site?
- Is a site management strategy required?

5.1.3 Identify Inputs to the Decision

Inputs to the decisions are:

- The site description provided in **Section 2**;
- The potential for contamination of the site as detailed in **Section 4**;
- Soil environmental data collected by soil sampling and analysis consisting of total concentrations;
- Soil criteria based on the proposed land use as defined in **Section 6**; and
- Confirmation that data generated by sample analysis are of an acceptable quality to allow reliable comparison to assessment criteria by assessment of quality assurance / quality control as per the data quality indicators established in **Section 5.1.6**

5.1.4 Define the Study Boundaries

The study boundary is described as the land-based extent of the proposed WBAP as shown on **Figure 3**. Noting that the exact position of the seawall is unclear, the land based portion of the WBAP is considered to have an area of less than 0.1 hectares.

The vertical extent of the soil investigation was set to a maximum depth of 1.5 m below the base of the existing ground slab or refusal, whichever was shallower. This was anticipated to be a depth of approximately 2.0 m below ground level, based on results of previous investigations in proximity of the WBAP.

Due to the project objectives, seasonality was not assessed as part of this investigation. Data collected was considered to be representative of the timing and duration of the current investigation.

5.1.5 Develop and Decision Rule

Soil analytical data were assessed against the appropriate criteria as identified in **Section 6**. Given the low number of samples collected no statistical analysis of the data was considered. The decision rules adopted to answer the decisions identified in **Section 5.1.2** are summarised in **Table 5.1**.

Table 5.1: Summary of Decision Rules

Decisions Required to be Made	Decision Rule
1. Are there any unacceptable risks to onsite future receptors?	Analytical data was compared against the criteria in Section 6.2 with respect to soils: Where each of the reported concentrations was below the site criteria then the answer to the decision was No. If the criteria were not satisfied, the answer to the decision was Yes.
2. Are there any background contamination issues	Background soil concentrations as detailed in Trace Element Concentrations in Soils from Rural and Urban Areas of Australia (Henry Olzworthy <i>Et Al.</i> 1995 ^[1]) were used for comparison of site soil data. If there were any contaminants at concentrations substantially outside background ranges, then the answer was yes, otherwise the answer was no.
2. Are there any chemical mixtures?	Was there more than one group of contaminants present which increase the risk of harm? If there was, the answer to the decision was Yes. Otherwise, the answer to the decision was No.
3. Are there any aesthetic issues?	If there were any Asbestos Containing Material (ACM) fragments on the ground surface, any unacceptable odours, any soil discolouration, or excessive amounts of anthropogenic material, the answer to the decision was Yes. Otherwise, the answer to the decision was No.
4. Is there any evidence of, or potential for, migration of contaminants from the Site?	Based on assessment results, was there any evidence of, or the potential for, unacceptable contaminant concentrations to migrate from the site? If yes, the answer to the decisions was Yes. Otherwise, the answer to the decision was No.
5. Is a site management strategy required?	Is the answer to any of the above decisions Yes? If yes, a site management strategy is required to address unacceptable contamination concerns at the Site so as to make the Site suitable for permissible site uses. If no, a site management strategy is not required and the Site is considered suitable, from a contamination view point for the proposed use.

5.1.6 Specific Limits on Decision Errors

This step is to establish the decision maker's tolerable limits on decision errors, which are used to establish performance goals for limiting uncertainty in the data. Data generated during this project must be appropriate to allow decisions to be made with confidence.

Specific limits for this project have been adopted in accordance with the appropriate guidance from the NSW EPA, National Environmental Protection Measure (NEPM) (NEPC 2013²), appropriate Data Quality Indicators (DQIs, used to assess quality assurance / quality control) and standard JBS&G procedures for field sampling and handling.

^[1] 'Trace Element Concentrations in Soils from Rural and Urban Areas of Australia', Henry Olzowy *Et Al.*, (Henry Olzowy *et Al.* 1995)

² National Environmental Protection (Assessment of Site Contamination) Measure 1999. As compiled 16 May 2013 National Environmental Council (NEPC 2013)

To assess the usability of the data prior to making decisions, the data will be assessed against pre-determined DQIs for to precision, accuracy, representativeness, comparability, completeness and sensitivity (PARCCS parameters). The acceptable limit on decision error is 95% compliance with DQIs.

The pre-determined DQIs established for the project are discussed below in relation to the PARCCS parameters, and are shown in **Table 5.2**.

- **Precision** - measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques is assessed by calculating the Relative Percent Difference (RPD) of duplicate samples.
- **Accuracy** - measures the bias in a measurement system. The accuracy of the laboratory data that are generated during this study is a measure of the closeness of the analytical results obtained by a method to the 'true' value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards.
- **Representativeness** –expresses the degree which sample data accurately and precisely represent a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples on a representative basis across the site, and by using an adequate number of sample locations to characterise the site to the required accuracy.
- **Comparability** - expresses the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to collect samples; and ensuring analysing laboratories use consistent analysis techniques; and reporting methods.
- **Completeness** – is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study.
- **Sensitivity** – expresses the appropriateness of the chosen field and laboratory methods, including the limits of reporting, in producing reliable data in relation to the adopted site assessment criteria.

Table 5.2: Data Quality Indicators

Data Quality Indicators	Frequency	Data Quality Criteria
Precision		
Split duplicates (intra laboratory)	1 / 20 samples	<50% RPD ¹
Blind duplicates (inter laboratory)	1 / 20 samples	<50% RPD ¹
Laboratory Duplicates	1 / 20 samples	<50% RPD ¹
Accuracy		
Surrogate spikes	All organic samples	70-130%
Laboratory control samples	1 per lab batch	70-130%
Matrix spikes	1 per lab batch	70-130%
Representativeness		
Sampling appropriate for media and analytes	All samples	..2
Samples extracted and analysed within holding times.	-	Soil: organics (14 days), inorganics (6 months)
Laboratory Blanks	1 per lab batch	<LOR
Trip spike	1 per lab batch	70-130% recovery
Storage blank	1 per lab batch	<LOR
Rinsate sample	1 per sampling event/media	<LOR
Comparability		
Standard operating procedures for sample collection & handling	All Samples	All Samples
Standard analytical methods used for all analyses	All Samples	NATA accreditation
Consistent field conditions, sampling staff and laboratory analysis	All Samples	All samples ²
Limits of reporting appropriate and consistent	All Samples	All samples ²
Completeness		
Sample description and COCs completed and appropriate	All Samples	All samples ²
Appropriate documentation	All Samples	All samples ²
Satisfactory frequency and result for QC samples		95% compliance
Data from critical samples is considered valid	-	Critical samples valid
Sensitivity		
Analytical methods and limits of recovery appropriate for media and adopted Site assessment criteria	All samples	LOR ≤ site assessment criteria

¹ If the RPD between duplicates is greater than the pre-determined data quality indicator, a judgment will be made as to whether the excess is critical in relation to the validation of the data set or unacceptable sampling error is occurring in the field.

² A qualitative assessment of compliance with standard procedures and appropriate sample collection methods will be completed during the DQI compliance assessment.

5.2 Optimise the Design of Obtaining Data

Various strategies for developing a statistically based sampling plan are identified in EPA 1995, including judgemental, random, systematic and stratified sampling patterns.

Random sampling is not appropriate based on the areas of environmental concern identified in previous investigation and the site inspection. Stratified sampling is not appropriate given the size of the site, and purely judgemental sampling is inappropriate given the potential for localised impacts across much of the site.

Based on the site inspection and known history of the site, a generally systematic sampling program was considered the most appropriate for the current investigation. Table A of NSW EPA (1995) specifies that for detailed characterisation of soil conditions, the minimum sampling density on a site of 1000 m² area should can detect a circular hotspot 25m in diameter with a 95 % level of confidence. A minimum of 6 new evenly spaced locations was required to achieve these

requirements and provide general coverage of the site. A figure showing the distribution of sampling locations is provided as **Figure 5**. These positions were finalised on site in consultation with INSW, current leasees of the site and the potential presence of underground services.

5.2.1 Soil Sampling Approach

EPA (1995) recommends 6 sampling points for sites up to 1,000 m². The sampling locations for investigations are shown on **Figure 5**. Prior to commencement of the sampling event a total of 6 locations were proposed to be placed on a generally systematic grid. It is noted that during completion of field works, soil samples were unable to be collected from JBH04 and JBH05 due to the presence of multiple concrete slabs underlying the building at these locations, while the limited sample volume of sandstone bedrock obtained from JBH06 was considered insufficient for analysis by the analytical laboratory.

The final implemented sampling and analysis plan is summarised in **Table 5.3**.

Table 5.3: Executed Sampling and Analysis Plan

Media	Number of Sampling Locations	Primary Analyses (exc. QA/QC)
Soil	6 attempted, samples suitable for laboratory analysis obtained from only 3 locations	Heavy metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn) – 3 samples TPH – 3 samples BTEX – 3 samples PAHs – 3 samples OCP/OPPs – 3 samples PCBs – 3 samples VOCs/SVOCs – 3 samples Asbestos – 3 samples
Soil Vapour	1 (JBBH06)	VOCs – 1 samples

5.2.2 Soil Sampling Methodology

As discussed in **Section 2.2**, the land-based area of the site is entirely encapsulated by hardstand concrete or asphaltic pavements. Prior to advancing boreholes, concrete coring was undertaken with a bolt-mounted concrete coring drill. Concrete coring was successful at facilitating access to the sub-slab soil at locations JBH01, JBH02, JBH03 and JBH06. Concrete coring was not able to be completed at proposed locations JBH04 and JBBH06 due to the presence of concrete pavements to significant depth (i.e. in excess of 0.75 m).

At locations JBH01, JBH02, JBH03 and JBH06, once the overlying concrete was removed, one soil sample was collected via the use of a hand auger from the area immediately underlying the concrete slabs. At all boreholes, hand auger refusal was encountered on apparent sandstone bedrock within 100mm of the base of the deepest concrete slab. As such, a single soil sample was collected from fill material underlying the hardstands at JBBH01, JBBH02, JBBH03 and JBBH06.

Collected samples were immediately transferred to laboratory supplied sample jars and plastic resealable 'ziplock' bags (for field screening). Care was taken to minimise the potential for loss of volatile contaminants during sampling.

Filled sample jars were transferred to a chilled ice box for sample preservation prior to and during shipment to the testing laboratory. A chain-of-custody form was completed and forwarded with the samples to the testing laboratory. Based upon field observations and the PID screening results, samples were analysed in accordance with the laboratory schedule in **Table 5.3**.

5.2.3 Sub-slab Vapour Methodology

Noting the inability to complete sampling at two of the proposed locations, one subslab vapour sample was collected in proximity of JBH06. Sub-slab vapour sampling was considered appropriate due to the concrete slabs and sealed surfaces present across site surface and was considered to be of the most direct relevance to assessing potential contamination risks.

The following methodology was adopted for the installation of sub-slab vapour point:

- Recording of location;
- Coring of concrete slab (20 mm diameter); and
- Placement of a section of 6 mm diameter Teflon tube fixed with a Teflon sample tip into the cored hole to below the base of the slab, then sealing the core hole with air-drying clay and an overlying layer of bentonite slurry. The sub-slab point was purged and sampled immediately following installation.

The following methodology was adopted for the sampling of the sub-slab vapour point:

- Placement of a shroud around the sample point, and sealing by placement of clay or 'blue-tack' around the shroud edge;
- Purging of the sub-slab vapour point or soil vapour probe for a period using a calibrated photo-ionisation detector (PID) (10.6 eV lamp) and multi-gas meter to measure and record oxygen and methane (as an LEL) concentrations until the parameters stabilised;
- Assessment of leaks, by placing a rag soaked in 2-propanol around the probe/tubing within the shroud at the ground surface and continued purging with the PID. In the event of PID readings increasing significantly this was considered to indicate a potential leak and mitigation measures were required to adequately seal the point. The 2-propanol soaked rag and shroud remained in place during the sampling process as an indicator of leaks;
- Removal of tips from a carbon sorbent tube and connection to vapour point tubing. Connection of the downstream end of carbon sorbent tube to a closed three-way valve and syringe of known volume (100 mL);
- Collection of an approximate 6 L volume vapour sample by hand use of the syringe to draw the vapour sample through the carbon sorbent tube, using the three-way valve to prevent back-flow from the syringe through the tube. The volume of air was confirmed by the known volume of the syringe used to collect samples and by counting the number of syringe volumes passed through the carbon tube;
- Disassembly of the syringe and tubing, removal of the carbon tube, replacement of tube caps and placement in Zip-Lock bag; and
- Submission of the carbon tube for analysis for the VOC 8260 suite, which includes BTEXN compounds.

One duplicate vapour sample was collected by splitting the flow into three carbon tubes using a three-way valve.

Carbon tubes were supplied by Eurofins and were advised to be appropriate specific to the target analytes and the analysis method proposed (US EPA 8260).

5.2.4 Decontamination

Prior to the commencement of sampling activities, non-disposable sampling equipment, including the hand trowel and hand auger, was cleaned with a high pressure water/detergent spray, rinsed with water and then air dried. The equipment was then inspected to ensure that no soil, oil, debris or other contaminants were apparent on the equipment prior to the commencement of works.

Soil samples were removed from the hand auger head with the hand trowel and laid on clean plastic sheets for inspection prior to collection. A new pair of disposable nitrile gloves were used to collect each sample.

Sampling equipment was subsequently decontaminated using the above process between each sampling location.

A rinsate sample from the trowel was collected at the completion of field sampling activities to determine the effectiveness of the decontamination procedures implemented on re-usable sampling equipment.

5.2.5 Duplicate and Triplicate Sample Preparation

At selected sample locations sufficient soil was collected to provide a primary, blind (intra-laboratory) duplicate and split (inter-laboratory) duplicate (triplicate) sample using the sampling methodology outlined above.

The collected soil sample was divided laterally into three samples with minimal disturbance to reduce the potential for loss of volatiles and placed in three clean glass jars and sample bags as appropriate. Soil samples were not homogenised in order to minimise the loss of volatiles.

Each sample was labelled with primary, duplicate or triplicate sample identification before being placed in the same chilled esky for transport to the laboratory.

5.2.6 Laboratory Analysis

JBS&G contracted Eurofins MGT (Eurofins) as the primary laboratory for the required chemical analyses. The secondary laboratory was Envirolab Services Pty Ltd (Envirolab). Both laboratories were NATA accredited for the required analyses. In addition, the laboratories were required to meet JBS&G's internal quality assurance/quality control (QA/QC) requirements. The completed analysis schedule is summarised in **Table 5.3**.

In addition to the above primary analyses, to address the DQIs, field duplicate and triplicate soil samples were analysed at a rate of one per 20 primary samples. A rinsate sample was obtained from non-disposable soil sampling equipment, plus a single trip spike and single trip blank accompanied the sample batch.

6. Assessment Criteria

6.1 Regulatory Guidelines

Development of site assessment criteria and the associated scope of investigation was undertaken with consideration to aspects of the following guidelines, as relevant:

- *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)*, National Environment Protection Council (NEPC 2013);
- *Contaminated Sites: Sampling Design Guidelines*, NSW EPA, 1995 (EPA 1995);
- *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*, NSW OEH, 2011 (OEH 2011); and
- *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme*, 2nd Edition, NSW EPA, 2006 (DEC 2006).

6.2 Assessment Criteria Selection

Based on the proposed ongoing commercial/industrial use and industrial zoning, concentrations of contaminants in soil were compared against NEPC (2013) health-based investigation and screening levels (HILs and HSLs), and ecological investigation and screening levels (EILs and ESLs), for commercial/industrial land use, as outlined below and in **Table 6.1**:

- HILs: HIL D - Commercial/industrial, includes premises such as shops, offices, factories and industrial sites;
- HSLs: HSL D – Commercial/industrial; and
- EILs and ESLs: Commercial/industrial.

The results of asbestos observations and analysis were assessed in general accordance with NEPC (2013) and WA DOH (2009) guidance.

Table 6.1: Soil Assessment Criteria (all units in mg/kg)

Analytes	Limit of Reporting	Health-Based Investigation Level HIL-D ¹	Soil HSLs for Vapour Intrusion (Sand 0-1m)	EILs/ESLs Commercial and Industrial (Coarse soil)
METALS				
Arsenic	2	3000	-	160
Cadmium	0.4	900	-	-
Chromium (Total) ²	5	3600 (Cr VI)	-	310 ⁷
Copper	5	240 000	-	140 ⁷
Lead	5	1500	-	1800
Nickel	5	6000	-	55 ⁷
Mercury (inorganic)	0.05	730	-	-
Zinc	5	400 000	-	210 ⁷
TOTAL RECOVERABLE HYDROCARBONS				
F1 C6 – C10 Fraction	20	-	260	215
F2 >C10 – C16 Fraction	50	-	NL	170
F3 >C16 – C34 Fraction	100	-	-	1700
F4 >C34 – C40 Fraction	100	-	-	3300
BTEX				
Benzene	0.1	-	3	75
Toluene	0.1	-	NL	135
Ethylbenzene	0.1	-	NL	165
Total Xylenes	0.1	-	230	180
POLYCYCLIC AROMATIC HYDROCARBONS				
Naphthalene	0.5	-	NL	370
Benzo(a)pyrene	0.5	-	-	1.4
Carcinogenic PAHs ⁴	0.5	40 ⁴	-	-
Total PAH's	0.5	4000	-	-
ORGANOCHLORINE PESTICIDES				
Aldrin + Dieldrin	0.05	45	-	-
Chlordane	0.05	530	-	-
DDT + DDD + DDE	0.05	3600	-	640 (DDT only)
Heptachlor	0.05	50	-	-
Endosulfan	0.05	2000	-	-
Endrin	0.05	100	-	-
HCB	0.05	80	-	-
Methoxychlor	0.2	2500	-	-
Toxaphene	1	160	-	-
PCBs				
PCBs (total)	0.5	7	-	-
Asbestos				
Bonded ACM	0.1g/kg	0.05% (w/w) ⁵	-	-
FA and AF (friable asbestos)	Presence	0.001% (w/w) ^{5,6}	-	-
All forms of asbestos	Presence	No visible asbestos for surface soils	-	-

1 Table 1A (1) – Commercial/industrial, NEPC (2013)

2 HIL for Cr VI. If total Cr exceeds HIL then further analysis for Cr VI will need to be completed to verify the nature of Cr at the site

3 Table 1B (6), ESLs for TPH fractions, Commercial/industrial (sand soil type, 0-1 m), NEPC (2013)

4 As B(a)P TEQ

5 500 mL sample

6 Not applicable to free fibres

7 Indicative EIL criteria provided based on land use (i.e. commercial) proposed. No site specific cation exchange capacity values determined for the site. The EILs have been calculated by assuming an aged soil type with cation exchange capacity (CEC) of 5 cmol/kg soil pH of 5, organic carbon content of 1%, site location of NSW. It is noted that the site is completely sealed and there are no existing landscaped areas. As a result, comparison to ecological investigation levels (EILs) is provided for information purposes only.

7. Quality Assurance/Quality Control

7.1 QA/QC Results

Analysis of the Quality Analysis / Quality Control (QA/QC) has been undertaken for analytical results from assessment. QA/QC results for soil samples collected at the Site are summarised in **Table 7.1** and discussed in **Section 7.2**. Detailed QA/QC results are included in the laboratory reports in **Appendix H**, and in the Quality Assurance/Control in **Appendix I**.

Table 7.1: QA/QC Results Summary

Data Quality Indicator	Results	DQI met?
Precision		
Soil Blind duplicates (intra laboratory)	1 / 3 primary samples 0-173 % RPD	Partial ¹
Soil Blind triplicates (inter laboratory)	1/3 primary samples 0-66 % RPD	Partial ¹
Laboratory duplicates	<50 % RPD Intra laboratory samples were analysed at a rate of 1 in 20 samples.	Yes ¹
Accuracy		
Surrogate spikes	50 - 125 % Recovery Surrogate spikes were completed for all organic samples	Partial ¹
Laboratory Control Samples	1 / 3 primary samples 73-130 % Recovery	Yes
Matrix spikes	26-102 % Recovery Matrix spikes were completed for all organic and metals samples	Partial ¹
Representativeness		
Sampling appropriate for media and analytes	All sampling conducted in accordance with JBS&G procedures	Yes
Laboratory blanks	<LOR	Yes
Samples extracted and analysed within holding times.	All samples were extracted and analysed within holding times.	Yes
Trip spikes	96-103 %	Yes
Trip blanks	<LOR	Yes
Rinsate blank	<LOR	Yes
Comparability		
Standard operating procedures used for sample collection & handling	Two JBS&G field scientists used standard operating procedures throughout works.	Yes
Standard analytical methods used	Standard analytical methods used as listed in Tables 6.2, 6.3 and 6.4 .	Yes
Consistent field conditions, sampling staff and laboratory analysis	Sampling was conducted by two field staff members using standard operating procedures in the same conditions throughout the works. The laboratories remained consistent throughout the investigation.	Yes
Limits of reporting appropriate and consistent	Limits of reporting were consistent and appropriate.	Yes
Completeness		
Soil description & Chains of Custody completed	All borehole logs and Chains of Custody were completed appropriately.	Yes
Appropriate documentation	All appropriate field documentation processes were undertaken. Borehole logs and Calibration records are included as Appendix J .	Yes
Satisfactory frequency/result for QC samples	The QC results are considered adequate for the purposes of the investigation.	Yes
Data from critical samples is considered valid	Data from critical samples is considered valid.	Yes
Sensitivity		

Analytical methods and limits of recovery appropriate for media and adopted site assessment criteria	Appropriate laboratory analysis methods and detection limits were considered to have been achieved during the field and laboratory phases of this investigation.	Yes
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1. See discussion of DQI exceedances in **Section 7.2**.

7.2 QA/QC Discussion

7.2.1 Precision

RPDs calculated for the blind duplicate pair were within the JBS&G preferred range, with the exceptions of RPDs of 110% and 121% for copper and lead respectively, and RPDs in the range of 63 to 185% for several PAH compounds. These exceedances are considered to be the result of heterogeneity in the soil samples collected, and further, are considered not to affect the precision of the data collected.

RPDs calculated for the split duplicate pair were within the JBS&G preferred range, with the exceptions of an RPD of 66% for copper, and RPDs in the range of 63 to 185% for several PAH compounds. These exceedances are considered to be the result of heterogeneity in the soil samples collected, and further, are considered not to affect the precision of the data collected.

All laboratory duplicates returned RPDs within the acceptable limits.

On this basis the DQIs for precision are considered to have been achieved for this investigation.

7.2.2 Accuracy

Surrogate spike recoveries were within the acceptable range of 70-130%, with the exception of two SVOC surrogates of phenol-d6 and nitrobenzene-d6 with recoveries of 50 % and 65 % respectively, and OCP surrogate dibutylchlorendate in 2 samples with recoveries between 57 and 59%. While these values were outside of the JBS&G preferred range, it is noted that all reported surrogate recoveries were within the dynamic limits nominated by the laboratory. It is therefore considered that these low surrogate recoveries do not affect the accuracy of the reported data.

Laboratory control sample (LCS) recoveries were within the acceptable range of 70-130% and are considered acceptable.

Matrix spike and laboratory control sample recoveries were within the acceptable range of 70-130%, with the exception of recoveries below 70% for 3 SVOC compounds in the split duplicate sample. It is however noted that these low recoveries (between 26 and 45%) were within the acceptable range of dynamic limits nominated by the laboratory. .

On this basis the DQIs for accuracy are considered to have been achieved for this investigation.

7.2.3 Representativeness

The extraction and analysis of selected soil samples was completed within the recommended holding times for all analytes.

A rinsate sample was collected following decontamination of all non-disposable sampling equipment for the soil sampling event. All analyte concentrations in the rinsate blanks were below the laboratory limit of reporting (LOR).

A trip spike was submitted with the soil samples collected during the assessment. Trip spike recoveries for analytes was within the acceptable limit of 70-130%.

All laboratory blanks analysed reported analyte concentrations less than the laboratory LOR.

All field equipment was decontaminated appropriately as per the procedure identified in **Section 5.2.3**. Collected samples were immediately placed into the sample containers, sealed and then placed into chilled eskies to minimise volatile loss.

Based on the above comments the DQIs for representativeness were considered to have been satisfactorily achieved.

7.2.4 Comparability

Eurofins, the primary laboratory, and Envirolab Services, the secondary laboratory, are NATA accredited for all analytical methods used. The laboratories used similar analytical methods and the analytical data were comparable between laboratories as indicated by the results of duplicate analysis. Where different LORs were adopted by the laboratories, this did not impact upon the usability of the data given that all values were considerably less than the adopted assessment criteria.

The samples collected for assessment purposes are considered comparable as all samples were collected by experienced JBS&G personnel in accordance with standard JBS&G sampling methods.

7.2.5 Completeness

All laboratory and field documentation is complete and correct. Chain of custody documentation is provided with laboratory reports in **Appendix H**. Bore hole logs are presented in **Appendix J**.

The frequency of analysis of all QA/QC samples was considered appropriate and valid.

7.2.6 Sensitivity

The adopted soil analytical methods provided suitable LORs with respect to the adopted site assessment criteria.

7.2.7 QA/QC Conclusions

The field sampling and handling procedures across the site produced QA/QC results which indicate that soil and subslab data collected is of an acceptable quality.

The NATA certified laboratory reports indicate that the project laboratories were achieving levels of performance within its recommended control limits during the period when the samples from this program were analysed.

On the basis of the results of the field and laboratory QA/QC program, the soil and subslab vapour data is of an acceptable quality upon which to draw conclusions regarding the environmental condition of the site.

8. Results

8.1 Soil Observations

Soil sampling was conducted on 19 January 2017 at the sampling locations shown on **Figure 5**. Borehole logs are included in **Appendix K**.

As discussed in **Section 2.2**, the entire land-based portion of the site surface was sealed, with cover typically comprising indoor or outdoor concrete slabs, or asphalt.

A summary of soil conditions at the site is presented as follows. Concrete coring at 6 locations indicated that the surface slabs extended to a depth of between 0.25m at JBBH01 to in excess of 0.75m at JBBH04 and JBBH05 located within the on-site shore shed buildings. Coring equipment refusal occurred at depth in JBBH04 and JBBH05, where multiple (and suspended) concrete slab were encountered below the ground surface. At those locations where it was possible to fully penetrate the ground slab(s), boreholes were advanced through the underlying fill or sandstone, until hand auger refusal occurred in seemingly competent sandstone bedrock. Refusal typically occurred within 100mm of the base of the deepest concrete slab at each location. Fill material, where observed, comprised gravelly roadbase fill. No asbestos containing material (ACM), odours or staining were observed on site surfaces and no odours or staining were observed within the subsurface profile.

8.2 Soil Contamination Analytical Results

Detailed laboratory reports and chain of custody documentation are provided in **Appendix H**. Summarised soil analytical data for COPCs are presented in **Table A, Appendix K** and are discussed in the following sections.

8.2.1 Metals

All individual heavy metals concentrations were reported at levels less than the adopted health based assessment criteria for all samples analysed.

8.2.2 PAHs

Total PAH, B(a)P and carcinogenic PAHs as B(a)P Toxic Equivalence Quotient (TEQ) values for all analysed samples were reported at concentrations less than the adopted health-based site assessment criteria.

8.2.3 BTEX

Concentrations of all BTEX were reported below the laboratory LOR and the adopted health based site assessment criteria in all soil samples selected for analysis.

8.2.4 TRHs

Concentrations of all TRH were reported below the laboratory LOR and/or the adopted health based assessment criteria for all samples analysed.

8.2.5 OCPs/PCBs

Concentrations of OCP compounds were reported below the adopted health based assessment criteria for all soil samples selected for analysis.

Concentrations of total PCB compounds were reported below the laboratory LOR and the adopted health based assessment criteria for all soil samples selected for analysis.

8.2.6 VOCs/SVOCs

Concentrations of all VOCs and SVOCs were reported below the laboratory LOR for all samples analysed.

8.2.7 Asbestos

Asbestos fines (AF) and friable asbestos (FA) were not detected at or above the reporting limit of 0.001 % w/w in any of the samples analysed.

8.3 Sub-Slab Vapour

8.3.1 Field Observations

The sub-slab vapour monitoring was undertaken on 20 January 2017 by experienced JBS&G field scientists. During purging, sub slab oxygen levels were found to be approximately 20.9%, PID measurements ranged from 0 to 0.3 ppm and there was no LEL (expressed in terms of CH₄) above the instrument level of reporting (as provided in **Appendix J**). The probe was purged for a period of at least 2 minutes with an MX6 Multi Gas Detector which purges at a rate of 300 mL/min and no significant odours were noted in air purged from below the slab.

8.3.2 Analytical Results

Sub-slab soil vapour analytical results in off-site locations along the western site boundary are presented in **Table B, Appendix K**.

Review of **Table B, Appendix K** indicates that all VOCs and BTEX compounds were reported to be below detection limits in both the primary and duplicate vapour samples.

9. Site Characterisation

Based on the decision making process for assessing urban redevelopment sites detailed in DEC (2006) and discussed in **Section 5.1.2**, the decisions required to be made are discussed below.

9.1 Potential Risk to On-Site Users

Representative soil samples were analysed for COPCs identified at the site (as listed in **Table 4.3**). Reported concentrations of the COPCs were below the adopted NEPC (2013) human health criteria for commercial land use. Based on the analytical results for the COPCs, no unacceptable risk to future on-site human receptors have been identified within site soils. While it is acknowledged that site conditions and access constraints at the time of sampling prevented the analysis of soil samples from 3 of the 6 proposed soil bores, the subsurface profile at each of these locations was generally consistent with the sampled boreholes, for which all COPCs were within the relevant criteria.

Furthermore:

- the presence of competent bedrock at shallow depths below the existing concrete slabs at the site, suggests that future works on the site are unlikely to involve the installation, or maintenance of underground services; and
- the results of the sub-slab vapour sample collected at JBBH06, provides data to indicate that concentrations of common, and volatile, urban contaminants are not present in sub-slab vapours at the site at levels in excess of laboratory reporting limits.

On this basis it is considered that there is no unacceptable risk associated with the potentially complete exposure pathways identified in **Table 4.2** for current and future users of the site.

9.2 Soil Background Issues

Soil contaminant results indicate there are likely no issues relating to local area background conditions that require consideration with respect to the suitability of the site.

9.3 Chemical Mixtures

There were no potential chemical mixtures identified during the investigation that may pose a management issue at the site.

9.4 Aesthetic Issues

No visible ACM, odours, stains or other aesthetic concerns were identified on ground surfaces or within site soils sampled during the investigation that may pose an unacceptable issue at the site.

9.5 Potential Migration of Contaminants

Based on contaminant concentrations identified at the site during this investigation, there is not considered to be any significant potential for migration of contaminants from the site.

9.6 Site Management Strategy

Results of the current investigation did not identify any impacts that indicate widespread or gross contamination of the land. Based on the findings and limitations of this investigation, the site is considered suitable for continued commercial land use. Standard unexpected find protocols should be implemented during any future development.

10. Conclusions and Recommendations

10.1 Findings

- The site is located within the Walsh Bay Conservation Zone, with a surrounding locality comprised of residential, commercial and public domain land uses.
- The site, which comprises the Walsh Bay Pier 2/3 and Wharf 4/5 structures and the adjacent shore shed buildings, is estimated to have an approximate area of less than 2 hectares.
- Historical information indicates that the existing Pier 2/3, Wharf 4/5 and shore shed buildings were constructed circa 1910, however the alignment of the existing built structures and seawall are consistent with earlier versions of the Walsh Bay wharves in operation as early as 1890.
- At the time of the site inspection and sampling completed the entire site surface comprised a concrete ground slab. The site was being used as a commercial performing arts centre with public foreshore access external to the existing buildings. The existing Pier 2/3 and Wharf 4/5 buildings were observed to be fully suspended structures founded on timber piles driven into the seabed. Based on observations made during the inspection it would appear that more than 50% of the shore shed buildings are similarly founded on timber piles driven in the seabed. Less than 50% of the existing shore shed buildings are founded on a seawall and possibly backfill material.
- Whilst current use of the site is considered to have negligible potential for contamination of land and sea, the site was previously used as part of the Walsh Bay Wharves shipping facility. This former use, in combination with the location of the site in the central inner city suggested that heavy metals, OCPs, PCBs, PAHs, PCBs, TPH and asbestos were contaminants of potential concern in soil and sediments underlying the site. The proximity of the WBAP to the former Millers Point Gasworks has also led to the inclusion of VOCs and SVOCs as potential contaminants of concern for the site.
- The installation of six boreholes was attempted across the site to assess the potential for these contaminants to be present. One or more concrete slabs at the ground surface at each location, with sandstone bedrock was encountered at all completed locations within 100mm of the slab bases. No evidence of aesthetic issues such as significant anthropogenic inclusions, odours or staining were observed during sampling.
- Representative soil samples were from three of the installed boreholes were successfully analysed for contaminants of potential concern (COPCs) identified at the site. Reported concentrations of the COPCs were below the adopted NEPC (2013) human health criteria for standard commercial land use. Based on the analytical results for the COPCs, no unacceptable risk to future on-site human or ecological receptors have been identified within site soils sampled during this investigation. Results of the current investigation did not identify any impacts that indicate widespread or gross contamination of the land. This was also confirmed by the results of analytical testing on one sub-slab vapour sample collected in proximity of bore JBBH06.
- With respect to contaminated sediments in the seabed, review of current studies has indicated that impacts present in sediments across the Sydney Harbour area include heavy metals, PAHs, TPH, OCPs and PCBs. These impacts would be expected to be present within the seabed portion of the site, however the impacts are considered not to be attributable to the current or recent historical use of the site.

- Seawater in the vicinity of the site is likely to be impacted with heavy metals and bacteriological contaminants, however this is consistent within impacts across the entire Sydney Harbour and are considered not to be attributable to the current use of the site.

10.2 Conclusions

The WBACP SSDA SEARs Condition Number 11, requires the Contamination Assessment Works, or ESAs:

- *Demonstrate compliance with the requirements of SEPP 55.*
- *If remediation works are required, the EIS must include a Remedial Action Plan (RAP). The RAP must be prepared in accordance with the contaminated land planning guidelines under section 145C of the Environmental Planning and Assessment Act 1979 and relevant guidelines produced or approved under section 105 of the Contaminated Land Management Act 1997.*
- *The RAP must be- accompanied by a Site Audit Statement prepared by a NSW EPA accredited site auditor certifying that the site can be made suitable for the proposed use(s).'*

In response to this condition, the results of this ESA conclude that a RAP is not required for the uses proposed under the WBACP SSDA.

Rather, based on the findings of this investigation and subject to the limitations presented in **Section 11**, JBS&G concludes that the site is suitable for the continued commercial land use as proposed by the WBACP SSDA. A standard unexpected find protocols should be implemented during any future development works to enable identification and suitable management of any potential contamination concerns as may be encountered at the site.

Additionally, available information suggests that potential contaminants in sediment at the site do not appear to represent a potential human health risk for continued commercial use of the site and the associated arts/cultural use.

Collectively JBS&G considers that these results confirm that the site is suitable for the uses proposed under the Walsh Bay Project SSDA.

11. Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only, and has been based in part on information obtained from the client and other parties.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

JBS&G accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by JBS&G, and should not be relied upon by other parties, who should make their own enquires.

Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements.

Limited sampling and laboratory analyses were undertaken as part of the investigations undertaken, as described herein. Ground conditions between sampling locations and media may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS&G reserves the right to review the report in the context of the additional information.

12. References

JBS&G Australia Pty Ltd, *'Phase 1 Environmental Site Assessment, Proposed Walsh Bay Arts Precinct Redevelopment, Walsh Bay Wharves, Dawes Point NSW, JBS&G 43329-56537 (Rev 2), 23 June 2014 (JBS&G 2014)*

Design 5 Architects, *'Walsh Bay Arts Precinct; Heritage Assessment Report', February 2014, (Design 5 2014)*

Cadence Australia Pty Ltd, Draft *'Environmental, Construction and Site Management Plan' 27 July 2016, (Cadence 2016).*

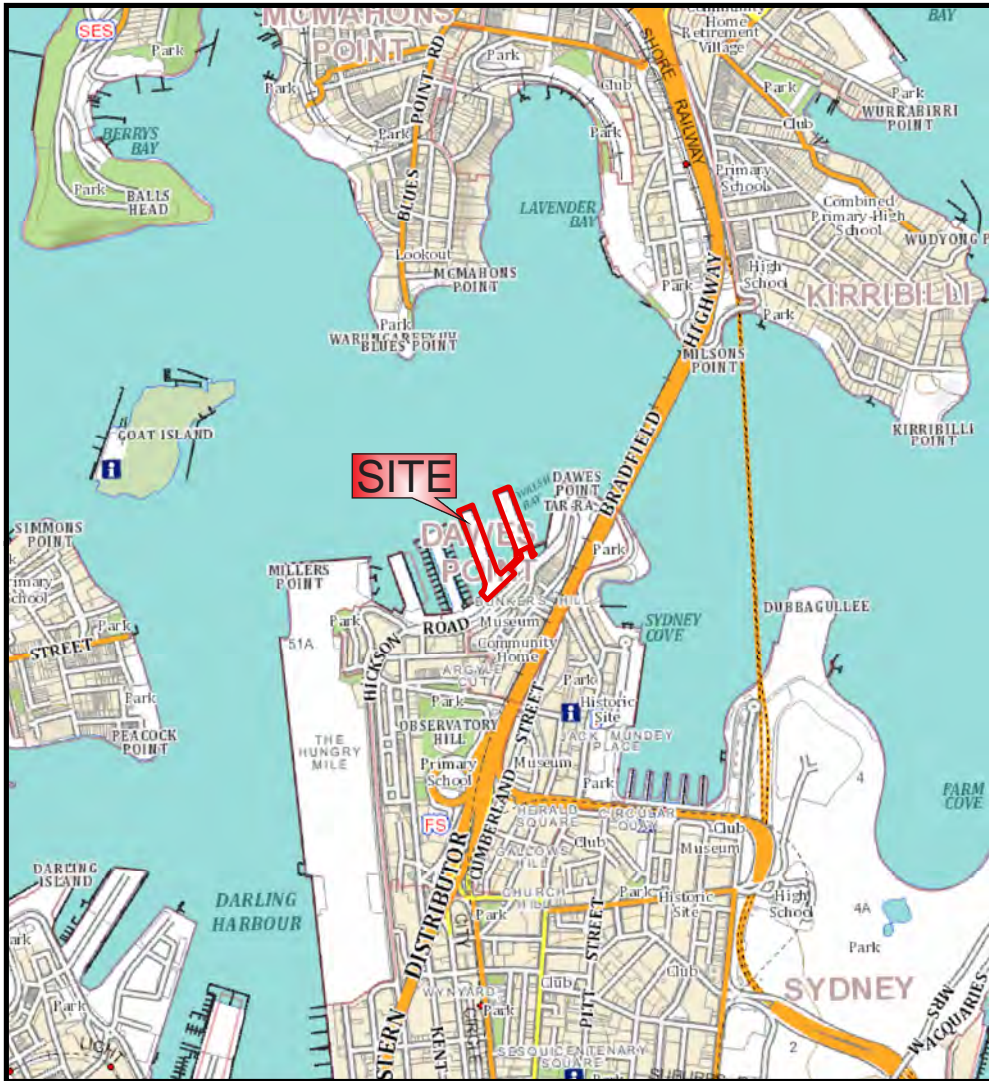
Cardno (NSW/ACT) Pty Ltd, 7 November 2016 *Walsh Bay Redevelopment Preliminary Sediment Investigation' (Cardno 2016).*

Prensa Pty Limited *'Hazardous Materials Re-Assessment, Wharf 4-5 Hickson Road Walsh Bay NSW, dated September 2012 (Prensa 2012).*

HLA-Envirosciences Pty Limited *'Initial Contamination Assessment, Walsh Bay Redevelopment Project, Sydney NSW' dated August 1996 (HLA 1996).*

Patterson Britton Pty Limited *'Walsh Bay Redevelopment, Master Plan Development Application Marine Report' dated 1996 (PB 1996).*

Figures



0 200 400 800
m
Scale: 1:20,000

Source: Base Image - © SIX Maps www.maps.six.nsw.gov.au, accessed 17-03-2014

0 50 100 200
m
Scale: 1:4,750

Source: Base Image - © NearMap www.nearmap.com, imagery date 19-0-2013, accessed 17-03-2014

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Legend:

Approximate Site Boundary

Datum: GDA 1994 MGA Zone 56 - AHD			
A4			
A	Original Issue - R02	BC	28-08-2017
Rev	Description	Dm.	Date:

JBS&G Figure 1: Site Location

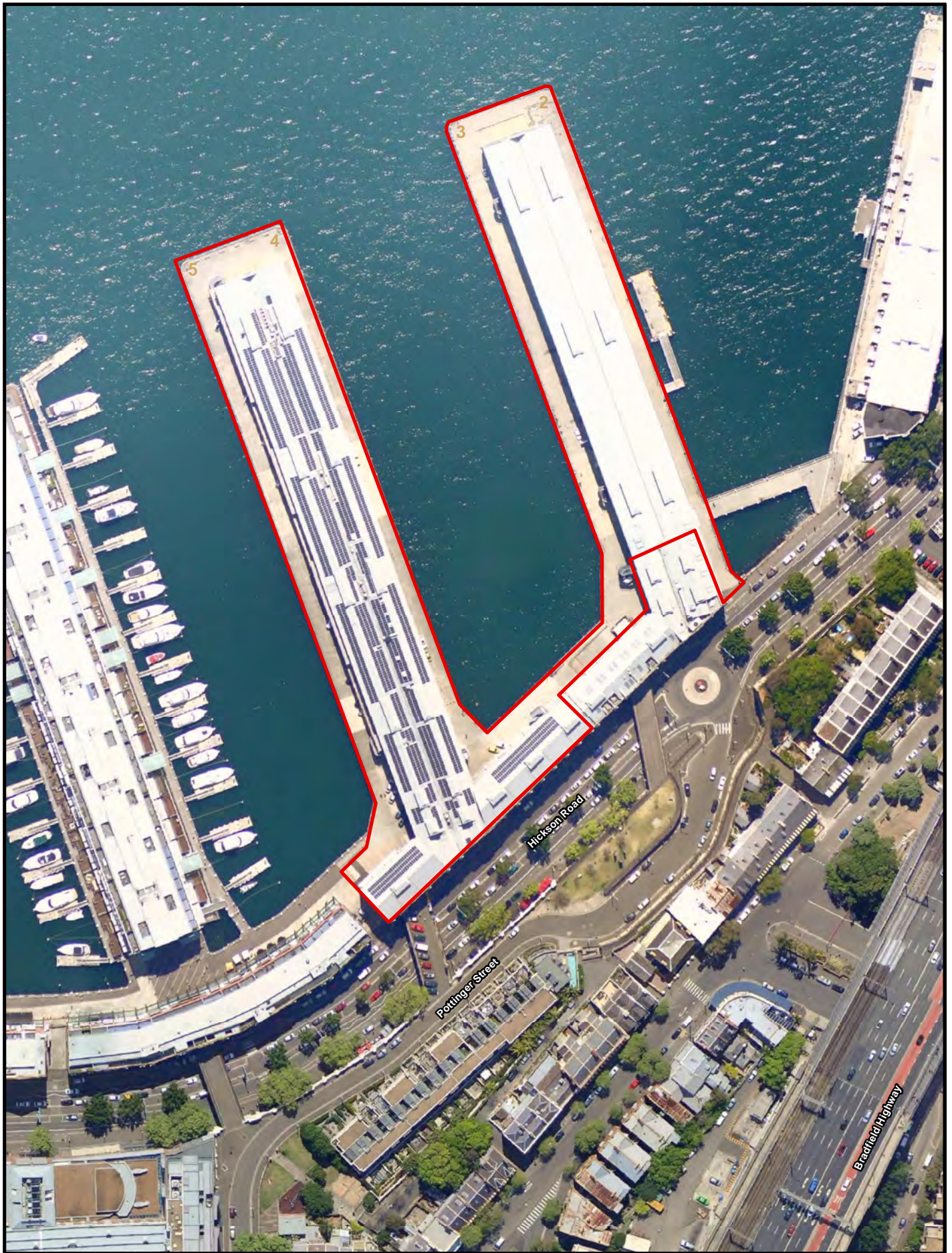
Client: Infrastructure NSW

Project: Walsh Bay Arts Precinct

Job No: 52304

File Name: 52304_01





Source: Base Image - © www.nearmap.com.au - Imagery Date September 19, 2013

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m

Scale: 1:1,800

Datum: GDA 1994 MGA Zone 56 - AHD

A4			
A	Original Issue - R02	BC	28-08-2017
Rev	Description	Drn.	Date:

Legend:

Approximate Site Boundary

JBS&G Figure 2: Site Layout

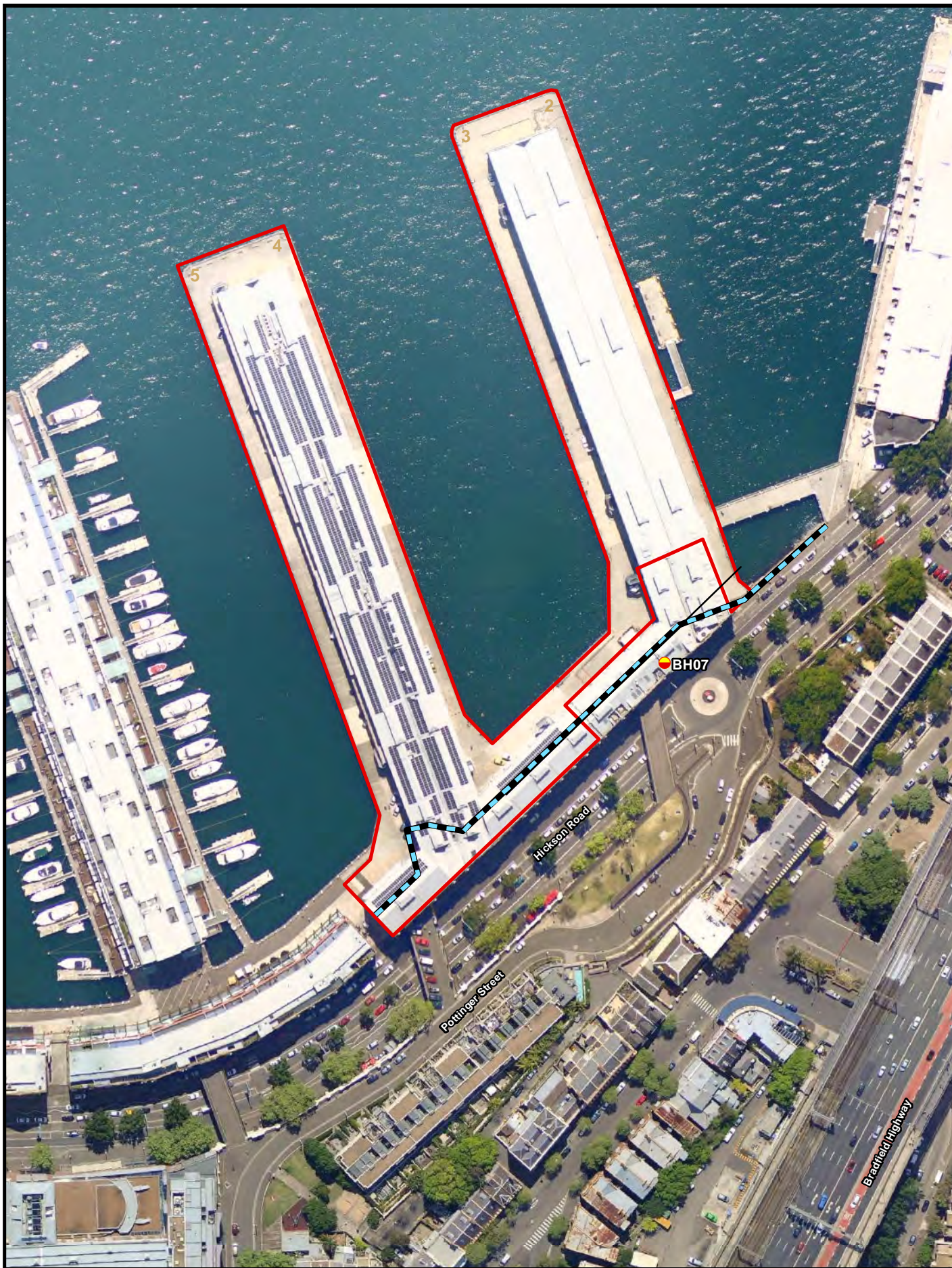
Client: Infrastructure NSW

Project: Walsh Bay Arts Precinct

Job No: 52304

File Name: 52304_02





Source: Base Image - © www.nearmap.com.au - Imagery Date September 19, 2013

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0 15 30 60 m

Scale: 1:1,800

Datum: GDA 1994 MGA Zone 56 - AHD

A4			
A	Original Issue - R02	BC	19-09-2017
Rev	Description	Drn.	Date:

Legend:

Approximate Site Boundary

Approximate Location of Seawall

Former Soil Sampling Location (HLA 1996)



Figure 3: Proposed Building Envelope

Client: Infrastructure NSW

Project: Walsh Bay Arts Precinct

Job No: 52304

File Name: 52304_03



Source: Design 5 Architects, 2014. Walsh Bay Arts Precinct, Heritage Assessment Report DRAFT. Near Map Imagery 22-08-2017.

© 2017 JBS&G

0	25	50	100
m			
Scale: 1:3,750			
Datum: GDA 1994 MGA Zone 56 - AHD			
A4			
A	Original Issue - R02	BC	19-09-2017
Rev	Description	Drn.	Date:

Legend

- ▬ Approximate Site Boundary
- ⋯ Walsh Bay Wharves 1890
- ⋯ Walsh Bay Foreshore 1836



Figure 4: Early Foreshore and Wharves

Client: Infrastructure NSW

Project: Walsh Bay Arts Precinct

Job No: 52304

File Name: 52304_04



Source: Base Image - © www.nearmap.com.au - Imagery Date September 19, 2013

© 2017 JBS&G

0 10 20 40 m

Scale: 1:1,000

Datum: GDA 1994 MGA Zone 56 - AHD

A4			
A	Original Issue - R02	BC	19-09-2017
Rev	Description	Drn.	Date:

Legend:

- Approximate Site Boundary
- Approximate Location of Seawall
- Former Soil Sampling Location (HLA 1996)
- Proposed Location (unable to advance)
- Sample Locations
- ▲ Subslab Sample Location



Figure 5: Sampling Locations

Client: Infrastructure NSW

Project: Walsh Bay Arts Precinct

Job No: 52304

File Name: 52304_05

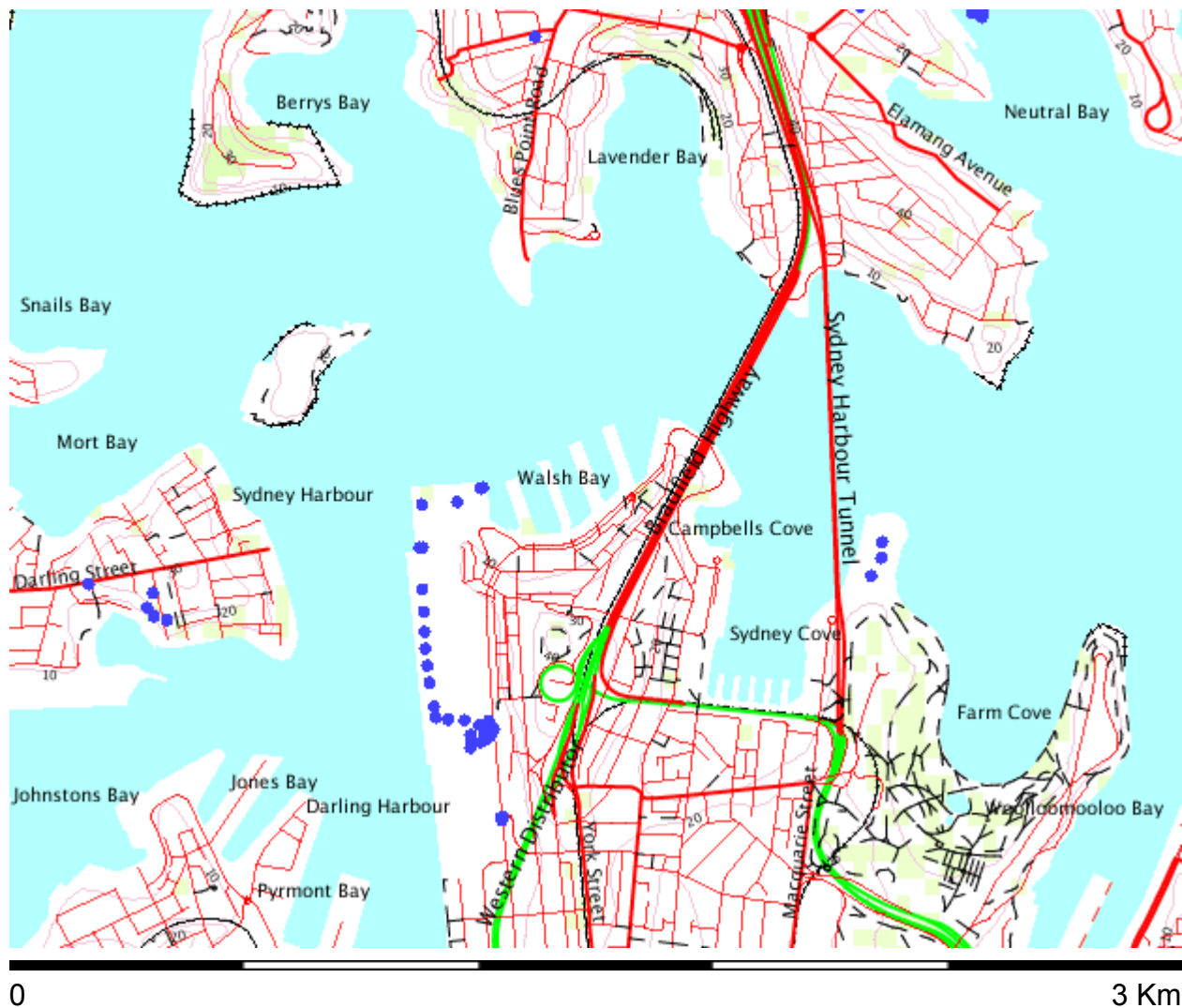


Appendix A Registered Groundwater Bore Search

43329

Map created with NSW Natural Resource Atlas - <http://www.nratlas.nsw.gov.au>

Wednesday, February 12, 2014

**Legend**

Symbol	Layer	Custodian
	Cities and large towns	renderImage: Cannot build image from features
	Populated places	renderImage: Cannot build image from features
	Towns	
	Groundwater Bores	
	Catchment Management Authority boundaries	
	Major rivers	

Topographic base map

Groundwater Works Summary

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Work Requested -- GW109085

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW109085
LIC-NUM 10BL602334
AUTHORISED-PURPOSES MONITORING BORE
INTENDED-PURPOSES MONITORING BORE
WORK-TYPE Bore
WORK-STATUS
CONSTRUCTION-METHOD
OWNER-TYPE Other Govt
COMMENCE-DATE
COMPLETION-DATE 2008-07-22
FINAL-DEPTH (metres) 5.68
DRILLED-DEPTH (metres) 5.68
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY SYDNEY WATER
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN
AREA-DISTRICT
CMA-MAP
GRID-ZONE
SCALE
ELEVATION
ELEVATION-SOURCE
NORTHING 6251263.00
EASTING 333786.00
LATITUDE 33 51' 57"
LONGITUDE 151 12' 11"
GS-MAP

AMG-ZONE 56
 COORD-SOURCE
 REMARK

Form-A [\(top\)](#)

COUNTY CUMBERLAND
 PARISH ST PHILIP
 PORTION-LOT-DP 1//87659

Licensed [\(top\)](#)

COUNTY CUMBERLAND
 PARISH ST PHILIP
 PORTION-LOT-DP 1 87659

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE- NO	PIPE- NO	COMPONENT- CODE	COMPONENT- TYPE	DEPTH- FROM (metres)	DEPTH- TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	5.68	120			
1	1	Casing	P.V.C.	0.00	3.20	40			

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.30	1.30	FILL,SILTY SAND MEDIUM TO COARSE		
1.30	2.10	0.80	FILL,SILT SAND CLAY MIXTURE		
2.10	2.20	0.10	FILL, SHINY GRAVEL ,BLACK SILT		
2.20	3.10	0.90	FILL,SILTY SAND BROWN RED		
3.10	4.00	0.90	FILL CLAY,GREY,BROWN,MOIST		
4.00	5.68	1.68	SAND,FINE TO MEDIUM		

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Work Requested -- GW109086

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW109086
LIC-NUM 10BL602334
AUTHORISED-PURPOSES MONITORING BORE
INTENDED-PURPOSES MONITORING BORE
WORK-TYPE Bore
WORK-STATUS
CONSTRUCTION-METHOD
OWNER-TYPE Other Govt
COMMENCE-DATE
COMPLETION-DATE 2008-07-22
FINAL-DEPTH (metres) 5.68
DRILLED-DEPTH (metres) 5.68
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY SYDNEY WATER
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN
AREA-DISTRICT
CMA-MAP
GRID-ZONE
SCALE
ELEVATION
ELEVATION-SOURCE
NORTHING 6251262.00
EASTING 333781.00
LATITUDE 33 51' 57"
LONGITUDE 151 12' 11"
GS-MAP

AMG-ZONE 56
 COORD-SOURCE
 REMARK

Form-A [\(top\)](#)

COUNTY CUMBERLAND
 PARISH ST PHILIP
 PORTION-LOT-DP 1//87659

Licensed [\(top\)](#)

COUNTY CUMBERLAND
 PARISH ST PHILIP
 PORTION-LOT-DP 1 87659

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE- NO	PIPE- NO	COMPONENT- CODE	COMPONENT- TYPE	DEPTH- FROM (metres)	DEPTH- TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	5.80	120			
1	1	Casing	P.V.C.	0.00	3.20	40			

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.50	0.50	FILL,MEDIUM TO COARSE		
0.50	1.00	0.50	FILL,SILTY SAND		
1.00	1.80	0.80	FILL,CLAYEY SAND FINE GRAINED		
1.80	2.00	0.20	FILL,GRAVELLY SAND		
2.00	3.20	1.20	FILL,SAND WITH SOME SILT		
3.20	3.80	0.60	FILL SILTY SAND		
3.80	4.50	0.70	FILL CLAY SILT SAND MIXTURE		
4.50	5.68	1.18	SAND,FINE TO MEDIUM GRAINED		

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Groundwater Works Summary

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Work Requested -- GW109087

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW109087
LIC-NUM 10BL602334
AUTHORISED-PURPOSES MONITORING BORE
INTENDED-PURPOSES MONITORING BORE
WORK-TYPE Bore
WORK-STATUS
CONSTRUCTION-METHOD
OWNER-TYPE Other Govt
COMMENCE-DATE
COMPLETION-DATE 2008-07-22
FINAL-DEPTH (metres) 8.50
DRILLED-DEPTH (metres) 8.50
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY SYDNEY WATER
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN
AREA-DISTRICT
CMA-MAP
GRID-ZONE
SCALE
ELEVATION
ELEVATION-SOURCE
NORTHING 6251252.00
EASTING 333783.00
LATITUDE 33 51' 57"
LONGITUDE 151 12' 11"
GS-MAP

AMG-ZONE 56
 COORD-SOURCE
 REMARK

Form-A [\(top\)](#)

COUNTY CUMBERLAND
 PARISH ST PHILIP
 PORTION-LOT-DP 1//87659

Licensed [\(top\)](#)

COUNTY CUMBERLAND
 PARISH ST PHILIP
 PORTION-LOT-DP 1 87659

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE- NO	PIPE- NO	COMPONENT- CODE	COMPONENT- TYPE	DEPTH- FROM (metres)	DEPTH- TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	8.50	120			
1	1	Casing	P.V.C.	0.00	3.20	40			

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	1.00	1.00	FILL,CLAY MIXED WITH COARSE GRAVEL		
1.00	1.50	0.50	FILL SAND MEDIUM GRAINED		
1.50	2.20	0.70	FILL,SILTY SAND,MOIST,FIRM WITH GRAVEL		
2.20	3.50	1.30	FILL,SAND MEDIUM GRAINED,GREY/BROWN		
3.50	4.00	0.50	FILL,SILTY SAND,MOIST,LOOSE TO FIRM		
4.00	4.50	0.50	FILL,CRUSHED SANDSTONE		
4.50	5.90	1.40	SAND MEDIUM TO FINE ,SILT BROWN,CLAY		
5.90	7.00	1.10	CLAY,HIGH PLASTICITY,WET,SHELLS		
7.00	8.50	1.50	SAND,FINE TO MEDIUM GRAINED,BEIGE		

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Work Requested -- GW109712

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW109712
LIC-NUM 10BL163286
AUTHORISED-PURPOSES MONITORING BORE
INTENDED-PURPOSES MONITORING BORE
WORK-TYPE Well
WORK-STATUS
CONSTRUCTION-METHOD
OWNER-TYPE Other Govt
COMMENCE-DATE
COMPLETION-DATE 2004-01-21
FINAL-DEPTH (metres) 5.80
DRILLED-DEPTH (metres) 5.80
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY MINISTER FOR POLICE
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL 2.64
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN
AREA-DISTRICT
CMA-MAP
GRID-ZONE
SCALE
ELEVATION
ELEVATION-SOURCE
NORTHING 6251938.00
EASTING 332788.00
LATITUDE 33 51' 35"
LONGITUDE 151 11' 33"
GS-MAP

AMG-ZONE 56
 COORD-SOURCE
 REMARK

Form-A [\(top\)](#)

COUNTY CUMBERLAND
 PARISH PETERSHAM
 PORTION-LOT-DP 1//773671

Licensed [\(top\)](#)

COUNTY CUMBERLAND
 PARISH PETERSHAM
 PORTION-LOT-DP 1 812813

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE- NO	PIPE- NO	COMPONENT- CODE	COMPONENT- TYPE	DEPTH- FROM (metres)	DEPTH- TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	5.80	100			
1	1	Casing	PVC Class 18	0.00	5.80	50			Screwed; Seated on Bottom
1		Annulus	Crushed Aggregate	0.00	0.00				Graded; GS: 1- 5.8mm

Water Bearing Zones [\(top\)](#)

FROM- DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK- CAT- DESC	S- W-L	D- D- L	YIELD	TEST-HOLE- DEPTH (metres)	DURATION	SALINITY
0.00	5.80	5.80		2.64					

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO- MATERIAL	COMMENT
0.00	1.50	1.50	TOPSOIL AND FILL		
1.50	5.80	4.30	WEATHERED SANDSTONE,MEDIUM TO COARSE GRAINED		

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Work Requested -- GW109713

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW109713
LIC-NUM	10BL163286
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	Other
OWNER-TYPE	Other Govt
COMMENCE-DATE	
COMPLETION-DATE	2004-01-21
FINAL-DEPTH (metres)	6.00
DRILLED-DEPTH (metres)	6.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	MINISTER FOR POLICE
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	2.52
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251951.00
EASTING	332750.00
LATITUDE	33 51' 34"
LONGITUDE	151 11' 31"
GS-MAP	

AMG-ZONE 56
 COORD-SOURCE
 REMARK

Form-A [\(top\)](#)

COUNTY CUMBERLAND
 PARISH PETERSHAM
 PORTION-LOT-DP 1//812813

Licensed [\(top\)](#)

COUNTY CUMBERLAND
 PARISH PETERSHAM
 PORTION-LOT-DP 1 812813

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE- NO	PIPE- NO	COMPONENT- CODE	COMPONENT- TYPE	DEPTH- FROM (metres)	DEPTH- TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	6.00	100			Other
1	1	Casing	PVC Class 18	0.00	6.00	50			Screwed
1		Annulus	Crushed Aggregate	0.00	0.00				Graded; GS: 1- 6mm

Water Bearing Zones [\(top\)](#)

FROM- DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK- CAT- DESC	S- W-L	D- D- L	YIELD	TEST-HOLE- DEPTH (metres)	DURATION	SALINITY
6.00	6.00	0.00		2.52					

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO- MATERIAL	COMMENT
0.00	2.60	2.60	FILL		
2.60	6.00	3.40	SANDSTONE,WEATHERED,MEDIUM TO COARSE GRAINED/SOME CLAY		

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW109714

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW109714
LIC-NUM	10BL163286
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	Other
OWNER-TYPE	Other Govt
COMMENCE-DATE	
COMPLETION-DATE	2004-01-22
FINAL-DEPTH (metres)	5.90
DRILLED-DEPTH (metres)	5.90
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	MINISTER FOR POLICE
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	2.55
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6252032.00
EASTING	332745.00
LATITUDE	33 51' 32"
LONGITUDE	151 11' 31"
GS-MAP	

AMG-ZONE 56
 COORD-SOURCE
 REMARK

Form-A [\(top\)](#)

COUNTY CUMBERLAND
 PARISH PETERSHAM
 PORTION-LOT-DP 1//812813

Licensed [\(top\)](#)

COUNTY CUMBERLAND
 PARISH PETERSHAM
 PORTION-LOT-DP 1 812813

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE- NO	PIPE- NO	COMPONENT- CODE	COMPONENT- TYPE	DEPTH- FROM (metres)	DEPTH- TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	5.90	100			Other
1	1	Casing	PVC Class 18	0.00	5.90	50			Screwed; Seated on Bottom
1		Annulus	Crushed Aggregate	0.00	0.00				Graded; GS: .5- 5.9mm

Water Bearing Zones [\(top\)](#)

FROM- DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK- CAT- DESC	S- W-L	D- D- L	YIELD	TEST-HOLE- DEPTH (metres)	DURATION	SALINITY
0.00	5.90	5.90		2.55					

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO- MATERIAL	COMMENT
0.00	1.20	1.20	FILL		
1.20	5.90	4.70	SANDSTONE WEATHERED,MEDIUM TO COARSE,GRAINED,SOME CLAY		

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Groundwater Works Summary

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Work Requested -- GW109715

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW109715
LIC-NUM	10BL163286
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	Other
OWNER-TYPE	Other Govt
COMMENCE-DATE	
COMPLETION-DATE	2004-01-22
FINAL-DEPTH (metres)	5.90
DRILLED-DEPTH (metres)	5.90
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	MINISTER FOR POLICE
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	4.40
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6252060.00
EASTING	332556.00
LATITUDE	33 51' 31"
LONGITUDE	151 11' 24"
GS-MAP	

AMG-ZONE 56
 COORD-SOURCE
 REMARK

Form-A [\(top\)](#)

COUNTY CUMBERLAND
 PARISH PETERSHAM
 PORTION-LOT-DP 1//812813

Licensed [\(top\)](#)

COUNTY CUMBERLAND
 PARISH PETERSHAM
 PORTION-LOT-DP 1 812813

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE- NO	PIPE- NO	COMPONENT- CODE	COMPONENT- TYPE	DEPTH- FROM (metres)	DEPTH- TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	5.90	100			Other
1	1	Casing	PVC Class 18	0.00	5.90	50			Screwed; Seated on Bottom
1		Annulus	Crushed Aggregate	0.00	0.00				Graded; GS: 1- 5.9mm

Water Bearing Zones [\(top\)](#)

FROM- DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK- CAT- DESC	S- W-L	D- D- L	YIELD	TEST-HOLE- DEPTH (metres)	DURATION	SALINITY
0.00	5.90	5.90		4.40					

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO- MATERIAL	COMMENT
0.00	1.20	1.20	FILL		
1.20	5.90	4.70	SANDSTONE WEATHERED MEDIUM TO COARSE GRAINED,CLAY SEAMS		

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW109716

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW109716
LIC-NUM	10BL163286
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	Other
OWNER-TYPE	Other Govt
COMMENCE-DATE	
COMPLETION-DATE	2004-01-22
FINAL-DEPTH (metres)	6.00
DRILLED-DEPTH (metres)	6.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	MINISTER FOR POLICE
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	1.79
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251981.00
EASTING	332729.00
LATITUDE	33 51' 33"
LONGITUDE	151 11' 30"
GS-MAP	

AMG-ZONE 56
 COORD-SOURCE
 REMARK

Form-A [\(top\)](#)

COUNTY CUMBERLAND
 PARISH PETERSHAM
 PORTION-LOT-DP 1//812813

Licensed [\(top\)](#)

COUNTY CUMBERLAND
 PARISH PETERSHAM
 PORTION-LOT-DP 1 812813

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE- NO	PIPE- NO	COMPONENT- CODE	COMPONENT- TYPE	DEPTH- FROM (metres)	DEPTH- TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	6.00	100			Other
1	1	Casing	PVC Class 18	0.00	6.00	50			Screwed; Seated on Bottom
1		Annulus	Crushed Aggregate	0.00	0.00				Graded; GS: 1- 5mm

Water Bearing Zones [\(top\)](#)

FROM- DEPTH (metres)	TO-DEPTH (metres)	THICKNESS (metres)	ROCK- CAT- DESC	S- W-L	D- D- L	YIELD	TEST-HOLE- DEPTH (metres)	DURATION	SALINITY
0.00	6.00	6.00		1.79					

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	4.20	4.20	FILL		
4.20	5.80	1.60	MARINE SILT		
5.80	6.00	0.20	SANDSTONE		

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Groundwater Works Summary

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Work Requested -- GW111570

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW111570
LIC-NUM	10BL604689
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Auger - Solid Flight
OWNER-TYPE	Other Govt
COMMENCE-DATE	
COMPLETION-DATE	2011-06-27
FINAL-DEPTH (metres)	6.00
DRILLED-DEPTH (metres)	6.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	SYDNEY PORTS CORPORATION
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	2.72
SALINITY	
YIELD	1.00

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6252417.00
EASTING	333701.00
LATITUDE	33 51' 20"
LONGITUDE	151 12' 8"
GS-MAP	

AMG-ZONE 56
 COORD-SOURCE
 REMARK

Form-A [\(top\)](#)

COUNTY CUMBERLAND
 PARISH ST PHILIP
 PORTION-LOT-DP 2//876514

Licensed [\(top\)](#)

COUNTY CUMBERLAND
 PARISH ST PHILIP
 PORTION-LOT-DP 2 876514

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE- NO	PIPE- NO	COMPONENT- CODE	COMPONENT- TYPE	DEPTH- FROM (metres)	DEPTH- TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	6.00	90			Auger - Solid Flight
1	1	Casing	PVC Class 18	0.00	2.00	61	51		Screwed; Seated on Bottom; End cap
1	1	Opening	Slots - Horizontal	2.00	5.80	61			PVC Class 18; Casing - Machine Slotted; SL: 40mm; A: .5mm; Screwed
1		Annulus	Bentonite/Grout	0.10	1.00				
1		Annulus	Crushed Aggregate	1.00	6.00				Graded; GS: 1-3mm

Water Bearing Zones [\(top\)](#)

FROM- DEPTH (metres)	TO- DEPTH (metres)	THICKNESS (metres)	ROCK- CAT- DESC	S- W-L	D- D-L	YIELD	TEST- HOLE- DEPTH (metres)	DURATION	SALINITY
2.50	6.00	3.50		2.72	5.80	1.00			

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.20	0.20	CONCRETE		

0.20	1.00	0.80	FILL,CLAYEY SAND,YELLOW BROWN
1.00	6.00	5.00	FILL. SAND,YELLOW

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Groundwater Works Summary

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Work Requested -- GW111571

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW111571
LIC-NUM	10BL604689
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	Equipped - bore used for obs
CONSTRUCTION-METHOD	Auger - Solid Flight
OWNER-TYPE	Other Govt
COMMENCE-DATE	
COMPLETION-DATE	2011-06-27
FINAL-DEPTH (metres)	6.00
DRILLED-DEPTH (metres)	6.00
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	SYDNEY PORTS CORPORATION
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	2.65
SALINITY	
YIELD	1.00

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6252420.00
EASTING	333707.00
LATITUDE	33 51' 20"
LONGITUDE	151 12' 9"
GS-MAP	

AMG-ZONE 56
 COORD-SOURCE
 REMARK

Form-A [\(top\)](#)

COUNTY CUMBERLAND
 PARISH ST PHILIP
 PORTION-LOT-DP 2//876514

Licensed [\(top\)](#)

COUNTY CUMBERLAND
 PARISH ST PHILIP
 PORTION-LOT-DP 2 876514

Construction [\(top\)](#)

Negative depths indicate Above Ground Level;H-Hole;P-Pipe;OD-Outside Diameter;
 ID-Inside Diameter;C-Cemented;SL-Slot Length;A-Aperture;GS-Grain Size;Q-Quantity

HOLE- NO	PIPE- NO	COMPONENT- CODE	COMPONENT- TYPE	DEPTH- FROM (metres)	DEPTH- TO (metres)	OD (mm)	ID (mm)	INTERVAL	DETAIL
1		Hole	Hole	0.00	6.00	90			Auger - Solid Flight
1	1	Casing	PVC Class 18	0.00	2.00	61	51		Screwed; Seated on Bottom; Open End
1	1	Opening	Slots - Horizontal	2.00	5.80	61			PVC Class 18; Casing - Machine Slotted; SL: 40mm; A: .5mm; Screwed
1		Annulus	Bentonite/Grout	0.10	1.00				
1		Annulus	Crushed Aggregate	1.00	6.00				Graded; GS: 1-3mm

Water Bearing Zones [\(top\)](#)

FROM- DEPTH (metres)	TO- DEPTH (metres)	THICKNESS (metres)	ROCK- CAT- DESC	S- W-L	D- D-L	YIELD	TEST- HOLE- DEPTH (metres)	DURATION	SALINITY
2.50	6.00	3.50		2.65	5.80	1.00			

Drillers Log [\(top\)](#)

FROM	TO	THICKNESS	DESC	GEO-MATERIAL	COMMENT
0.00	0.20	0.20	CONCRETE		

0.20	1.80	1.60	FILL,CLAYEY SAND,YELLOW BROWN
1.80	6.00	4.20	FILL,SAND YELLOW

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Groundwater Works Summary

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Work Requested -- GW112871

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW112871
LIC-NUM 10BL604486
AUTHORISED-PURPOSES MONITORING BORE
INTENDED-PURPOSES MONITORING BORE
WORK-TYPE Well
WORK-STATUS
CONSTRUCTION-METHOD
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 2011-02-11
FINAL-DEPTH (metres) 20.00
DRILLED-DEPTH (metres)
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY SYDNEY OPERA HOUSE TRUST
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN
AREA-DISTRICT
CMA-MAP
GRID-ZONE
SCALE
ELEVATION
ELEVATION-SOURCE
NORTHING 6252193.00
EASTING 334880.00
LATITUDE 33 51' 28"
LONGITUDE 151 12' 54"
GS-MAP

AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

COUNTY CUMBERLAND
PARISH ST JAMES
PORTION-LOT-DP 5//775888

Licensed [\(top\)](#)

COUNTY CUMBERLAND
PARISH ST JAMES
PORTION-LOT-DP 5 775888

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW112872

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW112872
LIC-NUM 10BL604486
AUTHORISED-PURPOSES MONITORING BORE
INTENDED-PURPOSES MONITORING BORE
WORK-TYPE Well
WORK-STATUS
CONSTRUCTION-METHOD
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 2011-04-28
FINAL-DEPTH (metres) 20.12
DRILLED-DEPTH (metres)
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY SYDNEY OPERA HOUSE TRUST
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN
AREA-DISTRICT
CMA-MAP
GRID-ZONE
SCALE
ELEVATION
ELEVATION-SOURCE
NORTHING 6252249.00
EASTING 334881.00
LATITUDE 33 51' 26"
LONGITUDE 151 12' 54"
GS-MAP

AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

COUNTY CUMBERLAND
PARISH ST JAMES
PORTION-LOT-DP 5//775888

Licensed [\(top\)](#)

COUNTY CUMBERLAND
PARISH ST JAMES
PORTION-LOT-DP 5 775888

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW112873

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW112873
LIC-NUM 10BL604486
AUTHORISED-PURPOSES MONITORING BORE
INTENDED-PURPOSES MONITORING BORE
WORK-TYPE Well
WORK-STATUS
CONSTRUCTION-METHOD
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 2011-04-28
FINAL-DEPTH (metres) 15.10
DRILLED-DEPTH (metres)
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY SYDNEY OPERA HOUSE TRUST
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN
AREA-DISTRICT
CMA-MAP
GRID-ZONE
SCALE
ELEVATION
ELEVATION-SOURCE
NORTHING 6252129.00
EASTING 334851.00
LATITUDE 33 51' 30"
LONGITUDE 151 12' 53"
GS-MAP

AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

COUNTY CUMBERLAND
PARISH ST JAMES
PORTION-LOT-DP 5//775888

Licensed [\(top\)](#)

COUNTY CUMBERLAND
PARISH ST JAMES
PORTION-LOT-DP 5 775888

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113553

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113553
LIC-NUM	10BL604425
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2011-01-06
FINAL-DEPTH (metres)	5.20
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6252368.00
EASTING	333632.00
LATITUDE	33 51' 21"
LONGITUDE	151 12' 6"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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COUNTY CUMBERLAND
PARISH ST PHILIP
PORTION-LOT-DP 5//876514

Licensed [\(top\)](#)

COUNTY CUMBERLAND
PARISH ST PHILIP
PORTION-LOT-DP 5 876514

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW113554

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113554
LIC-NUM	10BL604425
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2011-01-06
FINAL-DEPTH (metres)	5.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6252357.00
EASTING	333529.00
LATITUDE	33 51' 21"
LONGITUDE	151 12' 2"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Work Requested -- GW113555

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113555
LIC-NUM	10BL604425
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2011-01-06
FINAL-DEPTH (metres)	14.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6252205.00
EASTING	333533.00
LATITUDE	33 51' 26"
LONGITUDE	151 12' 2"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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COUNTY CUMBERLAND
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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Work Requested -- GW113556

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113556
LIC-NUM	10BL604425
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2011-01-06
FINAL-DEPTH (metres)	14.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6252205.00
EASTING	333524.00
LATITUDE	33 51' 26"
LONGITUDE	151 12' 1"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113557

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113557
LIC-NUM	10BL604425
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2011-01-06
FINAL-DEPTH (metres)	12.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6252060.00
EASTING	333535.00
LATITUDE	33 51' 31"
LONGITUDE	151 12' 2"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113558

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113558
LIC-NUM	10BL604425
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2011-01-06
FINAL-DEPTH (metres)	14.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251980.00
EASTING	333541.00
LATITUDE	33 51' 34"
LONGITUDE	151 12' 2"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Work Requested -- GW113559

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113559
LIC-NUM	10BL604425
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2011-01-06
FINAL-DEPTH (metres)	4.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251910.00
EASTING	333544.00
LATITUDE	33 51' 36"
LONGITUDE	151 12' 2"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Work Requested -- GW113560

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113560
LIC-NUM	10BL604425
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2011-01-06
FINAL-DEPTH (metres)	3.60
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251850.00
EASTING	333548.00
LATITUDE	33 51' 38"
LONGITUDE	151 12' 2"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Work Requested -- GW113561

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113561
LIC-NUM	10BL604425
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2011-01-06
FINAL-DEPTH (metres)	4.50
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251791.00
EASTING	333555.00
LATITUDE	33 51' 40"
LONGITUDE	151 12' 2"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Work Requested -- GW113562

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW113562
LIC-NUM 10BL604425
AUTHORISED-PURPOSES MONITORING BORE
INTENDED-PURPOSES MONITORING BORE
WORK-TYPE Bore
WORK-STATUS
CONSTRUCTION-METHOD
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 2011-01-06
FINAL-DEPTH (metres) 10.70
DRILLED-DEPTH (metres)
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY BARANGAROO DELIVERY AUTHORITY
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN
AREA-DISTRICT
CMA-MAP
GRID-ZONE
SCALE
ELEVATION
ELEVATION-SOURCE
NORTHING 6251731.00
EASTING 333562.00
LATITUDE 33 51' 42"
LONGITUDE 151 12' 3"
GS-MAP

AMG-ZONE 56
COORD-SOURCE
REMARK

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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113563

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113563
LIC-NUM	10BL604425
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2011-01-06
FINAL-DEPTH (metres)	11.70
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251647.00
EASTING	333577.00
LATITUDE	33 51' 45"
LONGITUDE	151 12' 3"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113564

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113564
LIC-NUM	10BL604425
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2011-01-06
FINAL-DEPTH (metres)	7.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251610.00
EASTING	333582.00
LATITUDE	33 51' 46"
LONGITUDE	151 12' 3"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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COUNTY CUMBERLAND
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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113565

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113565
LIC-NUM	10BL604425
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2011-01-06
FINAL-DEPTH (metres)	4.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

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REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251603.00
EASTING	333619.00
LATITUDE	33 51' 46"
LONGITUDE	151 12' 5"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113566

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113566
LIC-NUM	10BL604425
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Bore
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2011-01-06
FINAL-DEPTH (metres)	3.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251601.00
EASTING	333667.00
LATITUDE	33 51' 46"
LONGITUDE	151 12' 7"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

COUNTY CUMBERLAND
PARISH ST PHILIP
PORTION-LOT-DP 5//876514

Licensed [\(top\)](#)

COUNTY CUMBERLAND
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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW113596

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113596
LIC-NUM	10BL604366
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2009-12-08
FINAL-DEPTH (metres)	14.10
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251591.00
EASTING	333741.00
LATITUDE	33 51' 46"
LONGITUDE	151 12' 9"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113597

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113597
LIC-NUM	10BL604366
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2009-12-07
FINAL-DEPTH (metres)	9.50
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251600.00
EASTING	333738.00
LATITUDE	33 51' 46"
LONGITUDE	151 12' 9"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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COUNTY CUMBERLAND
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Licensed [\(top\)](#)

COUNTY CUMBERLAND
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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113598

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113598
LIC-NUM	10BL604366
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2010-02-10
FINAL-DEPTH (metres)	13.20
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251581.00
EASTING	333745.00
LATITUDE	33 51' 47"
LONGITUDE	151 12' 10"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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Licensed [\(top\)](#)

COUNTY CUMBERLAND
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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113599

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113599
LIC-NUM	10BL604366
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2010-02-09
FINAL-DEPTH (metres)	13.50
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251505.00
EASTING	333687.00
LATITUDE	33 51' 49"
LONGITUDE	151 12' 7"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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COUNTY CUMBERLAND
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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113602

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113602
LIC-NUM	10BL604366
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2010-02-11
FINAL-DEPTH (metres)	17.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251531.00
EASTING	333727.00
LATITUDE	33 51' 48"
LONGITUDE	151 12' 9"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113603

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113603
LIC-NUM	10BL604366
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2010-02-19
FINAL-DEPTH (metres)	14.50
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251525.00
EASTING	333717.00
LATITUDE	33 51' 49"
LONGITUDE	151 12' 9"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113604

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113604
LIC-NUM	10BL604366
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2010-02-23
FINAL-DEPTH (metres)	8.20
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251538.00
EASTING	333735.00
LATITUDE	33 51' 48"
LONGITUDE	151 12' 9"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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COUNTY CUMBERLAND
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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113605

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113605
LIC-NUM	10BL604366
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2010-02-23
FINAL-DEPTH (metres)	3.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251547.00
EASTING	333744.00
LATITUDE	33 51' 48"
LONGITUDE	151 12' 10"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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COUNTY CUMBERLAND
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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113606

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113606
LIC-NUM	10BL604366
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2010-03-04
FINAL-DEPTH (metres)	13.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251550.00
EASTING	333686.00
LATITUDE	33 51' 48"
LONGITUDE	151 12' 7"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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COUNTY CUMBERLAND
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COUNTY CUMBERLAND
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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113607

Works Details [\(top\)](#)

GROUNDWATER NUMBER GW113607
LIC-NUM 10BL604366
AUTHORISED-PURPOSES MONITORING BORE
INTENDED-PURPOSES
WORK-TYPE Well
WORK-STATUS
CONSTRUCTION-METHOD
OWNER-TYPE Private
COMMENCE-DATE
COMPLETION-DATE 2010-02-22
FINAL-DEPTH (metres) 7.20
DRILLED-DEPTH (metres)
CONTRACTOR-NAME
DRILLER-NAME
PROPERTY BARANGAROO DELIVERY AUTHORITY
GWMA -
GW-ZONE -
STANDING-WATER-LEVEL
SALINITY
YIELD

Site Details [\(top\)](#)

REGION 10 - SYDNEY SOUTH COAST
RIVER-BASIN
AREA-DISTRICT
CMA-MAP
GRID-ZONE
SCALE
ELEVATION
ELEVATION-SOURCE
NORTHING 6251558.00
EASTING 333727.00
LATITUDE 33 51' 48"
LONGITUDE 151 12' 9"
GS-MAP

AMG-ZONE 56
COORD-SOURCE
REMARK

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COUNTY CUMBERLAND
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COUNTY CUMBERLAND
PARISH ST PHILIP
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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113608

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113608
LIC-NUM	10BL604366
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2010-03-02
FINAL-DEPTH (metres)	13.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251570.00
EASTING	333754.00
LATITUDE	33 51' 47"
LONGITUDE	151 12' 10"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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COUNTY CUMBERLAND
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Licensed [\(top\)](#)

COUNTY CUMBERLAND
PARISH ST PHILIP
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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

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Work Requested -- GW113610

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113610
LIC-NUM	10BL604366
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2010-02-26
FINAL-DEPTH (metres)	12.20
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251579.00
EASTING	333722.00
LATITUDE	33 51' 47"
LONGITUDE	151 12' 9"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

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COUNTY CUMBERLAND
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COUNTY CUMBERLAND
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Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

Warning To Clients: This raw data has been supplied to the Department of Infrastructure, Planning and Natural Resources (DIPNR) by drillers, licensees and other sources. The DIPNR does not verify the accuracy of this data. The data is presented for use by you at your own risk. You should consider verifying this data before relying on it. Professional hydrogeological advice should be sought in interpreting and using this data.

Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
Document Generated on Wednesday, February 12, 2014

[Print Report](#)

[Works Details](#) [Site Details](#) [Form A](#) [Licensed](#) [Construction](#) [Water Bearing Zones](#) [Drillers Log](#)

Work Requested -- GW113611

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113611
LIC-NUM	10BL604366
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2010-03-02
FINAL-DEPTH (metres)	7.50
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251539.00
EASTING	333687.00
LATITUDE	33 51' 48"
LONGITUDE	151 12' 7"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

COUNTY CUMBERLAND
PARISH ST PHILIP
PORTION-LOT-DP 5//876514

Licensed [\(top\)](#)

COUNTY CUMBERLAND
PARISH ST PHILIP
PORTION-LOT-DP 3 876514

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Groundwater Works Summary

For information on the meaning of fields please see [Glossary](#)
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Work Requested -- GW113612

Works Details [\(top\)](#)

GROUNDWATER NUMBER	GW113612
LIC-NUM	10BL604366
AUTHORISED-PURPOSES	MONITORING BORE
INTENDED-PURPOSES	MONITORING BORE
WORK-TYPE	Well
WORK-STATUS	
CONSTRUCTION-METHOD	
OWNER-TYPE	Private
COMMENCE-DATE	
COMPLETION-DATE	2010-03-03
FINAL-DEPTH (metres)	13.00
DRILLED-DEPTH (metres)	
CONTRACTOR-NAME	
DRILLER-NAME	
PROPERTY	BARANGAROO DELIVERY AUTHORITY
GWMA	-
GW-ZONE	-
STANDING-WATER-LEVEL	
SALINITY	
YIELD	

Site Details [\(top\)](#)

REGION	10 - SYDNEY SOUTH COAST
RIVER-BASIN	
AREA-DISTRICT	
CMA-MAP	
GRID-ZONE	
SCALE	
ELEVATION	
ELEVATION-SOURCE	
NORTHING	6251585.00
EASTING	333710.00
LATITUDE	33 51' 47"
LONGITUDE	151 12' 8"
GS-MAP	

AMG-ZONE 56
COORD-SOURCE
REMARK

Form-A [\(top\)](#)

COUNTY CUMBERLAND
PARISH ST PHILIP
PORTION-LOT-DP 5//876514

Licensed [\(top\)](#)

COUNTY CUMBERLAND
PARISH ST PHILIP
PORTION-LOT-DP 3 876514

Water Bearing Zones [\(top\)](#)

no details

Drillers Log [\(top\)](#)

no details

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Appendix B Structural Concept Design Report (TTW 2014)



Walsh Bay Arts Precinct
Concept Structural Design Report

for Bates Smart

26th February 2014

Job No. 131646

Taylor Thomson Whitting (NSW) Pty Ltd. Consulting Engineers ACN 113 578 377
48 Chandos Street St Leonards NSW 2065 PO Box 738 Crows Nest 1585
T 61 2 9439 7288 F 61 2 9439 3146 ttwsyd@ttw.com.au www.ttw.com.au

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5.0 PIER 2/3 LEVEL 2 PERFORMANCE SPACES.....	2
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APPENDIX A

APPENDIX B

1.0 BACKGROUND

The existing structures in the Walsh Bay Arts Precinct, namely Pier 2/3, Pier 4/5 and the Shore Sheds are all timber structures originally constructed in the 1920's as cargo wharfs and storage sheds. The original structures have undergone various alterations, upgrades and repairs.

The original two-level structures were built entirely from hardwood timber. They consist of a sub-structure of piles, headstocks and girders supporting a concrete deck around the perimeter of the Piers and a timber deck inside the building, and a superstructure consisting of floor trusses and roof trusses.

2.0 STRUCTURAL ASSESSMENT & MAINTENANCE

Detailed condition surveys and structural assessments of both Pier 2/3 and Wharf 4/5 have been carried over the last decade. This work has been carried out for NSW Public Works with TTW acting as their consultant for Pier 2/3 and GHD for Wharf 4/5. TTW issued their final "Preliminary Structural Assessment" report for Pier 2/3 on 24th November 2010. For both Pier 2/3 and Wharf 4/5 the results of the condition surveys of the sub-structure and super-structure has been used to carry out a structural analysis of the piers for gravity and lateral loads (wind and earthquake) for compliance with current Australian Standards. The results of the analysis and design checks has enabled repair work to be specified and prioritised. Technical Specifications have been prepared by TTW for Pier 2/3 (issued May 2013) and by GHD for Wharf 4/5 (issued November 2010).

The condition surveys consist of visual surveys plus termite monitoring and inspections. From 2011 until now detailed surveys of all of the piles, headstocks and storey posts have been carried out. Structural Maintenance specifications have been prepared for Pier 2/3 and Wharf 4/5 which detail the requirements for pile repair & replacement for piles, headstocks, girders, storey posts and other miscellaneous items.

The structural maintenance work required for the piers has been documented by TTW and GHD including priorities on the importance of the repair work. A 10 year maintenance program is now in place which has both preventative and planned maintenance items. Preventative items include ongoing condition surveys (including pile surveys) every 4 years and termite control. Planned maintenance is the repair/replacement work documented by TTW and GHD. The majority of this work is the repair of timber piles and the replacement of timber piles with jack-up piles in cases where the pile has degraded beyond the point of being repairable. Other maintenance items in the 10 year program consist of repair/replacement of non-structural items such as drainage, doors & windows and weatherboards.

3.0 SUB-STRUCTURE

The original timber piles are set out on a 10ft by 10ft grid in the Piers. In the upgrades and repairs carried out on the Piers many of the piles have been regarded as redundant and not repaired as the live load for the recent use of the Piers is much less than the loads required for its original function as a cargo wharf. The opportunity now exists to add jack-up piles to in these redundant pile locations to provide extra footing capacity to support the additional loads intended for Pier 2/3 as described below.

The proposed new lifts in Pier 2/3 will require pits below deck level. There may also be new water storage tanks located under the deck. Both the lift pits and water tanks could be reinforced concrete structures supported on the timber piles. If required the base of the pits

and tanks could be below the water level.

4.0 PIER 2/3 LEVEL 1 & 3

The new mezzanine floor structures will need to be of lightweight construction to minimise the additional load applied to the existing columns and piles. The new mezzanine construction could be similar to those added to the Shore Sheds about 10 years ago which consisted of steel floor beams, steel joists and a topping slab. The drawings of the Shore Sheds mezzanine structure are enclosed in Appendix B.

5.0 PIER 2/3 LEVEL 2 PERFORMANCE SPACES

Acoustic requirements for the performance spaces will require new concrete jack-up slabs to be constructed over the existing L2 floor structure. The additional load from these concrete slabs will require additional jack-up piles to be installed. In addition where new mezzanines floors are being added resulting in increased column loads, additional jack-up piles will be required.

The existing central row of columns in Pier 2/3 supporting the roof trusses will need to be removed in the performance spaces. The plans enclosed in Appendix A show the locations of the columns to be removed. For both the Bell Rehearsal space and ACO Auditorium it is proposed to retain the existing timber trusses. A new steel supporting beam will be provided above the Bell Rehearsal space and a new steel truss above the ACO Auditorium.

6.0 WHARF 4/5 BANGARRA SPACE

For Studio 2 it is proposed to remove an existing column at Ground level. A new steel beam and jack-up piles will be required as shown on the drawings in Appendix A.

7.0 INFORMATION PROVIDED FOR THE FINAL BUSINESS CASE

Information has been provided for costing of the structural items in the Final Business Case. This included advice regarding pile replacement; new mezzanine floor structure; performance space floor slab to achieve acoustic performance; typical truss design where columns are to be removed; and typical structure for waterfront square.

Authorised by:
TAYLOR THOMSON WHITTING (NSW) PTY LTD



David Carolan
Director

P:\2013\1316\131646\Reports\TTW\140226 Concept Design report for SSDA_DRAFT.doc

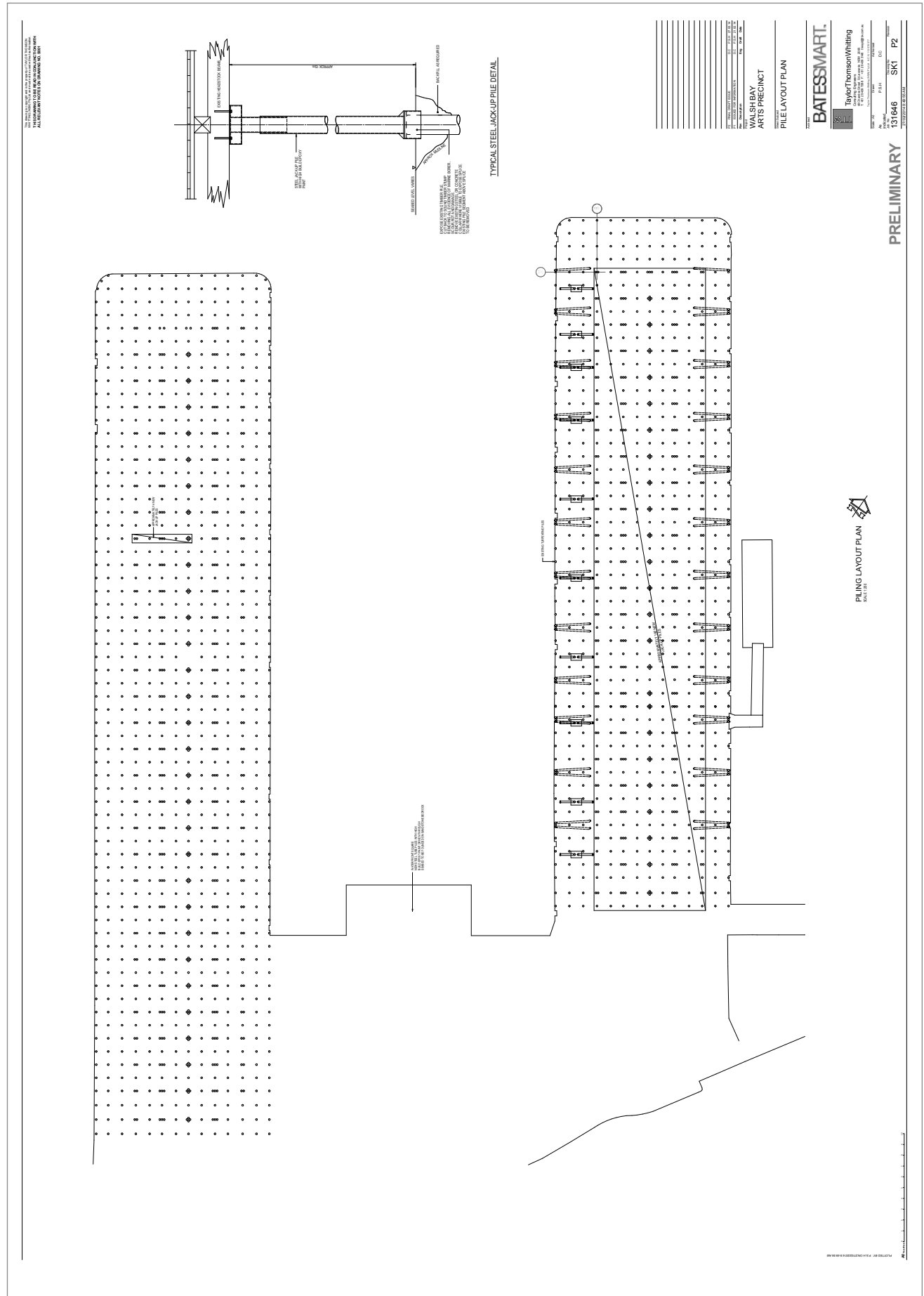
131646

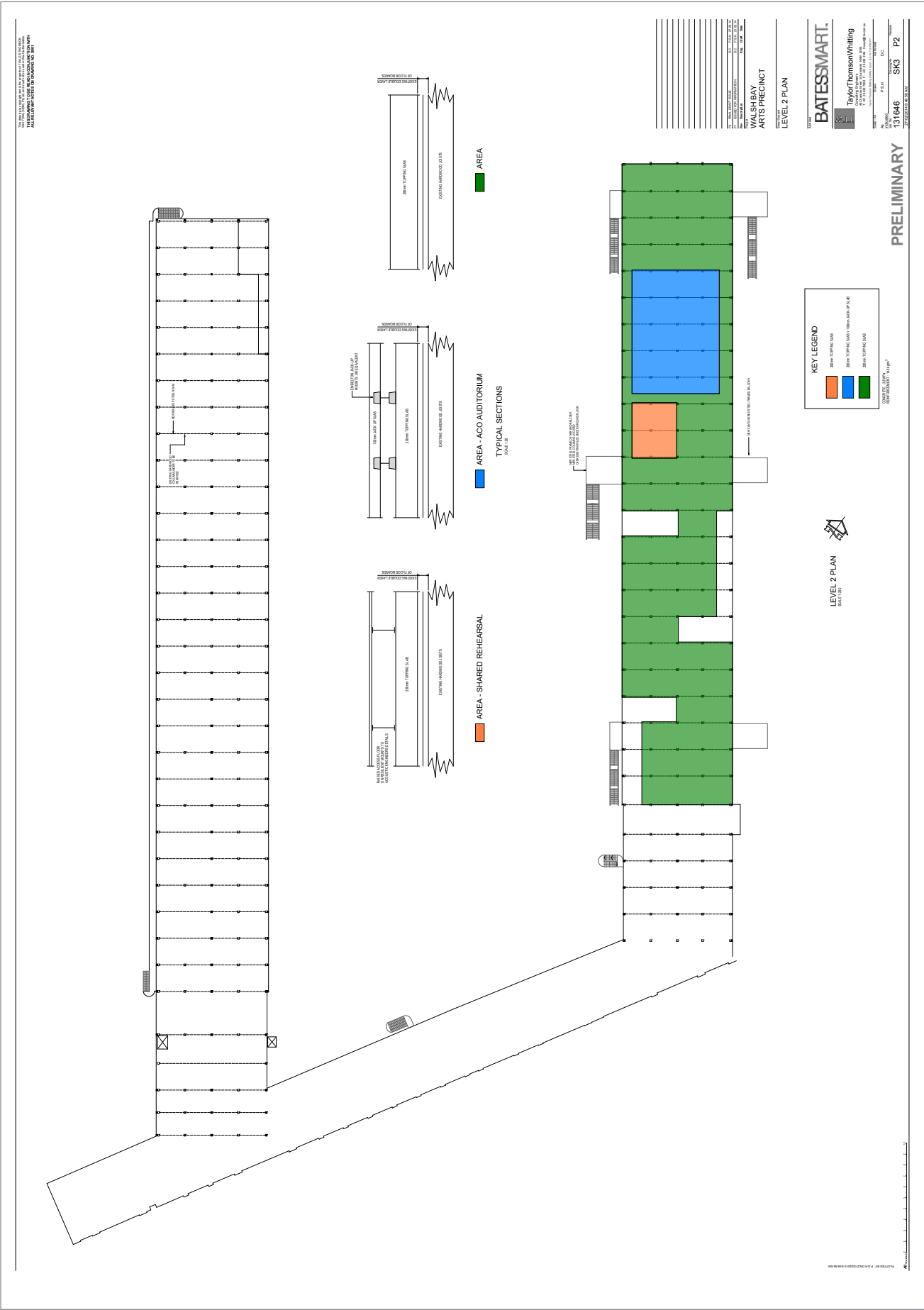
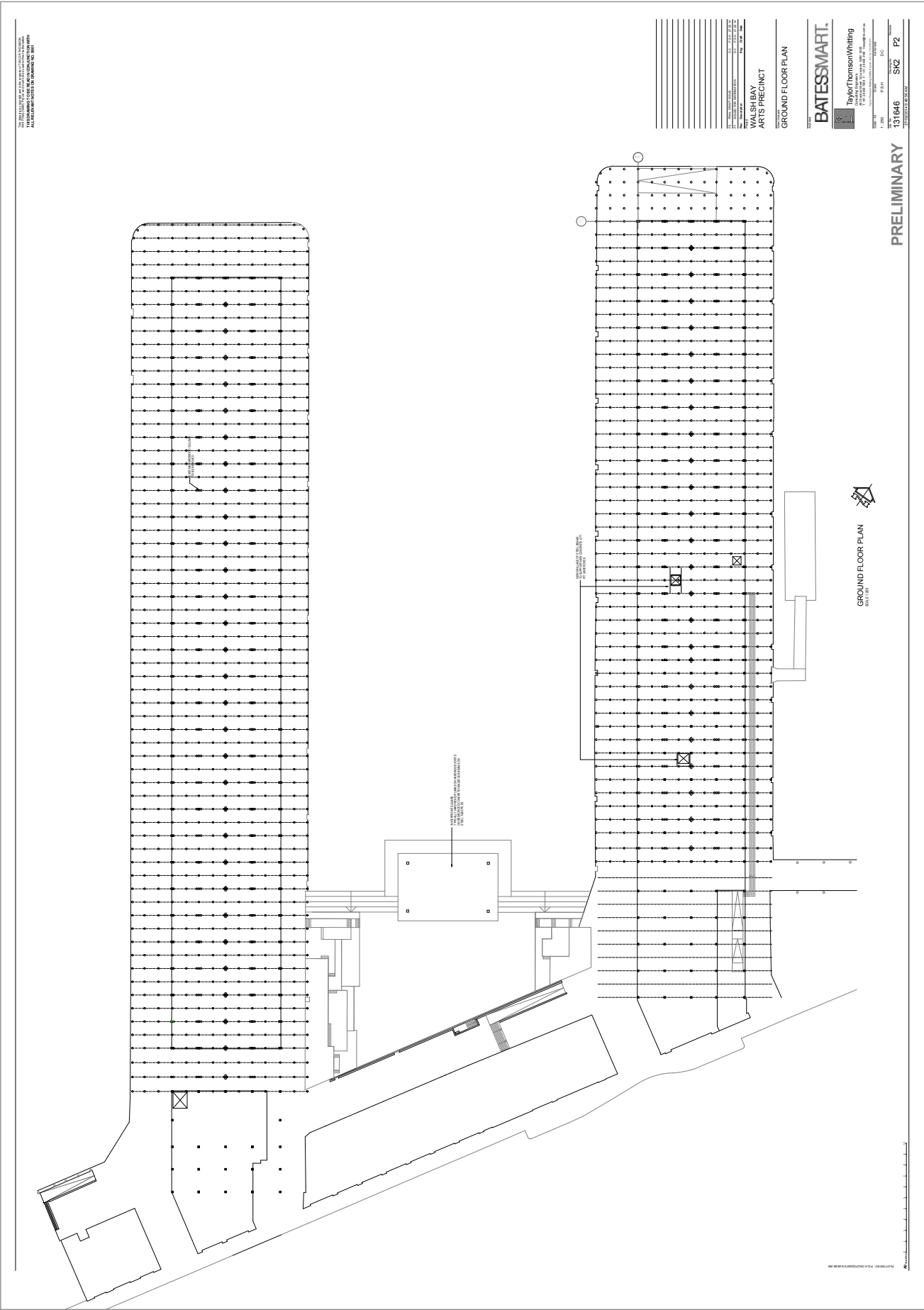
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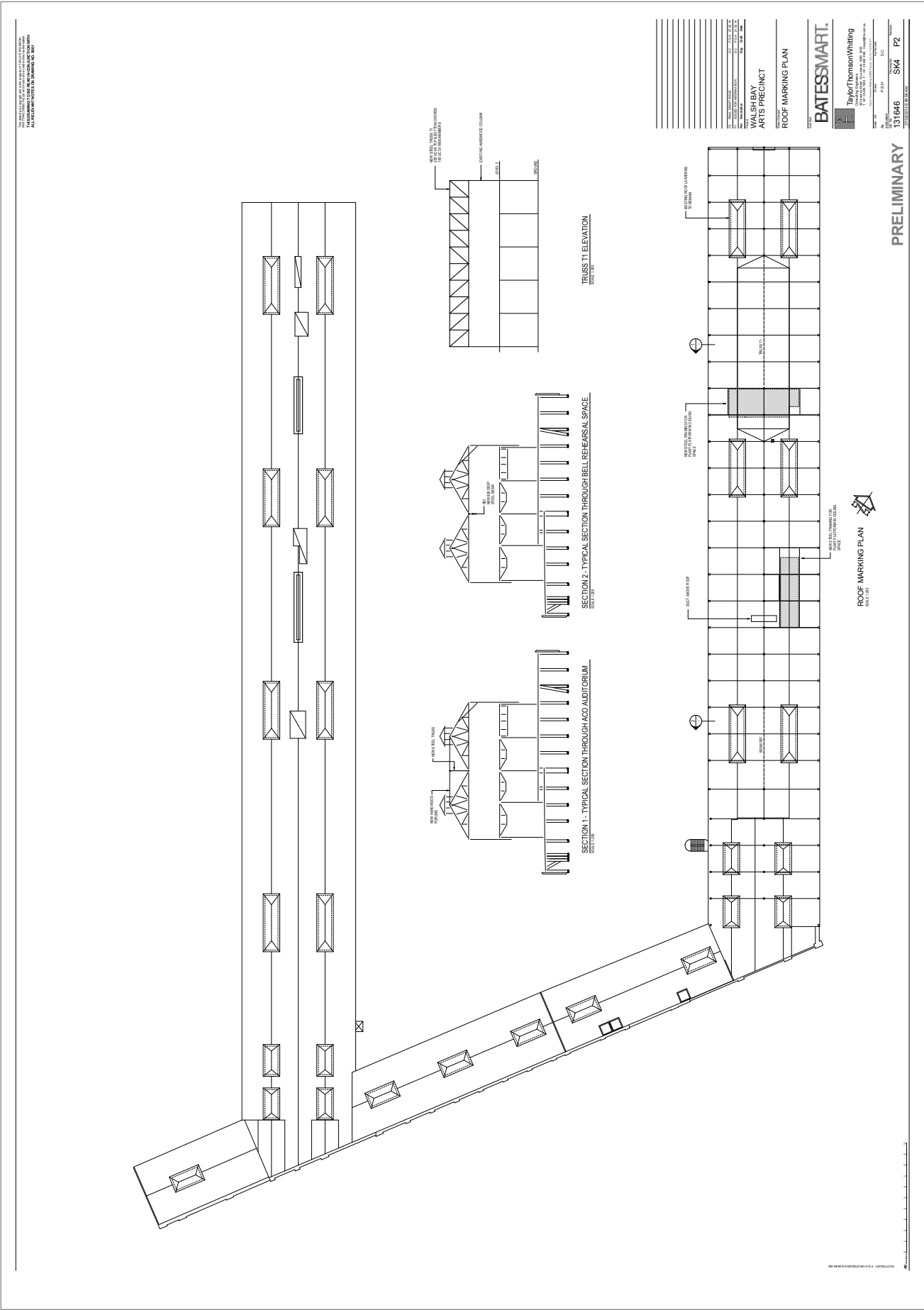
Structure Plans

Page 3

BATESSMART™

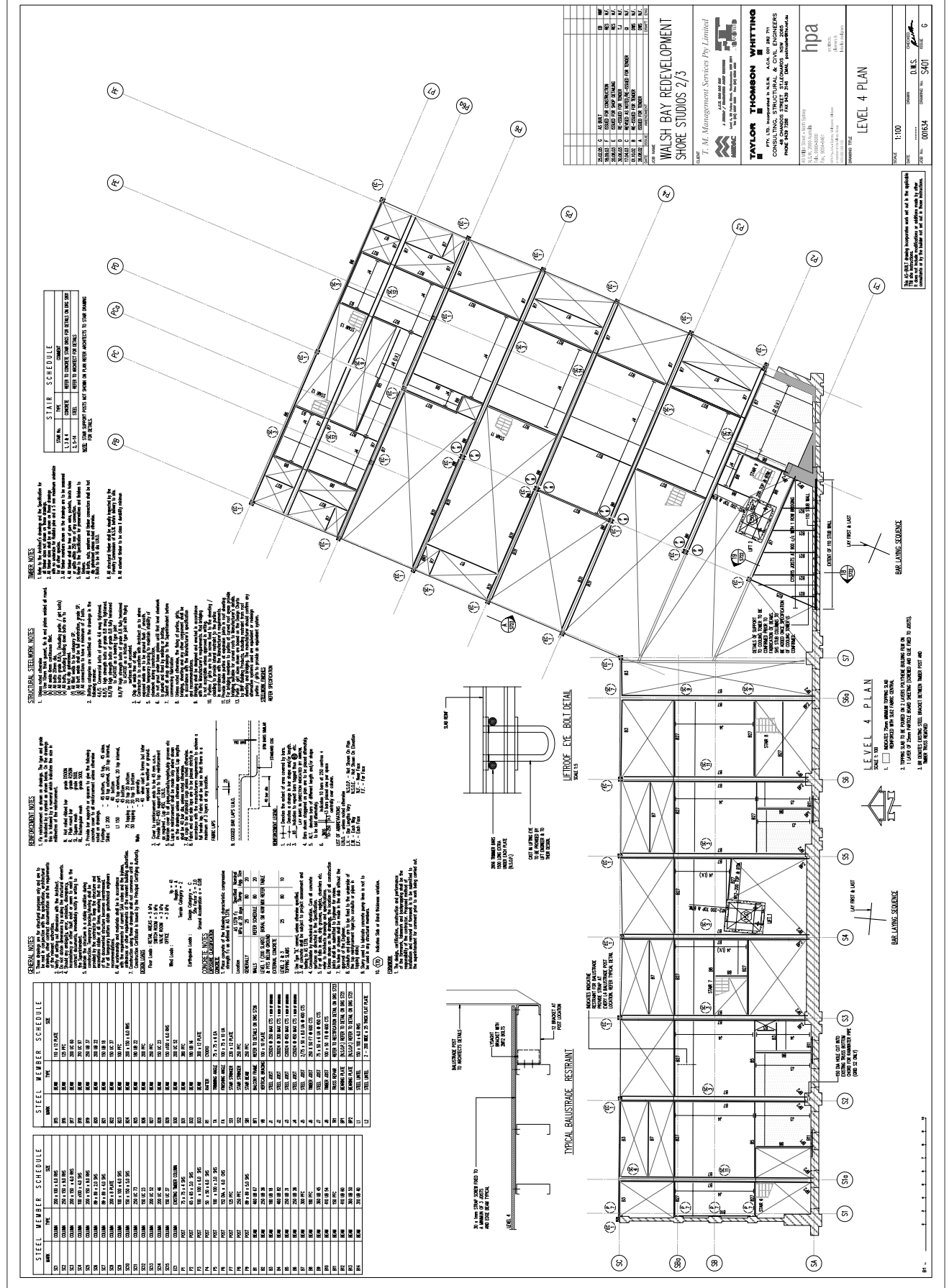


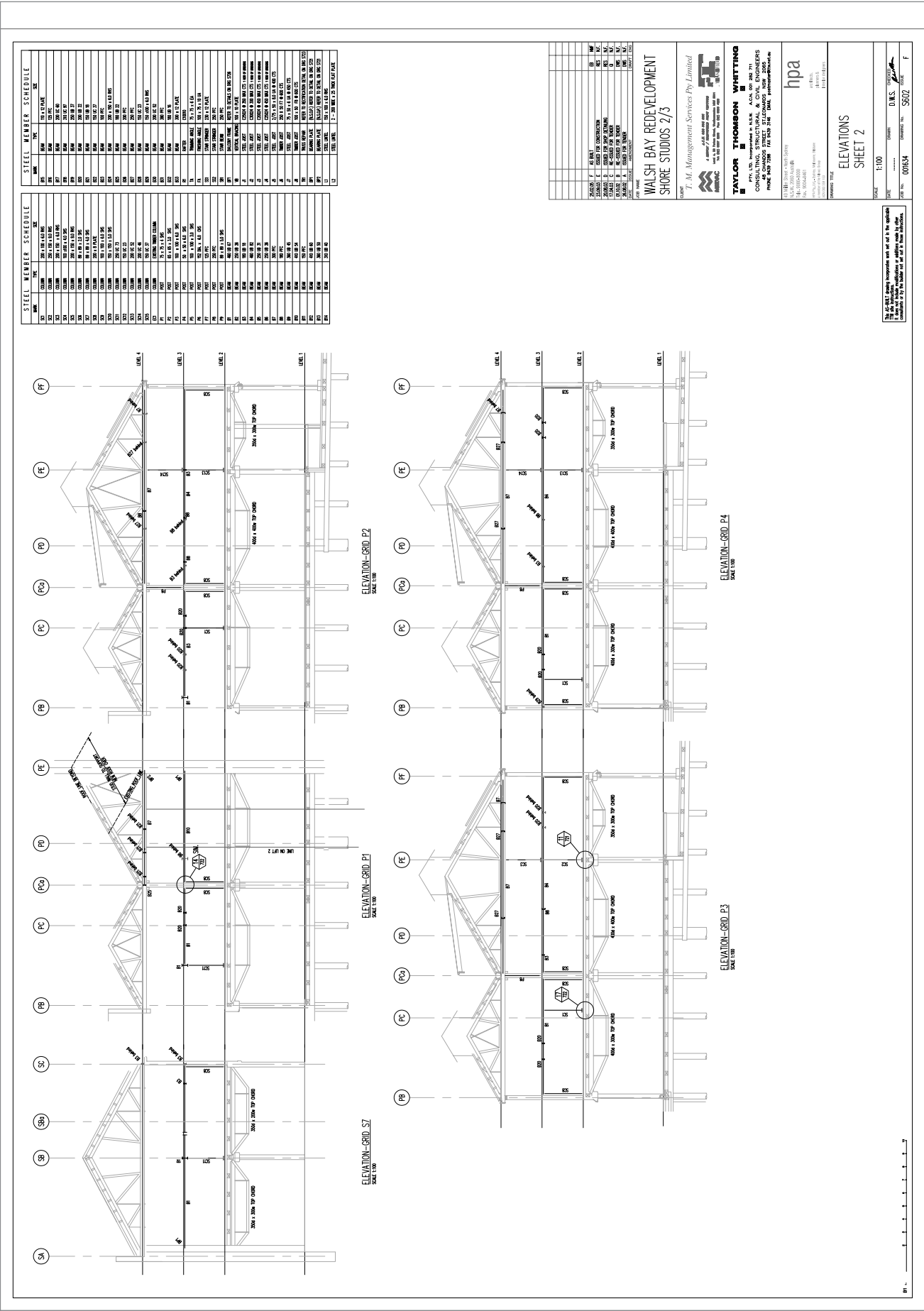
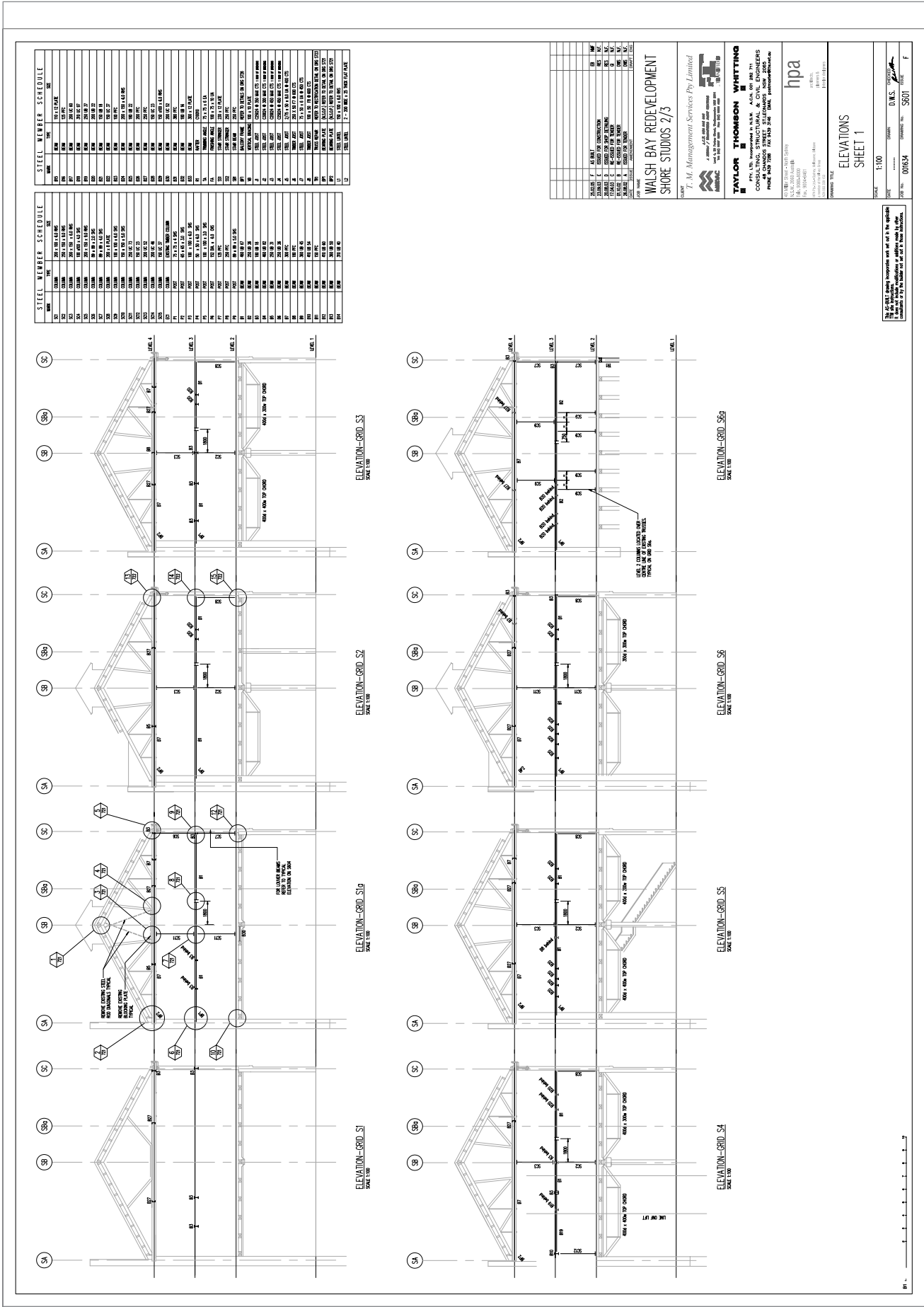




Appendix B
Information for FBC

Existing Shore Shed mezzanine
drawings







Appendix C Historical Aerial Images



Source: Base Image - © Department of Lands

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0 25 50 100 m			
Scale: 1:2,500			
Datum: GDA 1994 MGA Zone 56 - AHD			
A4			
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Rev	Description	Drm.	Date:

Legend:

Approximate Site Boundary

JBS&G Figure: Walsh Bay - 1930

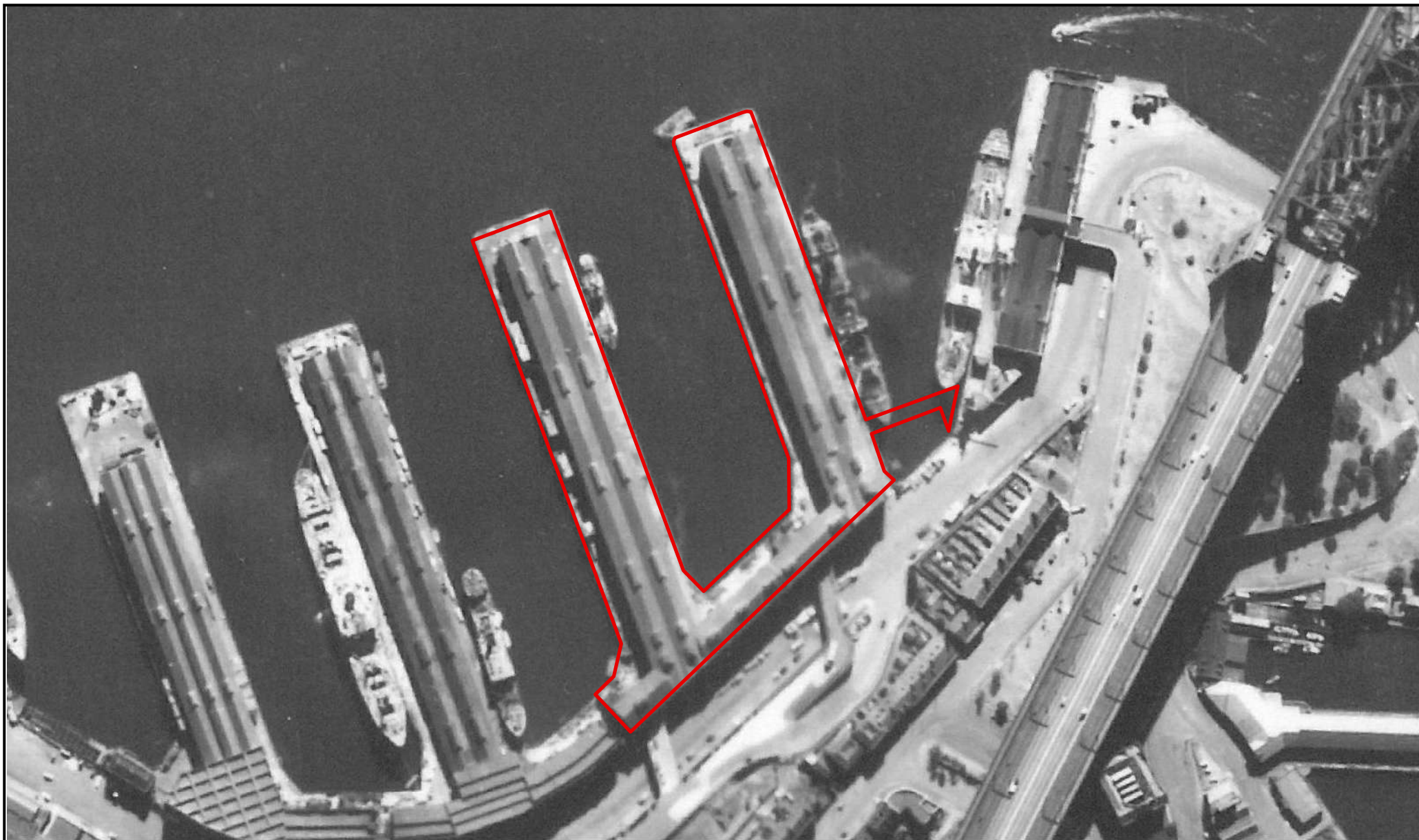
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Project: Walsh Bay Preliminary Site Assessment

Job No: 43329

File Name: 43329_1930





Source: Base Image - © Department of Lands

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Scale:1:2,500

Datum: GDA 1994 MGA Zone 56 - AHD

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Rev	Description	Drm.	Date:

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Approximate Site Boundary

JBS&G Figure: Walsh Bay - 1951

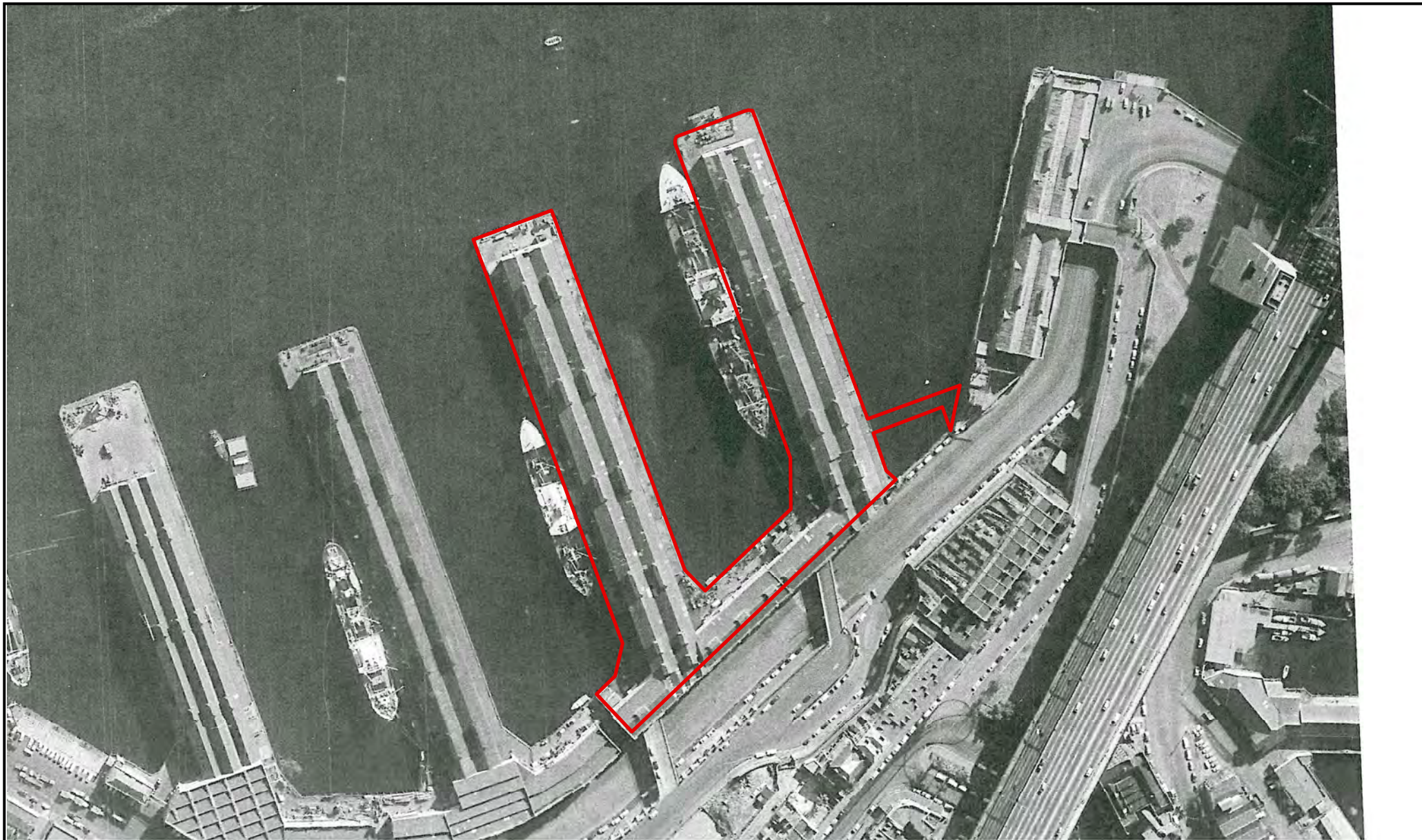
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Project: Walsh Bay Preliminary Site Assessment

Job No: 43329

File Name: 43329_1951





Source: Base Image - © Department of Lands

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m

Scale: 1:2,500

Datum: GDA 1994 MGA Zone 56 - AHD

A4			
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Rev	Description	Drm.	Date:

Legend:

Approximate Site Boundary

JBS&G Figure: Walsh Bay - 1961

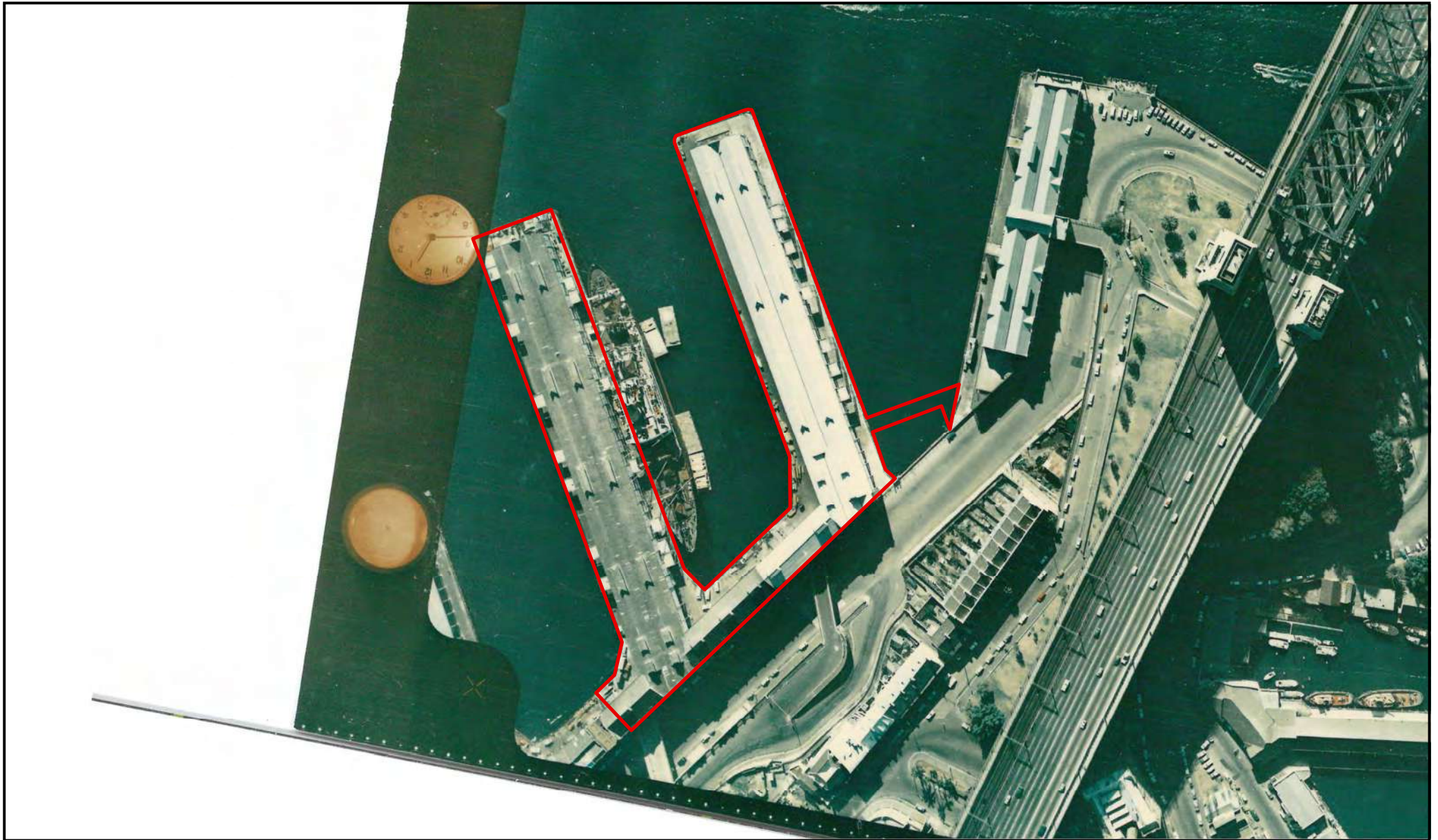
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Project: Walsh Bay Preliminary Site Assessment

Job No: 43329

File Name: 43329_1961





Source: Base Image - © Department of Lands

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Datum: GDA 1994 MGA Zone 56 - AHD			
A4			
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Rev	Description	Drm.	Date:

Legend:

Approximate Site Boundary

JBS&G Figure: Walsh Bay - 1970

Client: ARTS NSW

Project: Walsh Bay Preliminary Site Assessment

Job No: 43329

File Name: 43329_1970





Source: Base Image - © Department of Lands

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0 25 50 100 m			
Scale: 1:2,500			
Datum: GDA 1994 MGA Zone 56 - AHD			
A4			
0	Original Issue - Aerials	LL	26-02-2014
Rev	Description	Drm.	Date:

Legend:

Approximate Site Boundary

JBS&G Figure: Walsh Bay - 1986

Client: ARTS NSW

Project: Walsh Bay Preliminary Site Assessment

Job No: 43329

File Name: 43329_1986





Source: Base Image - © Department of Lands

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0 25 50 100
m

Scale: 1:2,500

Datum: GDA 1994 MGA Zone 56 - AHD

A4			
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Rev	Description	Dm.	Date:

Legend:

Approximate Site Boundary

JBS&G Figure: Walsh Bay - 1999

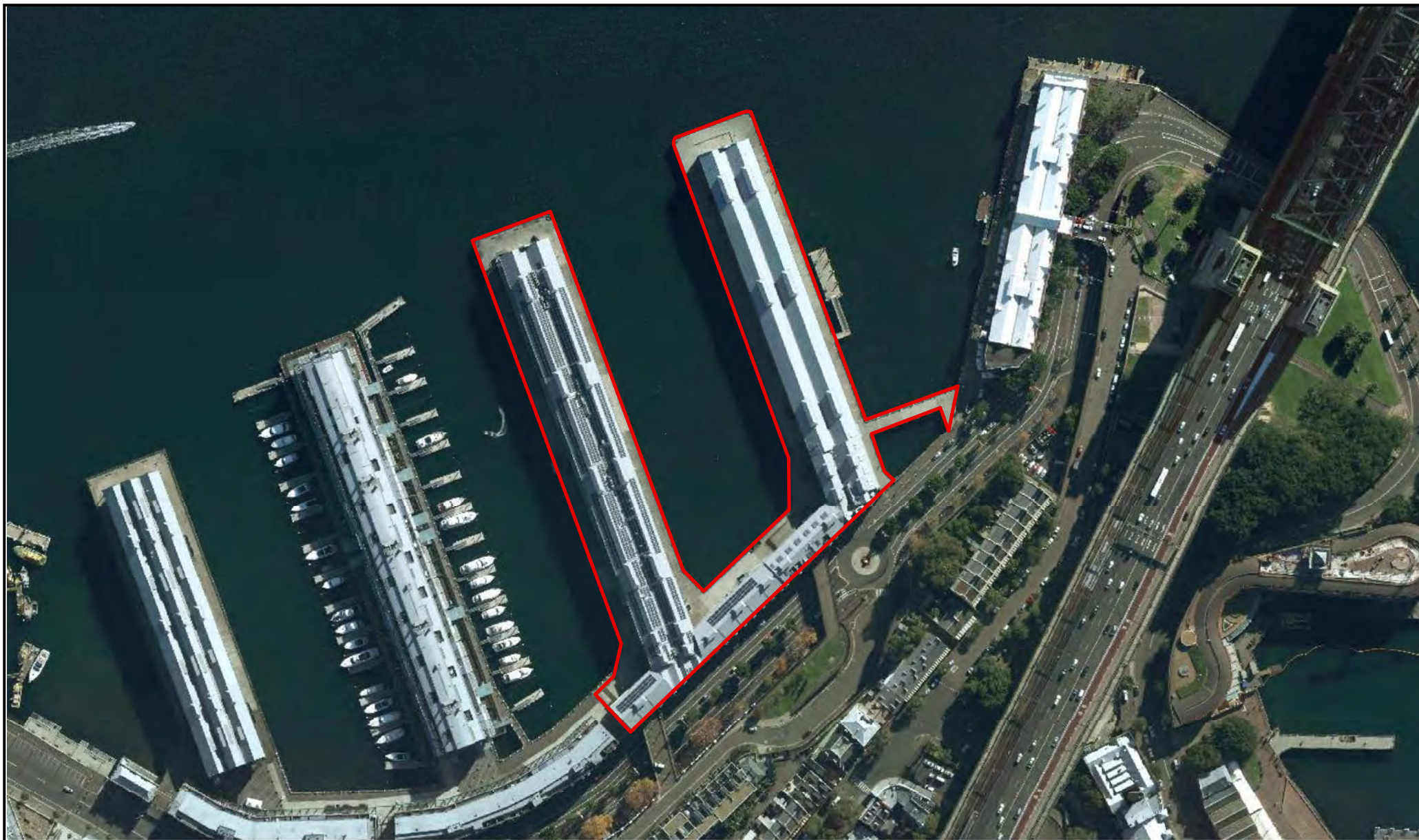
Client: ARTS NSW

Project: Walsh Bay Preliminary Site Assessment

Job No: 43329

File Name: 43329_1999





Source: Base Image - © SIX Maps www.maps.six.nsw.gov.au, Imagery Date: 13/04/2011, Accessed: 26/02/2014

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m

Scale:1:2,500

Datum: GDA 1994 MGA Zone 56 - AHD

A4			
0	Original Issue - Aerials	LL	26-02-2014
Rev	Description	Drm.	Date:

Legend:

Approximate Site Boundary

JBS&G Figure: Walsh Bay - 2011

Client: ARTS NSW

Project: Walsh Bay Preliminary Site Assessment

Job No: 43329

File Name: 43329_2011



Appendix D NSW EPA Public Register Search Results



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<u>Number</u>	<u>Name</u>	<u>Location</u>	<u>Type</u>	<u>Status</u>	<u>Issued date</u>		
3142	AUSTRALIAN RAIL TRACK CORPORATION LIMITED	GPO BOX 14, SYDNEY, NSW 2001	POEO licence	Issued	20 Dec 2000		
1011934	AUSTRALIAN RAIL TRACK CORPORATION LIMITED	GPO BOX 14, SYDNEY, NSW 2001	s.58 Licence Variation	Issued	05 Oct 2001		
1015602	AUSTRALIAN RAIL TRACK CORPORATION LIMITED	GPO BOX 14, SYDNEY, NSW 2001	s.58 Licence Variation	Issued	01 May 2002		
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1029702	AUSTRALIAN RAIL TRACK CORPORATION LIMITED	GPO BOX 14, SYDNEY, NSW 2001	s.58 Licence Variation	Issued	01 Aug 2003		
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1092348	AUSTRALIAN RAIL TRACK CORPORATION LIMITED	GPO BOX 14, SYDNEY, NSW 2001	s.58 Licence Variation	Issued	30 Sep 2008		Wet Pub
1093829	AUSTRALIAN RAIL TRACK CORPORATION LIMITED	GPO BOX 14, SYDNEY, NSW 2001	s.58 Licence Variation	Issued	14 Nov 2008		
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1501777	AUSTRALIAN RAIL TRACK CORPORATION LIMITED	GPO BOX 14, SYDNEY, NSW 2001	s.58 Licence Variation	Issued	28 Sep 2011		

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14 February 2014



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<u>Number</u>	<u>Name</u>	<u>Location</u>	<u>Type</u>	<u>Status</u>	<u>Issued date</u>		
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1519381	AUSTRALIAN RAIL TRACK CORPORATION LIMITED	GPO BOX 14, SYDNEY, NSW 2001	s.58 Licence Variation	Issued	20 Jan 2014		
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14 February 2014