REPORT TO

KINCOPPAL-ROSE BAY SCHOOL

ON

PRELIMINARY SITE INVESTIGATION WITH LIMITED SAMPLING

FOR

PROPOSED DEVELOPMENT AT KINCOPPAL-ROSE BAY SCHOOL

AT

CORNER NEW SOUTH HEAD ROAD AND VAUCLUSE ROAD, VAUCLUSE, NSW

Date: 2 March 2020
Ref: E32915BDrpt

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Executive Summary

Mr. Terry Mahady of Mahady Management on behalf of Kincoppal-Rose Bay, School of the Sacred Heart (KRB) ('the client') commissioned JK Environments (JKE) to undertake a preliminary Site Investigation with Limited Sampling (PSI) for the proposed development at KRB situated on the corner of New South Head Road and Vaucluse Road, Vaucluse, NSW ('the site'). The site location is shown on Figure 1.

This report has been prepared to support the lodgement of a State Significant Development Application (SSDA). The assessment was limited to the proposed development areas only as shown on Figure 2. For the purpose of this report, targeted assessment areas have been referred to as 'the site', whilst the whole property has been referred to as 'the wider site'.

Based on the details provided, the proposed development includes construction of a two-storey Early Learning Centre (ELC) building in Precinct A, a two-storey bus/carpark in Precinct B and a road/elevated walkway in Precinct B. Required earthworks include excavations to a maximum depth of approximately 2m for the proposed ELC building and a new bus/carpark. It is assumed that the proposed new road will be at, or close to, existing surface levels.

The primary aims of the assessment were to identify any past or present potentially contaminating activities at the site, identify the potential for site contamination, and make an assessment of the soil and groundwater contamination conditions. The assessment objectives were to:

- Provide an appraisal of the past site use(s) based on a review of historical records;
- Assess the current site conditions and use(s) via a site walkover inspection;
- Identify potential contamination sources/areas of environmental concern (AEC) and contaminants of potential concern (CoPC);
- Assess the soil and groundwater contamination conditions via implementation of a sampling and analysis program;
- Prepare a conceptual site model (CSM);
- Assess the potential risks posed by contamination to the receptors identified in the CSM (Tier 1 assessment);
- Provide a preliminary waste classification for off-site disposal of soil;
- Assess whether the site is suitable or can be made suitable for the proposed development (from a contamination viewpoint); and
- Assess whether further intrusive investigation and/or remediation is required.

The scope of work included a review of historical information, a site inspection, and sampling from 10 boreholes and one groundwater monitoring well. Based on the historical information and site observations, JKE identified the site as being historically used as school grounds including onboarding facilities (accommodation) as well as possibly for religious use. Potential sources of contamination identified within the site included; historical site filling activities; possible use of pesticides; and hazardous building materials within current and former structures on the site.

The investigation identified lead and carcinogenic PAHs contamination in soils in northern and southern parts of the site within the areas of proposed development works. The source of contamination was identified as the fill material historically imported onto the site. The contaminants requiring remediation include: lead contamination hotspot in the northern part of the site where the new ELC building is proposed, carcinogenic PAHs within the southern part of the site area where the new two-storey bus/carpark is proposed, and TRH F3 identified also within northern and southern parts of the site which poses a risk to ecological receptors. These TRH exceedances where co-located with carcinogenic PAHs requiring remediation due to the potential risk to human health. The extent of soil impacted by the contaminants has not been identified and is a data gap which will require addressing as part of the remediation works.

Significant contamination of groundwater was not identified. Elevated concentrations of heavy metal Zinc was detected in the groundwater sample, though were representative of groundwater conditions within an urban environment and considered to be a regional issue. A number of PAH compounds namely: phenanthrene, anthracene, fluoranthene and benzo(a)pyrene were also detected above the ecological and human health SAC in the groundwater sample. However, JKE are of the opinion that slow groundwater recharge and sediment present within the well during sampling may have cause interference with the PAH analysis. In addition, groundwater conditions and quality should be further confirmed during the remediation/validation process.

Based on the findings of the assessment, JKE are of the opinion that the site can be made suitable for the proposed development, subject to the implementation of the following recommendations:

- Prepare a Remediation Action Plan (RAP) to address the contamination issues identified at the site. The RAP will include the requirements for addressing the data gaps identified in this assessment and for the preparation of an unexpected find protocol (UFP); and
- Undertake a validation assessment documenting the remediation works.

The conclusions and recommendations should be read in conjunction with the limitations presented in the body of this report.

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Abbreviations

Asbestos Fines/Fibrous Asbestos	**AF/FA**
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Added Contaminant Limits	**ACL**
Asbestos Containing Material	**ACM**
Australian Drinking Water Guidelines	**ADWG**
Area of Environmental Concern	**AEC**
Australian Height Datum	**AHD**
Acid Sulfate Soil	**ASS**
Above-Ground Storage Tank	**AST**
Below Ground Level	**BGL**
Benzo(a)pyrene Toxicity Equivalent Factor	**BaP TEQ**
Bureau of Meteorology	**BOM**
Benzene, Toluene, Ethylbenzene, Xylene	**BTEX**
Cation Exchange Capacity	**CEC**
Contaminated Land Management	**CLM**
Contaminant(s) of Potential Concern	**CoPC**
Chain of Custody	**COC**
Conceptual Site Model	**CSM**
Development Application	**DA**
Dial Before You Dig	**DBYD**
Data Quality Indicator	**DQI**
Data Quality Objective	**DQO**
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Ecological Investigation Level	**EIL**
Environmental Investigation Services	**EIS**
Ecological Screening Level	**ESL**
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Environmental Site Assessment	**ESA**
Ecological Screening Level	**ESL**
Fibre Cement Fragment(s)	**FCF**
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Health Investigation Level	**HILs**
Hardness Modified Trigger Values	**HMTV**
Health Screening Level	**HSL**
Health Screening Level-Site Specific Assessment	**HSL-SSA**
International Organisation of Standardisation	**ISO**
JK Environments	**JKE**
Lab Control Spike	**LCS**
Light Non-Aqueous Phase Liquid	**LNAPL**
Map Grid of Australia	**MGA**
National Association of Testing Authorities	**NATA**
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Site Audit Statement	**SAS**
Site Audit Report	**SAR**
Site Specific Assessment	**SSA**
Source, Pathway, Receptor	**SPR**
Specific Contamination Concentration	**SCC**
Standard Penetration Test	**SPT**
Standard Sampling Procedure	**SSP**
Standing Water Level	**SWL**
Trip Blank	**TB**
Toxicity Characteristic Leaching Procedure	**TCLP**
Total Recoverable Hydrocarbons	**TRH**
Trip Spike	**TS**
Upper Confidence Limit	**UCL**
United States Environmental Protection Agency	**USEPA**
Underground Storage Tank	**UST**
Virgin Excavated Natural Material	**VENM**
Volatile Organic Compounds	**VOC**
World Health Organisation	**WHO**
Work Health and Safety	**WHS**

Units

Litres	**L**
Metres BGL	**mBGL**
Metres	**m**
Millivolts	**mV**
Millilitres	**ml or mL**
Milliequivalents	**meq**
micro Siemens per Centimetre	**µS/cm**
Micrograms per Litre	**µg/L**
Milligrams per Kilogram	**mg/kg**
Milligrams per Litre	**mg/L**
Parts Per Million	**ppm**
Percentage	**%**

1 INTRODUCTION

Mr. Terry Mahady of Mahady Management on behalf of Kincoppal-Rose Bay, School of the Sacred Heart (KRB) ('the client') commissioned JK Environments (JKE) to undertake a preliminary Site Investigation with Limited Sampling (PSI) for the proposed development at KRB situated on the corner of New South Head Road and Vaucluse Road, Vaucluse, NSW ('the site'). The site location is shown on Figure 1.

The assessment was limited to the proposed development areas only as shown on Figure 2. For the purpose of this report, targeted assessment areas have been referred to as 'the site', whilst the whole property has been referred to as 'the wider site'.

This report has been prepared to support the lodgement of a State Significant Development Application (SSDA).

A geotechnical investigation was undertaken in conjunction with this assessment by JK Geotechnics (JKG). The results of the investigation are presented in a separate report (Ref: 32975PHrpt, dated 26 February 2020)[1]. This report should be read in conjunction with the JKG report.

Environmental Investigation Services (EIS) has recently been re-branded to JK Environments and will continue to function as the environmental division of JK Group alongside JK Geotechnics and JK Drilling.

1.1 Proposed Development Details

The proposed development includes construction of a two-storey Early Learning Centre (ELC) building in Precinct A, a two-storey bus/carpark in Precinct B and a road/elevated walkway in Precinct B. Required earthworks include excavations to a maximum depth of approximately 2m are envisaged for the proposed ELC building and a new bus/carpark. It is assumed that the proposed new road will be at, or close to, existing surface levels.

1.2 Aims and Objectives

The primary aims of the PSI were to identify any past or present potentially contaminating activities at the site, identify the potential for site contamination, and make a preliminary assessment of the soil and groundwater contamination conditions. The objectives of the PSI were to:

- Provide an appraisal of the past site use(s) based on the review of available historical information for the site;
- Assess the current site conditions and use(s) via a site walkover inspection;
- Identify potential contamination sources/areas of environmental concern (AEC) and contaminants of potential concern (CoPC);
- Assess the soil and groundwater contamination conditions via implementation of a preliminary sampling and analysis program;
- Prepare a conceptual site model (CSM);

[1] Referred to as JKG report

- Assess the potential risks posed by contamination to the receptors identified in the CSM (Tier 1 assessment);
- Provide a preliminary waste classification for off-site disposal of soil;
- Assess whether the site is suitable or can be made suitable for the proposed development (from a contamination viewpoint); and
- Assess whether further intrusive investigation and/or remediation is required.

1.3 Scope of Work

The assessment was undertaken generally in accordance with a JKE proposal (Ref: EP50877BD) of 16 December 2019 and written acceptance from the client of 7 January 2020. The scope of work included the following:

- Review of site information, including background and site history information from a Lotsearch Pty Ltd *Environmental Risk and Planning Report* and other sources;
- Preparation of a CSM;
- Design and implementation of a sampling, analysis and quality plan (SAQP);
- Interpretation of the analytical results against the adopted Site Assessment Criteria (SAC);
- Data Quality Assessment; and
- Preparation of a report including a Tier 1 risk assessment.

The scope of work was undertaken with reference to the National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended (2013)[2], other guidelines made under or with regards to the Contaminated Land Management Act (1997)[3] and State Environmental Planning Policy No.55 – Remediation of Land (1998)[4]. A list of reference documents/guidelines is included in the appendices.

[2] National Environment Protection Council (NEPC), (2013). *National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013).* (referred to as NEPM 2013)

[3] Contaminated Land Management Act 1997 (NSW) (referred to as CLM Act 1997)

[4] *State Environmental Planning Policy No. 55 – Remediation of Land 1998* (NSW) (referred to as SEPP55)

2 SITE INFORMATION

2.1 JK Geotechnical Investigation

JKG was commissioned to complete geotechnical investigations for the proposed development at the site. The scope of work included: drilling ten boreholes (BH1 to BH10) across the site to depths ranging between 0.40-9.30m below ground level (mBGL); Standard Penetration Testing (SPT) and Dynamic Cone Penetrometer (DCP) testing at selected borehole locations; groundwater observations during drilling; laboratory testing of selected samples for geotechnical parameters; and preparation of three separate reports for each individual development site presenting the results of the investigation.

The soil stratigraphy observed in the boreholes generally comprised:

- Asphaltic concrete, ranging in thickness between 50mm and 90mm, were encountered in BH1, BH2 and BH3;
- FILL: consisting of Silty Sand with inclusions comprising varying sizes and fractions of igneous and sandstone gravel, clay, roots, brick fragments and occasional sandstone cobbles and boulders at depth (in some of the locations). Fill material was encountered in all locations from the surface or beneath the asphaltic concrete extending down to 0.2-6.2mBGL; overlaying
- NATURAL RESIDUAL SOILS: comprising Silty Sand, Clayey Sand and Gravelly Sand, were encountered in BH2, BH6, BH7 and BH8 beneath the fill, extending down to at least between 0.4 and 9.20mBGL; underlain by
- BEDROCK: Sandstone bedrock was encountered in most of the boreholes at varying depths between 0.4-6.2mBGL. Bedrock was not encountered in BH2 only.

All boreholes were dry on completion of drilling. A groundwater monitoring well was installed at BH2 to allow for further groundwater monitoring. In BH2, the groundwater was observed at depths ranging between 8.0-8.5mBGL after completion of drilling and upon return to the site at a later date. In BH8, groundwater was encountered on completion of hand auguring at 1.8m depth, just above the soil/bedrock interface. No long-term monitoring of the groundwater levels was undertaken.

2.2 Site Identification

Table 2-1: Site Identification

Current Site Owner:	Kincoppal-Rose Bay School
Site Address:	Corner of New South Head Road and Vaucluse Road, Vaucluse, NSW
Lot & Deposited Plan:	Lot 104 in DP1092747
Current Land Use:	Educational Establishment
Proposed Land Use:	Educational Establishment
Local Government Authority:	Woollahra Municipal Council
Current Zoning:	SP2 – Educational Establishment
Site Area (m^2):	Approximately 4,500m^2 - the site (i.e. targeted assessment areas) 60,380 m^2 – the wider site

RL (AHD in m) (approx.):	10-60 mAHD
Geographical Location (decimal degrees) (approx.):	Latitude: -33.862451 Longitude: 151.270816
Site Location Plan:	Figure 1
Sample Location Plan:	Figure 2

2.3 Site Location and Regional Setting

The wider site is located in a predominantly residential area of Vaucluse. The wider site is bounded by mainly residential properties to the north, east and south, Hermitage Reserve to the west, Forsyth Park to the south/south-east and St. Michael's Anglican Church which is located on the property adjoining the site to the north/north-east. The wider site is located approximately 28m to the east of Rose Bay.

2.4 Topography

The regional topography is characterised by a west facing hillside that falls towards Rose Bay. The site area is situated across the length of the hillside which has slope towards the west at an approximate average of 10.5°. Parts of the site appear to have been levelled to account for the slope and accommodate the existing buildings and infrastructure across the wider site area.

2.5 Site Inspection

A walkover inspection of the site was undertaken by JKE on 28 January 2020. The inspection was limited to accessible areas of the site and immediate surrounds. A detailed inspection of the wider site was outside the scope of the assessment. An internal inspection of buildings was not undertaken.

A summary of the inspection findings is outlined in the following subsections:

2.5.1 Current Site Use and/or Indicators of Former Site Use

At the time of the inspection, the wider site was occupied by Kincoppal-Rose Bay School which was originally founded in 1882.

2.5.2 Buildings, Structures and Roads

Numerous single and multi-storey buildings and structures including accessing roads, footpaths and landscaping areas were identified across the wider property, including on or within close proximity to the proposed development areas comprising the site.

2.5.3 Boundary Conditions, Soil Stability and Erosion

The wider site boundaries were observed to have property fence. However, site areas were not fenced. Obvious signs of soil erosion were not observed.

2.5.4 Visible or Olfactory Indicators of Contamination

Buildings identified to be present at the wider site appeared to have been constructed in different time periods, and some are heritage listed items. Based on the age of some of these buildings, it is considered likely that hazardous building materials including asbestos could potentially be present at the site.

No obvious visible or olfactory signs of contamination were observed during drilling works on site.

2.5.5 Presence of Drums/Chemicals, Waste and Fill Material

A review of the chemicals used and stored within the site was not undertaken. JKE presumed general domestic-grade and cleaning chemicals were used at the wider site.

Fill soils were encountered within all boreholes drilled during fieldworks. Deeper fill was also identified in some parts of the site, and is indicative of cut/fill activities which historically took place across parts of the site for levelling purposes. No information regarding potential source of identified fill material was provided.

2.5.6 Drainage and Services

Surface water is not expected to accumulate at the site due to the presence of adequate drainage in the form of stormwater pits and drainage channels throughout the wider site. The majority of surface water runoff from the site is expected to be discharged into the municipal stormwater system. Some runoff from the site is also expected to eventuate into Rose Bay which is located to the east.

2.5.7 Sensitive Environments

Sensitive environments such as wetlands, ponds, creeks or extensive areas of natural vegetation were not identified at the site. Hermitage Foreshore Reserve area was located to the east of the site. The Rose Bay foreshore is located beyond the reserve.

2.5.8 Landscaped Areas and Visible Signs of Plant Stress

Numerous mature native trees, landscaped areas and strips of vegetation were observed throughout the wider site. No obvious signs of vegetation stress or grass dieback were observed anywhere in the vicinity of the site.

2.6 Surrounding Land Use

During our inspection, JKE observed the following land uses in the immediate surrounds:

- North – residential and St. Michaels Anglican Church;
- South – residential and Forsyth Park recreational area;
- East – school playing fields and sporting grounds further across Vaucluse Road and residential further across New South Head Road; and
- West – Hermitage Foreshore Reserve area and Rose Bay.

JKE did not observe any land uses in the immediate surrounds that were identified as potential contamination sources for the site.

2.7 Underground Services

The 'Dial Before You Dig' (DBYD) plans were reviewed for the assessment in order to establish whether any major underground services exist at the site or in the immediate vicinity that could act as a preferential pathway for contamination migration. Major services were not identified that would be expected to act as preferential pathways for contamination migration.

2.8 Section 10.7 Planning Certificate

The section 10.7 (2 and 5) planning certificates were reviewed for the assessment. Copies of the certificates are attached in the appendices. A summary of the relevant information is outlined below:

- The land is not deemed to be: significantly contaminated; subject to a management order; subject of an approved voluntary management proposal; or subject to an on-going management order under the provisions of the CLM Act 1997;
- The land is not the subject of a Site Audit Statement (SAS);
- The land is not located in a heritage conservation area; and
- The land is located within an acid sulfate soil (ASS) risk area.

3 GEOLOGY AND HYDROGEOLOGY

3.1 Regional Geology

Regional geological information presented in the Lotsearch report (attached in the appendices) indicated that the site is underlain by Hawkesbury Sandstone, which typically consists of medium to coarse grained quartz sandstone with minor shale and laminite lenses. The geological map also indicates an igneous dyke to pass through the site. The subsurface conditions within, and adjacent to a dyke can be extremely variable. The bedrock in contact with the dyke can vary considerably in terms of its depth below the surface.

3.2 Acid Sulfate Soil (ASS) Risk and Planning

The site is not located in an acid sulfate soil (ASS) risk area according to the risk maps prepared by the Department of Land and Water Conservation.

ASS information presented in the Lotsearch report indicated that the site is located within a Class 5 risk area in accordance with the Woollahra Local Environmental Plan (LEP 2014). Works in Class 5 areas that could pose an environmental risk in terms of ASS include works within 500m of adjacent Class 1,2,3,4 land which are likely to lower the water table below 1m AHD on the adjacent Class 1,2,3,4 land. This is unlikely to be the case due to site's elevation above the sea level (i.e. 10-60 mAHD) and the anticipated depth of soil disturbance as part of the proposed development works.

3.3 Hydrogeology

Hydrogeological information presented in the Lotsearch report indicated that the regional aquifer on-site and in the areas immediately surrounding the site includes porous, extensive aquifers of low to moderate productivity. There are a total of seven registered bores within the report buffer of 700m. In summary:

- The nearest registered bore was located approximately 260m north from the site. This was utilised for domestic purposes;
- The majority of the bores were registered for domestic purposes;
- There were no nearby (i.e. within 700m) registered downgradient or cross gradient bores which could potentially become impacted by contaminated groundwater (if present) from the site; and
- Information from the closest registered bores identified standing water levels (SWLs) which ranged from 1.83 to 7.63m below surface.

The information reviewed for this assessment indicated that the subsurface conditions at the site are expected to consist of moderate to high permeability residual sandy soils overlying sandstone bedrock which is typically encountered at moderate to shallow depths. Abstraction and use of groundwater at the site may be viable under these conditions, however the use of groundwater is not proposed as part of the development. There is a reticulated water supply in the area and consumption of groundwater is not expected to occur.

Considering the local topography and surrounding land features, it is generally expected for groundwater to flow east through the site towards Rose Bay.

3.4 Receiving Water Bodies

The site location and regional topography indicates that excess surface water flows have the potential to enter Rose Bay which is located approximately 28 metres west of the site. This water body is a potential receptor.

4 SITE HISTORY INFORMATION

4.1 Review of Historical Aerial Photographs

Historical aerial photographs were included in the Lotsearch report. JKE has reviewed the photographs and summarised relevant information in the following table:

Table 4-1: Summary of Historical Aerial Photographs

Year	Details
1930	The wider site appeared to have been occupied by a number of currently present buildings in southern parts on the western side of Vaucluse Road. Majority of the surrounding properties to the north, east and south appeared to have been residential in nature at this time. Land to the west appeared to have been vegetated throughout and was followed by Rose Bay.
1943	A number of currently existing buildings were further confirmed to have been present around central parts of the wider site. One of the properties adjoining the wider site area to the north appeared to be a place of public worship. Overall the site and surrounding features appeared to be generally similar to the previous historical aerial photograph.
1955	The site and surrounding features appeared generally similar to the previous photograph.
1961	The site and surrounding features appeared generally similar to the previous photograph.
1965	New buildings appeared to have been developed or under construction in the northern part of the wider site. No other discernible changes were noted for the site and the surrounding areas which appeared generally similar to the 1961 photograph.
1970	The buildings in the northern part of the wider site appeared to have been completed and are same or similar to the once currently present. No other discernible changes were noted for the site and the surrounding areas.
1982	A number of structural additions/alterations appeared to have been completed in various areas across the wider site. The surrounding areas appeared generally similar to the 1970 photograph.
1991	Upgrades to the school playing fields to the east of Vaucluse Road were noted including addition of structures. No other discernible changes were noted for the site and the surrounding areas.
2000	Structural additions/alterations were noted in various parts of the wider site areas. No other discernible changes were noted for the site and the surrounding areas.
2007	The site and surrounding features appeared generally similar to the previous photograph.
2014	Further upgrades and various structural additions were noted for the site including the school playing fields. They overall layout of the wider site appeared to have been same or very similar to what is currently present. No other significant changes were noted for the site and the surrounding areas.
2018	The site and surrounding features appeared generally similar to the previous photograph.
2019	The site and surrounding features appeared generally similar to the previous photograph.

4.2 SafeWork NSW Records

SafeWork NSW records were reviewed for the assessment. Copies of relevant documents are attached in the appendices. The search did not identify any licences to store dangerous goods including underground fuel storage tanks (USTs), above ground storage tanks (ASTs) or chemicals at the site.

4.3 NSW EPA Records

The Lotsearch report (attached in the appendices) included information from the NSW EPA databases for the following:

- Records maintained in relation to contaminated land under Section 58 of the CLM Act 1997;
- Records of sites notified in accordance with the Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997 (2015)[5]; and
- Licensed activities under the Protection of the Environment Operations Act (1997)[6].

The search included the site area and surrounding areas in the report buffer of 1,000m. The search indicated the following:

- There were no records for the site or any properties in the report buffer under Section 58 of the CLM Act 1997. There were records for one property within the report buffer, being a service station approximately 788m south of the site. Though this property is recorded as "Contamination currently regulated under the CLM Act", JKE considered this property unlikely to pose an off-site source of contamination risk to the site;
- The site has not been notified with regards to the Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997. However, the service station property south of the site (i.e. same as above) has two current and seven former notices. It is noted that this property is located cross gradient and is unlikely to pose an off-site source of contamination risk to the site; and
- There were no records for licenced activities at the site under the POEO Act 1997. Historical licenses were identified for several properties within the report buffer, including the application of herbicides along waterways, however these activities are considered unlikely to pose a contamination risk to the site.

4.4 Historical Business Directory and Additional Lotsearch Information

Historical business records for the site and surrounding areas in the report buffer of 250m were included in the Lotsearch report (attached in the appendices). The records indicated a motor garage/service station business which was registered matched to New South Head Road in 1983.

JKE are of the opinion that this historical business in the report buffer is unlikely to represent a potential off-site source of site contamination due to the age of the business and the uncertainty associated with the exact location of this business.

[5] NSW EPA, (2015). *Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997.* (referred to as Duty to Report Contamination)

[6] Protection of the Environment Operations Act 1997 (NSW) (referred to as POEO Act 1997)

In addition to the above, JKE have reviewed additional information contained within the Lotsearch report and note the following:

- The wider site is identified as a local heritage item listed as "Kincoppal, Roman Catholic Convent of the Sacred Heart and school";
- There were two other local heritage items within 250m of the site;
- There were no state heritage items at the site or in the immediate surrounds; and
- There were no significant ecological constraints at the site or in the immediate surrounds.

4.5 Summary of Site History Information

A time line summary of the historical land uses and activities is presented in the table below. The information presented in the table is based on a weight of evidence assessment of the site history documentation and observations made by JKE.

Table 4-2: Summary of Historical Land Uses

Year(s)	Potential Land Use / Activities
Pre-1930 - Current	School grounds and accommodation as well as possibly for religious use.

4.6 Integrity of Site History Information

The majority of the site history information was obtained from government organisations as outlined in the relevant sections of this report. The veracity of the information from these sources is considered to be relatively high. A certain degree of information loss can be expected given the lack of specific land use details over time. JKE have relied upon the Lotsearch report and have not independently verified any information contained within. However, it is noted that the Lotsearch report is generated based on databases maintained by various government agencies and is expected to be reliable.

5 CONCEPTUAL SITE MODEL

NEPM (2013) defines a CSM as a representation of site related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM for the site is presented in the following sub-sections and is based on the site information (including the site inspection information) and the review of site history information. Reference should also be made to the figures attached in the appendices.

A review of the CSM in relation to source, pathway and receptor (SPR) linkages has been undertaken as part of the Tier 1 risk assessment process, as outlined in Section 10.

5.1 Potential Contamination Sources/AEC and CoPC

The potential contamination sources/AEC and CoPC are presented in the following table:

Table 5-1: Potential (and/or known) Contamination Sources/AEC and Contaminants of Potential Concern

Source / AEC	CoPC
Fill material – The site appears to have been historically filled to achieve the existing levels. The fill may have been imported from various sources and could be contaminated.	Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), petroleum hydrocarbons (referred to as total recoverable hydrocarbons – TRHs), benzene, toluene, ethylbenzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs), organophosphate pesticides (OPPs), polychlorinated biphenyls (PCBs) and asbestos.
Use of pesticides – Pesticides may have been used beneath the buildings and/or around the site.	Heavy metals and OCPs
Hazardous Building Material – Hazardous building materials may be present as a result of former building and demolition activities. These materials may also be present in the existing buildings/ structures on site.	Asbestos, lead and PCBs

5.2 Mechanism for Contamination, Affected Media, Receptors and Exposure Pathways

The mechanisms for contamination, affected media, receptors and exposure pathways relevant to the potential contamination sources/AEC are outlined in the following CSM table:

Table 5-2: CSM

Potential mechanism for contamination	Potential mechanisms for contamination include: • Fill material – importation of impacted material, 'top-down' impacts (e.g. placement of fill, leaching from surficial material etc), or sub-surface release (e.g. impacts from buried material); • Use of pesticides – 'top-down' and spills (e.g. during normal use, application and/or improper storage); • Hazardous building materials – 'top-down' (e.g. demolition resulting in surficial impacts in unpaved areas).

Affected media	Soil and groundwater have been identified as potentially affected media. The potential for soil vapour impacts is considered to be relatively low. However, soil vapour would need to be considered in the event significant contamination is identified in soil and/or groundwater.
Receptor identification	Human receptors include site occupants/users (including adults and children), construction workers and intrusive maintenance workers. Off-site human receptors include adjacent land users, and recreational water users within Rose Bay. Ecological receptors include terrestrial organisms and plants within unpaved areas (including the proposed landscaped areas), and marine ecology in Rose Bay.
Potential exposure pathways	Potential exposure pathways relevant to the human receptors include ingestion, dermal absorption and inhalation of dust (all contaminants) and vapours (volatile TRH, naphthalene and BTEX). The potential for exposure would typically be associated with the construction and excavation works, and future use of the site. Potential exposure pathways for ecological receptors include primary contact and ingestion. Exposure during future site use could occur via direct contact with soil in unpaved areas such as gardens, inhalation of airborne asbestos fibres during soil disturbance, or inhalation of vapours within enclosed spaces such as buildings and basements. Exposure to groundwater may potentially occur through direct migration and potential exposure to groundwater seepage through sandstone outcrops within Hermitage Reserve area and in Rose Bay.
Potential exposure mechanisms	The following have been identified as potential exposure mechanisms for site contamination: • Vapour intrusion into the proposed basement and/or building (either from soil contamination or volatilisation of contaminants from groundwater); • Contact (dermal, ingestion or inhalation) with exposed soils in landscaped areas and/or unpaved areas; • Migration of groundwater off-site and into nearby water body (Rose Bay), including aquatic ecosystems and those being used for recreation; and • Contact (dermal, ingestion or inhalation) with groundwater seepage through sandstone outcrops within Hermitage Reserve area.
Presence of preferential pathways for contaminant movement	Local underground services such as sewer and stormwater have the potential to act as preferential pathways for contaminant migration at the site.

6 SAMPLING, ANALYSIS AND QUALITY PLAN

6.1 Data Quality Objectives (DQO)

Data Quality Objectives (DQOs) were developed to define the type and quality of data required to achieve the project objectives outlined in Section 1.2. The DQOs were prepared with reference to the process outlined in Schedule B2 of NEPM (2013) and the Guidelines for the NSW Site Auditor Scheme, 3rd Edition (2017)[7]. The seven-step DQO approach for this project is outlined in the following sub-sections.

The DQO process is validated in part by the Data Quality Assurance/Quality Control (QA/QC) Evaluation. The Data (QA/QC) Evaluation is summarised in Section 8.1 and the detailed evaluation is provided in the appendices.

6.1.1 Step 1 - State the Problem

The CSM identified potential sources of contamination/AEC at the site that may pose a risk to human health and the environment. Investigation data is required to assess the contamination status of the site, assess the risks posed by the contaminants in the context of the proposed development/intended land use, and assess whether remediation is required. This information will be considered by the certifying authority in exercising its functions in relation to issuing of the construction certificate for the proposed development.

A waste classification is required prior to off-site disposal of excavated soil/bedrock.

The DQOs were developed by the author of this report and checked by the reviewer. Both the author and reviewer were joint decision-makers in relation to Step 2 of the DQO process.

6.1.2 Step 2 - Identify the Decisions of the Study

The objectives of the assessment are outlined in Section 1.2. The decisions to be made reflect these objectives and are as follows:

- Did the site inspection, or does the historical information identify potential contamination sources/AEC at the site?
- Are any results above the SAC?
- Do potential risks associated with contamination and acid sulfate soils exist, and if so, what are they?
- Is remediation required?
- Is the site characterisation sufficient to provide adequate confidence in the above decisions?
- Is the site suitable for the proposed development, or can the site be made suitable subject to further characterisation and/or remediation?

6.1.3 Step 3 - Identify Information Inputs

The primary information inputs required to address the decisions outlined in Step 2 include the following:

- Site information, including site observations and site history documentation;
- Sampling of potentially affected media, including soil and groundwater;

[7] NSW EPA (2017). *Guidelines for the NSW Site Auditor Scheme, 3rd ed.* (referred to as Site Auditor Guidelines 2017)

- Observations of sub-surface variables such as soil type, photo-ionisation detector (PID) concentrations, odours and staining, and groundwater physiochemical parameters;
- Laboratory analysis of soils and groundwater for the CoPC identified in the CSM; and
- Field and laboratory QA/QC data.

6.1.4 Step 4 - Define the Study Boundary

The sampling was confined to the site boundaries as shown in Figure 2 and was limited vertically to a depth of 8.7mBGL (spatial boundary). The sampling was completed on 28 January 2020 and 3 February 2020 (temporal boundary). The assessment of potential risk to adjacent land users has been made based on data collected within the site boundary.

Sampling was not undertaken within the existing building footprints due to access constraints.

6.1.5 Step 5 - Develop an Analytical Approach (or Decision Rule)

6.1.5.1 Tier 1 Screening Criteria

The laboratory data will be assessed against relevant Tier 1 screening criteria (referred to as SAC), as outlined in Section 7. Exceedances of the SAC do not necessarily indicate a requirement for remediation or a risk to human health and/or the environment. Exceedances are considered in the context of the CSM and valid SPR-linkages.

For this assessment, the individual results have been assessed as either above or below the SAC. Statistical evaluation of the dataset via calculation of mean values and/or 95% upper confidence limit (UCL) values has not been undertaken due to the spatial distribution of the data and the number of samples submitted for analysis.

6.1.5.2 Field and Laboratory QA/QC

Field QA/QC included analysis of intra-laboratory duplicates, trip spike, trip blank and rinsate samples. Further details regarding the sampling and analysis undertaken, and the acceptable limits adopted, is provided in the Data Quality (QA/QC) Evaluation in the appendices.

The suitability of the laboratory data is assessed against the laboratory QA/QC criteria which is outlined in the attached laboratory reports. These criteria were developed and implemented in accordance with the laboratory's National Association of Testing Authorities, Australia (NATA) accreditation and align with the acceptable limits for QA/QC samples as outlined in NEPM (2013) and other relevant guidelines.

In the event that acceptable limits are not met by the laboratory analysis, other lines of evidence are reviewed (e.g. field observations of samples, preservation, handling etc) and, where required, consultation with the laboratory is undertaken in an effort to establish the cause of the non-conformance. Where uncertainty exists, JKE typically adopt the most conservative concentration reported (or in some cases, consider the data from the affected sample as an estimate).

6.1.5.3 Appropriateness of Practical Quantitation Limits (PQLs)

The PQLs of the analytical methods are considered in relation to the SAC to confirm that the PQLs are less than the SAC. In cases where the PQLs are greater than the SAC, a discussion of this is provided.

6.1.6 Step 6 – Specify Limits on Decision Errors

To limit the potential for decision errors, a range of quality assurance processes are adopted. A quantitative assessment of the potential for false positives and false negatives in the analytical results is undertaken with reference to Schedule B(3) of NEPM (2013) using the data quality assurance information collected.

Decision errors can be controlled through the use of hypothesis testing. The test can be used to show either that the baseline condition is false or that there is insufficient evidence to indicate that the baseline condition is false. The null hypothesis is an assumption that is assumed to be true in the absence of contrary evidence. For this assessment, the null hypothesis has been adopted which is that, there is considered to be a complete SPR linkage for the CoPC identified in the CSM unless this linkage can be proven not to (or unlikely to) exist. The null hypothesis has been adopted for this assessment.

6.1.7 Step 7 - Optimise the Design for Obtaining Data

The most resource-effective design will be used in an optimum manner to achieve the assessment objectives. Adjustment of the assessment design can occur following consultation or feedback from project stakeholders. For this investigation, the design was optimised via consideration of the various lines of evidence used to select the sample locations, the media being sampled, and also by the way in which the data were collected.

The sampling plan and methodology are outlined in the following sub-sections.

6.2 Soil Sampling Plan and Methodology

The soil sampling plan and methodology adopted for this assessment is outlined in the table below:

Table 6-1: Soil Sampling Plan and Methodology

Aspect	Input
Sampling Density	Samples for all CoPC were collected from 10 locations (BH1 to BH10) as shown on the attached Figure 2. The sampling plan was not designed to meet the minimum sampling density for hotspot identification, as outlined in the NSW EPA Contaminated Sites Sampling Design Guidelines (1995)[8].
Sampling Plan	The sampling locations were placed on a judgemental sampling plan and were broadly positioned for site coverage, taking into consideration areas that were not easily accessible. This sampling plan was considered suitable to make a preliminary assessment of potential risks associated with the AEC and CoPC identified in the CSM, and assess whether further investigation is warranted.

[8] NSW EPA, (1995), *Contaminated Sites Sampling Design Guidelines.* (referred to as EPA Sampling Design Guidelines 1995)

Aspect	Input
Set-out and Sampling Equipment	Sampling locations were set out using a tape measure. In-situ sampling locations were checked for underground services by an external contractor prior to sampling. Samples were collected using a drill rig equipped with spiral flight augers. Soil samples were obtained from a Standard Penetration Test (SPT) split-spoon sampler, or directly from the auger when conditions did not allow use of the SPT sampler.
Sample Collection and Field QA/QC	Soil samples were obtained on 28 January 2020 and 3 February 2020 in accordance with the standard sampling procedure (SSP) attached in the appendices. Soil samples were collected from the fill and natural profiles based on field observations. The sample depths are shown on the logs attached in the appendices. Samples were placed in glass jars with plastic caps and Teflon seals with minimal headspace. Samples for asbestos analysis were placed in zip-lock plastic bags. During sampling, soil at selected depths was split into primary and duplicate samples for field QA/QC analysis. Rinsate sample was obtained during the decontamination process of the drilling equipment as part of the field QA/QC.
Field Screening	A portable Photoionisation Detector (PID) fitted with a 10.6mV lamp was used to screen the samples for the presence of volatile organic compounds (VOCs). PID screening for VOCs was undertaken on soil samples using the soil sample headspace method. VOC data was obtained from partly filled zip-lock plastic bags following equilibration of the headspace gases. PID calibration records are maintained on file by JKE. Fill/spoil at the sampling locations was visually inspected during the works for the presence of fibre cement fragments (FCF). The field screening for asbestos quantification included the following: • A representative 10L sample was collected from fill at 1m intervals, or from each distinct fill profile; • Each 10L sample was weighed using an electronic scale; • Each bulk sample was passed through a sieve with a 7.1mm aperture and inspected for the presence of fibre cement; • The condition of fibre cement or any other suspected asbestos materials was noted on the field records; and • If observed, any fragments of fibre cement in the 10L sample were collected, placed in a zip-lock bag and assigned a unique identifier. Calculations for asbestos content were undertaken based on the requirements outlined in Schedule B1 of NEPM (2013), as summarised in Section 7.1. The scale used to weigh the samples was not calibrated, however this is not considered significant as this method of providing a weight for the bulk sample is considered to be considerably more accurate than applying a nominal soil density conversion.
Decontami-nation and	Sampling personnel used disposable nitrile gloves during sampling activities. Re-usable sampling equipment was decontaminated as outlined in the SSP.

Aspect	Input
Sample Preservation	Soil samples were preserved by immediate storage in an insulated sample container with ice. On completion of the fieldwork, the samples were stored temporarily in fridges in the JKE warehouse before being delivered in the insulated sample container to a NATA registered laboratory for analysis under standard chain of custody (COC) procedures.

6.3 Groundwater Sampling Plan and Methodology

The groundwater sampling plan and methodology is outlined in the table below:

Table 6-2: Groundwater Sampling Plan and Methodology

Aspect	Input
Sampling Plan	A groundwater monitoring well was installed in BH2 (MW2). The well was positioned to gain a snap-shot of the groundwater conditions. Considering the topography and the location of the nearest down-gradient water body, MW2 was considered to be in the down-gradient area of the proposed Early Learning Centre (ELC) building and would be expected to provide an indication of groundwater flowing across (beneath) this part of the site and beyond the down-gradient wider site boundary.
Monitoring Well Installation Procedure	The monitoring well construction details are documented on the appropriate borehole logs attached in the appendices. The monitoring well was installed to depths of approximately 9.32mBGL. The well was generally constructed as follows: • 50mm diameter Class 18 PVC (machine slotted screen) was installed in the lower section of the well to intersect groundwater; • 50mm diameter Class 18 PVC casing was installed in the upper section of the well (screw fixed); • A 2mm sand filter pack was used around the screen section for groundwater infiltration; • A hydrated bentonite seal/plug was used on top of the sand pack to seal the well; and • A gatic cover was installed at the surface with a concrete plug to limit the inflow of surface water.
Monitoring Well Development	The monitoring well was developed on 28 January 2020 using a submersible electrical pump in accordance with the SSP. Due to the hydrogeological conditions, groundwater inflow into the well was relatively low, therefore the well was pumped until it was effectively dry. The field monitoring records and calibration data are attached in the appendices.
Groundwater Sampling	The monitoring wells were allowed to recharge for approximately five to six days after development. Groundwater samples were obtained on 3 February 2020. Prior to sampling, the monitoring well was checked for the presence of Light Non-Aqueous Phase Liquids (LNAPL) using an inter-phase probe electronic dip meter. The monitoring well head space was checked for VOCs using a calibrated PID unit. The samples were obtained using a peristaltic pump/disposable plastic bailer. During sampling, the following parameters were monitored using calibrated field instruments (see SSP): • Standing water level (SWL) using an electronic dip meter; and • pH, temperature, electrical conductivity (EC), dissolved oxygen (DO) and redox potential (Eh) using a YSI Multi-probe water quality meter.

Aspect	Input
	Steady state conditions were considered to have been achieved when the difference in the pH measurements was less than 0.2 units and the difference in conductivity was less than 10%. Groundwater samples were obtained directly from the single use PVC tubing and placed in the sample containers. Duplicate sample was obtained by alternate filling of sample containers. This technique was adopted to minimise disturbance of the samples and loss of volatile contaminants associated with mixing of liquids in secondary containers, etc. Groundwater removed from the wells during development and sampling was transported to JKE in jerry cans and stored in holding drums prior to collection by a licensed waste water contractor for off-site disposal. The field monitoring record and calibration data are attached in the appendices.
Decontaminant and Sample Preservation	The decontamination procedure adopted during sampling is outlined in the SSP attached in the appendices. Brand new pump tubing was used for the sampling event which was discarded upon completion. Prior to development, the electric pump and associated wiring were thoroughly cleaned and pump was flushed with potable water followed by a pulse of demineralised water. The samples were preserved with reference to the analytical requirements and placed in an insulated container with ice in accordance with the SSP. On completion of the fieldwork, the samples were temporarily stored in a fridge at the JKE office, before being delivered in the insulated sample container to a NATA registered laboratory for analysis under standard COC procedures.

6.4 Analytical Schedule

The analytical schedule (for primary samples) is outlined in the following table:

Table 6-3: Analytical Schedule (Primary Samples)

Analyte/CoPC	Fill Samples	Natural Soil Samples	Groundwater Samples
Heavy Metals	14	4	1
TRH/BTEX	14	4	1
PAHs	14	4	1
OCPs/OPPs	10	-	-
PCBs	10	-	-
Asbestos	6	-	-
VOCs	-	-	1
pH/CEC/Clay Content (%)	1	-	-

Analyte/CoPC	Fill Samples	Natural Soil Samples	Groundwater Samples
pH/EC/hardness	-	-	1
Toxicity characteristic leachate procedure (TCLP) Metals and/or PAHs for waste classification purposes	8	-	-

6.4.1 Laboratory Analysis

Samples were analysed by an appropriate, NATA Accredited laboratory using the analytical methods detailed in Schedule B(3) of NEPM 2013. Reference should be made to the laboratory reports attached in the appendices for further details.

Table 6-4: Laboratory Details

Samples	Laboratory	Report Reference
All primary samples and field QA/QC samples including (intra-laboratory duplicates, trip blanks, trip spikes and field rinsate samples)	Envirolab Services Pty Ltd NSW, NATA Accreditation Number – 2901 (ISO/IEC 17025 compliance)	235671, 235671-A, 236009, 236009-A and 236004.

7 SITE ASSESSMENT CRITERIA (SAC)

The SAC were derived from the NEPM 2013 and other guidelines as discussed in the following sub-sections. The guideline values for individual contaminants are presented in the attached report tables and further explanation of the various criteria adopted is provided in the appendices.

7.1 Soil

Soil data were compared to relevant Tier 1 screening criteria in accordance with NEPM (2013) as outlined below.

7.1.1 Human Health

- Health Investigation Levels (HILs) for a 'residential with accessible soils' exposure scenario (HIL-A);
- Health Screening Levels (HSLs) for a 'low-high density residential' exposure scenario (HSL-A & HSL-B). HSLs were calculated based on conservative assumptions including a 'sand' type and a depth interval of 0m to 1m;
- Where exceedances of the HSLs were reported for hydrocarbons (TRH/BTEX and naphthalene), the soil health screening levels for direct contact presented in the CRC Care Technical Report No. 10 – Health screening levels for hydrocarbons in soil and groundwater Part 1: Technical development document (2011)[9] were considered; and
- Asbestos was assessed on the basis of presence/absence. Asbestos in bulk field samples was assessed against the HSL-A criteria. A summary of the asbestos criteria is provided in the table below:

Table 7-1: Details for Asbestos SAC

Guideline	Applicability
Asbestos in Soil	The HSL-A criteria were adopted for the assessment of asbestos in soil. The SAC adopted for asbestos were derived from the NEPM 2013 and are based on WA DoH (2009) guidance. The SAC include the following: • <0.01% w/w bonded asbestos containing material (ACM) in soil; and • <0.001% w/w asbestos fines/fibrous asbestos (AF/FA) in soil. The NEPM (2013) and WA DoH (2009) also specify that the surface should be free of visible asbestos. Concentrations for bonded ACM concentrations in soil are based on the following equation which is presented in Schedule B1 of NEPM (2013): $$\textbf{\% w/w asbestos in soil} = \frac{\textbf{\% asbestos content x bonded ACM (kg)}}{\text{Soil volume (L) x soil density (kg/L)}}$$ However, we are of the opinion that the actual soil volume in a 10L bucket varies considerably due to the presence of voids, particularly when assessing cohesive soils. Therefore, each bucket sample was weighed using electronic scales and the above equation was adjusted as follows (we note that the units have also converted to grams):

[9] Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC Care), (2011). Technical Report No. 10 - *Health screening levels for hydrocarbons in soil and groundwater Part 1: Technical development document*

Guideline	Applicability
	% w/w asbestos in soil = $\frac{\text{**% asbestos content x bonded ACM (g)**}}{\text{Soil weight (g)}}$

7.1.2 Environment (Ecological – terrestrial ecosystems)

- Ecological Investigation Levels (EILs) and Ecological Screening Levels (ESLs) for an 'urban residential and public open space' (URPOS) exposure scenario. These have only been applied to the top 2m of soil as outlined in NEPM (2013). The criterion for benzo(a)pyrene has been increased from the value presented in NEPM (2013) based on the Canadian Soil Quality Guidelines[10];
- ESLs were adopted based on the soil type;
- EILs for selected metals were calculated based on the most conservative added contaminant limit (ACL) values presented in Schedule B(1) of NEPM (2013) and published ambient background concentration (ABC) values presented in the document titled Trace Element Concentrations in Soils from Rural and Urban Areas of Australia (1995)[11]; and
- Where exceedances of the EILs were reported for zinc, site specific EILs were calculated using the soil parameters for pH and cation exchange capacity. Sample BH2 (0.75-0.95) was analysed, with laboratory soil parameter values adopted to select the added contaminant limit (ACL) values presented in Schedule B(1) of NEPM (2013), and published ambient background concentration (ABC) presented in the document titled Trace Element Concentrations in Soils from Rural and Urban Areas of Australia (1995). This method is considered to be adequate for the Tier 1 screening.

7.1.3 Management Limits for Petroleum Hydrocarbons

Management limits for petroleum hydrocarbons (as presented in Schedule B1 of NEPM 2013) were considered (if required) following evaluation of human health and ecological risks, and risks to groundwater.

7.1.4 Waste Classification

Data for the waste classification assessment were assessed in accordance with the Waste Classification Guidelines, Part 1: Classifying Waste (2014)[12] as outlined in the following table:

Table 7-2: Waste Categories

Category	Description
General Solid Waste (non-putrescible)	• If Specific Contaminant Concentration (SCC) ≤ Contaminant Threshold (CT1) then Toxicity Characteristics Leaching Procedure (TCLP) not needed to classify the soil as general solid waste; and • If TCLP ≤ TCLP1 and SCC ≤ SCC1 then treat as general solid waste.

[10] Canadian Council of Ministers of the Environment, (1999). *Canadian soil quality guidelines for the protection of environmental and human health: Benzo(a)Pyrene (1997)* (referred to as the Canadian Soil Quality Guidelines)

[11] Olszowy, H., Torr, P., and Imray, P., (1995), *Trace Element Concentrations in Soils from Rural and Urban Areas of Australia. Contaminated Sites Monograph Series No. 4*. Department of Human Services and Health, Environment Protection Agency, and South Australian Health Commission

[12] NSW EPA, (2014). *Waste Classification Guidelines, Part 1: Classifying Waste.* (referred to as Waste Classification Guidelines 2014)

Category	Description
Restricted Solid Waste (non-putrescible)	• If SCC ≤ CT2 then TCLP not needed to classify the soil as restricted solid waste; and • If TCLP ≤ TCLP2 and SCC ≤ SCC2 then treat as restricted solid waste.
Hazardous Waste	• If SCC > CT2 then TCLP not needed to classify the soil as hazardous waste; and • If TCLP > TCLP2 and/or SCC > SCC2 then treat as hazardous waste.
Virgin Excavated Natural Material (VENM)	Natural material (such as clay, gravel, sand, soil or rock fines) that meet the following: • That has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial mining or agricultural activities; • That does not contain sulfidic ores or other waste; and • Includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved from time to time by a notice published in the NSW Government Gazette.

7.2 Groundwater

Groundwater data were compared to relevant Tier 1 screening criteria in accordance with NEPM (2013), following an assessment of environmental values in accordance with the Guidelines for the Assessment and Management of Groundwater Contamination (2007)[13]. Environmental values for this assessment include aquatic ecosystems, human uses, and human-health risks in non-use scenarios.

7.2.1 Human Health

- HSLs for a 'low-high density residential' exposure scenario (HSL-A/HSL-B). HSLs were calculated based on the soil type and the observed depth to groundwater; and
- The Australian Drinking Water Guidelines 2011 (updated 2018)[14] were multiplied by a factor of 10 to assess potential risks associated with incidental/recreational-type exposure to groundwater (e.g. within down-gradient water bodies, or associated with the groundwater seepage through sandstone outcrops within Hermitage Reserve area). These have been deemed as 'recreational' SAC.

7.2.2 Environment (Ecological - aquatic ecosystems)

Groundwater Investigation Levels (GILs) for 95% protection of marine species were adopted based on the Default Guideline Values in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2018)[15]. The 99% trigger values were adopted where required to account for bioaccumulation. Low and moderate reliability trigger values were also adopted for some contaminants where high-reliability trigger values don't exist.

[13] NSW Department of Environment and Conservation, (2007). *Guidelines for the Assessment and Management of Groundwater Contamination*

[14] National Health and Medical Research Council (NHMRC), (2018). *National Water Quality Management Strategy, Australian Drinking Water Guidelines 2011* (referred to as ADWG 2011)

[15] Australian and New Zealand Governments (ANZG), (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia (referred to as ANZG 2018)

8 RESULTS

8.1 Summary of Data (QA/QC) Evaluation

The data evaluation is presented in the appendices. In summary, JKE are of the opinion that the data are adequately precise, accurate, representative, comparable and complete to serve as a basis for interpretation to achieve the investigation objectives.

8.2 Subsurface Conditions

A summary of the subsurface conditions encountered during the investigation is presented in the following table. Reference should be made to the borehole logs attached in the appendices for further details.

Table 8-1: Summary of Subsurface Conditions

Profile	Description
Pavement	Asphaltic Concrete (AC) pavement was encountered at the surface in BH1, BH2 and BH3, ranging in thickness between 50mm and 90mm.
Fill	Fill was encountered at the surface or beneath the AC pavement in all boreholes and extended to depths of approximately 0.2 to 6.2mBGL. BH10 was terminated in the fill at a depth of approximately 0.45m. Relatively deep fill greater than 2mBGL was encountered in boreholes BH2 and BH3 located near the proposed ELC building. The fill typically comprised gravelly silty sand, silty sand, fine to coarse grained, with inclusions comprising of varying sizes and fractions of igneous and sandstone gravel, clay, roots, brick fragments and occasional sandstone cobbles and boulders at depth (in some of the locations).
Natural Residual Soil	Natural soil was encountered in BH2, BH6, BH7 and BH8 beneath the fill and extended down to at least between 0.4 and 9.20mBGL. Residual natural soil typically comprised Silty Sand, Clayey Sand and Gravelly Sand.
Bedrock	Sandstone bedrock was encountered in most of the boreholes at depths varying from approximately 0.4-6.2mBGL. Bedrock was not encountered in BH2 only. BH2 encountered deep sands.
Groundwater	All boreholes were dry on completion of drilling. A groundwater monitoring well was installed at BH2 to allow for further groundwater monitoring. In BH2, the groundwater was observed at depths ranging between 8.0-8.5mBGL after completion of drilling and upon return to the site at a later date. In BH8, groundwater was encountered on completion of hand auguring at 1.8m depth, just above the soil/bedrock interface.

8.3 Field Screening

A summary of the field screening results is presented in the following table:

Table 8-2: Summary of Field Screening

Aspect	Details
PID Screening of Soil Samples for VOCs	PID soil sample headspace readings are presented in attached report tables and the COC documents attached in the appendices. The results ranged from 0ppm to 6.2ppm equivalent isobutylene. These results indicate PID detectable VOCs. Samples with elevated PID readings were analysed for TRH and BTEX.

Aspect	Details
Bulk Screening for Asbestos	The bulk field screening results are summarised in the attached report tables. All results were below the SAC.
Groundwater Depth & Flow	Groundwater seepage was encountered in boreholes BH2 and BH8 during drilling at depths of approximately 8.0 and 1.8m respectively. The SWL was measured within MW2 on two separate occasions during development and sampling and was measured at 8.02mBGL. It is anticipated that excavation for the proposed ELC building will be approximately 2mBGL and is not expected to intercept the groundwater. Groundwater beneath the site is expected to flow in the westerly direction towards Rose Bay.
Groundwater Field Parameters	Field measurements recorded during sampling were as follows: - pH ranged from 6.71 to 7.36; - EC ranged from 515µS/cm to 554µS/cm; - Eh ranged from -20.1mV to -32.5mV; and - DO ranged from 0.8ppm to 10.1ppm.
LNAPLs petroleum hydrocarbons	Phase separated product (i.e. LNAPL) were not detected using the interphase probe during groundwater sampling.

8.4 Soil Laboratory Results

The soil laboratory results are compared to the relevant SAC in the attached report tables. A summary of the results assessed against the SAC is presented below:

8.4.1 Human Health and Environmental (Ecological) Assessment

Table 8-3: Summary of Soil Laboratory Results – Human Health and Environmental (Ecological)

Analyte	Results Compared to SAC
Heavy Metals	The concentration of heavy metal Lead exceeded the SAC for human health of 300mg/kg in the following sample: • BH2 (0.75-0.95m) – 810 mg/kg. The concentration was greater than 250% of the SAC. All other heavy metal results were below the SAC for human health. All heavy metal results were below the ecological SAC.
TRH	All TRH results were below the adopted human health based SAC as well as direct contact (including for workers in trenches) criteria values. However, the following exceedances of ecological SAC were identified: The concentrations of TRH F3 fraction were above the adopted ESL of 300 mg/kg in the following samples: • BH1 (0.05-0.15m) – 350 mg/kg; and • BH8 (0.6-0.7m) – 340 mg/kg.
BTEX	All BTEX results were below the SAC. All BTEX concentrations were below the laboratory PQLs.

Analyte	Results Compared to SAC
PAHs	The concentration of carcinogenic PAHs (i.e. Benzo(a)pyrene TEQ) exceeded the SAC for human health of 3mg/kg in the following sample: • BH8 (0.6-0.7m) – 6.9 mg/kg. All other PAH results were below the SAC for human health. All PAH results for samples collected at depths below 1mBGL were below the SAC.
OCPs and OPPs	All OCP and OPP results were below the SAC. All OCP and OPP concentrations were below the laboratory PQLs.
PCBs	All PCB results were below the SAC. All PCB concentrations were below the laboratory PQLs.
Asbestos	All asbestos results were below the SAC (i.e. asbestos was absent in the samples analysed for the investigation).

8.4.2 Waste Classification Assessment

The laboratory results were assessed against the criteria presented in Part 1 of the Waste Classification Guidelines, as summarised previously in this report. The results are presented in the report tables attached in the appendices. A summary of the results is presented in the following table:

Table 8-4: Summary of Soil Laboratory Results Compared to CT and SCC Criteria

Analyte	No. of Samples Analysed	No. of Results > CT Criteria	No. of Results > SCC Criteria	Comments
Heavy Metals	18	6	0	Lead concentrations exceeded the CT1 criterion in the following six fill samples: • BH2 (0.1-0.2m); • BH2 (0.75-0.95m); • BH8 (0.0-0.1m); • BH8 (0.6-0.7m); • BH9 (0.0-0.1m); and • BH10 (0.0-0.1m). The maximum lead concentration was 810mg/kg.
TRH	18	0	0	-
BTEX	18	0	0	-
Total PAHs	18	0	0	-
Benzo(a)pyrene	18	3	0	B(a)P concentration exceeded the CT1 criterion in the following three fill samples: • BH5 (0.0-0.1m); • BH7 (0.0-0.1m); and • BH8 (0.6-0.7m). The maximum B(a)P concentration was 4.7mg/kg.

Analyte	No. of Samples Analysed	No. of Results > CT Criteria	No. of Results > SCC Criteria	Comments
OCPs & OPPs	10	0	0	-
PCBs	10	0	0	-
Asbestos	6	-	-	Asbestos was not detected in the samples analysed.

Table 8-5: Summary of Soil Laboratory Results Compared to TCLP Criteria

Analyte	No. of Samples Analysed	No. of Results > TCLP Criteria	Comments
Lead	6	0	The six fill samples from BH2, BH8, BH9 and BH10 with lead concentrations above the CT1 criterion were analysed for TCLP lead. All results were below the TCLP1 criterion.
Benzo(a)pyrene	3	0	Three fill samples from BH5, BH7 and BH8 with Benzo(a)pyrene concentrations above the CT1 criterion were analysed for TCLP Benzo(a)pyrene. All results were below the TCLP1 criterion.

8.5 Groundwater Laboratory Results

The groundwater laboratory results are compared to the relevant SAC in the attached report tables. A summary of the results assessed against the SAC is presented in the following table:

Table 8-6: Summary of Groundwater Laboratory Results – Human Health and Environmental (Ecological)

Analyte	Results Compared to SAC
Heavy Metals	Zinc (maximum 21µg/L) concentrations exceeded the ecological SAC of 15µg/L. All other results for heavy metals were below the SAC.
TRH	All TRH results were below the SAC.
BTEX	All BTEX results were below the SAC.
Other VOCs	All VOC results were below the SAC.
PAHs	The following PAH concentrations exceeded the adopted human health-based (recreational) and ecological-based SAC: • Phenanthrene (maximum 2.9µg/L) exceeded the ecological SAC of 0.6µg/L; • Anthracene (maximum 0.8µg/L) exceeded the ecological SAC of 0.01µg/L • Fluoranthene (maximum 3.3µg/L) exceeded the ecological SAC of 1µg/L; and • Benzo(a)pyrene (maximum 1.6µg/L) exceeded the ecological and human health-based (recreational) SAC of 0.1µg/L. Detect concentrations above the laboratory PQL were also reported for other tested PAH compounds for which there are currently no listed criteria values.

Analyte	Results Compared to SAC
Other Parameters	pH results were outside the EIL and recreational SAC range. The pH was recorded to be 6.10 in the sample collected from MW2. This is not considered to be a result of site contamination. The EC ranged from 515µS/cm to 554µS/cm.

9 PRELIMINARY WASTE CLASSIFICATION

9.1 Preliminary Classification of Fill

Based on the results of the assessment, and at the time of reporting, the fill material is classified as **General Solid Waste (non-putrescible)**. Though some concentrations of lead and benzo(a)pyrene exceeded the CT1 thresholds, all of the concentrations were below the SCC1 thresholds. Undertaking TCLP analysis for lead and benzo(a)pyrene on all fill samples which exceeded the CT1 thresholds indicated that the soils generally leached low concentrations of lead, whilst the benzo(a)pyrene was generally immobile. The TCLP results for the analysed samples were below the TCLP1 thresholds for general solid waste.

The classification of the fill soils is preliminary in nature and will require confirmation, including further sampling and analysis, prior to disposal off-site. The anticipated waste quantities should also be confirmed at that time and documented in the report.

Fill should be disposed of to a facility that is licensed by the NSW EPA to receive this waste stream. The facility should be contacted to obtain the required approvals prior to commencement of excavation.

9.2 Preliminary Classification of Natural Soil and Bedrock

Based on the results of the assessment, and at the time of reporting, the natural soils at the site, generally comprising silty sand/clayey sand/gravelly sand are unlikely to meet the definition of VENM for off-site disposal or re-use purposes, and are assigned a preliminary classification of **General Solid Waste (non-putrescible)**. JKE note that low concentrations of PAHs were encountered within the sample of natural soil material collected from BH8 (1.6-1.8m). JKE recommends that additional testing be undertaken of the natural soil to confirm the final classification for off-site disposal.

Based on the results of the assessment, and at the time of reporting, JKE are of the opinion that the natural bedrock at the site is likely to meet the definition of **VENM** for off-site disposal or re-use purposes.

In accordance with Part 1 of the Waste Classification Guidelines, VENM is pre-classified as general solid waste and can also be disposed of accordingly to a facility that is licensed to accept it.

The classification of the natural soils and bedrock are preliminary in nature and will require confirmation following the removal of overlying fill soils, including additional sampling and analysis, prior to disposal off-site. The anticipated waste quantities should also be confirmed at that time and documented in the report.

10 DISCUSSION

10.1 Tier 1 Risk Assessment and Review of CSM

For a contaminant to represent a risk to a receptor, the following three conditions must be present:

1. Source – The presence of a contaminant;
2. Pathway – A mechanism or action by which a receptor can become exposed to the contaminant; and
3. Receptor – The human or ecological entity which may be adversely impacted following exposure to contamination.

If one of the above components is missing, the potential for adverse risks is relatively low.

10.1.1 Soil

10.1.1.1 Heavy Metals

Lead was detected at concentration which exceeded the HIL SAC in fill soil sample collected from BH2 (0.75-0.95m). BH2 was located within the northern part of the site where new ELC building is being proposed (see Figure 3). The concentration was greater than 250% of the SAC and considered a hotspot which will require remediation. The source of the lead is considered to be associated with the fill material, with further testing of underlying natural material confirming lead concentration below the SAC. The fill appears to have been historically imported onto the site.

Based on the information provided by the client, it is anticipated that excavation for the proposed ELC building will extend down to approximately 2m below the surface. Elevated concentration of lead was detected at depths of approximately 0.75-0.95mBGL which will potentially be disturbed during the course of the proposed development works at this part of the site. Therefore, there is a potential for a complete SPR linkage for lead within this area. On this basis, lead is considered to pose a potential human health risk which will require remediation.

JKE note that analysis of groundwater at this location indicate low concentration of dissolved heavy metal lead within the samples tested. In addition, leachability analysis which was undertaken on fill samples from this location for waste classification purposes revealed low concentrations of dissolved lead. Based on this, it was considered unlikely for lead to migrate into the groundwater at this location.

10.1.1.2 PAHs

Carcinogenic PAHs were detected at concentration which exceeded the HIL SAC in fill soil sample collected from BH8 (0.6-0.7m). BH8 was located within the southern part of the site where new two-storey bus/carpark is being proposed (see Figure 3). The source of Carcinogenic PAHs is considered to be associated with the fill material, with further testing of underlying natural material confirming concentration of Carcinogenic PAHs below the SAC.

Based on the information provided by the client, it is anticipated that excavation for the proposed new two-storey bus/carpark will extend down to approximately 1m below the surface. Elevated concentration of Carcinogenic PAHs was detected at depths of approximately 0.6-0.7mBGL which will potentially be disturbed during the course of the proposed development works at this part of the site. Therefore, there is a potential

for a complete SPR linkage for carcinogenic PAHs within this area. On this basis, carcinogenic PAHs are considered to pose a potential human health risk which will require remediation.

JKE note that leachability analysis was undertaken on samples from this location for waste classification purposes, with the TCLP results indicating the PAHs were generally immobile and unlikely to migrate into the groundwater beneath the site.

10.1.1.3 TRH

The concentration of TRH F3 in BH1 (0.05-0.15m) and BH8 (0.6-0.7m) exceeded the EIL SAC. BH1 was located within the northern part of the site where new ELC building is being proposed, whilst BH8 was located within the southern part of the site where the new two-storey bus/carpark is proposed to be developed (see Figure 3). The sources of the TRHs are considered to be associated with the fill material, with further testing of underlying natural material confirming TRH concentrations below the SAC.

The elevated concentrations were detected at shallow depths which are likely to be disturbed during the course of the proposed development works. On this basis, JKE consider that the SPR linkage is complete, and that the TRH F3 within these areas poses a risk to ecological receptors. JKE note that impact in BH8 (0.6-0.7m) is co-located with a human health risk, as identified in Section 10.1.1.2 and can be remediation in conjunction with the impacted material.

10.1.2 Groundwater

10.1.2.1 Heavy Metals

Zinc concentration in excess of the ecological (GIL marine) SAC was reported for the sample from MW2. Zinc in groundwater is considered to be a regional issue which is common in urban environments due to runoff and leaking water infrastructure.

Trace concentrations of zinc were identified in all fill samples analysed as part of this assessment. Most of the identified fill material on site was noted to be well above the observed groundwater table with majority of the site area being unpaved. The potential for zinc to have leached from the fill soil and added to the contaminant load in the groundwater is considered to be low.

Identified concentration of zinc in groundwater does not pose a risk to the on-site receptors in the context of the proposed development. However, some treatment may be needed for off-site disposal of groundwater to the storm water in the event of dewatering.

10.1.2.2 Hydrocarbons

Most hydrocarbon concentrations (i.e. TRH, BTEX and VOCs) in groundwater were below the SAC with an exception of some of the PAH compounds namely: phenanthrene, anthracene, fluoranthene and benzo(a)pyrene which were recorded above the ecological and human health SAC. In addition, trace concentrations of other PAHs were also identified within the groundwater sample.

The source of these PAHs in groundwater could not be confirmed with great degree of certainty at this stage. Physio-chemical properties of the identified PAHs, and in particular benzo(a)pyrene, suggest a very low water solubility factor. PAHs and especially benzo(a)pyrene tend to bind to particulate matter rather than leach/dissolve in order to be transported in groundwater. Field observations made during development and sampling of MW2 indicated a very low recharge rate into this well with some sediment loading. We are of the opinion that this sediment may have caused interference with the PAH analysis. This was further substantiated by the analytical data for the duplicate sample which reported significantly higher concentrations of PAHs as compared to the primary sample.

10.1.3 Acid Sulfate Soils

Based on the information reviewed for this assessment, JKE are of the opinion that there is a relatively low potential for ASS or potential (PASS) to be disturbed during the proposed development works described in Section 1.1 of this report. This conclusion is based on the following:

- The ASS risk map for the area indicates that the site is located within an area of no known occurrence of ASS;
- Further, information reviewed as part of this assessment indicated that the site is located within a Class 5 risk area for ASS. Works in Class 5 areas that could pose an environmental risk in terms of ASS include works within 500m of adjacent Class 1,2,3,4 land which are likely to lower the water table below 1m AHD on the adjacent Class 1,2,3,4 land. This is unlikely to be the case due to site's elevation above the sea level (i.e. 10-60 mAHD) and the anticipated depth of soil disturbance as part of the proposed development works; and
- The boreholes drilled for this assessment encountered residual natural soils and bedrock. Layers of peat or other organic material indicative of PASS were not encountered in the soils.

10.2 Decision Statements

The decision statements are addressed below:

> *Did the site inspection, or does the historical information identify potential contamination sources/AEC at the site?*

The historical information identified potential sources of contamination, being: the historical levelling and filling of the site; potential use of pesticides within the site; and the presence of potentially hazardous building materials within the existing structures and in the ground as a result of weathering and/or previous demolition activities. The site inspection confirmed that site levelling activities had historically taken place, and based on the apparent age of some of the buildings present across the wider site, hazardous building materials may potentially be present on site.

> *Are any results above the SAC?*

Lead was detected at concentration which exceeded the human health SAC in fill soil sample collected from BH2. Carcinogenic PAHs were detected at concentration which also exceeded the human health SAC in fill soil sample collected from BH8.

TRH F3 were detected above the ecological SAC in BH1 and BH8.

Zinc was identified above the ecological SAC for groundwater water within MW2. A number of PAH compounds namely: phenanthrene, anthracene, fluoranthene and benzo(a)pyrene were detected above the ecological and human health SAC.

Do potential risks associated with contamination and acid sulfate soils exist, and if so, what are they?

The presence of elevated concentrations of Lead in fill within the northern part of the site where new ELC building is being proposed (in the vicinity of BH2) and carcinogenic PAHs in fill within the southern part of the site where the new two-storey bus/carpark is being proposed (in the vicinity of BH8) pose a potential risk to human health.

The presence of TRH F3 at elevated concentrations within northern and southern parts of the site where new ELC building and the new two-storey bus/carpark are being proposed (in the vicinity of BH1 and BH8) pose a potential risk to ecological receptors.

The elevated metal concentrations within the groundwater are considered a regional issue and are not considered to pose a risk to ecological receptors at the site.

The presence of PAHs in the groundwater are anomalous and risks associated with the PAHs identified in groundwater to date are considered to be low. This will necessitate further assessment of groundwater as part of the site validation process.

Based on the weight of evidence collected and evaluated for this assessment , there is considered to be a low potential for ASS (AASS or PASS) to be disturbed during the proposed development described in Section **Error! Reference source not found.** of this report. On this basis, an ASSMP is not considered necessary for the proposed development.

Is remediation required?

Remediation is required to address the carcinogenic PAHs and lead within the fill soils in relation to human health risk. Remediation is also required to address the TRH F3 impact within fill soils in relation to ecological receptors. JKE note that some impacts are co-located with a potential human health risk posed by carcinogenic PAHs.

Is the site characterisation sufficient to provide adequate confidence in the above decisions?

Yes. Though the sampling pattern was not probabilistic, the approach provided adequate spatial coverage of the site, and representative samples were analysed based on the results of field screening and observations.

Is the site suitable for the proposed development, or can the site be made suitable subject to further characterisation and/or remediation?

The site can be made suitable for the proposed development subject to appropriate remediation.

10.3 Data Gaps

An assessment of data gaps is provided in the following table:

Table 10-1: Data Gap Assessment

Data Gap	Assessment
Groundwater flow direction not confirmed / groundwater assessment limited in scope	The existence of only one groundwater monitoring well on site available for sampling presents limitations and creates data gaps associated with the limited scope of groundwater assessment at this stage. Groundwater flow direction could not be confirmed with great degree of accuracy and sensible assessment of groundwater quality between up-gradient and down-gradient locations at the site is also unable to be properly completed. Actual depth to groundwater table beneath the site was not ascertained. Groundwater conditions and quality could be further confirmed during the remediation/validation process.
Delineation of identified contamination hotspot.	This data gap relates to the lack of information associated with the lateral extent of the identified hotspot of lead impacted fill material in the vicinity of BH2. The Carcinogen PAHs detected in BH8 has not been adequately delineated. Given the limited scope of anticipated excavations as part of the construction works this data gap can be addressed as part of RAP protocols including during waste classification for off-site disposal of excavated material as part of the development.
Characterisation of soils for waste classification purposes	Based on the results of the intrusive investigation, the characteristics of fill and natural soils across the site vary considerably. The waste classifications provided within this report are preliminary in nature due to the limited samples and variation encountered, and will require confirmation prior to off-site disposal of soils and bedrock.

11 CONCLUSIONS AND RECOMMENDATIONS

The assessment included a review of historical information, soil sampling from 10 boreholes and groundwater sampling from one monitoring well onsite. The site has historically been used as school grounds including onboarding facilities (accommodation) as well as possibly for religious use.

The investigation identified lead and carcinogenic PAHs contamination in soils in northern and southern parts of the site within the areas of proposed development works. The source of contamination was identified as the fill material historically imported onto the site. The contaminants requiring remediation include: lead contamination hotspot in the northern part of the site where the new ELC building is proposed, carcinogenic PAHs within the southern part of the site area where the new two-storey bus/carpark is proposed, and TRH F3 identified also within northern and southern parts of the site which poses a risk to ecological receptors. These TRH exceedances where co-located with carcinogenic PAHs requiring remediation due to the potential risk to human health.

Based on the findings of the assessment, JKE are of the opinion that the site can be made suitable for the proposed development described in Section 1.1, subject to the implementation of the following recommendations:

- Prepare a RAP to address the data gaps and contamination issues identified at the site. This will include the requirements to complete the data gap assessment and the preparation of an unexpected find protocol (UFP); and
- Undertake a validation assessment documenting the remediation works.

At this stage, JKE consider that there is no requirement to notify the NSW EPA under the NSW EPA Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997 (2015)[16], provided the recommendations provided above are implemented.

JKE consider that the report objectives outlined in Section 1.2 have been addressed.

[16] NSW EPA, (2015). *Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997* (referred to as Duty to Report Contamination)

12 LIMITATIONS

The report limitations are outlined below:

- JKE accepts no responsibility for any unidentified contamination issues at the site. Any unexpected problems/subsurface features that may be encountered during development works should be inspected by an environmental consultant as soon as possible;
- Previous use of this site may have involved excavation for the foundations of buildings, services, and similar facilities. In addition, unrecorded excavation and burial of material may have occurred on the site. Backfilling of excavations could have been undertaken with potentially contaminated material that may be discovered in discrete, isolated locations across the site during construction work;
- This report has been prepared based on site conditions which existed at the time of the investigation; scope of work and limitation outlined in the JKE proposal; and terms of contract between JKE and the client (as applicable);
- The conclusions presented in this report are based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, visual observations of the site and immediate surrounds and documents reviewed as described in the report;
- Subsurface soil and rock conditions encountered between investigation locations may be found to be different from those expected. Groundwater conditions may also vary, especially after climatic changes;
- The investigation and preparation of this report have been undertaken in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined in the report;
- Where information has been provided by third parties, JKE has not undertaken any verification process, except where specifically stated in the report;
- JKE has not undertaken any assessment of off-site areas that may be potential contamination sources or may have been impacted by site contamination, except where specifically stated in the report;
- JKE accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1990 constructed buildings or fill material at the site;
- JKE have not and will not make any determination regarding finances associated with the site;
- Additional investigation work may be required in the event of changes to the proposed development or land use. JKE should be contacted immediately in such circumstances;
- Material considered to be suitable from a geotechnical point of view may be unsatisfactory from a soil contamination viewpoint, and vice versa; and
- This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose.

Important Information About This Report

These notes have been prepared by JKE to assist with the assessment and interpretation of this report.

The Report is based on a Unique Set of Project Specific Factors
This report has been prepared in response to specific project requirements as stated in the JKE proposal document which may have been limited by instructions from the client. This report should be reviewed, and if necessary, revised if any of the following occur:

- The proposed land use is altered;
- The defined subject site is increased or sub-divided;
- The proposed development details including size, configuration, location, orientation of the structures or landscaped areas are modified;
- The proposed development levels are altered, eg addition of basement levels; or
- Ownership of the site changes.

JKE will not accept any responsibility whatsoever for situations where one or more of the above factors have changed since completion of the assessment. If the subject site is sold, ownership of the assessment report should be transferred by JKE to the new site owners who will be informed of the conditions and limitations under which the assessment was undertaken. No person should apply an assessment for any purpose other than that originally intended without first conferring with the consultant.

Changes in Subsurface Conditions
Subsurface conditions are influenced by natural geological and hydrogeological process and human activities. Groundwater conditions are likely to vary over time with changes in climatic conditions and human activities within the catchment (e.g. water extraction for irrigation or industrial uses, subsurface waste water disposal, construction related dewatering). Soil and groundwater contaminant concentrations may also vary over time through contaminant migration, natural attenuation of organic contaminants, ongoing contaminating activities and placement or removal of fill material. The conclusions of an assessment report may have been affected by the above factors if a significant period of time has elapsed prior to commencement of the proposed development.

This Report is based on Professional Interpretations of Factual Data
Site assessments identify actual subsurface conditions at the actual sampling locations at the time of the investigation. Data obtained from the sampling and subsequent laboratory analyses, available site history information and published regional information is interpreted by geologists, engineers or environmental scientists and opinions are drawn about the overall subsurface conditions, the nature and extent of contamination, the likely impact on the proposed development and appropriate remediation measures.

Actual conditions may differ from those inferred, because no professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, but steps can be taken to help minimise the impact. For this reason, site owners should retain the services of their consultants throughout the development stage of the project, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

Assessment Limitations
Although information provided by a site assessment can reduce exposure to the risk of the presence of contamination, no environmental site assessment can eliminate the risk. Even a rigorous professional assessment may not detect all contamination on a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which showed no signs of contamination when sampled. Contaminant analysis cannot possibly cover every type of contaminant which may occur; only the most likely contaminants are screened.

Misinterpretation of Site Assessments by Design Professionals

Costly problems can occur when other design professionals develop plans based on misinterpretation of an assessment report. To minimise problems associated with misinterpretations, the environmental consultant should be retained to work with appropriate professionals to explain relevant findings and to review the adequacy of plans and specifications relevant to contamination issues.

Logs Should not be Separated from the Assessment Report

Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site remediation or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problem, however contractors can still misinterpret the logs during bid preparation if separated from the text of the assessment. If this occurs, delays, disputes and unanticipated costs may result. In all cases it is necessary to refer to the rest of the report to obtain a proper understanding of the assessment. Please note that logs with the 'Environmental Log' header are not suitable for geotechnical purposes as they have not been peer reviewed by a Senior Geotechnical Engineer.

To reduce the likelihood of borehole and test pit log misinterpretation, the complete assessment should be available to persons or organisations involved in the project, such as contractors, for their use. Denial of such access and disclaiming responsibility for the accuracy of subsurface information does not insulate an owner from the attendant liability. It is critical that the site owner provides all available site information to persons and organisations such as contractors.

Read Responsibility Clauses Closely

Because an environmental site assessment is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in written transmittals. These are definitive clauses designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the environmental site assessment, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to any questions.

Appendix A: Report Figures

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

This plan should be read in conjunction with the Environmental report.

Title: **SITE LOCATION PLAN**

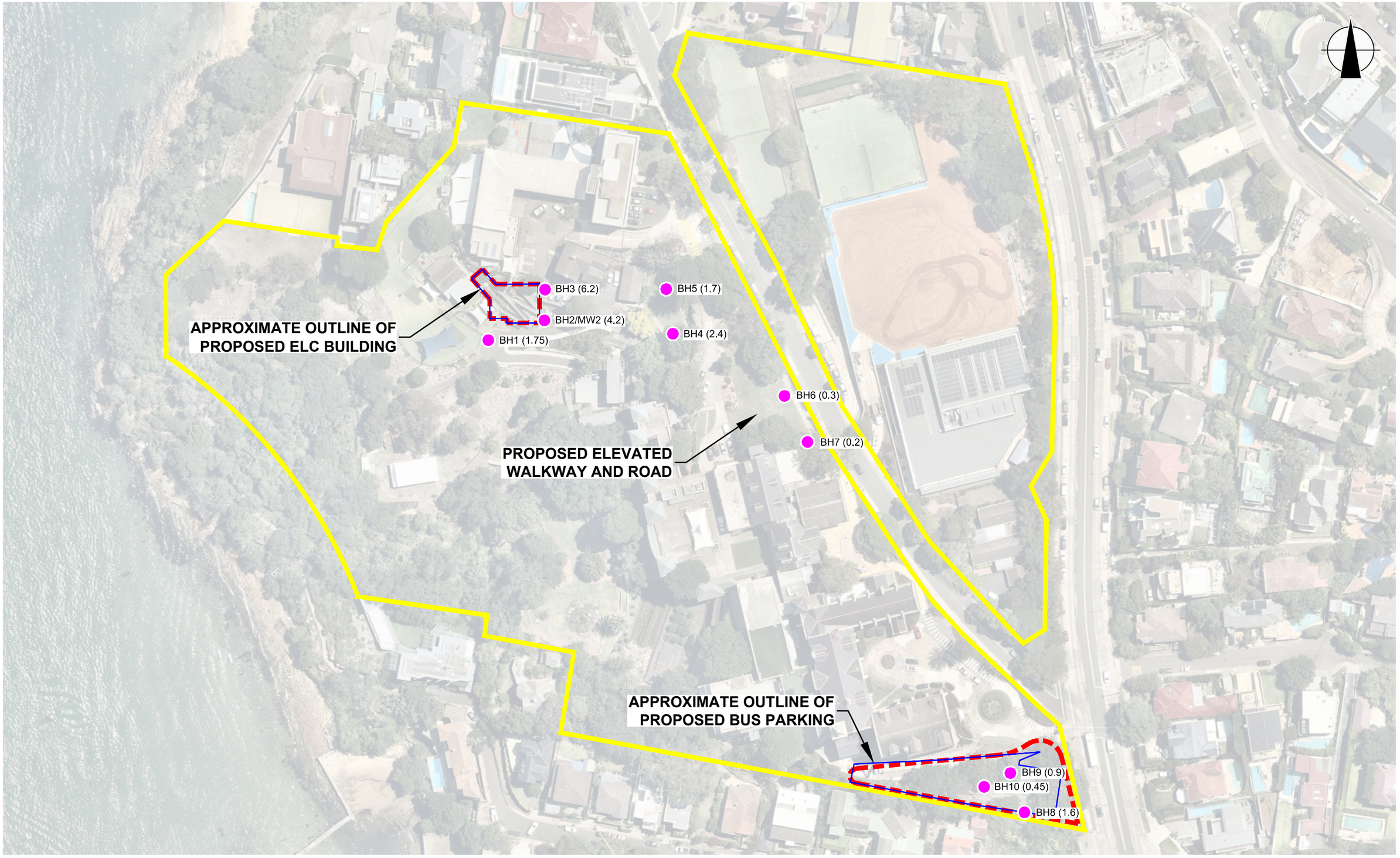
Location: CORNER NEW SOUTH HEAD ROAD AND VAUCLUSE ROAD, VAUCLUSE, NSW (Lot 104 in DP1092747)

Project No: E32915BD

Figure: 1

JKEnvironments

PLOT DATE: 2/03/2020 1:39:28 PM DWG FILE: Z:\5 EIS\5C EIS JOBS\32000'S\E32915BD VAUCLUSE\CAD\E32915BD.DWG



LEGEND

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE WIDER PROPERTY BOUNDARY
- BH(Fill depth) — BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m)

0 13 26 39 52 65

SCALE 1:1300 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title: **SAMPLE LOCATION PLAN**

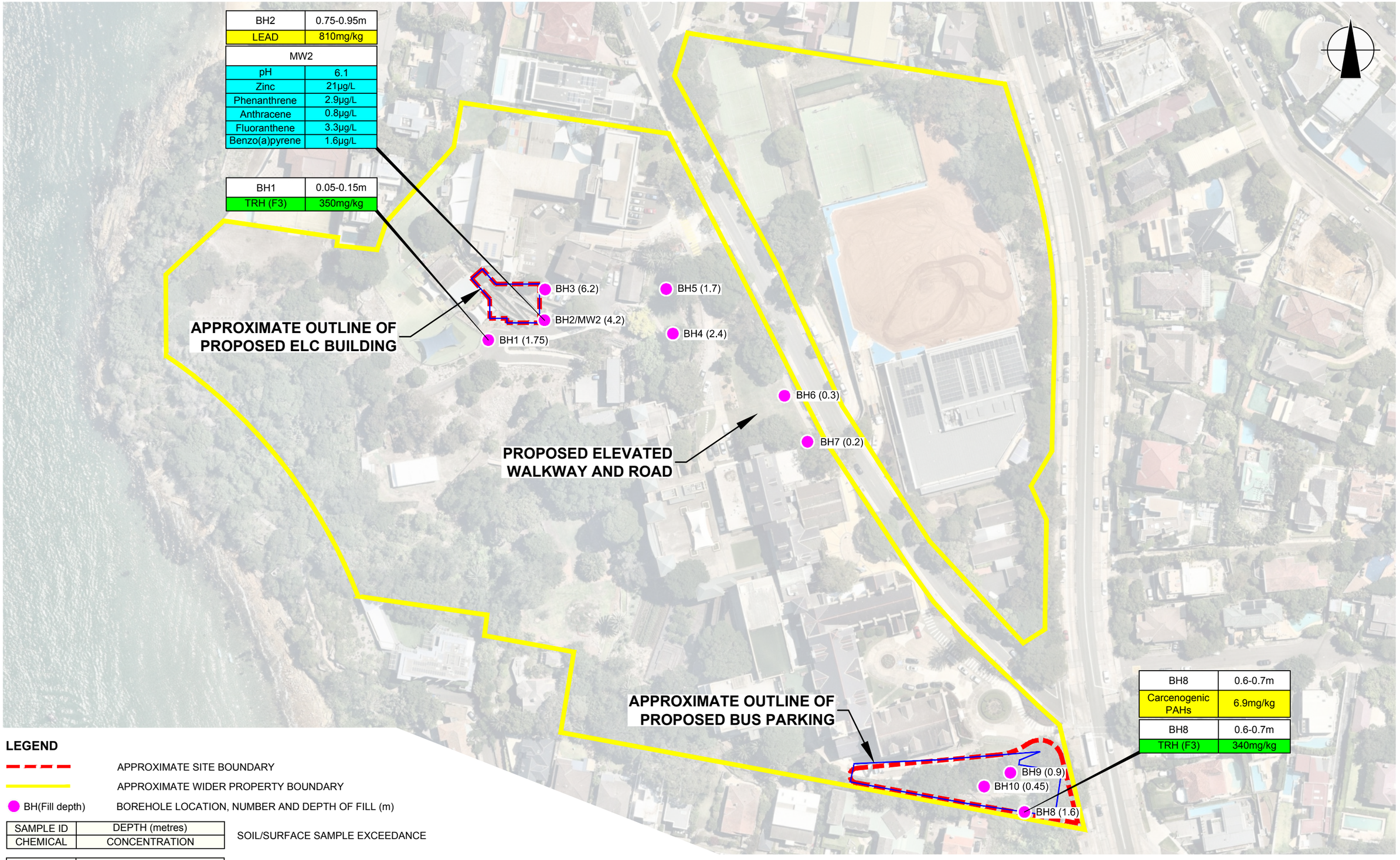
Location: CORNER NEW SOUTH HEAD ROAD AND VAUCLUSE ROAD, VAUCLUSE, NSW (Lot 104 in DP1092747)

Project No: E32915BD

Figure: 2

JKEnvironments

PLOT DATE: 3/03/2020 2:13:03 PM DWG FILE: Z:\5 EIS\5C EIS JOBS\32000SIE32915BD VAULCLUSE\CAD\E32915BD.DWG



LEGEND

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE WIDER PROPERTY BOUNDARY
- BH(Fill depth) — BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m)

SAMPLE ID	DEPTH (metres)
CHEMICAL	CONCENTRATION

SOIL/SURFACE SAMPLE EXCEEDANCE

SAMPLE ID	-
CHEMICAL	CONCENTRATION (µg/L)

GROUNDWATER SAMPLE EXCEEDANCE

- SOIL/SURFACE CONTAMINATION ABOVE SAC FOR HUMAN HEALTH RISK
- SOIL CONTAMINATION ABOVE SAC FOR ECOLOGICAL RISK
- GROUNDWATER CONTAMINATION ABOVE SAC

0 13 26 39 52 65
SCALE 1:1300 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title: **SITE CONTAMINATION PLAN**

Location: CORNER NEW SOUTH HEAD ROAD AND VAUCLUSE ROAD, VAUCLUSE, NSW (Lot 104 in DP1092747)

Project No: E32915BD

Figure: 3

JKEnvironments

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Appendix B: Laboratory Results Summary Tables

ABBREVIATIONS AND EXPLANATIONS

Abbreviations used in the Tables:

ABC:	Ambient Background Concentration
ACM:	Asbestos Containing Material
ADWG:	AustralianDrinking Water Guidelines
AF:	Asbestos Fines
ANZG	Australian and New Zealand Guidelines
B(a)P:	Benzo(a)pyrene
CEC:	Cation Exchange Capacity
CRC:	Cooperative Research Centre
CT:	Contaminant Threshold
EILs:	Ecological Investigation Levels
ESLs:	Ecological Screening Levels
FA:	Fibrous Asbestos
GIL:	Groundwater Investigation Levels
GSW:	General Solid Waste
HILs:	Health Investigation Levels
HSLs:	Health Screening Levels
HSL-SSA:	Health Screening Level-SiteSpecific Assessment
kg/L	kilograms per litre
NA:	Not Analysed
NC:	Not Calculated
NEPM:	National Environmental Protection Measure
NHMRC:	National Health and Medical Research Council
NL:	Not Limiting
NSL:	No Set Limit
OCP:	Organochlorine Pesticides
OPP:	Organophosphorus Pesticides
PAHs:	Polycyclic Aromatic Hydrocarbons
%w/w:	weight per weight
ppm:	Parts per million
PCBs:	Polychlorinated Biphenyls
PCE:	Perchloroethylene (Tetrachloroethylene or Teterachloroethene)
pH_{KCL} :	pH of filtered 1:20, 1M KCL extract, shaken overnight
pH_{ox} :	pH of filtered 1:20 1M KCl after peroxide digestion
PQL:	Practical Quantitation Limit
RS:	Rinsate Sample
RSL:	Regional Screening Levels
RSW:	Restricted Solid Waste
SAC:	Site Assessment Criteria
SCC:	Specific Contaminant Concentration
S_{Cr}:	Chromium reducible sulfur
S_{POS}:	Peroxide oxidisable Sulfur
SSA:	Site Specific Assessment
SSHSLs:	Site Specific Health Screening Levels
TAA:	Total Actual Acidity in 1M KCL extract titrated to pH6.5
TB:	Trip Blank
TCA:	1,1,1 Trichloroethane (methyl chloroform)
TCE:	Trichloroethylene (Trichloroethene)
TCLP:	Toxicity Characteristics Leaching Procedure
TPA:	Total Potential Acidity, 1M KCL peroxide digest
TS:	Trip Spike
TRH:	Total Recoverable Hydrocarbons
TSA:	Total Sulfide Acidity (TPA-TAA)
UCL:	Upper Level Confidence Limit on Mean Value
USEPA	United States Environmental Protection Agency
VOCC:	Volatile Organic Chlorinated Compounds
WHO:	World Health Organisation

Table Specific Explanations:

HIL Tables:

- The chromium results are for Total Chromium which includes Chromium III and VI. For initial screening purposes, we have assumed that the samples contain only Chromium VI unless demonstrated otherwise by additional analysis.
- Carcinogenic PAHs is a toxicity weighted sum of analyte concentrations for a specific list of PAH compounds relative to B(a)P. It is also refered to as the B(a)P Toxic Equivalence Quotient (TEQ).
- Statistical calculations are undertaken using ProUCL (USEPA). Statistical calculation is usually undertaken using data from fill samples.

EIL/ESL Table:

Site specific ABC values for specific metals have been adopted.

Waste Classification and TCLP Table:

- Data assessed using the NSW EPA Waste Classification Guidelines, Part 1: Classifying Waste (2014).
- The assessment of Total Moderately Harmful pesticides includes: Dichlorovos, Dimethoate, Fenitrothion, Ethion, Malathion and Parathion.
- Assessment of Total Scheduled pesticides include: HBC, alpha-BHC, gamma-BHC, beta-BHC, Heptachlor, Aldrin, Heptachlor Epoxide, gamma-Chlordane, alpha-chlordane, pp-DDE, Dieldrin, Endrin, pp-DDD, pp-DDT, Endrin Aldehyde.

QA/QC Table:

- Field blank, Inter and Intra laboratory duplicate results are reported in mg/kg.
- Trip spike results are reported as percentage recovery.
- Field rinsate results are reported in µg/L.

JKEnvironments

TABLE S1
SOIL LABORATORY RESULTS COMPARED TO NEPM 2013.
HIL-A: 'Residential with garden/accessible soils; children's day care centers; preschools; and primary schools'

All data in mg/kg unless stated otherwise			HEAVY METALS								PAHs		ORGANOCHLORINE PESTICIDES (OCPs)							OP PESTICIDES (OPPs)	TOTAL PCBs	ASBESTOS FIBRES
			Arsenic	Cadmium	Chromium VI	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	Carcinogenic PAHs	HCB	Endosulfan	Methoxychlor	Aldrin & Dieldrin	Chlordane	DDT, DDD & DDE	Heptachlor	Chlorpyrifos		
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	100
Site Assessment Criteria (SAC)			100	20	100	6000	300	40	400	7400	300	3	10	270	300	6	50	240	6	160	1	Detected/Not Detected
Sample Reference	**Sample Depth**	**Sample Description**																				
BH1	0.05-0.15	F: Gravelly silty sand	<4	<0.4	**12**	**54**	**17**	<0.1	**8**	**39**	**11**	**1.1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH1	0.05-0.15	F: Gravelly silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH2	0.1-0.2	F: Silty sand	**9**	<0.4	**84**	**51**	**250**	**0.2**	**15**	**91**	**1.2**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH2	0.75-0.95	F: Silty sand	**12**	<0.4	**9**	**25**	**810**	**2.4**	**3**	**330**	**0.72**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH2	4.8-4.95	Silty sand	<4	<0.4	**8**	<1	**6**	<0.1	<1	**6**	<0.05	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH2	0.2-0.5	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH3	0.4-0.5	F: Silty sand	**34**	<0.4	**8**	**9**	**69**	**0.2**	**5**	**39**	**0.5**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH4	0-0.1	F: Silty sand	<4	<0.4	**5**	**10**	**45**	<0.1	**1**	**42**	**3.9**	**0.7**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH4	0.5-0.6	F: Silty sand	<4	<0.4	**7**	**3**	**16**	<0.1	**1**	**13**	**0.1**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH4	0.1-0.3	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH5	0-0.1	F: Silty sand	<4	<0.4	**6**	**14**	**49**	<0.1	**2**	**55**	**15**	**1.6**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH5	1.7-1.8	Sanstone	<4	<0.4	**17**	**2**	**19**	<0.1	**1**	**31**	<0.05	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH5	0-0.3	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH6	0-0.1	F: Silty sand	**6**	<0.4	**8**	**23**	**81**	<0.1	**3**	**61**	**5.4**	**1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH6 (Lab Replicate)	0-0.1	F: Silty sand	**7**	<0.4	**12**	**21**	**83**	**0.1**	**3**	**59**	**3.5**	**0.7**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH7	0-0.1	F: Silty sand	**6**	<0.4	**6**	**20**	**86**	<0.1	**3**	**53**	**9.6**	**1.7**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH7	0.2-0.3	Silty sand	<4	<0.4	**3**	**6**	**32**	<0.1	<1	**15**	**0.6**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH8	0-0.1	F: Silty sand	**9**	**0.4**	**11**	**36**	**160**	**0.1**	**4**	**130**	**1.3**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH8	0.6-0.7	F: Silty sand	**6**	<0.4	**10**	**80**	**160**	**0.1**	**7**	**190**	**40**	**6.9**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH8	1.6-1.8	Clayey Sand	**5**	<0.4	**15**	**10**	**29**	<0.1	**1**	**20**	**1.3**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH9	0-0.1	F: Silty sand	**33**	**0.4**	**13**	**43**	**190**	**0.1**	**4**	**150**	**6.1**	**0.9**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH10	0-0.1	F: Silty sand	**24**	<0.4	**9**	**34**	**200**	**0.1**	**4**	**160**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
SDUP2	-	Field Duplicate	**6**	<0.4	**62**	**51**	**170**	**0.1**	**12**	**130**	**0.73**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SDUP6	-	Field Duplicate	**32**	<0.4	**10**	**43**	**160**	**0.1**	**3**	**140**	**5.7**	**0.9**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Number of Samples			20	20	20	20	20	20	20	20	20	20	10	10	10	10	10	10	10	10	10	6
Maximum Value			34	0.4	84	80	810	2.4	15	330	40	6.9	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	Not Detected

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**

TABLE S2
SOIL LABORATORY RESULTS COMPARED TO HSLs
All data in mg/kg unless stated otherwise

					C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	Field PID Measurement
PQL - Envirolab Services					25	50	0.2	0.5	1	1	1	ppm
NEPM 2013 HSL Land Use Category					HSL-A/B:LOW/HIGH DENSITY RESIDENTIAL							
Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**								
BH1	0.05-0.15	F: Gravelly silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.4
BH1	0.05-0.15	F: Gravelly silty sand	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA	-
BH2	0.1-0.2	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.3
BH2	0.75-0.95	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.6
BH2	4.8-4.95	Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	1.9
BH2	0.2-0.5	F: Silty sand	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA	-
BH3	0.4-0.5	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	1.1
BH4	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.5
BH4	0.5-0.6	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	2.2
BH4	0.1-0.3	F: Silty sand	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA	-
BH5	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	3.4
BH5	1.7-1.8	Sanstone	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	7.7
BH5	0-0.3	F: Silty sand	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA	-
BH6	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH6 (Lab Replicate)	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH7	0-0.1	F: Silty sand	0m to <1m	Sand	<25	**51**	<0.2	<0.5	<1	<3	<1	1.1
BH7	0.2-0.3	Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	6.2
BH8	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.9
BH8	0.6-0.7	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH8	1.6-1.8	Clayey Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH9	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH10	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.1
SDUP2	-	Field Duplicate	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	NA
SDUP6	-	Field Duplicate	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	NA
Total Number of Samples					20	20	20	20	20	20	20	18
Maximum Value					<PQL	51	<PQL	<PQL	<PQL	<PQL	<PQL	7.7

Concentration above the SAC — **VALUE**
Concentration above the PQL — **Bold**
The guideline corresponding to the concentration above the SAC is highlighted in grey in the Site Assessment Criteria Table below

HSL SOIL ASSESSMENT CRITERIA

Sample Reference	Sample Depth	Sample Description	Depth Category	Soil Category	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene
BH1	0.05-0.15	F: Gravelly silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH1	0.05-0.15	F: Gravelly silty sand	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA
BH2	0.1-0.2	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH2	0.75-0.95	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH2	4.8-4.95	Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH2	0.2-0.5	F: Silty sand	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA
BH3	0.4-0.5	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH4	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH4	0.5-0.6	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH4	0.1-0.3	F: Silty sand	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA
BH5	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH5	1.7-1.8	Sanstone	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH5	0-0.3	F: Silty sand	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA
BH6	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH6 (Lab Replicate)	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH7	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH7	0.2-0.3	Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH8	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH8	0.6-0.7	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH8	1.6-1.8	Clayey Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH9	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH10	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
SDUP2	-	Field Duplicate	0m to <1m	Sand	45	110	0.5	160	55	40	3
SDUP6	-	Field Duplicate	0m to <1m	Sand	45	110	0.5	160	55	40	3

TABLE S3
SOIL LABORATORY RESULTS COMPARED TO MANAGEMENT LIMITS
All data in mg/kg unless stated otherwise

			C_6-C_{10} (F1) plus BTEX	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)
PQL - Envirolab Services			25	50	100	100
NEPM 2013 Land Use Category			**RESIDENTIAL, PARKLAND & PUBLIC OPEN SPACE**			
Sample Reference	**Sample Depth**	**Soil Texture**				
BH1	0.05-0.15	Coarse	<25	<50	**350**	**360**
BH1	0.05-0.15	Coarse	NA	NA	NA	NA
BH2	0.1-0.2	Coarse	<25	<50	**190**	**350**
BH2	0.75-0.95	Coarse	<25	<50	<100	<100
BH2	4.8-4.95	Coarse	<25	<50	<100	<100
BH2	0.2-0.5	Coarse	NA	NA	NA	NA
BH3	0.4-0.5	Coarse	<25	<50	<100	<100
BH4	0-0.1	Coarse	<25	<50	<100	<100
BH4	0.5-0.6	Coarse	<25	<50	<100	<100
BH4	0.1-0.3	Coarse	NA	NA	NA	NA
BH5	0-0.1	Coarse	<25	<50	**160**	<100
BH5	1.7-1.8	Coarse	<25	<50	<100	<100
BH5	0-0.3	Coarse	NA	NA	NA	NA
BH6	0-0.1	Coarse	<25	<50	<100	<100
BH6 (Lab Replicate)	0-0.1	Coarse	<25	<50	**100**	<100
BH7	0-0.1	Coarse	<25	**51**	**110**	<100
BH7	0.2-0.3	Coarse	<25	<50	<100	<100
BH8	0-0.1	Coarse	<25	<50	<100	<100
BH8	0.6-0.7	Coarse	<25	<50	**340**	**100**
BH8	1.6-1.8	Coarse	<25	<50	<100	<100
BH9	0-0.1	Coarse	<25	<50	<100	<100
BH10	0-0.1	Coarse	<25	<50	<100	<100
SDUP2	-	Coarse	<25	<50	**230**	**400**
SDUP6	-	Coarse	<25	<50	<100	<100
Total Number of Samples			20	20	20	20
Maximum Value			<PQL	51	340	400

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**

MANAGEMENT LIMIT ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Soil Texture**	C_6-C_{10} (F1) plus BTEX	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)
BH1	0.05-0.15	Coarse	700	1000	2500	10000
BH1	0.05-0.15	Coarse	--	--	--	--
BH2	0.1-0.2	Coarse	700	1000	2500	10000
BH2	0.75-0.95	Coarse	700	1000	2500	10000
BH2	4.8-4.95	Coarse	700	1000	2500	10000
BH2	0.2-0.5	Coarse	--	--	--	--
BH3	0.4-0.5	Coarse	700	1000	2500	10000
BH4	0-0.1	Coarse	700	1000	2500	10000
BH4	0.5-0.6	Coarse	700	1000	2500	10000
BH4	0.1-0.3	Coarse	--	--	--	--
BH5	0-0.1	Coarse	700	1000	2500	10000
BH5	1.7-1.8	Coarse	700	1000	2500	10000
BH5	0-0.3	Coarse	--	--	--	--
BH6	0-0.1	Coarse	700	1000	2500	10000
BH6 (Lab Replicate)	0-0.1	Coarse	700	1000	2500	10000
BH7	0-0.1	Coarse	700	1000	2500	10000
BH7	0.2-0.3	Coarse	700	1000	2500	10000
BH8	0-0.1	Coarse	700	1000	2500	10000
BH8	0.6-0.7	Coarse	700	1000	2500	10000
BH8	1.6-1.8	Coarse	700	1000	2500	10000
BH9	0-0.1	Coarse	700	1000	2500	10000
BH10	0-0.1	Coarse	700	1000	2500	10000
SDUP2	-	Coarse	700	1000	2500	10000
SDUP6	-	Coarse	700	1000	2500	10000

TABLE S4
SOIL LABORATORY RESULTS COMPARED T0 DIRECT CONTACT CRITERIA
All data in mg/kg unless stated otherwise

Analyte		C_6-C_{10}	>C_{10}-C_{16}	>C_{16}-C_{34}	>C_{34}-C_{40}	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	PID
PQL - Envirolab Services		25	50	100	100	0.2	0.5	1	1	1	
CRC 2011 -Direct contact Criteria		4,400	3,300	4,500	6,300	100	14,000	4,500	12,000	1,400	
Site Use		RESIDENTIAL WITH ACCESSIBLE SOIL- DIRECT SOIL CONTACT									
Sample Reference	**Sample Depth**										
BH1	0.05-0.15	<25	<50	**350**	**360**	<0.2	<0.5	<1	<3	<1	**0.4**
BH1	0.05-0.15	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
BH2	0.1-0.2	<25	<50	**190**	**350**	<0.2	<0.5	<1	<3	<1	**0.3**
BH2	0.75-0.95	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.6**
BH2	4.8-4.95	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**1.9**
BH2	0.2-0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
BH3	0.4-0.5	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**1.1**
BH4	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.5**
BH4	0.5-0.6	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**2.2**
BH4	0.1-0.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
BH5	0-0.1	<25	<50	**160**	<100	<0.2	<0.5	<1	<3	<1	**3.4**
BH5	1.7-1.8	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**7.7**
BH5	0-0.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
BH6	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH6 (Lab Replicate)	0-0.1	<25	<50	**100**	<100	<0.2	<0.5	<1	<3	<1	0
BH7	0-0.1	<25	**51**	**110**	<100	<0.2	<0.5	<1	<3	<1	**1.1**
BH7	0.2-0.3	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**6.2**
BH8	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.9**
BH8	0.6-0.7	<25	<50	**340**	**100**	<0.2	<0.5	<1	<3	<1	0
BH8	1.6-1.8	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH9	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH10	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.1**
SDUP2	-	<25	<50	**230**	**400**	<0.2	<0.5	<1	<3	<1	NA
SDUP6	-	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	NA
Total Number of Samples		20	20	20	20	20	20	20	20	20	18
Maximum Value		<PQL	51	350	400	<PQL	<PQL	<PQL	<PQL	<PQL	7.7

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**

TABLE S5
ASBESTOS QUANTIFICATION - FIELD OBSERVATIONS AND LABORATORY RESULTS
HSL-A: Residential with garden/accessible soils; children's day care centers; preschools; and primary schools

HSL-A: Residential with garden/accessible soils; children's day care centers; preschools; and primary schools

FIELD DATA															LABORATORY DATA										
Date Sampled	Sample reference	Sample Depth	Visible ACM in top 100mm	Approx. Volume of Soil (L)	Soil Mass (g)	Mass ACM (g)	Mass Asbestos in ACM (g)	[Asbestos from ACM in soil] (%w/w)	Mass ACM <7mm (g)	Mass Asbestos in ACM <7mm (g)	[Asbestos from ACM <7mm in soil] (%w/w)	Mass FA (g)	Mass Asbestos in FA (g)	[Asbestos from FA in soil] (%w/w)	Lab Report Number	Sample refeference	Sample Depth	Sample Mass (g)	Asbestos ID in soil (AS4964) >0.1g/kg	Trace Analysis	Total Asbestos (g/kg)	Asbestos ID in soil <0.1g/kg	ACM >7mm Estimation (g)	FA and AF Estimation (g)	ACM >7mm Estimation %(w/w)	FA and AF Estimation %(w/w)
SAC			**No**					**0.01**			**0.001**			**0.001**											**0.01**	**0.001**
28/01/2020	BH1	0.05-0.15	No	-	9,700	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	235671	BH1	0.05-0.15	961.42	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
28/01/2020	BH2	0.2-0.5	No	-	11,400	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	235671	BH2	0.2-0.5	766.54	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
28/01/2020	BH4	0.1-0.3	No	-	9,700	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	235671	BH4	0.1-0.3	988.25	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
28/01/2020	BH5	0-0.3	No	-	7,650	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	235671	BH5	0-0.3	773.5	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
3/02/2020	BH8	0-0.1	No	-	10,100	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	236009	BH8	0-0.1	597.78	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
3/02/2020	BH9	0-0.1	No	-	9,200	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	236009	BH9	0-0.1	631.41	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected: Synthetic mineral fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
3/02/2020	BH7	0-0.1	NA	-	NA	NA	--	--	NA	--	--	NA	--	--	236009	BH7	0-0.1	15	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	–	–	–	–	–	–

Concentration above the SAC **VALUE**

JKEnvironments

TABLE S6
SOIL LABORATORY RESULTS COMPARED TO NEPM 2013 EILs AND ESLs
All data in mg/kg unless stated otherwise

Land Use Category				URBAN RESIDENTIAL AND PUBLIC OPEN SPACE																	
							AGED HEAVY METALS-EILs						EILs		ESLs							
				pH	CEC (cmolc/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	$>C_{10}$-C_{16} (F2) plus napthalene	$>C_{16}$-C_{34} (F3)	$>C_{34}$-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
PQL - Envirolab Services				-	1	-	4	1	1	1	1	1	1	0.1	25	50	100	100	0.2	0.5	1	1	0.05
Ambient Background Concentration (ABC)				-	-	-	NSL	13	28	163	5	122	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL
Sample Reference	**Sample Depth**	**Sample Description**	**Soil Texture**																				
BH1	0.05-0.15	F: Gravelly silty sand	Coarse	NA	NA	NA	<4	**12**	**54**	**17**	**8**	**39**	<1	<0.1	<25	<50	**350**	**360**	<0.2	<0.5	<1	<3	**0.8**
BH1	0.05-0.15	F: Gravelly silty sand	Coarse	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH2	0.1-0.2	F: Silty sand	Coarse	NA	NA	NA	**9**	**84**	**51**	**250**	**15**	**91**	<1	<0.1	<25	<50	**190**	**350**	<0.2	<0.5	<1	<3	**0.2**
BH2	0.75-0.95	F: Silty sand	Coarse	**10.2**	**45**	**9**	**12**	**9**	**25**	**810**	**3**	**330**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.1**
BH2	4.8-4.95	Silty sand	Coarse	NA	NA	NA	<4	**8**	<1	**6**	<1	**6**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH2	0.2-0.5	F: Silty sand	Coarse	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH3	0.4-0.5	F: Silty sand	Coarse	NA	NA	NA	**34**	**8**	**9**	**69**	**5**	**39**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH4	0-0.1	F: Silty sand	Coarse	NA	NA	NA	<4	**5**	**10**	**45**	**1**	**42**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.4**
BH4	0.5-0.6	F: Silty sand	Coarse	NA	NA	NA	<4	**7**	**3**	**16**	**1**	**13**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH4	0.1-0.3	F: Silty sand	Coarse	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH5	0-0.1	F: Silty sand	Coarse	NA	NA	NA	<4	**6**	**14**	**49**	**2**	**55**	<1	<0.1	<25	<50	**160**	<100	<0.2	<0.5	<1	<3	**1.2**
BH5	1.7-1.8	Sanstone	Coarse	NA	NA	NA	<4	**17**	**2**	**19**	**1**	**31**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH5	0-0.3	F: Silty sand	Coarse	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH6	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**6**	**8**	**23**	**81**	**3**	**61**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.66**
BH6 (Lab Replicate)	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**7**	**12**	**21**	**83**	**3**	**59**	<1	<0.1	<25	<50	**100**	<100	<0.2	<0.5	<1	<3	**0.4**
BH7	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**6**	**6**	**20**	**86**	**3**	**53**	<1	<0.1	<25	**51**	**110**	<100	<0.2	<0.5	<1	<3	**1.2**
BH7	0.2-0.3	Silty sand	Coarse	NA	NA	NA	<4	**3**	**6**	**32**	<1	**15**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.1**
BH8	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**9**	**11**	**36**	**160**	**4**	**130**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.2**
BH8	0.6-0.7	F: Silty sand	Coarse	NA	NA	NA	**6**	**10**	**80**	**160**	**7**	**190**	<1	NA	<25	<50	**340**	**100**	<0.2	<0.5	<1	<3	**4.7**
BH8	1.6-1.8	Clayey Sand	Coarse	NA	NA	NA	**5**	**15**	**10**	**29**	**1**	**20**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.2**
BH9	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**33**	**13**	**43**	**190**	**4**	**150**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.63**
BH10	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**24**	**9**	**34**	**200**	**4**	**160**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
SDUP2	-	Field Duplicate	Coarse	NA	NA	NA	**6**	**62**	**51**	**170**	**12**	**130**	<1	NA	<25	<50	**230**	**400**	<0.2	<0.5	<1	<3	<0.05
SDUP6	-	Field Duplicate	Coarse	NA	NA	NA	**32**	**10**	**43**	**160**	**3**	**140**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.62**
Total Number of Samples				1	1	1	20	20	20	20	20	20	20	10	20	20	20	20	20	20	20	20	20
Maximum Value				10.2	45	9	34	84	80	810	15	330	<PQL	<PQL	<PQL	51	350	400	<PQL	<PQL	<PQL	<PQL	4.7

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**
The guideline corresponding to the elevated value is highlighted in grey in the EIL and ESL Assessment Criteria Table below

EIL AND ESL ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Sample Description**	**Soil Texture**	pH	CEC (cmolc/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	$>C_{10}$-C_{16} (F2) plus napthalene	$>C_{16}$-C_{34} (F3)	$>C_{34}$-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
BH1	0.05-0.15	F: Gravelly silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH1	0.05-0.15	F: Gravelly silty sand	Coarse	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BH2	0.1-0.2	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH2	0.75-0.95	F: Silty sand	Coarse	10.2	45	9	100	410	260	1300	560	1400	170	--	180	120	300	2800	50	85	70	105	20
BH2	4.8-4.95	Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH2	0.2-0.5	F: Silty sand	Coarse	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BH3	0.4-0.5	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH4	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH4	0.5-0.6	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH4	0.1-0.3	F: Silty sand	Coarse	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BH5	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH5	1.7-1.8	Sanstone	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH5	0-0.3	F: Silty sand	Coarse	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BH6	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH6 (Lab Replicate)	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH7	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH7	0.2-0.3	Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH8	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH8	0.6-0.7	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH8	1.6-1.8	Clayey Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH9	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH10	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
SDUP2	-	Field Duplicate	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
SDUP6	-	Field Duplicate	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20

TABLE S7
SOIL LABORATORY RESULTS COMPARED TO WASTE CLASSIFICATION GUIDELINES
All data in mg/kg unless stated otherwise

			HEAVY METALS								PAHs		OC/OP PESTICIDES				Total PCBs	TRH					BTEX COMPOUNDS				ASBESTOS FIBRES
			Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	B(a)P	Total Endosulfans	Chloropyrifos	Total Moderately Harmful	Total Scheduled		C_6-C_9	C_{10}-C_{14}	C_{15}-C_{28}	C_{29}-C_{36}	Total C_{10}-C_{36}	Benzene	Toluene	Ethyl benzene	Total Xylenes	
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.05	0.1	0.1	0.1	0.1	0.1	25	50	100	100	50	0.2	0.5	1	1	100
General Solid Waste CT1			100	20	100	NSL	100	4	40	NSL	200	0.8	60	4	250	50	50	650		NSL		10,000	10	288	600	1,000	-
General Solid Waste SCC1			500	100	1900	NSL	1500	50	1050	NSL	200	10	108	7.5	250	50	50	650		NSL		10,000	18	518	1,080	1,800	-
Restricted Solid Waste CT2			400	80	400	NSL	400	16	160	NSL	800	3.2	240	16	1000	50	50	2600		NSL		40,000	40	1,152	2,400	4,000	-
Restricted Solid Waste SCC2			2000	400	7600	NSL	6000	200	4200	NSL	800	23	432	30	1000	50	50	2600		NSL		40,000	72	2,073	4,320	7,200	-
Sample Reference	**Sample Depth**	**Sample Description**																									
BH1	0.05-0.15	F: Gravelly silty sand	<4	<0.4	**12**	**54**	**17**	<0.1	**8**	**39**	**11**	**0.8**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	**170**	**280**	**450**	<0.2	<0.5	<1	<3	NA
BH1	0.05-0.15	F: Gravelly silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH2	0.1-0.2	F: Silty sand	**9**	<0.4	**84**	**51**	**250**	**0.2**	**15**	**91**	**1.2**	**0.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	**200**	**200**	<0.2	<0.5	<1	<3	NA
BH2	0.75-0.95	F: Silty sand	**12**	<0.4	**9**	**25**	**810**	**2.4**	**3**	**330**	**0.72**	**0.1**	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH2	4.8-4.95	Silty sand	<4	<0.4	**8**	<1	**6**	<0.1	<1	**6**	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH2	0.2-0.5	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH3	0.4-0.5	F: Silty sand	**34**	<0.4	**8**	**9**	**69**	**0.2**	**5**	**39**	**0.5**	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH4	0-0.1	F: Silty sand	<4	<0.4	**5**	**10**	**45**	<0.1	**1**	**42**	**3.9**	**0.4**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH4	0.5-0.6	F: Silty sand	<4	<0.4	**7**	**3**	**16**	<0.1	**1**	**13**	**0.1**	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH4	0.1-0.3	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH5	0-0.1	F: Silty sand	<4	<0.4	**6**	**14**	**49**	<0.1	**2**	**55**	**15**	**1.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH5	1.7-1.8	Sanstone	<4	<0.4	**17**	**2**	**19**	<0.1	**1**	**31**	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH5	0-0.3	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH6	0-0.1	F: Silty sand	**6**	<0.4	**8**	**23**	**81**	<0.1	**3**	**61**	**5.4**	**0.66**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH6 (Lab Replicate)	0-0.1	F: Silty sand	**7**	<0.4	**12**	**21**	**83**	**0.1**	**3**	**59**	**3.5**	**0.4**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH7	0-0.1	F: Silty sand	**6**	<0.4	**6**	**20**	**86**	<0.1	**3**	**53**	**9.6**	**1.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	**52**	<100	<100	**52**	<0.2	<0.5	<1	<3	NA
BH7	0.2-0.3	Silty sand	<4	<0.4	**3**	**6**	**32**	<0.1	<1	**15**	**0.6**	**0.1**	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH8	0-0.1	F: Silty sand	**9**	**0.4**	**11**	**36**	**160**	**0.1**	**4**	**130**	**1.3**	**0.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	Not Detected
BH8	0.6-0.7	F: Silty sand	**6**	<0.4	**10**	**80**	**160**	**0.1**	**7**	**190**	**40**	**4.7**	NA	NA	NA	NA	NA	<25	<50	**190**	**190**	**380**	<0.2	<0.5	<1	<3	NA
BH8	1.6-1.8	Clayey Sand	**5**	<0.4	**15**	**10**	**29**	<0.1	**1**	**20**	**1.3**	**0.2**	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH9	0-0.1	F: Silty sand	**33**	**0.4**	**13**	**43**	**190**	**0.1**	**4**	**150**	**6.1**	**0.63**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	Not Detected
BH10	0-0.1	F: Silty sand	**24**	<0.4	**9**	**34**	**200**	**0.1**	**4**	**160**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
SDUP2	-	Field Duplicate	**6**	<0.4	**62**	**51**	**170**	**0.1**	**12**	**130**	**0.73**	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	**220**	**220**	<0.2	<0.5	<1	<3	NA
SDUP6	-	Field Duplicate	**32**	<0.4	**10**	**43**	**160**	**0.1**	**3**	**140**	**5.7**	**0.62**	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
Total Number of Samples			20	20	20	20	20	20	20	20	20	20	10	10	10	10	10	20	20	20	20	20	20	20	20	20	6
Maximum Value			34	0.4	84	80	810	2.4	15	330	40	4.7	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	52	190	280	450	<PQL	<PQL	<PQL	<PQL	Not Detected
Statistical Analysis on Fill Samples																											
Number of Fill Samples			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Mean Value			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Standard Deviation			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
% UCL			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
UCL Value			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Concentration above the CT1 — **VALUE**
Concentration above SCC1 — **VALUE**
Concentration above the SCC2 — **VALUE**
Concentration above PQL — **Bold**

TABLE S8

SOIL LABORATORY TCLP RESULTS

All data in mg/L unless stated otherwise

			Lead	B(a)P
PQL - Envirolab Services			0.03	0.001
TCLP1 - General Solid Waste			5	0.04
TCLP2 - Restricted Solid Waste			20	0.16
TCLP3 - Hazardous Waste			>20	>0.16
Sample Reference	**Sample Depth**	**Sample Description**		
BH2	0.1-0.2	F: Silty sand	**0.3**	NA
BH2	0.75-0.95	F: Silty sand	**1.2**	NA
BH5	0-0.1	F: Silty sand	NA	<0.001
BH7	0-0.1	F: Silty sand	NA	<0.001
BH8	0-0.1	F: Silty sand	<0.03	NA
BH8	0.6-0.7	F: Silty sand	**0.07**	<0.001
BH9	0-0.1	F: Silty sand	**0.06**	NA
BH10	0-0.1	F: Silty sand	**0.1**	NA
Total Number of samples			6	3
Maximum Value			1.20	<PQL

General Solid Waste	**VALUE**
Restricted Solid Waste	**VALUE**
Hazardous Waste	**VALUE**
Concentration above PQL	**Bold**

TABLE S9
SOIL QA/QC SUMMARY

			TRH C6 - C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Benzene	Toluene	Ethylbenzene	m+p-xylene	o-Xylene
PQL Envirolab SYD			*25*	*50*	*100*	*100*	*0.2*	*0.5*	*1*	*2*	*1*
PQL Envirolab VIC			*25*	*50*	*100*	*100*	*0.2*	*0.5*	*1.0*	*2.0*	*1.0*
Intra	BH2	0.1-0.2	<25	<50	190	350	<0.2	<0.5	<1	<2	<1
laboratory	SDUP2		<25	<50	230	400	<0.2	<0.5	<1	<2	<1
duplicate	MEAN		nc	nc	210	375	nc	nc	nc	nc	nc
	RPD %		nc	nc	19%	13%	nc	nc	nc	nc	nc
Intra	BH9	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1
laboratory	SDUP6		<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc
Field	STB1		NA	NA	NA	NA	<0.2	<0.5	<1	<2	<1
Blank	3/02/20										
Trip	STS1		-	-	-	-	103%	102%	108%	101%	113%
Spike	3/02/20										
Field	SFR1	µg/L	NA	NA	NA	NA	<1	<1	<1	<2	<1
Rinsate	3/02/20										

			Naphthalene	Acenaphthylene	Acenaph-thene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthra-cene	Benzo(g,h,i)perylene
PQL Envirolab SYD			*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.05*	*0.1*	*0.1*	*0.1*
PQL Envirolab VIC			*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*
Intra	BH2	0.1-0.2	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.2	0.3	<0.1	<0.1	0.2	0.2	<0.1	<0.1	0.1
laboratory	SDUP2		<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.2	0.2	0.1	0.2	<0.2	<0.05	<0.1	<0.1	<0.1
duplicate	MEAN		nc	nc	nc	nc	0.1	nc	0.2	0.25	0.075	0.125	0.15	0.1125	nc	nc	0.075
	RPD %		nc	nc	nc	nc	0%	nc	0%	40%	67%	120%	67%	156%	nc	nc	67%
Intra	BH9	0-0.1	<0.1	<0.1	<0.1	<0.1	0.4	<0.1	1	1	0.6	0.7	1	0.63	0.4	0.1	0.4
laboratory	SDUP6		<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.8	0.9	0.6	0.7	1	0.62	0.3	0.1	0.4
duplicate	MEAN		nc	nc	nc	nc	0.3	nc	0.9	0.95	0.6	0.7	1	0.625	0.35	0.1	0.4
	RPD %		nc	nc	nc	nc	67%	nc	22%	11%	0%	0%	0%	2%	29%	0%	0%
Field	STB1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Blank	3/02/20																
Trip	STS1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spike	3/02/20																
Field	SFR1	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rinsate	3/02/20																

			HCB	alpha- BHC	gamma- BHC	beta- BHC	Heptachlor	delta- BHC	Aldrin	Heptachlor Epoxide	Gamma- Chlordane	alpha- chlordane	Endosulfan I	pp- DDE	Dieldrin	Endrin	pp- DDD	Endosulfan II	pp- DDT	Endrin Aldehyde	Endosulfan Sulphate	Methoxychlor
PQL Envirolab SYD			*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
PQL Envirolab VIC			*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Intra	BH2	0.1-0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
laboratory	SDUP2		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Intra	BH9	0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
laboratory	SDUP6		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Field	STB1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Blank	3/02/20																					
Trip	STS1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spike	3/02/20																					
Field	SFR1	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rinsate	3/02/20																					

			Azinphos-methyl (Guthion)	Bromophos-ethyl	Chlorpyriphos	Chlorpyriphos-methyl	Diazinon	Dichlorvos	Dimethoate	Ethion	Fenitrothion	Malathion	Parathion	Ronnel	Total PCBS	Arsenic	Cadmium	Chromium VI	Copper	Lead	Mercury	Nickel	Zinc
PQL Envirolab SYD			*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*4*	*0.4*	*1*	*1*	*1*	*0.1*	*1*	*1*
PQL Envirolab VIC			*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*4.0*	*0.4*	*1.0*	*1.0*	*1.0*	*0.1*	*1.0*	*1.0*
Intra	BH2	0.1-0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	9	<0.4	84	51	250	0.2	15	91
laboratory	SDUP2		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	<0.4	62	51	170	0.1	12	130
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	7.5	nc	73	51	210	0.15	13.5	110.5
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	40%	nc	30%	0%	38%	67%	22%	35%
Intra	BH9	0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	33	0.4	13	43	190	0.1	4	150
laboratory	SDUP6		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	32	<0.4	10	43	160	0.1	3	140
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	32.5	0.3	11.5	43	175	0.1	3.5	145
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	3%	67%	26%	0%	17%	0%	29%	7%
Field	STB1		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Blank	3/02/20																						
Trip	STS1		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spike	3/02/20																						
Field	SFR1	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rinsate	3/02/20																						

Result outside of QA/QC acceptance criteria

TABLE G1
SUMMARY OF GROUNDWATER LABORATORY RESULTS COMPARED TO ECOLOGICAL GILs SAC
All results in µg/L unless stated otherwise.

	PQL Envirolab Services	ANZG 2018 Marine Waters	SAMPLES MW2	MW2 (Lab Replicate)	WDUP1
Inorganic Compounds and Parameters					
pH		7 - 8.5	6.1	NA	NA
Electrical Conductivity (µS/cm)	1	NSL	**450**	NA	NA
Turbidity (NTU)		NSL	NA	NA	NA
Metals and Metalloids					
Arsenic (As III)	1	2.3	<1	<1	<1
Cadmium	0.1	0.7	<0.1	<0.1	<0.1
Chromium (SAC for Cr III adopted)	1	27	**6**	**6**	**6**
Copper	1	1.3	<1	<1	**1**
Lead	1	4.4	**1**	**1**	**1**
Total Mercury (inorganic)	0.05	0.1	<0.05	<0.05	<0.05
Nickel	1	7	**3**	**3**	**3**
Zinc	1	15	**19**	**20**	**21**
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)					
Benzene	1	500	<1	<1	<1
Toluene	1	180	<1	<1	<1
Ethylbenzene	1	5	<1	<1	<1
m+p-xylene	2	75	<2	<2	<2
o-xylene	1	350	<1	<1	<1
Total xylenes	2	NSL	<2	<2	<2
Volatile Organic Compounds (VOCs), including chlorinated VOCs					
Dichlorodifluoromethane	10	NSL	<10	<10	NA
Chloromethane	10	NSL	<10	<10	NA
Vinyl Chloride	10	100	<10	<10	NA
Bromomethane	10	NSL	<10	<10	NA
Chloroethane	10	NSL	<10	<10	NA
Trichlorofluoromethane	10	NSL	<10	<10	NA
1,1-Dichloroethene	1	700	<1	<1	NA
Trans-1,2-dichloroethene	1	NSL	<1	<1	NA
1,1-dichloroethane	1	250	<1	<1	NA
Cis-1,2-dichloroethene	1	NSL	<1	<1	NA
Bromochloromethane	1	NSL	<1	<1	NA
Chloroform	1	370	<1	<1	NA
2,2-dichloropropane	1	NSL	<1	<1	NA
1,2-dichloroethane	1	1900	<1	<1	NA
1,1,1-trichloroethane	1	270	<1	<1	NA
1,1-dichloropropene	1	NSL	<1	<1	NA
Cyclohexane	1	NSL	<1	<1	NA
Carbon tetrachloride	1	240	<1	<1	NA
Benzene	1	500	<1	<1	NA
Dibromomethane	1	NSL	<1	<1	NA
1,2-dichloropropane	1	900	<1	<1	NA
Trichloroethene	1	330	<1	<1	NA
Bromodichloromethane	1	NSL	<1	<1	NA
trans-1,3-dichloropropene	1	NSL	<1	<1	NA
cis-1,3-dichloropropene	1	NSL	<1	<1	NA
1,1,2-trichloroethane	1	1900	<1	<1	NA
Toluene	1	180	<1	<1	NA
1,3-dichloropropane	1	1100	<1	<1	NA
Dibromochloromethane	1	NSL	<1	<1	NA
1,2-dibromoethane	1	NSL	<1	<1	NA
Tetrachloroethene	1	70	<1	<1	NA
1,1,1,2-tetrachloroethane	1	NSL	<1	<1	NA
Chlorobenzene	1	55	<1	<1	NA
Ethylbenzene	1	5	<1	<1	NA
Bromoform	1	NSL	<1	<1	NA
m+p-xylene	2	75	<2	<2	NA
Styrene	1	NSL	<1	<1	NA
1,1,2,2-tetrachloroethane	1	400	<1	<1	NA
o-xylene	1	350	<1	<1	NA
1,2,3-trichloropropane	1	NSL	<1	<1	NA
Isopropylbenzene	1	30	<1	<1	NA
Bromobenzene	1	NSL	<1	<1	NA
n-propyl benzene	1	NSL	<1	<1	NA
2-chlorotoluene	1	NSL	<1	<1	NA
4-chlorotoluene	1	NSL	<1	<1	NA
1,3,5-trimethyl benzene	1	NSL	<1	<1	NA
Tert-butyl benzene	1	NSL	<1	<1	NA
1,2,4-trimethyl benzene	1	NSL	<1	<1	NA
1,3-dichlorobenzene	1	260	<1	<1	NA
Sec-butyl benzene	1	NSL	<1	<1	NA
1,4-dichlorobenzene	1	60	<1	<1	NA
4-isopropyl toluene	1	NSL	<1	<1	NA
1,2-dichlorobenzene	1	160	<1	<1	NA
n-butyl benzene	1	NSL	<1	<1	NA
1,2-dibromo-3-chloropropane	1	NSL	<1	<1	NA
1,2,4-trichlorobenzene	1	20	<1	<1	NA
Hexachlorobutadiene	1	NSL	<1	<1	NA
1,2,3-trichlorobenzene	1	3	<1	<1	NA
Polycyclic Aromatic Hydrocarbons (PAHs)					
Naphthalene	0.2	50	<0.2	<0.2	<0.2
Acenaphthylene	0.1	NSL	<0.1	<0.1	**0.3**
Acenaphthene	0.1	NSL	<0.1	<0.1	**0.2**
Fluorene	0.1	NSL	<0.1	<0.1	**0.3**
Phenanthrene	0.1	0.6	**0.8**	**0.8**	**2.9**
Anthracene	0.1	0.01	**0.2**	**0.3**	**0.8**
Fluoranthene	0.1	1	**0.9**	**0.9**	**3.3**
Pyrene	0.1	NSL	**0.9**	**0.9**	**3.4**
Benzo(a)anthracene	0.1	NSL	**0.5**	**0.5**	**1.9**
Chrysene	0.1	NSL	**0.5**	**0.5**	**1.6**
Benzo(b,j+k)fluoranthene	0.2	NSL	**0.6**	**0.6**	**2**
Benzo(a)pyrene	0.1	0.1	**0.4**	**0.5**	**1.6**
Indeno(1,2,3-c,d)pyrene	0.1	NSL	**0.2**	**0.2**	**0.6**
Dibenzo(a,h)anthracene	0.1	NSL	<0.1	<0.1	**0.2**
Benzo(g,h,i)perylene	0.1	NSL	**0.2**	**0.2**	**0.6**

Concentration above the SAC	**VALUE**
Concentration above the PQL	**Bold**
GIL >PQL	Red

TABLE G2
SUMMARY OF GROUNDWATER LABORATORY RESULTS COMPARED TO HUMAN CONTACT GILs
All results in µg/L unless stated otherwise.

	PQL Envirolab Services	Recreational (10 x NHMRC ADWG)	SAMPLES MW2	MW2 (Lab Replicate)	WDUP1
Inorganic Compounds and Parameters					
pH		6.5 - 8.5	6.1	NA	NA
Electrical Conductivity (µS/cm)	1	NSL	**450**	NA	NA
Turbidity (NTU)		NSL	NA	NA	NA
Metals and Metalloids					
Arsenic (As III)	1	100	<1	<1	<1
Cadmium	0.1	20	<0.1	<0.1	<0.1
Chromium (total)	1	500	**6**	**6**	**6**
Copper	1	20000	<1	<1	**1**
Lead	1	100	**1**	**1**	**1**
Total Mercury (inorganic)	0.05	10	<0.05	<0.05	<0.05
Nickel	1	200	**3**	**3**	**3**
Zinc	1	30000	**19**	**20**	**21**
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)					
Benzene	1	10	<1	<1	<1
Toluene	1	8000	<1	<1	<1
Ethylbenzene	1	3000	<1	<1	<1
m+p-xylene	2	NSL	<2	<2	<2
o-xylene	1	NSL	<1	<1	<1
Total xylenes	2	6000	<2	<2	<2
Volatile Organic Compounds (VOCs), including chlorinated VOCs					
Dichlorodifluoromethane	10	NSL	<10	<10	NA
Chloromethane	10	NSL	<10	<10	NA
Vinyl Chloride	10	3	<10	<10	NA
Bromomethane	10	NSL	<10	<10	NA
Chloroethane	10	NSL	<10	<10	NA
Trichlorofluoromethane	10	NSL	<10	<10	NA
1,1-Dichloroethene	1	300	<1	<1	NA
Trans-1,2-dichloroethene	1	600	<1	<1	NA
1,1-dichloroethane	1	NSL	<1	<1	NA
Cis-1,2-dichloroethene	1	600	<1	<1	NA
Bromochloromethane	1	2500	<1	<1	NA
Chloroform	1		<1	<1	NA
2,2-dichloropropane	1	NSL	<1	<1	NA
1,2-dichloroethane	1	30	<1	<1	NA
1,1,1-trichloroethane	1	NSL	<1	<1	NA
1,1-dichloropropene	1	NSL	<1	<1	NA
Cyclohexane	1	NSL	<1	<1	NA
Carbon tetrachloride	1	30	<1	<1	NA
Benzene	1	10	<1	<1	NA
Dibromomethane	1	NSL	<1	<1	NA
1,2-dichloropropane	1	NSL	<1	<1	NA
Trichloroethene	1	NSL	<1	<1	NA
Bromodichloromethane	1	NSL	<1	<1	NA
trans-1,3-dichloropropene	1	1000	<1	<1	NA
cis-1,3-dichloropropene	1	1000	<1	<1	NA
1,1,2-trichloroethane	1	NSL	<1	<1	NA
Toluene	1	8000	<1	<1	NA
1,3-dichloropropane	1	NSL	<1	<1	NA
Dibromochloromethane	1	NSL	<1	<1	NA
1,2-dibromoethane	1	NSL	<1	<1	NA
Tetrachloroethene	1	500	<1	<1	NA
1,1,1,2-tetrachloroethane	1	NSL	<1	<1	NA
Chlorobenzene	1	3000	<1	<1	NA
Ethylbenzene	1	3000	<1	<1	NA
Bromoform	1	NSL	<1	<1	NA
m+p-xylene	2	NSL	<2	<2	NA
Styrene	1	300	<1	<1	NA
1,1,2,2-tetrachloroethane	1	NSL	<1	<1	NA
o-xylene	1	NSL	<1	<1	NA
1,2,3-trichloropropane	1	NSL	<1	<1	NA
Isopropylbenzene	1	NSL	<1	<1	NA
Bromobenzene	1	NSL	<1	<1	NA
n-propyl benzene	1	NSL	<1	<1	NA
2-chlorotoluene	1	NSL	<1	<1	NA
4-chlorotoluene	1	NSL	<1	<1	NA
1,3,5-trimethyl benzene	1	NSL	<1	<1	NA
Tert-butyl benzene	1	NSL	<1	<1	NA
1,2,4-trimethyl benzene	1	NSL	<1	<1	NA
1,3-dichlorobenzene	1	200	<1	<1	NA
Sec-butyl benzene	1	NSL	<1	<1	NA
1,4-dichlorobenzene	1	400	<1	<1	NA
4-isopropyl toluene	1	NSL	<1	<1	NA
1,2-dichlorobenzene	1	15000	<1	<1	NA
n-butyl benzene	1	NSL	<1	<1	NA
1,2-dibromo-3-chloropropane	1	NSL	<1	<1	NA
1,2,4-trichlorobenzene	1	300	<1	<1	NA
1,2,3-trichlorobenzene	1		<1	<1	NA
Hexachlorobutadiene	1	7	<1	<1	NA
Polycyclic Aromatic Hydrocarbons (PAHs)					
Naphthalene	0.2	NSL	<0.2	<0.2	<0.2
Acenaphthylene	0.1	NSL	<0.1	<0.1	**0.3**
Acenaphthene	0.1	NSL	<0.1	<0.1	**0.2**
Fluorene	0.1	NSL	<0.1	<0.1	**0.3**
Phenanthrene	0.1	NSL	**0.8**	**0.8**	**2.9**
Anthracene	0.1	NSL	**0.2**	**0.3**	**0.8**
Fluoranthene	0.1	NSL	**0.9**	**0.9**	**3.3**
Pyrene	0.1	NSL	**0.9**	**0.9**	**3.4**
Benzo(a)anthracene	0.1	NSL	**0.5**	**0.5**	**1.9**
Chrysene	0.1	NSL	**0.5**	**0.5**	**1.6**
Benzo(b,j+k)fluoranthene	0.2	NSL	**0.6**	**0.6**	**2**
Benzo(a)pyrene	0.1	0.1	**0.4**	**0.5**	**1.6**
Indeno(1,2,3-c,d)pyrene	0.1	NSL	**0.2**	**0.2**	**0.6**
Dibenzo(a,h)anthracene	0.1	NSL	<0.1	<0.1	**0.2**
Benzo(g,h,i)perylene	0.1	NSL	**0.2**	**0.2**	**0.6**

Concentration above the SAC — **VALUE**
Concentration above the PQL — **Bold**
GIL >PQL — Red

TABLE G3
GROUNDWATER LABORATORY RESULTS COMPARED TO HSLs
All data in µg/L unless stated otherwise

				C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	PID
PQL - Envirolab Services				10	50	1	1	1	2	1	
NEPM 2013 - Land Use Category				**HSL-A/B: LOW/HIGH DENSITY RESIDENTIAL**							
Sample Reference	**Water Depth**	**Depth Category**	**Soil Category**								
MW2	8.02	4m to <8m	Sand	<10	<50	<1	<1	<1	<2	<1	1.2
MW2 (Lab Replicate)	8.02	4m to <8m	Sand	<10	<50	<1	<1	<1	<2	<1	NA
WDUP1	8.02	4m to <8m	Sand	<10	<50	<1	<1	<1	<2	<1	NA
Total Number of Samples				3	3	3	3	3	3	3	1
Maximum Value				<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	1.2

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**
The guideline corresponding to the elevated value is highlighted in grey in the Groundwater Assessment Criteria Table below

HSL GROUNDWATER ASSESSMENT CRITERIA

Sample Reference	**Water Depth**	**Depth Category**	**Soil Category**	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene
MW2	8.02	4m to <8m	Sand	1000	1000	800	NL	NL	NL	NL
MW2 (Lab Replicate)	8.02	4m to <8m	Sand	1000	1000	800	NL	NL	NL	NL
WDUP1	8.02	4m to <8m	Sand	1000	1000	800	NL	NL	NL	NL

TABLE G4
GROUNDWATER INTRA-LABORATORY DUPLICATE RESULTS & RPD CALCULATIONS
All results in µg/L unless stated otherwise

SAMPLE	ANALYSIS	Envirolab PQL	INITIAL	REPEAT	MEAN	RPD %
Sample Ref = MW2	Arsenic	1	<1	<1	NC	NC
Dup Ref = WDUP1	Cadmium	0.1	<0.1	<0.1	NC	NC
	Chromium	1	6	6	6	0
Envirolab Report: 236004	Copper	1	<1	1	1	67
	Lead	1	1	1	1	0
	Mercury	0.05	<0.05	<0.05	NC	NC
	Nickel	1	3	3	3	0
	Zinc	1	19	21	20	10
	Naphthalene	0.2	<0.2	<0.2	NC	NC
	Acenaphthylene	0.1	<0.1	0.3	0	143
	Acenaphthene	0.1	<0.1	0.2	0	120
	Fluorene	0.1	<0.1	0.3	0	143
	Phenanthrene	0.1	0.8	2.9	2	114
	Anthracene	0.1	0.2	0.8	1	120
	Fluoranthene	0.1	0.9	3.3	2	114
	Pyrene	0.1	0.9	3.4	2	116
	Benzo(a)anthracene	0.1	0.5	1.9	1	117
	Chrysene	0.1	0.5	1.6	1	105
	Benzo(b,j+k)fluoranthene	0.2	0.6	2	1	108
	Benzo(a)pyrene	0.1	0.4	1.6	1	120
	Indeno(123-cd)pyrene	0.1	0.2	0.6	0	100
	Dibenzo(ah)anthracene	0.1	<0.1	0.2	0	120
	Benzo(ghi)perylene	0.1	0.2	0.6	0	100
	Total OCPs	0.1	-	-	NC	NC
	Total OPPs	0.1	-	-	NC	NC
	Total PCBs	0.1	-	-	NC	NC
	TRH C6-C10 (F1)	10	<10	<10	NC	NC
	TRH >C10-C16 (F2)	50	<50	<50	NC	NC
	TRH >C16-C34 (F3)	100	110	290	200	90
	TRH >C34-C40 (F4)	100	<100	110	80	75
	Benzene	1	<1	<1	NC	NC
	Toluene	1	<1	<1	NC	NC
	Ethylbenzene	1	<1	<1	NC	NC
	m+p-xylene	2	<2	<2	NC	NC
	o-xylene	1	<1	<1	NC	NC

RPD Results Above the Acceptance Criteria VALUE

Appendix C: Site Information and Site History

Lotsearch Environmental Risk and Planning Report

LOTSEARCH

LOTSEARCH ENVIRO PROFESSIONAL

Date: 09 Jan 2020 15:42:51

Reference: LS010577 EP

Address: Corner New South Head Road, Rose Bay, NSW 2030

Dataset Listing

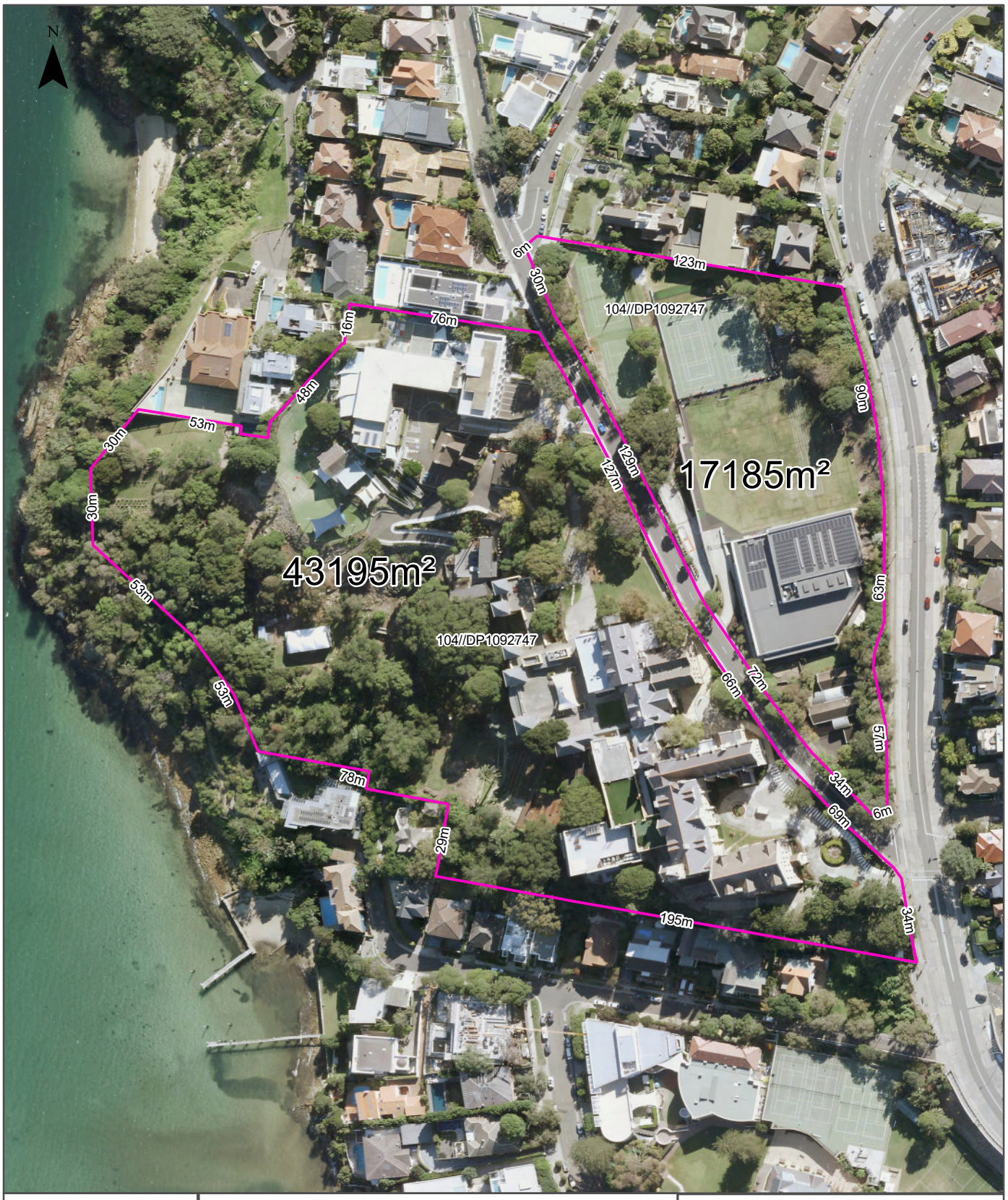
Datasets contained within this report, detailing their source and data currency:

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Cadastre Boundaries	NSW Department of Finance, Services & Innovation	29/10/2019	29/10/2019	Quarterly	-	-	-	-
Topographic Data	NSW Department of Finance, Services & Innovation	25/06/2019	25/06/2019	As required	-	-	-	-
List of NSW contaminated sites notified to EPA	Environment Protection Authority	18/12/2019	16/12/2019	Monthly	1000	0	0	1
Contaminated Land Records of Notice	Environment Protection Authority	16/12/2019	16/12/2019	Monthly	1000	0	0	1
Former Gasworks	Environment Protection Authority	07/01/2020	11/10/2017	Monthly	1000	0	0	0
National Waste Management Facilities Database	Geoscience Australia	05/11/2019	07/03/2017	Quarterly	1000	0	0	0
EPA PFAS Investigation Program	Environment Protection Authority	07/01/2020	07/01/2020	Monthly	2000	0	0	0
Defence PFAS Investigation & Management Program	Department of Defence	18/12/2019	18/12/2019	Monthly	2000	0	0	0
Airservices Australia National PFAS Management Program	Airservices Australia	18/12/2019	18/12/2019	Monthly	2000	0	0	0
Defence 3 Year Regional Contamination Investigation Program	Department of Defence	18/12/2019	18/12/2019	Monthly	2000	0	0	0
EPA Other Sites with Contamination Issues	Environment Protection Authority	13/12/2018	13/12/2018	Annually	1000	0	0	0
Licensed Activities under the POEO Act 1997	Environment Protection Authority	07/01/2020	07/01/2020	Monthly	1000	0	0	0
Delicensed POEO Activities still regulated by the EPA	Environment Protection Authority	07/01/2020	07/01/2020	Monthly	1000	0	0	0
Former POEO Licensed Activities now revoked or surrendered	Environment Protection Authority	07/01/2020	07/01/2020	Monthly	1000	0	3	3
UPSS Environmentally Sensitive Zones	Environment Protection Authority	14/04/2015	12/01/2010	As required	1000	1	1	1
UBD Business Directories 1950 - 1991 (Premise & Intersection Matches)	Hardie Grant			Not required	100	0	14	14
UBD Business Directories 1950 - 1991 (Road & Area Matches)	Hardie Grant			Not required	100	-	10	10
UBD Business Directory Drycleaners & Motor Garages/Service Stations (Premise & Intersection Matches)	Hardie Grant			Not required	250	0	0	0
UBD Business Directory Drycleaners & Motor Garages/Service Stations (Road & Area Matches)	Hardie Grant			Not required	250	-	1	1
Points of Interest	NSW Department of Finance, Services & Innovation	19/09/2019	19/09/2019	Quarterly	1000	3	6	48
Tanks (Areas)	NSW Department of Finance, Services & Innovation	19/09/2019	19/09/2019	Quarterly	1000	0	0	1
Tanks (Points)	NSW Department of Finance, Services & Innovation	19/09/2019	19/09/2019	Quarterly	1000	0	0	1
Major Easements	NSW Department of Finance, Services & Innovation	19/09/2019	19/09/2019	Quarterly	1000	0	2	10
State Forest	NSW Department of Finance, Services & Innovation	18/01/2018	18/01/2018	As required	1000	0	0	0
NSW National Parks and Wildlife Service Reserves	NSW Office of Environment & Heritage	16/01/2019	14/11/2018	Annually	1000	1	1	1
Hydrogeology Map of Australia	Commonwealth of Australia (Geoscience Australia)	08/10/2014	17/03/2000	As required	1000	1	1	1
Botany Groundwater Management Zones	NSW Department of Primary Industries	15/03/2018	01/10/2005	As required	1000	0	0	0
Groundwater Boreholes	NSW Dept. of Primary Industries - Water NSW; Commonwealth of Australia (Bureau of Meteorology)	24/07/2018	23/07/2018	Annually	2000	0	0	137
Geological Units 1:100,000	NSW Dept. of Industry, Resources & Energy	20/08/2014		None planned	1000	1	-	7

Dataset Name	Custodian	Supply Date	Currency Date	Update Frequency	Dataset Buffer (m)	No. Features Onsite	No. Features within 100m	No. Features within Buffer
Geological Structures 1:100,000	NSW Dept. of Industry, Resources & Energy	20/08/2014		None planned	1000	1	-	4
Naturally Occurring Asbestos Potential	NSW Dept. of Industry, Resources & Energy	04/12/2015	24/09/2015	Unknown	1000	0	0	0
Atlas of Australian Soils	ABARES	19/05/2017	17/02/2011	As required	1000	1	1	1
Soil Landscapes	NSW Office of Environment & Heritage	12/08/2014		None planned	1000	2	-	8
Environmental Planning Instrument Acid Sulfate Soils	NSW Department of Planning and Environment	06/12/2019	11/10/2019	Weekly	500	1	-	-
Atlas of Australian Acid Sulfate Soils	CSIRO	19/01/2017	21/02/2013	As required	1000	1	2	3
Dryland Salinity - National Assessment	National Land and Water Resources Audit	18/07/2014	12/05/2013	None planned	1000	0	0	0
Dryland Salinity Potential of Western Sydney	NSW Office of Environment & Heritage	12/05/2017	01/01/2002	None planned	1000	-	-	-
Mining Subsidence Districts	NSW Department of Finance, Services & Innovation	19/09/2019	19/09/2019	Quarterly	1000	0	0	0
Environmental Planning Instrument SEPP State Significant Precincts	NSW Department of Planning and Environment	06/12/2019	07/12/2018	Weekly	1000	0	0	0
Environmental Planning Instrument Land Zoning	NSW Department of Planning and Environment	06/12/2019	29/11/2019	Weekly	1000	1	8	50
Commonwealth Heritage List	Australian Government Department of the Environment and Energy - Heritage Branch	16/01/2019	31/07/2018	Unknown	1000	0	0	0
National Heritage List	Australian Government Department of the Environment and Energy - Heritage Branch	16/01/2019	28/09/2018	Unknown	1000	0	0	0
State Heritage Register - Curtilages	NSW Office of Environment & Heritage	08/11/2019	09/11/2018	Quarterly	1000	0	0	5
Environmental Planning Instrument Heritage	NSW Department of Planning and Environment	06/12/2019	29/11/2019	Weekly	1000	1	4	83
Bush Fire Prone Land	NSW Rural Fire Service	28/08/2019	03/06/2019	Quarterly	1000	0	0	0
Native Vegetation of the Sydney Metropolitan Area	NSW Office of Environment & Heritage	01/03/2017	16/12/2016	As required	1000	2	4	8
Ramsar Wetlands of Australia	Commonwealth of Australia Department of the Environment	08/10/2014	24/06/2011	As required	1000	0	0	0
Groundwater Dependent Ecosystems	Bureau of Meteorology	14/08/2017	15/05/2017	Unknown	1000	0	0	2
Inflow Dependent Ecosystems Likelihood	Bureau of Meteorology	14/08/2017	15/05/2017	Unknown	1000	0	0	1
NSW BioNet Species Sightings	NSW Office of Environment & Heritage	09/01/2020	09/01/2020	Weekly	10000	-	-	-

Site Diagram

Corner New South Head Road, Rose Bay, NSW 2030



Legend

- Site Boundary
- Internal Parcel Boundaries

Total Area: 60380m²

Total Perimeter: 1590m

Scale: 0 25 50 100 Meters

Data Sources: Aerial Imagery: © Aerometrex Pty Ltd

Disclaimers:

Measurements are approximate only and may have been simplified or smaller lengths removed for readability.

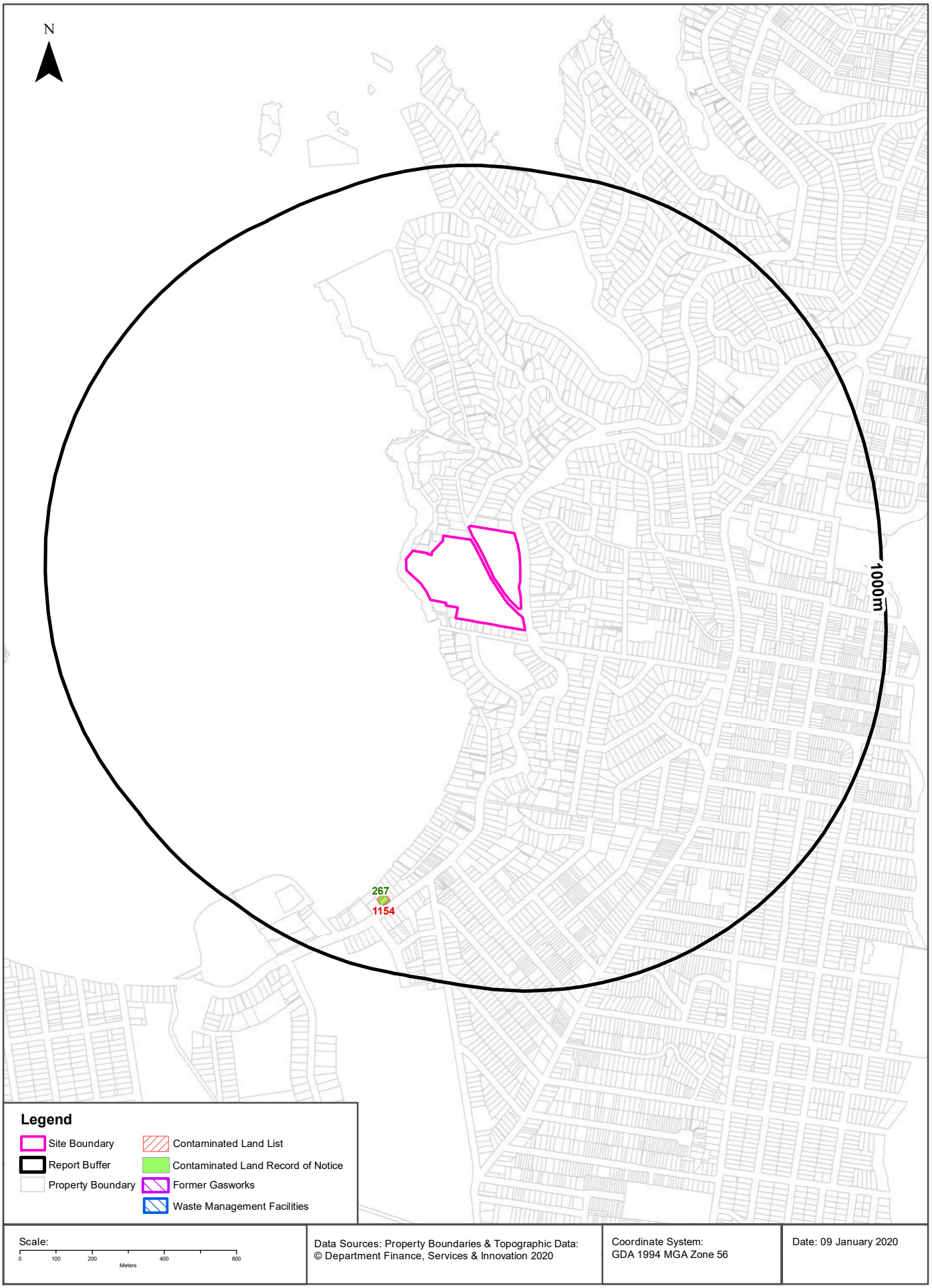
Parcels that make up a small percentage of the total site area have not been labelled for increased legibility.

Coordinate System: GDA 1994 MGA Zone 56

Date: 09 January 2020

Contaminated Land & Waste Management Facilities

Corner New South Head Road, Rose Bay, NSW 2030



Contaminated Land & Waste Management Facilities

Corner New South Head Road, Rose Bay, NSW 2030

List of NSW contaminated sites notified to EPA

Records from the NSW EPA Contaminated Land list within the dataset buffer:

Map Id	Site	Address	Suburb	Activity	Management Class	Status	Location Confidence	Dist (m)	Direction
1154	Rose Bay Budget Service station	638 -646 New South Head Road	Rose Bay	Service Station	Contamination currently regulated under CLM Act	Current EPA List	Premise Match	788m	South

The values within the EPA site management class in the table above, are given more detailed explanations in the table below:

EPA site management class	Explanation
Contamination being managed via the planning process (EP&A Act)	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation. The contamination of this site is managed by the consent authority under the Environmental Planning and Assessment Act 1979 (EP&A Act) planning approval process, with EPA involvement as necessary to ensure significant contamination is adequately addressed. The consent authority is typically a local council or the Department of Planning and Environment.
Contamination currently regulated under CLM Act	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation under the Contaminated Land Management Act 1997 (CLM Act). Management of the contamination is regulated by the EPA under the CLM Act. Regulatory notices are available on the EPA's Contaminated Land Public Record of Notices.
Contamination currently regulated under POEO Act	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation. Management of the contamination is regulated under the Protection of the Environment Operations Act 1997 (POEO Act). The EPA's regulatory actions under the POEO Act are available on the POEO public register.
Contamination formerly regulated under the CLM Act	The EPA has determined that the contamination is no longer significant enough to warrant regulation under the Contaminated Land Management Act 1997 (CLM Act). The contamination was addressed under the CLM Act.
Contamination formerly regulated under the POEO Act	The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed under the Protection of the Environment Operations Act 1997 (POEO Act).
Contamination was addressed via the planning process (EP&A Act)	The EPA has determined that the contamination is no longer significant enough to warrant regulation. The contamination was addressed by the appropriate consent authority via the planning process under the Environmental Planning and Assessment Act 1979 (EP&A Act).
Ongoing maintenance required to manage residual contamination (CLM Act)	The EPA has determined that ongoing maintenance, under the Contaminated Land Management Act 1997 (CLM Act), is required to manage the residual contamination. Regulatory notices under the CLM Act are available on the EPA's Contaminated Land Public Record of Notices.
Regulation being finalised	The EPA has completed an assessment of the contamination and decided that the contamination is significant enough to warrant regulation under the Contaminated Land Management Act 1997. A regulatory approach is being finalised.
Regulation under the CLM Act not required	The EPA has completed an assessment of the contamination and decided that regulation under the Contaminated Land Management Act 1997 is not required.
Under assessment	The contamination is being assessed by the EPA to determine whether regulation is required. The EPA may require further information to complete the assessment. For example, the completion of management actions regulated under the planning process or Protection of the Environment Operations Act 1997. Alternatively, the EPA may require information via a notice issued under s77 of the Contaminated Land Management Act 1997 or issue a Preliminary Investigation Order.

NSW EPA Contaminated Land List Data Source: Environment Protection Authority

Contaminated Land & Waste Management Facilities

Corner New South Head Road, Rose Bay, NSW 2030

Contaminated Land: Records of Notice

Record of Notices within the dataset buffer:

Map Id	Name	Address	Suburb	Notices	Area No	Location Confidence	Distance	Direction
267	Rose Bay Budget Service Station	638-646 New South Head ROAD	Rose Bay	2 current and 7 former	3304	Premise Match	788m	South

Contaminated Land Records of Notice Data Source: Environment Protection Authority

Former Gasworks

Former Gasworks within the dataset buffer:

Map Id	Location	Council	Further Info	Location Confidence	Distance	Direction
N/A	No records in buffer					

Former Gasworks Data Source: Environment Protection Authority

National Waste Management Site Database

Sites on the National Waste Management Site Database within the dataset buffer:

Site Id	Owner	Name	Address	Suburb	Class	Landfill	Reprocess	Transfer	Comments	Loc Conf	Dist (m)	Direction
N/A	No records in buffer											

Waste Management Facilities Data Source: Geoscience Australia

PFAS Investigation Programs

Corner New South Head Road, Rose Bay, NSW 2030

EPA PFAS Investigation Program

Sites that are part of the EPA PFAS investigation program, within the dataset buffer:

Id	Site	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

EPA PFAS Investigation Program: Environment Protection Authority

Defence PFAS Investigation & Management Program

Sites being investigated or managed by the Department of Defence for PFAS contamination within the dataset buffer:

Map ID	Base Name	Address	Loc Conf	Dist	Dir
N/A	No records in buffer				

Defence PFAS Investigation & Management Program Data Custodian: Department of Defence, Australian Government

Airservices Australia National PFAS Management Program

Sites being investigated or managed by Airservices Australia for PFAS contamination within the dataset buffer:

Map ID	Site Name	Impacts	Loc Conf	Dist	Dir
N/A	No records in buffer				

Airservices Australia National PFAS Management Program Data Custodian: Airservices Australia

Defence Sites

Corner New South Head Road, Rose Bay, NSW 2030

Defence 3 Year Regional Contamination Investigation Program

Sites which have been assessed as part of the Defence 3 Year Regional Contamination Investigation Program within the dataset buffer:

Property ID	Base Name	Address	Known Contamination	Loc Conf	Dist	Dir
N/A	No records in buffer					

Defence 3 Year Regional Contamination Investigation Program, Data Custodian: Department of Defence, Australian Government

EPA Other Sites with Contamination Issues

Corner New South Head Road, Rose Bay, NSW 2030

EPA Other Sites with Contamination Issues

This dataset contains other sites identified on the EPA website as having contamination issues. This dataset currently includes:

- James Hardie asbestos manufacturing and waste disposal sites
- Radiological investigation sites in Hunter's Hill
- Pasminco Lead Abatement Strategy Area

Sites within the dataset buffer:

Site Id	Site Name	Site Address	Dataset	Comments	Location Confidence	Distance	Direction
N/A	No records in buffer						

EPA Other Sites with Contamination Issues: Environment Protection Authority

EPA Activities

Corner New South Head Road, Rose Bay, NSW 2030

Licensed Activities under the POEO Act 1997

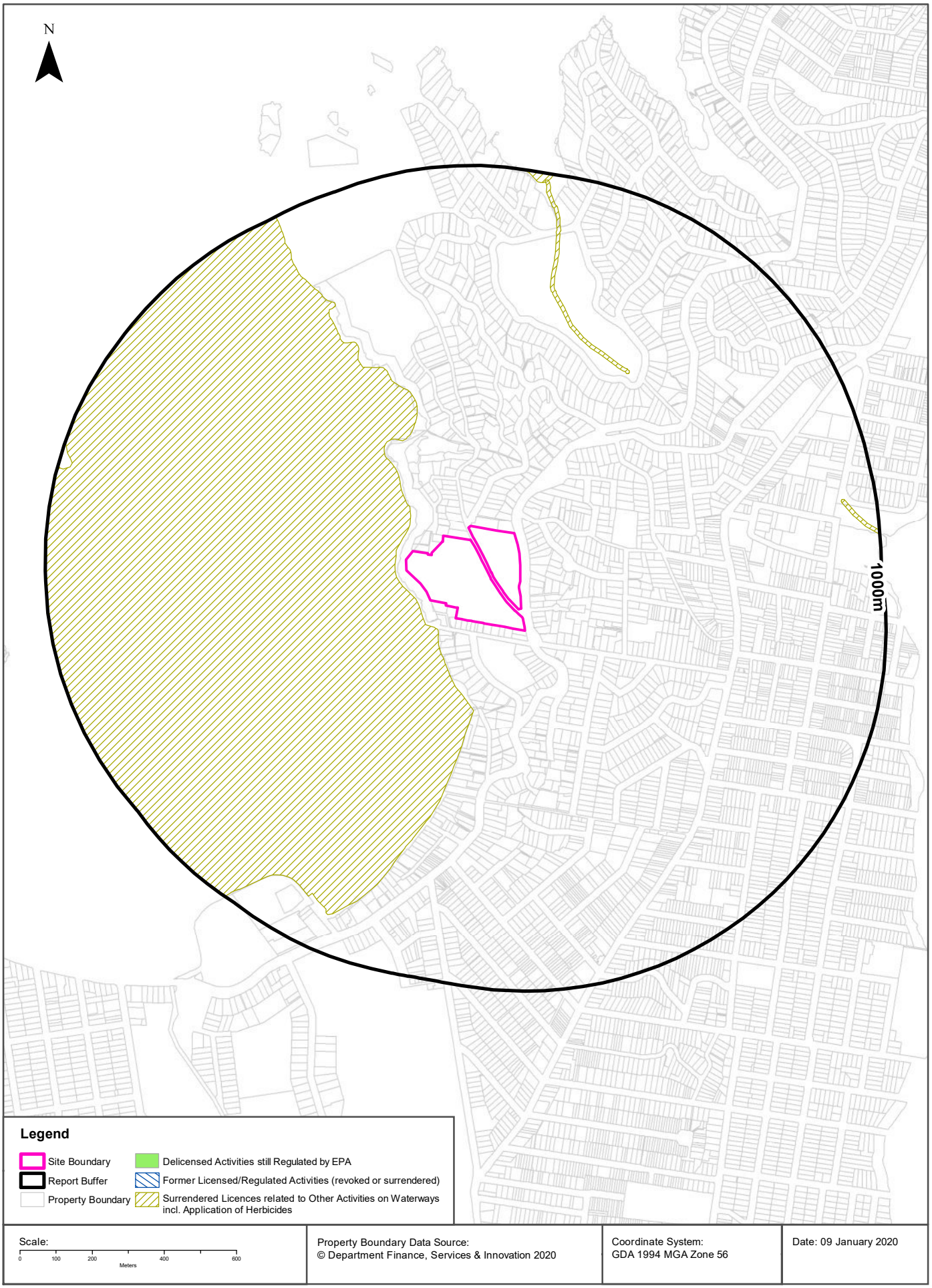
Licensed activities under the Protection of the Environment Operations Act 1997, within the dataset buffer:

EPL	Organisation	Name	Address	Suburb	Activity	Loc Conf	Distance	Direction
N/A	No records in buffer							

POEO Licence Data Source: Environment Protection Authority

Delicensed & Former Licensed EPA Activities

Corner New South Head Road, Rose Bay, NSW 2030



EPA Activities

Corner New South Head Road, Rose Bay, NSW 2030

Delicensed Activities still regulated by the EPA

Delicensed activities still regulated by the EPA, within the dataset buffer:

Licence No	Organisation	Name	Address	Suburb	Activity	Loc Conf	Distance	Direction
N/A	No records in buffer							

Delicensed Activities Data Source: Environment Protection Authority

Former Licensed Activities under the POEO Act 1997, now revoked or surrendered

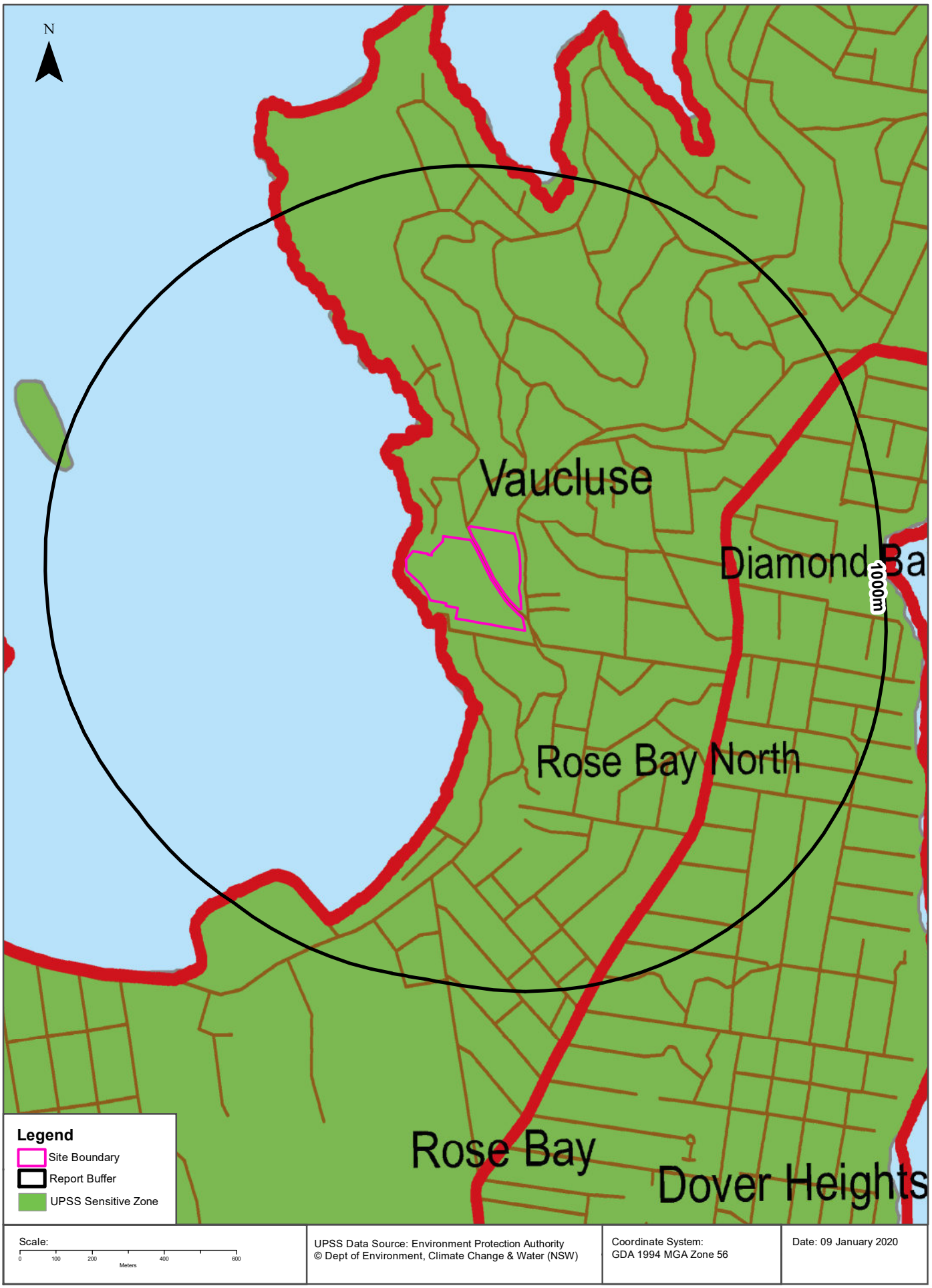
Former Licensed activities under the Protection of the Environment Operations Act 1997, now revoked or surrendered, within the dataset buffer:

Licence No	Organisation	Location	Status	Issued Date	Activity	Loc Conf	Distance	Direction
4653	LUHRMANN ENVIRONMENT MANAGEMENT PTY LTD	WATERWAYS THROUGHOUT NSW	Surrendered	06/09/2000	Other Activities / Non Scheduled Activity - Application of Herbicides	Network of Features	28m	-
4838	Robert Orchard	Various Waterways throughout New South Wales - SYDNEY NSW 2000	Surrendered	07/09/2000	Other Activities / Non Scheduled Activity - Application of Herbicides	Network of Features	28m	-
6630	SYDNEY WEED & PEST MANAGEMENT PTY LTD	WATERWAYS THROUGHOUT NSW - PROSPECT, NSW, 2148	Surrendered	09/11/2000	Other Activities / Non Scheduled Activity - Application of Herbicides	Network of Features	28m	-

Former Licensed Activities Data Source: Environment Protection Authority

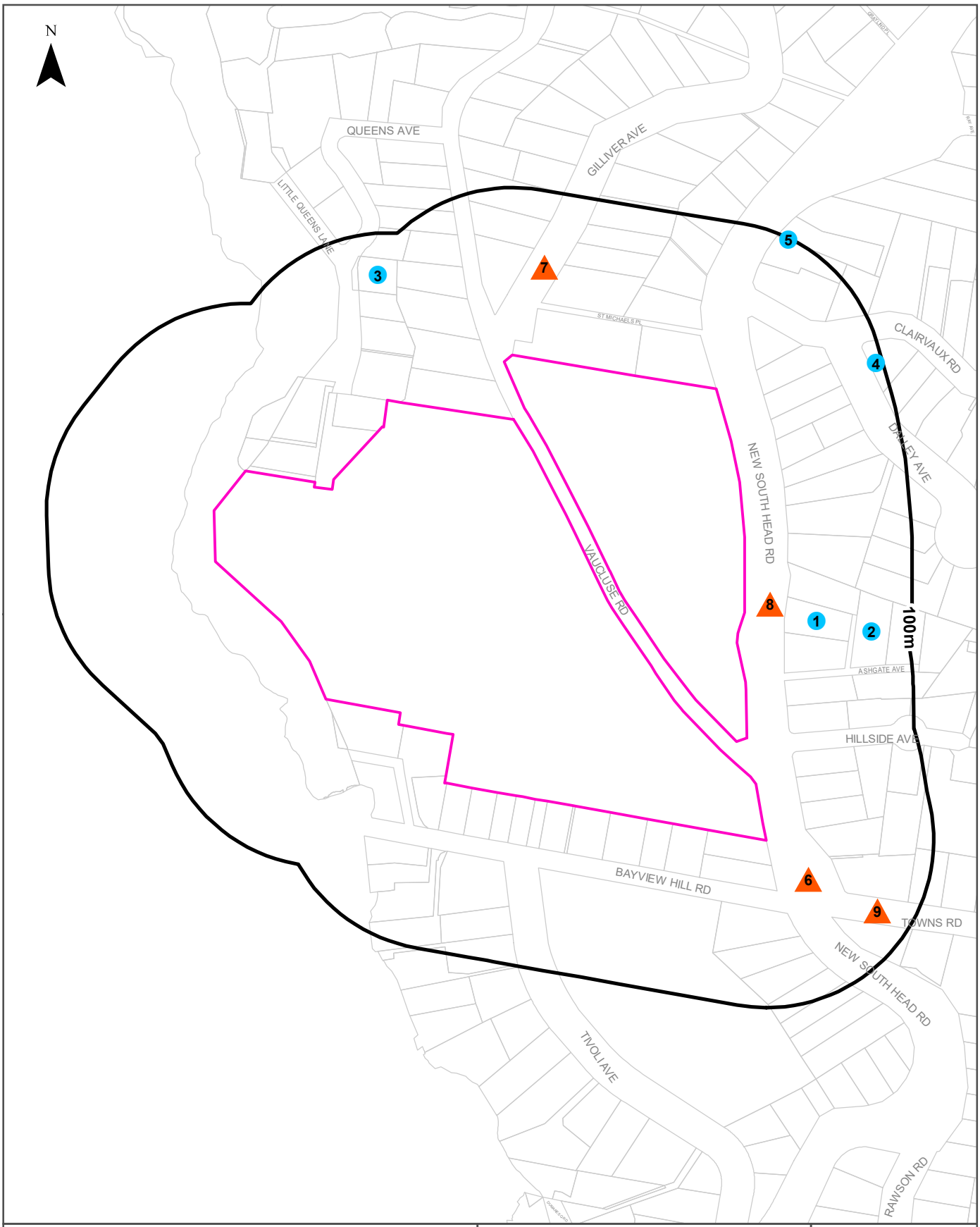
UPSS Sensitive Zones

Corner New South Head Road, Rose Bay, NSW 2030



Historical Business Directories 1950-1991

Corner New South Head Road, Rose Bay, NSW 2030



Legend

- Site Boundary
- Buffer 100m
- Property Boundary
- Business directory records mapped to a specific premise
- Business directory records mapped to a road intersection
- Business directory records mapped to a road corridor
- Business directory records mapped to a general area

Scale: 0 40 80 120 160 Meters

Coordinate System: GDA 1994 MGA Zone 56

Date: 09 January 2020

Historical Business Directories

Corner New South Head Road, Rose Bay, NSW 2030

Business Directory Records 1950-1991
Premise or Road Intersection Matches

Universal Business Directory records from years 1991, 1986, 1982, 1978, 1975, 1970, 1965, 1961 & 1950, mapped to a premise or road intersection within the dataset buffer:

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Property Boundary or Road Intersection	Direction
1	ARCHITECTS	Robson, G. K., 15 New South Head Rd., Vaucluse	268479	1961	Premise Match	24m	East
2	FOOD-FROZEN-MFRS. &/OR IMPS. &/OR DISTS.	Deran Foods Pty. Ltd., 3 Ashgate Ave., Vaucluse. 2030	34148	1986	Premise Match	63m	East
	FOOD - FROZEN - MFRS. &/OR IMPS. &/OR DISTS. (F4740)	Deran Foods Pty. Ltd., 3 Ashgate Ave., Vaucluse. 2030.	31853	1982	Premise Match	63m	East
	FOOD-FROZEN-MFRS &/OR IMPS &/OR DISTS.	Deran Foods Pty. Ltd., 3 Ashgate Ave., Vaucluse. 2030	28840	1978	Premise Match	63m	East
	FOOD-FROZEN-MFRS &/OR IMPS &/OR DISTS.	Deran Foods Pty. Ltd., 3 Ashgate Ave., Vaucluse. 2030	33405	1975	Premise Match	63m	East
3	MEDICAL PRACTITIONERS.	Brideman, S., 3 Queens Ave., Vaucluse. 2030	42259	1978	Premise Match	63m	North West
	MEDICAL PRACTITIONERS.	Brideman, S., 3 Queens Ave., Vaucluse. 2030.	49807	1975	Premise Match	63m	North West
	MEDICAL PRACTITIONERS (M216)	Bridgeman, S., 3 Queens Ave., Vaucluse	326292	1970	Premise Match	63m	North West
	Medical Practitioners	Bridgeman, S., 3 Queens Ave., Vaucluse	110890	1965	Premise Match	63m	North West
	MEDICAL PRACTITIONERS	Bridgeman, S., 3 Queens Ave., Vaucluse	334656	1961	Premise Match	63m	North West
4	MEDICAL PRACTITIONERS	Broughton, J. W., 1 Clairvaux Rd., Vaucluse	72523	1950	Premise Match	90m	North East
5	MEDICAL PRACTITIONERS (M216)	Love, C. J., 33 New South Head Rd., Vaucluse	327488	1970	Premise Match	98m	North East
	Medical Practitioners	Love, C. J., 33 New South Head Rd., Vaucluse	111997	1965	Premise Match	98m	North East
	MEDICAL PRACTITIONERS	Love, C. J., 33 & 40 New South Head Rd., Vaucluse	335707	1961	Premise Match	98m	North East

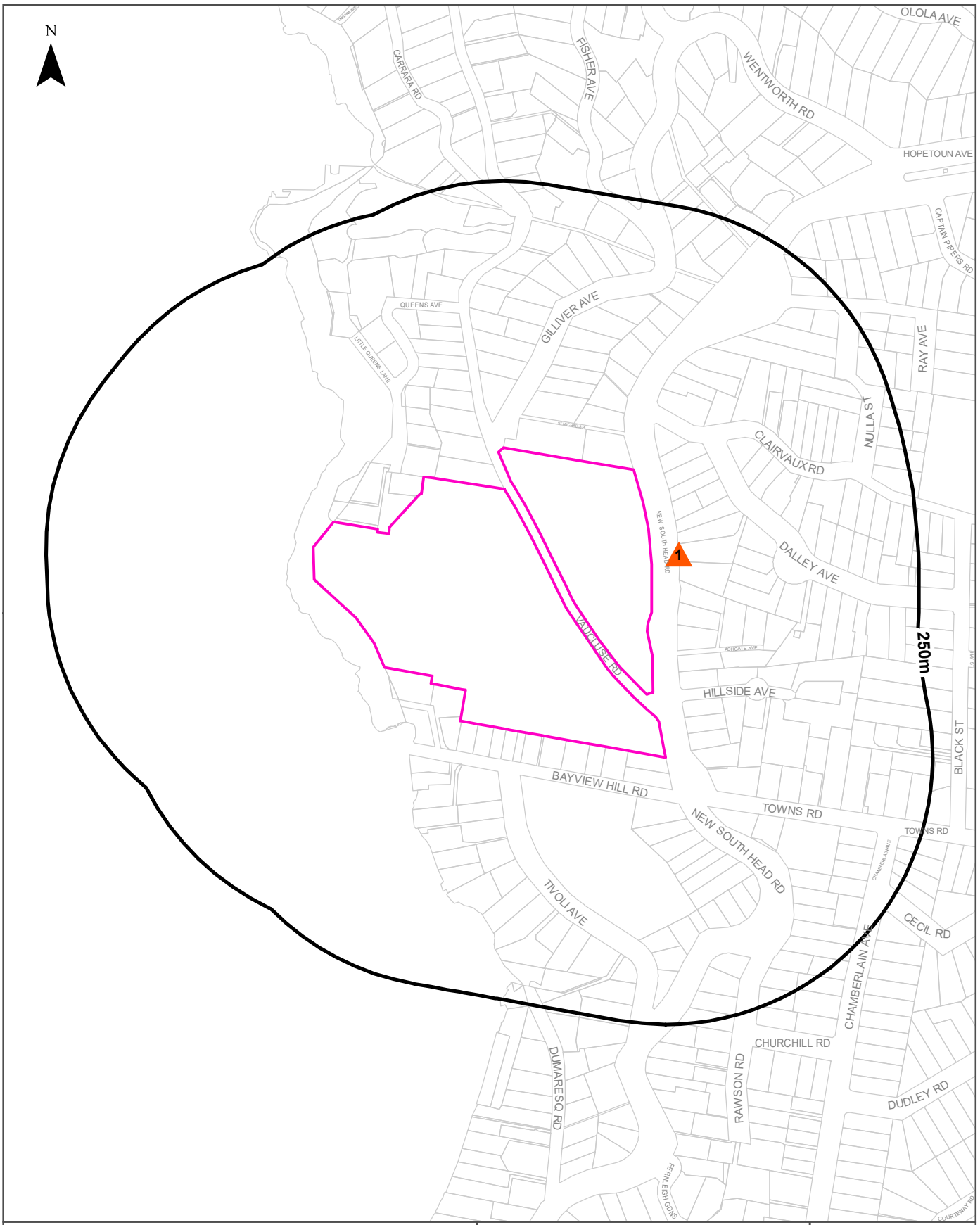
Business Directory Records 1950-1991
Road or Area Matches

Universal Business Directory records from years 1991, 1986, 1982, 1978, 1975, 1970, 1965, 1961 & 1950, mapped to a road or an area, within the dataset buffer. Records are mapped to the road when a building number is not supplied, cannot be found, or the road has been renumbered since the directory was published:

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
6	RESTAURANTS.	Captain Cook Floating Restaurant., New South Head Rd., Rose Bay. 2029	73618	1975	Road Match	0m
	Schools/Colleges - Private/Public	Sacred Heart Convent Schools., New South Head Rd., Rose Bay	142986	1965	Road Match	0m
	BUSINESS AGENTS &/OR BROKERS	Hubert, B. & Co., New South Head Rd., Rose Bay	279551	1961	Road Match	0m
	SCHOOLS/COLLEGES-PRIVATE/PUBLIC	Kambala School for Girls, New South Head Rd., Rose Bay	248312	1961	Road Match	0m
	SCHOOLS/COLLEGES-PRIVATE/PUBLIC	Sacred Heart Convent Schools, New South Head Rd., Rose Bay	248369	1961	Road Match	0m
	MERCANTILE AGENTS	Noblett, G. M., New South Head Rd., Rose Bay	74194	1950	Road Match	0m
7	Schools/Colleges - Private/Public	St. Michael's Preparatory School., Gilliver Ave., Vaucluse	142964	1965	Road Match	0m
	SCHOOLS/COLLEGES-PRIVATE/PUBLIC	St. Michael's Preparatory School, Gilliver Ave., Vaucluse	248441	1961	Road Match	0m
8	MILK BARS & CONFECTIONERS	Ball, C. E., New South Head Rd., Vaucluse	76316	1950	Road Match	0m
9	FRUITERERS & GREENGROCERS	Sanders, A. T., Towns Rd., Vaucluse	51132	1950	Road Match	58m

Dry Cleaners, Motor Garages & Service Stations

Corner New South Head Road, Rose Bay, NSW 2030



Legend

- Site Boundary
- Buffer 250m
- Property Boundary
- Business directory records mapped to a specific premise
- Business directory records mapped to a road intersection
- Business directory records mapped to a road corridor
- Business directory records mapped to a general area

Scale: 0 60 120 180 240 Meters

Coordinate System: GDA 1994 MGA Zone 56

Date: 09 January 2020

Historical Business Directories

Corner New South Head Road, Rose Bay, NSW 2030

Dry Cleaners, Motor Garages & Service Stations 1948-1993 Premise or Road Intersection Matches

Dry Cleaners, Motor Garages & Service Stations from UBD Business Directories, mapped to a premise or road intersection, within the dataset buffer.

Note: The Universal Business Directories were published between 1948 and 1993. Dry Cleaners, Motor Garages & Service Stations have been extracted from all of these directories except the following years 1951, 1955, 1957, 1960, 1963, 1973, 1974, 1977, 1987.

Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Property Boundary or Road Intersection	Direction
	No records in buffer						

Dry Cleaners, Motor Garages & Service Stations 1948-1993 Road or Area Matches

Dry Cleaners, Motor Garages & Service Stations from UBD Business Directories, mapped to a road or an area, within the dataset buffer. Records are mapped to the road when a building number is not supplied, cannot be found, or the road has been renumbered since the directory was published.

Note: The Universal Business Directories were published between 1948 and 1993. Dry Cleaners, Motor Garages & Service Stations have been extracted from all of these directories except the following years 1951, 1955, 1957, 1960, 1963, 1973, 1974, 1977, 1987.

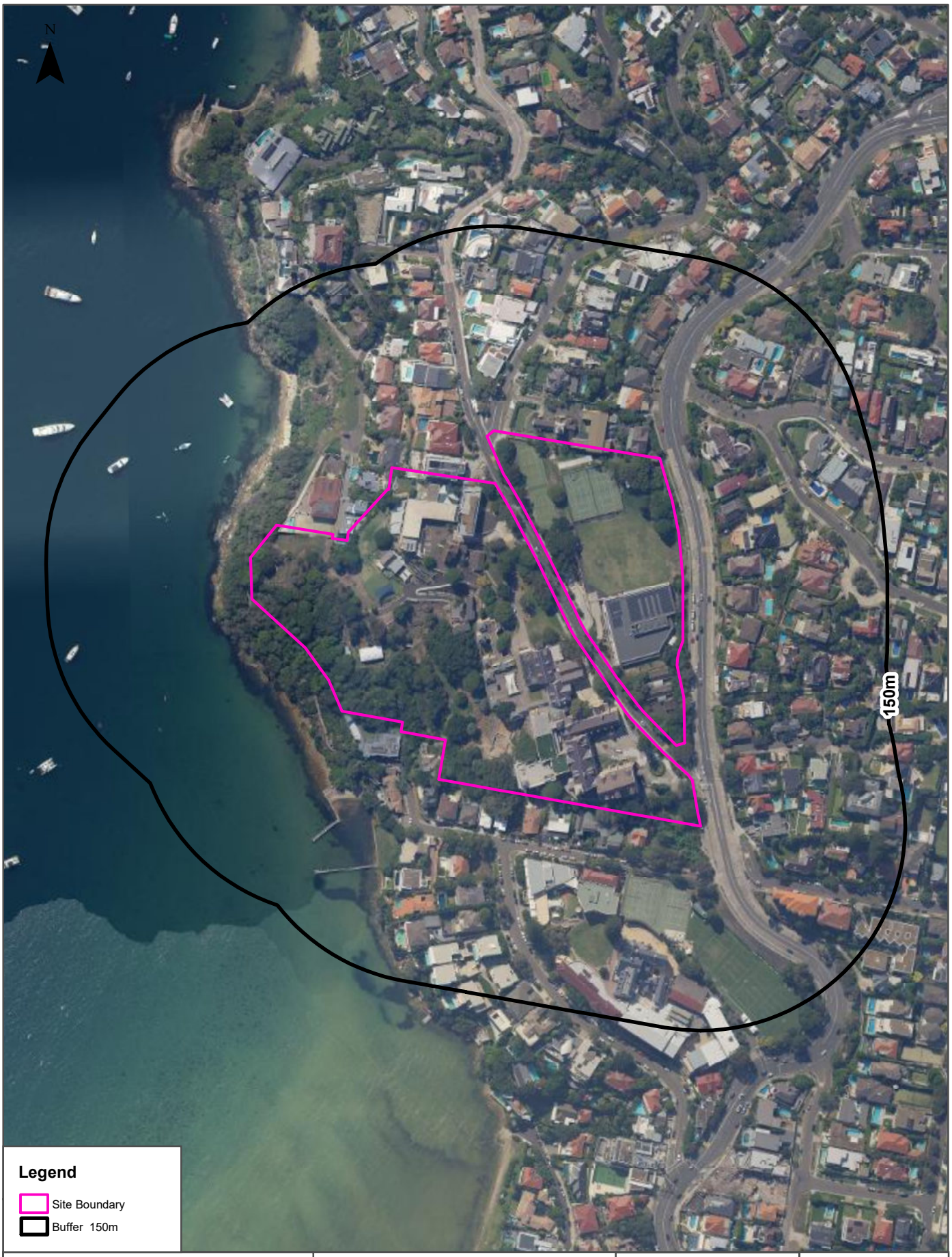
Map Id	Business Activity	Premise	Ref No.	Year	Location Confidence	Distance to Road Corridor or Area
1	MOTOR GARAGES &/OR ENGINEERS &/OR SERVICE STATIONS.	Esso Vaucluse Service Station, New South Head Rd., Vaucluse. 2030	65779	1983	Road Match	0m

Aerial Imagery 2019

Corner New South Head Road, Rose Bay, NSW 2030

Aerial Imagery 2018

Corner New South Head Road, Rose Bay, NSW 2030



Aerial Imagery 2014

Corner New South Head Road, Rose Bay, NSW 2030

Aerial Imagery 2007

Corner New South Head Road, Rose Bay, NSW 2030

Scale: 0 40 80 120 160 Meters	Data Sources: Aerial Imagery © Aerometrex Pty Ltd	Coordinate System: GDA 1994 MGA Zone 56	Date: 09 January 2020

Aerial Imagery 2000

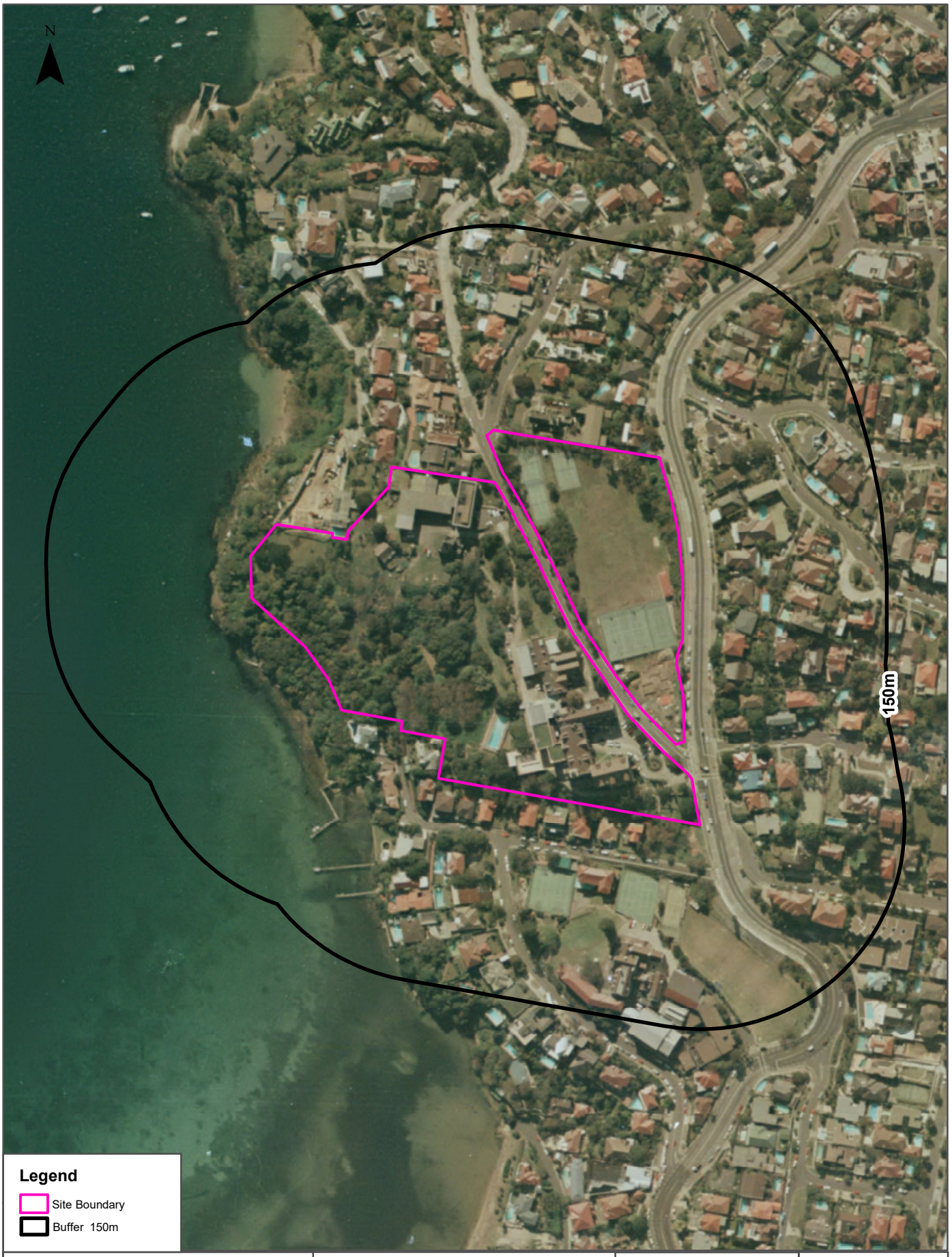
Corner New South Head Road, Rose Bay, NSW 2030

Scale:	Data Sources: Aerial Imagery © Aerometrex Pty Ltd	Coordinate System: GDA 1994 MGA Zone 56	Date: 09 January 2020

0 40 80 120 160
Meters

Aerial Imagery 1991

Corner New South Head Road, Rose Bay, NSW 2030



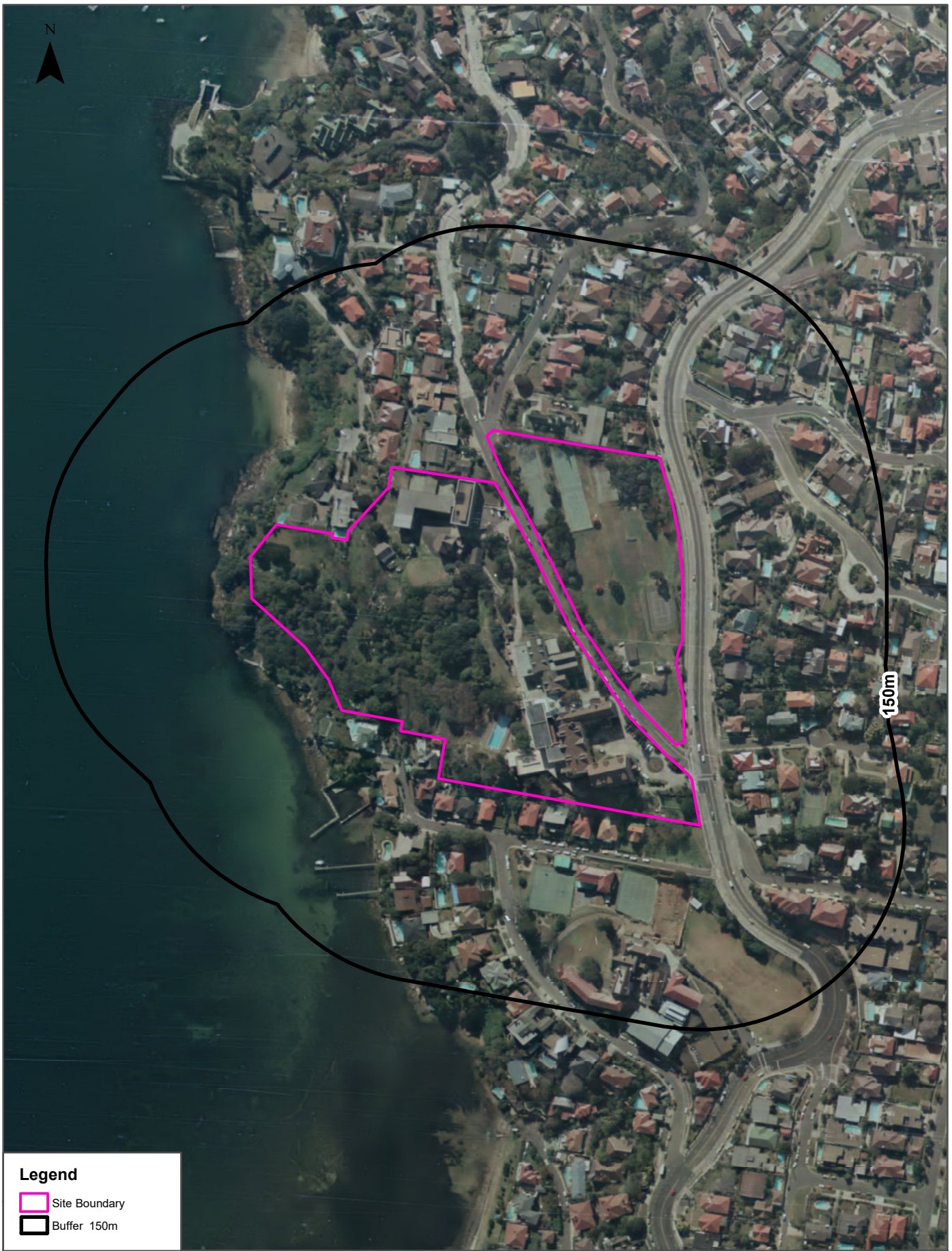
Data Sources: Aerial Imagery © Department of Finance, Services & Innovation

Coordinate System: GDA 1994 MGA Zone 56

Date: 09 January 2020

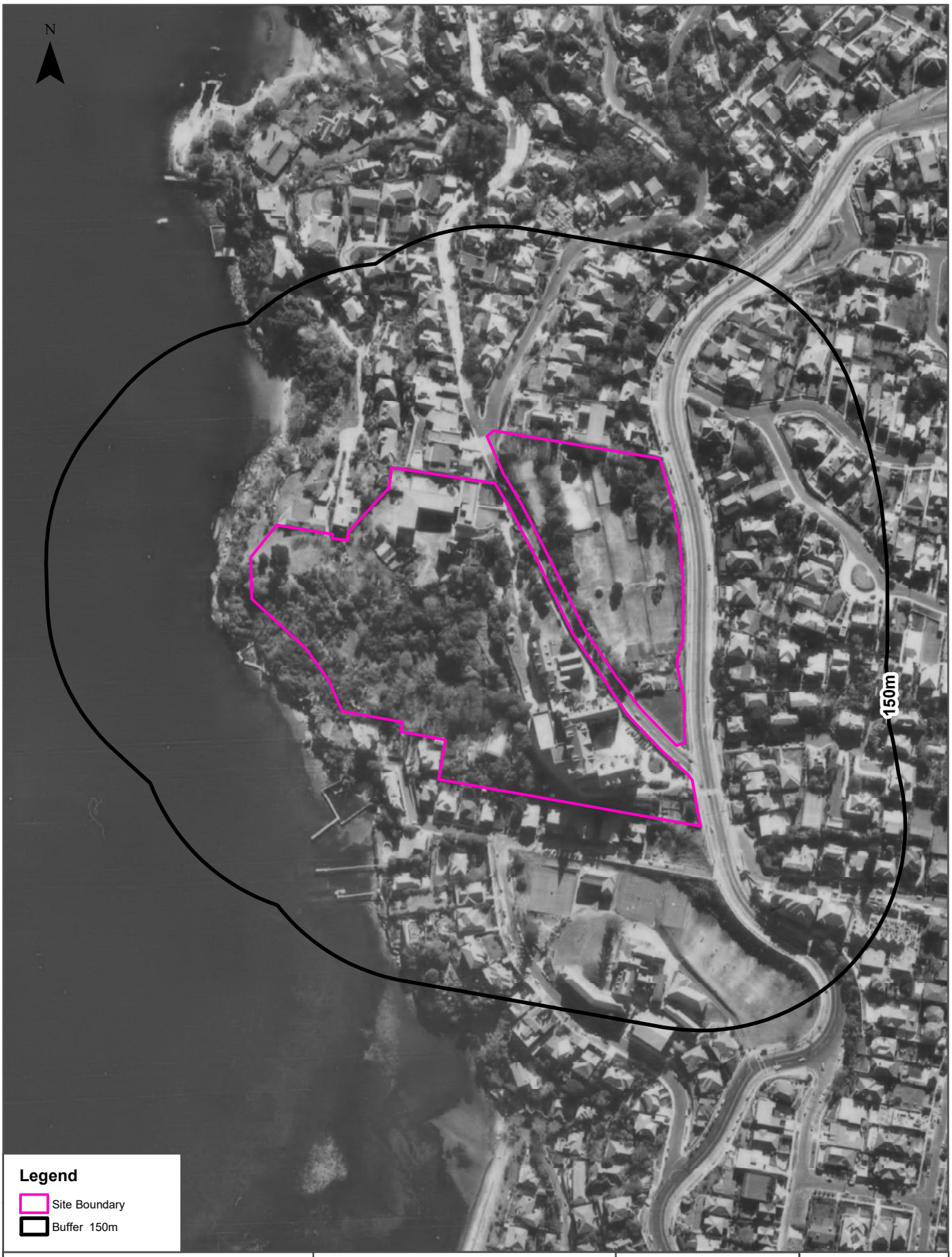
Aerial Imagery 1982

Corner New South Head Road, Rose Bay, NSW 2030



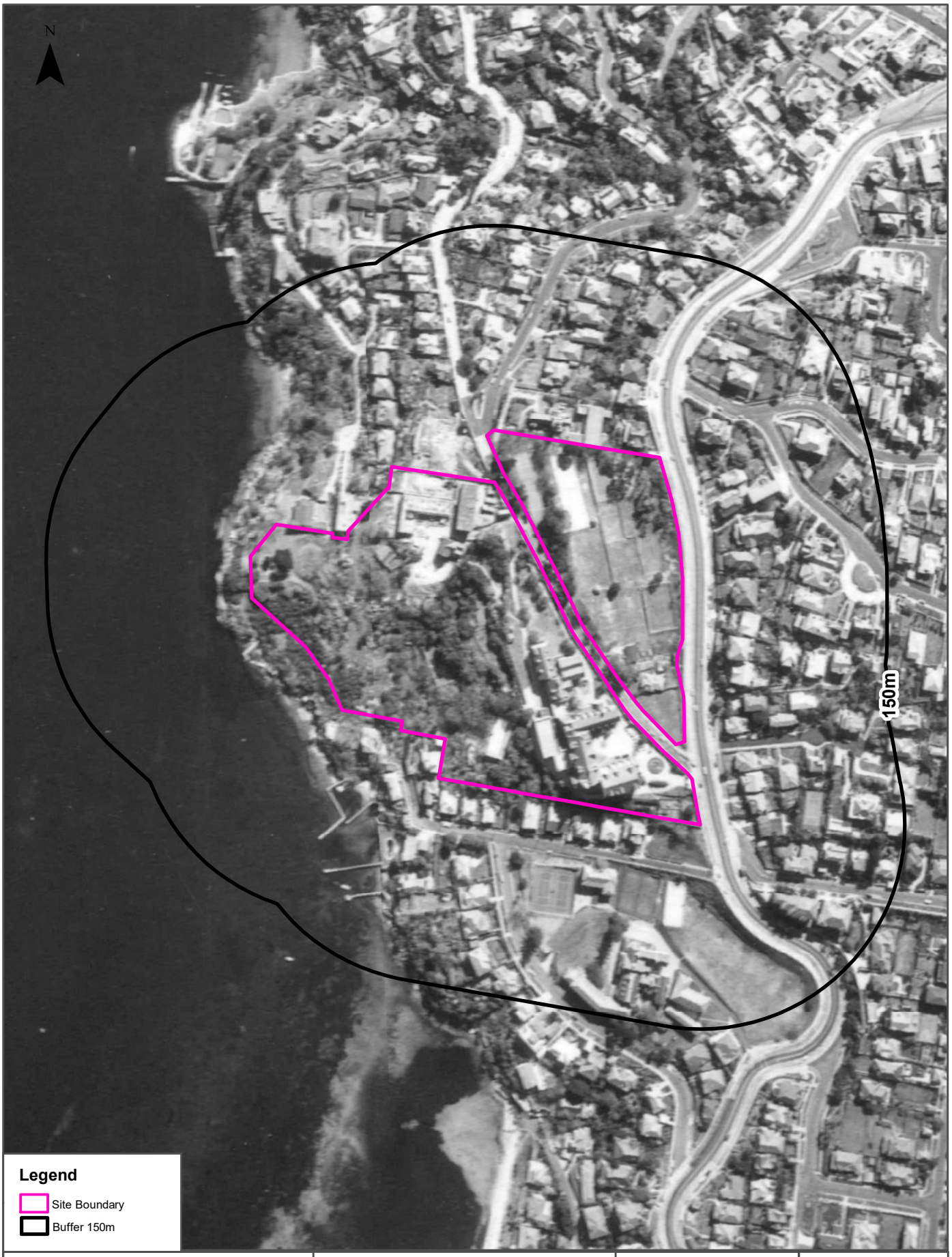
Aerial Imagery 1970

Corner New South Head Road, Rose Bay, NSW 2030



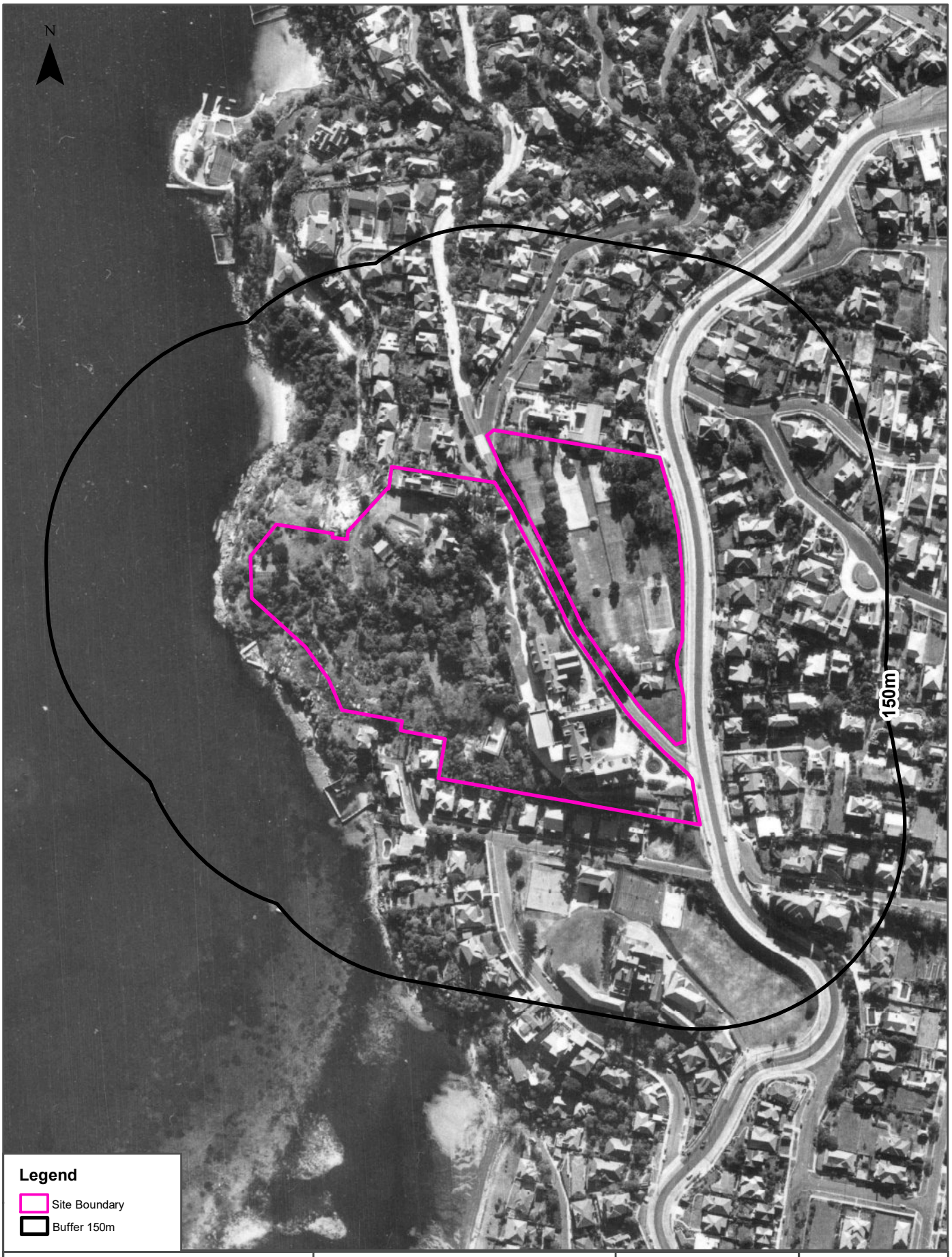
Aerial Imagery 1965

Corner New South Head Road, Rose Bay, NSW 2030



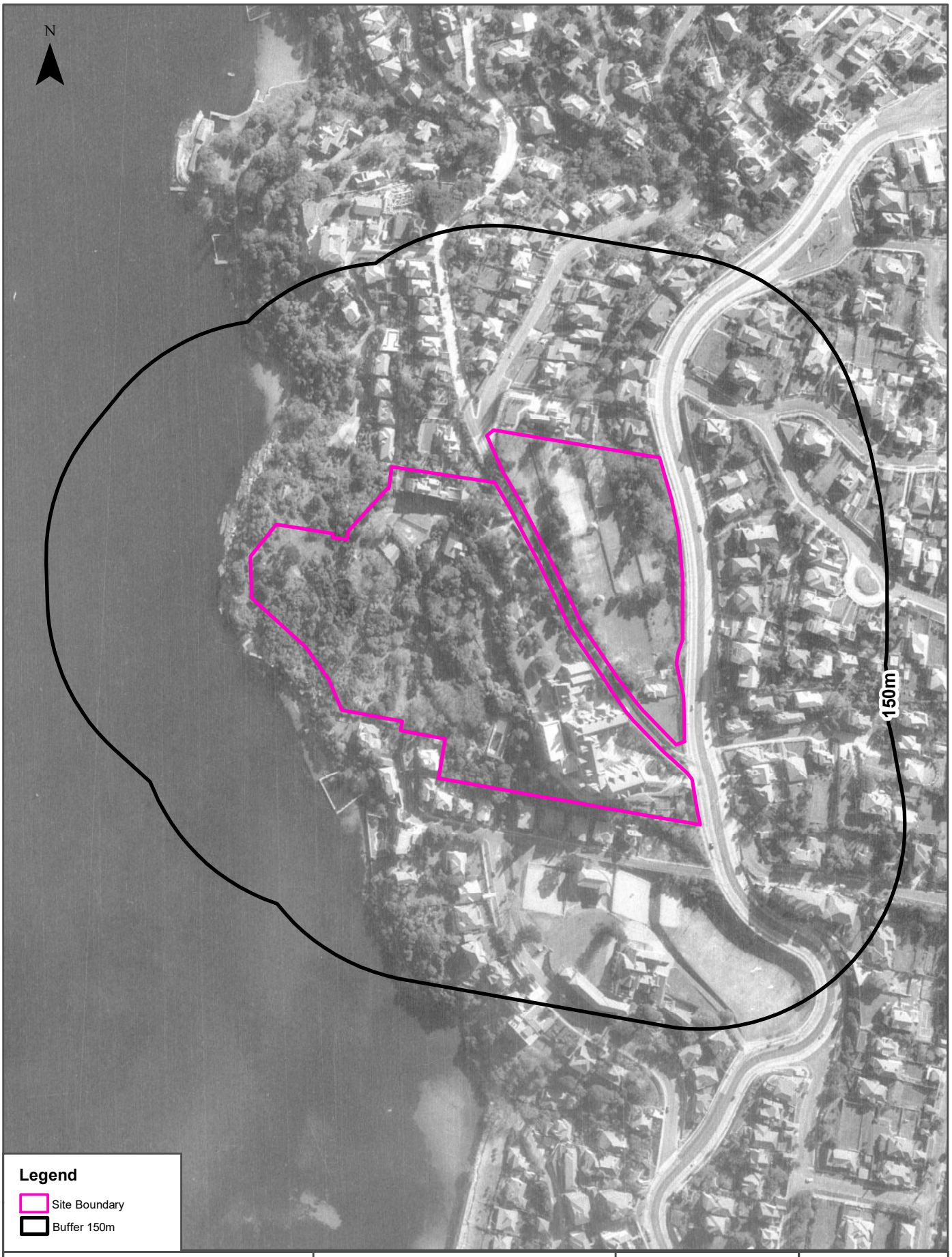
Aerial Imagery 1961

Corner New South Head Road, Rose Bay, NSW 2030



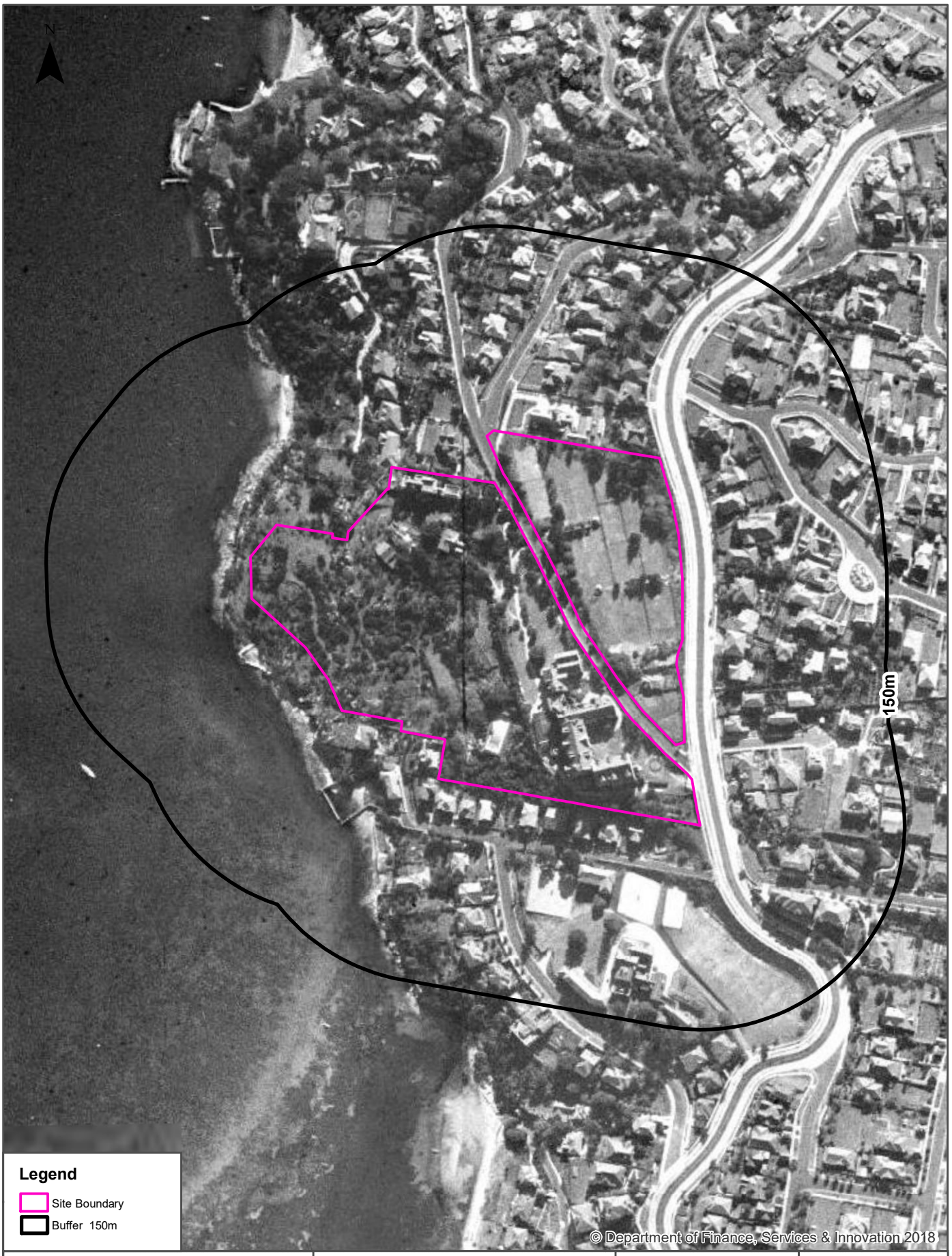
Aerial Imagery 1955

Corner New South Head Road, Rose Bay, NSW 2030



Aerial Imagery 1943

Corner New South Head Road, Rose Bay, NSW 2030

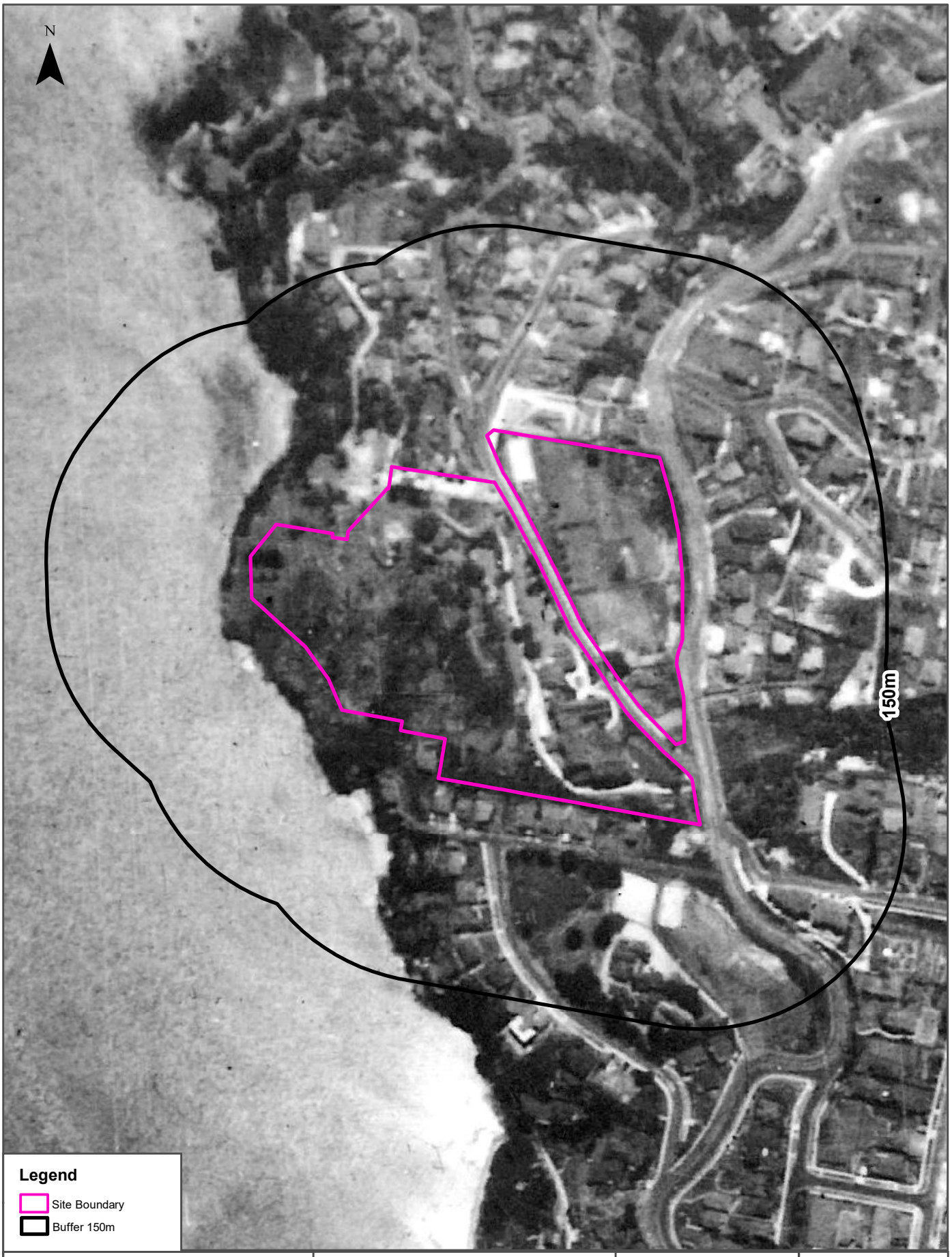


Scale:	Data Sources: Aerial Imagery © Department of Finance, Services & Innovation	Coordinate System: GDA 1994 MGA Zone 56	Date: 09 January 2020

0 40 80 120 160 Meters

Aerial Imagery 1930

Corner New South Head Road, Rose Bay, NSW 2030



Topographic Map 2015

Corner New South Head Road, Rose Bay, NSW 2030

Scale: 0 100 200 400 600 Meters

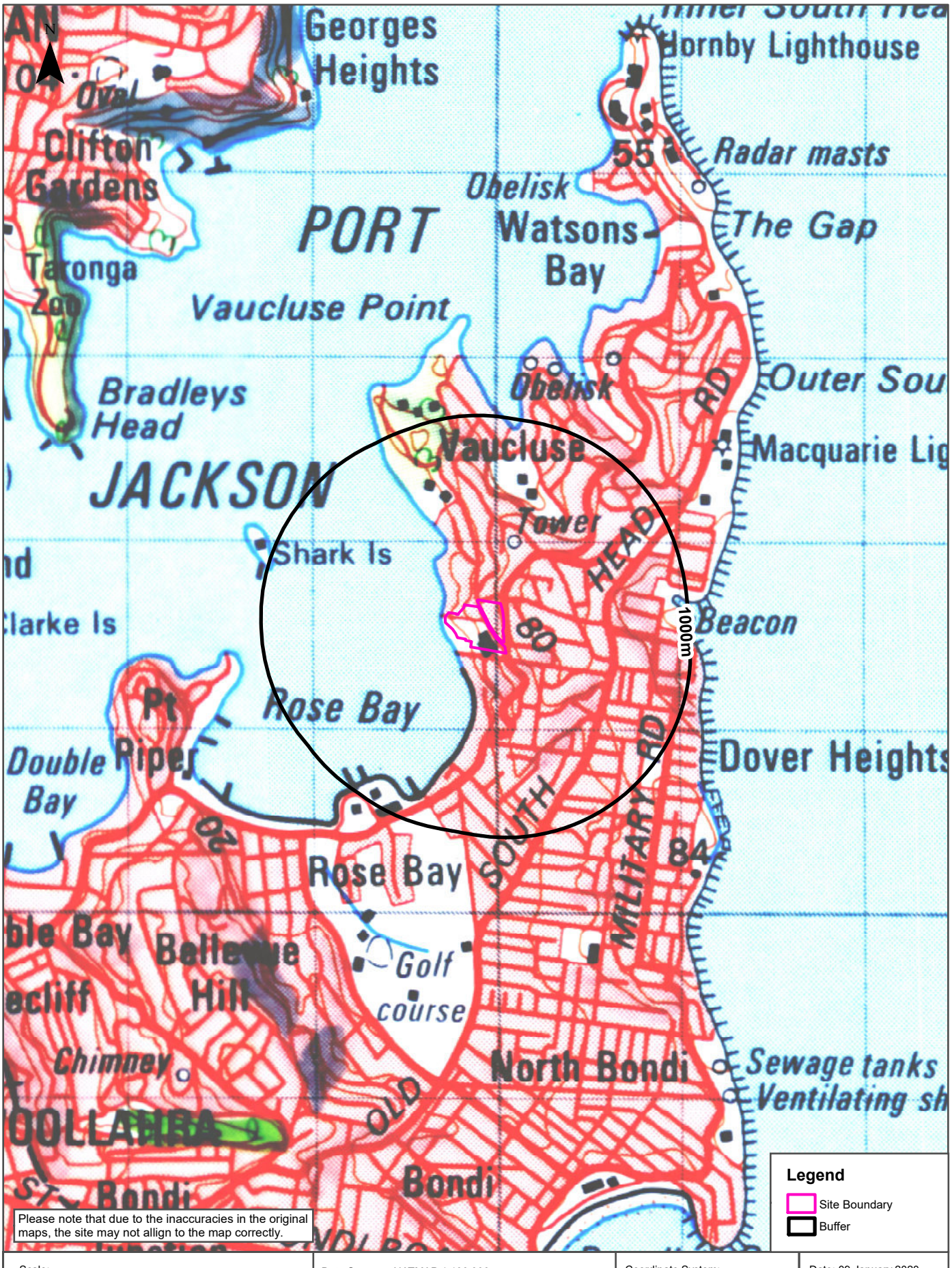
Data Sources: Topographic Map Data © NSW Land and Property Information

Coordinate System: GDA 1994 MGA Zone 56

Date: 09 January 2020

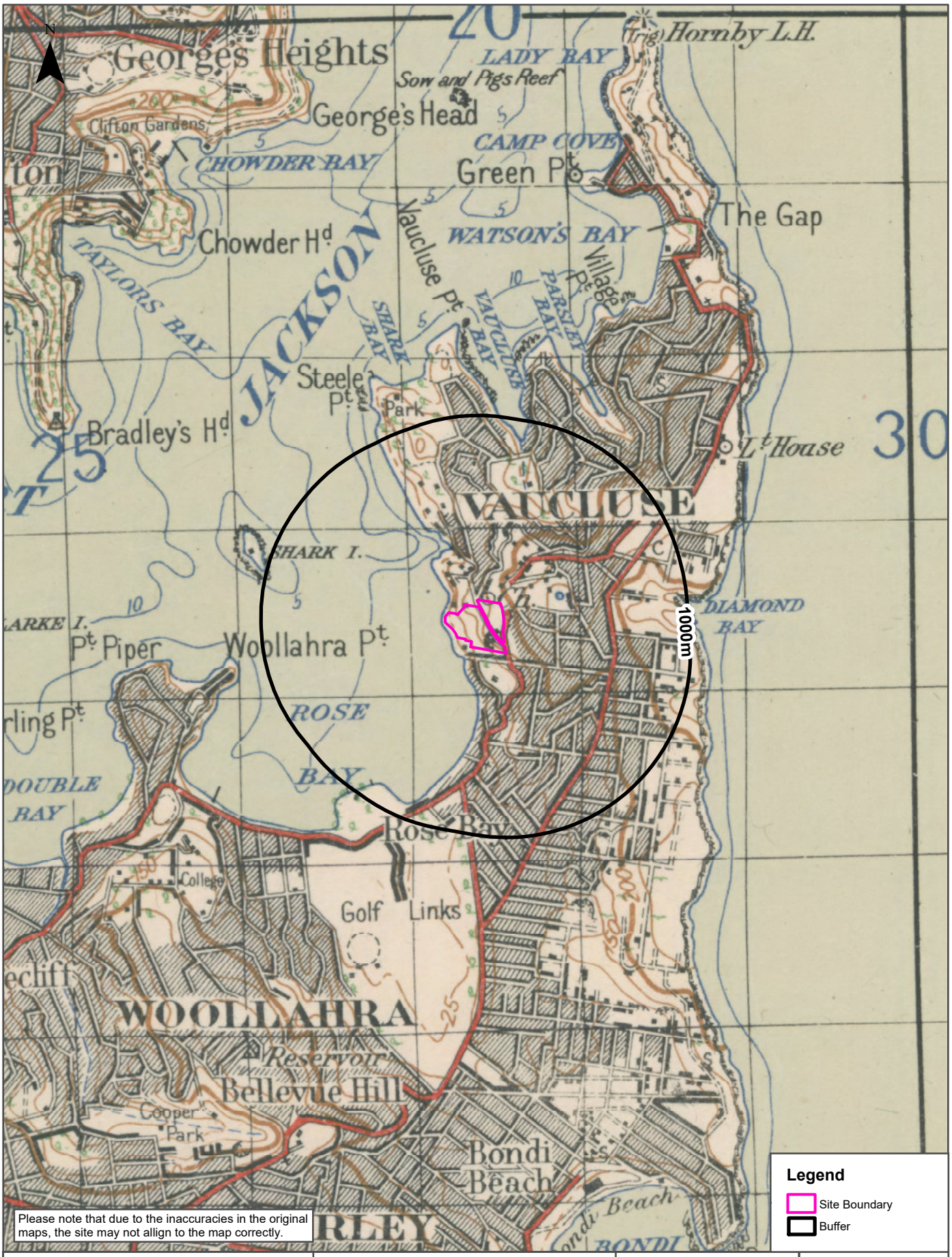
Historical Map 1975

Corner New South Head Road, Rose Bay, NSW 2030



Historical Map c.1936

Corner New South Head Road, Rose Bay, NSW 2030



Scale: 0 125 250 500 750 1,000 1,250 Meters

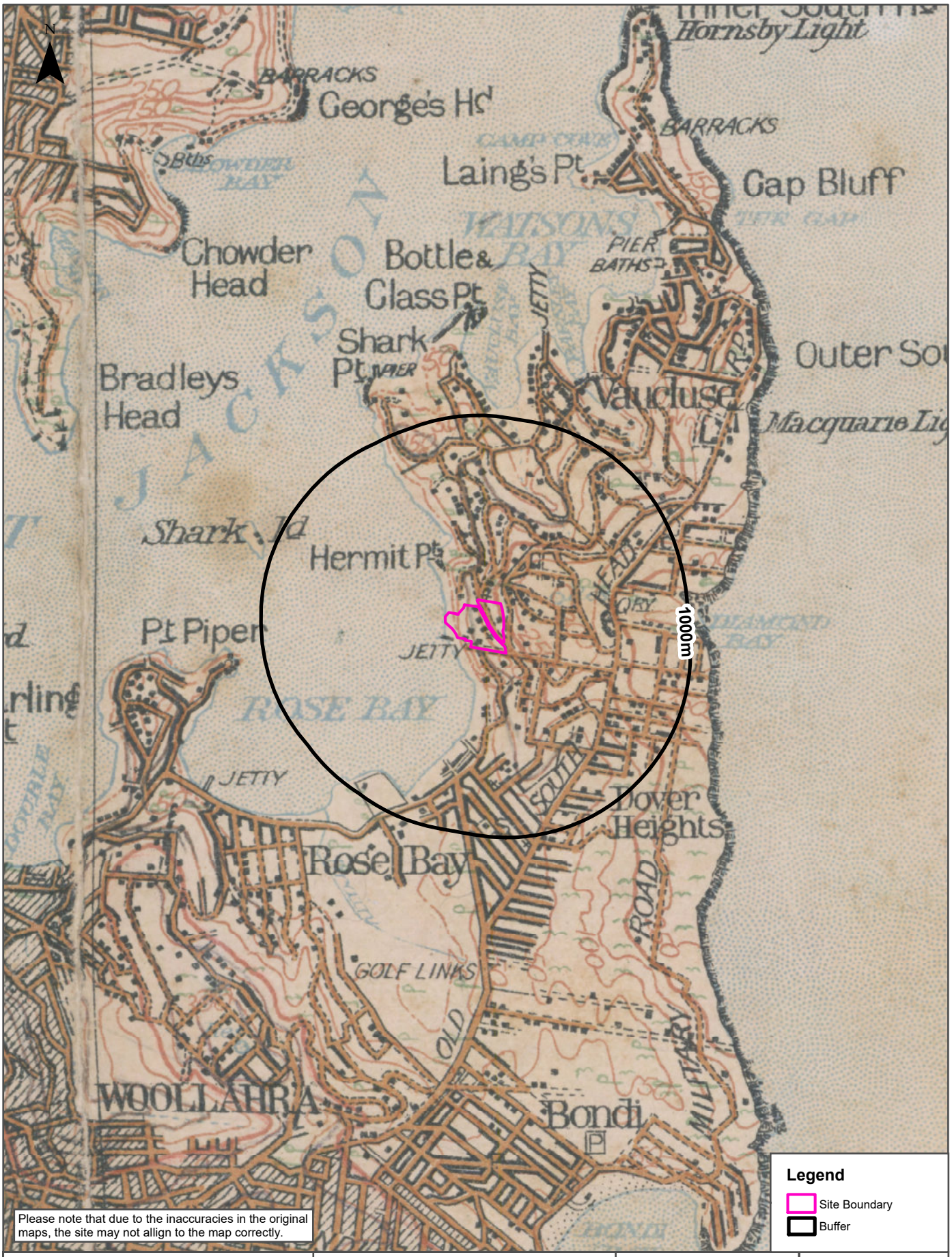
Data Sources: Australia 1:63360, Produced by Australian Section Imperial General Staff

Coordinate System: GDA 1994 MGA Zone 56

Date: 09 January 2020

Historical Map c.1917

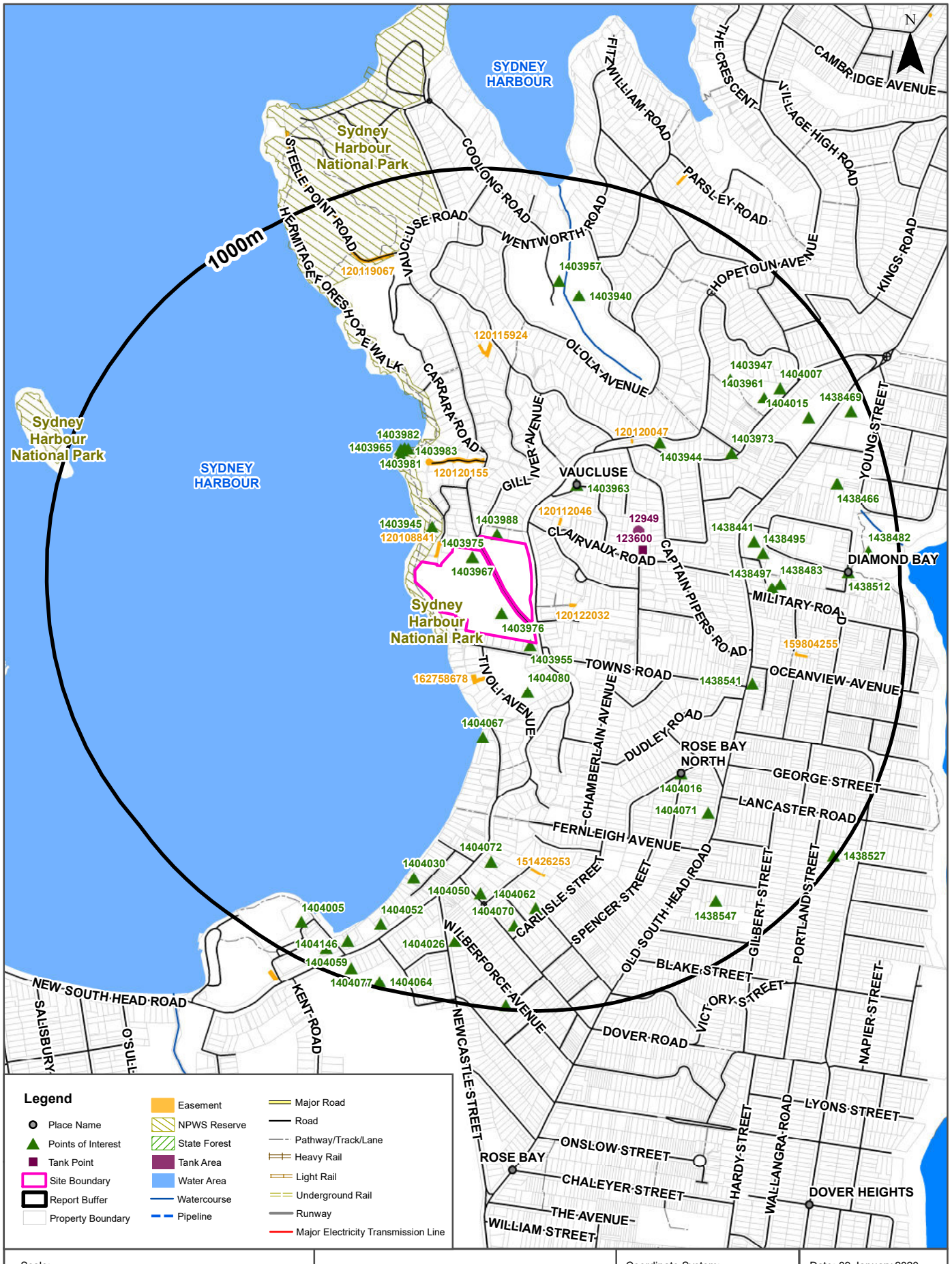
Corner New South Head Road, Rose Bay, NSW 2030



Scale: 0 125 250 500 750 1,000 1,250 Meters	Data Sources: Australia 1:63360, Produced by Australian Section Imperial General Staff	Coordinate System: GDA 1994 MGA Zone 56	Date: 09 January 2020

Topographic Features

Corner New South Head Road, Rose Bay, NSW 2030



Topographic Features

Corner New South Head Road, Rose Bay, NSW 2030

Points of Interest

What Points of Interest exist within the dataset buffer?

Map Id	Feature Type	Label	Distance	Direction
1403967	Convent/Monastery	ROSE BAY CONVENT	0m	Onsite
1403975	Primary School	KINCOPPAL ROSE BAY SCHOOL OF THE SACRED HEART	0m	Onsite
1403976	High School	KINCOPPAL ROSE BAY SCHOOL OF THE SACRED HEART	0m	Onsite
1403955	Park	FORSYTH PARK	8m	South East
1403988	Place Of Worship	ST MICHAEL'S ANGLICAN CHURCH	14m	North
1403945	Park	HERMITAGE RESERVE	78m	North West
1404080	Combined Primary-Secondary School	KAMBALA	135m	South East
1403963	Suburb	VAUCLUSE	213m	North East
1404067	Park	DUMARESQ RESERVE	277m	South
1403938	Headland	HERMIT POINT	283m	North West
1403982	Wharf	Wharf	292m	North West
1403965	Slipway	Slipway	295m	North West
1403983	Wharf	Wharf	298m	North West
1403981	Wharf	Wharf	300m	North West
1403944	Lookout	JOHNSTONS LOOKOUT	457m	North East
1404016	Urban Place	ROSE BAY NORTH	529m	South East
1438541	Post Office	ROSE BAY NORTH POST OFFICE	596m	East
1404072	Place Of Worship	ST MARY MAGDALENE	606m	South
1438441	Sports Field	BOWLING GREENS	610m	East
1403973	Post Office	VAUCLUSE POST OFFICE	612m	North East
1438495	Community Facility	DIAMOND BAY BOWLING CLUB	631m	East
1438497	Community Facility	KIMBERLEY RESERVE COMMUNITY HALL	652m	East
1404071	Place Of Worship	SOUTH HEAD SYNAGOGUE	655m	South East
1438483	Park	KIMBERLEY RESERVE	675m	East
1404030	Park	PERCIVAL PARK	687m	South
1403940	Historic Site	VAUCLUSE HOUSE HISTORIC SITE	690m	North
1404050	Post Office	ROSE BAY POST OFFICE	697m	South
1403947	Park	SAMUEL PARK	713m	North East
1403957	Park	VAUCLUSE PARK	721m	North
1404062	Primary School	MCAULEY PRIMARY SCHOOL	721m	South
1403961	Sports Field	BOWLING GREENS	760m	North East

Map Id	Feature Type	Label	Distance	Direction
1404070	Place Of Worship	ST ANDREW'S PRESBYTERIAN CHURCH	770m	South
1404007	Community Facility	VAUCLUSE BOWLING CLUB	811m	North East
1404052	Retirement Village	ROSE BAY TOWERS RETIREMENT VILLAGE	830m	South
1404026	Park	PANNERONG RESERVE	835m	South
1404015	Nursing Home	MARK MORAN AT VAUCLUSE	842m	North East
1438547	Retirement Village	PRINCESS GARDENS	853m	South East
1438512	Urban Place	DIAMOND BAY	859m	East
1438466	Community Home	VAUCLUSE NURSING HOME	859m	East
1404146	Park	TINGIRA RESERVE	901m	South
1404005	Community Facility	WOOLLAHRA SAILING CLUB	908m	South West
1438482	Park	DIAMOND BAY RESERVE	916m	East
1404059	Club	ROSE BAY RSL CLUB T/AS CLUB ROSE BAY	941m	South West
1438469	Cemetery	SOUTH HEAD GENERAL CEMETERY	954m	North East
1404077	Sports Court	TENNIS COURTS	968m	South
1404064	Sports Court	TENNIS COURTS	982m	South
1404046	Primary School	ROSE BAY PUBLIC SCHOOL	987m	South
1438527	Park	DUDLEY PAGE RESERVE	991m	South East

Topographic Features

Corner New South Head Road, Rose Bay, NSW 2030

Tanks (Areas)

What are the Tank Areas located within the dataset buffer?
Note. The large majority of tank features provided by LPI are derived from aerial imagery & are therefore primarily above ground tanks.

Map Id	Tank Type	Status	Name	Feature Currency	Distance	Direction
12949	Water	Operational	VAUCLUSE RESERVOIR	01/01/2008	289m	East

Tanks (Points)

What are the Tank Points located within the dataset buffer?
Note. The large majority of tank features provided by LPI are derived from aerial imagery & are therefore primarily above ground tanks.

Map Id	Tank Type	Status	Name	Feature Currency	Distance	Direction
123600	Water	Operational		02/09/2000	308m	East

Major Easements

What Major Easements exist within the dataset buffer?
Note. Easements provided by LPI are not at the detail of local governments. They are limited to major easements such as Right of Carriageway, Electrical Lines (66kVa etc.), Easement to drain water & Significant subterranean pipelines (gas, water etc.).

Map Id	Easement Class	Easement Type	Easement Width	Distance	Direction
120108841	Primary	Undefined		20m	North West
120112046	Primary	Undefined		98m	North East
120122032	Primary	Undefined		104m	East
162758678	Primary	Right of way	variable	114m	South
120120155	Primary	Undefined		201m	North
120120047	Primary	Undefined		399m	North East
120115924	Primary	Undefined		489m	North
151426253	Primary	Right of way	1.83 VARIABLE	613m	South
159804255	Primary	Right of way	3m and Variable	704m	East
120119067	Primary	Undefined		799m	North

Topographic Features

Corner New South Head Road, Rose Bay, NSW 2030

State Forest

What State Forest exist within the dataset buffer?

State Forest Number	State Forest Name	Distance	Direction
N/A	No records in buffer		

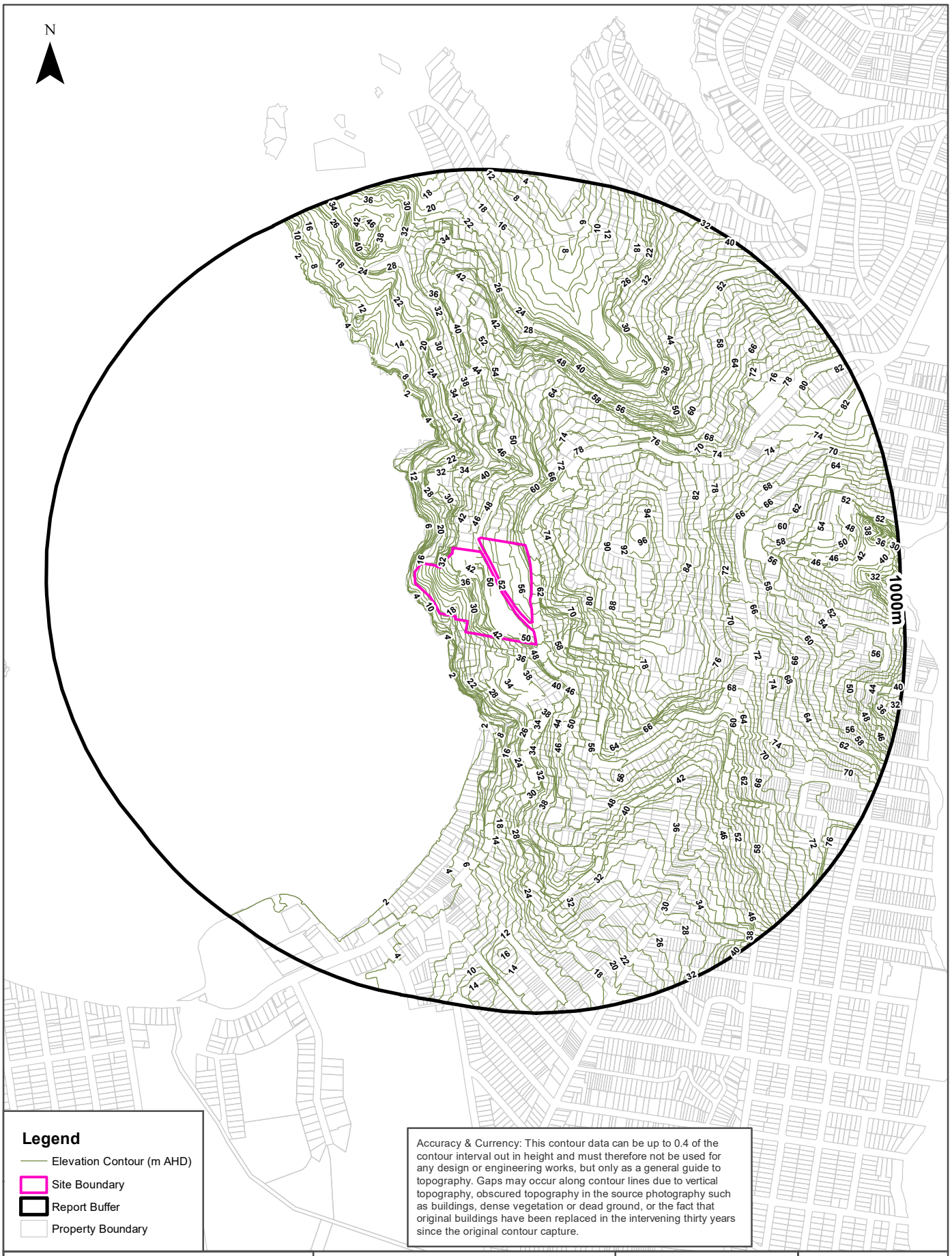
National Parks and Wildlife Service Reserves

What NPWS Reserves exist within the dataset buffer?

Reserve Number	Reserve Type	Reserve Name	Gazetted Date	Distance	Direction
N0039	NATIONAL PARK	Sydney Harbour National Park	04/04/1975	0m	Onsite

Elevation Contours (m AHD)

Corner New South Head Road, Rose Bay, NSW 2030



Hydrogeology & Groundwater

Corner New South Head Road, Rose Bay, NSW 2030

Hydrogeology

Description of aquifers on-site:

Description
Porous, extensive aquifers of low to moderate productivity

Description of aquifers within the dataset buffer:

Description
Porous, extensive aquifers of low to moderate productivity

Hydrogeology Map of Australia : Commonwealth of Australia (Geoscience Australia)

Botany Groundwater Management Zones

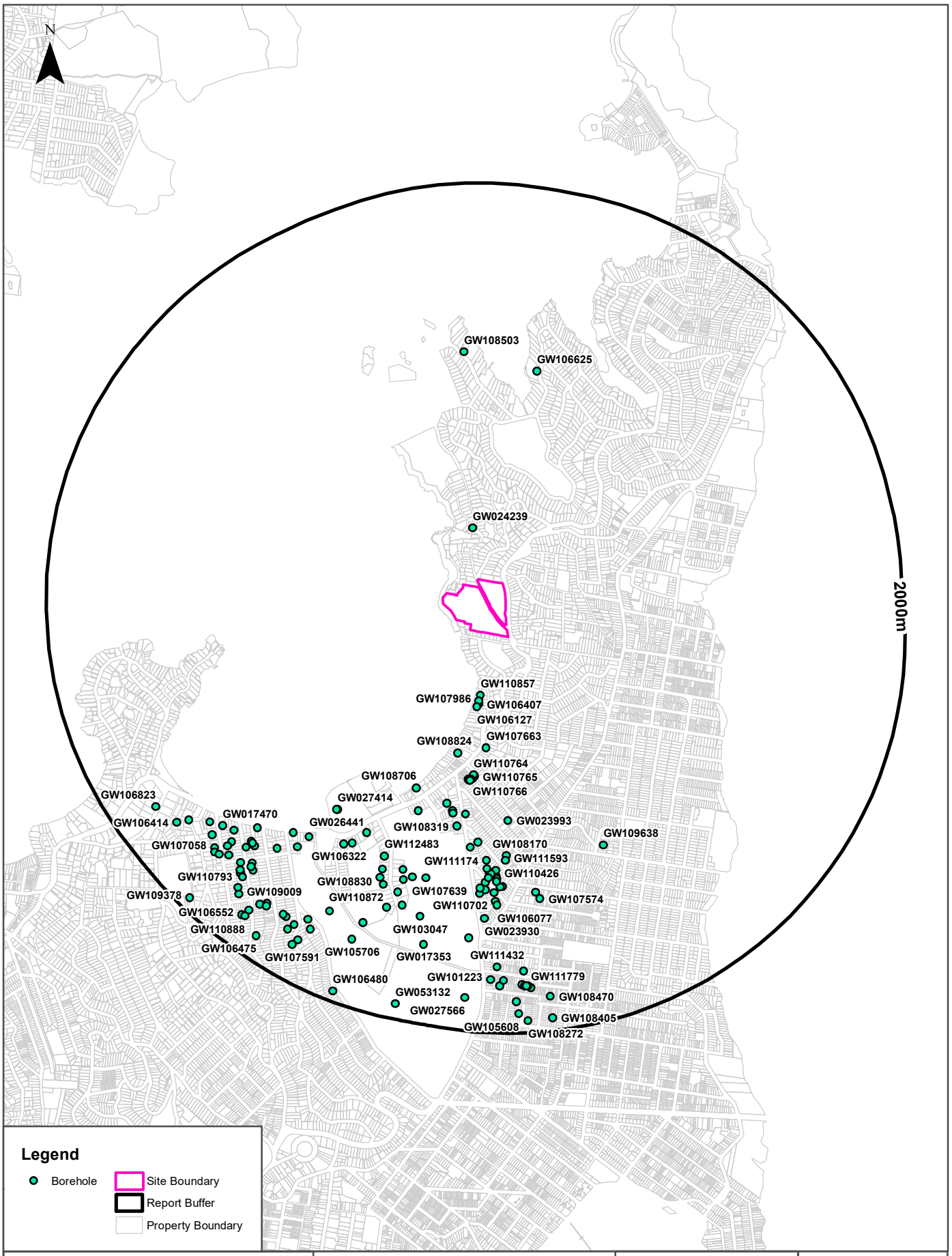
Groundwater management zones relating to the Botany Sand Beds aquifer within the dataset buffer:

Management Zone No.	Restriction	Distance	Direction
N/A	No records in buffer		

Botany Groundwater Management Zones Data Source : NSW Department of Primary Industries

Groundwater Boreholes

Corner New South Head Road, Rose Bay, NSW 2030



Hydrogeology & Groundwater

Corner New South Head Road, Rose Bay, NSW 2030

Groundwater Boreholes

Boreholes within the dataset buffer:

GW No.	Licence No	Work Type	Owner Type	Authorised Purpose	Intended Purpose	Name	Complete Date	Final Depth (m)	Drilled Depth (m)	Salinity (mg/L)	SWL (m)	Yield (L/s)	Elev (AHD)	Dist	Dir
GW024239	10BL018780, 10WA108139	Well	Private	Domestic	General Use			8.50						260m	North
GW110857	10BL602606, 10WA109260	Spear	Private	Domestic	Domestic		05/05/2009	4.00	4.00	Good	2.00	0.500		316m	South
GW107986	10BL600147, 10WA109053	Spear	Private	Domestic	Domestic		28/03/2006	3.66	3.66		1.83	1.000		346m	South
GW106407	10BL163517, 10WA108751	Spear	Private	Domestic	Domestic		20/09/2004	4.00	4.00		2.00	0.500		362m	South
GW106127	10BL162226, 10WA108585	Spear	Private	Domestic	Domestic		18/03/2004	4.00	4.00		2.00	0.500		375m	South
GW107663	10BL165825, 10WA109023	Spear	Private	Domestic	Domestic		12/12/2005	11.59	11.59	Good	7.63	1.000		571m	South
GW108824	10BL165640, 10WA109006	Spear	Private	Domestic	Domestic		27/03/2007	6.10	6.10	Good	2.75	1.000		622m	South
GW110764	10BL165807	Well	Private	Monitoring Bore	Monitoring Bore		01/01/2005	6.00			3.00	0.300		718m	South
GW110765	10BL165807	Well	Private	Monitoring Bore	Monitoring Bore		01/01/2005	6.00			3.00	0.300		723m	South
GW110766	10BL165807	Well	Private	Monitoring Bore	Monitoring Bore		01/01/2005	6.00			3.00	0.300		734m	South
GW110767	10BL165807	Well	Private	Monitoring Bore	Monitoring Bore		01/01/2005	6.00			3.00	0.300		741m	South
GW110770	10BL165807	Well	Private	Monitoring Bore	Monitoring Bore		01/01/2005	6.00			3.00	0.300		744m	South
GW110768	10BL165807	Well	Private	Monitoring Bore	Monitoring Bore		01/01/2005	6.00			3.00	0.300		747m	South
GW110769	10BL165807	Well	Private	Monitoring Bore	Monitoring Bore		01/01/2005	6.00			3.00	0.300		749m	South
GW108706	10BL601561, 10WA107647	Spear	Private	Domestic	Domestic		21/05/2007	4.00	4.00	Good	2.00	0.500		842m	South
GW016957	10BL007937, 10WA107449	Spear	Private	Domestic	General Use			6.70		Good				882m	South
GW109090	10BL162378, 10WA107501	Spear	Private	Domestic	Domestic		22/07/2008	6.10		Good	3.05			914m	South
GW109047	10BL602233, 10WA107666	Spear	Private	Domestic	Domestic		15/07/2008	12.00						919m	South

GW No.	Licence No	Work Type	Owner Type	Authorised Purpose	Intended Purpose	Name	Complete Date	Final Depth (m)	Drilled Depth (m)	Salinity (mg/L)	SWL (m)	Yield (L/s)	Elev (AHD)	Dist	Dir
GW107451	10BL163537, 10WA107534	Spear	Private	Domestic	Domestic		08/03/2005	6.10	6.10		3.50	1.000		926m	South
GW023993	10BL017470, 10WA107457	Spear	Private	Domestic	General Use		01/03/1966	6.00	6.10	Good				928m	South
GW101708	10BL158911, 10WA107487	Bore		Domestic	Irrigation		01/02/1999	6.00	6.00		2.00	0.500		949m	South
GW108319	10BL165712, 10WA107585	Spear	Private	Domestic	Domestic		25/11/2005	6.00	6.60		4.00	1.000		986m	South
GW107848	10BL600009, 10WA107597	Spear	Private	Domestic	Domestic		20/03/2006	9.50	9.50					1047m	South
GW107343	10BL165357, 10WA107576	Spear	Private	Domestic	Domestic		15/08/2005	9.50	9.50					1080m	South
GW106625	10BL163747, 10WA108781	Spear	Private	Domestic	Domestic		28/10/2004	35.00	35.00	220	8.00	3.000		1085m	North
GW108170	10BL600471, 10WA107602	Spear	Private	Domestic	Domestic		05/08/2006	10.50	10.50					1104m	South
GW027414	10BL020157, 10WA107777	Bore	Private	Recreation (groundwater)	Irrigation		01/09/1965	16.30	16.30					1125m	South West
GW026441	10BL018724, 10WA107775	Bore	Local Govt	Recreation (groundwater)	Irrigation		01/07/1966	8.20	8.20	Potable				1128m	South West
GW111593	10BL165350, 10WA107575	Bore	Private	Domestic	Domestic		01/01/2006	9.00	9.00		4.00			1130m	South
GW111174	10BL600559, 10WA107607	Spear	Private	Domestic	Domestic		26/10/2010	12.00	12.00					1133m	South
GW108503	10BL165367, 10WA108976	Bore	Private	Domestic	Domestic		25/01/2007	60.00	60.00	Good	9.20	2.000		1148m	North
GW108435	10BL165449, 10WA107577	Spear	Private	Domestic	Domestic		02/09/2005	5.50	5.50		4.00	1.200		1148m	South West
GW109638	10BL601890, 10WA109212	Spear	Private	Domestic	Domestic		08/10/2008	82.00	82.00	Good	37.40	1.000		1156m	South East
GW109232	10BL601022, 10WA107631	Spear	Private	Domestic	Domestic		19/08/2008	12.00						1176m	South
GW108471	10BL601146, 10WA107634	Spear	Private	Domestic	Domestic		05/02/2007	12.00	12.00					1181m	South
GW106073	10BL163136, 10WA107518	Bore	Private	Domestic	Domestic		20/05/2004	9.46	9.46		7.01	1.000		1193m	South
GW107110	10BL163079, 10WA107517	Spear	Private	Domestic	Domestic		18/05/2004	9.76	9.76	Good	6.71	1.000		1201m	South

GW No.	Licence No	Work Type	Owner Type	Authorised Purpose	Intended Purpose	Name	Complete Date	Final Depth (m)	Drilled Depth (m)	Salinity (mg/L)	SWL (m)	Yield (L/s)	Elev (AHD)	Dist	Dir
GW110426	10BL602999, 10WA107694	Spear	Private	Domestic	Domestic		15/04/2009	13.12	13.12	Good	7.15	1.000		1208m	South
GW112483	10BL603690, 10WA107702	Bore	Private	Domestic	Domestic		01/01/2010	8.00	8.00					1220m	South
GW111591	10BL163179, 10WA107521	Spear	Private	Domestic	Domestic		31/05/2009	10.06	10.07	good	6.71	1.000		1222m	South
GW107316	10BL165293, 10WA107572	Spear	Private	Domestic	Domestic		19/08/2005	10.98	10.98			1.000		1222m	South
GW106322	10BL163399, 10WA107530	Spear	Private	Domestic	Domestic		12/07/2004	6.00	6.00	Good	2.00	0.500		1228m	South West
GW107196	10BL164121, 10WA107542	Spear	Private	Domestic	Domestic		16/05/2005	9.15	9.75		6.41	1.000		1235m	South
GW110723	10BL600711, 10WA107612	Spear	Private	Domestic	Domestic		18/02/2007	15.00	14.03		2.00	2.500		1245m	South
GW111466	10BL604315	Spear	Private	Domestic	Domestic		01/03/2011	4.00	4.00		2.00	0.500		1252m	South West
GW106016	10BL162657, 10WA107507	Bore	Private	Domestic	Domestic		01/06/2005	10.00	10.00					1255m	South
GW111642	10BL600819, 10WA107622	Spear	Private	Domestic	Domestic		16/01/2007	10.00	10.00		10.00			1262m	South
GW108672	10BL601498, 10WA107639	Spear	Private	Domestic	Domestic		29/03/2007	11.00	11.00					1263m	South
GW107639	10BL164282, 10BL164717, 10CA107721	Bore		Irrigation, Recreation (groundwater), Test Bore	Irrigation, Recreation (groundwater)		05/11/2004	23.00	23.00	160	0.90	4.000		1271m	South
GW106800	10BL163348, 10WA107529	Spear	Private	Domestic	Domestic		13/11/2004	10.00	10.00					1276m	South
GW031066	10BL022482, 10WA107462	Spear	Private	Domestic	General Use		01/04/1968	13.50	13.60					1281m	South
GW106003	10BL163212, 10WA107523	Spear	Private	Domestic	Domestic		27/07/2004	10.06	10.07	Good	7.32	1.000		1282m	South
GW107319	10BL163321, 10WA107526	Spear	Private	Domestic	Domestic		20/07/2005	8.54	8.54		5.49	1.000		1285m	South
GW107527	10BL165518, 10WA107579	Spear	Private	Domestic	Domestic		17/10/2005	12.81	12.81	Good	8.85	1.000		1294m	South
GW108917	10BL601756	Spear	Private	Domestic	Domestic		17/06/2008	8.00						1297m	South
GW107353	10BL163329, 10WA107527	Spear	Private	Domestic	Domestic		01/09/2005	9.50	9.50					1303m	South

GW No.	Licence No	Work Type	Owner Type	Authorised Purpose	Intended Purpose	Name	Complete Date	Final Depth (m)	Drilled Depth (m)	Salinity (mg/L)	SWL (m)	Yield (L/s)	Elev (AHD)	Dist	Dir
GW106660	10BL164016, 10WA107540	Spear	Private	Domestic	Domestic		15/11/2004	9.00	9.00					1304m	South
GW107529	10BL163432, 10WA108735	Spear	Private	Domestic	Domestic		17/10/2005	5.80	5.80	Good	2.13	1.000		1320m	South West
GW108830	10BL164483, 10WA107555	Spear	Private	Domestic	Domestic		28/05/2007	7.93	7.93		4.88	1.000		1330m	South
GW107574	10BL165734, 10WA107587	Spear	Private	Domestic	Domestic		20/10/2005	10.00	10.00					1331m	South
GW110702	10BL600712, 10WA107613	Spear	Private	Domestic	Domestic		01/05/2007	12.00			12.00	0.080		1337m	South
GW107877	10BL164828, 10WA108934	Spear	Private	Domestic	Domestic		27/04/2005	6.00	6.00		2.00	0.500		1348m	South West
GW106077	10BL162185, 10WA107496	Spear	Private	Domestic	Domestic		14/06/2004	12.20	12.20	Good	18.23	1.000		1354m	South
GW110872	10BL600609, 10WA107609	Spear	Private	Domestic	Domestic		01/01/2006	8.00			2.00	2.500		1356m	South
GW106123	10BL162317, 10WA107499	Bore	Private	Domestic	Domestic		20/04/2004	17.00	19.80	329	11.40	0.200		1371m	South
GW106321	10BL163398, 10WA108729	Spear	Private	Domestic	Domestic		01/07/2004	4.00	4.00	Good	2.00	0.500		1396m	South West
GW023930	10BL017467, 10WA107456	Spear	Private	Domestic	General Use		01/04/1966	7.60	7.60	Good				1428m	South
GW107453	10BL163405, 10BL604134, 10WA107707	Spear	Private	Domestic	Domestic		18/10/2010	26.00	26.00	good	8.00	1.000		1428m	South
GW111112	10BL601808, 10WA109208	Spear	Private	Domestic	Domestic		04/03/2010	7.95	7.95	good	1.22	1.000		1448m	South West
GW110667	10BL601301, 10WA109171	Spear	Private	Domestic	Domestic		02/10/2004	6.00	6.00	Good	3.00	0.500		1461m	South West
GW105985	10BL162684, 10WA107509	Spear	Private	Domestic	Domestic		05/03/2004	5.00	5.00					1461m	South
GW103047	10BL141619, 10CA107721	Excavation		Irrigation, Recreation (groundwater)	Irrigation, Recreation (groundwater)									1467m	South
GW107515	10BL163901, 10WA108802	Spear	Private	Domestic	Domestic		13/10/2005	4.00	4.00	Good	2.00	0.500		1520m	South West
GW106583	10BL163902, 10WA108803	Spear	Private	Domestic	Domestic		28/09/2004	6.00	6.00		2.00	0.500		1521m	South West

GW No.	Licence No	Work Type	Owner Type	Authorised Purpose	Intended Purpose	Name	Complete Date	Final Depth (m)	Drilled Depth (m)	Salinity (mg/L)	SWL (m)	Yield (L/s)	Elev (AHD)	Dist	Dir
GW106216	10BL163652, 10WA108768	Spear	Private	Domestic	Domestic		17/08/2004	5.00	5.00			0.500		1527m	South West
GW053131	10BL117113, 10BL118216, 10CA107721	Bore	Private	Irrigation, Recreation (groundwater), Test Bore	Irrigation, Recreation (groundwater)		01/01/1981	18.00	27.50	0-500 ppm				1532m	South
GW106391	10BL163751, 10WA108783	Bore	Private	Domestic	Domestic		11/09/2004	8.50	8.50		3.00	0.500		1542m	South West
GW107874	10BL164580, 10WA108903	Spear	Private	Domestic	Domestic		15/01/2006	6.00	6.00					1559m	South West
GW017470	10BL008915, 10WA108090	Spear	Private	Domestic	General Use			4.50	4.60					1567m	South West
GW108684	10BL600839, 10CA107741	Bore	Private	Irrigation, Recreation (groundwater)	Recreation (groundwater)		12/02/1996	20.00	21.00	Good	3.50	8.000		1571m	South
GW108001	10BL600034, 10BL600602, 10CA107741	Bore		Irrigation, Recreation (groundwater), Test Bore	Irrigation, Recreation (groundwater)		01/03/2006	18.70	18.70	210	1.90	6.500		1586m	South West
GW108008	10BL165080, 10WA108951	Spear	Private	Domestic	Domestic		23/08/2005	7.00	7.00					1590m	South West
GW106866	10BL164094, 10WA108827	Spear	Private	Domestic	Domestic		28/02/2005	5.18	5.19	Good	2.13	1.000		1599m	South West
GW017353	10BL008918	Bore	Private	Not Known	Irrigation		01/04/1959	17.30	17.40	Good				1602m	South
GW111560	10BL600768, 10WA109116	Spear	Private	Domestic	Domestic		20/01/2007	7.00	7.00					1606m	South West
GW105645	10BL162625, 10WA108638	Bore		Domestic			22/03/2005							1617m	South West
GW107180	10BL165190, 10WA108959	Spear	Private	Domestic	Domestic		10/06/2005	8.00	8.00		3.00	0.500		1622m	South West
GW107860	10BL600080, 10WA109049	Bore		Domestic			19/02/2007							1626m	South West
GW106116	10BL162858, 10WA108661	Spear	Private	Domestic	Domestic		24/03/2004	4.00	4.00	Good	2.00	0.500		1636m	South West
GW108960	10BL602207, 10WA109237	Spear	Private	Domestic	Domestic		26/06/2008	5.00						1638m	South West
GW107063	10BL164721, 10WA108918	Spear	Private	Domestic	Domestic		10/01/2005	7.00	7.00		3.00	0.500		1649m	South West
GW110796	10BL601312, 10WA109173	Spear	Private	Domestic	Domestic		12/02/2008	6.00	6.00					1666m	South West

GW No.	Licence No	Work Type	Owner Type	Authorised Purpose	Intended Purpose	Name	Complete Date	Final Depth (m)	Drilled Depth (m)	Salinity (mg/L)	SWL (m)	Yield (L/s)	Elev (AHD)	Dist	Dir
GW111 432	10BL601 954, 10WA10 7659	Spear	Private	Domestic	Domestic		09/04/2011	8.00	8.00					1667m	South
GW105 706	10BL161 707, 10CA10 7741	Bore		Irrigation, Recreation (groundwater)	Irrigation, Recreation (groundwater)		12/02/1996	20.00	21.00	Good	3.50	8.000		1669m	South
GW111 116	10BL600 175, 10WA10 9055	Bore	Private	Domestic	Domestic		27/04/2006	11.00	11.00		6.50			1673m	South West
GW107 058	10BL164 827, 10WA10 8933	Spear	Private	Domestic	Domestic		25/02/2005	7.00	7.00	385	3.00	1.000		1674m	South West
GW110 793	10BL601 230, 10WA10 9162	Spear	Private	Domestic	Domestic		15/02/2008	6.00	6.00					1676m	South West
GW107 613	10BL164 350, 10WA10 8867	Spear	Private	Domestic	Domestic		10/01/2005	7.00	7.00	387	3.00	0.500		1680m	South West
GW105 955	10BL163 323, 10WA10 8716	Bore		Domestic			23/05/2005							1682m	South West
GW111 564	10BL600 949, 10WA10 9132	Spear	Private	Domestic	Domestic		05/12/2008	5.00	5.00		3.00	0.500		1686m	South West
GW101 057	10BL158 140, 10WA10 7474	Spear	Private	Domestic	Domestic		08/09/1997	6.00	6.00			1.000		1688m	South
GW106 478	10BL164 255, 10WA10 8853	Spear	Private	Domestic	Domestic		26/10/2004	6.00	6.00					1688m	South West
GW111 597	10BL165 353, 10WA10 8973	Spear	Private	Domestic	Domestic		01/01/2005	7.00	7.00		4.50			1710m	South West
GW108 477	10BL601 191, 10WA10 9158	Spear	Private	Domestic	Domestic		07/02/2007	8.00	8.00					1715m	South West
GW113 011	10BL164 383, 10WA10 8875	Spear	Private	Domestic	Domestic		02/07/2007	8.00	8.00					1716m	South West
GW111 312	10BL601 913, 10WA10 9213	Spear	Private	Domestic	Domestic		01/06/2007	8.00	8.00					1719m	South West
GW108 790	10BL601 689, 10WA10 9201	Spear	Private	Domestic	Domestic		12/06/2007	8.00	8.00					1730m	South West
GW101 223	10BL158 319, 10WA10 7475	Bore	Private	Domestic	Domestic		17/12/1997	10.67	10.67	Good	7.62	1.000		1732m	South
GW108 823	10BL165 669, 10WA10 9009	Spear	Private	Domestic	Domestic		17/01/2007	11.50	11.50	Good		1.000		1732m	South West
GW107 586	10BL165 692, 10WA10 7581	Spear	Private	Domestic	Domestic		12/11/2005	7.20	7.20	175	3.70	0.500		1736m	South

GW No.	Licence No	Work Type	Owner Type	Authorised Purpose	Intended Purpose	Name	Complete Date	Final Depth (m)	Drilled Depth (m)	Salinity (mg/L)	SWL (m)	Yield (L/s)	Elev (AHD)	Dist	Dir
GW106414	10BL163189, 10BL601496, 10WA109188	Bore		Domestic	Domestic		31/08/2005	40.00	40.00	Good	22.00	0.150		1738m	South West
GW106462	10BL162253, 10WA108589	Spear	Private	Domestic	Domestic		12/11/2004	6.00	6.00	Good	4.00	0.500		1741m	South West
GW108946	10BL601953, 10WA109215	Spear	Private	Domestic	Domestic		19/06/2008	8.00						1742m	South West
GW107382	10BL164870, 10WA107562	Spear	Private	Domestic	Domestic		09/08/2005	8.54	8.54	Good	4.58	1.000		1756m	South
GW111310	10BL600468, 10WA107601	Spear	Private	Domestic	Domestic		09/02/2011	8.00	8.00					1761m	South
GW111274	10BL600578, 10WA107608	Spear	Private	Domestic	Domestic		02/12/2006	6.00	6.00	good	4.00	0.500		1764m	South
GW107758	10BL165838, 10WA107590	Spear	Private	Domestic	Domestic		09/01/2006	6.00	6.00	Good	4.00	0.500		1764m	South
GW107017	10BL165001, 10WA107565	Spear	Private	Domestic	Domestic		29/03/2005	6.00	6.00	Good	3.00	0.500		1765m	South
GW109009	10BL601783, 10WA109207	Spear	Private	Domestic	Domestic		09/07/2008	7.32		Good	4.38	1.000		1765m	South West
GW111455	10BL601644, 10WA109197	Spear	Private	Domestic	Domestic		09/04/2011	10.00	10.00					1766m	South West
GW106823	10BL163514, 10BL163515, 10WA109435	Bore		Recreation (groundwater), Test Bore	Recreation (groundwater)		07/02/2004	102.50	102.50	181	16.00	1.250		1773m	South West
GW111779	10BL165894, 10WA107593	Spear	Private	Domestic	Domestic		14/12/2005	7.00	7.00	good	5.00	0.500		1775m	South
GW107671	10BL164145, 10WA108837	Spear	Private	Domestic	Domestic		01/09/2005	9.50	9.50					1790m	South West
GW106835	10BL164715, 10WA108917	Spear	Private	Domestic	Domestic		18/02/2005	6.00	6.00	Good	3.00	0.500		1798m	South West
GW107591	10BL165652, 10WA109007	Spear	Private	Domestic	Domestic		01/11/2005	10.00	10.00					1822m	South West
GW108470	10BL601122, 10WA107632	Spear	Private	Domestic	Domestic		03/02/2007	12.00	12.00					1827m	South
GW110888	10BL601618, 10WA109194	Spear	Private	Domestic	Domestic		01/01/2007	9.00			2.00	2.500		1833m	South West
GW027566	10BL105734, 10CA107721	Bore	Private	Irrigation, Recreation (groundwater)	Irrigation		01/07/1965	23.80	25.30	Good				1834m	South

GW No.	Licence No	Work Type	Owner Type	Authorised Purpose	Intended Purpose	Name	Complete Date	Final Depth (m)	Drilled Depth (m)	Salinity (mg/L)	SWL (m)	Yield (L/s)	Elev (AHD)	Dist	Dir
GW106552	10BL163895, 10WA108799	Spear	Private	Domestic	Domestic		22/11/2004	7.50	7.50	Good	6.00	0.500		1837m	South West
GW106734	10BL164220, 10WA107546	Spear	Private	Domestic	Domestic		23/11/2004	4.00	4.00	Good	2.00	0.500		1840m	South
GW106475	10BL164115, 10WA108831	Bore	Private	Domestic	Domestic		14/10/2004	20.00	20.00					1882m	South West
GW105608	10BL162123, 10WA107495	Bore	Private	Domestic	Domestic		15/11/2003	6.00	6.00					1904m	South
GW053132	10BL117114, 10BL118497, 10CA107721	Bore	Private	Irrigation, Recreation (groundwater), Test Bore	G/water Xplore		01/01/1981	18.00	25.00	0-500 ppm				1923m	South
GW108405	10BL600705, 10WA107611	Spear	Private	Domestic	Domestic		28/11/2006	8.00	8.00					1935m	South
GW109378	10BL165173, 10BL602616, 10WA109549	Bore	Private	Recreation (groundwater), Test Bore	Recreation (groundwater)		02/10/2008	150.00	150.00	223	68.00	0.300		1940m	South West
GW108272	10BL600289, 10WA107600	Spear	Private	Domestic	Domestic		08/10/2006	8.00	8.00					1940m	South
GW106480	10BL164194, 10WA107544	Spear	Private	Stock	Stock		21/10/2004	4.00	4.00		2.00	0.500		1948m	South

Hydrogeology & Groundwater

Corner New South Head Road, Rose Bay, NSW 2030

Driller's Logs

Drill log data relevant to the boreholes within the dataset buffer:

Groundwater No	Drillers Log	Distance	Direction
GW110857	0.00m-0.30m TOPSOIL 0.30m-2.50m SAND BROWN 2.50m-4.00m SAND YELLOW	316m	South
GW107986	0.00m-3.66m sand	346m	South
GW106407	0.00m-0.30m topsoil 0.30m-3.50m sand, yellow 3.50m-4.00m sand, grey	362m	South
GW106127	0.00m-0.40m topsoil 0.40m-3.30m sand, dark brown 3.30m-4.00m sand, grey silty	375m	South
GW107663	0.00m-11.59m Sand, unconsolidated	571m	South
GW108824	0.00m-6.10m sand	622m	South
GW108706	0.00m-0.30m topsoil 0.30m-3.00m sand, yellow 3.00m-4.00m sand, brown	842m	South
GW107451	0.00m-6.10m sand	926m	South
GW023993	0.00m-0.91m Sand Grey 0.91m-1.52m Sand White 1.52m-2.13m Sand Hard Cemented 2.13m-3.65m Sand 3.65m-6.09m Sand Yellow Water Supply	928m	South
GW101708	0.00m-0.50m Topsoil, Fill, Rocks 0.50m-6.00m Light Brown Sand	949m	South
GW108319	0.00m-6.60m sand	986m	South
GW107848	0.00m-9.50m sand	1047m	South
GW107343	0.00m-9.50m sand	1080m	South
GW106625	0.00m-0.30m BLACK CLAY 0.30m-10.00m WEATHERED YELLOW SANDSTONE 10.00m-35.00m YELLOW/WHITE/RED SANDSDTONE	1085m	North
GW108170	0.00m-10.50m sand	1104m	South
GW027414	0.00m-0.30m Made Ground 0.30m-0.60m Sand White Silty 0.60m-1.92m Peat Black Sandy 1.92m-2.68m Sand White 2.68m-6.24m Sand 6.24m-6.40m Clay Grey Sandy 6.40m-14.93m Sand White Water Supply 14.93m-16.30m Sand White Water Supply Clay Bands	1125m	South West
GW026441	0.00m-0.10m Made Ground 0.10m-2.43m Sand Fossils:shell Fragments 2.43m-2.74m Peat 2.74m-3.65m Sand Fossils:shell Fragments 3.65m-4.57m Sand Silt Fossils:shell Fragments Water Supply 4.57m-8.22m Sand Grey Wet Fossils:shell Fragments Water Supply	1128m	South West
GW111174	0.00m-12.00m SAND	1133m	South

Groundwater No	Drillers Log	Distance	Direction
GW108435	0.00m-5.50m Sand, unconsolidated	1148m	South West
GW108503	0.00m-1.00m Soil, black, garden 1.00m-3.00m Sandy Clay, grey 3.00m-31.00m Sandstone, white yellow 31.00m-60.00m Sandstone, white	1148m	North
GW109638	0.00m-1.00m TOPSOIL 1.00m-82.00m WHITE SANDSTONE	1156m	South East
GW108471	0.00m-12.00m sand	1181m	South
GW106073	0.00m-9.46m sand, unconsolidated	1193m	South
GW107110	0.00m-9.76m Sand, unconsolidated	1201m	South
GW110426	0.00m-13.12m UNCONSOLIDATED ALL SANDS	1208m	South
GW107316	0.00m-10.98m Sand, unconsolidated	1222m	South
GW111591	0.00m-10.06m UNCONSOLIDATED ALL SANDS	1222m	South
GW106322	0.00m-0.30m topsoil 0.30m-3.00m sand, yellow 3.00m-6.00m sand, brown silty	1228m	South West
GW107196	0.00m-9.75m sand	1235m	South
GW110723	0.00m-14.03m UNCONSOLIDATE ALL SAND	1245m	South
GW111466	0.00m-0.30m TOPSOIL 0.30m-4.00m SAND WHITE	1252m	South West
GW106016	0.00m-10.00m sand	1255m	South
GW108672	0.00m-11.00m sand	1263m	South
GW107639	0.00m-0.20m TOPSOIL 0.20m-0.40m PEAT LAYER 0.40m-1.20m GREY SAND 1.20m-4.50m WHITE SAND 4.50m-6.20m BROWN SAND 6.20m-8.70m YELLOW SAND 8.70m-13.50m BROWN SILTY SAND 13.50m-17.40m WHITE SAND 17.40m-18.20m BROWN PEAT 18.20m-22.60m BROWN SILTY SAND 22.60m-23.00m GREY SANDSTONE	1271m	South
GW106800	0.00m-10.00m sand	1276m	South
GW031066	0.00m-3.35m Made Ground 3.35m-4.87m Sand Peaty Moist 4.87m-7.46m Sand Peaty Wet 7.46m-10.66m Sand Grey Water Supply 10.66m-12.49m Sand Yellow Water Supply 12.49m-13.56m Sand Grey Clay Seams Water Supply	1281m	South
GW106003	0.00m-10.06m sand, unconsolidated	1282m	South
GW107319	0.00m-8.54m Sand, unconsolidated	1285m	South
GW107527	0.00m-12.81m Sand, unconsolidated	1294m	South
GW107353	0.00m-9.50m SAND	1303m	South
GW106660	0.00m-9.00m sand	1304m	South
GW107529	0.00m-5.79m Sand, unconsolidated	1320m	South West
GW108830	0.00m-7.93m sand	1330m	South
GW107574	0.00m-10.00m sand	1331m	South

Groundwater No	Drillers Log	Distance	Direction
GW107877	0.00m-0.30m topsoil 0.30m-2.40m sand, yellow 2.40m-6.00m sand, brown	1348m	South West
GW106077	0.00m-12.20m sand, uconsolidated	1354m	South
GW106123	0.00m-0.50m fill, concrete 0.50m-17.00m sand 17.00m-19.80m silty sand & small clay bands	1371m	South
GW106321	0.00m-0.30m topsoil 0.30m-2.50m sand, yellow 2.50m-4.00m sand, brown	1396m	South West
GW023930	0.00m-0.60m Stones 0.60m-3.50m Sand Hard Cemented 3.50m-7.62m Sand Yellow Water Supply	1428m	South
GW107453	0.00m-12.20m YELLOW SAND 12.20m-16.30m WHITE SAND 16.30m-18.50m GREY SAND 18.50m-18.70m BLACK PEAT 18.70m-21.30m BROWN SAND 21.30m-21.50m BLACK PEAT 21.50m-26.00m WHITE SAND	1428m	South
GW111112	0.00m-7.95m UNCONSOLIDATED ALL SAND	1448m	South West
GW105985	0.00m-5.00m sand	1461m	South
GW110667	0.00m-0.30m TOPSOIL 0.30m-2.50m SAND YELLOW 2.50m-4.30m SAND BROWN SILTY 4.30m-6.00m SAND GREY	1461m	South West
GW107515	0.00m-0.50m topsoil 0.50m-2.50m sand, yellow 2.50m-4.00m sand, grey	1520m	South West
GW106583	0.00m-0.30m tospoil 0.30m-4.20m sand, brown silty 4.20m-6.00m sand, light brown	1521m	South West
GW106216	0.00m-0.30m topsoil 0.30m-2.20m sand, brown 2.20m-5.00m sand, dark yellow	1527m	South West
GW053131	0.00m-2.43m Sand Peaty Water Supply 2.43m-3.00m Sand Grey Water Supply 3.00m-9.10m Sand Peat Water Supply 9.10m-14.30m Sand Water Supply 14.30m-14.60m Clay Sand Water Supply 14.30m-14.60m Peat Water Supply 14.60m-20.10m Peat Sand Water Supply 20.10m-25.90m Clay Sand 20.10m-25.90m Peat 25.90m-27.50m Sand Claybound	1532m	South
GW106391	0.00m-8.50m sand	1542m	South West
GW107874	0.00m-6.00m sand	1559m	South West
GW017470	0.00m-4.57m Sand	1567m	South West
GW108684	0.00m-0.20m BROWN SANDY TOPSOIL 0.20m-1.10m YELLOW SAND WITH SHELLS 1.10m-3.00m BROWN PEAT 3.00m-5.50m LIGHT BROWN SAND 5.50m-8.50m GREY SILTY SAND 8.50m-10.50m DARK GREY SAND,PEAT 10.50m-11.50m LIGHT BROWN SILTY SAND 11.50m-13.00m WHITE SAND 13.00m-16.00m SILTY YELLOW SAND 16.00m-19.50m WHITE SILTY SAND 19.50m-20.50m WHITE SAND WITH CLAY 20.50m-21.00m WHITE SANDSTONE	1571m	South

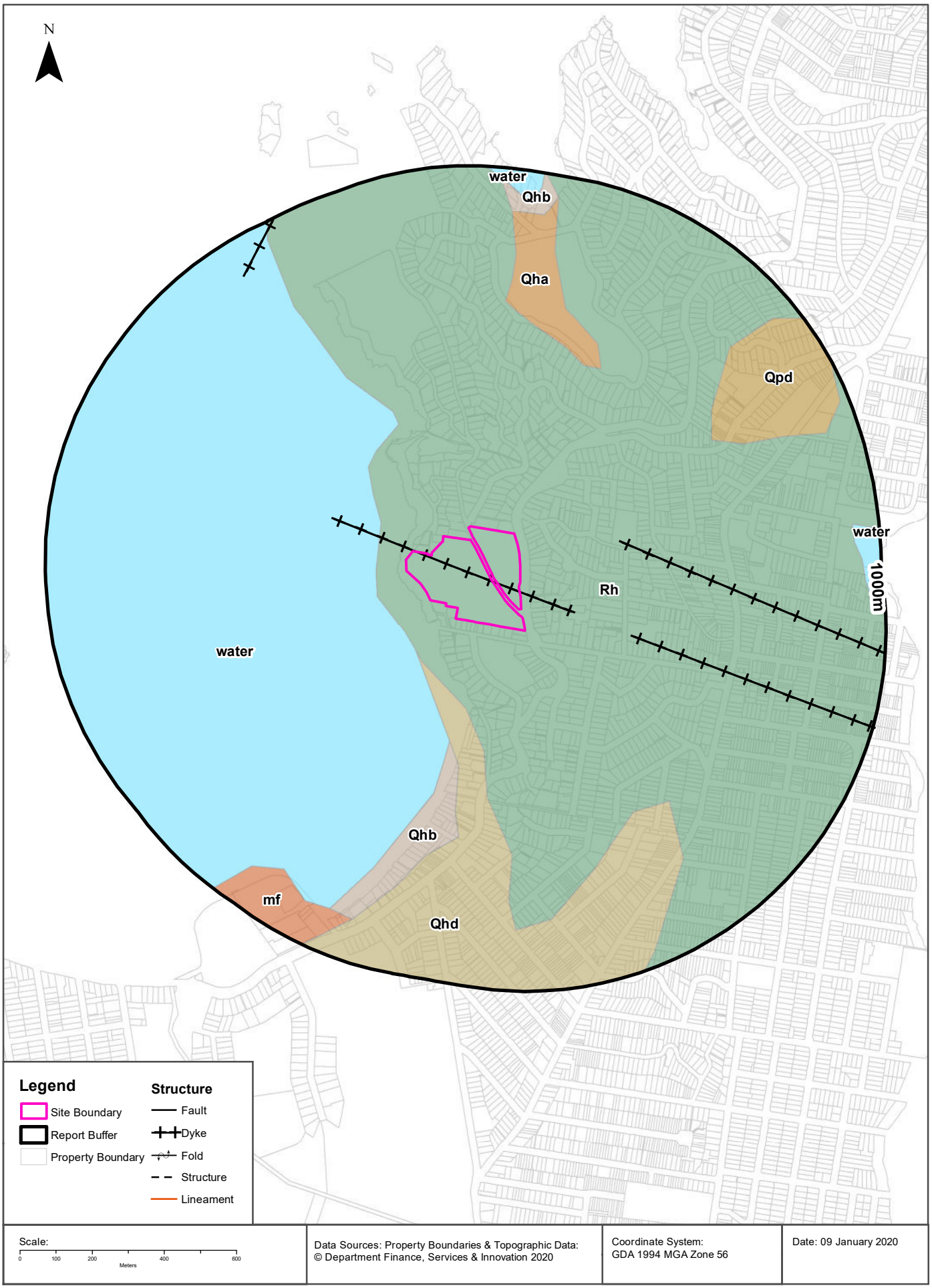
Groundwater No	Drillers Log	Distance	Direction
GW108001	0.00m-0.70m BRICKS AND FILL AND SAND 0.70m-0.80m GREY SAND 0.80m-2.90m HEAVY BLACK PEAT 2.90m-10.00m LIGHT GREY SAND 10.00m-12.00m SAND WITH SMALL PEAT BANDS 12.00m-13.50m LIGHT GREY SAND 13.50m-16.00m SAND WITH PEAT BANDS 16.00m-18.70m LIGHT GREY SAND	1586m	South West
GW108008	0.00m-7.00m sand	1590m	South West
GW106866	0.00m-5.18m Sand, unconsolidated	1599m	South West
GW017353	0.00m-0.60m Peat 0.60m-2.43m Sand White 2.43m-6.40m Peat 2.43m-6.40m Sand White 6.40m-7.62m Sand White Water Supply 7.62m-9.14m Sand Water Supply 9.14m-10.97m Peat Sand Water Supply 10.97m-12.49m Sand White Water Supply 12.49m-17.37m Peat Sand Water Supply	1602m	South
GW111560	0.00m-7.00m ALL SAND	1606m	South West
GW107180	0.00m-8.00m sand	1622m	South West
GW106116	0.00m-0.30m topsoil 0.30m-2.50m sand, brown 2.50m-4.00m sand, yellow	1636m	South West
GW110796	0.00m-6.00m ALL SAND	1666m	South West
GW111432	0.00m-8.00m SAND	1667m	South
GW105706	0.00m-0.20m BROWN SANDY TOP SOIL 0.20m-1.10m YELLOW SAND WITH SHELLS 1.10m-3.00m BROWN CLAY 3.00m-5.50m LIGHT BROWN SAND 5.50m-8.50m GREY SILTY SAND 8.50m-10.50m DARK GREY SAND 10.50m-11.50m LIGHT BROWN SILTY SAND 11.50m-13.00m WHITE SAND 13.00m-16.00m SILTY YELLOW SAND 16.00m-19.50m WHITE SILTY SAND 19.50m-20.50m WHITE SAND WITH CLAY 20.50m-21.00m WHITE SANDSTONE	1669m	South
GW111116	0.00m-11.00m CONSOLIDATED SANDS	1673m	South West
GW110793	0.00m-6.00m ALL SAND	1676m	South West
GW107613	0.00m-7.00m sand	1680m	South West
GW101057	0.00m-6.00m UNCONSOLIDATED. ALL SAND	1688m	South
GW106478	0.00m-6.00m sand	1688m	South West
GW111597	0.00m-6.00m SAND GREY,NO ODOUR,CLEAN WATER	1710m	South West
GW108477	0.00m-8.00m Sand	1715m	South West
GW113011	0.00m-8.00m SAND	1716m	South West
GW108790	0.00m-8.00m sand	1730m	South West
GW101223	0.00m-10.67m Unconsolidated - all sand.	1732m	South
GW108823	0.00m-11.50m sand	1732m	South West
GW107586	0.00m-7.20m sand	1736m	South
GW106462	0.00m-0.30m topsoil 0.30m-3.20m sand, yellow 3.20m-4.50m sand, grey 4.50m-6.00m sand, orange	1741m	South West

Groundwater No	Drillers Log	Distance	Direction
GW107382	0.00m-5.54m Sand, unconsolidated	1756m	South
GW111310	0.00m-8.00m SAND	1761m	South
GW107758	0.00m-0.30m topsoil 0.30m-2.50m sand, brown 2.50m-5.00m sand, yellow 5.00m-6.00m sand, grey	1764m	South
GW111274	0.00m-0.30m FILL 0.30m-3.30m SAND YELLOW 3.30m-6.00m SAND BROWN	1764m	South
GW107017	0.00m-0.30m topsoil 0.30m-3.50m sand, brown 3.50m-5.00m sand, silty brown 5.00m-6.00m sand, grey	1765m	South
GW106823	0.00m-16.00m SAND 16.00m-16.20m SANDSTONE SOFT 16.20m-16.50m IRONSTONE 16.50m-21.00m SANDSTONE/IRONSTONE BANDS 21.00m-21.50m CLAY WHITE 21.50m-25.00m SANDSTONE,IRONSTONE,QUARTZ 25.00m-31.00m SANDSTONE L/BROWN 31.00m-40.00m SANDSTONE L/GREY 40.00m-40.50m SANDSTONE,QUARTZ 40.50m-49.00m SANDSTONE GREY 49.00m-50.00m SANDSTONE , QUARTZ 50.00m-52.00m SANDSTONE GREY 52.00m-56.00m SANDSTONE, QUARTZ 56.00m-61.50m SANDSTONE GREY 61.50m-68.50m SANDSTONE/QUARTZ BANDS 68.50m-69.50m SANDSTONE,QUARTZ 69.50m-70.00m SILTSTONE 70.00m-70.50m SANDSTONE FRACTURED SOFT 70.50m-71.50m SANDSTONE GREY 71.50m-72.50m SILTSTONE 72.50m-81.00m SANDSTONE , QUARTZ BANDS 81.00m-93.50m SANDSTONE GREY 93.50m-94.00m SANDSTONE,QUARTZ SOFT 94.00m-102.50m SANDSTONE GREY	1773m	South West
GW111779	0.00m-0.30m TOPSOIL 0.30m-5.00m YELLOW SAND 5.00m-7.00m BROWN SAND	1775m	South
GW107671	0.00m-9.50m sand	1790m	South West
GW106835	0.00m-0.30m Topsoil 0.30m-3.20m Sand, light brown 3.20m-4.50m Sand, yellow 4.50m-6.00m Sand, coarse, yellow, with orange silty water	1798m	South West
GW107591	0.00m-10.00m sand	1822m	South West
GW108470	0.00m-12.00m sand	1827m	South
GW027566	0.00m-0.30m Sand Greyish Dry 0.30m-1.82m Sand Dark Brown Moist 1.82m-3.04m Sand Greyish Some Clean Water Supply 3.04m-4.87m Sand Peaty 4.87m-5.18m Sand Grey Slightly Peaty Water Supply 5.18m-5.79m Sand Grey Peat Bands 5.79m-6.40m Peat 6.40m-10.66m Sand Peaty Water Supply 10.66m-11.27m Sand Peat Bands 11.27m-14.02m Sand Slightly Peaty Water Supply 14.02m-16.76m Sand Peaty Water Supply 16.76m-17.06m Peat 17.06m-18.89m Sand Peaty Water Supply 18.89m-19.20m Peat 19.20m-19.50m Sand Peaty Water Supply 19.50m-19.81m Peat 19.81m-21.64m Sand Slightly Peaty Water Supply 21.64m-23.62m Sand Very Dirty Peaty Water Supply 23.62m-23.92m Clay Grey 23.92m-24.99m Sand Light Brown Slightly Clayey Quartz Gravel Some Water Supply 24.99m-25.29m Clay Grey	1834m	South
GW106552	0.00m-0.30m topsoil 0.30m-4.30m sand, yellow 4.30m-6.00m sand, brown 6.00m-7.50m sand, yellow silty	1837m	South West

Groundwater No	Drillers Log	Distance	Direction
GW106734	0.00m-0.30m topsoil 0.30m-1.50m sand, brown 1.50m-4.00m sand, whtie	1840m	South
GW106475	0.00m-5.00m sand 5.00m-10.00m clay 10.00m-11.00m sand 11.00m-20.00m clay	1882m	South West
GW105608	0.00m-6.00m sand	1904m	South
GW053132	0.00m-3.00m Peat Sandy 3.00m-6.10m Sand Peat Water Supply 6.10m-9.14m Sand White Water Supply 9.14m-10.60m Sand Peat Water Supply 10.60m-10.97m Peat Water Supply 10.97m-12.20m Sand Water Supply 12.20m-18.30m Sand Peat Water Supply 18.30m-24.40m Peat Sandy Water Supply 24.40m-25.00m Sandstone Water Supply	1923m	South
GW108405	0.00m-8.00m sand	1935m	South
GW108272	0.00m-8.00m sand	1940m	South
GW109378	0.00m-13.00m SANDY CLAY 13.00m-20.00m SANDSTONE WEATHERED 20.00m-21.00m CLAYSTONE 21.00m-44.00m SANDSTONE GREY 44.00m-48.00m SANDSTONE QUARTZ 48.00m-53.00m SANDSTONE CLAY BANDS 53.00m-60.00m SANDSTONE GREY 60.00m-61.00m SANDSTONE CLAY BANDS 61.00m-66.00m SANDSTONE QUARTZ 66.00m-70.00m SANDSTONE GREY 70.00m-71.50m SHALE 71.50m-79.00m SANDSTONE GREY 79.00m-84.00m SANDSTONE QUARTZ 84.00m-86.00m SANDSTONE GREY 86.00m-86.50m SANDSTONE FRACTURED 86.50m-94.50m SANDSTONE GREY 94.50m-100.00m SANDSTONE QUARTZ 100.00m-112.00m SANDSTONE GREY 112.00m-119.00m SANDSTONE QUARTZ 119.00m-126.00m SANDSTONE GREY 126.00m-134.00m SANDSTONE QUARTZ 134.00m-142.00m SANDSTONE GREY 142.00m-142.50m SILTSTONE 142.50m-150.00m SANDSTONE GREY	1940m	South West
GW106480	0.00m-0.30m topsoil 0.30m-2.50m sand, yellow 2.50m-4.00m sand, yellow silty	1948m	South

Geology 1:100,000

Corner New South Head Road, Rose Bay, NSW 2030



Geology

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Geological Units

What are the Geological Units onsite?

Symbol	Description	Unit Name	Group	Sub Group	Age	Dom Lith	Map Sheet	Dataset
Rh	Medium to coarse grained quartz sandstone, very minor shale and laminate lenses				Triassic		Sydney	1:100,000

What are the Geological Units within the dataset buffer?

Symbol	Description	Unit Name	Group	Sub Group	Age	Dom Lith	Map Sheet	Dataset
mf	Man-made fill. Dredged estuarine sand and mud, demolition rubble, industrial and household waste.				Quaternary		Sydney	1:100,000
Qha	Silty to peaty quartz sand, silt, and clay. Ferruginous and humic cementation in places. Common shell layers				Quaternary		Sydney	1:100,000
Qhb	Coarse quartz sand, verying amounts of shell fragment				Quaternary		Sydney	1:100,000
Qhd	Medium to fine-grained marine sand with podsols				Quaternary		Sydney	1:100,000
Qpd	Medium to fine-grained marine sand with podsols				Quaternary		Sydney	1:100,000
Rh	Medium to coarse grained quartz sandstone, very minor shale and laminate lenses				Triassic		Sydney	1:100,000
water							Sydney	1:100,000

Geological Structures

What are the Geological Structures onsite?

Feature	Name	Description	Map Sheet	Dataset
Dyke			Sydney	1:100,000

What are the Geological Structures within the dataset buffer?

Feature	Name	Description	Map Sheet	Dataset
Dyke			Sydney	1:100,000
Dyke			Sydney	1:100,000
Dyke			Sydney	1:100,000
Dyke			Sydney	1:100,000

Naturally Occurring Asbestos Potential

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Naturally Occurring Asbestos Potential

Naturally Occurring Asbestos Potential within the dataset buffer:

Potential	Sym	Strat Name	Group	Formation	Scale	Min Age	Max Age	Rock Type	Dom Lith	Description	Dist	Dir
No records in buffer												

Mining Subsidence District Data Source: © State of New South Wales through NSW Department of Industry, Resources & Energy

Atlas of Australian Soils

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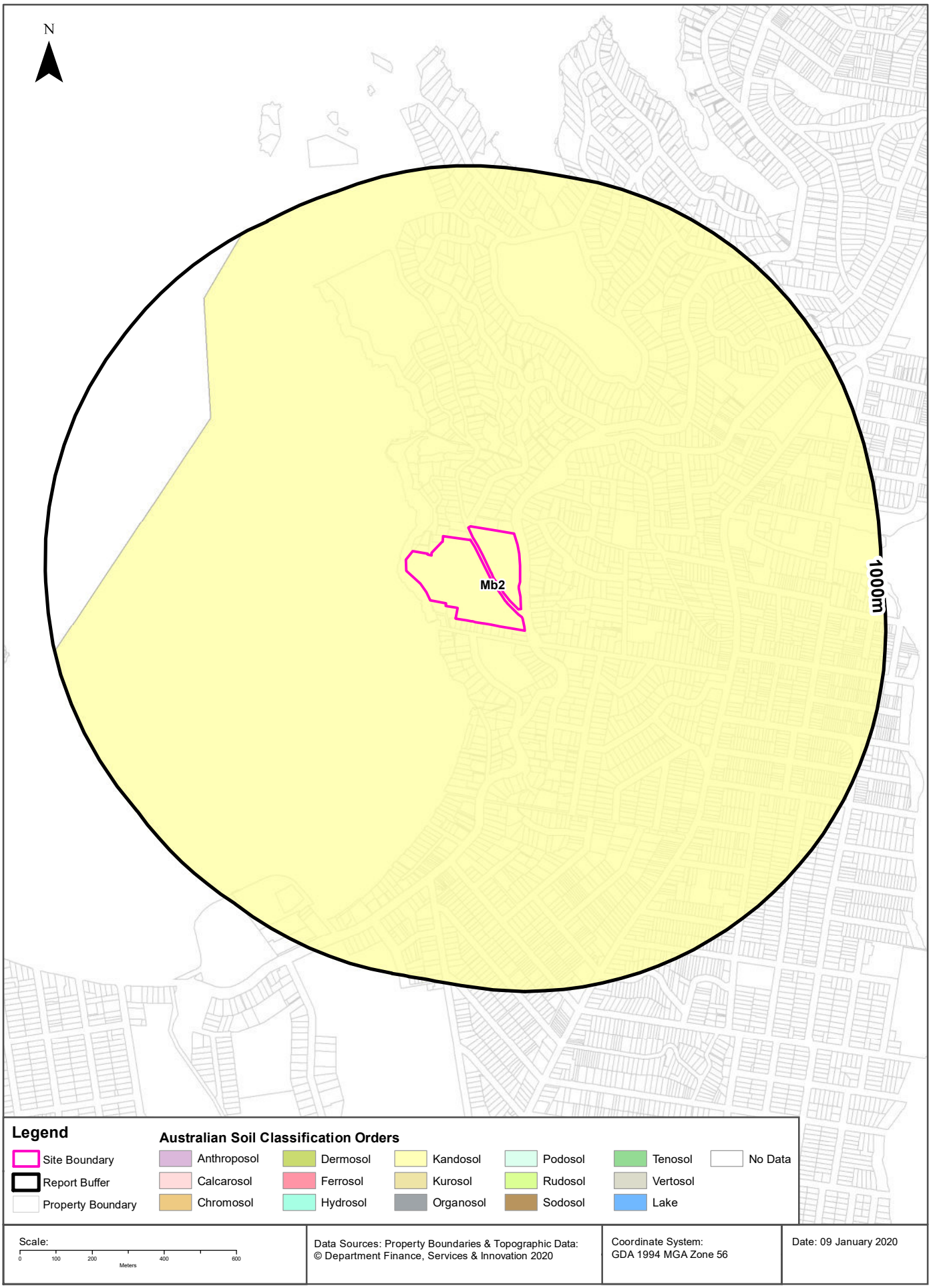

Soils

Corner New South Head Road, Rose Bay, NSW 2030

Atlas of Australian Soils

Soil mapping units and Australian Soil Classification orders within the dataset buffer:

Map Unit Code	Soil Order	Map Unit Description	Distance
Mb2	Kandosol	Dissected sandstone plateau of moderate to strong relief with sandstone pillars, ledges, and slabs-- level to undulating ridges, irregularly benched slopes, steep ridges, cliffs, canyons, narrow sandy valleys: chief soils are (i) on areas of gentle to moderate relief, acid yellow leached earths (Gn2.74) and (Gn2.34) and acid leached yellow earths (Gn2.24)-sometimes these soils contain ironstone gravel; and (ii) on, or adjacent to, areas of strong relief, siliceous sands (Uc1.2), leached sands (Uc2.12) and (Uc2.2), and shallow forms of the above (Gn2) soils. Associated are: (i) on flat to gently undulating remnants of the original plateau surface, leached sands (Uc2.3), siliceous sands (Uc1.2), sandy earths (Uc5.22), and (Gn2) soils as for (i) above (these areas are in part comparable with unit Cb29); (ii) on flat ironstone gravelly remnants of the original plateau surface, (Gn2) soils as for unit Mb5(i); (iii) on gently undulating ridges where interbedded shales are exposed, shallow, often stony (Dy3.41), (Dr2.21), and related soils similar to unit Tb35; (iv) narrow valleys of (Uc2.3) soils flanked by moderate slopes of (Dy3.41) soils; (v) escarpments of steep hills with shallow (Dy) and (Dr) soils between sandstone pillars; and (vi) shallow (Um) soils, such as (Um6.21) on steep hills of basic rocks. As mapped, minor areas of units Mg20, Mm1, and Mw8 are included. Data are limited.	0m

Soil Landscapes

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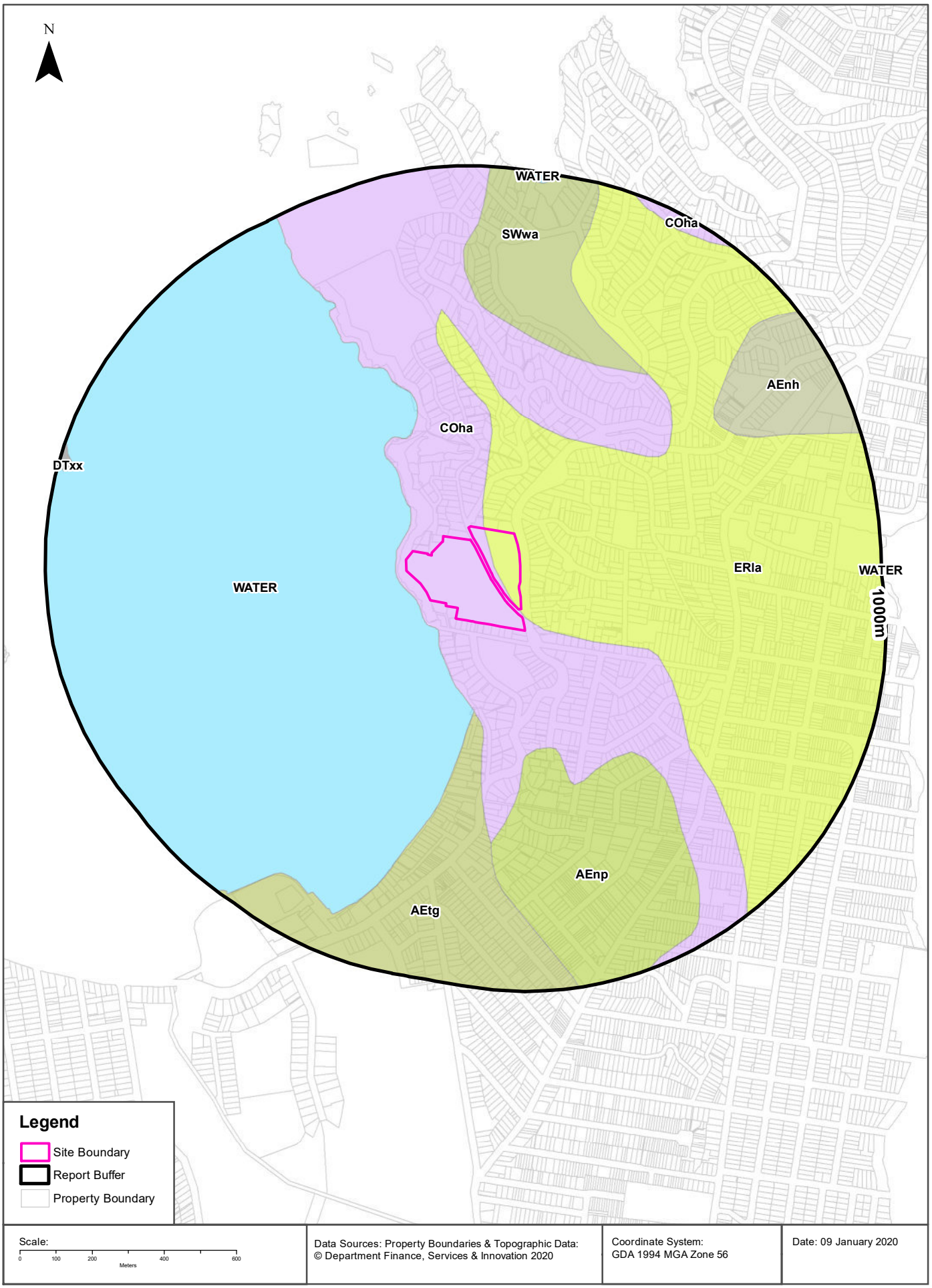

Soils

Corner New South Head Road, Rose Bay, NSW 2030

Soil Landscapes

What are the onsite Soil Landscapes?

Soil Code	Name	Group	Process	Map Sheet	Scale
COha	HAWKESBURY		COLLUVIAL	Sydney	1:100,000
ERla	LAMBERT		EROSIONAL	Sydney	1:100,000

What are the Soil Landscapes within the dataset buffer?

Soil Code	Name	Group	Process	Map Sheet	Scale
AEnh	NORTH HEAD		AEOLIAN	Sydney	1:100,000
AEnp	NEWPORT		AEOLIAN	Sydney	1:100,000
AEtg	TUGGERAH		AEOLIAN	Sydney	1:100,000
COha	HAWKESBURY		COLLUVIAL	Sydney	1:100,000
DTxx	DISTURBED TERRAIN		DISTURBED TERRAIN	Sydney	1:100,000
ERla	LAMBERT		EROSIONAL	Sydney	1:100,000
SWwa	WARRIEWOOD		SWAMP	Sydney	1:100,000
WATER	WATER		WATER	Sydney	1:100,000

Acid Sulfate Soils

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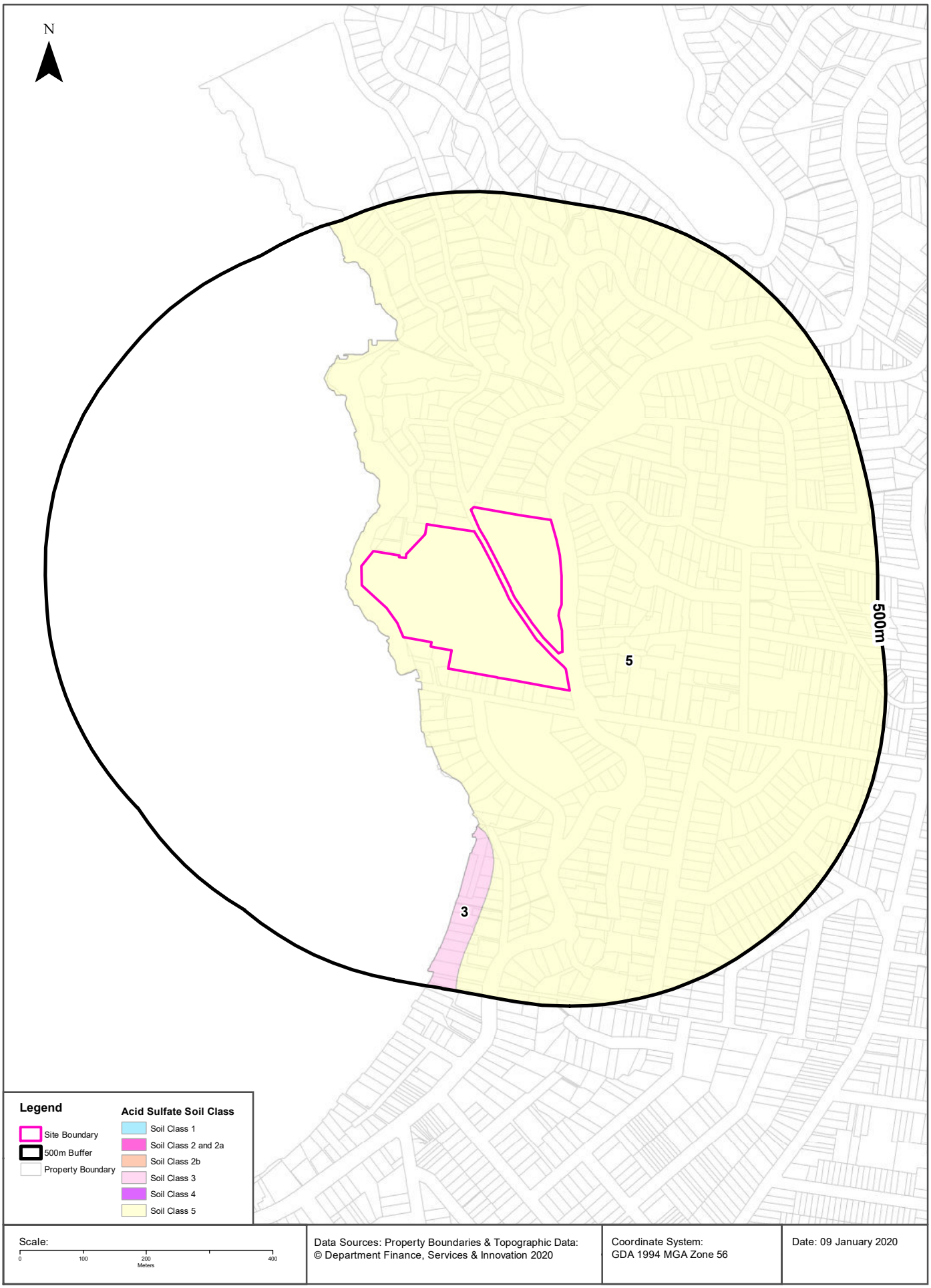


Acid Sulfate Soils

Corner New South Head Road, Rose Bay, NSW 2030

Environmental Planning Instrument - Acid Sulfate Soils

What is the on-site Acid Sulfate Soil Plan Class that presents the largest environmental risk?

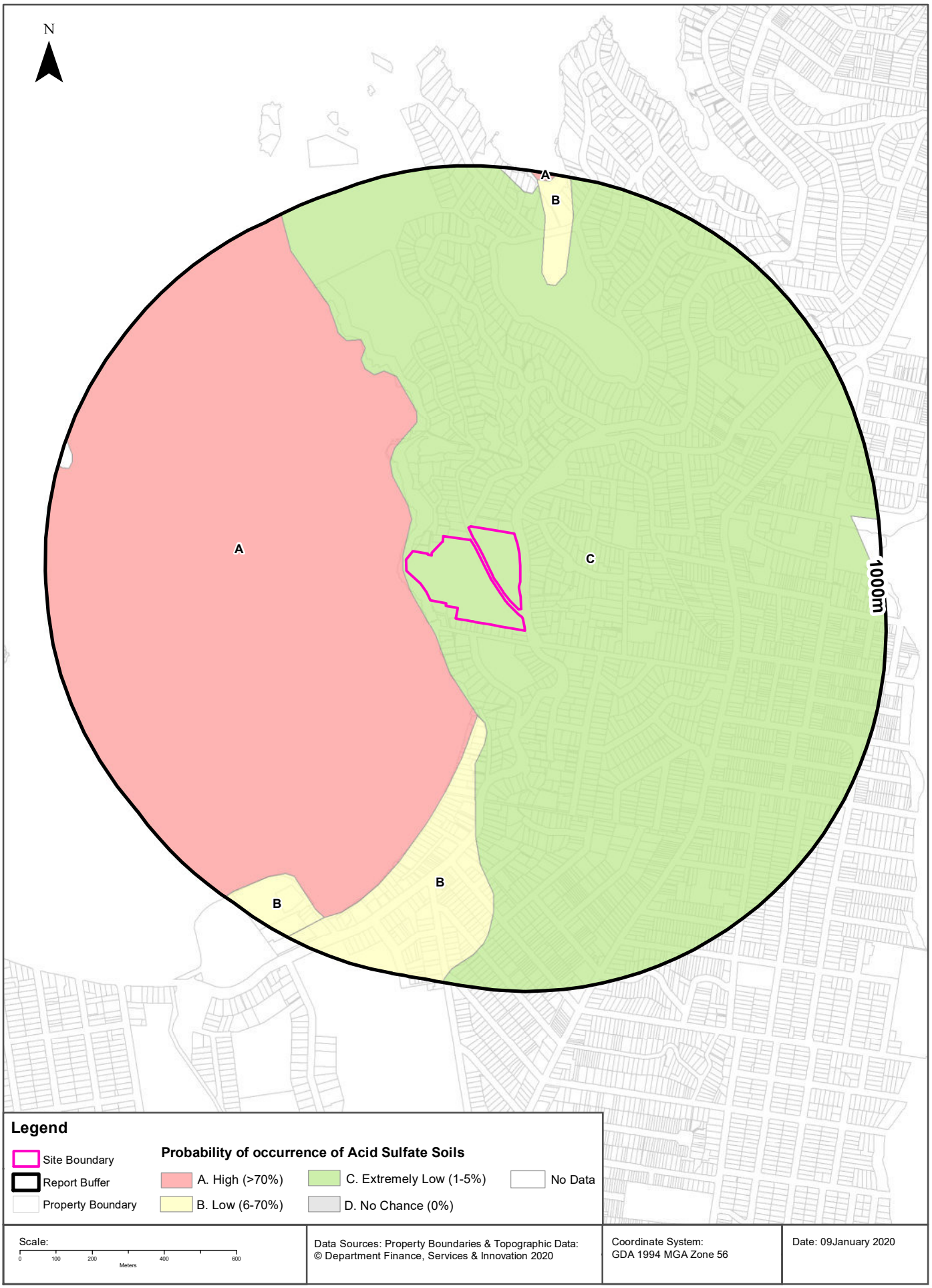
Soil Class	Description	EPI Name
5	Works within 500 metres of adjacent Class 1, 2, 3, or 4 land that is below 5 metres AHD and by which the watertable is likely to be lowered below 1 metre AHD on adjacent Class 1, 2, 3 or 4 land, present an environmental risk	Woollahra Local Environmental Plan 2014

If the on-site Soil Class is 5, what other soil classes exist within 500m?

Soil Class	Description	EPI Name	Distance	Direction
3	Works more than 1 metre below natural ground surface present an environmental risk; Works by which the watertable is likely to be lowered more than 1 metre below natural ground surface, present an environmental risk	Woollahra Local Environmental Plan 2014	236m	South

Atlas of Australian Acid Sulfate Soils

Corner New South Head Road, Rose Bay, NSW 2030



Acid Sulfate Soils

Corner New South Head Road, Rose Bay, NSW 2030

Atlas of Australian Acid Sulfate Soils

Atlas of Australian Acid Sulfate Soil categories within the dataset buffer:

Class	Description	Distance
C	Extremely low probability of occurrence. 1-5% chance of occurrence with occurrences in small localised areas.	0m
A	High Probability of occurrence. >70% chance of occurrence.	9m
B	Low Probability of occurrence. 6-70% chance of occurrence.	254m

Dryland Salinity

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Dryland Salinity - National Assessment

Is there Dryland Salinity - National Assessment data onsite?

No

Is there Dryland Salinity - National Assessment data within the dataset buffer?

No

What Dryland Salinity assessments are given?

Assessment 2000	Assessment 2020	Assessment 2050	Distance	Direction
N/A	N/A	N/A	N/A	N/A

Dryland Salinity Data Source : National Land and Water Resources Audit
The Commonwealth and all suppliers of source data used to derive the maps of "Australia, Forecast Areas Containing Land of High Hazard or Risk of Dryland Salinity from 2000 to 2050" do not warrant the accuracy or completeness of information in this product. Any person using or relying upon such information does so on the basis that the Commonwealth and data suppliers shall bear no responsibility or liability whatsoever for any errors, faults, defects or omissions in the information. Any persons using this information do so at their own risk.
In many cases where a high risk is indicated, less than 100% of the area will have a high hazard or risk.

Dryland Salinity Potential of Western Sydney

Dryland Salinity Potential of Western Sydney within the dataset buffer?

Feature Id	Classification	Description	Distance	Direction
N/A	Outside Data Coverage			

Dryland Salinity Potential of Western Sydney Data Source : NSW Office of Environment and Heritage

Mining Subsidence Districts

Corner New South Head Road, Rose Bay, NSW 2030

Mining Subsidence Districts

Mining Subsidence Districts within the dataset buffer:

District	Distance	Direction
There are no Mining Subsidence Districts within the report buffer		

State Environmental Planning Policy

Corner New South Head Road, Rose Bay, NSW 2030

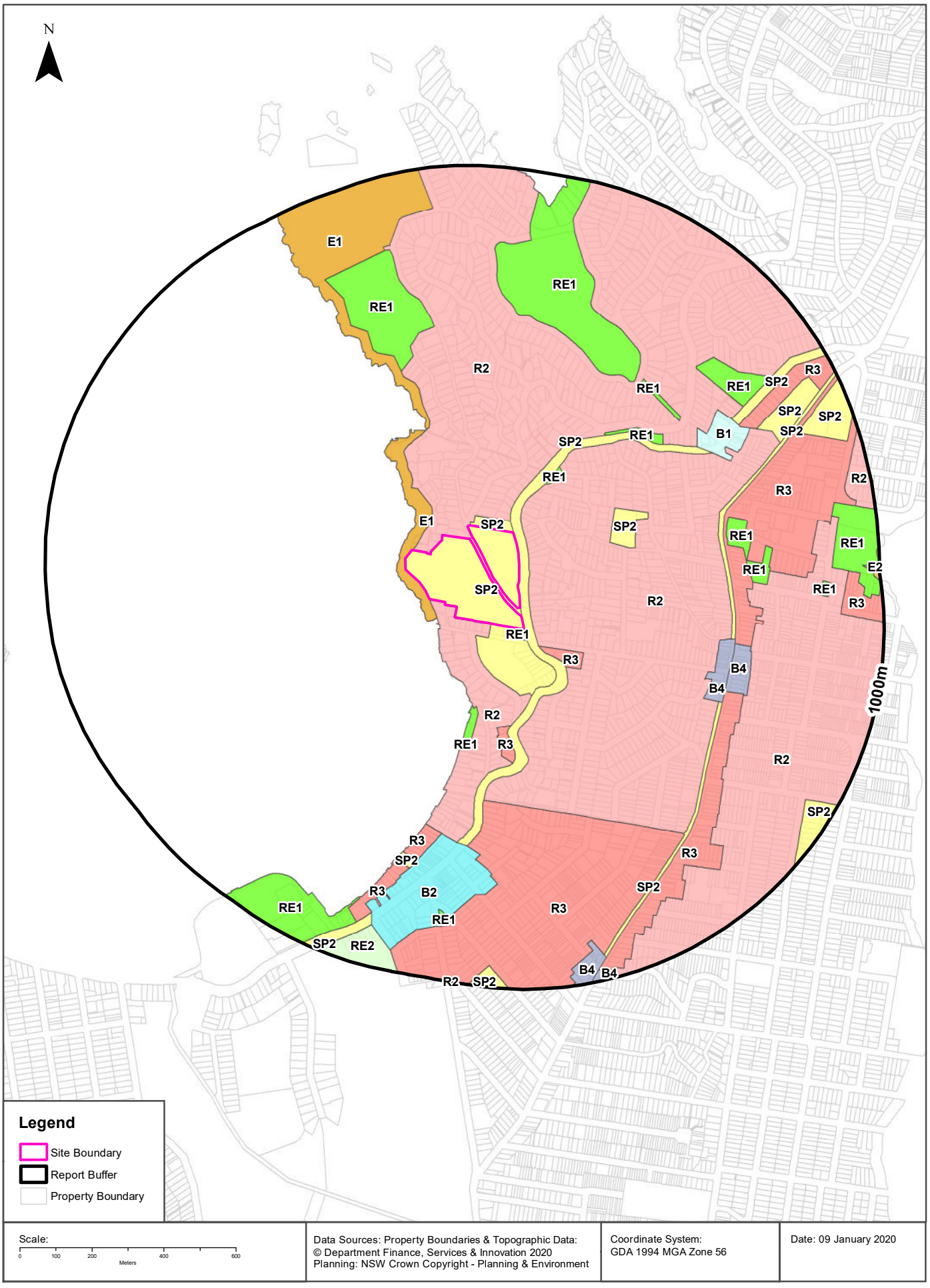
State Significant Precincts

What SEPP State Significant Precincts exist within the dataset buffer?

Map Id	Precinct	EPI Name	Published Date	Commenced Date	Currency Date	Amendment	Distance	Direction
N/A	No Records in Buffer							

EPI Planning Zones

Corner New South Head Road, Rose Bay, NSW 2030



Environmental Planning Instrument

Corner New South Head Road, Rose Bay, NSW 2030

Land Zoning

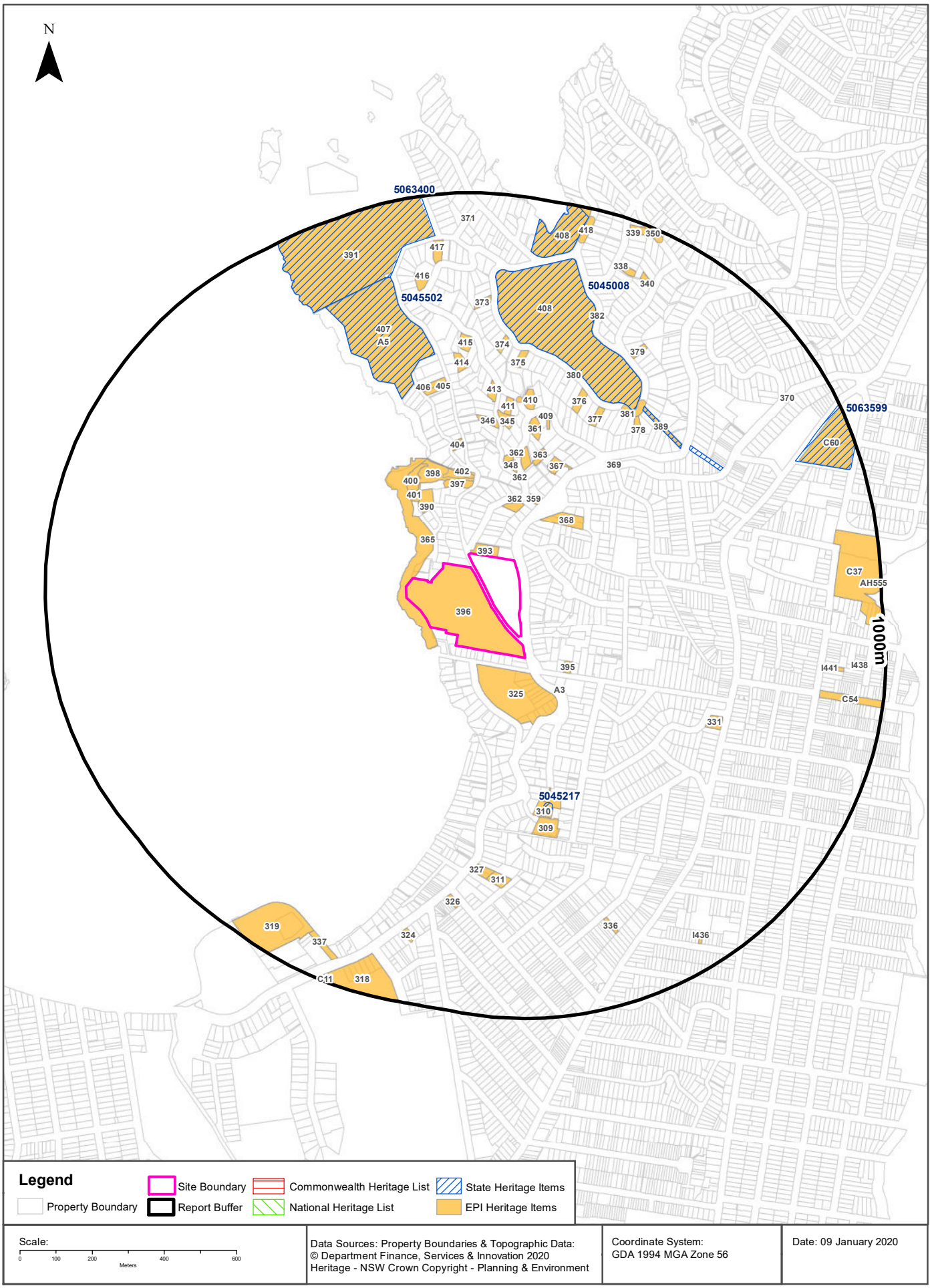
What EPI Land Zones exist within the dataset buffer?

Zone	Description	Purpose	EPI Name	Published Date	Commenced Date	Currency Date	Amendment	Distance	Direction
SP2	Infrastructure	Educational Establishment	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		0m	Onsite
E1	National Parks and Nature Reserves		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		0m	North West
R2	Low Density Residential		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		0m	North East
RE1	Public Recreation		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		0m	South East
SP2	Infrastructure	Classified Road	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		0m	South East
SP2	Infrastructure	Place of Public Worship	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		0m	North
R2	Low Density Residential		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		23m	East
R3	Medium Density Residential		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		60m	South East
RE1	Public Recreation		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		163m	North East
RE1	Public Recreation		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		233m	South
SP2	Infrastructure	Water Supply System	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		254m	East
R3	Medium Density Residential		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		269m	South
E1	National Parks and Nature Reserves		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		291m	North
RE1	Public Recreation		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		372m	North East
RE1	Public Recreation		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		468m	North
R3	Medium Density Residential		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		486m	South
RE1	Public Recreation		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		507m	North
B4	Mixed Use		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		519m	East
RE1	Public Recreation		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		546m	North East
SP2	Infrastructure	Classified Road	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		555m	North East
B1	Neighbourhood Centre		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		562m	North East
R3	Medium Density Residential		Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019		568m	East
SP2	Infrastructure	Classified Road	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		575m	South East
R3	Medium Density Residential		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		579m	South
RE1	Public Recreation		Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019		579m	East
B4	Mixed Use		Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019		580m	East
R3	Medium Density Residential		Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019		582m	South East
B2	Local Centre		Woollahra Local Environmental Plan 2014	08/06/2018	08/06/2018	08/06/2018	Amendment No 9	598m	South

Zone	Description	Purpose	EPI Name	Published Date	Commenced Date	Currency Date	Amendment	Distance	Direction
R2	Low Density Residential		Waverley Local Environmental Plan 2012	07/07/2017	07/07/2017	20/09/2019	Amendment No 11	627m	South East
RE1	Public Recreation		Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019		629m	East
SP2	Infrastructure	Sewerage System	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		668m	South
RE1	Public Recreation		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		682m	North East
R3	Medium Density Residential		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		692m	North East
R3	Medium Density Residential		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		693m	South
SP2	Infrastructure	Seniors Housing	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		732m	North East
RE1	Public Recreation		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		807m	South
RE1	Public Recreation		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		821m	South West
RE1	Public Recreation		Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019		825m	East
SP2	Infrastructure	Cemetery	Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019		833m	North East
SP2	Infrastructure	Classified Road	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		850m	South West
RE1	Public Recreation		Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019		867m	East
R3	Medium Density Residential		Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019		879m	East
B4	Mixed Use		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		882m	South
RE2	Private Recreation		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		884m	South
SP2	Infrastructure	Water Supply System	Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019		912m	South East
R2	Low Density Residential		Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019		923m	East
SP2	Infrastructure	Educational Establishment	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		938m	South
E2	Environmental Conservation		Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019		950m	South East
B4	Mixed Use		Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019		967m	South
R2	Low Density Residential		Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	08/06/2018		995m	South

Heritage Items

Corner New South Head Road, Rose Bay, NSW 2030



Heritage

Corner New South Head Road, Rose Bay, NSW 2030

Commonwealth Heritage List

What are the Commonwealth Heritage List Items located within the dataset buffer?

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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National Heritage List

What are the National Heritage List Items located within the dataset buffer?
Note. Please click on Place Id to activate a hyperlink to online website.

Place Id	Name	Address	Place File No	Class	Status	Register Date	Distance	Direction
N/A	No records in buffer							

Heritage Data Source: Australian Government Department of the Environment and Energy - Heritage Branch
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State Heritage Register - Curtilages

What are the State Heritage Register Items located within the dataset buffer?

Map Id	Name	Address	LGA	Listing Date	Listing No	Plan No	Distance	Direction
5045217	Site of Ficus superba var. henneana tree	3-4 Fernleigh Gardens Rose Bay	Woollahra	02/04/1999	00578	1580	406m	South
5045502	Strickland House	52 Vaucluse Road Vaucluse	Woollahra	02/04/1999	00722	2487	468m	North
5045008	Vaucluse House	69A Wentworth Road, Vaucluse	Woollahra	02/04/1999	00955	3197	507m	North
5063400	Nielsen Park	Greycliffe Avenue, Vaulcuse	Woollahra	28/08/2017	01988	2955	782m	North
5063599	South Head General Cemetery	793 Old South Head Road, Vaucluse	Waverly	25/08/2017	01991	3052	827m	North East

Heritage Data Source: NSW Crown Copyright - Office of Environment & Heritage
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Environmental Planning Instrument - Heritage

What are the EPI Heritage Items located within the dataset buffer?

Map Id	Name	Classification	Significance	EPI Name	Published Date	Commenced Date	Currency Date	Distance	Direction
396	Kincoppal, Roman Catholic Convent of the Sacred Heart and school	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	0m	Onsite
393	St. Michael's Anglican Church - church, interiors, grounds sandstone works, gatepost, arch, obelisk	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	0m	North
365	Hermit Bay slipway and landing	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	0m	North West
325	Kambala School - Tivoli and interoirs, gateposts, gates and flanking walls with railing, Pines	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	40m	South East
395	4 Norfolk Island Pines	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	109m	South East
A3	Emma's Well	Item - Archaeological	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	118m	South East
368	Werribree - house and interiors, gardens, retaining walls, fences, covered gateways, trees	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	134m	North East
358	Scribbly Gum	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	134m	North
390	House and interiors, front fencing	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	150m	North West
362	Scribbly Gum, Sydney Pink Gum, Swamp Mahogany	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	159m	North
359	House and Interiors	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	168m	North East
397	Former gatehouse to The Hermitage and interiors, front fencing, 3 sandstone gateposts	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	182m	North
401	2 Cook Pines, Norfolk Island Pine	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	185m	North West
398	The Hermitage - house and interiors, grounds, gateposts, gates, fencing, stone works	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	201m	North
399	Norfolk Island Pine, Hoop Pine, Bunya Pine, fencing to Vaucluse Rd	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	209m	North
400	Gardens formerly part of The Hermitage	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	214m	North West
403	Stone and wrought iron fence, formerly part of The Hermitage	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	217m	North
362	Scribbly Gum, Sydney Pink Gum, Swamp Mahogany	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	220m	North

Map Id	Name	Classification	Significance	EPI Name	Published Date	Commenced Date	Currency Date	Distance	Direction
402	Watercourse - stormwater drainage comprising channels, bridge and stone walling	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	223m	North
348	Sydney Pink Gum	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	241m	North
360	House and interiors, gardens	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	252m	North
347	Port Jackson Fig	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	262m	North
367	Kainga - house and interiors, excluding the freestanding garage, cabana, pool, spa, gateposts	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	263m	North East
363	House and interiors	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	270m	North East
362	Scribbly Gum, Sydney Pink Gum, Swamp Mahogany	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	284m	North
404	House and interiors	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	288m	North
361	House and interiors	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	338m	North
346	Sydney Pink Gum	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	353m	North
345	House and interiors, stone works, gardens	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	355m	North
310	Fiscus superba, var. henneana (cedar fig)	Item - General	State	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	366m	South
369	Bus Stop shelter, former tram stop	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	373m	North East
409	Eastern Channel Lighthouse - Rear Lead	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	374m	North
411	House and interiors, front fencing	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	397m	North
410	Glasson House - house and interiors	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	422m	North
413	Greenway - all buildings, interiors and works, grounds, grove of Sydney Pink Gums	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	426m	North
377	Sydney Pink Gum, Swamp Mahogany	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	429m	North East
412	Sydney Pink Gum	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	436m	North
309	Fernleigh Castle - main building and interiors	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	443m	South
376	2 Forest Red, Sydney Pink and Scribbly Gum	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	444m	North East
405	Swamp Mahogany	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	456m	North

Map Id	Name	Classification	Significance	EPI Name	Published Date	Commenced Date	Currency Date	Distance	Direction
407	Strickland House - Buildings and interiors, wharf, gardens, grounds, former quarry	Item - General	State	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	468m	North
A5	Strickland House - Buildings and interiors, wharf, gardens, grounds, former quarry	Item - Archaeological	State	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	468m	North
406	Sydney Pink Gums	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	469m	North
378	Sydney Pink Gum	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	483m	North East
414	House and interiors	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	502m	North
408	Vaucluse (Wentworth) Housebuildings and interiors, stables and interiors, outbuildings, gates	Item - General	State	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	507m	North
381	Swamp Mahogany, 2 Sydney Pink Gums	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	511m	North East
375	Sydney Pink Gum	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	530m	North
331	Former Kings Theatre building and interiors	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	532m	South East
380	Forest Red Gum	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	533m	North East
389	Sydney Pink Gum, Swamp Mahogany, Forest Red Mahogany	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	546m	North East
415	House and interiors	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	558m	North
374	Weinreich House - house, including interior, and grounds	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	560m	North
327	Mary Magdalene Catholic Church - church and interiors	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	585m	South
311	House and interiors	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	597m	South
379	2 Sydney Pink Gums	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	649m	North East
373	Scribbly Gum	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	677m	North
326	Rose Bay Hotel and interiors	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	680m	South
382	Scribbly Gum	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	709m	North East
416	Sydney Pink Gum	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	742m	North
336	House, interiors and grounds	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	751m	South East

Map Id	Name	Classification	Significance	EPI Name	Published Date	Commenced Date	Currency Date	Distance	Direction
391	Shark Beach promenade and Amenities	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	782m	North
324	Post Office and interiors	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	793m	South
417	Palmeyrie - house and interiors, front gardens and sandstone works	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	809m	North
C54	Oceanview Avenue	Conservation Area - Landscape	Local	Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019	820m	East
I441	1930's style bungalow	Item - General	Local	Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019	827m	East
C60	South Head Cemetery	Conservation Area - Landscape	Local	Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019	833m	North East
408	Vaucluse (Wentworth) Housebuildings and interiors, stables and interiors, outbuildings, gates	Item - General	State	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	843m	North
340	Sydney Pink Gum	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	844m	North East
338	House and interiors	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	852m	North East
319	Site of former Rose Bay Flying Boat Base	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	854m	South West
C37	Coastal Sandstone Escarpment	Conservation Area - Landscape	Local	Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019	867m	East
370	Bus stop shelter, former tram stop	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	868m	North East
337	5 Norfolk Island Pines	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	882m	South West
318	Royal Sydney Golf Club - Clubhouse and interiors, grove of paperparks along Norwich Road	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	884m	South
I436	Late Victorian style terrace	Item - General	Local	Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019	898m	South East
418	Swamp Mahogany, 3 Forest Red Gums	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	899m	North
I438	1950's house	Item - General	Local	Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019	909m	East
371	Bangalay	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	921m	North
339	2 Forest Red Gums	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	964m	North East
350	3 Forest Red Gums	Item - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	966m	North East
C11	Kent Road Heritage Conservation Area	Conservation Area - General	Local	Woollahra Local Environmental Plan 2014	23/01/2015	23/05/2015	06/09/2019	975m	South
AH555	Rock Engraving	Aboriginal Object	Local	Waverley Local Environmental Plan 2012	26/10/2012	26/10/2012	20/09/2019	976m	East

Natural Hazards

Corner New South Head Road, Rose Bay, NSW 2030

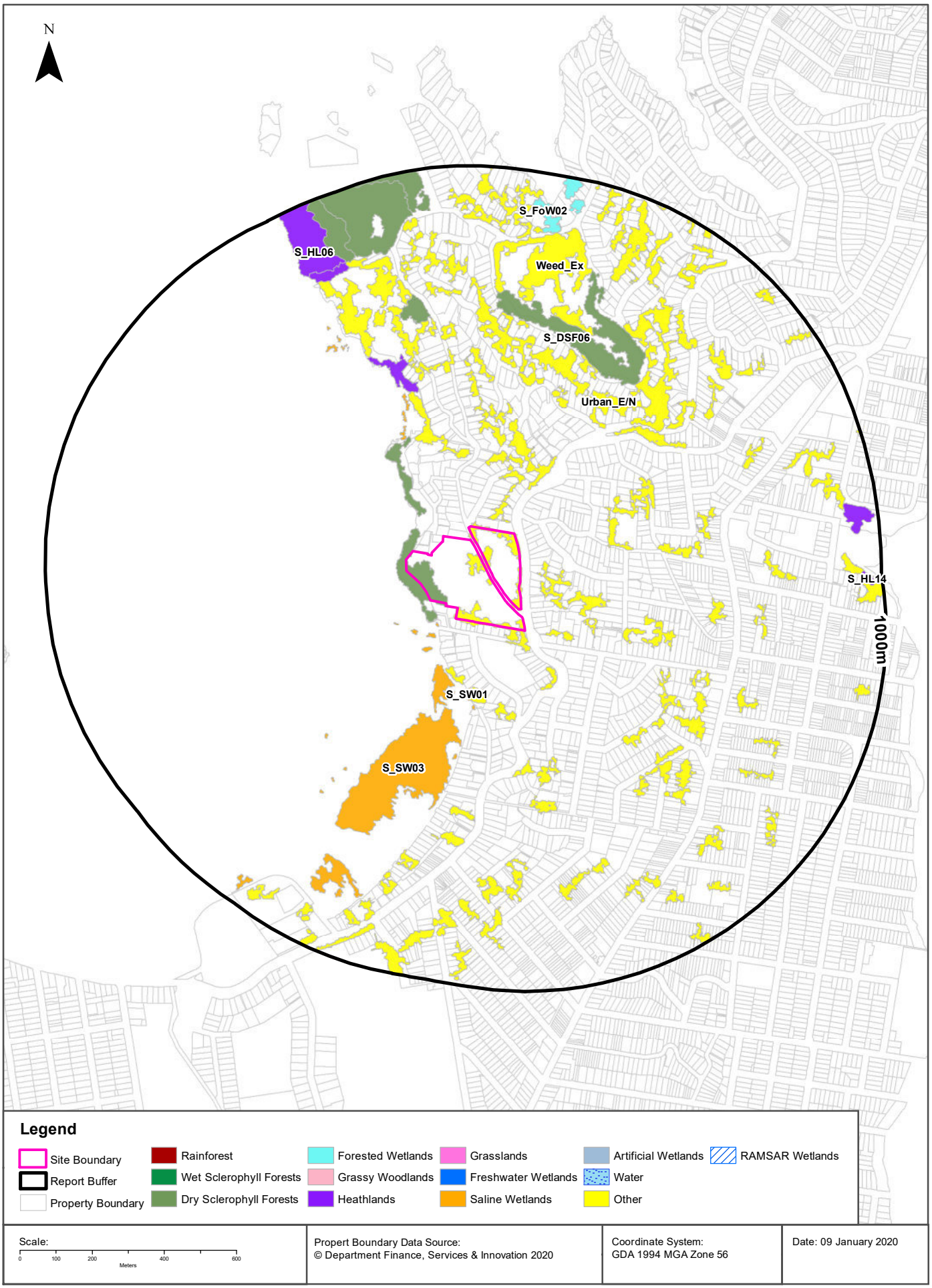
Bush Fire Prone Land

What are the nearest Bush Fire Prone Land Categories that exist within the dataset buffer?

Bush Fire Prone Land Category	Distance	Direction
No records within buffer		

Ecological Constraints - Native Vegetation & RAMSAR Wetlands

Corner New South Head Road, Rose Bay, NSW 2030



Ecological Constraints

Corner New South Head Road, Rose Bay, NSW 2030

Native Vegetation

What native vegetation exists within the dataset buffer?

Map ID	Map Unit Name	Threatened Ecological Community NSW	Threatened Ecological Community EPBC Act	Understorey	Disturbance	Disturbance Index	Dominant Species	Dist	Direction
S_DSF06	S_DSF06: Coastal Sandstone Foreshores Forest			17: Pittosporum dominant	13: Weeds	3: High	A.costata/E.botryoides/C.gummiferaB.integrifolia/E.piperita	0m	Onsite
Urban_E/N	Urban_E/N: Urban Exotic/Native			00: Not assessed	00: Not assessed	0: Not assessed	Urban Exotic/Native	0m	Onsite
S_SW01	S_SW01: Estuarine Mangrove Forest			00: Not assessed	00: Not assessed	0: Not assessed	Mangroves	50m	South West
S_SW03	S_SW03: Seagrass Meadows			00: Not assessed	00: Not assessed	0: Not assessed	Seagrass (DPI)	72m	South West
Weed_Ex	Weed_Ex: Weeds and Exotics			00: Not assessed	00: Not assessed	0: Not assessed	Exotic Species >90%cover	189m	North
S_HL06	S_HL06: Coastal Headland Banksia Heath			17: Pittosporum dominant	13: Weeds	3: High	B.ericifolia/Kunzea spp/A.distyla	398m	North
S_FoW02	S_FoW02: Coastal Flats Swamp Mahogany Forest	Swamp Sclerophyll Forest on Coastal Floodplains		15: Grassy natives and exotics	31: Parkland open understorey	4: Very high	E.robusta	834m	North
S_HL14	S_HL14: Coastal Clifftop Marsh			18: Swampy sedges, shrubs, ferns and herbs	13: Weeds	3: High	Gleichenia spp/S.virginicus/Acacia spp.	943m	East

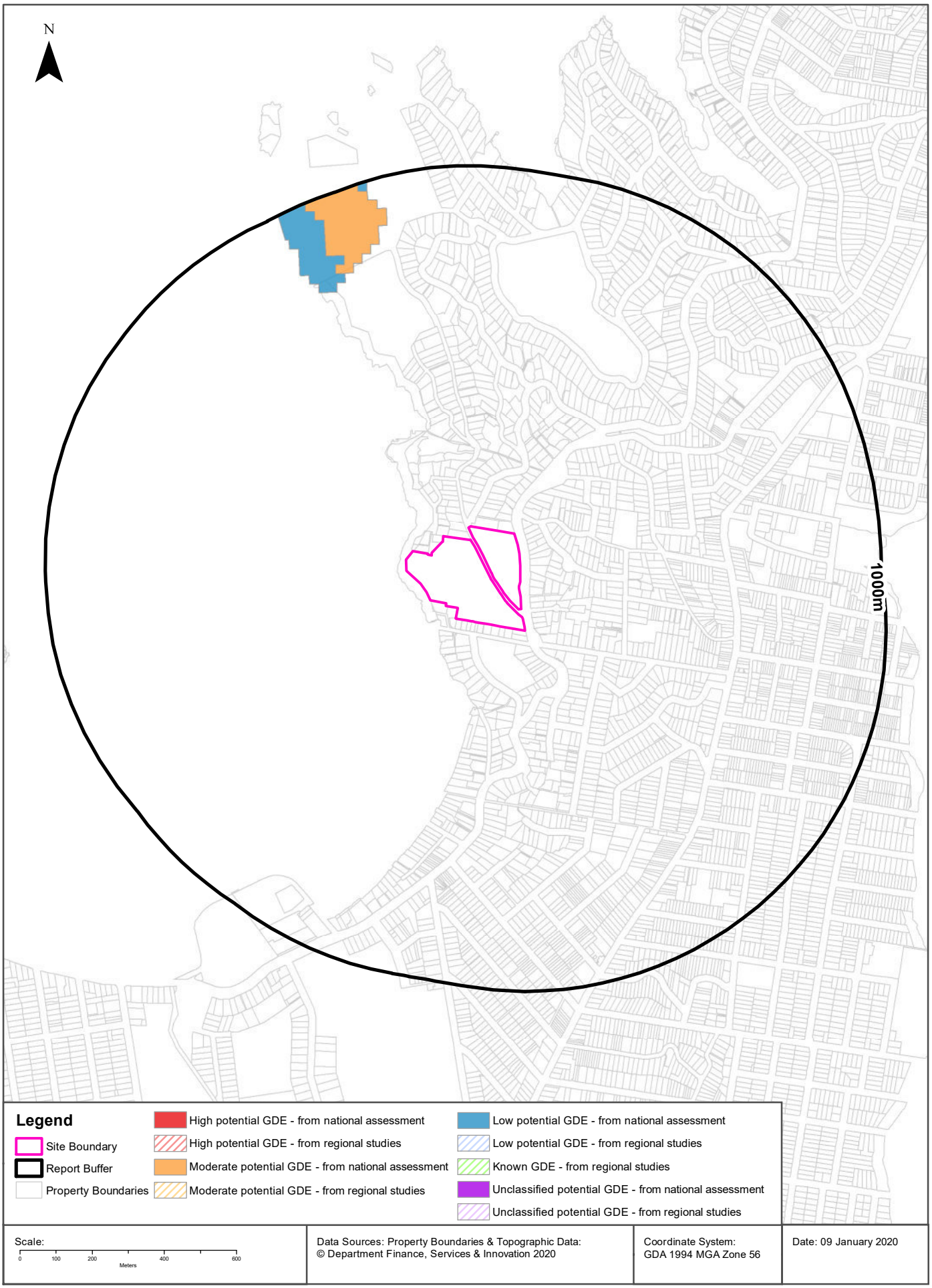
Ramsar Wetlands

What Ramsar Wetland areas exist within the dataset buffer?

Map Id	Ramsar Name	Wetland Name	Designation Date	Source	Distance	Direction
N/A	No records in buffer					

Ecological Constraints - Groundwater Dependent Ecosystems Atlas

Corner New South Head Road, Rose Bay, NSW 2030



Ecological Constraints

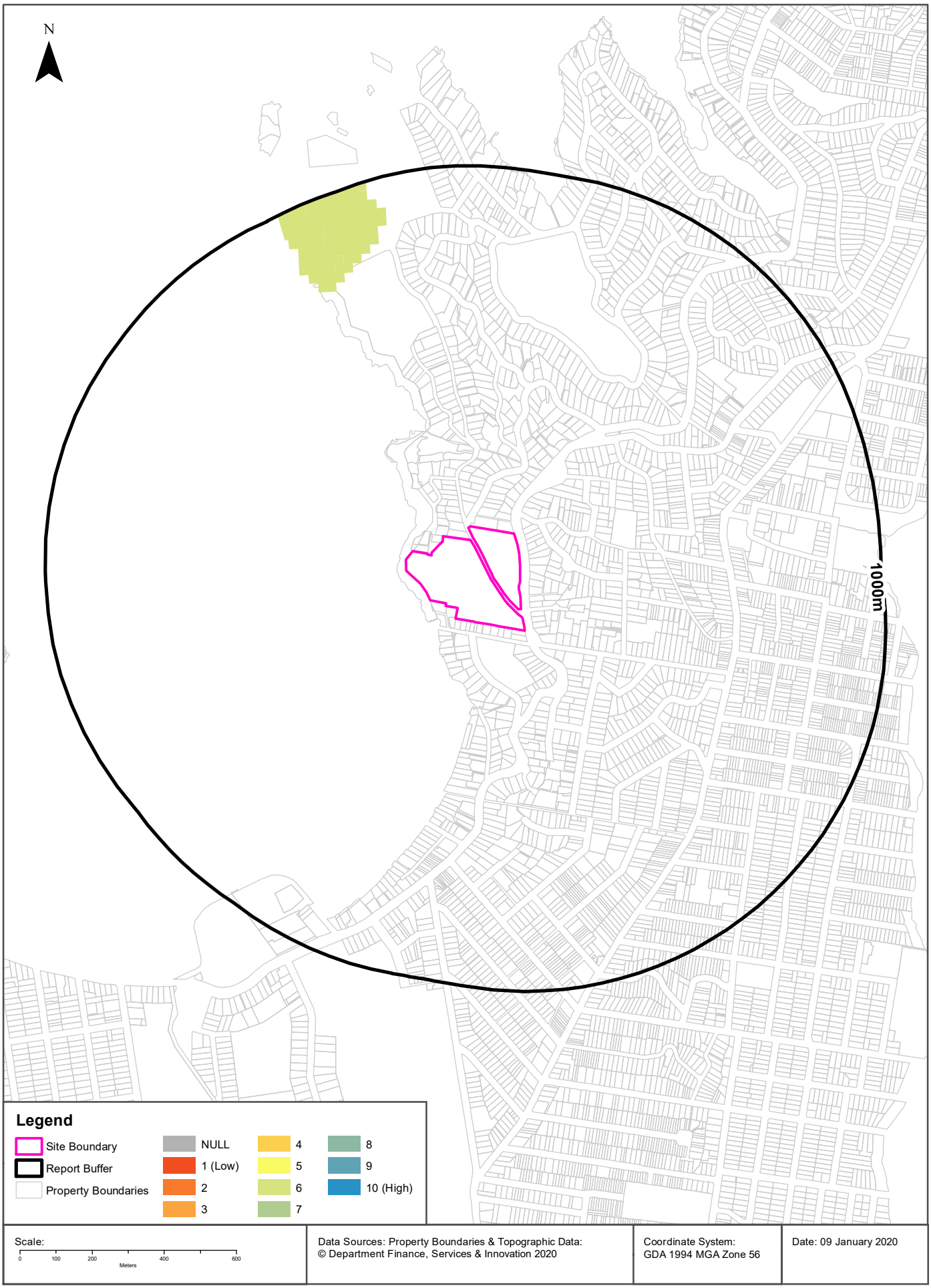
Corner New South Head Road, Rose Bay, NSW 2030

Groundwater Dependent Ecosystems Atlas

Type	GDE Potential	Geomorphology	Ecosystem Type	Aquifer Geology	Distance
Terrestrial	Low potential GDE - from national assessment	Undulating to low hilly country, mainly on shale.	Vegetation	Consolidated sedimentary	739m
Terrestrial	Moderate potential GDE - from national assessment	Undulating to low hilly country, mainly on shale.	Vegetation	Consolidated sedimentary	771m

Ecological Constraints - Inflow Dependent Ecosystems Likelihood

Corner New South Head Road, Rose Bay, NSW 2030



Ecological Constraints

Corner New South Head Road, Rose Bay, NSW 2030

Inflow Dependent Ecosystems Likelihood

Type	IDE Likelihood	Geomorphology	Ecosystem Type	Aquifer Geology	Distance
Terrestrial	6	Undulating to low hilly country, mainly on shale.	Vegetation	Consolidated sedimentary	739m

Ecological Constraints

Corner New South Head Road, Rose Bay, NSW 2030

NSW BioNet Atlas

Species on the NSW BioNet Atlas that have a NSW or federal conservation status, a NSW sensitivity status, or are listed under a migratory species agreement, and are within 10km of the site?

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Animalia	Amphibia	Litoria aurea	Green and Golden Bell Frog	Endangered	Not Sensitive	Vulnerable	
Animalia	Amphibia	Pseudophryne australis	Red-crowned Toadlet	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Actitis hypoleucos	Common Sandpiper	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Anous stolidus	Common Noddy	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Anseranas semipalmata	Magpie Goose	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Anthochaera phrygia	Regent Honeyeater	Critically Endangered	Not Sensitive	Critically Endangered	
Animalia	Aves	Apus pacificus	Fork-tailed Swift	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Ardea ibis	Cattle Egret	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Ardenna carneipes	Flesh-footed Shearwater	Vulnerable	Not Sensitive	Not Listed	ROKAMBA;JAMBA
Animalia	Aves	Ardenna grisea	Sooty Shearwater	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Ardenna pacificus	Wedge-tailed Shearwater	Not Listed	Not Sensitive	Not Listed	JAMBA
Animalia	Aves	Ardenna tenuirostris	Short-tailed Shearwater	Not Listed	Not Sensitive	Not Listed	ROKAMBA;JAMBA
Animalia	Aves	Artamus cyanopterus cyanopterus	Dusky Woodswallow	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Botaurus poiciloptilus	Australasian Bittern	Endangered	Not Sensitive	Endangered	
Animalia	Aves	Burhinus grallarius	Bush Stone-curlew	Endangered	Not Sensitive	Not Listed	
Animalia	Aves	Calidris acuminata	Sharp-tailed Sandpiper	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Calidris ferruginea	Curlew Sandpiper	Endangered	Not Sensitive	Critically Endangered	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Calidris melanotos	Pectoral Sandpiper	Not Listed	Not Sensitive	Not Listed	ROKAMBA;JAMBA
Animalia	Aves	Callocephalon fimbriatum	Gang-gang Cockatoo	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Calonectris leucomelas	Streaked Shearwater	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Calyptorhynchus banksii samueli	Red-tailed Black-Cockatoo (inland subspecies)	Vulnerable	Category 2	Not Listed	
Animalia	Aves	Calyptorhynchus lathami	Glossy Black-Cockatoo	Vulnerable	Category 2	Not Listed	
Animalia	Aves	Charadrius veredus	Oriental Plover	Not Listed	Not Sensitive	Not Listed	ROKAMBA;JAMBA
Animalia	Aves	Daphoenositta chrysoptera	Varied Sittella	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Diomedea exulans	Wandering Albatross	Endangered	Not Sensitive	Endangered	JAMBA
Animalia	Aves	Egretta sacra	Eastern Reef Egret	Not Listed	Not Sensitive	Not Listed	CAMBA

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Animalia	Aves	Epthianura albifrons	White-fronted Chat	Endangered Population, Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Erythrotriorchis radiatus	Red Goshawk	Critically Endangered	Category 2	Vulnerable	
Animalia	Aves	Esacus magnirostris	Beach Stone-curlew	Critically Endangered	Not Sensitive	Not Listed	
Animalia	Aves	Eudyptula minor	Little Penguin	Endangered Population	Not Sensitive	Not Listed	
Animalia	Aves	Falco subniger	Black Falcon	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Fregata ariel	Lesser Frigatebird	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Gallinago hardwickii	Latham's Snipe	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Glossopsitta pusilla	Little Lorikeet	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Gygis alba	White Tern	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Haematopus fuliginosus	Sooty Oystercatcher	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Haematopus longirostris	Pied Oystercatcher	Endangered	Not Sensitive	Not Listed	
Animalia	Aves	Haliaeetus leucogaster	White-bellied Sea-Eagle	Vulnerable	Not Sensitive	Not Listed	CAMBA
Animalia	Aves	Hieraaetus morphnoides	Little Eagle	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Hirundapus caudacutus	White-throated Needletail	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Hydroprogne caspia	Caspian Tern	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Ixobrychus flavicollis	Black Bittern	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Lathamus discolor	Swift Parrot	Endangered	Category 3	Critically Endangered	
Animalia	Aves	Limosa lapponica	Bar-tailed Godwit	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Lophochroa leadbeateri	Major Mitchell's Cockatoo	Vulnerable	Category 2	Not Listed	
Animalia	Aves	Lophoictinia isura	Square-tailed Kite	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Macronectes giganteus	Southern Giant Petrel	Endangered	Not Sensitive	Endangered	
Animalia	Aves	Macronectes halli	Northern Giant-Petrel	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Aves	Manorina melanotis	Black-eared Miner	Critically Endangered	Not Sensitive	Endangered	
Animalia	Aves	Merops ornatus	Rainbow Bee-eater	Not Listed	Not Sensitive	Not Listed	JAMBA
Animalia	Aves	Neophema pulchella	Turquoise Parrot	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Neophema splendida	Scarlet-chested Parrot	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Ninox connivens	Barking Owl	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Ninox strenua	Powerful Owl	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Numenius madagascariensis	Eastern Curlew	Not Listed	Not Sensitive	Critically Endangered	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Numenius minutus	Little Curlew	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Numenius phaeopus	Whimbrel	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA; JAMBA
Animalia	Aves	Onychoprion fuscata	Sooty Tern	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Pandion cristatus	Eastern Osprey	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Petroica boodang	Scarlet Robin	Vulnerable	Not Sensitive	Not Listed	

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Animalia	Aves	Pezoporus wallicus wallicus	Eastern Ground Parrot	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Phaethon lepturus	White-tailed Tropicbird	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Phaethon rubricauda	Red-tailed Tropicbird	Vulnerable	Not Sensitive	Not Listed	CAMBA
Animalia	Aves	Phoebetria fusca	Sooty Albatross	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Aves	Pluvialis fulva	Pacific Golden Plover	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA;JAMBA
Animalia	Aves	Pluvialis squatarola	Grey Plover	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA;JAMBA
Animalia	Aves	Polytelis swainsonii	Superb Parrot	Vulnerable	Category 3	Vulnerable	
Animalia	Aves	Pterodroma leucoptera leucoptera	Gould's Petrel	Vulnerable	Not Sensitive	Endangered	
Animalia	Aves	Pterodroma solandri	Providence Petrel	Vulnerable	Not Sensitive	Not Listed	JAMBA
Animalia	Aves	Ptilinopus regina	Rose-crowned Fruit-Dove	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Ptilinopus superbus	Superb Fruit-Dove	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Puffinus assimilis	Little Shearwater	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Stagonopleura guttata	Diamond Firetail	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Stercorarius longicaudus	Long-tailed Jaeger	Not Listed	Not Sensitive	Not Listed	JAMBA
Animalia	Aves	Stercorarius maccormicki	South Polar Skua	Not Listed	Not Sensitive	Not Listed	JAMBA
Animalia	Aves	Stercorarius parasiticus	Arctic Jaeger	Not Listed	Not Sensitive	Not Listed	ROKAMBA;JAMBA
Animalia	Aves	Stercorarius pomarinus	Pomarine Jaeger	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Sterna hirundo	Common Tern	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA;JAMBA
Animalia	Aves	Sternula albifrons	Little Tern	Endangered	Not Sensitive	Not Listed	ROKAMBA;CAMBA;JAMBA
Animalia	Aves	Stictonetta naevosa	Freckled Duck	Vulnerable	Not Sensitive	Not Listed	
Animalia	Aves	Sula dactylatra	Masked Booby	Vulnerable	Not Sensitive	Not Listed	ROKAMBA;JAMBA
Animalia	Aves	Sula sula	Red-footed Booby	Not Listed	Not Sensitive	Not Listed	CAMBA;JAMBA
Animalia	Aves	Thalassarche cauta	Shy Albatross	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Aves	Thalassarche chrysostoma	Grey-headed Albatross	Not Listed	Not Sensitive	Endangered	
Animalia	Aves	Thalassarche melanophris	Black-browed Albatross	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Aves	Thinornis rubricollis	Hooded Plover	Critically Endangered	Not Sensitive	Vulnerable	
Animalia	Aves	Tringa incana	Wandering Tattler	Not Listed	Not Sensitive	Not Listed	JAMBA
Animalia	Aves	Tringa nebularia	Common Greenshank	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA;JAMBA
Animalia	Aves	Tringa stagnatilis	Marsh Sandpiper	Not Listed	Not Sensitive	Not Listed	ROKAMBA;CAMBA;JAMBA
Animalia	Aves	Tyto novaehollandiae	Masked Owl	Vulnerable	Category 3	Not Listed	
Animalia	Aves	Tyto tenebricosa	Sooty Owl	Vulnerable	Category 3	Not Listed	
Animalia	Insecta	Petalura gigantea	Giant Dragonfly	Endangered	Not Sensitive	Not Listed	
Animalia	Mammalia	Aepyprymnus rufescens	Rufous Bettong	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Arctocephalus forsteri	New Zealand Fur-seal	Vulnerable	Not Sensitive	Not Listed	

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Animalia	Mammalia	Arctocephalus pusillus doriferus	Australian Fur-seal	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Cercartetus nanus	Eastern Pygmy-possum	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Mammalia	Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable	Not Sensitive	Endangered	
Animalia	Mammalia	Dasyurus viverrinus	Eastern Quoll	Endangered	Not Sensitive	Endangered	
Animalia	Mammalia	Dugong dugon	Dugong	Endangered	Not Sensitive	Not Listed	
Animalia	Mammalia	Eubalaena australis	Southern Right Whale	Endangered	Not Sensitive	Endangered	
Animalia	Mammalia	Falsistrellus tasmaniensis	Eastern False Pipistrelle	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	Endangered	Not Sensitive	Endangered	
Animalia	Mammalia	Macrotis lagotis	Bilby	Presumed Extinct	Not Sensitive	Vulnerable	
Animalia	Mammalia	Megaptera novaeangliae	Humpback Whale	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Mammalia	Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Miniopterus australis	Little Bent-winged Bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Miniopterus orianae oceanensis	Large Bent-winged Bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Myotis macropus	Southern Myotis	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Perameles nasuta	Long-nosed Bandicoot	Endangered Population	Not Sensitive	Not Listed	
Animalia	Mammalia	Petaurus norfolcensis	Squirrel Glider	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Phascolarctos cinereus	Koala	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Mammalia	Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Mammalia	Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Mammalia	Scoteanax rueppellii	Greater Broad-nosed Bat	Vulnerable	Not Sensitive	Not Listed	
Animalia	Reptilia	Antaresia stimsoni	Stimson's Python	Vulnerable	Not Sensitive	Not Listed	
Animalia	Reptilia	Aspidites ramsayi	Woma	Vulnerable	Not Sensitive	Not Listed	
Animalia	Reptilia	Caretta caretta	Loggerhead Turtle	Endangered	Not Sensitive	Endangered	
Animalia	Reptilia	Chelonia mydas	Green Turtle	Vulnerable	Not Sensitive	Vulnerable	
Animalia	Reptilia	Dermochelys coriacea	Leatherback Turtle	Endangered	Not Sensitive	Endangered	
Animalia	Reptilia	Eretmochelys imbricata	Hawksbill Turtle	Not Listed	Not Sensitive	Vulnerable	
Animalia	Reptilia	Tiliqua occipitalis	Western Blue-tongued Lizard	Vulnerable	Not Sensitive	Not Listed	
Animalia	Reptilia	Varanus rosenbergi	Rosenberg's Goanna	Vulnerable	Not Sensitive	Not Listed	
Fungi	Flora	Hygrocybe collucera		Endangered	Not Sensitive	Not Listed	
Fungi	Flora	Hygrocybe griseoramosa		Endangered	Not Sensitive	Not Listed	
Fungi	Flora	Hygrocybe reesiae		Vulnerable	Not Sensitive	Not Listed	
Plantae	Flora	Acacia bynoeana	Bynoe's Wattle	Endangered	Not Sensitive	Vulnerable	
Plantae	Flora	Acacia gordonii		Endangered	Not Sensitive	Endangered	

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Plantae	Flora	Acacia terminalis subsp. terminalis	Sunshine Wattle	Endangered	Not Sensitive	Endangered	
Plantae	Flora	Allocasuarina portuensis	Nielsen Park She-oak	Endangered	Category 3	Endangered	
Plantae	Flora	Amperea xiphoclada var. pedicellata		Presumed Extinct	Not Sensitive	Extinct	
Plantae	Flora	Asterolasia buxifolia		Endangered	Not Sensitive	Not Listed	
Plantae	Flora	Baeckea kandos		Endangered	Category 3	Endangered	
Plantae	Flora	Caladenia tessellata	Thick Lip Spider Orchid	Endangered	Category 2	Vulnerable	
Plantae	Flora	Callistemon linearifolius	Netted Bottle Brush	Vulnerable	Category 3	Not Listed	
Plantae	Flora	Chamaesyce psammogeton	Sand Spurge	Endangered	Not Sensitive	Not Listed	
Plantae	Flora	Dichanthium setosum	Bluegrass	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Diuris arenaria	Sand Doubletail	Endangered	Category 2	Not Listed	
Plantae	Flora	Doryanthes palmeri	Giant Spear Lily	Vulnerable	Not Sensitive	Not Listed	
Plantae	Flora	Epacris purpurascens var. purpurascens		Vulnerable	Not Sensitive	Not Listed	
Plantae	Flora	Eucalyptus camfieldii	Camfield's Stringybark	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Eucalyptus fracta	Broken Back Ironbark	Vulnerable	Not Sensitive	Not Listed	
Plantae	Flora	Eucalyptus leucoxylon subsp. pruinosa	Yellow Gum	Vulnerable	Not Sensitive	Not Listed	
Plantae	Flora	Eucalyptus nicholii	Narrow-leaved Black Peppermint	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Eucalyptus pulverulenta	Silver-leafed Gum	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Eucalyptus scoparia	Wallangarra White Gum	Endangered	Not Sensitive	Vulnerable	
Plantae	Flora	Euphrasia collina subsp. muelleri	Mueller's Eyebright	Endangered	Not Sensitive	Endangered	
Plantae	Flora	Grammitis stenophylla	Narrow-leaf Finger Fern	Endangered	Category 3	Not Listed	
Plantae	Flora	Grevillea caleyi	Caley's Grevillea	Critically Endangered	Category 3	Critically Endangered	
Plantae	Flora	Hibbertia puberula		Endangered	Not Sensitive	Not Listed	
Plantae	Flora	Lasiopetalum joyceae		Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Macadamia integrifolia	Macadamia Nut	Not Listed	Not Sensitive	Vulnerable	
Plantae	Flora	Macadamia tetraphylla	Rough-shelled Bush Nut	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Melaleuca biconvexa	Biconvex Paperbark	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Melaleuca deanei	Deane's Paperbark	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Microtis angusii	Angus's Onion Orchid	Endangered	Category 2	Endangered	
Plantae	Flora	Persoonia hirsuta	Hairy Geebung	Endangered	Category 3	Endangered	
Plantae	Flora	Persoonia laxa		Presumed Extinct	Not Sensitive	Extinct	
Plantae	Flora	Pimelea curviflora var. curviflora		Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Prasophyllum fuscum	Slaty Leek Orchid	Critically Endangered	Category 2	Vulnerable	
Plantae	Flora	Prostanthera junonis	Somersby Mintbush	Endangered	Not Sensitive	Endangered	

Kingdom	Class	Scientific	Common	NSW Conservation Status	NSW Sensitivity Class	Federal Conservation Status	Migratory Species Agreements
Plantae	Flora	Prostanthera marifolia	Seaforth Mintbush	Critically Endangered	Category 3	Critically Endangered	
Plantae	Flora	Rhodamnia rubescens	Scrub Turpentine	Critically Endangered	Not Sensitive	Not Listed	
Plantae	Flora	Sarcochilus hartmannii	Hartman's Sarcochilus	Vulnerable	Category 2	Vulnerable	
Plantae	Flora	Syzygium paniculatum	Magenta Lilly Pilly	Endangered	Not Sensitive	Vulnerable	
Plantae	Flora	Tetratheca glandulosa		Vulnerable	Not Sensitive	Not Listed	
Plantae	Flora	Tetratheca juncea	Black-eyed Susan	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Thesium australe	Austral Toadflax	Vulnerable	Not Sensitive	Vulnerable	
Plantae	Flora	Triplarina imbricata	Creek Triplarina	Endangered	Not Sensitive	Endangered	

Data does not include NSW category 1 sensitive species.

Location Confidences

Where Lotsearch has had to georeference features from supplied addresses, a location confidence has been assigned to the data record. This indicates a confidence to the positional accuracy of the feature. Where applicable, a code is given under the field heading “LC” or “LocConf”. These codes lookup to the following location confidences:

LC Code	Location Confidence
Premise match	Georeferenced to the site location / premise or part of site
General area or suburb match	Georeferenced with the confidence of the general/approximate area
Road match	Georeferenced to the road or rail
Road intersection	Georeferenced to the road intersection
Feature is a buffered point	Feature is a buffered point
Land adjacent to geocoded site	Land adjacent to Georeferenced Site
Network of features	Georeferenced to a network of features

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    irrespective of how that liability arises including in contract or tort, liability under indemnity or for any other common law, equitable or statutory cause of action or otherwise.
12. These Terms are subject to New South Wales law.

Section 10.7 Certificates

PLANNING CERTIFICATE UNDER SECTION 10.7 (2) and (5)
ENVIRONMENTAL PLANNING & ASSESSMENT ACT

JK Environments Pty Ltd
Attn: Anthony Barkway
PO Box 976
North Ryde BC NSW 1670

Applicant's reference:
E32915BD avb

Woollahra Municipal Council
ABN 32 218 483 245

Redleaf Council Chambers
536 New South Head Road
Double Bay NSW 2028
Correspondence to
General Manager
PO Box 61
Double Bay NSW 1360
DX 3607 Double Bay
records@woollahra.nsw.gov.au
www.woollahra.nsw.gov.au
Telephone: (02) 9391 7000
Facsimile: (02) 9391 7044

Certificate number: 25
Certificate issue date: 08/01/2020
Transaction ID: 507352
Certificate fee: $133.00 (standard)

DESCRIPTION OF PROPERTY

Address: 2 Vaucluse Road VAUCLUSE NSW 2030
Title: LOT: 104 PT: PRT DP: 1092747
Parish: Alexandria
County: Cumberland

This planning certificate should be read in conjunction with the *Woollahra Local Environmental Plan 2014* and/or the *Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005*. These are available on the NSW legislation website at www.legislation.nsw.gov.au

The land to which this certificate relates, being the lot or one of the lots described in the corresponding application, is shown in the Council's records as being situated at the street address described on page 1 of this certificate.

It is the applicant's responsibility to confirm that the legal description of the lot to which the application relates is accurate and current. Council does not check the accuracy or currency of the information; nor does Council have the copyright to this information.

The legal description of land is obtained from NSW Land and Property Information. Applicants must verify all property and lot information with NSW Land and Property Information. The information contained in this certificate relates only to the lot described on the certificate.

Where the street address comprises more than one lot in one or more deposited plans or strata plans, separate planning certificates can be obtained upon application for the other lots. Those certificates may contain different information than is contained in this certificate.

SECTION 10.7(2) DETAILS

In accordance with section 10.7(2) of the *Environmental Planning and Assessment Act 1979* , at the date of this certificate the following information is provided in respect of the prescribed matters to be included in a planning certificate.

1. NAMES OF RELEVANT ENVIRONMENTAL PLANNING INSTRUMENTS

(a) The following environmental planning instrument applies to the land:

Woollahra Local Environmental Plan 2014 (commenced 23 May 2015)

(b) Zone:

SP2 Infrastructure

(c) Development that may be carried out within the zone without development consent:

Roads

(d) Development that may be carried out within the zone with development consent:

Community facilities; Environmental protection works; Recreation areas; The purpose shown on the Land Zoning Map, including any development that is ordinarily incidental or ancillary to development for that purpose

Also refer to Schedule 1 of the LEP "Additional permitted uses" to see if this schedule applies to your land.

(e) Development that is prohibited within the zone:

Any development not specified in item (c) or (d) above.

(f) Do any development standards apply to the land that set minimum land dimensions for the erection of a dwelling house on the land? If yes, what are the minimum dimensions?

No

(g) Does the land include or comprise 'critical habitat' under the provisions of the local environmental plan applying to the land?

No

(h) Is the land located in a heritage conservation area under the provisions of the local environmental plan applying to the land?

No

(i) Is there an item of environmental heritage situated on the land under the provisions of the local environmental plan applying to the land?

Yes. Refer to Woollahra Local Environmental Plan 2014, Schedule 5 Environmental Heritage and the Heritage Map for more information.

2. NAMES OF RELEVANT EXHIBITED PROPOSED ENVIRONMENTAL PLANNING INSTRUMENTS

The following proposed environmental planning instruments, including a planning proposal for a LEP or a draft environmental planning instrument have been the subject of community consultation or on public exhibition under the *Environmental Planning and Assessment Act 1979* (unless the Director-General has notified Council that the making of the proposed instrument has been deferred indefinitely or has not been approved.)

Properties affected: Rose Bay Uniting Church and Wesley Hall at 518a Old South Head Road, Rose Bay
Details: A planning proposal has been prepared to amend the *Woollahra Local Environmental Plan 2014* to list as a heritage item the *Rose Bay Uniting Church and Wesley Hall Group – church and interiors (including moveable heritage, vestry and 1924 additions)* .

Re-exhibition period: Wednesday 12 June to Friday 12 July 2019.

Properties affected: The Four in Hand Hotel at 105 Sutherland Street, Paddington
Details: A planning proposal has been prepared to amend the *Woollahra Local Environmental Plan 2014* to list as a heritage item *The Four in Hand Hotel* at 105 Sutherland Street, Paddington .

Exhibition period: Wednesday 29 May to Friday 28 June 2019.

3. NAMES OF RELEVANT DEVELOPMENT CONTROL PLANS

The following table contains a list of development control plans that have been prepared by Council under Division 6 of Part 3 of the *Environmental Planning and Assessment Act 1979* (including any made by the Council under section 72 of the Act before repeal of that section). Please check the table to see the relevancy of the plans to the land that is the subject of this certificate.

(a) The following development control plan applies to the land:

Woollahra Development Control Plan 2015 (commenced 23 May 2015)

4. NAMES OF RELEVANT DEVELOPMENT CONTROL PLANS PREPARED BY THE DIRECTOR GENERAL

The following development control plans have been prepared by the Director-General under Division 6 of Part 3 of the *Environmental Planning and Assessment Act 1979* (including any made by the Director-General under section 51A, before the repeal of that section).

Sydney Harbour Foreshores and Waterways Area Development Control Plan 2005

This DCP applies to certain land within the Woollahra Municipality being land within the Foreshores and Waterways area identified on the Sydney Regional Environmental Plan (Sydney Harbour Catchment) Foreshores and Waterways Area Map.

5. NAMES OF RELEVANT STATE ENVIRONMENTAL PLANNING POLICIES

Below is a list of all State environmental planning policies that apply to the Woollahra Municipality.

Depending on circumstances set down in each SEPP, the policy may be specifically applicable to the land that is the subject of this certificate. You are advised to peruse the policy for the necessary details. Refer to NSW Department of Planning and Environment.

- State Environmental Planning Policy No. 1 – Development Standards
- State Environmental Planning Policy No. 19 – Bushland in Urban Areas
- State Environmental Planning Policy No. 21 – Caravan Parks
- State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
- State Environmental Planning Policy No. 50 – Canal Estate Development
- State Environmental Planning Policy No. 55 – Remediation of Land
- State Environmental Planning Policy No. 64 – Advertising and Signage
- State Environmental Planning Policy No. 65 – Design Quality of Residential Apartment Development
- State Environmental Planning Policy No. 70 – Affordable Housing (Revised Schemes)
- State Environmental Planning Policy (Affordable Rental Housing) 2009
- State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004
- State Environmental Planning Policy (Coastal Management) 2018
- State Environmental Planning Policy (Concurrence) 2018
- State Environmental Planning Policy (Educational Establishments and Child Care Facilities) 2017
- State Environmental Planning Policy (Exempt and Complying Development Codes) 2008
- State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004
- State Environmental Planning Policy (Infrastructure) 2007
- State Environmental Planning Policy (Major Development) 2005
- State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007
- State Environmental Planning Policy (Miscellaneous Consent Provisions) 2007
- State Environmental Planning Policy (State and Regional Development) 2011
- State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017

Deemed SEPPs:

- Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
  This REP applies to all land within the Woollahra Municipality except for land at Christison Park, Vaucluse as shown on the Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005 Sydney Harbour Catchment Map

5.A STATE ENVIRONMENTAL PLANNING POLICY (COASTAL MANAGEMENT) 2018

Is the land subject to the coastal zone under *State Environmental Planning Policy (Coastal Management) 2018*?

Yes

Disclaimer: This statement is based on information supplied by a third party public authority. The accuracy of this information has not been verified by Woollahra Council and if the information is vital for the proposed end use, then it should be verified by the applicant.

6. NAMES OF PROPOSED STATE ENVIRONMENTAL PLANNING POLICIES

The following proposed State Environmental Planning Policies have been the subject of community consultation or on public exhibition under the *Environmental Planning and Assessment Act 1979* (unless the Director-General has notified Council that the making of the proposed instrument has been deferred indefinitely or has not been approved.)

There are currently no proposed State Environmental Planning Policies applying to the land.

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7. COMPLYING DEVELOPMENT

Is the land, land on which complying development may be carried out under the *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008* ?

Housing Code
Complying development under the Housing Code may not be carried out on the land because it is land that comprises an item that is listed as a heritage item in Woollahra Local Environmental Plan (LEP) 2014.

Notwithstanding the above, complying development under that Code may be undertaken in either of the following circumstances:

1. If the development has been granted an exemption under section 57 (2) of the Heritage Act 1977, or is subject to an exemption under section 57 (1A) or (3) of that Act.

2. If the complying development is not located on that part of the land described and mapped as an item in Woollahra LEP 2014.

Refer to the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 for full details.

Rural Housing Code
Rural Housing Code is not applicable to Woollahra Local Government Area.

Low Rise Medium Density Housing Code
Low Rise Medium Density Housing Code is not applicable to Woollahra Local Government Area.

Greenfield Housing Code
Greenfield Housing Code is not applicable to Woollahra Local Government Area.

Inland Code
Inland Code is not applicable to Woollahra Local Government Area.

Housing Alterations Code
Complying development under the Housing Alterations Code may not be carried out on the land because it is land that comprises an item that is listed as a heritage item in Woollahra Local Environmental Plan (LEP) 2014.

Notwithstanding the above, complying development under that Code may be undertaken in either of the following circumstances:

1. If the development has been granted an exemption under section 57 (2) of the Heritage Act 1977, or is subject to an exemption under section 57 (1A) or (3) of that Act.

2. If the complying development is not located on that part of the land described and mapped as an item in Woollahra LEP 2014.

Refer to the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 for full details.

General Development Code
Complying development under the General Development Code may not be carried out on the land because it is land that comprises an item that is listed as a heritage item in Woollahra Local Environmental Plan (LEP) 2014.

Notwithstanding the above, complying development under that Code may be undertaken in either of the following circumstances:

1. If the development has been granted an exemption under section 57 (2) of the Heritage Act 1977, or is subject to an exemption under section 57 (1A) or (3) of that Act.

2. If the complying development is not located on that part of the land described and mapped as an item in Woollahra LEP 2014.

Refer to the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 for full details.

Commercial and Industrial Alterations Code
Complying development under the Commercial and Industrial Alterations Code may not be carried out on the land because it is land that comprises an item that is listed as a heritage item in Woollahra Local Environmental Plan (LEP) 2014.

Notwithstanding the above, complying development under that Code may be undertaken in either of the following circumstances:

1. If the development has been granted an exemption under section 57 (2) of the Heritage Act 1977, or is subject to an exemption under section 57 (1A) or (3) of that Act.

2. If the complying development is not located on that part of the land described and mapped as an item in Woollahra LEP 2014.

Refer to the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 for full details.

Commercial and Industrial (New Buildings and Additions) Code
Complying development under the Commercial and Industrial (New Buildings and Additions) Code may not be carried out on the land because it is land that comprises an item that is listed as a heritage item in Woollahra Local Environmental Plan (LEP) 2014.

Notwithstanding the above, complying development under that Code may be undertaken in either of the following circumstances:

1. If the development has been granted an exemption under section 57 (2) of the Heritage Act 1977, or is subject to an exemption under section 57 (1A) or (3) of that Act.

2. If the complying development is not located on that part of the land described and mapped as an item in Woollahra LEP 2014.

Refer to the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 for full details.

Container Recycling Facilities Code
Complying development under the Container Recycling Facilities Code may not be carried out on the land because it is land that comprises an item that is listed as a heritage item in Woollahra Local Environmental Plan (LEP) 2014.

Notwithstanding the above, complying development under that Code may be undertaken in either of the following circumstances:

1. If the development has been granted an exemption under section 57 (2) of the Heritage Act 1977, or is subject to an exemption under section 57 (1A) or (3) of that Act.

Subdivisions Code
Complying development under the Subdivisions Code may not be carried out on the land because it is land that comprises an item that is listed as a heritage item in Woollahra Local Environmental Plan (LEP) 2014.

Notwithstanding the above, complying development under that Code may be undertaken in either of the following circumstances:

1. If the development has been granted an exemption under section 57 (2) of the Heritage Act 1977, or is subject to an exemption under section 57 (1A) or (3) of that Act.

2. If the complying development is not located on that part of the land described and mapped as an item in Woollahra LEP 2014.

Refer to the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 for full details.

Demolition Code
Complying development under the Demolition Code may not be carried out on the land because it is land that comprises an item that is listed as a heritage item in Woollahra Local Environmental Plan (LEP) 2014.

Notwithstanding the above, complying development under that Code may be undertaken in either of the following circumstances:

1. If the development has been granted an exemption under section 57 (2) of the Heritage Act 1977, or is subject to an exemption under section 57 (1A) or (3) of that Act.

2. If the complying development is not located on that part of the land described and mapped as an item in Woollahra LEP 2014.

Refer to the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 for full details.

Fire Safety Code
Complying development under the Fire Safety Code may not be carried out on the land because it is land that comprises an item that is listed as a heritage item in Woollahra Local Environmental Plan (LEP) 2014.

Notwithstanding the above, complying development under that Code may be undertaken in either of the following circumstances:

1. If the development has been granted an exemption under section 57 (2) of the Heritage Act 1977, or is subject to an exemption under section 57 (1A) or (3) of that Act.

2. If the complying development is not located on that part of the land described and mapped as an item in Woollahra LEP 2014.

Refer to the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 for full details.

8. ANNUAL CHARGES UNDER LOCAL GOVERNMENT ACT 1993 FOR COASTAL PROTECTION SERVICES THAT RELATE TO EXISTING COASTAL PROTECTION WORKS

Has the owner (or any previous owner) of the land consented in writing to the land being subject to annual charges under section 496B of the *Local Government Act 1993* for coastal protection services that relate to existing coastal protection works (within the meaning of section 553B of that Act)?

No

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9. MINE SUBSIDENCE

Is the land proclaimed to be a mine subsidence district within the meaning of section 15 of the *Mine Subsidence Compensation Act 1961* ?

No

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10. ROAD WIDENING OR ROAD REALIGNMENT

Is the land affected by any road widening or road realignment under:

(a) Division 2 of Part 3 of the Roads Act 1993; or

(b) any environmental planning instrument; or

(c) any resolution of the Council?

No

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11. COUNCIL AND OTHER PUBLIC AUTHORITY POLICIES ON HAZARD RISK RESTRICTIONS

Is the land affected by a policy:

(a) adopted by the Council that restricts the development of the land because of the likelihood of land slip, bushfire, tidal inundation, subsidence, acid sulfate soils or any other risk (other than flooding)?

Yes

Woollahra LEP 2014, clause 6.1 (Acid sulfate soils) may require an assessment of acid sulfate soils for certain types of development located on certain land identified on the Acid Sulfate Soils Map of the LEP.

Woollahra DCP 2015 includes a policy on contaminated land which may restrict the development of the land. This policy is implemented when zoning or land use changes are proposed on lands which have previously been used for certain purposes. Applicants must consider Council's DCP as well as State legislation including the State Environmental Planning Policy No. 55 – Remediation of Land.

(b) adopted by any other public authority and notified to the Council for the express purpose of its adoption by that authority being referred to in planning certificates issued by the Council, that restricts the development of the land because of the likelihood of land slip, bushfire, tidal inundation, subsidence, acid sulfate soils or any other risk (other than flooding)?

No

12. FLOOD RELATED DEVELOPMENT CONTROLS INFORMATION

(a) Is development on the land or part of the land for the purposes of dwelling houses, dual occupancies, multi dwelling housing or residential flat buildings (not including development for the purposes of group homes or seniors housing) subject to flood related development controls?

Yes.

Part or all of the subject land may be subject to flood related development controls, applicants are advised to inspect relevant flood reports and consult with Council's Technical Services Department. Further flood investigations may be required to accurately determine the nature of flooding on the site.

(b) Is development on the land or part of the land for any other purpose subject to flood related development controls?

Yes.

Part or all of the subject land may be subject to flood related development controls, applicants are advised to inspect relevant flood reports and consult with Council's Technical Services Department. Further flood investigations may be required to accurately determine the nature of flooding on the site.

Note: Words and expressions used in this item have the same meanings as in the instrument set out in the Schedule to the *Standard Instrument (Local Environmental Plans) Order 2006*.

13. LAND RESERVED FOR ACQUISITION

Does an environmental planning instrument or proposed environmental planning instrument applying to the land make provision in relation to the acquisition of the land by a public authority, as referred to in section 27 of the *Environmental Planning and Assessment Act 1979* ?

No

14. CONTRIBUTIONS PLAN

The following contributions plan may apply to the land:
- Woollahra Section 94A Development Contributions Plan 2011 (31 August 2011)
- Woollahra Section 94 Contributions Plan (31 March 2003).

15. BIODIVERSITY CERTIFIED LAND

Is the land biodiversity certified land under Part 8 of the *Biodiversity Conservation Act 2016*?

No

16. BIODIVERSITY STEWARDSHIP SITES

Is the land a biodiversity stewardship site under a biodiversity stewardship agreement under Part 5 of the *Biodiversity Conservation Act 2016*?

No

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17. NATIVE VEGETATION CLEARING SET ASIDES

Does the land contain a set aside area under section 60ZC of the *Local Land Services Act 2013*?

No

Disclaimer: This statement is based on information supplied by a third party public authority. The accuracy of this information has not been verified by Woollahra Council and if the information is vital for the proposed end use, then it should be verified by the applicant.

18. BUSH FIRE PRONE LAND

Is the land to which this certificate relates bush fire prone land?

No

Disclaimer: This statement is based on information supplied by a third party public authority. The accuracy of this information has not been verified by Woollahra Council and if the information is vital for the proposed end use, then it should be verified by the applicant.

19. PROPERTY VEGETATION PLANS

Is the land the subject of a property vegetation plan approved under Part 4 of the *Native Vegetation Act 2003* (and that continues in force) ?

No

Disclaimer: This statement is based on information supplied by a third party public authority. The accuracy of this information has not been verified by Woollahra Council and if the information is vital for the proposed end use, then it should be verified by the applicant.

20. ORDERS UNDER TREES (DISPUTES BETWEEN NEIGHBOURS) ACT 2006

Has an order been made under the *Trees (Disputes Between Neighbours) Act 2006* to carry out work in relation to a tree on the land (but only if Council has been notified of the order).

No

Disclaimer: This statement is based on information supplied by a third party public authority. The accuracy of this information has not been verified by Woollahra Council and if the information is vital for the proposed end use, then it should be verified by the applicant.

21. DIRECTIONS UNDER PART 3A

Is there a direction by the Minister in force under section 75P (2) (c1) of the Act that a provision of an environmental planning instrument prohibiting or restricting the carrying out of a project or a stage of a project on the land under Part 4 of the Act does not have effect?

No

Disclaimer: This statement is based on information supplied by a third party public authority. The accuracy of this information has not been verified by Woollahra Council and if the information is vital for the proposed end use, then it should be verified by the applicant.

22. SITE COMPATIBILITY CERTIFICATES AND CONDITIONS FOR SENIORS

Is there a current site compatibility certificate (seniors housing), of which the Council is aware *?*

No

Are there any terms of a kind referred to in clause 18(2) of *State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004* that have been imposed as a condition of consent to a development application granted after 11 October 2007?

No

Disclaimer: This statement is based on information supplied by a third party public authority. The accuracy of this information has not been verified by Woollahra Council and if the information is vital for the proposed end use, then it should be verified by the applicant.

23. SITE COMPATIBILITY CERTIFICATES FOR INFRASTRUCTURE, SCHOOLS OR TAFE ESTABLISHMENTS

Is there a valid site compatibility certificate (infrastructure) or site compatibility certificate (schools or TAFE establishments), of which the Council is aware *?*

No

Disclaimer: This statement is based on information supplied by a third party public authority. The accuracy of this information has not been verified by Woollahra Council and if the information is vital for the proposed end use, then it should be verified by the applicant.

24. SITE COMPATIBILITY CERTIFICATES AND CONDITIONS FOR AFFORDABLE HOUSING

Is there a current site compatibility certificate (affordable rental housing), of which the Council is aware *?*

No

Are there any terms of a kind referred to in clause 17(1) or 37(1) of *State Environmental Planning Policy (Affordable Rental Housing) 2009* that have been imposed as a condition of consent to a development application in respect of the land?

No

Disclaimer: This statement is based on information supplied by a third party public authority. The accuracy of this information has not been verified by Woollahra Council and if the information is vital for the proposed end use, then it should be verified by the applicant.

25. PAPER SUBDIVISION INFORMATION

Is there a development plan adopted by a relevant authority that applies to the land or that is proposed to be subject to a consent ballot?

No

26. SITE VERIFICATION CERTIFICATE

Is there a current site verification certificate of which this council is aware?

No

Note: A site verification certificate sets out the Director-General's opinion as to whether the land concerned is or is not biophysical strategic agricultural land or critical industry cluster land – see Division 3 of Part 4AA of *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*

27. MATTERS ARISING UNDER THE CONTAMINATED LAND MANAGEMENT ACT 1997

(a) Is the land (or part of the land) to which this certificate relates significantly contaminated land?

No

(b) Is the land to which this certificate relates subject to a management order?

No

(c) Is the land to which this certificate relates the subject of an approved voluntary management proposal?

No

(d) Is the land to which this certificate relates subject to an ongoing maintenance order?

No

(e) Is the land to which this certificate relates the subject of a site audit statement?

No

Note: These matters are prescribed by section 59 (2) of the *Contaminated Land Management Act 1997* as additional matters to be specified in a planning certificate. Section 53B requires site auditors to furnish local authorities with copies of audit statements relating to site audits for the purposes of statutory requirements.

Disclaimer: This statement is based on information supplied by a third party public authority. The accuracy of this information has not been verified by Woollahra Council and if the information is vital for the proposed end use, then it should be verified by the applicant.

28. LOOSE-FILL ASBESTOS INSULATION

Does the land include any residential premises (within the meaning of Division 1A of Part 8 of the *Home Building Act 1989*) listed on the register that is required to be maintained under that Division.

No

Disclaimer: This statement is based on information supplied by a third party public authority. The accuracy of this information has not been verified by Woollahra Council and if the information is vital for the proposed end use, then it should be verified by the applicant.

29. AFFECTED BUILDING NOTICES AND BUILDING PRODUCT RECTIFICATION ORDERS

(a) Is there any affected building notice in force in respect of the land?

No

(b) Is there any building product rectification order in force in respect of the land that has not been fully complied with?

No

(c) Is there any outstanding notice of intention to make a building product rectification order?

No

Note: ***affected building notice*** has the same meaning as in Part 4 of the *Building Products (Safety) Act 2017.*
building product rectification order has the same meaning as in the *Building Products (Safety) Act 2017.*

Disclaimer: This statement is based on information supplied by a third party public authority. The accuracy of this information has not been verified by Woollahra Council and if the information is vital for the proposed end use, then it should be verified by the applicant.

SECTION 10.7(5) DETAILS

This certificate is directed to the following relevant matters affecting the land.

Note : When information pursuant to section 10.7(5) is requested the Council is under no obligation to furnish any of the information supplied herein pursuant to that section.

Council draws your attention to section 10.7(6), which states that a Council shall not incur any liability in respect of any advice provided in good faith pursuant to sub-section (5). The absence of any reference to any matter affecting the land shall not imply that the land is not affected by any matter not referred to in this planning certificate.

1. OTHER CONTROLS FROM WOOLLAHRA LOCAL ENVIRONMENTAL PLAN 2014

a) What is the maximum size of any lot resulting from a subdivision of land (as shown on the Lot Size Map)? Refer to clause 4.1 Minimum subdvision lot size.

No minimum lot size applies

b) Is the land affected by a foreshore building line (as shown on the Foreshore Building Line Map)? Refer to clause 6.4 Limited development on foreshore areas.

No

2. STATE HERITAGE REGISTER ITEMS

Is the land identified under the provisions of the *Heritage Act 1977*?

No

Disclaimer: This statement is based on information supplied by a third party public authority. The accuracy of this information has not been verified by Woollahra Council and if the information is vital for the proposed end use, then it should be verified by the applicant.

3. COMMONWEALTH HERITAGE LIST

Is the land identified as a Commonwealth Heritage Place under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999?*

No

Disclaimer: This statement is based on information supplied by a third party public authority. The accuracy of this information has not been verified by Woollahra Council and if the information is vital for the proposed end use, then it should be verified by the applicant.

4. RESOLUTION OF COUNCIL TO PREPARE A PLANNING PROPOSAL FOR A LOCAL ENVIRONMENTAL PLAN

A list of Council decisions to prepare a planning proposal for a local environmental plan is provided below. These planning proposals have not been exhibited under section 57 of the *Environmental Planning and Assessment Act 1979* .

Property affected: Double Bay Centre
Date of decision: 20 August 2018
Relevant terms of the resolution:

Item No: 9.1 (R1)
A. THAT Council resolve to prepare a planning proposal to amend Woollahra Local Environmental Plan 2014 by introducing new provisions which protect the provision of commercial floor space in the Double Bay Centre.

Property affected: See terms of the resolution
Date of decision: on 25 March 2019
Relevant terms of the resolution:

Item No: 9.1 (R2)

A. THAT Council prepare a planning proposal to amend clause 4.1A of Woollahra LEP 2014 by inserting minimum lot size standards for manor house and multi dwelling housing (terraces).

Property affected: See terms of the resolution
Date of decision: 29 April 2019
Relevant terms of the resolution:

Item No: 9.1 (R3)

A. THAT Council prepare a planning proposal to amend Woollahra Local Environmental Plan 2014 by introducing:
   1. A maximum FSR of 0.5:1 for low desnsity residential development in the R2 Low Density Residential and R3 Medium Density Residential zones.
   2. A maximum FSR of 0.75:1 for low density residential development in the Wolseley Road, Point Piper, area as shown in *Figure 1* in the report to the Environmental Planning Committee meeting of 4 March 2019.
   3. A range of maximum FSRs as set out in the report to the Environmental Planning Committee meeting on 4 March 2019 for low density residential development on small lots in the R2 Low Density Residential Development And R3 Medium Density Residential zones.
   4. Specific objectives and other associated amendments to facilitate 1, 2 and 3.
   5. The FSRs in A1, 2 and 3 and associated changes referred to in A4 will not apply to the Paddington, Watsons Bay and Woollahra Heritage Conservation Areas.

G. That noting our concern for development in smaller lots (400sqm or less) that Council seeks advice from the Woollahra Local Planning Panel on the best methods to apply FSR to smaller lots outlined in point A. (3).

Property affected: Sewerage Pumping Station, Percival Park, Rose Bay
Date of decision: 9 September 2019
Relevant terms of the resolution:

Item No: 13.1(R1)

A. THAT a planning proposal be prepared to list the sewerage pumping station (SPS 46) and sandstone gate posts and metal gates in Percival Park at 13 Collins Avenue, Rose Bat as a heritage item in Woollahra Local Environmental Plan 2014.

Property affected: See terms of resolution
Date of decision: 11 November 2019
Relevant terms of the resolution:

Item No: 13.1(R2)

A. THAT a planning proposal to amend the Flood Planning Map of Woollahra Local Environmental Plan 2014 based on the adopted Paddington Floodplain Risk Management Study and Plan 2019.

Property affected: 30 Wyuna Road, Point Piper
Date of decision: 11 November 2019
Relevant terms of the resolution:

Item No: 13.3(R3)

A. THAT a planning proposal be prepared to list the property at 30 Wyuna Road, Point Piper as a heritage item in Woollahra Local Environmental Plan 2014.

Property affected: See terms of resolution
Date of decision: 11 November 2019
Relevant terms of the resolution:

Item No: 13.3(R4)

C. THAT a planning proposal be prepared to increase the minimum lost size of attached dual occupancies in the R2 zone to 800m2.

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5. COASTAL HAZARDS

An Estuary Planning Levels Report (August 2014) by Cardno is a supporting document to the Woollahra Development Control Plan 2015.

The Estuary Planning Levels Report identifies:
- foreshore properties which may be subject to current coastal inundation risks caused by local wind and wave setup, and/or wave run-up/overtopping; and
- foreshore properties which may be subject to future coastal inundation risks caused by sea level rise.

The report recommends planning controls to minimise the effects of coastal inundation risks. The Report can be inspected at Council or on Council's website.

6. RESOLUTIONS OF COUNCIL RELATING TO HERITAGE LISTINGS OR CONTRIBUTORY ITEMS IN DEVELOPMENT CONTROL PLANS

Properties affected: 8A Cooper Street, Paddington
Date of decision: 27 November 2006
Relevant terms of resolution:

E. That pending gazettal of the following properties as local heritage items in Woollahra Local Environmental Plan 1995, further investigation be undertaken to determine if a nomination to the State Heritage Register should be prepared:

Cooper Street	*Paddington*	*8A*	*House*

Property affected: 4 Dunara Gardens, Point Piper
Date of decision: 18 December 2006
Relevant terms of the resolution:

D. That pending gazettal of the following property as local heritage item in Woollahra Local Environmental Plan 1995, further investigation be undertaken to determine if a nomination to the State Heritage Register should be prepared:

Dunara Gardens	*Point Piper*	*4*	*House*

Property affected: Cooper Park in the suburbs of Bellevue Hill and Woollahra
Date of decision: 27 November 2017
Relevant terms of the resolution:

THAT Council requests staff to prepare and submit a report including a heritage assessment and draft heritage inventory sheet for Cooper Park to Urban Planning Committee to facilitate Cooper Park (and its elements) being:

1. included in the Woollahra Local Environmental Plan as a heritage item; and
2. listed as a heritage item of state significance on the NSW State Heritage Register.

Property affected: See terms of resolution
Date of decision: 23 April 2018
Relevant terms of the resolution:

Item No: 11.1
That Council requests staff to prepare and submit a report including a heritage assessment and draft heritage inventory sheet for each of:
1. The Sydney Croquet Club building and green (having its address in Woollahra Park, O'Sullivan Road, Rose Bay); and

2. The Woollahra Golf Club clubhouse and George Grimley Pavilion (having its address in Woollahra Park at 50 O'Sullivan Road, Rose Bay)

to the relevant Council Committee to facilitate the Sydney Croquet Club building and greens and the Woollahra Gold Club clubhouse and George Grimley Pavilion (and their elements) being:
1. Included in the Woollahra Local Environmental Plan as a heritage item; and
2. Listed as a heritage item of state significance on the NSW State Heritage Register.

Property affected: See terms of resolution
Date of decision: 18 June 2018
Relevant terms of the resolution:

Item No: 11.1
THAT Council
A. Request staff to undertake an assessment of heritage significance for the Rose Bay Scout Hall (former RAAF Officers' Canteen) located in Vickery Avenue, Rose Bay, and report to the Environmental Planning Committee on whether the property has sufficient heritage significance to be listed as:
   i) a local heritage item in the Woollahra Local Environment Plan 2014 (WLEP), and
   ii) an item of State Heritage under the Heritage Act 1977.

Property affected: 2A Cooper Street, Double Bay
Date of decision: 29 October 2018
Relevant terms of the resolution:

Item No: 9.1 (R1)
D. THAT Council support the nomination to list Gaden House at 2A Cooper Street, Double Bay as a heritage item on the State Heritage Register and submit it to the Office of Environment and Heritage.

Property affected: See terms of resolution
Date of decision: 8 April 2019
Relevant terms of the resolution:

Item No: 11.2
THAT Council requests staff to undertake an assessment of heritage significance for the following properties located in Rose Bay, NSW;
i) St Andrews Scots Presbyterian Church, corner of Dover Rd and Carlisle Street, Rose Bay;
ii) Old School Hall, Rose Bay Public School, Albermarle Ave, Rose Bay; and
iii) McAuley Catholic School and outbuildings (formerly Christian Brothers College Rose Bay),

and report to the Environmental Planning Committee on whether these items have sufficient heritage significance to be listed as:
i) a local heritage item in the Woollahra Local Environmental Plan 2014 (WLEP); and/or
ii) an item on the State Heritage Register under the Heritage Act 1977.

Property affected: See terms of resolution
Date of decision: 8 April 2019
Relevant terms of the resolution:

Item No: 11.3
THAT Council
B. Requests staff to commission a report to investigate potential heritage significance of places of worship in the Woollahra Local Government area in order to identify items of heritage significance at either a local or State level, with a view to having those identified items listed as;
   (a) a local heritage item in the Woollahra Local Environmental Plan 2014 (WLEP); and/or
   (b) an item on the State Heritage Register under the Heritage Act 1977.

Property affected: 3 Trelawney Street, Woollahra
Date of decision: 11 November 2019
Relevant terms of the resolution:

Item No: 16.3
THAT Council proceeds urgently to assess Trelawney Court at number 3 Trelawney Street, Woollahra with a view to a local heritage listing.

Property affected: See terms of resolution
Date of decision: 11 November 2019
Relevant terms of the resolution:

Item No: 16.4
A. Notes the detailed report on Californian Bungalows presented to the Urban Planning Committee on 22 June 2015.
B. Notes the recommendation to Council on 22 June 2015 to prepare a planning proposal to list 16 Bunyula Road, 6 March Street, 165 O'Sullivan Road, 44 Russell Street, 5A Vivian Street, Bellevue Hill and 10 Parsley Bay, Vaucluse as heritage items in Schedule 5 of the Woollahra LEP 2014.
C. Requests the Director of Planning to review the above mentioned recommendation and provide an updated recommendation to Council on the merit of heritage listing the properties mentioned above.
D. Requests staff to prepare a report on arts and crafts buildings, including any examples of outstanding significance recommended for listing in Schedule 5 of the Woollahra LEP.

Property affected: See terms of resolution
Date of decision: 11 November 2019
Relevant terms of the resolution:

Item No: 16.5

THAT Council:
A. Request staff to report to the Environmental Planning Committee on how the detailed controls for Inter-War residential flat buildings found in B3.8.7 of the Woollahra DCP 2015 can be applied to the Paddington, Woollahra and Watsons Bay Heritage Conservations Areas.
B. Notes community concern about the recent demolition of interwar residential flat buildings at 12 and 16 William Street, Double Bay, and 75 and 77 O'Sullivan Road, Bellevue Hill, and requests staff to provide commentary on the most effective means of protecting from

demolition interwar buildings located in all zones across the municipality, including if appropriate the invocation of LEP provisions.

7. DRAFT WATSONS BAY FLOOD RISK MANAGEMENT STUDY AND PLAN (MAY 2016)

The Draft Watsons Bay Flood Risk Management Study and Plan (May 2016) has been prepared in accordance with the NSW Floodplain Development Manual. The Draft Plan aims to provide solutions to existing flooding problems and ensure that new development is compatible with the flood hazard and does not create additional flooding problems.

The Woollahra Local Environmental Plan 2014 maps land that is identified as flood planning area, and is therefore subject to the controls in Cl 6.3 flood planning. The Draft Plan includes additional properties in Watsons Bay that are in the flood planning area.

These properties are: **14-16, 18-25 Cliff Street; 1-2, 43 Cove Street; HMAS Watson (Lot 3 DP 605078); 1-2, 6-7, 11-12, 10-24 Marine Parade; 31, 33 Pacific Street; Robertson Park (22 Military Road); 2 Short Street; Sydney Harbour National Park (Lot 1, 2 DP 605078) and 25 Victoria Street.**

The Draft Plan includes the following properties that are not identified as flood planning area: **1, 3, 5, 7 Victoria Street and 29 Cliff Street.**

The report can be inspected at Council or on Council's website. For further information contact Council's engineer.

8. PADDINGTON FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN (July 2019)

At the meeting of 9 September 2019, Council adopted the *Paddington Floodplain Risk Management Study and Plan* dated July 2019

The Study and Plan was prepared in accordance with the NSW Floodplain Development Manual. The Study and Plan aims to provide solutions to existing flooding problems and ensure that new development is compatible with flood hazard and does not create additional flooding problems.

The *Woollahra Local Environmental Plan 2014* maps land that is identified as flood planning area, and is therefore subject to the controls in Cl 6.3 flood planning. The Study and Plan includes additional properties in the Paddington area that are in the flood planning area.

The *Woollahra Local Environmental Plan 2014* maps will be updated, based on the information contained in the adopted Study and Plan.

Should the applicant require further information about any other matter please contact Council's Planning and Development Division.

Anne White
per:
Gary James
General Manager

SafeWork NSW Records

NSW GOVERNMENT | SafeWork NSW

Locked Bag 2906, Lisarow NSW 2252
Customer Experience 13 10 50
ABN 81 913 830 179 | www.safework.nsw.gov.au

Our Ref: D20/062350

30 January 2020

Anthony Barkway
JK Environments
PO Box 976
North Ryde BC NSW 1670

Dear Anthony Barkway

RE SITE: 1A & 2 Vaucluse Road Vaucluse NSW 2030

I refer to your site search request received by SafeWork NSW on 15 January 2020 requesting information on Storage of Hazardous Chemicals for the above site.

A search of the records held by SafeWork NSW has not located any records pertaining to the above-mentioned premises.

For further information or if you have any questions, please call us on 13 10 50 or email licensing@safework.nsw.gov.au

Yours sincerely

Customer Service Officer
Customer Experience - Operations
SafeWork NSW

Appendix D: Borehole Logs

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BOREHOLE LOG

Borehole No. 1

1 / 1

PROPOSED ELC BUILDING

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH1 **Method:** SPIRAL AUGER **R.L. Surface:** 35.1 m

Date: 28/1/20 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION						35			-	ASPHALTIC CONCRETE: 50mm.t	M			
										FILL: Gravelly silty sand, fine to coarse grained, light grey, fine to medium grained igneous gravel.				APPEARS MODERATELY COMPACTED
					N = 11 5,6,5					FILL: Silty sand, fine to coarse grained, light brown, trace of clay and fine to medium grained sandstone gravel.				
						34	1							
					N > 3 2,3/ 100mm REFUSAL				-	SANDSTONE: fine to coarse grained, light grey and red brown.	DW	M - H		HAWKESBURY SANDSTONE
						33	2			END OF BOREHOLE AT 2.00 m				HIGH 'TC' BIT RESISTANCE
						32	3							'TC' BIT REFUSAL
						31	4							
						30	5							
						29	6							

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BOREHOLE LOG

Borehole No. 2

PROPOSED ELC BUILDING

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH1 **Method:** SPIRAL AUGER **R.L. Surface:** 38.6 m

Date: 28/1/20 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
										ASPHALTIC CONCRETE: 90mm.t				
					N = 4 2,2,2	38	1		-	FILL: Silty sand, fine to coarse grained, brown, with brick fragments, trace of sandstone gravel and clay.	M			APPEARS POORLY COMPACTED
					N = 7 4,4,3	37	2							
					N = 4 6,2,2	36	3							
						35	4							
					N = 8 4,5,3	34	5		SM	Silty SAND: fine to coarse grained, light orange brown, with clay, trace of fine to coarse grained ironstone gravel.	M	L		CONTINUAL SPIRAL AUGER DRILLING (i.e. NO INSITU TESTING) BELOW 4.95m IN ORDER TO ATTEMPT TO PROVE BEDROCK
						33	6							
						32								

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BOREHOLE LOG

Borehole No. 2 **2 / 2**

PROPOSED ELC BUILDING

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH1 **Method:** SPIRAL AUGER **R.L. Surface:** 38.6 m

Date: 28/1/20 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
ON 3/2/20						31	8		SM	Silty SAND: fine to coarse grained, light orange brown, with clay, trace of fine to coarse grained ironstone gravel.	M	L		
ON COMPLETION OF AUGERING	■			■		30	9		SW	Gravelly SAND: fine to coarse grained, light orange brown, fine to coarse grained ironstone gravel, with clay .	W			
						29	10			END OF BOREHOLE AT 9.20 m				GROUNDWATER MONITORING WELL INSTALLED TO 9.2m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 3.2m TO 9.2m. CASING 3.2m TO 0.2m. 2mm SAND FILTER PACK 2.8m TO 9.2m. BENTONITE SEAL 2.4m TO 2.8m. BACKFILLED WITH CUTTINGS TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.
						28	11							
						27	12							
						26	13							
						25								

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BOREHOLE LOG

Borehole No. 3

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH1 **Method:** SPIRAL AUGER **R.L. Surface:** 40.6 m

Date: 28/1/20 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION									-	ASPHALTIC CONCRETE: 50mm.t FILL: Silty sand, fine grained, brown, trace of clay. FILL: Silty sand, fine to medium grained, brown and light brown. FILL: Silty sand, fine to coarse grained, brown and dark brown, trace of igneous gravel and brick fragments.	M			APPEARS WELL COMPACTED
					N = 21 10,11,10	40	1							
					N = 6 5,4,2	39	2							APPEARS POORLY COMPACTED
					N = 15 7,4,11	38	3							APPEARS WELL COMPACTED
						37	4			as above, but with sandstone boulders and cobbles.				BANDS OF LOW 'TC' BIT RESISTANCE
					Nc = 12	36	5							
					15		6							
					11 /100mm REFUSAL	35			-	SANDSTONE: fine to coarse grained, light grey, grey and red brown, with occasional medium strength bands.	XW - DW	Hd - VL		HAWKESBURY SANDSTONE VERY LOW RESISTANCE WITH MODERATE BANDS
						34								

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BOREHOLE LOG

Borehole No. 3 **2 / 2**

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH1 **Method:** SPIRAL AUGER **R.L. Surface:** 40.6 m

Date: 28/1/20 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
						33	8		-	SANDSTONE: fine to coarse grained, light grey and grey, with occasional medium strength iron indurated bands.	XW - DW	Hd - VL		VERY LOW RESISTANCE WITH MODERATE BANDS
						32	9				DW	M - H		HIGH RESISTANCE
						31	10			END OF BOREHOLE AT 9.30 m				'TC' BIT REFUSAL
						30	11							
						29	12							
						28	13							
						27								

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BOREHOLE LOG

Borehole No. 4
1 / 1

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH2 **Method:** SPIRAL AUGER **R.L. Surface:** N/A

Date: 28/1/20 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION									FILL: Silty sand, fine to coarse grained, brown and light brown, trace of root fibres.	M			GRASS COVER APPEARS POORLY COMPACTED
					N = 7 3,4,3	1							
									as above, but light orange brown.				
					N = 2 5,1,1	2							
								-	SANDSTONE: fine to coarse grained, orange brown.	XW - DW	Hd - VL		HAWKESBURY SANDSTONE VERY LOW 'TC' BIT RESISTANCE
						3			as above, but light grey.	SW	M - H		MODERATE TO HIGH RESISTANCE
									END OF BOREHOLE AT 3.20 m				'TC' BIT REFUSAL
						4							
						5							
						6							

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BOREHOLE LOG

Borehole No. 5

1 / 1

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH2 **Method:** SPIRAL AUGER **R.L. Surface:** N/A

Date: 28/1/20 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION									FILL: Silty sand, fine to coarse grained, brown and dark brown, with sandstone cobbles and boulders, trace of root fibres.	M			GRASS COVER APPEARS MODERATELY COMPACTED
					N > 13 6,13/ 150mm REFUSAL	1							
						2		-	SANDSTONE: fine to coarse grained, light brown.	DW	M		HAWKESBURY SANDSTONE MODERATE TO HIGH 'TC' BIT RESISTANCE
									END OF BOREHOLE AT 2.50 m				'TC' BIT REFUSAL
						3							
						4							
						5							
						6							

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BOREHOLE LOG

Borehole No. 6

1 / 1

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH2 **Method:** HAND AUGER **R.L. Surface:** 51.4 m

Date: 3/2/20 **Datum:** AHD

Plant Type: **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■		■	■	REFER TO DCP TEST RESULTS					FILL: Silty sand, fine to coarse grained, dark brown, trace of roots and root fibres.	M			GRASS COVER
				■		51			SM	Silty SAND: fine to medium grained, orange brown, trace of clay.	M	MD		RESIDUAL
										END OF BOREHOLE AT 0.50 m				HAND AUGER REFUSAL ON INFERRED SANDSTONE BEDROCK

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BOREHOLE LOG

Borehole No. 7

1 / 1

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH2 **Method:** HAND AUGER **R.L. Surface:** 51.8 m

Date: 3/2/20 **Datum:** AHD

Plant Type: **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■				REFER TO DCP TEST RESULTS					FILL: Silty sand, fine to coarse grained, dark brown, trace of roots and root fibres.	M			
	■			■					SM		M	D		RESIDUAL
										Silty SAND: fine to coarse grained, light orange brown.				HAND AUGER REFUSAL ON INFERRED SANDSTONE BEDROCK
										END OF BOREHOLE AT 0.40 m				
						51	1							
						50	2							
						49	3							
						48	4							
						47	5							
						46	6							
						45								

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BOREHOLE LOG

Borehole No. 8

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH3 **Method:** HAND AUGER **R.L. Surface:** N/A

Date: 3/2/20 **Datum:**

Plant Type: **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
ON COMPELTION OF AUGERING					REFER TO DCP TEST RESULTS	1			FILL: Silty sand, fine to medium grained, brown, trace of roots and root fibres.	M			GRASS COVER APPEARS MODERATELY COMPACTED
									as above, but grey and light brown, trace of fine to medium grained ironstone gravel, concrete fragments and slag.				APPEARS POORLY COMPACTED
								SC	Clayey SAND: fine to coarse grained, light brown.	W	VL		RESIDUAL
						2			REFER TO CORED BOREHOLE LOG				
						3							
						4							
						5							
						6							

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CORED BOREHOLE LOG

Borehole No. 8

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH3 **Core Size:** TT56 **R.L. Surface:** N/A

Date: 3/2/20 **Inclination:** VERTICAL **Datum:**

Plant Type: MELVELLE **Bearing:** N/A **Logged/Checked By:** D.A.F./A.J.H.

Water Loss\Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	DEFECT DETAILS: SPACING (mm) (600, 200, 60, 20)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
				START CORING AT 1.80m						
		2		NO CORE 0.32m						
				SANDSTONE: fine to coarse grained, light grey, orange brown and red brown, bedded at 0-15°.	DW	M	0.50, 0.80		(2.36m) Be, 0°, Fe Sn	Hawkesbury Sandstone
		3		as above, but light grey and grey.	FR					
100% RETURN				NO CORE 0.15m						
				SANDSTONE: fine to coarse grained, light grey. with grey laminae, bedded at 0-20°.	FR	M	0.60, 0.90, 1.0, 1.0, 0.80, 1.0			Hawkesbury Sandstone
		4								
		5								
		6		END OF BOREHOLE AT 5.95 m						
		7								

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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BOREHOLE LOG

Borehole No. 9

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH3 **Method:** HAND AUGER **R.L. Surface:** N/A

Date: 3/2/20 **Datum:**

Plant Type: **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING	■			■	REFER TO DCP TEST RESULTS				FILL: Silty sand, fine to coarse grained, brown and dark brown, trace of fine to medium grained sandstone gravel, roots and root fibres.	M			GRASS COVER APPEARS POORLY COMPACTED
	■			■					FILL: Silty sand, fine to coarse grained, light orange brown and brown, with fine to medium grained sandstone gravel and clay.				
						1			REFER TO CORED BOREHOLE LOG				
						2							
						3							
						4							
						5							
						6							

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CORED BOREHOLE LOG

Borehole No. 9 **2 / 2**

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH3 **Core Size:** TT56 **R.L. Surface:** N/A

Date: 3/2/20 **Inclination:** VERTICAL **Datum:**

Plant Type: MELVELLE **Bearing:** N/A **Logged/Checked By:** D.A.F./A.J.H.

Water Loss\Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL 0.1 L 0.3 M 1 H 3 VH 10 EH	DEFECT DETAILS SPACING (mm) 600 200 60 20	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
				START CORING AT 0.90m						
100% RETURN		1		SANDSTONE: fine to coarse grained, red brown and orange brown, bedded at 10-20°.	DW	H	1.2			Hawkesbury Sandstone
							1.1		(1.40m) Be, 10°, Fe Sn	
		2			SW - FR	M	0.70			
				SANDSTONE: fe to coarse grained, light grey, with occasional grey laminae, bedded at 5-15°.			0.90		(2.42m) Be, 10°, Fe Sn	
		3					0.60			
				NO CORE 0.13m						
		4		SANDSTONE: fine to coarse grained, light grey, with occasional grey laminae, bedded at 5-15°.	FR	M	0.80			Hawkesbury Sandstone
							0.80			
				END OF BOREHOLE AT 4.70 m						
		5								
		6								

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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BOREHOLE LOG

Borehole No. 10

1 / 1

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH3 **Method:** HAND AUGER **R.L. Surface:** N/A

Date: 3/2/20 **Datum:**

Plant Type: **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION					REFER TO DCP TEST RESULTS				FILL: Silty sand, fine to coarse grained, dark brown, trace of fine to coarse grained sandstone gravel.	M			APPEARS POORLY COMPACTED
									END OF BOREHOLE AT 0.45 m				HAND AUGER REFUSAL ON INFERRED SANDSTONE BEDROCK

ENVIRONMENTAL LOGS EXPLANATION NOTES

INTRODUCTION

These notes have been provided to amplify the environmental report in regard to classification methods, field procedures and certain matters relating to the logging of soil and rock. Not all notes are necessarily relevant to all reports.

Where geotechnical borehole logs are utilised for environmental purpose, reference should also be made to the explanatory notes included in the geotechnical report. Environmental logs are not suitable for geotechnical purposes.

The ground is a product of continuing natural and man-made processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Environmental studies include gathering and assimilating limited facts about these characteristics and properties in order to understand or predict the behaviour of the ground on a particular site under certain conditions. This report may contain such facts obtained by inspection, excavation, probing, sampling, testing or other means of investigation. If so, they are directly relevant only to the ground at the place where and time when the investigation was carried out.

DESCRIPTION AND CLASSIFICATION METHODS

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726:2017 *'Geotechnical Site Investigations'*. In general, descriptions cover the following properties – soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geoenvironmental practice.

Soil types are described according to the predominating particle size and behaviour as set out in the attached soil classification table qualified by the grading of other particles present (eg. sandy clay) as set out below:

Soil Classification	Particle Size
Clay	< 0.002mm
Silt	0.002 to 0.075mm
Sand	0.075 to 2.36mm
Gravel	2.36 to 63mm
Cobbles	63 to 200mm
Boulders	> 200mm

Non-cohesive soils are classified on the basis of relative density, generally from the results of Standard Penetration Test (SPT) as below:

Relative Density	SPT 'N' Value (blows/300mm)
Very loose (VL)	< 4
Loose (L)	4 to 10
Medium dense (MD)	10 to 30
Dense (D)	30 to 50
Very Dense (VD)	> 50

Cohesive soils are classified on the basis of strength (consistency) either by use of a hand penetrometer, vane shear, laboratory testing and/or tactile engineering examination. The strength terms are defined as follows.

Classification	Unconfined Compressive Strength (kPa)	Indicative Undrained Shear Strength (kPa)
Very Soft (VS)	≤ 25	≤ 12
Soft (S)	> 25 and ≤ 50	> 12 and ≤ 25
Firm (F)	> 50 and ≤ 100	> 25 and ≤ 50
Stiff (St)	> 100 and ≤ 200	> 50 and ≤ 100
Very Stiff (VSt)	> 200 and ≤ 400	> 100 and ≤ 200
Hard (Hd)	> 400	> 200
Friable (Fr)	Strength not attainable – soil crumbles	

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, defects, etc. Where relevant, further information regarding rock classification is given in the text of the report. In the Sydney Basin, 'shale' is used to describe fissile mudstone, with a weakness parallel to bedding. Rocks with alternating inter-laminations of different grain size (eg. siltstone/claystone and siltstone/fine grained sandstone) are referred to as 'laminite'.

INVESTIGATION METHODS

The following is a brief summary of investigation methods currently adopted by the Company and some comments on their use and application. All methods except test pits, hand auger drilling and portable Dynamic Cone Penetrometers require the use of a mechanical rig which is commonly mounted on a truck chassis or track base.

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the insitu soils and 'weaker' bedrock if it is safe to descend into the pit. The depth of penetration is limited to about 3m for a backhoe and up to 6m for a large excavator. Limitations of test pits are the problems associated with disturbance and difficulty of reinstatement and the consequent effects on close-by structures. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction or to design and construct the

structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling: A borehole of 50mm to 100mm diameter is advanced by manually operated equipment. Refusal of the hand auger can occur on a variety of materials such as obstructions within any fill, tree roots, hard clay, gravel or ironstone, cobbles and boulders, and does not necessarily indicate rock level.

Continuous Spiral Flight Augers: The borehole is advanced using 75mm to 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling and insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the auger flights, but they can be very disturbed and layers may become mixed. Information from the auger sampling (as distinct from specific sampling by SPTs or undisturbed samples) is of limited reliability due to mixing or softening of samples by groundwater, or uncertainties as to the original depth of the samples. Augering below the groundwater table is of even lesser reliability than augering above the water table.

Rock Augering: Use can be made of a Tungsten Carbide (TC) bit for auger drilling into rock to indicate rock quality and continuity by variation in drilling resistance and from examination of recovered rock cuttings. This method of investigation is quick and relatively inexpensive but provides only an indication of the likely rock strength and predicted values may be in error by a strength order. Where rock strengths may have a significant impact on construction feasibility or costs, then further investigation by means of cored boreholes may be warranted.

Wash Boring: The borehole is usually advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be assessed from the cuttings, together with some information from "feel" and rate of penetration.

Mud Stabilised Drilling: Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilise the borehole. The term 'mud' encompasses a range of products ranging from bentonite to polymers. The mud tends to mask the cuttings and reliable identification is only possible from intermittent intact sampling (eg. from SPT and U50 samples) or from rock coring, etc.

Continuous Core Drilling: A continuous core sample is obtained using a diamond tipped core barrel. Provided full core recovery is achieved (which is not always possible in very low strength rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation. In rocks, NMLC or HQ triple tube core barrels, which give a core of about 50mm and 61mm diameter, respectively, is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as NO CORE. The location of NO CORE recovery is determined on site by the supervising engineer; where the location is uncertain, the loss is placed at the bottom of the drill run.

Standard Penetration Tests: Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils, as a means of indicating density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289.6.3.1–2004 (R2016) *'Methods of Testing Soils for Engineering Purposes, Soil Strength and Consolidation Tests – Determination of the Penetration Resistance of a Soil – Standard Penetration Test (SPT)'*.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63.5kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

- In the case where full penetration is obtained with successive blow counts for each 150mm of, say, 4, 6 and 7 blows, as

  N = 13
  4, 6, 7

- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm, as

  N > 30
  15, 30/40mm

The results of the test can be related empirically to the engineering properties of the soil.

A modification to the SPT is where the same driving system is used with a solid 60° tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid Cone Penetration Test (SCPT) are shown as 'N_c' on the borehole logs, together with the number of blows per 150mm penetration.

LOGS

The borehole or test pit logs presented herein are an interpretation of the subsurface conditions, and their reliability will depend to some extent on the frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will enable the most reliable assessment, but is not always practicable or possible to justify on economic grounds. In any case, the boreholes or test pits represent only a very small sample of the total subsurface conditions.

The terms and symbols used in preparation of the logs are defined in the following pages.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than 'straight line' variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

GROUNDWATER

Where groundwater levels are measured in boreholes, there are several potential problems:

- Although groundwater may be present, in low permeability soils it may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes and may not be the same at the time of construction.
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole or 'reverted' chemically if reliable water observations are to be made.

More reliable measurements can be made by installing standpipes which are read after the groundwater level has stabilised at intervals ranging from several days to perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from perched water tables or surface water.

FILL

The presence of fill materials can often be determined only by the inclusion of foreign objects (eg. bricks, steel, etc) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably assess the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density and material type is much greater than with natural soil deposits. Consequently, there is an increased risk of adverse environmental characteristics or behaviour. If the volume and nature of fill is of importance to a project, then frequent test pit excavations are preferable to boreholes.

LABORATORY TESTING

Laboratory testing has not been undertaken to confirm the soil classification and rock strengths indicated on the environmental logs unless noted in the report.

SYMBOL LEGENDS

SOIL


FILL


TOPSOIL


CLAY (CL, CI, CH)


SILT (ML, MH)


SAND (SP, SW)


GRAVEL (GP, GW)


SANDY CLAY (CL, CI, CH)


SILTY CLAY (CL, CI, CH)


CLAYEY SAND (SC)


SILTY SAND (SM)


GRAVELLY CLAY (CL, CI, CH)


CLAYEY GRAVEL (GC)


SANDY SILT (ML, MH)


PEAT AND HIGHLY ORGANIC SOILS (Pt)

ROCK


CONGLOMERATE


SANDSTONE


SHALE/MUDSTONE


SILTSTONE


CLAYSTONE


COAL


LAMINITE


LIMESTONE


PHYLLITE, SCHIST


TUFF


GRANITE, GABBRO


DOLERITE, DIORITE


BASALT, ANDESITE


QUARTZITE

OTHER MATERIALS


BRICKS OR PAVERS


CONCRETE


ASPHALTIC CONCRETE

CLASSIFICATION OF COARSE AND FINE GRAINED SOILS

Major Divisions		Group Symbol	Typical Names	Field Classification of Sand and Gravel	Laboratory Classification	
Coarse grained soil (more than 65% of soil excluding oversize fraction is greater than 0.075mm)	GRAVEL (more than half of coarse fraction is larger than 2.36mm	GW	Gravel and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 4$ $1 < C_c < 3$
		GP	Gravel and gravel-sand mixtures, little or no fines, uniform gravels	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		GM	Gravel-silt mixtures and gravel-sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	Fines behave as silt
		GC	Gravel-clay mixtures and gravel-sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	Fines behave as clay
	SAND (more than half of coarse fraction is smaller than 2.36mm)	SW	Sand and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 6$ $1 < C_c < 3$
		SP	Sand and gravel-sand mixtures, little or no fines	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		SM	Sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	N/A
		SC	Sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	

Major Divisions		Group Symbol	Typical Names	Field Classification of Silt and Clay			Laboratory Classification
				Dry Strength	Dilatancy	Toughness	% < 0.075mm
Fine grained soils (more than 35% of soil excluding oversize fraction is less than 0.075mm)	SILT and CLAY (low to medium plasticity)	ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or silt with low plasticity	None to low	Slow to rapid	Low	Below A line
		CL, CI	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay	Medium to high	None to slow	Medium	Above A line
		OL	Organic silt	Low to medium	Slow	Low	Below A line
	SILT and CLAY (high plasticity)	MH	Inorganic silt	Low to medium	None to slow	Low to medium	Below A line
		CH	Inorganic clay of high plasticity	High to very high	None	High	Above A line
		OH	Organic clay of medium to high plasticity, organic silt	Medium to high	None to very slow	Low to medium	Below A line
	Highly organic soil	Pt	Peat, highly organic soil	–	–	–	–

Laboratory Classification Criteria

A well graded coarse grained soil is one for which the coefficient of uniformity $Cu > 4$ and the coefficient of curvature $1 < C_c < 3$. Otherwise, the soil is poorly graded. These coefficients are given by:

$$C_U = \frac{D_{60}}{D_{10}} \qquad and \qquad C_C = \frac{(D_{30})^2}{D_{10}\, D_{60}}$$

Where D_{10}, D_{30} and D_{60} are those grain sizes for which 10%, 30% and 60% of the soil grains, respectively, are smaller.

NOTES:

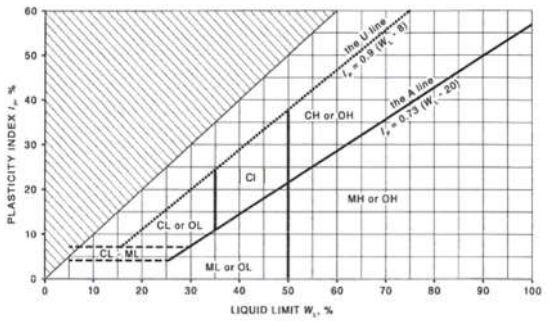
1 For a coarse grained soil with a fines content between 5% and 12%, the soil is given a dual classification comprising the two group symbols separated by a dash; for example, for a poorly graded gravel with between 5% and 12% silt fines, the classification is GP-GM.

2 Where the grading is determined from laboratory tests, it is defined by coefficients of curvature (C_c) and uniformity (C_u) derived from the particle size distribution curve.

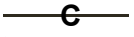
3 Clay soils with liquid limits > 35% and ≤ 50% may be classified as being of medium plasticity.

4 The U line on the Modified Casagrande Chart is an approximate upper bound for most natural soils.

Modified Casagrande Chart for Classifying Silts and Clays according to their Behaviour



LOG SYMBOLS

Log Column	Symbol	Definition
Groundwater Record		Standing water level. Time delay following completion of drilling/excavation may be shown.
		Extent of borehole/test pit collapse shortly after drilling/excavation.
		Groundwater seepage into borehole or test pit noted during drilling or excavation.
Samples	ES	Sample taken over depth indicated, for environmental analysis.
	U50	Undisturbed 50mm diameter tube sample taken over depth indicated.
	DB	Bulk disturbed sample taken over depth indicated.
	DS	Small disturbed bag sample taken over depth indicated.
	ASB	Soil sample taken over depth indicated, for asbestos analysis.
	ASS	Soil sample taken over depth indicated, for acid sulfate soil analysis.
	SAL	Soil sample taken over depth indicated, for salinity analysis.
Field Tests	N = 17 4, 7, 10	Standard Penetration Test (SPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration. 'Refusal' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	N_c = 5 7 3R	Solid Cone Penetration Test (SCPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60° solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	VNS = 25 PID = 100	Vane shear reading in kPa of undrained shear strength. Photoionisation detector reading in ppm (soil sample headspace test).
Moisture Condition (Fine Grained Soils)	w > PL $w \approx$ PL w < PL $w \approx$ LL w > LL	Moisture content estimated to be greater than plastic limit. Moisture content estimated to be approximately equal to plastic limit. Moisture content estimated to be less than plastic limit. Moisture content estimated to be near liquid limit. Moisture content estimated to be wet of liquid limit.
(Coarse Grained Soils)	D M W	DRY – runs freely through fingers. MOIST – does not run freely but no free water visible on soil surface. WET – free water visible on soil surface.
Strength (Consistency) Cohesive Soils	VS S F St VSt Hd Fr ( )	VERY SOFT – unconfined compressive strength ≤ 25kPa. SOFT – unconfined compressive strength > 25kPa and ≤ 50kPa. FIRM – unconfined compressive strength > 50kPa and ≤ 100kPa. STIFF – unconfined compressive strength > 100kPa and ≤ 200kPa. VERY STIFF – unconfined compressive strength > 200kPa and ≤ 400kPa. HARD – unconfined compressive strength > 400kPa. FRIABLE – strength not attainable, soil crumbles. Bracketed symbol indicates estimated consistency based on tactile examination or other assessment.
Density Index/ Relative Density (Cohesionless Soils)	VL L MD D VD ( )	**Density Index (I_D) Range (%)** / **SPT 'N' Value Range (Blows/300mm)** VERY LOOSE ≤ 15 / 0 – 4 LOOSE > 15 and ≤ 35 / 4 – 10 MEDIUM DENSE > 35 and ≤ 65 / 10 – 30 DENSE > 65 and ≤ 85 / 30 – 50 VERY DENSE > 85 / > 50 Bracketed symbol indicates estimated density based on ease of drilling or other assessment.
Hand Penetrometer Readings	300 250	Measures reading in kPa of unconfined compressive strength. Numbers indicate individual test results on representative undisturbed material unless noted otherwise.

Log Column	Symbol	Definition
Remarks	'V' bit	Hardened steel 'V' shaped bit.
	'TC' bit	Twin pronged tungsten carbide bit.
	T_{60}	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.
	Soil Origin	The geological origin of the soil can generally be described as: RESIDUAL – soil formed directly from insitu weathering of the underlying rock. No visible structure or fabric of the parent rock. EXTREMELY WEATHERED – soil formed directly from insitu weathering of the underlying rock. Material is of soil strength but retains the structure and/or fabric of the parent rock. ALLUVIAL – soil deposited by creeks and rivers. ESTUARINE – soil deposited in coastal estuaries, including sediments caused by inflowing creeks and rivers, and tidal currents. MARINE – soil deposited in a marine environment. AEOLIAN – soil carried and deposited by wind. COLLUVIAL – soil and rock debris transported downslope by gravity, with or without the assistance of flowing water. Colluvium is usually a thick deposit formed from a landslide. The description 'slopewash' is used for thinner surficial deposits. LITTORAL – beach deposited soil.

Classification of Material Weathering

Term		Abbreviation		Definition
Residual Soil		RS		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely Weathered		XW		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
Highly Weathered	Distinctly Weathered (Note 1)	HW	DW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately Weathered		MW		The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly Weathered		SW		Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh		FR		Rock shows no sign of decomposition of individual minerals or colour changes.

NOTE 1: The term 'Distinctly Weathered' is used where it is not practicable to distinguish between 'Highly Weathered' and 'Moderately Weathered' rock. 'Distinctly Weathered' is defined as follows: *'Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores'*. There is some change in rock strength.

Rock Material Strength Classification

Term	Abbreviation	Uniaxial Compressive Strength (MPa)	Guide to Strength	
			Point Load Strength Index $Is_{(50)}$ (MPa)	Field Assessment
Very Low Strength	VL	0.6 to 2	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30mm thick can be broken by finger pressure.
Low Strength	L	2 to 6	0.1 to 0.3	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium Strength	M	6 to 20	0.3 to 1	Scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High Strength	H	20 to 60	1 to 3	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High Strength	VH	60 to 200	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High Strength	EH	> 200	> 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Appendix E: Laboratory Report/s & COC Documents

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CERTIFICATE OF ANALYSIS 235671

Client Details

Client	Environmental Investigation Services
Attention	A Barkway
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E32915BD, Vaucluse**
Number of Samples	35 Soil
Date samples received	22/01/2020
Date completed instructions received	22/01/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	07/02/2020
Date of Issue	07/02/2020

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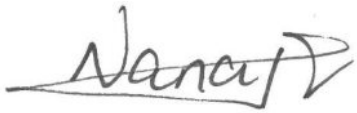
Asbestos Approved By
Analysed by Asbestos Approved Identifier: Aida Marner
Authorised by Asbestos Approved Signatory: Lucy Zhu

Results Approved By
Josh Williams, Senior Chemist
Loren Bardwell, Senior Chemist
Lucy Zhu, Asbestos Supervisor
Steven Luong, Organics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		235671-1	235671-6	235671-7	235671-15	235671-21
Your Reference	UNITS	BH1	BH2	BH2	BH3	BH4
Depth		0.05-0.15	0.1-0.2	0.75-0.95	0.4-0.5	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020	01/02/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	95	80	91	86	80

vTRH(C6-C10)/BTEXN in Soil					
Our Reference		235671-22	235671-27	235671-30	235671-33
Your Reference	UNITS	BH4	BH5	BH5	SDUP2
Depth		0.5-0.6	0-0.1	1.7-1.8	-
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	100	85	86	91

svTRH (C10-C40) in Soil						
Our Reference		235671-1	235671-6	235671-7	235671-15	235671-21
Your Reference	UNITS	BH1	BH2	BH2	BH3	BH4
Depth		0.05-0.15	0.1-0.2	0.75-0.95	0.4-0.5	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	05/02/2020	05/02/2020	05/02/2020	05/02/2020	05/02/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	170	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	280	200	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	350	190	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	360	350	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	720	540	<50	<50	<50
Surrogate o-Terphenyl	%	113	72	70	66	78

svTRH (C10-C40) in Soil					
Our Reference		235671-22	235671-27	235671-30	235671-33
Your Reference	UNITS	BH4	BH5	BH5	SDUP2
Depth		0.5-0.6	0-0.1	1.7-1.8	-
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	05/02/2020	05/02/2020	05/02/2020	05/02/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	220
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	160	<100	230
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	400
Total +ve TRH (>C10-C40)	mg/kg	<50	160	<50	630
Surrogate o-Terphenyl	%	102	64	85	88

PAHs in Soil						
Our Reference		235671-1	235671-6	235671-7	235671-15	235671-21
Your Reference	UNITS	BH1	BH2	BH2	BH3	BH4
Depth		0.05-0.15	0.1-0.2	0.75-0.95	0.4-0.5	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	1.7	0.1	<0.1	<0.1	0.2
Anthracene	mg/kg	0.4	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	2.2	0.2	0.2	0.1	0.6
Pyrene	mg/kg	2.3	0.3	0.2	0.2	0.7
Benzo(a)anthracene	mg/kg	0.9	<0.1	0.1	<0.1	0.4
Chrysene	mg/kg	1	<0.1	0.1	0.1	0.4
Benzo(b,j+k)fluoranthene	mg/kg	1	0.2	<0.2	<0.2	0.7
Benzo(a)pyrene	mg/kg	0.80	0.2	0.1	<0.05	0.4
Indeno(1,2,3-c,d)pyrene	mg/kg	0.3	<0.1	<0.1	<0.1	0.2
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	0.5	0.1	<0.1	<0.1	0.3
Total +ve PAH's	mg/kg	11	1.2	0.72	0.5	3.9
Benzo(a)pyrene TEQ calc (zero)	mg/kg	1.0	<0.5	<0.5	<0.5	0.6
Benzo(a)pyrene TEQ calc(half)	mg/kg	1.1	<0.5	<0.5	<0.5	0.6
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	1.1	<0.5	<0.5	<0.5	0.7
Surrogate p-Terphenyl-d14	%	84	85	83	80	83

PAHs in Soil					
Our Reference		235671-22	235671-27	235671-30	235671-33
Your Reference	UNITS	BH4	BH5	BH5	SDUP2
Depth		0.5-0.6	0-0.1	1.7-1.8	-
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Naphthalene	mg/kg	<0.1	0.2	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	0.9	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	2.0	<0.1	0.1
Anthracene	mg/kg	<0.1	0.6	<0.1	<0.1
Fluoranthene	mg/kg	0.1	2.7	<0.1	0.2
Pyrene	mg/kg	<0.1	2.6	<0.1	0.2
Benzo(a)anthracene	mg/kg	<0.1	1.3	<0.1	0.1
Chrysene	mg/kg	<0.1	1.3	<0.1	0.2
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	1.2	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	0.5	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	0.6	<0.1	<0.1
Total +ve PAH's	mg/kg	0.1	15	<0.05	0.73
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	1.6	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	1.6	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	1.6	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	81	87	83	76

Organochlorine Pesticides in soil					
Our Reference		235671-1	235671-6	235671-21	235671-27
Your Reference	UNITS	BH1	BH2	BH4	BH5
Depth		0.05-0.15	0.1-0.2	0-0.1	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	122	116	123	119

Organophosphorus Pesticides in Soil					
Our Reference		235671-1	235671-6	235671-21	235671-27
Your Reference	UNITS	BH1	BH2	BH4	BH5
Depth		0.05-0.15	0.1-0.2	0-0.1	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	122	116	123	119

PCBs in Soil					
Our Reference		235671-1	235671-6	235671-21	235671-27
Your Reference	UNITS	BH1	BH2	BH4	BH5
Depth		0.05-0.15	0.1-0.2	0-0.1	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	122	116	123	119

Acid Extractable metals in soil						
Our Reference		235671-1	235671-6	235671-7	235671-15	235671-21
Your Reference	UNITS	BH1	BH2	BH2	BH3	BH4
Depth		0.05-0.15	0.1-0.2	0.75-0.95	0.4-0.5	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Date analysed	-	03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Arsenic	mg/kg	<4	9	12	34	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	12	84	9	8	5
Copper	mg/kg	54	51	25	9	10
Lead	mg/kg	17	250	810	69	45
Mercury	mg/kg	<0.1	0.2	2.4	0.2	<0.1
Nickel	mg/kg	8	15	3	5	1
Zinc	mg/kg	39	91	330	39	42

Acid Extractable metals in soil					
Our Reference		235671-22	235671-27	235671-30	235671-33
Your Reference	UNITS	BH4	BH5	BH5	SDUP2
Depth		0.5-0.6	0-0.1	1.7-1.8	-
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Date analysed	-	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Arsenic	mg/kg	<4	<4	<4	6
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	7	6	17	62
Copper	mg/kg	3	14	2	51
Lead	mg/kg	16	49	19	170
Mercury	mg/kg	<0.1	<0.1	<0.1	0.1
Nickel	mg/kg	1	2	1	12
Zinc	mg/kg	13	55	31	130

Moisture						
Our Reference		235671-1	235671-6	235671-7	235671-15	235671-21
Your Reference	UNITS	BH1	BH2	BH2	BH3	BH4
Depth		0.05-0.15	0.1-0.2	0.75-0.95	0.4-0.5	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Moisture	%	8.1	5.2	8.1	12	5.1

Moisture					
Our Reference		235671-22	235671-27	235671-30	235671-33
Your Reference	UNITS	BH4	BH5	BH5	SDUP2
Depth		0.5-0.6	0-0.1	1.7-1.8	-
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Moisture	%	4.3	9.3	6.9	4.8

Asbestos ID - soils NEPM - ASB-001					
Our Reference		235671-5	235671-13	235671-26	235671-31
Your Reference	UNITS	BH1	BH2	BH4	BH5
Depth		0.05-0.15	0.2-0.5	0.1-0.3	0-0.3
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date analysed	-	05/02/2020	05/02/2020	05/02/2020	05/02/2020
Sample mass tested	g	961.42	766.54	988.25	773.5
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1	<0.1	<0.1	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected
ACM >7mm Estimation*	g	–	–	–	–
FA and AF Estimation*	g	–	–	–	–
ACM >7mm Estimation*	%(w/w)	<0.01	<0.01	<0.01	<0.01
FA and AF Estimation*#2	%(w/w)	<0.001	<0.001	<0.001	<0.001

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** #1 Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF) **NOTE** #2 The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.
AT-008	Determination of VOCs sampled onto coconut shell charcoal sorbent tubes, that can be desorbed using carbon disulphide, and analysed by GC-MS.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).

Method ID	Methodology Summary
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS.
Org-012/017	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS and/or GC-MS/MS. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	[NT]
Date extracted	-			01/02/2020	[NT]	[NT]	[NT]	[NT]	01/02/2020	[NT]
Date analysed	-			01/02/2020	[NT]	[NT]	[NT]	[NT]	01/02/2020	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	104	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	104	[NT]
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	[NT]	[NT]	102	[NT]
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	[NT]	[NT]	102	[NT]
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	105	[NT]
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	93	[NT]	[NT]	[NT]	[NT]	99	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	[NT]
Date extracted	-			01/02/2020	[NT]	[NT]	[NT]	[NT]	01/02/2020	[NT]
Date analysed	-			05/02/2020	[NT]	[NT]	[NT]	[NT]	05/02/2020	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	79	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	76	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	123	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	79	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	76	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	123	[NT]
Surrogate o-Terphenyl	%		Org-003	100	[NT]	[NT]	[NT]	[NT]	108	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	[NT]
Date extracted	-			01/02/2020	[NT]	[NT]	[NT]	[NT]	01/02/2020	[NT]
Date analysed	-			06/02/2020	[NT]	[NT]	[NT]	[NT]	06/02/2020	[NT]
Naphthalene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Acenaphthylene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Phenanthrene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Anthracene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Pyrene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	120	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012/017	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012/017	<0.05	[NT]	[NT]	[NT]	[NT]	114	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	82	[NT]	[NT]	[NT]	[NT]	88	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	[NT]
Date extracted	-			01/02/2020	[NT]	[NT]	[NT]	[NT]	01/02/2020	[NT]
Date analysed	-			06/02/2020	[NT]	[NT]	[NT]	[NT]	06/02/2020	[NT]
alpha-BHC	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	87	[NT]
HCB	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
gamma-BHC	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	79	[NT]
delta-BHC	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	96	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	87	[NT]
gamma-Chlordane	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Dieldrin	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Endrin	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Endosulfan II	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	83	[NT]
Methoxychlor	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	123	[NT]	[NT]	[NT]	[NT]	119	[NT]

QUALITY CONTROL: Organophosphorus Pesticides in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	[NT]
Date extracted	-			01/02/2020	[NT]	[NT]	[NT]	[NT]	01/02/2020	[NT]
Date analysed	-			06/02/2020	[NT]	[NT]	[NT]	[NT]	06/02/2020	[NT]
Dichlorvos	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	130	[NT]
Dimethoate	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Fenitrothion	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	87	[NT]
Malathion	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	91	[NT]
Chlorpyriphos	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Parathion	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	82	[NT]
Bromophos-ethyl	mg/kg	0.1	AT-008	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ethion	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	123	[NT]	[NT]	[NT]	[NT]	119	[NT]

QUALITY CONTROL: PCBs in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	[NT]
Date extracted	-			01/02/2020	[NT]	[NT]	[NT]	[NT]	01/02/2020	[NT]
Date analysed	-			06/02/2020	[NT]	[NT]	[NT]	[NT]	06/02/2020	[NT]
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-006	123	[NT]	[NT]	[NT]	[NT]	119	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	[NT]
Date prepared	-			03/02/2020	[NT]	[NT]	[NT]	[NT]	03/02/2020	[NT]
Date analysed	-			03/02/2020	[NT]	[NT]	[NT]	[NT]	03/02/2020	[NT]
Arsenic	mg/kg	4	Metals-020	<4	[NT]	[NT]	[NT]	[NT]	106	[NT]
Cadmium	mg/kg	0.4	Metals-020	<0.4	[NT]	[NT]	[NT]	[NT]	103	[NT]
Chromium	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	107	[NT]
Copper	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Lead	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	111	[NT]
Mercury	mg/kg	0.1	Metals-021	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Nickel	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Zinc	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	113	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

Asbestos-ID in soil: NEPM
This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013. This is reported outside our scope of NATA accreditation.

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Environmental Investigation Services
Attention	A Barkway

Sample Login Details

Your reference	E32915BD, Vaucluse
Envirolab Reference	235671
Date Sample Received	22/01/2020
Date Instructions Received	22/01/2020
Date Results Expected to be Reported	07/02/2020

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	35 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	15.0
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
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Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Organochlorine Pesticides in soil	Organophosphorus Pesticides in Soil	PCBsin Soil	Acid Extractable metalsin soil	Asbestos ID - soils NEPM - ASB-001	On Hold
BH1-0.05-0.15	✓	✓	✓	✓	✓	✓	✓		
BH1-0.6-0.7									✓
BH1-1.3-1.5									✓
BH1-1.75-1.85									✓
BH1-0.05-0.15								✓	
BH2-0.1-0.2	✓	✓	✓	✓	✓	✓	✓		
BH2-0.75-0.95	✓	✓	✓				✓		
BH2-1.7-1.95									✓
BH2-2.8-3									✓
BH2-4.2-4.3									✓
BH2-4.8-4.95									✓
BH2-8.5-8.7									✓
BH2-0.2-0.5								✓	
BH3-0.05-0.15									✓
BH3-0.4-0.5	✓	✓	✓				✓		
BH3-0.7-0.95									✓
BH3-1.7-1.95									✓
BH3-3.3-3.45									✓
BH3-4.3-4.5									✓
BH3-6.2-6.4									✓
BH4-0-0.1	✓	✓	✓	✓	✓	✓	✓		
BH4-0.5-0.6	✓	✓	✓				✓		
BH4-1-1.15									✓
BH4-1.7-1.95									✓
BH4-2.7-2.9									✓
BH4-0.1-0.3								✓	
BH5-0-0.1	✓	✓	✓	✓	✓	✓	✓		
BH5-0.4-0.5									✓
BH5-1-1.1									✓
BH5-1.7-1.8	✓	✓	✓				✓		
BH5-0-0.3								✓	
SDUP1									✓

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Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Organochlorine Pesticides in soil	Organophosphorus Pesticides in Soil	PCBsin Soil	Acid Extractable metalsin soil	Asbestos ID - soils NEPM - ASB-001	On Hold
SDUP2	✓	✓	✓				✓		
SDUP3									✓
SDUP4									✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

ENVIROLAB

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph. (02) 9910 6200

COC 30/1

Job No: 235671

Date Received: 30/1/20
Time Received: 15:50.
Received by: SYH.

29/1/20 } samples.
16:09

15:50

Temp: Cool/Ambient
Cooling: Ice/Icepack

SAMPLE AND CHAIN OF CUSTODY FORM

TO: Security: Intact/Broken/None
ENVIROLAB SERVICES PTY LTD
12 ASHLEY STREET
CHATSWOOD NSW 2067
P: (02) 99106200
F: (02) 99106201

Attention: Aileen

EIS Job Number: E32915BD

Date Results Required: STANDARD

Page: 1 of 2

FROM:
JKEnvironments
REAR OF 115 WICKS ROAD
MACQUARIE PARK, NSW 2113
P: 02-9888 5000 F: 02-9888 5001
Attention:
abarkaway@jkenvironments.com.au

Location: Vaucluse
Sampler: MMP

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	PID	Sample Description	Combo 3	Combo 6	Asbestos WA	HOLD
28.1.20	1	BH1	0.05-0.15	G, A	0.4	F: Gravelly silty sand		X		
28.1.20	2	BH1	0.6-0.7	G, A	0.6	F: Silty sand				X
28.1.20	3	BH1	1.3-1.5	G, A	1.5	F: Silty sand				X
28.1.20	4	BH1	1.75-1.85	G	1.6	Sandstone				X
28.1.20	5	BH1	0.05-0.15	A	-	F: Gravelly silty sand			X	
28.1.20	6	BH2	0.1-0.2	G, A	0.3	F: Silty sand		X		
28.1.20	7	BH2	0.75-0.95	G, A	0.6	F: Silty sand	X			
28.1.20	8	BH2	1.7-1.95	G, A	0.7	F: Silty sand				X
28.1.20	9	BH2	2.8-3	G, A	0.3	F: Silty sand				X
28.1.20	10	BH2	4.2-4.3	G	1.4	Silty sand				X
28.1.20	11	BH2	4.8-4.95	G	1.9	Silty sand				X
28.1.20	12	BH2	8.5-8.7	G	8.9	Sandstone				X
28.1.20	13	BH2	0.2-0.5	A	-	F: Silty sand			X	
28.1.20	14	BH3	0.05-0.15	G, A	0.6	F: Silty sand				X
28.1.20	15	BH3	0.4-0.5	G, A	1.1	F: Silty sand	X			
28.1.20	16	BH3	0.7-0.95	G, A	0.5	F: Silty sand				X
28.1.20	17	BH3	1.7-1.95	G, A	0.5	F: Silty sand				X
28.1.20	18	BH3	3.3-3.45	G, A	0.8	F: Silty sand				X
28.1.20	19	BH3	4.3-4.5	G, A	2.2	F: Silty sand				X
28.1.20	20	BH3	6.2-6.4	G	4.2	Sandstone				X
28.1.20	21	BH4	0-0.1	G, A	0.5	F: Silty sand		X		
28.1.20	22	BH4	0.5-0.6	G, A	2.2	F: Silty sand	X			
28.1.20	23	BH4	1-1.15	G, A	0.4	F: Silty sand				X
28.1.20	24	BH4	1.7-1.95	G, A	1.6	F: Silty sand				X
28.1.20	25	BH4	2.7-2.9	G	2	Sandstone				X

Remarks (comments/detection limits required):

Sample Containers:
G - 250mg Glass Jar
A - Ziplock Asbestos Bag
P - Plastic Bag

Relinquished By: Anthony Barkway	Date: 30.01.2020	Time:	Received By:	Date: 30/1

4.9°C.

235671

SAMPLE AND CHAIN OF CUSTODY FORM

TO:		FROM:
ENVIROLAB SERVICES PTY LTD 12 ASHLEY STREET CHATSWOOD NSW 2067 P: (02) 99106200 F: (02) 99106201 Attention: Aileen	EIS Job Number: E32915BD Date Results Required: STANDARD Page: 2 of 2	JKEnvironments REAR OF 115 WICKS ROAD MACQUARIE PARK, NSW 2113 P: 02-9888 5000 F: 02-9888 5001 Attention: abarkaway@jkenvironments.com.au

Location: Vaucluse

Sampler: MMP

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	PID	Sample Description			Combo 3	Combo 6		Asbestos WA	HOLD						
28.1.20	26	BH4	0.1-0.3	A	-	F: Silty sand						X							
28.1.20	27	BH5	0-0.1	G, A	3.4	F: Silty sand				X									
28.1.20	28	BH5	0.4-0.5	G, A	2.8	F: Silty sand							X						
28.1.20	29	BH5	1-1.1	G, A	6.4	F: Silty sand							X						
28.1.20	30	BH5	1.7-1.8	G	7.7	Sanstone			X										
28.1.20	31	BH5	0-0.3	G	-	F: Silty sand						X							
28.1.20	32	SDUP1	-	G	-	Soil							X						
28.1.20	33	SDUP2	-	G	-	Soil			X										
28.1.20	34	SDUP3	-	G	-	Soil							X						
28.1.20	35	SDUP4	-	G	-	Soil							X						

Remarks (comments/detection limits required):

Sample Containers:
G - 250mg Glass Jar
A - Ziplock Asbestos Bag
P - Plastic Bag

Relinquished By: Anthony Barkway	Date: 30.01.2020	Time:	Received By:	Date: 30/1

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www.envirolab.com.au

CERTIFICATE OF ANALYSIS 235671-A

Client Details

Client	Environmental Investigation Services
Attention	A Barkway
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E32915BD, Vaucluse**
Number of Samples	35 Soil
Date samples received	22/01/2020
Date completed instructions received	12/02/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	19/02/2020
Date of Issue	19/02/2020

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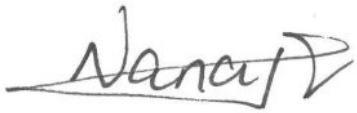
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Diego Bigolin, Team Leader, Inorganics
Josh Williams, Senior Chemist
Ken Nguyen, Reporting Supervisor
Loren Bardwell, Senior Chemist
Priya Samarawickrama, Senior Chemist
Steven Luong, Organics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil		
Our Reference		235671-A-11
Your Reference	UNITS	BH2
Depth		4.8-4.95
Date Sampled		28/01/2020
Type of sample		Soil
Date extracted	-	13/02/2020
Date analysed	-	14/02/2020
TRH C_6 - C_9	mg/kg	<25
TRH C_6 - C_{10}	mg/kg	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25
Benzene	mg/kg	<0.2
Toluene	mg/kg	<0.5
Ethylbenzene	mg/kg	<1
m+p-xylene	mg/kg	<2
o-Xylene	mg/kg	<1
naphthalene	mg/kg	<1
Total +ve Xylenes	mg/kg	<3
Surrogate aaa-Trifluorotoluene	%	98

svTRH (C10-C40) in Soil		
Our Reference		235671-A-11
Your Reference	UNITS	BH2
Depth		4.8-4.95
Date Sampled		28/01/2020
Type of sample		Soil
Date extracted	-	13/02/2020
Date analysed	-	14/02/2020
TRH C_{10} - C_{14}	mg/kg	<50
TRH C_{15} - C_{28}	mg/kg	<100
TRH C_{29} - C_{36}	mg/kg	<100
TRH >C_{10} -C_{16}	mg/kg	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50
TRH >C_{16} -C_{34}	mg/kg	<100
TRH >C_{34} -C_{40}	mg/kg	<100
Total +ve TRH (>C10-C40)	mg/kg	<50
Surrogate o-Terphenyl	%	101

PAHs in Soil		
Our Reference		235671-A-11
Your Reference	UNITS	BH2
Depth		4.8-4.95
Date Sampled		28/01/2020
Type of sample		Soil
Date extracted	-	13/02/2020
Date analysed	-	14/02/2020
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	<0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	<0.1
Anthracene	mg/kg	<0.1
Fluoranthene	mg/kg	<0.1
Pyrene	mg/kg	<0.1
Benzo(a)anthracene	mg/kg	<0.1
Chrysene	mg/kg	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2
Benzo(a)pyrene	mg/kg	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1
Total +ve PAH's	mg/kg	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5
Surrogate p-Terphenyl-d14	%	87

Acid Extractable metals in soil		
Our Reference		235671-A-11
Your Reference	UNITS	BH2
Depth		4.8-4.95
Date Sampled		28/01/2020
Type of sample		Soil
Date prepared	-	13/02/2020
Date analysed	-	14/02/2020
Arsenic	mg/kg	<4
Cadmium	mg/kg	<0.4
Chromium	mg/kg	8
Copper	mg/kg	<1
Lead	mg/kg	6
Mercury	mg/kg	<0.1
Nickel	mg/kg	<1
Zinc	mg/kg	6

Moisture		
Our Reference		235671-A-11
Your Reference	UNITS	BH2
Depth		4.8-4.95
Date Sampled		28/01/2020
Type of sample		Soil
Date prepared	-	13/02/2020
Date analysed	-	14/02/2020
Moisture	%	13

Metals in TCLP USEPA1311				
Our Reference		235671-A-6	235671-A-7	235671-A-27
Your Reference	UNITS	BH2	BH2	BH5
Depth		0.1-0.2	0.75-0.95	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil
Date extracted	-	17/02/2020	17/02/2020	17/02/2020
Date analysed	-	17/02/2020	17/02/2020	17/02/2020
pH of soil for fluid# determ.	pH units	9.5	9.4	9.0
pH of soil TCLP (after HCl)	pH units	2.1	2.6	1.8
Extraction fluid used	-	1	1	1
pH of final Leachate	pH units	5.7	6.0	4.9
Lead in TCLP	mg/L	0.3	1.2	[NA]

PAHs in TCLP (USEPA 1311)		
Our Reference		235671-A-27
Your Reference	UNITS	BH5
Depth		0-0.1
Date Sampled		28/01/2020
Type of sample		Soil
Date extracted	-	14/02/2020
Date analysed	-	17/02/2020
Naphthalene in TCLP	mg/L	<0.001
Acenaphthylene in TCLP	mg/L	<0.001
Acenaphthene in TCLP	mg/L	<0.001
Fluorene in TCLP	mg/L	<0.001
Phenanthrene in TCLP	mg/L	<0.001
Anthracene in TCLP	mg/L	<0.001
Fluoranthene in TCLP	mg/L	<0.001
Pyrene in TCLP	mg/L	<0.001
Benzo(a)anthracene in TCLP	mg/L	<0.001
Chrysene in TCLP	mg/L	<0.001
Benzo(bjk)fluoranthene in TCLP	mg/L	<0.002
Benzo(a)pyrene in TCLP	mg/L	<0.001
Indeno(1,2,3-c,d)pyrene - TCLP	mg/L	<0.001
Dibenzo(a,h)anthracene in TCLP	mg/L	<0.001
Benzo(g,h,i)perylene in TCLP	mg/L	<0.001
Total +ve PAH's	mg/L	NIL (+)VE
Surrogate p-Terphenyl-d14	%	84

Misc Inorg - Soil		
Our Reference		235671-A-7
Your Reference	UNITS	BH2
Depth		0.75-0.95
Date Sampled		28/01/2020
Type of sample		Soil
Date prepared	-	14/02/2020
Date analysed	-	14/02/2020
pH 1:5 soil:water	pH Units	10.2

Clay 50-120g		
Our Reference		235671-A-7
Your Reference	UNITS	BH2
Depth		0.75-0.95
Date Sampled		28/01/2020
Type of sample		Soil
Date prepared	-	17/02/2020
Date analysed	-	18/02/2020
Clay in soils <2µm	% (w/w)	9

CEC		
Our Reference		235671-A-7
Your Reference	UNITS	BH2
Depth		0.75-0.95
Date Sampled		28/01/2020
Type of sample		Soil
Date prepared	-	17/02/2020
Date analysed	-	18/02/2020
Exchangeable Ca	meq/100g	44
Exchangeable K	meq/100g	0.5
Exchangeable Mg	meq/100g	0.21
Exchangeable Na	meq/100g	<0.1
Cation Exchange Capacity	meq/100g	45

Method ID	Methodology Summary
AS1289.3.6.3	Determination Particle Size Analysis using AS1289.3.6.3 and AS1289.3.6.1 and in house method INORG-107. Clay fraction at <2µm reported.
EXTRACT.7	Toxicity Characteristic Leaching Procedure (TCLP) using Zero Headspace Extraction (zHE) using AS4439 and USEPA 1311.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-004	Toxicity Characteristic Leaching Procedure (TCLP) using in house method INORG-004. Please note that the mass used may be scaled down from the default based on sample mass available.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
Metals-020	Determination of various metals by ICP-AES.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-012/017	Leachates are extracted with Dichloromethane and analysed by GC-MS and/or GC-MS/MS.

Method ID	Methodology Summary
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			13/02/2020	[NT]	[NT]	[NT]	[NT]	13/02/2020	[NT]
Date analysed	-			14/02/2020	[NT]	[NT]	[NT]	[NT]	14/02/2020	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	87	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	87	[NT]
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	[NT]	[NT]	89	[NT]
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	[NT]	[NT]	113	[NT]
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	81	[NT]
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	76	[NT]
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	70	[NT]
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	110	[NT]	[NT]	[NT]	[NT]	113	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			13/02/2020	[NT]	[NT]	[NT]	[NT]	13/02/2020	[NT]
Date analysed	-			13/02/2020	[NT]	[NT]	[NT]	[NT]	13/02/2020	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	97	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	110	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	97	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	110	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
Surrogate o-Terphenyl	%		Org-003	100	[NT]	[NT]	[NT]	[NT]	113	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			13/02/2020	[NT]	[NT]	[NT]	[NT]	13/02/2020	[NT]
Date analysed	-			14/02/2020	[NT]	[NT]	[NT]	[NT]	14/02/2020	[NT]
Naphthalene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	80	[NT]
Acenaphthylene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	80	[NT]
Phenanthrene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	86	[NT]
Anthracene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	82	[NT]
Pyrene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	76	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	78	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012/017	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012/017	<0.05	[NT]	[NT]	[NT]	[NT]	100	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	90	[NT]	[NT]	[NT]	[NT]	83	[NT]

QUALITY CONTROL: Acid Extractable metals in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			13/02/2020	[NT]	[NT]	[NT]	[NT]	13/02/2020	[NT]
Date analysed	-			14/02/2020	[NT]	[NT]	[NT]	[NT]	14/02/2020	[NT]
Arsenic	mg/kg	4	Metals-020	<4	[NT]	[NT]	[NT]	[NT]	101	[NT]
Cadmium	mg/kg	0.4	Metals-020	<0.4	[NT]	[NT]	[NT]	[NT]	101	[NT]
Chromium	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Copper	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Lead	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Mercury	mg/kg	0.1	Metals-021	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Nickel	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Zinc	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	102	[NT]

QUALITY CONTROL: Metals in TCLP USEPA1311						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			17/02/2020	[NT]	[NT]	[NT]	[NT]	17/02/2020	[NT]
Date analysed	-			17/02/2020	[NT]	[NT]	[NT]	[NT]	17/02/2020	[NT]
Lead in TCLP	mg/L	0.03	Metals-020 ICP-AES	<0.03	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: PAHs in TCLP (USEPA 1311)					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			14/02/2020	[NT]	[NT]	[NT]	[NT]	14/02/2020	[NT]
Date analysed	-			17/02/2020	[NT]	[NT]	[NT]	[NT]	17/02/2020	[NT]
Naphthalene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	101	[NT]
Acenaphthylene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	93	[NT]
Phenanthrene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	92	[NT]
Anthracene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	92	[NT]
Pyrene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	97	[NT]
Benzo(a)anthracene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	120	[NT]
Benzo(bjk)fluoranthene in TCLP	mg/L	0.002	Org-012/017	<0.002	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	75	[NT]
Indeno(1,2,3-c,d)pyrene - TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	113	[NT]	[NT]	[NT]	[NT]	82	[NT]

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			14/02/2020	[NT]	[NT]	[NT]	[NT]	14/02/2020	[NT]
Date analysed	-			14/02/2020	[NT]	[NT]	[NT]	[NT]	14/02/2020	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: CEC					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			17/02/2020	[NT]	[NT]	[NT]	[NT]	17/02/2020	[NT]
Date analysed	-			18/02/2020	[NT]	[NT]	[NT]	[NT]	18/02/2020	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Exchangeable K	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Exchangeable Na	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	114	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

pH
Samples were out of the recommended holding time for this analysis.

Envirolab Services Pty Ltd
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SAMPLE RECEIPT ADVICE

Client Details

Client	Environmental Investigation Services
Attention	A Barkway

Sample Login Details

Your reference	E32915BD, Vaucluse
Envirolab Reference	235671-A
Date Sample Received	22/01/2020
Date Instructions Received	12/02/2020
Date Results Expected to be Reported	19/02/2020

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	35 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	15.0
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Acid Extractable metalsin soil	pH of soil for fluid#determ.	pH of soil TCLP (after HCl)	Extraction fluid used	pH of final Leachate	Lead in TCLP	Naphthalene in TCLP	Acenaphthylene in TCLP	Acenaphthene in TCLP	Fluorene in TCLP	Phenanthrene in TCLP	Anthracene in TCLP	Fluoranthene in TCLP	Pyrene in TCLP	Benzo(a)anthracene in TCLP	Chrysene in TCLP	Benzo(bjk)fluoranthene in TCLP	Benzo(a)pyrene in TCLP	Indeno(1,2,3-c,d)pyrene - TCLP	Dibenzo(a,h)anthracene in TCLP	Benzo(g,h,i)perylene in TCLP	Total +vePAH's	Surrogate p-Terphenyl-d14	Misc Inorg - Soil	Clay 50-120g	CEC	On Hold
BH1-0.05-0.15																														✓
BH1-0.6-0.7																														✓
BH1-1.3-1.5																														✓
BH1-1.75-1.85																														✓
BH1-0.05-0.15																														✓
BH2-0.1-0.2					✓	✓	✓	✓	✓																					
BH2-0.75-0.95					✓	✓	✓	✓	✓																		✓	✓	✓	
BH2-1.7-1.95																														✓
BH2-2.8-3																														✓
BH2-4.2-4.3																														✓
BH2-4.8-4.95	✓	✓	✓	✓																										
BH2-8.5-8.7																														✓
BH2-0.2-0.5																														✓
BH3-0.05-0.15																														✓
BH3-0.4-0.5																														✓
BH3-0.7-0.95																														✓
BH3-1.7-1.95																														✓
BH3-3.3-3.45																														✓
BH3-4.3-4.5																														✓
BH3-6.2-6.4																														✓

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Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Acid Extractable metalsin soil	pH of soil for fluid#determ.	pH of soil TCLP (after HCl)	Extraction fluid used	pH of final Leachate	Lead in TCLP	Naphthalene in TCLP	Acenaphthylene in TCLP	Acenaphthene in TCLP	Fluorene in TCLP	Phenanthrene in TCLP	Anthracene in TCLP	Fluoranthene in TCLP	Pyrene in TCLP	Benzo(a)anthracene in TCLP	Chrysene in TCLP	Benzo(bjk)fluoranthene in TCLP	Benzo(a)pyrene in TCLP	Indeno(1,2,3-c,d)pyrene - TCLP	Dibenzo(a,h)anthracene in TCLP	Benzo(g,h,i)perylene in TCLP	Total +vePAH's	Surrogate p-Terphenyl-d14	Misc Inorg - Soil	Clay 50-120g	CEC	On Hold
BH4-0-0.1																													✓
BH4-0.5-0.6																													✓
BH4-1-1.15																													✓
BH4-1.7-1.95																													✓
BH4-2.7-2.9																													✓
BH4-0.1-0.3																													✓
BH5-0-0.1					✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
BH5-0.4-0.5																													✓
BH5-1-1.1																													✓
BH5-1.7-1.8																													✓
BH5-0-0.3																													✓
SDUP1																													✓
SDUP2																													✓
SDUP3																													✓
SDUP4																													✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

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Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt. Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Andrew (Fitzy) Fitzsimons

From: Ken Nguyen
Sent: Wednesday, 12 February 2020 11:12 AM
To: Anthony Barkway
Cc: Andrew (Fitzy) Fitzsimons
Subject: RE: JKE - Extra testing request for Registration 235671 E32915BD, Vaucluse

Follow Up Flag: Follow up
Flag Status: Flagged

Ref: 235671-A
TAT: Std
Due: 19/2/20

Hi Anthony,

No problem, we'll get it logged in.

Kind Regards,
Ken

Kind Regards,

Ken Nguyen | Customer Service / Chemist | Envirolab Services Pty Ltd
(Monday to Friday 10am to 6pm)
Great Science. Great Service.
12 Ashley Street Chatswood NSW 2067
T 612 9910 6200 **F** 612 9910 6201
E knguyen@envirolab.com.au | **W** www.envirolab.com.au

From: Anthony Barkway <ABarkway@jkenvironments.com.au>
Sent: Wednesday, 12 February 2020 9:37 AM
To: Ken Nguyen <KNguyen@envirolab.com.au>
Subject: JKE - Extra testing request for Registration 235671 E32915BD, Vaucluse

Hi Ken,

Could I please request extra testing for some of the samples within the above batch as follows:

Sample Number + Depth	Lab Ref:	Tests Required
BH2 0.1-0.2	6	TCLP Lead
BH2 0.75-0.95	7	TCLP Lead, pH+CEC+Clay Content
BH2 4.8-4.95	11	Combo 3
BH5 0.0-0.1	27	TCLP PAHs

Thank you!

Kind Regards

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CERTIFICATE OF ANALYSIS 236009

Client Details

Client	Environmental Investigation Services
Attention	A Barkway
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E32915BD, Vaucluse**
Number of Samples	16 SOIL, 1 WATER
Date samples received	05/02/2020
Date completed instructions received	05/02/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	12/02/2020
Date of Issue	11/02/2020

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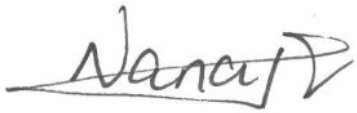
Asbestos Approved By
Analysed by Asbestos Approved Identifier: Lucy Zhu
Authorised by Asbestos Approved Signatory: Lucy Zhu

Results Approved By
Jaimie Loa-Kum-Cheung, Metals Supervisor
Josh Williams, Senior Chemist
Lucy Zhu, Asbestos Supervisor
Steven Luong, Organics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		236009-1	236009-3	236009-4	236009-5	236009-6
Your Reference	UNITS	BH6	BH7	BH7	BH8	BH8
Depth		0-0.1	0-0.1	0.2-0.3	0-0.1	0.6-0.7
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	88	84	91	84	90

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		236009-7	236009-8	236009-11	236009-14	236009-15
Your Reference	UNITS	BH8	BH9	BH10	SDUP6	STB1
Depth		1.6-1.8	0-0.1	0-0.1	-	-
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	76	87	72	70	93

vTRH(C6-C10)/BTEXN in Soil		
Our Reference		236009-16
Your Reference	UNITS	STS1
Depth		-
Date Sampled		03/02/2020
Type of sample		SOIL
Date extracted	-	06/02/2020
Date analysed	-	06/02/2020
Benzene	mg/kg	103%
Toluene	mg/kg	102%
Ethylbenzene	mg/kg	108%
m+p-xylene	mg/kg	101%
o-Xylene	mg/kg	113%
Surrogate aaa-Trifluorotoluene	%	95

svTRH (C10-C40) in Soil						
Our Reference		236009-1	236009-3	236009-4	236009-5	236009-6
Your Reference	UNITS	BH6	BH7	BH7	BH8	BH8
Depth		0-0.1	0-0.1	0.2-0.3	0-0.1	0.6-0.7
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	07/02/2020	07/02/2020	07/02/2020	07/02/2020	07/02/2020
TRH C_{10} - C_{14}	mg/kg	<50	52	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	190
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	190
TRH >C_{10} -C_{16}	mg/kg	<50	51	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	51	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	110	<100	<100	340
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	100
Total +ve TRH (>C10-C40)	mg/kg	<50	160	<50	<50	450
Surrogate o-Terphenyl	%	72	81	81	72	87

svTRH (C10-C40) in Soil					
Our Reference		236009-7	236009-8	236009-11	236009-14
Your Reference	UNITS	BH8	BH9	BH10	SDUP6
Depth		1.6-1.8	0-0.1	0-0.1	-
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	07/02/2020	07/02/2020	07/02/2020	07/02/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50
Surrogate o-Terphenyl	%	70	70	69	72

PAHs in Soil						
Our Reference		236009-1	236009-3	236009-4	236009-5	236009-6
Your Reference	UNITS	BH6	BH7	BH7	BH8	BH8
Depth		0-0.1	0-0.1	0.2-0.3	0-0.1	0.6-0.7
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	08/02/2020	08/02/2020	08/02/2020	08/02/2020	08/02/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.7
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.2	0.3	<0.1	<0.1	2.0
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.4
Fluoranthene	mg/kg	0.8	1.2	0.1	0.2	5.3
Pyrene	mg/kg	0.9	1.4	0.1	0.2	5.7
Benzo(a)anthracene	mg/kg	0.5	0.9	0.1	0.1	3.8
Chrysene	mg/kg	0.6	1.1	0.1	0.2	4.2
Benzo(b,j+k)fluoranthene	mg/kg	1	2	<0.2	0.3	7.0
Benzo(a)pyrene	mg/kg	0.66	1.2	0.1	0.2	4.7
Indeno(1,2,3-c,d)pyrene	mg/kg	0.3	0.7	<0.1	<0.1	2.4
Dibenzo(a,h)anthracene	mg/kg	<0.1	0.2	<0.1	<0.1	0.8
Benzo(g,h,i)perylene	mg/kg	0.4	0.9	<0.1	0.1	2.9
Total +ve PAH's	mg/kg	5.4	9.6	0.60	1.3	40
Benzo(a)pyrene TEQ calc (zero)	mg/kg	0.9	1.7	<0.5	<0.5	6.9
Benzo(a)pyrene TEQ calc(half)	mg/kg	0.9	1.7	<0.5	<0.5	6.9
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	1	1.7	<0.5	<0.5	6.9
Surrogate p-Terphenyl-d14	%	90	94	95	84	91

PAHs in Soil					
Our Reference		236009-7	236009-8	236009-11	236009-14
Your Reference	UNITS	BH8	BH9	BH10	SDUP6
Depth		1.6-1.8	0-0.1	0-0.1	-
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	08/02/2020	08/02/2020	08/02/2020	08/02/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	0.4	<0.1	0.2
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.2	1	<0.1	0.8
Pyrene	mg/kg	0.2	1	<0.1	0.9
Benzo(a)anthracene	mg/kg	0.2	0.6	<0.1	0.6
Chrysene	mg/kg	0.2	0.7	<0.1	0.7
Benzo(b,j+k)fluoranthene	mg/kg	0.3	1	<0.2	1
Benzo(a)pyrene	mg/kg	0.2	0.63	<0.05	0.62
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	0.4	<0.1	0.3
Dibenzo(a,h)anthracene	mg/kg	<0.1	0.1	<0.1	0.1
Benzo(g,h,i)perylene	mg/kg	0.1	0.4	<0.1	0.4
Total +ve PAH's	mg/kg	1.3	6.1	<0.05	5.7
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	0.9	<0.5	0.9
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	0.9	<0.5	0.9
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	0.9	<0.5	0.9
Surrogate p-Terphenyl-d14	%	97	92	95	96

Organochlorine Pesticides in soil						
Our Reference		236009-1	236009-3	236009-5	236009-8	236009-11
Your Reference	UNITS	BH6	BH7	BH8	BH9	BH10
Depth		0-0.1	0-0.1	0-0.1	0-0.1	0-0.1
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	08/02/2020	08/02/2020	08/02/2020	08/02/2020	08/02/2020
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	96	108	110	96	101

Organophosphorus Pesticides in Soil						
Our Reference		236009-1	236009-3	236009-5	236009-8	236009-11
Your Reference	UNITS	BH6	BH7	BH8	BH9	BH10
Depth		0-0.1	0-0.1	0-0.1	0-0.1	0-0.1
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	08/02/2020	08/02/2020	08/02/2020	08/02/2020	08/02/2020
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	96	108	110	96	101

PCBs in Soil						
Our Reference		236009-1	236009-3	236009-5	236009-8	236009-11
Your Reference	UNITS	BH6	BH7	BH8	BH9	BH10
Depth		0-0.1	0-0.1	0-0.1	0-0.1	0-0.1
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	08/02/2020	08/02/2020	08/02/2020	08/02/2020	08/02/2020
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	96	108	110	96	101

Acid Extractable metals in soil						
Our Reference		236009-1	236009-3	236009-4	236009-5	236009-6
Your Reference	UNITS	BH6	BH7	BH7	BH8	BH8
Depth		0-0.1	0-0.1	0.2-0.3	0-0.1	0.6-0.7
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Arsenic	mg/kg	6	6	<4	9	6
Cadmium	mg/kg	<0.4	<0.4	<0.4	0.4	<0.4
Chromium	mg/kg	8	6	3	11	10
Copper	mg/kg	23	20	6	36	80
Lead	mg/kg	81	86	32	160	160
Mercury	mg/kg	<0.1	<0.1	<0.1	0.1	0.1
Nickel	mg/kg	3	3	<1	4	7
Zinc	mg/kg	61	53	15	130	190

Acid Extractable metals in soil					
Our Reference		236009-7	236009-8	236009-11	236009-14
Your Reference	UNITS	BH8	BH9	BH10	SDUP6
Depth		1.6-1.8	0-0.1	0-0.1	-
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
Date prepared	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Arsenic	mg/kg	5	33	24	32
Cadmium	mg/kg	<0.4	0.4	<0.4	<0.4
Chromium	mg/kg	15	13	9	10
Copper	mg/kg	10	43	34	43
Lead	mg/kg	29	190	200	160
Mercury	mg/kg	<0.1	0.1	0.1	0.1
Nickel	mg/kg	1	4	4	3
Zinc	mg/kg	20	150	160	140

Moisture						
Our Reference		236009-1	236009-3	236009-4	236009-5	236009-6
Your Reference	UNITS	BH6	BH7	BH7	BH8	BH8
Depth		0-0.1	0-0.1	0.2-0.3	0-0.1	0.6-0.7
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	07/02/2020	07/02/2020	07/02/2020	07/02/2020	07/02/2020
Moisture	%	13	11	3.1	8.1	6.9

Moisture					
Our Reference		236009-7	236009-8	236009-11	236009-14
Your Reference	UNITS	BH8	BH9	BH10	SDUP6
Depth		1.6-1.8	0-0.1	0-0.1	-
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
Date prepared	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	07/02/2020	07/02/2020	07/02/2020	07/02/2020
Moisture	%	24	12	10	20

Asbestos ID - soils		
Our Reference		236009-3
Your Reference	UNITS	BH7
Depth		0-0.1
Date Sampled		03/02/2020
Type of sample		SOIL
Date analysed	-	08/02/2020
Sample mass tested	g	Approx. 15g
Sample Description	-	Brown fine-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected

Asbestos ID - soils NEPM - ASB-001			
Our Reference		236009-5	236009-8
Your Reference	UNITS	BH8	BH9
Depth		0-0.1	0-0.1
Date Sampled		03/02/2020	03/02/2020
Type of sample		SOIL	SOIL
Date analysed	-	10/02/2020	10/02/2020
Sample mass tested	g	597.78	631.41
Sample Description	-	Brown fine-grained soil & rocks	Brown fine-grained soil & rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected Synthetic mineral fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected	No visible asbestos detected
ACM >7mm Estimation*	g	–	–
FA and AF Estimation*	g	–	–
ACM >7mm Estimation*	%(w/w)	<0.01	<0.01
FA and AF Estimation*#2	%(w/w)	<0.001	<0.001

BTEX in Water		
Our Reference		236009-17
Your Reference	UNITS	SFR1
Depth		-
Date Sampled		03/02/2020
Type of sample		WATER
Date extracted	-	06/02/2020
Date analysed	-	06/02/2020
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Surrogate Dibromofluoromethane	%	104
Surrogate toluene-d8	%	98
Surrogate 4-BFB	%	107

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** #1 Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF) **NOTE** #2 The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.
AT-008	Determination of VOCs sampled onto coconut shell charcoal sorbent tubes, that can be desorbed using carbon disulphide, and analysed by GC-MS.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).

Method ID	Methodology Summary
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS.
Org-012/017	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS and/or GC-MS/MS. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236009-3
Date extracted	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
TRH C_6 - C_9	mg/kg	25	Org-016	<25	1	<25	<25	0	83	91
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	1	<25	<25	0	83	91
Benzene	mg/kg	0.2	Org-016	<0.2	1	<0.2	<0.2	0	82	88
Toluene	mg/kg	0.5	Org-016	<0.5	1	<0.5	<0.5	0	79	86
Ethylbenzene	mg/kg	1	Org-016	<1	1	<1	<1	0	87	95
m+p-xylene	mg/kg	2	Org-016	<2	1	<2	<2	0	81	92
o-Xylene	mg/kg	1	Org-016	<1	1	<1	<1	0	78	89
naphthalene	mg/kg	1	Org-014	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	88	1	88	78	12	89	83

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236009-3
Date extracted	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			07/02/2020	1	07/02/2020	07/02/2020		07/02/2020	07/02/2020
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	1	<50	<50	0	105	98
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	1	<100	<100	0	108	80
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	1	<100	<100	0	123	#
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	1	<50	<50	0	105	98
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	1	<100	100	0	108	80
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	1	<100	<100	0	123	#
Surrogate o-Terphenyl	%		Org-003	73	1	72	71	1	83	81

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236009-3
Date extracted	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			08/02/2020	1	08/02/2020	08/02/2020		08/02/2020	08/02/2020
Naphthalene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	86	96
Acenaphthylene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	84	104
Phenanthrene	mg/kg	0.1	Org-012/017	<0.1	1	0.2	0.1	67	92	86
Anthracene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012/017	<0.1	1	0.8	0.5	46	88	86
Pyrene	mg/kg	0.1	Org-012/017	<0.1	1	0.9	0.6	40	84	81
Benzo(a)anthracene	mg/kg	0.1	Org-012/017	<0.1	1	0.5	0.3	50	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012/017	<0.1	1	0.6	0.3	67	64	80
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012/017	<0.2	1	1	0.8	22	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012/017	<0.05	1	0.66	0.4	49	80	70
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012/017	<0.1	1	0.3	0.2	40	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012/017	<0.1	1	0.4	0.3	29	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	94	1	90	84	7	92	89

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236009-3
Date extracted	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			08/02/2020	1	08/02/2020	08/02/2020		08/02/2020	08/02/2020
alpha-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	106	106
HCB	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	102	106
gamma-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	102	94
delta-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	118	107
Heptachlor Epoxide	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	110	99
gamma-Chlordane	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	110	99
Dieldrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	122	101
Endrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	104	99
Endosulfan II	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	104	88
Endrin Aldehyde	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	100	104
Methoxychlor	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	83	1	96	92	4	82	94

QUALITY CONTROL: Organophosphorus Pesticides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236009-3
Date extracted	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			08/02/2020	1	08/02/2020	08/02/2020		08/02/2020	08/02/2020
Dichlorvos	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	110	88
Dimethoate	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	108	98
Fenitrothion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	90	91
Malathion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	97	93
Chlorpyriphos	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	114	96
Parathion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	98	98
Bromophos-ethyl	mg/kg	0.1	AT-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	100	94
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	83	1	96	92	4	82	94

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236009-3
Date extracted	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			08/02/2020	1	08/02/2020	08/02/2020		08/02/2020	08/02/2020
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	74	67
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-006	83	1	96	92	4	82	94

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236009-3
Date prepared	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Arsenic	mg/kg	4	Metals-020	<4	1	6	7	15	98	100
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	<0.4	<0.4	0	97	92
Chromium	mg/kg	1	Metals-020	<1	1	8	12	40	107	97
Copper	mg/kg	1	Metals-020	<1	1	23	21	9	102	103
Lead	mg/kg	1	Metals-020	<1	1	81	83	2	112	118
Mercury	mg/kg	0.1	Metals-021	<0.1	1	<0.1	0.1	0	97	86
Nickel	mg/kg	1	Metals-020	<1	1	3	3	0	97	95
Zinc	mg/kg	1	Metals-020	<1	1	61	59	3	107	92

QUALITY CONTROL: BTEX in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			06/02/2020	[NT]	[NT]	[NT]	[NT]	06/02/2020	[NT]
Date analysed	-			06/02/2020	[NT]	[NT]	[NT]	[NT]	06/02/2020	[NT]
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	80	[NT]
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	86	[NT]
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	77	[NT]
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	81	[NT]
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	79	[NT]
Surrogate Dibromofluoromethane	%		Org-016	100	[NT]	[NT]	[NT]	[NT]	97	[NT]
Surrogate toluene-d8	%		Org-016	99	[NT]	[NT]	[NT]	[NT]	101	[NT]
Surrogate 4-BFB	%		Org-016	110	[NT]	[NT]	[NT]	[NT]	100	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

TRH Soil C10-C40 NEPM - # Percent recovery for the matrix spike is not possible to report as the high concentration of analytes in sample 236009-3 has caused interference.

Asbestos: Excessive sample volume was provided for asbestos analysis.
A portion of the supplied sample was sub-sampled according to Envirolab procedures. We cannot guarantee that this sub-sample is indicative of the entire sample.
Envirolab recommends supplying 40-50g (50mL) of sample in its own container as per AS4964-2004.
Note: Sample 236009-3 was sub-sampled from a bag provided by the client.

Asbestos-ID in soil: NEPM
This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013. This is reported outside our scope of NATA accreditation.

Envirolab Services Pty Ltd
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SAMPLE RECEIPT ADVICE

Client Details

Client	Environmental Investigation Services
Attention	A Barkway

Sample Login Details

Your reference	E32915BD, Vaucluse
Envirolab Reference	236009
Date Sample Received	05/02/2020
Date Instructions Received	05/02/2020
Date Results Expected to be Reported	12/02/2020

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	16 SOIL, 1 WATER
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	12.8
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

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Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Organochlorine Pesticides in soil	Organophosphorus Pesticides in Soil	PCBsin Soil	Acid Extractable metalsin soil	Asbestos ID - soils	Asbestos ID - soils NEPM - ASB-001	BTEX in Water	On Hold
BH6-0-0.1	✓	✓	✓	✓	✓	✓	✓				
BH6-0.3-0.4											✓
BH7-0-0.1	✓	✓	✓	✓	✓	✓	✓	✓			
BH7-0.2-0.3	✓	✓	✓				✓				
BH8-0-0.1	✓	✓	✓	✓	✓	✓	✓		✓		
BH8-0.6-0.7	✓	✓	✓				✓				
BH8-1.6-1.8	✓	✓	✓				✓				
BH9-0-0.1	✓	✓	✓	✓	✓	✓	✓		✓		
BH9-0.6-0.7											✓
BH9-0.8-0.9											✓
BH10-0-0.1	✓	✓	✓	✓	✓	✓	✓				
BH10-0.3-0.4											✓
SDUP5											✓
SDUP6	✓	✓	✓				✓				
STB1	✓										
STS1	✓										
SFR1										✓	

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

SAMPLE AND CHAIN OF CUSTODY FORM

TO:		FROM:
ENVIROLAB SERVICES PTY LTD 12 ASHLEY STREET CHATSWOOD NSW 2067 P: (02) 99106200 F: (02) 99106201 Attention: Aileen	EIS Job Number: E32915BD Date Results Required: STANDARD Page: 1 of 1	JKEnvironments REAR OF 115 WICKS ROAD MACQUARIE PARK, NSW 2113 P: 02-9888 5000 F: 02-9888 5001 Attention: abarkaway@jkenvironments.com.au

Location: Vaucluse

Sampler: MMP

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	PID	Sample Description	Combo 3	Combo 6	Combo 6a	Asbestos WA	HOLD	BTEX					
3.2.20	1	BH6	0-0.1	G, A	0	F: Silty sand		X									
3.2.20	2	BH6	0.3-0.4	G, A	0	Silty sand					X						
3.2.20	3	BH7	0-0.1	G, A	1.1	F: Silty sand			X								
3.2.20	4	BH7	0.2-0.3	G, A	6.2	Silty sand	X										
3.2.20	5	BH8	0-0.1	G, A	0.9	F: Silty sand		X		X							
3.2.20	6	BH8	0.6-0.7	G, A	0	F: Silty sand	X										
3.2.20	7	BH8	1.6-1.8	G	0	Clayey Sand	X										
3.2.20	8	BH9	0-0.1	G, A	0	F: Silty sand		X		X							
3.2.20	9	BH9	0.6-0.7	G, A	0	F: Silty sand					X						
3.2.20	10	BH9	0.8-0.9	G, A	0	F: Silty sand					X						
3.2.20	11	BH10	0-0.1	G, A	0.1	F: Silty sand		X									
3.2.20	12	BH10	0.3-0.4	G, A	0	F: Silty sand					X						
3.2.20	13	SDUP5	-	G	-						X						
3.2.20	14	SDUP6	-	G	-		X										
3.2.20	15	STB1	-	V	-							X					
3.2.20	16	STS1	-	V	-							X					
3.2.20	17	SFR1	-	V	-							X					

ENVIROLAB

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 236009

Date Received: 5.02.2020

Time Received: 12:45

Received By: EC

Temp: Cool/Ambient

Cooling: Ice/Icepack

Security: Intact/Broken/None

Remarks (comments/detection limits required):

Sample Containers:
G - 250mg Glass Jar
A - Ziplock Asbestos Bag
P - Plastic Bag

Relinquished By: Anthony Barkway	Date: 05.02.2020	Time:	Received By: EZS Trinidad Carvalho	Date: 5.02.2020

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 236009-A

Client Details

Client	Environmental Investigation Services
Attention	A Barkway
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E32915BD, Vaucluse**
Number of Samples	16 SOIL, 1 WATER
Date samples received	05/02/2020
Date completed instructions received	12/02/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	19/02/2020
Date of Issue	19/02/2020

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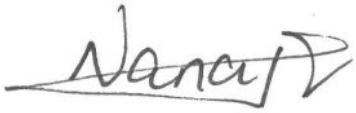
Results Approved By
Josh Williams, Senior Chemist
Loren Bardwell, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

Metals in TCLP USEPA1311						
Our Reference		236009-A-3	236009-A-5	236009-A-6	236009-A-8	236009-A-11
Your Reference	UNITS	BH7	BH8	BH8	BH9	BH10
Depth		0-0.1	0-0.1	0.6-0.7	0-0.1	0-0.1
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	17/02/2020	17/02/2020	17/02/2020	17/02/2020	17/02/2020
Date analysed	-	17/02/2020	17/02/2020	17/02/2020	17/02/2020	17/02/2020
pH of soil for fluid# determ.	pH units	6.6	6.7	6.9	6.6	6.7
pH of soil TCLP (after HCl)	pH units	1.7	1.7	1.7	1.7	1.7
Extraction fluid used	-	1	1	1	1	1
pH of final Leachate	pH units	4.9	4.9	4.9	4.9	4.9
Lead in TCLP	mg/L	[NA]	<0.03	0.07	0.06	0.1

PAHs in TCLP (USEPA 1311)			
Our Reference		236009-A-3	236009-A-6
Your Reference	UNITS	BH7	BH8
Depth		0-0.1	0.6-0.7
Date Sampled		03/02/2020	03/02/2020
Type of sample		SOIL	SOIL
Date extracted	-	18/02/2020	18/02/2020
Date analysed	-	19/02/2020	19/02/2020
Naphthalene in TCLP	mg/L	<0.001	<0.001
Acenaphthylene in TCLP	mg/L	0.001	<0.001
Acenaphthene in TCLP	mg/L	<0.001	<0.001
Fluorene in TCLP	mg/L	0.001	<0.001
Phenanthrene in TCLP	mg/L	<0.001	<0.001
Anthracene in TCLP	mg/L	<0.001	<0.001
Fluoranthene in TCLP	mg/L	<0.001	<0.001
Pyrene in TCLP	mg/L	<0.001	<0.001
Benzo(a)anthracene in TCLP	mg/L	<0.001	<0.001
Chrysene in TCLP	mg/L	<0.001	<0.001
Benzo(bjk)fluoranthene in TCLP	mg/L	<0.002	<0.002
Benzo(a)pyrene in TCLP	mg/L	<0.001	<0.001
Indeno(1,2,3-c,d)pyrene - TCLP	mg/L	<0.001	<0.001
Dibenzo(a,h)anthracene in TCLP	mg/L	<0.001	<0.001
Benzo(g,h,i)perylene in TCLP	mg/L	<0.001	<0.001
Total +ve PAH's	mg/L	0.0021	NIL (+)VE
Surrogate p-Terphenyl-d14	%	132	121

Method ID	Methodology Summary
EXTRACT.7	Toxicity Characteristic Leaching Procedure (TCLP) using Zero Headspace Extraction (zHE) using AS4439 and USEPA 1311.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-004	Toxicity Characteristic Leaching Procedure (TCLP) using in house method INORG-004. Please note that the mass used may be scaled down from the default based on sample mass available.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Org-012/017	Leachates are extracted with Dichloromethane and analysed by GC-MS and/or GC-MS/MS.

QUALITY CONTROL: Metals in TCLP USEPA1311						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			17/02/2020	[NT]	[NT]	[NT]	[NT]	17/02/2020	[NT]
Date analysed	-			17/02/2020	[NT]	[NT]	[NT]	[NT]	17/02/2020	[NT]
Lead in TCLP	mg/L	0.03	Metals-020 ICP-AES	<0.03	[NT]	[NT]	[NT]	[NT]	96	[NT]

QUALITY CONTROL: PAHs in TCLP (USEPA 1311)					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			18/02/2020	[NT]	[NT]	[NT]	[NT]	18/02/2020	[NT]
Date analysed	-			19/02/2020	[NT]	[NT]	[NT]	[NT]	19/02/2020	[NT]
Naphthalene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	84	[NT]
Acenaphthylene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	76	[NT]
Phenanthrene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	74	[NT]
Anthracene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	70	[NT]
Pyrene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	76	[NT]
Benzo(a)anthracene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	97	[NT]
Benzo(bjk)fluoranthene in TCLP	mg/L	0.002	Org-012/017	<0.002	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	94	[NT]
Indeno(1,2,3-c,d)pyrene - TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	117	[NT]	[NT]	[NT]	[NT]	121	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Environmental Investigation Services
Attention	A Barkway

Sample Login Details

Your reference	E32915BD, Vaucluse
Envirolab Reference	236009-A
Date Sample Received	05/02/2020
Date Instructions Received	12/02/2020
Date Results Expected to be Reported	19/02/2020

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	16 SOIL, 1 WATER
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	12.8
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	Metals in TCLP USEPA1311	Naphthalene in TCLP	Acenaphthylene in TCLP	Acenaphthene in TCLP	Fluorene in TCLP	Phenanthrene in TCLP	Anthracene in TCLP	Fluoranthene in TCLP	Pyrene in TCLP	Benzo(a)anthracene in TCLP	Chrysene in TCLP	Benzo(bjk)fluoranthene in TCLP	Benzo(a)pyrene in TCLP	Indeno(1,2,3-c,d)pyrene - TCLP	Dibenzo(a,h)anthracene in TCLP	Benzo(g,h,i)perylene in TCLP	Total +vePAH's	Surrogate p-Terphenyl-d14	On Hold
BH6-0-0.1																			✓
BH6-0.3-0.4																			✓
BH7-0-0.1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
BH7-0.2-0.3																			✓
BH8-0-0.1	✓																		
BH8-0.6-0.7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
BH8-1.6-1.8																			✓
BH9-0-0.1	✓																		
BH9-0.6-0.7																			✓
BH9-0.8-0.9																			✓
BH10-0-0.1	✓																		
BH10-0.3-0.4																			✓
SDUP5																			✓
SDUP6																			✓
STB1																			✓
STS1																			✓
SFR1																			✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Envirolab Services Pty Ltd
ABN 37 112 535 645
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customerservice@envirolab.com.au
www.envirolab.com.au

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt. Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Jessica Hie

From: Nick Sarlamis
Sent: Wednesday, 12 February 2020 10:18 AM
To: Anthony Barkway
Cc: Jessica Hie
Subject: RE: JKE - Extra testing request for Registration 236009 E32915BD, Vaucluse

236009-A
Due: 19/2/20
Std TAT

Morning Anthony,

We will get that organized.

Kind Regards,

Nick Sarlamis | Inorganics Supervisor | Envirolab Services Pty Ltd

Great Science. Great Service.
12 Ashley Street Chatswood NSW 2067
T 612 9910 6200 **F** 612 9910 6201
E nsarlamis@envirolab.com.au | **W** www.envirolab.com.au

From: Anthony Barkway <ABarkway@jkenvironments.com.au>
Sent: Wednesday, 12 February 2020 10:00 AM
To: Nick Sarlamis <NSarlamis@envirolab.com.au>
Subject: JKE - Extra testing request for Registration 236009 E32915BD, Vaucluse

Hi Nick,

Could I please request extra testing for some of the samples within the above batch as follows:

Sample Number + Depth	Lab Ref:	Tests Required
BH7 0.0-0.1	3	TCLP PAHs
BH8 0.0-0.1	5	TCLP Lead
BH8 0.6-0.7	6	TCLP Lead & TCLP PAHs
BH9 0.0-0.1	8	TCLP Lead
BH10 0.0-0.1	11	TCLP Lead

Thank you!

Kind Regards

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12 Ashley St Chatswood NSW 2067
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customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 236004

Client Details

Client	Environmental Investigation Services
Attention	A Barkway
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E32915BD, Vaucluse**
Number of Samples	2 Water
Date samples received	05/02/2020
Date completed instructions received	05/02/2020

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	12/02/2020
Date of Issue	12/02/2020

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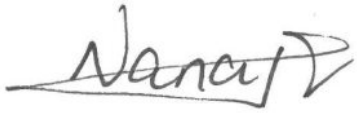
Results Approved By
Jaimie Loa-Kum-Cheung, Metals Supervisor
Josh Williams, Senior Chemist
Priya Samarawickrama, Senior Chemist
Steven Luong, Organics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

VOCs in water		
Our Reference	UNITS	236004-1
Your Reference		MW2
Date Sampled		03/02/2020
Type of sample		Water
Date extracted	-	06/02/2020
Date analysed	-	06/02/2020
Dichlorodifluoromethane	µg/L	<10
Chloromethane	µg/L	<10
Vinyl Chloride	µg/L	<10
Bromomethane	µg/L	<10
Chloroethane	µg/L	<10
Trichlorofluoromethane	µg/L	<10
1,1-Dichloroethene	µg/L	<1
Trans-1,2-dichloroethene	µg/L	<1
1,1-dichloroethane	µg/L	<1
Cis-1,2-dichloroethene	µg/L	<1
Bromochloromethane	µg/L	<1
Chloroform	µg/L	<1
2,2-dichloropropane	µg/L	<1
1,2-dichloroethane	µg/L	<1
1,1,1-trichloroethane	µg/L	<1
1,1-dichloropropene	µg/L	<1
Cyclohexane	µg/L	<1
Carbon tetrachloride	µg/L	<1
Benzene	µg/L	<1
Dibromomethane	µg/L	<1
1,2-dichloropropane	µg/L	<1
Trichloroethene	µg/L	<1
Bromodichloromethane	µg/L	<1
trans-1,3-dichloropropene	µg/L	<1
cis-1,3-dichloropropene	µg/L	<1
1,1,2-trichloroethane	µg/L	<1
Toluene	µg/L	<1
1,3-dichloropropane	µg/L	<1
Dibromochloromethane	µg/L	<1
1,2-dibromoethane	µg/L	<1
Tetrachloroethene	µg/L	<1
1,1,1,2-tetrachloroethane	µg/L	<1
Chlorobenzene	µg/L	<1
Ethylbenzene	µg/L	<1

VOCs in water		
Our Reference		236004-1
Your Reference	UNITS	MW2
Date Sampled		03/02/2020
Type of sample		Water
Bromoform	µg/L	<1
m+p-xylene	µg/L	<2
Styrene	µg/L	<1
1,1,2,2-tetrachloroethane	µg/L	<1
o-xylene	µg/L	<1
1,2,3-trichloropropane	µg/L	<1
Isopropylbenzene	µg/L	<1
Bromobenzene	µg/L	<1
n-propyl benzene	µg/L	<1
2-chlorotoluene	µg/L	<1
4-chlorotoluene	µg/L	<1
1,3,5-trimethyl benzene	µg/L	<1
Tert-butyl benzene	µg/L	<1
1,2,4-trimethyl benzene	µg/L	<1
1,3-dichlorobenzene	µg/L	<1
Sec-butyl benzene	µg/L	<1
1,4-dichlorobenzene	µg/L	<1
4-isopropyl toluene	µg/L	<1
1,2-dichlorobenzene	µg/L	<1
n-butyl benzene	µg/L	<1
1,2-dibromo-3-chloropropane	µg/L	<1
1,2,4-trichlorobenzene	µg/L	<1
Hexachlorobutadiene	µg/L	<1
1,2,3-trichlorobenzene	µg/L	<1
Surrogate Dibromofluoromethane	%	106
Surrogate toluene-d8	%	98
Surrogate 4-BFB	%	109

vTRH(C6-C10)/BTEXN in Water			
Our Reference	UNITS	236004-1	236004-2
Your Reference		MW2	WDUP1
Date Sampled		03/02/2020	03/02/2020
Type of sample		Water	Water
Date extracted	-	06/02/2020	06/02/2020
Date analysed	-	06/02/2020	06/02/2020
TRH C_6 - C_9	µg/L	<10	<10
TRH C_6 - C_{10}	µg/L	<10	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10	<10
Benzene	µg/L	<1	<1
Toluene	µg/L	<1	<1
Ethylbenzene	µg/L	<1	<1
m+p-xylene	µg/L	<2	<2
o-xylene	µg/L	<1	<1
Naphthalene	µg/L	<1	<1
Surrogate Dibromofluoromethane	%	106	106
Surrogate toluene-d8	%	98	101
Surrogate 4-BFB	%	109	108

svTRH (C10-C40) in Water			
Our Reference		236004-1	236004-2
Your Reference	UNITS	MW2	WDUP1
Date Sampled		03/02/2020	03/02/2020
Type of sample		Water	Water
Date extracted	-	06/02/2020	06/02/2020
Date analysed	-	07/02/2020	07/02/2020
TRH C_{10} - C_{14}	µg/L	<50	<50
TRH C_{15} - C_{28}	µg/L	<100	150
TRH C_{29} - C_{36}	µg/L	<100	190
TRH >C_{10} - C_{16}	µg/L	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50	<50
TRH >C_{16} - C_{34}	µg/L	110	290
TRH >C_{34} - C_{40}	µg/L	<100	110
Surrogate o-Terphenyl	%	84	83

PAHs in Water - Low Level			
Our Reference		236004-1	236004-2
Your Reference	UNITS	MW2	WDUP1
Date Sampled		03/02/2020	03/02/2020
Type of sample		Water	Water
Date extracted	-	06/02/2020	06/02/2020
Date analysed	-	06/02/2020	06/02/2020
Naphthalene	µg/L	<0.2	<0.2
Acenaphthylene	µg/L	<0.1	0.3
Acenaphthene	µg/L	<0.1	0.2
Fluorene	µg/L	<0.1	0.3
Phenanthrene	µg/L	0.8	2.9
Anthracene	µg/L	0.2	0.8
Fluoranthene	µg/L	0.9	3.3
Pyrene	µg/L	0.9	3.4
Benzo(a)anthracene	µg/L	0.5	1.9
Chrysene	µg/L	0.5	1.6
Benzo(b,j+k)fluoranthene	µg/L	0.6	2
Benzo(a)pyrene	µg/L	0.4	1.6
Indeno(1,2,3-c,d)pyrene	µg/L	0.2	0.6
Dibenzo(a,h)anthracene	µg/L	<0.1	0.2
Benzo(g,h,i)perylene	µg/L	0.2	0.6
Benzo(a)pyrene TEQ	µg/L	<0.5	2.2
Total +ve PAH's	µg/L	5.0	20
Surrogate p-Terphenyl-d14	%	84	84

HM in water - dissolved			
Our Reference	UNITS	236004-1	236004-2
Your Reference		MW2	WDUP1
Date Sampled		03/02/2020	03/02/2020
Type of sample		Water	Water
Date prepared	-	06/02/2020	06/02/2020
Date analysed	-	06/02/2020	06/02/2020
Arsenic-Dissolved	µg/L	<1	<1
Cadmium-Dissolved	µg/L	<0.1	<0.1
Chromium-Dissolved	µg/L	6	6
Copper-Dissolved	µg/L	<1	1
Lead-Dissolved	µg/L	1	1
Mercury-Dissolved	µg/L	<0.05	<0.05
Nickel-Dissolved	µg/L	3	3
Zinc-Dissolved	µg/L	19	21

Miscellaneous Inorganics		
Our Reference	UNITS	236004-1
Your Reference		MW2
Date Sampled		03/02/2020
Type of sample		Water
Date prepared	-	05/02/2020
Date analysed	-	05/02/2020
pH	pH Units	6.1
Electrical Conductivity	µS/cm	450

Cations in water Dissolved		
Our Reference		236004-1
Your Reference	UNITS	MW2
Date Sampled		03/02/2020
Type of sample		Water
Date digested	-	06/02/2020
Date analysed	-	06/02/2020
Calcium - Dissolved	mg/L	50
Magnesium - Dissolved	mg/L	3.6
Hardness	mgCaCO 3 /L	140

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-013	Water samples are analysed directly by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

QUALITY CONTROL: VOCs in water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			06/02/2020	1	06/02/2020	07/02/2020		06/02/2020	[NT]
Date analysed	-			06/02/2020	1	06/02/2020	07/02/2020		06/02/2020	[NT]
Dichlorodifluoromethane	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
Chloromethane	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
Vinyl Chloride	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
Bromomethane	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
Chloroethane	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
Trichlorofluoromethane	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
1,1-Dichloroethene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Trans-1,2-dichloroethene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,1-dichloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	82	[NT]
Cis-1,2-dichloroethene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Bromochloromethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Chloroform	µg/L	1	Org-013	<1	1	<1	<1	0	84	[NT]
2,2-dichloropropane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2-dichloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	82	[NT]
1,1,1-trichloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	81	[NT]
1,1-dichloropropene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Cyclohexane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Carbon tetrachloride	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Dibromomethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2-dichloropropane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Trichloroethene	µg/L	1	Org-013	<1	1	<1	<1	0	86	[NT]
Bromodichloromethane	µg/L	1	Org-013	<1	1	<1	<1	0	73	[NT]
trans-1,3-dichloropropene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
cis-1,3-dichloropropene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,1,2-trichloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Toluene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,3-dichloropropane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Dibromochloromethane	µg/L	1	Org-013	<1	1	<1	<1	0	71	[NT]
1,2-dibromoethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Tetrachloroethene	µg/L	1	Org-013	<1	1	<1	<1	0	84	[NT]
1,1,1,2-tetrachloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Chlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Ethylbenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Bromoform	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
m+p-xylene	µg/L	2	Org-013	<2	1	<2	<2	0	[NT]	[NT]
Styrene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,1,2,2-tetrachloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]

QUALITY CONTROL: VOCs in water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
o-xylene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2,3-trichloropropane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Isopropylbenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Bromobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
n-propyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
2-chlorotoluene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
4-chlorotoluene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,3,5-trimethyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Tert-butyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2,4-trimethyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,3-dichlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Sec-butyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,4-dichlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
4-isopropyl toluene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2-dichlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
n-butyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2-dibromo-3-chloropropane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2,4-trichlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Hexachlorobutadiene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2,3-trichlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-013	99	1	106	99	7	97	[NT]
Surrogate toluene-d8	%		Org-013	98	1	98	100	2	100	[NT]
Surrogate 4-BFB	%		Org-013	105	1	109	105	4	97	[NT]

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			06/02/2020	1	06/02/2020	07/02/2020		06/02/2020	[NT]
Date analysed	-			06/02/2020	1	06/02/2020	07/02/2020		06/02/2020	[NT]
TRH C_6 - C_9	µg/L	10	Org-016	<10	1	<10	<10	0	82	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-016	<10	1	<10	<10	0	82	[NT]
Benzene	µg/L	1	Org-016	<1	1	<1	<1	0	81	[NT]
Toluene	µg/L	1	Org-016	<1	1	<1	<1	0	86	[NT]
Ethylbenzene	µg/L	1	Org-016	<1	1	<1	<1	0	78	[NT]
m+p-xylene	µg/L	2	Org-016	<2	1	<2	<2	0	82	[NT]
o-xylene	µg/L	1	Org-016	<1	1	<1	<1	0	79	[NT]
Naphthalene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-016	99	1	106	99	7	97	[NT]
Surrogate toluene-d8	%		Org-016	98	1	98	100	2	100	[NT]
Surrogate 4-BFB	%		Org-016	105	1	109	105	4	97	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	[NT]
Date analysed	-			07/02/2020	1	07/02/2020	07/02/2020		07/02/2020	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-003	<50	1	<50	<50	0	104	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-003	<100	1	<100	<100	0	105	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-003	<100	1	<100	<100	0	114	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-003	<50	1	<50	<50	0	104	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-003	<100	1	110	100	10	105	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-003	<100	1	<100	<100	0	114	[NT]
Surrogate o-Terphenyl	%		Org-003	83	1	84	78	7	114	[NT]

QUALITY CONTROL: PAHs in Water - Low Level						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	236004-2
Date extracted	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Naphthalene	µg/L	0.2	Org-012/017	<0.2	1	<0.2	<0.2	0	108	80
Acenaphthylene	µg/L	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluorene	µg/L	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	98	72
Phenanthrene	µg/L	0.1	Org-012/017	<0.1	1	0.8	0.8	0	96	#
Anthracene	µg/L	0.1	Org-012/017	<0.1	1	0.2	0.3	40	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-012/017	<0.1	1	0.9	0.9	0	96	62
Pyrene	µg/L	0.1	Org-012/017	<0.1	1	0.9	0.9	0	100	64
Benzo(a)anthracene	µg/L	0.1	Org-012/017	<0.1	1	0.5	0.5	0	[NT]	[NT]
Chrysene	µg/L	0.1	Org-012/017	<0.1	1	0.5	0.5	0	110	74
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-012/017	<0.2	1	0.6	0.6	0	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-012/017	<0.1	1	0.4	0.5	22	78	#
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-012/017	<0.1	1	0.2	0.2	0	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-012/017	<0.1	1	0.2	0.2	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	82	1	84	80	5	90	77

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	236004-2
Date prepared	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	94	95
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	<0.1	0	103	102
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	6	6	0	101	101
Copper-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	101	98
Lead-Dissolved	µg/L	1	Metals-022	<1	1	1	1	0	105	102
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	100	97
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	3	3	0	99	98
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	19	20	5	99	101

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			05/02/2020	[NT]	[NT]	[NT]	[NT]	05/02/2020	[NT]
Date analysed	-			05/02/2020	[NT]	[NT]	[NT]	[NT]	05/02/2020	[NT]
pH	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	103	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]

QUALITY CONTROL: Cations in water Dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date digested	-			06/02/2020	[NT]	[NT]	[NT]	[NT]	06/02/2020	[NT]
Date analysed	-			06/02/2020	[NT]	[NT]	[NT]	[NT]	06/02/2020	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	106	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	107	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

PAHs in Water - Low Level - # Percent recovery for the matrix spike is not possible to report as the high concentration of analytes in sample 236004-2 have caused interference.

pH
Samples were out of the recommended holding time for this analysis.

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Environmental Investigation Services
Attention	A Barkway

Sample Login Details

Your reference	E32915BD, Vaucluse
Envirolab Reference	236004
Date Sample Received	05/02/2020
Date Instructions Received	05/02/2020
Date Results Expected to be Reported	12/02/2020

Sample Condition

Samples received in appropriate condition for analysis	Holding time exceedance
No. of Samples Provided	2 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	9.6
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Holding time exceedance - pH

Please contact the laboratory within 24 hours if you wish to cancel the aformentioned testing. Otherwise testing will proceed as per the COC and hence invoice accordingly.

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	VOCs in water	vTRH(C6-C10)/BTEXN in Water	svTRH (C10-C40) in Water	PAHs in Water - Low Level	HM in water - dissolved	pH	Electrical Conductivity	Cations in water Dissolved
MW2	✓	✓	✓	✓	✓	✓	✓	✓
WDUP1		✓	✓	✓	✓			

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

SAMPLE AND CHAIN OF CUSTODY FORM

TO:		FROM:
ENVIROLAB SERVICES PTY LTD 12 ASHLEY STREET CHATSWOOD NSW 2067 P: (02) 99106200 F: (02) 99106201 Attention: Aileen	EIS Job Number: E32915BD Date Results Required: STANDARD Page: 1 of 1	JKEnvironments REAR OF 115 WICKS ROAD MACQUARIE PARK, NSW 2113 P: 02-9888 5000 F: 02-9888 5001 Attention: abarkaway@jkenvironments.com.au

Location:	Vaucluse	Sample Preserved in Esky on Ice
Sampler:	MMP	Tests Required

Date Sampled	Lab Ref:	Sample Number	Sample Containers	PID	Sample Description		Combo 3L	VOCs	pH / EC	Hardness							
3.2.20	1	MW2	2x G1, 4xV, 1xH, 1xPVC	1.2	Water		X	X	X	X							
3.2.20	2	WDUP1	2x G1, 4xV, 1xH, 1xPVC	-	Water		X										

ENVIROLAB GROUP

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 236009
Date Received:
Time Received: 5/02/2020 12:45
Received By: TC
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Remarks (comments/detection limits required):	Sample Containers:
All analysis PQLs to ANZECC (2000) Detection Limits Please	G1 - 500mL Amber Glass Bottle G2 - 1L Amber Glass Bottle V - BTEX Vial H - HNO3 Wash PVC PVC - HDPE Plastic Bottles

Relinquished By: Anthony Barkway	Date: 05.02.2020	Time:	Received By: ES Tracaad Canales.	Date: 5.02.2020 12:45

Appendix F: Report Explanatory Notes

Standard Sampling Procedure

These protocols specify the basic procedures to be used when sampling soils or groundwater for environmental site assessments undertaken by JKE. The purpose of these protocols is to provide standard methods for: sampling, decontamination procedures for sampling equipment, sample preservation, sample storage and sample handling. Deviations from these procedures must be recorded.

A. Soil Sampling

- Prepare a borehole/test pit log or made a note of the sample description for stockpiles.
- Layout sampling equipment on clean plastic sheeting to prevent direct contact with ground surface. The work area should be at a distance from the drill rig/excavator such that the machine can operate in a safe manner.
- Ensure all sampling equipment has been decontaminated prior to use.
- Remove any surface debris from the immediate area of the sampling location.
- Collect samples and place in glass jar with a Teflon seal. This should be undertaken as quickly as possible to prevent the loss of any volatiles. If possible, fill the glass jars completely.
- Collect samples for asbestos analysis and place in a zip-lock plastic bag.
- Label the sampling containers with the JKE job number, sample location (eg. BH1), sampling depth interval and date. If more than one sample container is used, this should also be indicated (eg. 2 = Sample jar 1 of 2 jars).
- Photoionisation detector (PID) screening of volatile organic compounds (VOCs) should be undertaken on samples using the soil sample headspace method. Headspace measurements are taken following equilibration of the headspace gasses in partly filled zip-lock plastic bags. PID headspace data is recorded on the borehole/test pit log and the chain of custody forms.
- Record the lithology of the sample and sample depth on the borehole/test pit log generally in accordance with AS1726-2017[17].
- Store the sample in a sample container cooled with ice or chill packs. On completion of the sampling the sample container should be delivered to the lab immediately or stored in the refrigerator prior to delivery to the lab. All samples are preserved in accordance with the standards outlined in the report.
- Check for the presence of groundwater after completion of each borehole using an electronic dip metre or water whistle. Boreholes should be left open until the end of fieldwork where it is safe to do so. All groundwater levels in the boreholes should be rechecked on the completion of the fieldwork.
- Backfill the boreholes/test pits with the excavation cuttings or clean sand prior to leaving the site.

B. Decontamination Procedures for Soil Sampling Equipment

- All sampling equipment should be decontaminated between every sampling location. This excludes single use PVC tubing used for push tubes etc. Equipment and materials required for the decontamination include:
  - Phosphate free detergent (Decon 90);
  - Potable water;
  - Stiff brushes; and
  - Plastic sheets.
- Ensure the decontamination materials are clean prior to proceeding with the decontamination.
- Fill both buckets with clean potable water and add phosphate free detergent to one bucket.
- In the bucket containing the detergent, scrub the sampling equipment until all the material attached to the equipment has been removed.
- Rinse sampling equipment in the bucket containing potable water.
- Place cleaned equipment on clean plastic sheets.

[17] Standards Australia, (2017), *Geotechnical Site Investigations.* (AS1726-2017)

If all materials are not removed by this procedure, high-pressure water cleaning is recommended. If any equipment is not completely decontaminated by both these processes, then the equipment should not be used until it has been thoroughly cleaned.

C. Groundwater Sampling

Groundwater samples are more sensitive to contamination than soil samples and therefore adhesion to this protocol is particularly important to obtain reliable, reproducible results. The recommendations detailed in AS/NZS 5667.1:1998 are considered to form a minimum standard.

The basis of this protocol is to maintain the security of the borehole and obtain accurate and representative groundwater samples. The following procedure should be used for collection of groundwater samples from previously installed groundwater monitoring wells.

- After monitoring well installation, at least three bore volumes should be pumped from the monitoring wells (well development) to remove any water introduced during the drilling process and/or the water that is disturbed during installation of the monitoring well. This should be completed prior to purging and sampling.
- Groundwater monitoring wells should then be left to recharge for at least three days before purging and sampling. Prior to purging or sampling, the condition of each well should observed and any anomalies recorded on the field data sheets. The following information should be noted: the condition of the well, noting any signs of damage, tampering or complete destruction; the condition and operation of the well lock; the condition of the protective casing and the cement footing (raised or cracked); and, the presence of water between protective casing and well.
- Measure the groundwater level from the collar of the piezometer/monitoring well using an electronic dip meter. The collar level should be taken (if required) during the site visit using a dumpy level and staff.
- Purging and sampling of piezometers/monitoring wells is done on the same site visit when using micro-purge (or other low flow) techniques.
- Layout and organize all equipment associated with groundwater sampling in a location where they will not interfere with the sampling procedure and will not pose a risk of contaminating samples. Equipment generally required includes:
  - Stericup single-use filters (for heavy metals samples);
  - Bucket with volume increments;
  - Sample containers: teflon bottles with 1 ml nitric acid, 75mL glass vials with 1 mL hydrochloric acid, 1 L amber glass bottles;
  - Bucket with volume increments;
  - Flow cell;
  - pH/EC/Eh/Temperature meters;
  - Plastic drums used for transportation of purged water;
  - Esky and ice;
  - Nitrile gloves;
  - Distilled water (for cleaning);
  - Electronic dip meter;
  - Low flow peristaltic pump and associated tubing; and
  - Groundwater sampling forms.
- Ensure all non-disposable sampling equipment is decontaminated or that new disposable equipment is available prior to any work commencing at a new location. The procedure for decontamination of groundwater equipment is outlined at the end of this section.
- Disposable gloves should be used whenever samples are taken to protect the sampler and to assist in avoidance of contamination.
- Groundwater samples are obtained from the monitoring wells using low flow sampling equipment to reduce the disturbance of the water column and loss of volatiles.

- During pumping to purge the well, the pH, temperature, conductivity, dissolved oxygen, redox potential and groundwater levels are monitored (where possible) using calibrated field instruments to assess the development of steady state conditions. Steady state conditions are generally considered to have been achieved when the difference in the pH measurements is less than 0.2 units, the difference in conductivity is less than 10% and whilst the well is no longer in draw-down.
- All measurements are recorded on specific data sheets.
- Once steady state conditions are considered to have been achieved, groundwater samples are obtained directly from the pump tubing and placed in appropriate glass bottles, BTEX vials or plastic bottles.
- All samples are preserved in accordance with water sampling requirements specified by the laboratory and placed in an insulated container with ice. Groundwater samples are preserved by immediate storage in an insulated sample container with ice.
- At the end of each water sampling complete a chain of custody form for samples being sent to the laboratory.

D. <u>Decontamination Procedures for Groundwater Sampling Equipment</u>

- All equipment associated with the groundwater sampling procedure (other than single-use items) are decontaminated between every sampling location.
- The following equipment and materials are required for the decontamination procedure:
  - Phosphate free detergent;
  - Potable water;
  - Distilled water; and
  - Plastic Sheets or bulk bags (plastic bags).
- Fill one bucket with clean potable water and phosphate free detergent, and one bucket with distilled water.
- Flush potable water and detergent through pump head. Wash sampling equipment and pump head using brushes in the bucket containing detergent until all materials attached to the equipment are removed.
- Flush pump head with distilled water.
- Change water and detergent solution after each sampling location.
- Rinse sampling equipment in the bucket containing distilled water.
- Place cleaned equipment on clean plastic sheets.
- If all materials are not removed by this procedure that equipment should not be used until it has been thoroughly cleaned

QA/QC Definitions

The QA/QC terms used in this report are defined below. The definitions are in accordance with US EPA publication SW-846, entitled *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (1994)[18] methods and those described in *Environmental Sampling and Analysis, A Practical Guide,* (1991)[19]. The NEPM (2013) is consistent with these documents.

A. Practical Quantitation Limit (PQL), Limit of Reporting (LOR) & Estimated Quantitation Limit (EQL)

These terms all refer to the concentration above which results can be expressed with a minimum 95% confidence level. The laboratory reporting limits are generally set at ten times the standard deviation for the Method Detection Limit for each specific analyte. For the purposes of this report the LOR, PQL, and EQL are considered to be equivalent.

When assessing laboratory data it should be borne in mind that values at or near the PQL have two important limitations: *"The uncertainty of the measurement value can approach, and even equal, the reported value. Secondly, confirmation of the analytes reported is virtually impossible unless identification uses highly selective methods. These issues diminish when reliably measurable amounts of analytes are present. Accordingly, legal and regulatory actions should be limited to data at or above the reliable detection limit*" (Keith, 1991).

B. Precision

The degree to which data generated from repeated measurements differ from one another due to random errors. Precision is measured using the standard deviation or Relative Percent Difference (RPD).

C. Accuracy

Accuracy is a measure of the agreement between an experimental result and the true value of the parameter being measured (i.e. the proximity of an averaged result to the true value, where all random errors have been statistically removed). The assessment of accuracy for an analysis can be achieved through the analysis of known reference materials or assessed by the analysis of surrogates, field blanks, trip spikes and matrix spikes. Accuracy is typically reported as percent recovery.

D. Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is primarily dependent upon the design and implementation of the sampling program. Representativeness of the data is partially ensured by the avoidance of contamination, adherence to sample handing and analysis protocols and use of proper chain-of-custody and documentation procedures.

E. Completeness

Completeness is a measure of the number of valid measurements in a data set compared to the total number of measurements made and overall performance against DQIs. The following information is assessed for completeness:

- Chain-of-custody forms;
- Sample receipt form;
- All sample results reported;
- All blank data reported;
- All laboratory duplicate and RPDs calculated;

[18] US EPA, (1994). *SW-846: Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* (US EPA SW-846)
[19] Keith., H, (1991). *Environmental Sampling and Analysis, A Practical Guide*

- All surrogate spike data reported;
- All matrix spike and lab control spike (LCS) data reported and RPDs calculated;
- Spike recovery acceptable limits reported; and
- NATA stamp on reports.

F. Comparability

Comparability is the evaluation of the similarity of conditions (e.g. sample depth, sample homogeneity) under which separate sets of data are produced. Data comparability checks include a bias assessment that may arise from the following sources:

- Collection and analysis of samples by different personnel; Use of different techniques;
- Collection and analysis by the same personnel using the same methods but at different times; and
- Spatial and temporal changes (due to environmental dynamics).

G. Blanks

The purpose of laboratory and field blanks is to check for artefacts and interferences that may arise during sampling, transport and analysis.

H. Matrix Spikes

Samples are spiked with laboratory grade standards to detect interactive effects between the sample matrix and the analytes being measured. Matrix Spikes are reported as a percent recovery and are prepared for 1 in every 20 samples. Sample batches that contain less than 20 samples may be reported with a Matrix Spike from another batch. The percent recovery is calculated using the formula below. Acceptable recovery limits are 70% to 130%.

$$\frac{\text{(Spike Sample Result – Sample Result) x 100}}{\text{Concentration of Spike Added}}$$

I. Surrogate Spikes

Samples are spiked with a known concentration of compounds that are chemically related to the analyte being investigated but unlikely to be detected in the environment. The purpose of the Surrogate Spikes is to check the accuracy of the analytical technique. Surrogate Spikes are reported as percent recovery.

J. Duplicates

Laboratory duplicates measure precision, expressed as Relative Percent Difference. Duplicates are prepared from a single field sample and analysed as two separate extraction procedures in the laboratory. The RPD is calculated using the formula where D1 is the sample concentration and D2 is the duplicate sample concentration:

$$\frac{(D1 - D2) \times 100}{\{(D1 + D2)/2\}}$$

Appendix G: Data (QA/QC) Evaluation

Data (QA/QC) Evaluation

A. INTRODUCTION

This Data (QA/QC) Evaluation forms part of the validation process for the DQOs documented in Section 6.1 of this report. Checks were made to assess the data in terms of precision, accuracy, representativeness, comparability and completeness. These 'PARCC' parameters are referred to collectively as DQIs and are defined in the Report Explanatory Notes attached in the report appendices.

1. Field and Laboratory Considerations

The quality of the analytical data produced for this project has been considered in relation to the following:

- Sample collection, storage, transport and analysis;
- Laboratory PQLs;
- Field QA/QC results; and
- Laboratory QA/QC results.

2. Field QA/QC Samples and Analysis

A summary of the field QA/QC samples collected and analysed for this assessment is provided in the following table:

Sample Type	Sample Identification	Frequency (of Sample Type)	Analysis Performed
Intra-laboratory duplicate (soil)	SDUP2 (primary sample BH2 0.1-0.2m)	Approximately 11% of primary samples	Heavy metals, TRH/BTEX and PAHs.
Intra-laboratory duplicate (soil)	SDUP6 (primary sample BH9 0.0-0.1m)	As above	Heavy metals, TRH/BTEX and PAHs
Intra-laboratory duplicate (groundwater)	WDUP1 (primary sample MW2)	Approximately 33% of primary samples	Heavy metals, TRH/BTEX, PAHs and VOCs
Trip spike (soil)	STS1 (03.02.2020)	One for the assessment to demonstrate adequacy of preservation, storage and transport methods	BTEX
Trip blank (soil)	STB1 (03.02.2020)	One for the assessment to demonstrate adequacy of storage and transport methods	BTEX
Rinsate (soil SPT)	SFR1 (03.02.2020)	One for the assessment to demonstrate adequacy of decontamination methods	BTEX

The results for the field QA/QC samples are detailed in the laboratory summary tables (Table S9 and Table G4 inclusive) attached to the assessment report and are discussed in the subsequent sections of this Data (QA/QC) Evaluation report.

3. Data Assessment Criteria

JKE adopted the following criteria for assessing the field and laboratory QA/QC analytical results:

Field Duplicates

Acceptable targets for precision of field duplicates in this report will be 30% or less, consistent with NEPM (2013). RPD failures will be considered qualitatively on a case-by-case basis taking into account factors such as the concentrations used to calculate the RPD (i.e. RPD exceedance where concentrations are close to the PQL are typically not as significant as those where concentrations are reported at least five or 10 times the PQL), sample type, collection methods and the specific analyte where the RPD exceedance was reported.

Field Blanks and Rinsates

Acceptable targets for field blank and rinsate samples in this report will be less than the PQL for organic analytes. Metals will be considered on a case-by-case basis with regards to typical background concentrations in soils.

Trip Spikes

Acceptable targets for trip spike samples in this report will be 70% to 130%. This is in line with spike recovery limits adopted by the laboratory for organic analysis.

Laboratory QA/QC

The suitability of the laboratory data is assessed against the laboratory QA/QC criteria which is outlined in the laboratory reports. These criteria were developed and implemented in accordance with the laboratory's NATA accreditation and align with the acceptable limits for QA/QC samples as outlined in NEPM (2013) and other relevant guidelines.

A summary of the acceptable limits adopted by the primary laboratory (Envirolab) is provided below:

RPDs

- Results that are <5 times the PQL, any RPD is acceptable; and
- Results >5 times the PQL, RPDs between 0-50% are acceptable.

Laboratory Control Samples (LCS) and Matrix Spikes

- 70-130% recovery acceptable for metals and inorganics;
- 60-140% recovery acceptable for organics; and
- 10-140% recovery acceptable for VOCs.

Surrogate Spikes

- 60-140% recovery acceptable for general organics; and
- 10-140% recovery acceptable for VOCs.

Method Blanks

- All results less than PQL.

B. DATA EVALUATION

1. Sample Collection, Storage, Transport and Analysis

Samples were collected by trained field staff in accordance with the JKE SSP. The SSP was developed to be consistent with relevant guidelines, including NEPM (2013) and other guidelines made under the CLM Act 1997.

Appropriate sample preservation, handling and storage procedures were adopted. Laboratory analysis was undertaken within specified holding times in accordance with Schedule B(3) of NEPM (2013) and the laboratory NATA accredited methodologies.

Review of the project data also indicated that:

- COC documentation was adequately maintained;
- Sample receipt advice documentation was provided for all sample batches;
- All analytical results were reported; and
- Consistent units were used to report the analysis results.

2. Laboratory PQLs

Appropriate PQLs were adopted for the analysis and all PQLs were below the SAC. With the exception of the anthracene PQL for groundwater analysis which was 10 times greater than the ecological SAC. In light of the PAH concentrations reported for soil and groundwater, JKE are of the opinion that this is not significant, and it does not affect the quality of the dataset as a whole or the outcome of the assessment.

3. Field QA/QC Sample Results

Field Duplicates

The results indicated that field precision was acceptable. RPD non-conformances were reported for some analytes as discussed below:

- Elevated RPDs were reported for several Heavy metal and PAH compounds in soil SDUP2/BH2 (0.1-0.3m) and SDUP6/BH9 (0.0-0.1m); and
- Elevated RPDs were also reported for Heavy Metal Copper, several PAH compounds and TRH fractions F3 and F4 in groundwater WDUP1/MW2.

Values outside the acceptable limits for the groundwater QA/QC sample have been attributed to sediment which may have cause interference especially with the PAH analysis and also due to relatively low detectable concentrations close to laboratory PQLs of the analytes for which exceedances in RPD values were observed and which would therefore yield higher RPD values for detected variations.

Values outside the acceptable limits for the soil QA/QC sample have been attributed to the heterogeneous nature of fill material strata from which these samples were collected from and the 'nugget effect' which can mean some spatial variation between locations due to poor distribution of analytes. Sample heterogeneity presents difficulties associated with obtaining homogenous duplicate samples of heterogeneous matrices.

In addition, detectable concentrations of these analytes were relatively low and close to the laboratory PQLs which would yield higher RPD values for detected variations. As both the primary and duplicate sample results were less than the SAC, the exceedances are not considered to have had an adverse impact on the data set as a whole.

Field Blanks

During the investigation, one soil trip blank was placed in the esky during sampling and transported back to the laboratory. The results were all less than the PQLs, therefore cross contamination between samples that may have significance for data validity did not occur.

Rinsates

All results were below the PQL. This indicated that cross-contamination artefacts associated with sampling equipment were not present and the potential for cross-contamination to have occurred was low.

Trip Spikes

The results ranged from 102% to 113% and indicated that field preservation methods were appropriate.

4. Laboratory QA/QC

The analytical methods implemented by the laboratory were performed in accordance with their NATA accreditation and were consistent with Schedule B(3) of NEPM (2013). The frequency of data reported for the laboratory QA/QC (i.e. duplicates, spikes, blanks, LCS) was considered to be acceptable for the purpose of this assessment.

C. DATA QUALITY SUMMARY

JKE are of the opinion that the data are adequately precise, accurate, representative, comparable and complete to serve as a basis for interpretation to achieve the investigation objectives.

Non-conformances were reported for some field QA/QC samples and laboratory QA/QC analysis. These non-conformances were considered to be sporadic and minor, and were not considered to be indicative of systematic sampling or analytical errors. On this basis, these non-conformances are not considered to materially impact the report findings.

There was only one groundwater monitoring event undertaken for the assessment. On this basis there is some uncertainty around the representativeness of the groundwater data, particularly during different climatic conditions and after wet/dry periods. However, given the low contaminant concentrations reported, the site history and the surrounding land uses, this is not considered to alter the conclusions of the assessment.

Appendix H: Field Work Documents

JKEnvironments

Client:	Kincoppal - Rose Bay School	**Job No.:**	E32915BD
Project:	Proposed Developments at Kincoppal - Rose Bay School	**Well No.:**	MW2
Location:	Lot 104 in DP1092747, Cnr New South Head Road & Vaucluse Road, VAUCLUSE, NSW	**Depth (m):**	9.32

WELL FINISH DETAILS

	Gatic Cover ☒	Standpipe ☐	Other (describe) ☐

WELL DEVELOPMENT DETAILS

Method:	Dev. Pump	**SWL – Before (m):**	8.02
Date:	28.01.20	**Time – Before:**	13:20
Undertaken By:	MMP	**SWL – After (m):**	DRY
Total Vol. Removed:	5	**Time – After:**	13:40
PID Reading (ppm):	5.3		

Comments:

DEVELOPMENT MEASUREMENTS

Volume Removed (L)	Temp (°C)	DO (mg/L)	EC (µS/cm)	pH	Eh (mV)
1	26.4	10.1	520	7.36	-20.1
2	22.4	3.0	515	7.01	-21.0
3	21.3	2.1	532	6.82	-22.6
4	21.0	1.8	532	6.71	-24.9
5	21.7	0.8	554	6.23	-32.5
DRY					

Comments: Odours (YES / (NO)) NAPL/PSH (YES / (NO)), Sheen (YES / (NO)), Steady State Achieved (YES / (NO))

YSI Used: 5

Pump Dry

Slow Recharge

Tested By:	MMP	**Remarks:**
Date Tested:	28/1/20	- Steady state conditions - Difference in the pH less than 0.2 units, difference in the conductiveity less than 10% and SWL stable/not in drawdown
Checked By:	MD	- Minimum 3 monitoring well volumes purged, unless well purged until it is effectively dry
Date:	30/1/20	

JKEnvironments

Client:	Kincoppal - Rose Bay School	**Job No.:**	E32915BD
Project:	Proposed Developments at Kincoppal - Rose Bay School	**Well No.:**	MW2
Location:	Lot 104 in DP1092747, Cnr New South Head Road & Vaucluse Road, VAUCLUSE, NSW	**Depth (m):**	9.32

WELL FINISH

X	Gatic Cover		Standpipe		Other (describe)

WELL PURGE DETAILS:

Method:	Bailer	**SWL – Before:**	8.02
Date:	3/2/20	**Time – Before:**	12:45
Undertaken By:	MMP	**Total Vol Removed:**	5
Pump Program No:	—	**PID (ppm):**	1.2

PURGING / SAMPLING MEASUREMENTS

Time (min)	SWL (m)	Vol (L)	Notes	Temp (°C)	DO (mg/L)	EC (µS/cm)	pH	Eh (mV)
Pump wouldn't bailer used		supply	water	20.3	2.2	518	6.91	-26.6
				20.4	1.3	476.2	6.39	-28.2
			Sampling	commenced				
		DRY	following	sampling				
			( )	( )				

Comments: Odours (YES / NO), NAPL/PSH (YES / NO), Sheen (YES / NO), Steady State Achieved (YES / NO)

Sampling Containers Used: 2 x glass amber, 4 x BTEX vials, 1 x HNO3 plastic, x H2SO4 plastic, 1 x unpreserved plastic

YSI used: 5 DRY following sampling WOMP 1 (same # of sampling containers used)

Tested By: ~~Anthony Barkway~~ MMP	**Remarks:**
Date Tested: 3/2/20	- Steady state conditions
Checked By: MD	- difference in the pH less than 0.2 units, difference in conductivity less than 10% 10% and SWL stable/not in drawdown
Date: 12/2/20	

Appendix I: Guidelines and Reference Documents

Acid Sulfate Soils Management Advisory Committee (ASSMAC), (1998). Acid Sulfate Soils Manual

Australian and New Zealand Environment Conservation Council (ANZECC), (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality

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