PRELIMINARY (STAGE 1) SITE INVESTIGATION

PRELIMINARY SITE INVESTIGATION REPORT
PRELIMINARY CONTAMINATED LAND REPORT
PRELIMINARY GEOTECHNICAL ADVICE

Proposed Residential Sub-Division

45/49 Warriewood Road, Warriewood, NSW

Report To:

Mikara Developments Pty Ltd C/O

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Report By:

NG Child & Associates

28 February 2020

DOCUMENT CONTROL REGISTER

Project Reference	CA/20/126-2701
Project Name	Proposal to Undertake a Preliminary Site Investigation for a Proposed Residential Sub-Division at 45/49 Warriewood Road Warriewood NSW
Document Title	Preliminary Site Investigation: Proposed Residential Sub-Division 45/49 Warriewood Road, Warriewood NSW (Version 1; February 28th, 2020)
Document Reference	45/49 Warriewood Road – Preliminary Site Investigation Report (Version 1) – 280220.docx
Issue Type	Electronic
Attention	Mr Tarun Chadha, Archidrome

Version	Date	Document Reference	Prepared By	Checked By	Approved By
1	28 February 2020	45/49 Warriewood Road – Preliminary Site Investigation Report (Version 1) – 280220.docx	NGC	HMC	NGC

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EXECUTIVE SUMMARY

INTRODUCTION

Archidrome Architects, on behalf of its client Mikara Developments Pty Ltd, is involved in the planning and prospective delivery of a residential sub-division at 45/49 Warriewood Road, Warriewood, NSW. The proposed development is subject to the regulatory control of the Northern Beaches Council, and relevant NSW Government departments and agencies. Northern Beaches Council is the consent authority for the development. NG Child & Associates has undertaken a Stage 1 or Preliminary Site Investigation in relation the proposed development. The findings of that investigation are summarised below.

PRELIMINARY SITE INVESTIGATION

The site investigation and assessment were completed in accordance with all relevant guidelines and protocols, including those provided by in the NSW EPA document *Guidelines for Consultants Reporting on Contaminated Sites (1997, reprinted 2000 & 2011)*, and included in particular:

- A detailed review and consideration of the history and past uses of the site, based on a search of available title and ownership records;
- A thorough physical inspection of the site and surrounding properties; and
- Sampling, physical examination and laboratory analysis of soil samples at varying depths from five soil bores drilled by mechanized hand augur at representative locations throughout the site area.

SITE HISTORY

The site has in the past been used for market gardening, and a preliminary review of the physical appearance of representative soil samples from the site, together with appropriate supporting laboratory analysis, has been undertaken to ensure that chemical contamination form this past use of the land has not affected soil quality at the site, when assessed against the residential soil quality criteria relevant to the proposed development.

SITE INSPECTION

Based on the site inspections undertaken the general environmental condition of the 45/49 Warriewood Road Warriewood site is considered to be sound, and a detailed physical inspection of the site has not indicated any significant environmental or contamination issues prejudicial to the residential land use proposed for the site. However, it is noted that materials containing asbestos are likely to be present within the existing buildings and structures at the site; and that It is possible that minor quantities of other potentially hazardous or dangerous materials may be identified during any future demolition or construction works at the site.

SOIL SAMPLING & ANALYSIS

Twenty-three soil samples were collected from various depths at five soil bores installed by mechanized hand augur at representative locations throughout the site.

These samples were carefully examined on-site for any indications of contamination. Fifteen of these samples, including one duplicate sample and three asbestos analysis samples, were forwarded to a NATA registered laboratory (Envirolab Services Pty Ltd) for detailed chemical analysis targeting a wide range of potential contaminants potentially relevant to land subject to prior market gardening use. The key findings of this assessment of soil quality are as follows.

- None of the 23 soil samples collected from and examined at the site provided any physical indication during the drilling and sampling process of contamination, either by discoloration, staining, odour or hydrocarbon residue response to examination by a photoionisation detector;
- No indication of any significant presence of contaminated fill was noted at the site;
- None of the 15 representative soil samples from the site sent to the NATA accredited laboratory of Envirolab Services for analysis indicated the presence of heavy metals, petroleum hydrocarbons, phenolic compounds and polyaromatic hydrocarbon species at levels of potential concern, or at levels in excess of relevant residential land use guidelines;
- Asbestos was not detected in any of the representative surface and near surface soil samples from the site;
- On this basis, the soils at the site are assessed as being free of contamination, and soil quality at the site is considered appropriate for the residential land use proposed; and
- The absence of volatile contaminants in the sub surface at the site indicates that vapour intrusion from sub surface soil strata through and into any future slab floor or basement areas that might be considered at the site will not present an environmental, indoor air quality or other contamination problem.

OVERALL FINDINGS & RECOMMENDATIONS

The overall findings of this Preliminary or Stage 1 Site Investigation have established that the underlying soils at the site are free of contamination; that the site is suitable in general environmental and soil quality terms for the residential use proposed; and that no further or more detailed assessment is considered necessary to establish this finding. These findings are made subject to the following recommendations:

1. That appropriate handling and disposal practices, in accordance with relevant hazardous material handling and disposal guidelines, are observed in relation to any asbestos based materials encountered during future demolition and clearance works undertaken at the site;
2. That a Destructive Hazardous Material Survey per Australian Standard AS2601:2001 The Demolition of Structures and a supporting Demolition Management Plan should be prepared and implemented prior to the commencement of demolition and/or site clearance works;
3. That appropriate care is taken in respect of any other potentially hazardous or dangerous materials unexpectedly identified during any future demolition or clearance works involving the three existing dwellings at the site; and
4. That an appropriate “Unexpected Finds Protocol” is established and implemented during future site preparation and development works.

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28 February 2020

1 INTRODUCTION

1.1 INTRODUCTION

Archidrome Architects, on behalf of its client Mikara Developments Pty Ltd, is involved in the planning and prospective delivery of a residential sub-division at 45/49 Warriewood Road, Warriewood, NSW.

The proposed development site is described in 1.2 to 1.5 below.

The proposed development is subject to the regulatory control of the Northern Beaches Council, and relevant NSW Government departments and agencies.

Northern Beaches Council is the consent authority for the development.

Archidrome Architects has engaged NG Child & Associates to undertake a Preliminary (Stage 1) Site Investigation/Contamination Assessment of the site to confirm its suitability for the proposed residential land use.

The investigation will form part of the Development Application (DA) for the project.

Noel Child of NG Child & Associates is an appropriately qualified and experienced person to undertake the work required.

His experience and qualifications are summarised in Appendix I.

This document described the Preliminary Site Investigation undertaken at the 45/49 Warriewood Road Warriewood site and presents its findings and recommendations.

1.2 PROPOSED LOCATION

Recent satellite views and street maps showing the location of the proposed development are provided in Figures 1.1 and 1.2 respectively on the following page.

The direction of north is towards the top of both diagrams.

The site area is shown shaded in blue in both diagrams.

The proposed development site is bounded by Warriewood Road to the north; by prospective or existing residential developments to the east and west, and by Narrabeen Creek to the south and south-west.

The closest major road is Pittwater Road, some 50 metres to the east of the site.

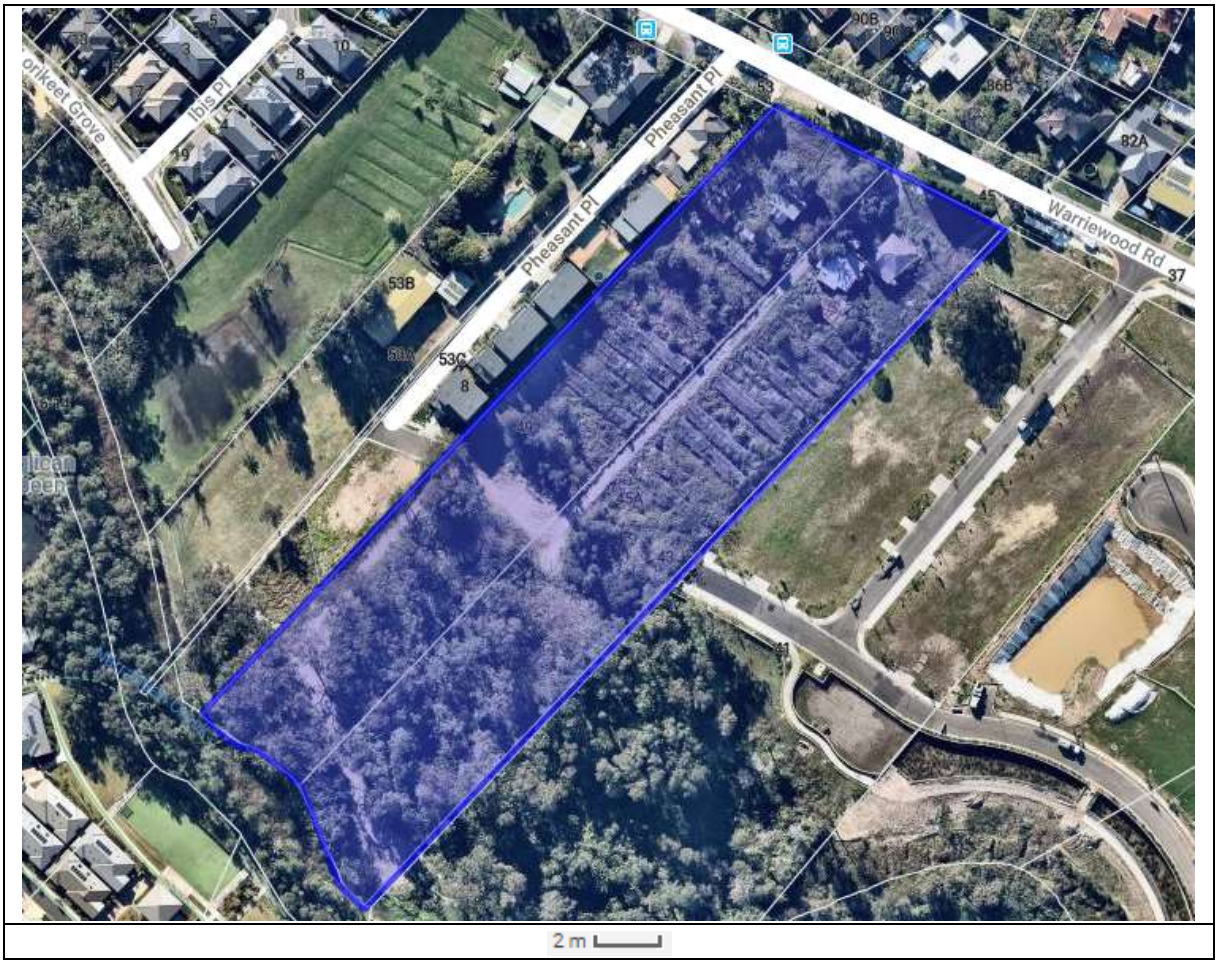


Figure 1.1 – Aerial View of the Proposed Development Site

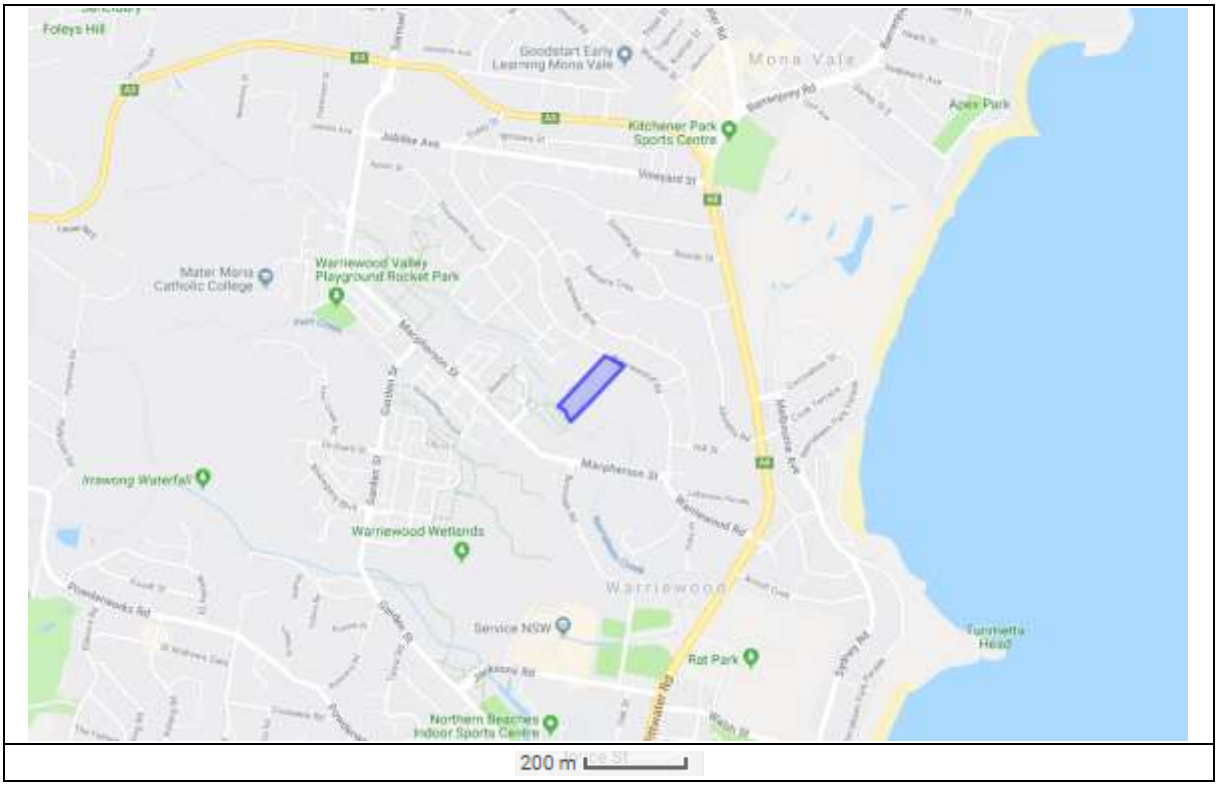


Figure 1.2 – Street Map Showing the Site Location

Views of the site from Warriewood Road, are provided in Figures 1.3 and 1.4, below.

Figure 1.3 – Existing Buildings and Structures on 49 Warriewood Road

Figure 1.4 – Existing Buildings and Structures on 45 Warriewood Road

1.3 ZONING

The zoning of the proposed development site, and surrounding properties, is shown in Figure 1.4, below.

Figure 1.5 – Land Zoning Diagram

The diagram provided in Figure 1.4 is sourced from the current Northern Beaches Local Environment Plan. The site is shown at the approximate centre of Figure 1.4 and is zoned R3 Medium Density Residential.

Immediate surrounding land is also zoned R3 Medium Density Residential, with R2 low density residential land present on the opposite (northern) side of Warriewood Road, and a strip of public recreation land along the creek line bordering the site to the south.

1.4 PROPERTY DETAILS

Survey details of the site are provided for reference in Figures 1.5 and 1.6, on the following pages. The site formally comprises Lots 1 & 2 in Deposited Plan (DP) 349085 and Lot 2 in DP 972209, and is known as 43, 35 & 49 Warriewood Road, Warriewood.

The aggregate site has an approximate area of 21,500 square metres.

1.5 PROJECT DESCRIPTION & PLAN

This proposed development involves a residential subdivision and development.

Site survey details are as follows:

Figure 1.6 Site Survey (Sheet 1 of 2)

Figure 1.7 Site Survey (Sheet 2 of 2)

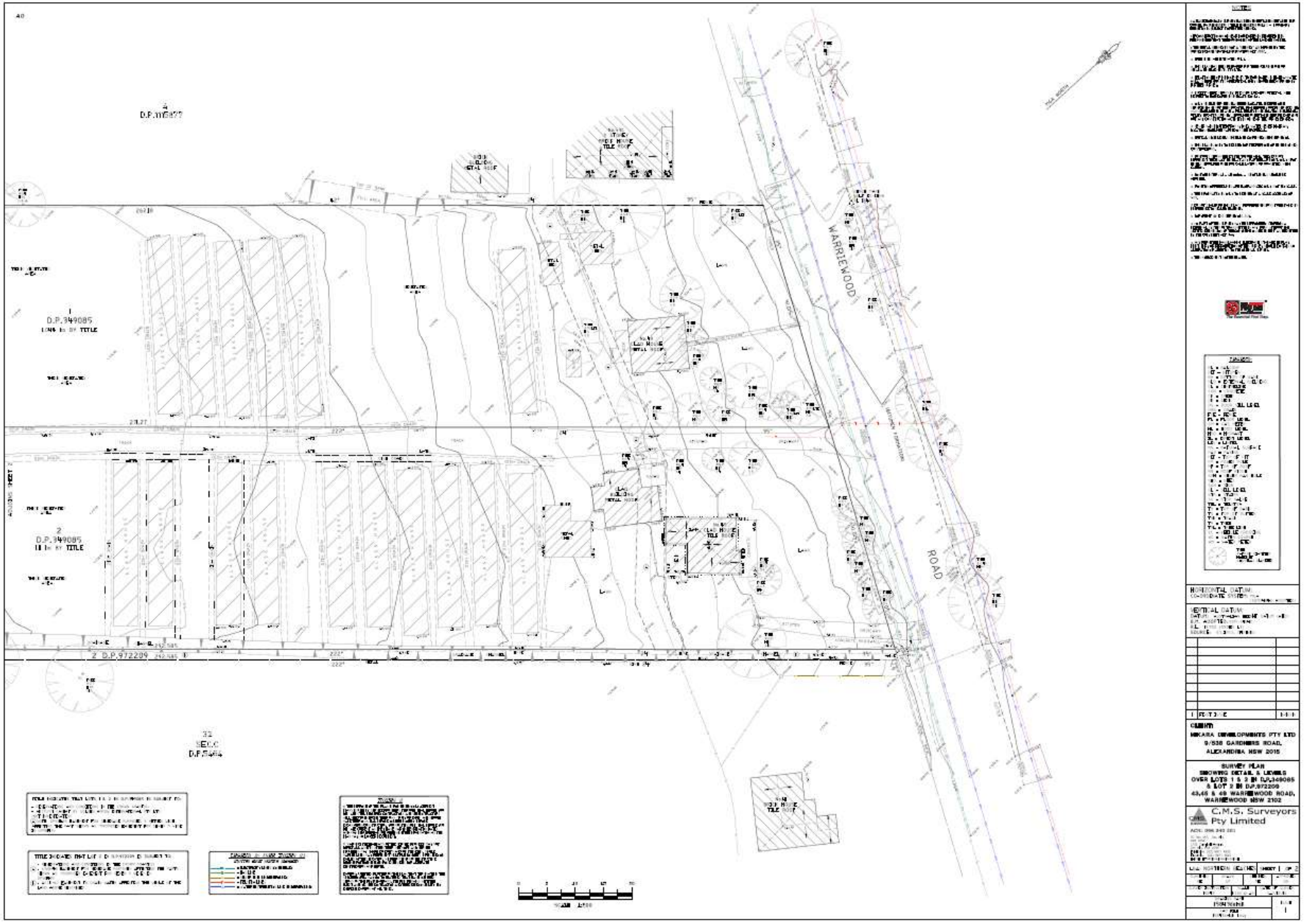


Figure 1.6 – Site Survey (Sheet 1 of 2)

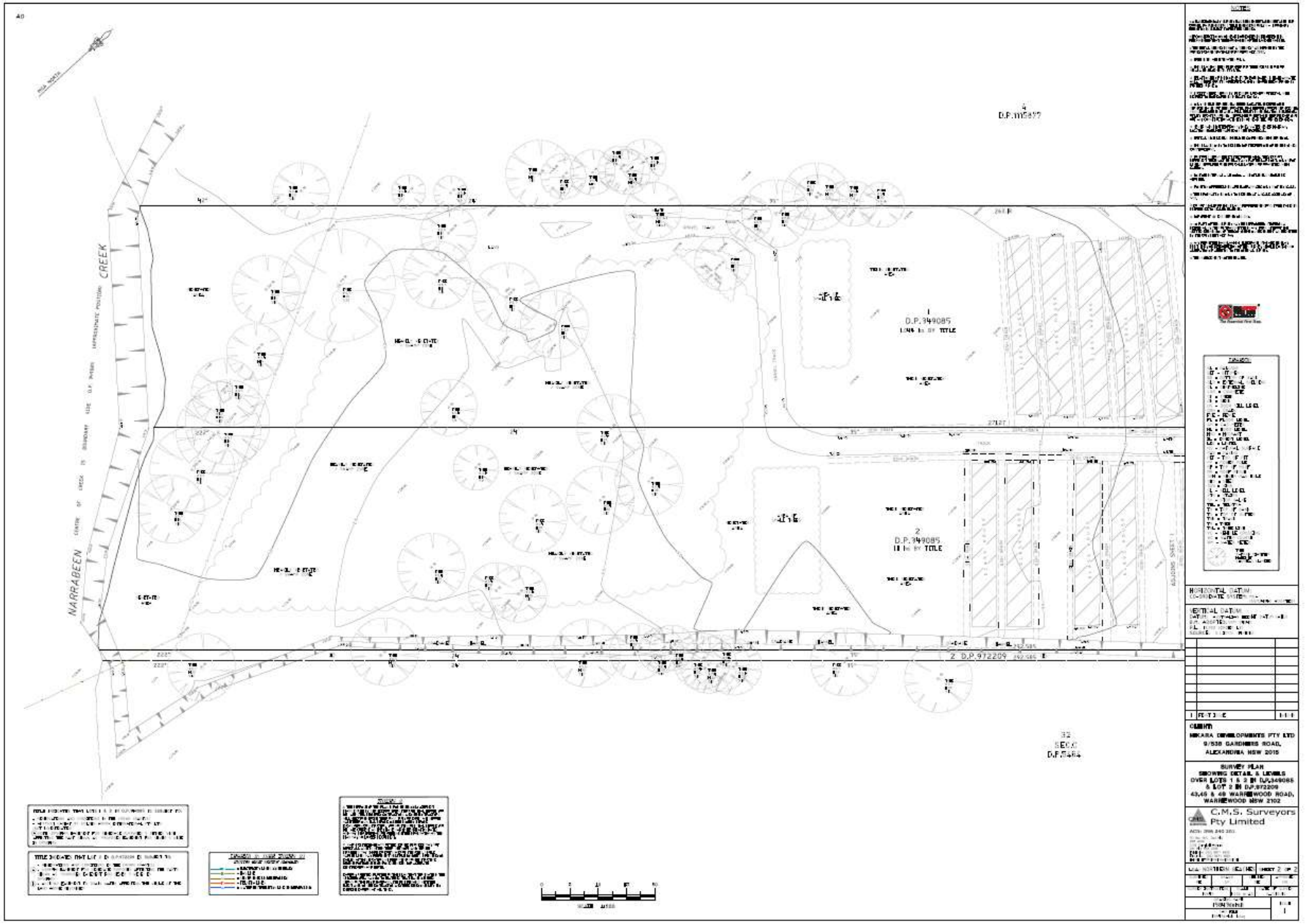


Figure 1.7 – Site Survey (Sheet 2 of 2)

2 ASSESSMENT GUIDELINES

2.1 INTRODUCTION

Guidelines for the environmental and contamination assessment of land have been established by relevant NSW Government agencies and departments, and these guidelines inform the assessment requirements of local government.

The requirements of these guidelines have been considered, along with other relevant guidelines, in the assessment proposal presented in this document.

2.2 NSW GOVERNMENT REQUIREMENTS

NSW Environment Protection Authority

The NSW Environment Protection Authority provides guidelines and protocols for the environmental assessment of land on both a preliminary and detailed assessment basis.

These guidelines and protocols are summarised in the guideline NSW EPA document *Guidelines for Consultants Reporting on Contaminated Sites (first published 1997; reprinted September 2000, reprinted with updated agency details and references August 2011),* and provide the appropriate basis for environmental site assessment undertaken in support of a Development Application to a local government authority in NSW.

This proposal has been prepared in accordance with those guidelines.

Planning NSW

Planning NSW's State Environmental Planning Policy 55 requires that an assessment of soil quality is required in cases where land previously used for non-residential purposes is proposed for residential development.

While the provisions of SEPP 55 typically apply to the use of former commercial or industrial land for residential purposes, it is appropriate that the requirements of the policy are considered in this case.

Medium density residential developments are regarded as sensitive land uses from a site contamination perspective, and maximum care and a precautionary approach regarding site assessment is considered appropriate.

2.3 TYPICAL INVESTIGATION & ASSESSMENT REQUIREMENTS

The following considerations typically apply to the approach of local government in NSW to environmental and contamination site investigations and assessments and are considered relevant to the assessment presented in this document, and to the level of investigation and assessment detail provided.

Pursuant to the provisions of the Environmental Planning and Assessment Act 1979 (as amended), Councils have a duty of care, when considering Rezoning, Development and Complying Development Certificate Applications, to consider fully the possibility of land contamination and the implications it has for any proposed future use of land.

In recognition of this duty of care, Councils typically (and not unreasonably) adopt a precautionary approach to the consideration of applications involving contaminated or potentially contaminated land.

The object of this approach is to enable any land contamination issues to be identified and dealt with at an early stage in the planning process. This approach can, as in this case, involve the requirement for a detailed environmental site investigation.

Councils will typically have regard for the sensitivity of a proposed land use in addition to any technical standards or requirements published by:

(a) The NSW Environment Protection Authority (NSW EPA);

(b) The Australian and New Zealand Environment Conservation Council (ANZECC);

(c) The National Health and Medical Research Council (NH&MRC);

(d) The National Environment Protection Council (NEPC); and

(e) Any other relevant authority.

The processes of identifying, evaluating and remediating contaminated land are documented in the ANZECC and NH&MRC publication entitled "Guidelines for the Assessment and Management of Contaminated Sites" (January 1992).

Councils typically consider these guidelines to be a mandatory reference for consultants assessing contamination levels and undertaking remediation works. Councils also generally require that consultants preparing contamination reports should also have a practical working knowledge of the various Environment Protection Authority and NEPC publications on contaminated land including:

(1) Environment Protection Authority (EPA), 1994, Contaminated Sites: Guidelines for Assessing Service Station Sites;

(2) EPA, 1995, Contaminated Sites: Sampling Design Guidelines;

(3) EPA, 1995, Contaminated Sites: Guidelines for the Vertical Mixing of Soil on Former Broad-Acre Agricultural Land;

(4) EPA, 1997, Guidelines for Consultants Reporting on Contaminated Sites;

(5) EPA, 1998, Guidelines for the NSW Auditor Scheme; and

(6) NEPC, 1999, Draft National Environmental Protection Measure - Assessment of Contaminated Sites.

Contaminated land is generally defined as land in, on or under which any substance is present at a concentration above that naturally present in, on or under the land and that poses, or is likely to pose, an immediate or long-term risk to human health or the environment (Environmental Planning & Assessment Act 1979, as amended). Contamination can result from many past and/or present occurrences, such as:

(a) The controlled or uncontrolled disposal of wastes, including sewage;

(b) Accidental leakage;

(c) Leakage during plant operation, storage or transportation of materials, products or wastes;

(d) The corrosion of underground tanks;

(e) The emission of particulate matter into the atmosphere;

(f) The migration of contaminants into a site from neighbouring land, either as vapour, leachate or movement of liquids through the soil; and

(g) The use of agricultural chemicals.

In accordance with the NSW EPA guidelines included at Appendix A, four stages or levels of environmental or contamination assessment are identified, as follows:

- Stage 1 – Preliminary Investigation
- Stage 2 – Detailed Investigation
- Stage 3 – Site Remedial Action Plan
- Stage 4 – Validation and Monitoring

In this case, either a Stage 1 or Stage 2 site investigation/contamination assessment will be required.

2.4 TYPICAL NSW LOCAL GOVERNMENT SITE ASSESSMENT GUIDELINES

Typical NSW local government requirements regarding the investigation and assessment of land, including contaminated land, are summarised below.

Land Investigation & Assessment Guidelines

1.0 Introduction

Pursuant to the provisions of the Environmental Planning and Assessment Act 1979 (as amended), local government consent authorities have a duty of care, when considering Rezoning, Development and Complying Development Certificate Applications, to consider fully the possibility of land contamination and the implications it has for any proposed future use of land. In recognition of this duty of care, local government in NSW will adopt a precautionary approach to its consideration of applications involving contaminated or potentially contaminated land. The object of this approach is to enable any land contamination issues to be identified and dealt with at an early stage in the planning process. For this to occur, Council has developed a set of procedures to be followed for rezoning proposals, Development Application (DAs) and for Complying Development Certificate Applications (CDCs). These procedures allow for a merit-based consideration of land contamination issues, i.e. in considering the implications of contamination,

Councils will have regard for the sensitivity of a proposed land use in addition to any technical standards or requirements published by:

(a) the NSW Environment Protection Authority (EPA) (incorporated into the NSW Department of Environment and Conservation);
(b) the Australian and New Zealand Environment Conservation Council (ANZECC);
(c) the National Health and Medical Research Council (NH&MRC);
(d) the National Environment Protection Council (NEPC); or
(e) any other relevant authority.

The procedural principles which apply to development proposals are spelt out in Development Control and Local Environment Plans.

Where applicable, the processes of identifying, evaluating and remediating contaminated land are documented in the ANZECC and NH&MRC publication entitled "*Guidelines for the Assessment and Management of Contaminated Sites" (January 1992)*".

Councils typically considers these guidelines to be a mandatory reference for consultants assessing sites and undertaking remediation works. Consultants preparing site investigation reports should also have a practical working knowledge of the various Environment Protection Authority and NEPC publications on contaminated land including:

1) Environment Protection Authority (EPA), 1994, Contaminated Sites: Guidelines for Assessing Service Station Sites.
2) EPA, 1995, Contaminated Sites: Sampling Design Guidelines.
3) EPA, 1995, Contaminated Sites: Guidelines for the Vertical Mixing of Soil on Former Broad-Acre Agricultural Land.
4) EPA, 1997, Guidelines for Consultants Reporting on Contaminated Sites.
5) EPA, 1998, Guidelines for the NSW Auditor Scheme.
6) NEPC, 1999, Draft National Environmental Protection Measure - Assessment of Contaminated Sites.

Contaminated land means land in, on or under which any substance is present at a concentration above that naturally present in, on or under the land and that poses, or is likely to pose, an immediate or long-term risk to human health or the environment (Environmental Planning & Assessment Act 1979, as amended). Contamination can result from many past and/or present occurrences, such as:

(a) the controlled or uncontrolled disposal of wastes, including sewage;
(b) accidental leakage;
(c) leakage during plant operation, storage or transportation of raw materials, finished products or wastes;
(d) the corrosion of underground tanks;
(e) the emission of particulate matter into the atmosphere;
(f) the migration of contaminants into a site from neighbouring land, either as vapour, leachate or movement of liquids through the soil; and
(g) the use of agricultural chemicals.

Councils typically view contamination as a subset of general pollution and will seek, in their assessment and determination of all applications, to ensure the continued compatibility of all development by minimising the potential for polluting discharges, fugitive emissions and controlled spillages by appropriate site management techniques. It is incumbent upon all developers to design and manage their sites in a manner consistent with this objective. Councils typically do not flavour site remediation which requires ongoing monitoring of capped contamination.

Provisions included in Council DCP's are typically based on the provisions of the State Government's Planning Guidelines for Managing Land Contamination (1998) and State Environmental Planning Policy (SEPP) No. 55 - Remediation of Land (as amended by Amendment 1). Both documents, as well as the Contaminated Land Management (CLM) Act 1997, should be consulted in the preparation and assessment of site contamination reports.

2.0 Necessary Information in the Decision-Making

Four stages or levels of contamination assessment are identified, as follows:

2.1.1 Stage 1 – Preliminary Investigation
2.1.2 Stage 2 – Detailed Investigation
2.1.3 Stage 3 – Site Remedial Action Plan
2.1.4 Stage 4 – Validation and Monitoring

In this case either a Stage 1 (preliminary) or Stage 2 (detailed) Site Investigation and contamination assessment will be required.

4 PURPOSE & SCOPE OF THE ASSESSMENT

4.1 OVERALL OBJECTIVE

The overall objective of this assessment has been to thoroughly investigate and assess all relevant general environmental, soil quality and potential contamination issues at the 45/49 Warriewood Road Warriewood site and prepare a Preliminary Site Investigation Assessment Report.

4.2 GENERAL APPROACH TO THE ASSESSMENT

The general approach to this investigation and assessment has involved a careful review of the issues that, in our professional opinion, and in terms of all relevant assessment guidelines and protocols as summarised in Section 3 of this report, require observation, consideration, testing and assessment in order to determine whether the general environmental condition of the site, including in particular soil quality, is appropriate for the residential land use proposed; whether it complies with relevant guidelines and criteria, and whether any remedial actions may be required to achieve these outcomes. The assessment has taken into account regulatory approval, due diligence and any known or potential environmental and environmental health related issues, and has involved the following:

- Use of the best available data regarding the background environment at and in the vicinity of the proposed development site;
- Consideration of all other known and relevant information in relation to the various environmental issues involved in the assessment;
- Consideration of all known and identifiable sources of actual or potential environmental impact, and the effects of any such potential impacts;
- Detailed inspection of the site and its immediate environs;
- Review and consideration of site history; and
- Soil sampling and analysis in accordance with the requirements of the NSW EPA document *Guidelines for Consultants Reporting on Contaminated Sites*.

4.3 SCOPE OF THIS ASSESSMENT

The three key areas of the assessment presented in this report are summarised in 4.3.1, 4.3.2 and 4.3.3 below.

4.3.1 Review of Site History

Past activities and land uses can influence the environmental condition of land and can result in the contamination of soils. To ensure that past uses of and activities at and near the 45/49 Warriewood Road Warriewood site are fully investigated and assessed, a review of available records regarding the history of the site has been undertaken.

The results of this aspect of the site assessment are presented in Section 5.

4.3.2 General Site Inspection & Assessment

To ensure that all relevant environmental and contamination issues are dealt with in the assessment, a physical inspection of the site and surrounding areas has been undertaken. This type of site inspection forms an important part the environmental assessment process, and the guidelines and protocols for environmental assessment provided by the NSW EPA in its guideline document *Guidelines for Consultants Reporting on Contaminated Sites*. A site inspection and general environmental assessment, describing the site and the location, and providing a review and consideration of all potential environmental risk and exposure issues, including consideration of nearby properties and activities, identifying any potential environmental impacts, including any potential hazardous risk issues, has been completed. The findings of this inspection process are reported in Section 6 of this report.

4.3.3 Soil Quality and Contamination Assessment

Soil contamination is a potential area of environmental risk and concern, primarily in cases when previously non-residential land is used for residential purposes. NSW State Environmental Planning Policy 55 (SEPP 55) requires the sampling, analysis and assessment of soil in relevant instances when land previously used for non-residential purposes is proposed for more sensitive land uses, including residential development.

The soil quality assessment undertaken has involved soil inspection, sampling and analysis form various depths at three representative and accessible locations throughout the site area, and has included the following considerations:

- **Physical Inspection:** A thorough physical inspection of the soils at the site, including the visual examination of all soil samples to identify an obvious physical indications of soil contamination or associated issues, including consideration of physical appearance, odour, and any indications of the use of imported or in any way potentially hazardous fill materials at the site;

- **Soil Sampling:** Collection and physical examination of soil samples from the three representative locations, and at various depths; and

- **Laboratory Analysis:** Testing and analysis of representative soil samples from the three sampling locations at the site to assess and quantify soil quality as follows:

    - **Asbestos:** Inspection and microscopic laboratory examination for the presence of asbestos;
    - **Metals & Metalloids:** Laboratory analysis of nine representative samples (including a duplicate sample) to determine the concentrations of heavy metals and metalloids that can be associated with soil contamination and potential health risks, including arsenic, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel and zinc;
    - **Hydrocarbons:** Laboratory analysis of representative samples to determine the possible presence of hydrocarbon (fuel and oil) residues including total petroleum hydrocarbons (TPH C6 – C36) and benzene, toluene, ethyl benzene, xylene and naphthalene (BTEXN);
    - **Volatile Organic Compounds:** Laboratory analysis of four selected samples to determine the possible presence of an extensive range of 65 volatile organic compounds (VOC's);
    - **Polyaromatic Hydrocarbons (PAH):** Laboratory analysis of four representative soil samples for a range of potential polyaromatic hydrocarbon contaminants, including benzo(a)pyrene; and
    - **Phenolics:** Laboratory analysis of three selected samples to determine the possible presence of any residual phenolic contaminants.

- **Reporting:** The preparation of this report, in accordance with relevant guidelines, setting out the findings of the assessment, and any relevant conclusions and recommendations.

The results of this soil quality and contamination assessment are presented in Section 7 of the report.

4.3.4 Asbestos & Hazardous Materials Survey

In accordance with all relevant local government/certifier and SafeWork NSW requirements:

> Typically, a Hazardous Materials Survey report is prepared by an appropriately qualified environmental consultant and submitted for Council or Principal Certifying Authority consideration. The report will identify any hazardous building materials contained in these structures and provide recommendations for their safe removal and disposal as a part of any demolition process.

Work includes site inspection; identification of any hazardous or potentially hazardous materials and preparation of a hazardous materials survey.

Particular emphasis is placed on the identification of any materials containing asbestos.

While the scope of this Preliminary Site Investigation did not include a detailed Hazardous Materials Survey, relevant comments and advice have been provided where applicable.

4.3.5 Preliminary Geotechnical Assessment

Based on the site inspection undertaken, and within the limitations of the very restricted sub-surface investigation undertaken as part of this investigation, preliminary comments in relation to geotechnical conditions and considerations at the site have been provided.

This preliminary geotechnical advice is presented in presented in Section 9 of the report.

4.3.6 Any Other Relevant Environmental Issues

In addition to the specific assessment tasks discussed in 4.3.1, 4.3.2, 4.3.3, 4.3.4 and 4.3.5 above, and in accordance with sound professional practice, any other matters of potential environmental relevance and significance noted during the assessment process have also been taken fully into account in the investigation, assessment and reporting process.

5 SITE HISTORY & PAST USE

5.1 PROPERTY SEARCH

A detailed property and title search of the 45/49 Warriewood Road Warriewood development site was undertaken as part of this assessment. Detailed results of the property and title searches involved have been provided for reference in Appendices C, D and E to this document. Summaries are provided below, together with any environmental or contamination implications arising from the history and past use of the property.

5.2 WARRIEWOOD HISTORY

Aboriginal History

Present day Warriewood covers former Guringai nation lands which have been occupied for thousands of years. The remains of open camps, shellfish middens and animal bones as well as charcoal drawings are reported to have been found throughout the area.

European Settlement

In the decades following European settlement of Australia, and fronting Warriewood Beach was first granted to Alexander McDonald in 1813, followed by grants of more land fronting Mona Vale and Turimetta Beaches in 1816 and 1821, resulting in a total landholding of 81 hectares.

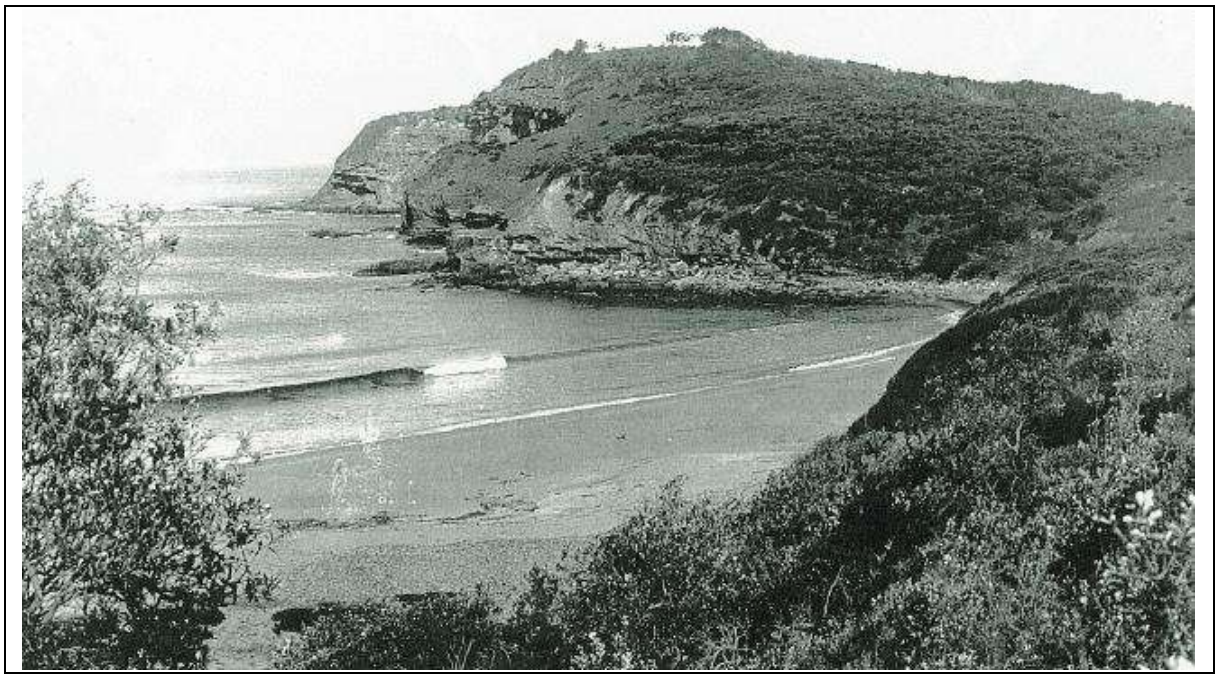


Figure 5.1 – Warriewood beach (circa 1900)

Following McDonald's accidental death in 1821, his land passed to Elizabeth Jenkins, the eldest daughter of James Jenkins, who would eventually own or control one of the largest landholdings on the Northern Beaches peninsula. James Jenkins was in possession of land at Narrabeen by the time he applied for land behind McDonald's grants at Warriewood in 1824 and 1825, which were officially granted in 1831.

In the meantime, Jenkins had purchased another 20 ha at Narrabeen immediately north of his own land that had originally been granted to Daniel Rowan. Jenkins and his family eventually owned the entire coastline between Mona Vale Hospital and Pacific Parade, Dee Why, totaling more than 700 ha.

When Jenkins died in 1835, his land at Warriewood passed to his wife Elizabeth, apart from the 81 ha that had been originally granted to McDonald which was inherited by Jenkins' daughter, Elizabeth Jr.

When Elizabeth Jenkins Sr died in 1874, the Warriewood land was divided between three of the Jenkins children, including Elizabeth Jr, who added her share to the 81 ha she had inherited from McDonald. The land that had been granted to James Jenkins in 1824 and 1825 was acquired by the Macpherson family, who also bought much of the land that now constitutes the suburb of Seaforth.

Until the turn of the twentieth century, land in the Warriewood Valley and Ingleside had been divided into lots ranging from 8 ha to 260 ha.

The land originally owned by McPherson was purchased for subdivision by Henry Halloran subdivided the Macpherson's land at Warriewood into 282 lots.

Reflecting the varying quality of the soil and Halloran's vision, 133 lots were subdivided as small township lots, 83 as larger hilltop sites and 66 even larger lots as farm blocks to take advantage of the best agricultural land. The auction of the Great Warriewood Estate, as Halloran called it, took place on October 1, 1906 but met with only limited success.

Halloran also subdivided the Rock Lily Estate immediately to the north, while another developer, Arthur Rickard, subdivided John Collins' 1857 grant on the northern side of Narrabeen Lagoon.

Although residential development in the Warriewood Valley was slow, the agricultural land, some of the most productive on the peninsula, was quickly taken up for market gardens.

By the 1930's glasshouses were increasing in number, mainly for the production of tomatoes, leading to the valley being referred to as "glass city" and "crystal valley".

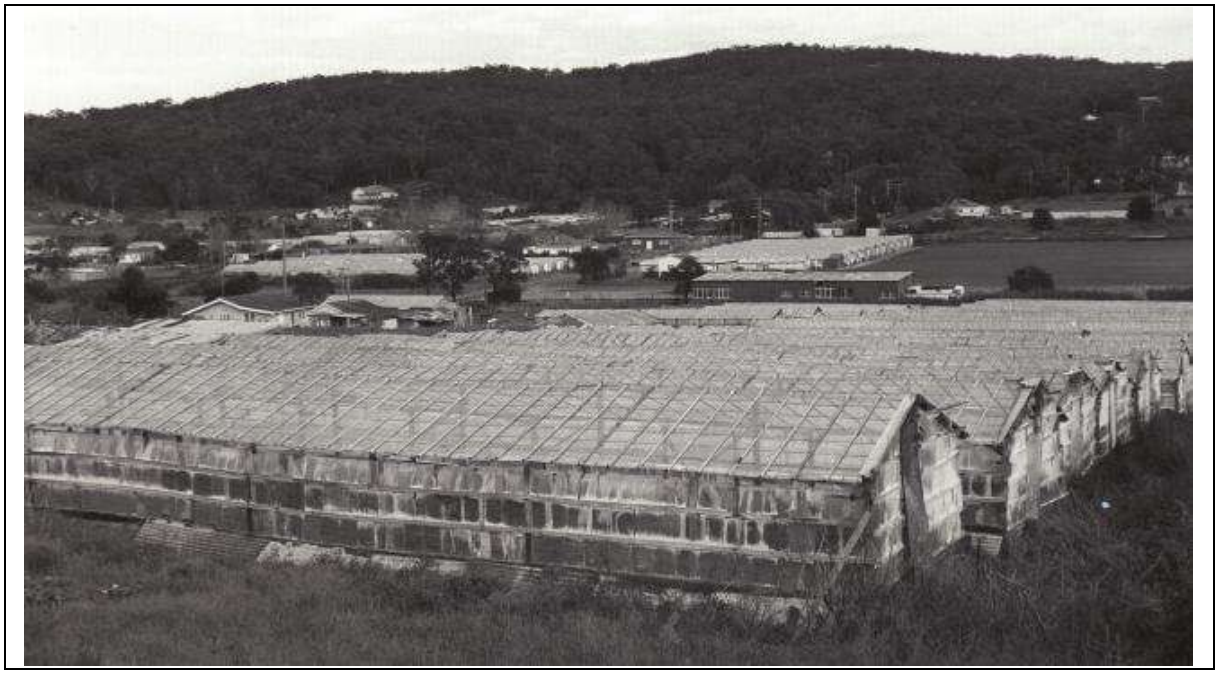


Figure 5.2 – Glasshouses in the Warriewood Valley in 1978

By the 1960's, however, the glasshouses began to disappear because of the loss of traditional markets and competition from growers in Queensland, along with increasing residential development.

The valley was also known for its numerous stables and a riding school called Boots and Saddles but at the time of this site investigation there are thought to be no more than 15 horses left in the area.

Today the rural atmosphere of Warriewood and some of the most fertile soil on the peninsula has largely given way to residential subdivision and development.

Figure 5.3 – Remnant Rural Land in the Warriewood Valley

5.3 SITE HISTORY & PAST USE

The property search provided details of ownership (and indications of land use) dating back to 1912, prior to which time the land involved is understood to have formed part of a larger agricultural holding, as typically described in 5.2 above.

From an environmental and contamination viewpoint, this overview since 1912 is considered to be a more than adequate review period.

Before 1912

As indicated above, prior to 1912, and after European colonisation of Australia, the site is understood to have formed part of a larger land grant or holding.

Prior to European settlement, the land was occupied by the Guringai aboriginal nation.

1912 - 1944

Between 1912 and 1944 the site currently under consideration comprised one parcel (Lot 33 Section C DP 5464) of 5 Acres 1 Rood 12 Perches.

- Between 1912 and 1919 the land was registered in the name George Henry Gardiner, greengrocer
- Between 1919 and 1921, following the death of George Henry Gardiner ownership of the land transferred to Alec John Gardiner, freeholder.
- Between 1921 and 1923 ownership transferred to Annie Elizabeth Gardiner, wife of George Henry Gardiner, market gardener
- Between 1923 and 1943 ownership transferred to Alec John Gardiner, freeholder
- Between 1943 and 1944 ownership transferred to Albert Farley, market gardener

1944 – Present Time

In 1944 the aggregate land was divided into two portions, Lot 2 DP 349085, Lot 1 DP 349085.

Lot 2 DP 349085

- Between 1944 and 1946 this lot was owned by Albert Farley, a market gardener.
- Between 1947 and 1949 the land was owned by Hannah Casey, a married woman.
- Between 1949 and 1953 the land was owned by Elsie Lorraine Nilan, a married woman.
- Between 1953 and 1959 ownership transferred to Foska Pikulich, wife of George Pikulich, farmer and Nevenko Pikulich, market gardener. Use during this period was almost certainly market gardening.
- Between 1959 and 1959 the land was owned Nevenko Pikulich, market gardener, and it is assumed that the market gardening use continued.
- Between 1959 and 1979 the land transferred to Ronald Erskine Pearce, clerk Vera Florence Jean Pearce, his wife. It is likley that residential use applied to the dwellings at the site, and market gardening continued on the other areas of the land.
- Between 1979 and 2005 the land was owned by Nevenko Pikulich, market gardener Zlatka Pikulich, his wife, and the same combination of residential and market gardening uses are considered likley to have continued.

Lot 1 DP 349085

- Between 1959 and 2016 this lot was owned by Zlatka Pikulich, a married woman, and Nevenko Pikulich, a market gardener.
- Between 2016 and 2017 the land transferred to Zlatka Pikulich, widow, following the death of Nevenko Pikulich.
- Between 2017 and 2018 the land was owned by Golden Arrow International Pty Ltd, and presumably held for investment/development purposes.
- Since 2018 the land has been owned by Warriewood Developers Pty Ltd.

(Lot 2 DP 349085 A & B)

- Between 2005 and 2016 this lot was owned by Zlatka Pikulich, a married woman, and Nevenko Pikulich, a market gardener.
- Between 2016 and 2017 2016 and 2017 the land transferred to Zlatka Pikulich, widow, following the death of Nevenko Pikulich.
- Between 2017 and 2018 the land was owned by Golden Arrow International Pty Ltd, and presumably held for investment/development purposes.
- Since 2018 the land has been owned by Warriewood Developers Pty Ltd.

5.4 IMPLICATIONS OF SITE HISTORY & PAST USE

It is considered unlikely that land use during the period prior to the 1912 which appears to have predominantly involved low intensity grazing and farming, would have had any significant environmental or contamination implications for the current residential subdivision proposal.

The use of the site for low intensity agricultural purposes prior to the 1912 is considered unlikely to have any significant soil contamination implications.

Between 1921 and 2016 significant portions of the land appear to have been used for market gardening purposes, with residential use applicable to the areas around both dwellings still present at the site.

This market gardening use has potential implications for soil and other subsurface contamination.

These implications have been addressed in greater detail in Sections 6 and 7 of this report.

6 SITE INSPECTION & ASSOCIATED ISSUES

6.1 INTRODUCTION

This assessment has included a general consideration of any identifiable environmental issues, risks and exposures associated with the proposed development site, or associated with properties and activities in the immediate vicinity of the site. This section of the assessment report deals with a number of important general environmental issues and takes into account those issues generally considered in what are frequently referred to as "Preliminary" or "Stage 1" Site Investigations. This aspect of the assessment is based on inspections of the site and surrounding areas undertaken by Noel Child of NG Child & Associates during December 2019 and February 2020.

More specific consideration of soil quality and potential soil contamination issues has been provided in Section 7 of this report, based on soil inspection, sampling and analysis undertaken as part of the inspection and assessment process.

6.2 PRELIMINARY (STAGE 1) SITE INVESTIGATION

The preliminary site investigation undertaken has involved as detailed as possible inspection of the proposed site and its immediate surroundings, taking into account the general environmental condition of the site, and including a review and assessment of past and current activities at the site; structural and engineering elements that may be relevant to the proposed development; nearby activities and operations, and any associated environmental risks, impacts or implications, and in accordance with relevant assessment guidelines. Issues considered included:

- **General Definition of the Site Boundaries**: A description of the proposed site, including the preparation of appropriate diagrams showing the location of the site in relation to existing streets and other relevant references (refer Section 2).
- **Site Photographs**: Representative photographs of the site, and nearby properties and civilities, illustrating relevant features, subject to access limitations described above (refer Section 2).
- **Site Activities:** A description of present activities and operations at and in the immediate vicinity of the site, noting any existing or potential environmental risks associated with these activities and operations.
- **Adjacent Activities**: A consideration and description of the general nature of nearby property activities, including relevant comment on existing or potential environmental risks or exposures associated with these activities and operations.
- **Site History**: A summary, to the extent that it can reasonably be obtained from local government and other sources, of the history of the past use of the proposed site, including appropriate consideration of any past operations or activities that may involve environmental risks or impacts.
- **Hazardous Goods & Materials**. An assessment of risks and potential risks associated with any hazardous goods or materials identified at or in the immediate vicinity the site, including residual constructions fragments from demolition activities previously undertaken at the site.
- **Possible Hazards Associated with Building and Construction Materials or Structural Elements.** Provision of general comments and relevant advice regarding any obvious or apparent issues in relation to building or construction materials, or structural elements, at or in the immediate vicinity of the proposed residential development. A preliminary consideration of potential hazardous materials issues, particularly regarding prospective demolition and site clearance operations, has been provided (refer Section 8).
- **Soil Contamination.** Physical inspection and assessment of soils for indications of contamination, including staining and odour. (Assessment supported by the limited but more detailed soil quality assessment provided in Section 7).
- **Road Traffic Impacts.** A general assessment of the potential environmental impacts of road traffic activities in the immediate vicinity of the site (excluding acoustic impacts), taking into account any impacts that these activities might have on the site.
- **Equipment and Infrastructure**. A review of any plant, equipment and infrastructure items at or in the immediate vicinity of the proposed site, and a review of any potential environmental risks or impacts.

- **Telephony, Power Distribution Infrastructure & other Potential EMF Sources**. A review of any significant items of mobile telephone, electrical power distribution infrastructure, or any other potential electromagnetic field sources at or in the immediate vicinity of the site, with a view to identifying any potential environmental impacts or possible health risk exposures.
- **Acoustic & Air Quality Issues**: General and preliminary consideration of acoustic and air quality issues, based on a physical inspection of the site and surrounding areas; and
- **Any Other Matters of Environmental Relevance:** Comment and advice on any other matters of an environmental nature considered relevant in terms of providing a thorough and complete environmental assessment of the proposed development.

This assessment presented in this report is intended to provide a concise, preliminary review of all general environmental issues, impacts and risks associated with the site.

6.3 SITE HISTORY

Refer specific review provided in Section 5.

The review of site history undertaken indicated past market gardening activities at the site, which have been further considered as part of this physical site inspection process, and in the soil sampling and analysis reported in Section , which follows.

6.4 SITE DEFINITION

Refer Section 1.

6.5 BUILDINGS & STRUCTURES

The 45/49 Warriewood Road site currently includes two residential dwellings and associated outbuildings and sheds, as illustrated in Figure 6.1 below, and Figure 6.2 on the following page.

Figure 6.1 – Existing Buildings and Structures on 49 Warriewood Road

Figure 6.2 – Existing Buildings and Structures on 45/49 Warriewood Road

The scope of this preliminary investigation did not include any detailed inspection of the existing dwellings or structures, or any detailed assessment or survey of any hazardous or potentially hazardous materials that may be present in those structures.

General observations have been provided where appropriate based on a general external inspection.

Given the apparent vintage and nature of the structures, and their -physical appearance, it is considered that potentially hazardous materials (including in particular asbestos cement sheeting in the form of “fibro”) are present, and comment re procedures to be followed during any future demolition operations have been provided for completeness in Section 8 and Appendix A.

6.6 PHYSICAL INDICATIONS OF CONTAMINATION OR POLLUTION

A general inspection of the overall site area was undertaken to identify any visible evidence of pollution or contamination.

Photographs of the external areas of the site have been included for reference in Figures 6.3 and 6.4 on the following page.

The results of this aspect of the site inspection have been summarised and included following Figure 6.4.

Figure 6.3 – Aerial View of Dwellings and Outbuildings

Figure 6.4 – Disused Glasshouse Structures in Northeastern Portion of Site

Site condition and general standards of housekeeping

The site and associated improvements were found to be in a reasonably sound condition, although some outbuildings and structures were noted to be in a poorly maintained state.

Presence of fuel, lubricant or chemical storage

No active fuel, lubricant or chemical storage facilities were noted at or in the immediate vicinity of the site, and no bulk chemical, fuel or lubricant storage facilities were noted.

Visible staining on the ground, or in the vicinity of drainage systems

No significant staining of structural or surface areas was noted throughout the site.

Evidence of waste disposal on or from the site

There was no indication of waste or waste disposal issues at or in the immediate vicinity of the property.

Odours

No unusual odours, or odours not typically associated with the current use of the property, were noted at or in the immediate vicinity of the site.

No odours were noted in or near any drains on or in the immediate vicinity of the site.

Likelihood of spillages associated with site practices

No practices or activities were noted at the site, or in its immediate vicinity, that could be considered likely to give rise to the possibility of significant spillages of fuels, chemicals or other potentially hazardous goods.

Summary

No physical indications of significant contamination or pollution were noted at or in the immediate vicinity of the 45/49 Warriewood Road Warriewood site.

6.7 SURFACE WATER & DRAINAGE

No significant or atypical surface water drainage issues or potential problems or hazards were noted at or in the immediate vicinity of the site.

Narrabeen Creek borders the site to the south-west, as shown in Figure 6.5 on the following page.

Figure 6.5 – Aerial View of Narrabeen Creek on the Southwestern Site Boundary

6.8 HAZARDOUS MATERIALS

Refer Section 8.

The dwellings at the site appears to be clad or partly clad in asbestos cement ("fibro") sheeting.

Some outbuildings and structures associated with the dwellings also appear to include potentially hazardous materials, including asbestos.

6.9 ACTIVITIES POSING POTENTIAL ENVIRONMENTAL RISK

General

In general terms, no practices or activities representing potential environmental risks or hazards were noted at, or in the site.

Plant, Equipment and Storerooms

No plant, equipment or other potentially hazardous storerooms or storage facilities were noted at or in the immediate vicinity of the site.

Operating Plant

No items of plant and equipment were noted in operation in the general area of the site.

6.10 NSW EPA CONTAMINATED SITE RECORDS

A search of the NSW EPA Register of Contaminated Sites did not indicate any past or current contamination notice or advice in relation to the subject site.

The 45/49 Warriewood Road Warriewood site was not listed as contaminated or potentially contaminated, and no notices in this regard were noted.

6.11 WORKCOVER NSW RECORDS OF UNDERGROUND STORAGE TANKS

A search of WorkCover records of underground storage tanks did not indicate the presence of any listed or notified underground fuel or chemical storage tanks at or in the immediate vicinity of the site.

While these WorkCover records are known to be incomplete, the site inspection undertaken did not indicate the presence of any such items at the site, and the review of site history presented in Section 5 did not identify any past operations at the site that might be expected to involve underground fuel storage tanks.

6.12 BUILDING & CONSTRUCTION MATERIALS

Refer Section 8.

6.13 ASBESTOS

Refer Section 8.

6.14 SOIL CONTAMINATION CONSIDERATIONS

There was no physical indication of soil contamination issues at the site.

Soil quality and potential soil contamination issues have been considered in greater detail in the Soil Quality & Contamination Assessment presented in Section 7.

6.15 NEARBY BUILDINGS AND ACTIVITIES

No significant environmental issues, exposures or risks of a general nature were noted in relation to any nearby buildings and activities.

Details of nearby buildings and activities are provided in Figures 6.7 to 6.10 on subsequent pages.

An aerial view of the site in relation to nearby land uses and activities is provided in Figure 6.6, below.

Figure 6.6 – Site Area in Relation to Surrounding Land Uses and Activities

6.16 ROAD TRAFFIC IMPACTS

The site has an immediate frontage to Warriewood Road, which appears to be a moderately busy local thoroughfare.

Warriewood Road viewed to the southeast and northwest from outside the subject site is shown in Figures 6.7 and 6.8 respectively on the following page.

Figure 6.7 – Warriewood Road Viewed to the Southeast from the Site

Figure 6.8 – Warriewood Road Viewed to the Northwest Outside the Site

6.17 AIR QUALITY

Although the site is located near a moderately busy thoroughfare (Warriewood Road), no obvious air quality or odour issues were apparent at the site, or in the vicinity of the existing dwellings and structures at the site.

The site area was noted to be open and subject to good natural air flow and ventilation.

No air quality issues are indicated in relation to the proposed residential development.

6.18 ELECTROMAGNETIC FIELD

No significant electromagnetic field sources were noted in the general vicinity of the site, or within a distance from the site considered likely to result in any electromagnetic field impact of potential concern at the proposed development site.

6.19 OTHER

No other significant environmental issues, exposures or impacts of a general nature were noted during the site inspection and assessment process.

6.20 KEY FINDINGS & RECOMMENDATIONS

6.20.1 Findings

Based on the site inspections undertaken the general environmental condition of the 45/49 Warriewood Road site is considered to be sound, and a detailed physical inspection of the site has not indicated any significant environmental or contamination issues prejudicial to the residential land use proposed for the site.

However, the following issues are noted:

1. Materials containing asbestos are present within the existing dwellings and outbuildings at the site (refer Section 8); and

2. It is possible that other potentially hazardous or dangerous materials may be identified during any future demolition, clearing and construction works at the site.

6.20.2 Recommendations

Based on the inspection of the site reported in 6.1 to 6.19 above, and the findings summarised in 6.20.1 above, the following recommendations are made:

1. That appropriate handling and disposal practices, in accordance with relevant asbestos handling and disposal guidelines as detailed in this report are observed during any future demolition and site clearing operations undertaken at the site;

2. That appropriate care is taken in respect of the possible identification of any other potentially hazardous or dangerous materials that may unexpectedly be identified during future demolition and site clearing operations; and

3. That an appropriate Unexpected Finds Protocol is developed and implemented during future works at the site.

7 SOIL QUALITY & CONTAMINATION ASSESSMENT

7.1 INTRODUCTION

This section of the report presents the results of a limited assessment of soil quality at the 45/49 Warriewood Road Warriewood site.

7.2 SOIL CONTAMINATION CONSIDERATIONS

The presence of contaminated soils or land, typically as a consequence of prior industrial uses, and/or the past importation and use of contaminated fill materials to sites, presents a significant cause for potential concern when such sites are proposed for redevelopment for more sensitive uses.

State Environmental Planning Policy 55 specifically addresses the redevelopment of contaminated or potentially contaminated sites.

SEPP 55 requires that planning authorities consider, at the development approval and/or rezoning stages as applicable, the potential for contamination to adversely affect the suitability of a site for its proposed use.

The policy states that land must not be developed if it is unsuitable for a proposed use because it is contaminated. If the land is unsuitable, remediation must take place before the land is developed.

In this case, past market gardening land use indicates that preliminary soil sampling and analysis is appropriate to support the physical site inspection undertaken and reported in the previous section of this report.

7.3 SOIL SAMPLING & ANALYSIS

In this case, land uses in the late 19th and first half of the 20th centuries appear to have included some small-scale agricultural practices.

As indicated in Section 5, past land use between approximately 1922 and 2016 has involved market gardening.

A review of past land uses, together with a detailed site inspection, indicates a potential for residual contamination from past uses of the site.

To provide greater certainty in this regard and given the sensitive nature of the residential land use proposed, soil samples were collected, examined and analysed from five bores drilled by mechanised hand augur at representative locations at the site.

The five soil sampling locations were chosen to provide a representative indication of soil quality required for this preliminary investigation.

7.4 SAMPLING LOCATIONS

Soil bores were drilled by hand augur at five representative locations.

Samples from all depths at the five locations were physically examined for any indications of contamination.

Representative samples from various depths at each of these five locations were subjected to laboratory analysis.

The five soil sampling locations are identified in Figure 7.1, on the following page.

Figure 7.1 – Soil Sampling Locations

As indicated above, the five sampling locations selected provide a distribution considered to be appropriate for a preliminary site investigation.

The five soil sampling locations are described in Table 7.1, below.

Table 7.1 – Soil Sample Location Details

Sample Location	Description	Type
1	Northeastern area of site behind dwellings and structures	1.5 metre soil bore
2	Central northwestern area of the site in former glasshouse area	1.5 metre soil bore
3	Central southeastern area of the site in former glasshouse area	1.5 metre soil bore
4	Real northwestern area of the site toward creek boundary	2.0 metre soil bore
5	Real southeastern area of the site toward creek boundary	2.0 metre soil bore

The soil bores were hand drilled to the limit imposed by soil conditions. 200 gram soil samples were collected and inspected from the surface, and at 500 mm depth increments tot termination of the soil bores.

Separate 500 gram soil samples were collected from the near surface at each location for asbestos analysis, based on 10 kg soil samples passed through a 7 mm sieve in accordance with relevant NSW EPA sampling guidelines.

Soil samples were physically examined for any indications of possible contamination, including odour, staining and any other discoloration, and were field tested using a portable photoionisation detector for the possible presence of hydrocarbon vapours. Representative samples were retained for laboratory analysis.

A duplicate samples was collected from Location 3 (1000 mm depth) for QA/QC purposes.

7.5 SAMPLING PROCEDURES

7.5.1 General

Sampling was undertaken in accordance with all relevant and applicable procedures and protocols, including:

- laboratory prepared, and approved sample jars and containers were used to collect samples;
- samples were collected as quickly as possible;
- once collected, the samples were immediately sealed and labelled with the following:
  - the name of the person who collected the sample
  - the date, time and place the sample was collected
  - the weather conditions at the time of collection
  - clear identification of the sample.
- sample containers were immediately placed in an insulated in a cooler below 4° C;
- sampling equipment was decontaminated before and between sampling events, using a phosphate free detergent solution, followed by a tap water rinse and a final rinse with distilled water;
- appropriate care was taken to ensure no cross contamination between sampling events; and
- appropriate care was taken to ensure that the decontamination process did not itself cause contamination of soils and groundwater systems, including those at the site.

7.5.2 Soil Sampling

Soil samples were collected on Friday December 6th, 2019 in accordance with all relevant and applicable procedures and protocols, including:

- digging and sampling equipment used was thoroughly cleaned before use, and again between each sampling event;
- appropriate care was taken to ensure no cross contamination between sampling events;
- appropriate care was taken to ensure that the decontamination process did not itself cause contamination of soils and groundwater systems, including those at the site; and
- safe work practices were followed.

7.5.3 Soil Samples

Soil samples were collected in accordance with the general procedures outlined in 7.5.1 and 7.5.2 above. In addition:

- Any indications of staining, unusual colours or odours were noted;
- Soil samples were collected from the surface, 300 mm, 500 mm, 1000 mm, 1500 mm at each location, and in two cases at 2000 mm.

Samples were transferred to laboratory provided 250g glass storage containers, labelled, placed in a cooler box. All samples, including the duplicate sample, were delivered on an urgent basis to the NATA accredited laboratory Envirolab Services Pty Ltd for analysis.

A copy of the relevant Chain of Custody documentation has been included for reference at Appendix G.

A total of 23 soil samples, including 1 duplicate sample and three samples for specific asbestos analysis, were collected and examined.

Sample identification is summarised in Table 7.2, below.

Table 7.2 – Soil Sample Identification

	Sample Location				
Sample Depth	**1**	**2**	**3**	**4**	**5**
0 – 300 mm	WAR-1-SUR (250g + 500g)	WAR-2-SUR (500g)	WAR-3-SUR (250g + 500g)	WAR-4-SUR (250g)	WAR-5-SUR (250g)
500 mm	WAR-1-0500 (250g)	WAR-2-0500 (250g)	WAR-3-0500 (250g)	WAR-4-0500 (250g)	WAR-5-0500 (250g)
1000 mm	WAR-1-1000 (250g)	WAR-2-1000 (250g)	WAR-3-1000 + D (250g)	WAR-4-1000 (250g)	WAR-5-1000 (250g)
1500 mm	WAR-1-1500 (250g)	WAR 2-1500 (250g)	WAR-3-1500 (250g)	WAR 4-1500 (250g)	WAR 5-1500 (250g)
2000 mm				WAR-4-2000 (Groundwater)	WAR-5-2000 (Groundwater)

All samples were subjected to careful physical inspection. Representative samples, highlighted in blue in Table 7.2, were subjected to further, confirmatory laboratory analysis.

A total of 15 samples, including 1 duplicate sample and three samples for specific asbestos analysis, were delivered for laboratory analysis.

7.6 LABORATORY ANALYSIS

Analysis of soil samples was performed by the NATA certified and accredited laboratory Envirolab Services Pty Ltd, using analytical methods in accordance with relevant NSW OEH and NSW EPA guidelines.

Analysis was performed for a wide range of chemicals known to be associated with site contamination issues, in accordance with relevant site investigation guidelines and protocols.

The following analytes were included:

- The eight heavy metals and metalloids arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc;
- Volatile total recoverable hydrocarbons (vTRH) in the range C6 – C9;
- Benzene, toluene, ethylbenzene, xylene and naphthalene (BTEXN);
- Semi volatile total recoverable hydrocarbons (sTRH) in the range C10 – C36;
- Polyaromatic hydrocarbons (PAH's);
- Phenols (total phenolics); and
- Asbestos

7.7 QUALITY ASSURANCE & QUALITY CONTROL (QA/QC)

7.7.1 QA/QC Documentation

All reports have been checked for conformance (and appropriate documentation provided) with the following:

- Quality Assurance and Quality Control (QA/QC) Procedures (as set out in Appendix V of the guidelines for the NSW Site Auditor Scheme (2nd Edition) (December 2006).

7.7.2 Field

A QA/QC plan was developed and implemented to ensure a high standard of work when undertaking the site assessment. This plan included:

- Ensuring quality and reproducibility of all sampling methods used at the site;
- Ensuring samples collected to be of the highest possible quality and integrity, to allow subsequent analysis to be completed to the highest possible degree of accuracy;
- Ensuring compliance with all relevant standards, including AS 4482.1-1997 and AS/NZS 5667-1-1998;
- 10% duplicate sampling of field samples - one blind replicate or field duplicate sample for every ten investigative samples;
- A trip blank was obtained and used prepared to detect any cross contamination during transport; and.
- A laboratory prepared spiked sample was provided, and were stored, handled and transported in exactly the same way as the field samples.

7.7.3 Laboratory

Appropriate QA/QC procedures in accordance with relevant professional standards and protocols were applied and followed in the laboratory. Refer to the laboratory report included at Appendix H for details.

7.8 CHAIN OF CUSTODY

An appropriate chain of custody process was used to detail the transfer of samples between the time of collection, and the time of arrival at the laboratory. Refer Appendix G for details.

7.9 ASSESSMENT CRITERIA

Full details of assessment criteria soils have been provided for reference at Appendix F. A summary of assessment guidelines in relation to the assessment of soil, including the site assessment criteria adopted for this investigation, is provided in Table 7.3 on the following page.

For the purposes of this assessment, soil quality guidelines applicable to Residential A (the most demanding category) are applicable.

Residential A guidelines apply to residential land uses involving the potential for garden/accessible soil (home grown produce <10% fruit and vegetable intake (no poultry), and also apply to childcare centres, preschools and primary schools. Residential B guidelines apply to residential land uses with minimal opportunities for soil access, including dwellings with fully and permanently paved yard space such as high-rise buildings and apartments.

In this case the strictest or Residential A guidelines are those applicable to residential subdivisions and developments and have been adopted for assessment purposes.

Table 7.3 – Guideline Levels: Soil Contamination

Substance	Health Based Investigation Levels (HBILs) [1] NEPM (May 2013 Update) Residential A	Background Range [2]	Vapour Intrusion (0-<1 to 2-<4m)	Adopted Site) Assessment Criteria
	mg/kg	mg/kg	mg/kg	mg/kg
Metals/Metalloids				
Arsenic, As	100	1 - 50		**100**
Beryllium, Be	60			**60**
Boron, B	4,500			**4,500**
Cadmium, Cd	20	1		**20**
Chromium (III), Cr [3]	48%			**190**
Chromium (VI), Cr	100	1		**100**
Chromium (total), Cr [3]	n/a	5 - 1000		**n/a**
Cobalt, Co	100			**100**
Copper, Cu	6,000	2 – 100		**6,000**
Lead, Pb	300	2 - 200		**300**
Manganese, Mn	3,800			**3,800**
Mercury, Hg [4]	10	0.03		**10**
Nickel, Ni	400	5 - 500		**400**
Zinc, Zn	7,400	10 - 300		**7,400**
Volatile Petroleum Hydrocarbons (vTPH) & BTEX [5]				
C6 – C10	180	Nil	45 - 110	**180**
Benzene	50	Nil	0.5 – 0.5	**50**
Toluene	85	Nil	160 - 310	**85**
Ethylbenzene	70	Nil	55 - NL	**70**
Total xylene	45	Nil	40 - 95	**45**
Naphthalene	10	Nil	3 - NL	**10**
Semi Volatile Petroleum Hydrocarbons (sTPH)				
C10 – C16	120 [6]	Nil	110 - 240	**120 [6]**
C16 – C34	300 [6]	Nil	n/a	**300 [6]**
C34 – C40	2800 [6]	Nil	n/a	**2800 [6]**
C10 – C36	ID [7]	Nil	n/a	**1000 [5]**
Other Analytes				
VOC's	(consider individually)			**n/a**
OCP	(refer Appendix E; Table E2)			**n/a**
OPP	(refer Appendix E; Table E2)			**n/a**
PAH's (non-carcinogenic)	300	n/a		**300**
PAH's (carcinogenic)	3	n/a		**3**
Benzo(a)pyrene	3	n/a		**3**
PCB's	1			**1**
Phenolics [9]	100	Nil		**100**
Asbestos	None	n/a		**None**

Notes

1. The limitations of health-based soil investigation levels are discussed in Schedule B (1) Guidelines on the Investigation Levels for Soil and Groundwater and Schedule B(7a) Guidelines on Health-based Investigation Levels, *National Environment Protection (Assessment of Site Contamination) Measure 1999 (*NEPC 1999), updated May 2013
2. Background ranges, where HILs or EILs are set, are taken from the Field Geologist's Manual, compiled by DA Berkman, Third Edition 1989. Publisher - The Australasian Institute of Mining & Metallurgy. This publication contains information on a more extensive list of soil elements than is included in this Table. Another source of information is Contaminated Sites Monograph No. 4: Trace Element Concentrations in Soils from Rural & Urban Areas of Australia, 1995. South Australian Health Commission.
3. Valence state not distinguished - expected as Cr (III).
4. Methyl mercury
5. Service Stations guidelines adopted as site criteria (precautionary)
6. May 2013 NEPM Update Table 1(B)6 – Appendix F Table F-9
7. Insufficient data available to establish a guideline level
8. as BaP TEQ
9. As pentachlorophenol (precautionary)

7.10 PHYSICAL INSPECTION RESULTS

All 22 soil samples identified in Table 7.2, including the 15 samples selected for further laboratory analysis were physically inspected at the time of soil boring and sampling.

There was nothing in the physical appearance or odour of any of the soil samples to indicate the presence of chemical or other contamination.

All samples were tested at the time of sampling with a portable photoionisation detector for the presence of hydrocarbon vapours. No samples indicated a positive response for hydrocarbon vapours.

7.11 LABORATORY RESULTS

7.11.1 Laboratory Analysis

A total of 15 samples as indicated by those highlighted in blue in Table 7.2, including 1 duplicate sample, were delivered to the NATA (National Association of Testing Authorities) certified laboratory Envirolab Services Pty Ltd for analysis.

Chain of custody documentation in relation to the handling and delivery of these soil samples has been included for reference at Appendix G.

In accordance with the scope of this investigation, the samples were subjected to laboratory analysis for the following analytes:

- The eight heavy metals and metalloids arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc;
- Volatile total recoverable hydrocarbons (vTRH) in the range C6 – C9;
- Semi volatile total recoverable hydrocarbons (sTRH) in the range C10 – C36;
- Benzene, toluene, ethylbenzene, xylene and naphthalene (BTEXN); and
- Semi-volatile total recoverable hydrocarbons in the ranges:
    - C10 – C14;
    - C15 – C28; and
    - C29 – C36
- Polyaromatic hydrocarbons (PAH's);
- Phenols; and
- Asbestos

In our professional opinion, this range of laboratory analyses provides an adequate and complete basis for the assessment of soil quality and potential soil contamination at the site. The range of analysis involved is satisfies, or exceeds, the requirements of relevant assessment guidelines and protocols.

Summaries of the results of the laboratory analyses undertaken are presented in Table 7.4 on the following page.

The detailed laboratory report from which these summaries have been prepared is included for reference at Appendix H.

Table 7.4 – Results of Analyses of Soil Samples

	Soil Quality Guideline (mg/kg)	Sample Description															
	Adopted Site Criterion	Location	1	1	1	2	2	3	3	3	3	4	4	4	5	5	5
		Depth mm	Sur	Sur	1000	Sur	500	Sur	Sur	1000	1000D	500	1000	1500	Sur	1000	15000
		Sample #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
METALS																	
Arsenic	**100**			<4	5		7		8	9	9	7	6	4	5	4	<4
Cadmium	**20**			<0.4	<0.4		<0.4		<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	**100**			7	9		8		10	9	8	6	7	6	5	4	5
Copper	**6,000**			9	8		14		15	12	12	10	9	8	10	7	6
Lead	**300**			23	10		16		18	14	13	11	9	10	11	9	10
Mercury	**10**			<0.1	<0.1		<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	**400**			4	3		<3		5	4	4	5	3	<3	4	<3	<3
Zinc	**7,400**			27	16		31		36	24	23	21	16	14	19	14	13
HYDROCARBONS C6-C9 & BTEX																	
TRH (C6 – C9)	**65**			<25	<25		<25		<25	<25	<25	<25	<25	<25	<25	<25	<25
Benzene	**1**			<0.2	<0.2		<0.2		<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	**1.4 - 130**			<0.5	<0.5		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	**3.1 - 50**			<1	<1		<1		<1	<1	<1	<1	<1	<1	<1	<1	<1
m+p-xylene	**n/a**			<2	<2		<2		<2	<2	<2	<2	<2	<2	<2	<2	<2
o-xylene	**n/a**			<1	<1		<1		<1	<1	<1	<1	<1	<1	<1	<1	<1
Total xylene	**14 - 25**			<3	<3		<3		<3	<3	<3	<3	<3	<3	<3	<3	<3
Naphthalene	**10**			<1	<1		<1		<1	<1	<1	<1	<1	<1	<1	<1	<1
HYDROCARBONS C10-C36																	
TPH C10 – C14	100			<50	<50		<50		<50	<50	<50	<50	<50	<50	<50	<50	<50
TPH C15 – C28	300			<100	<100		<100		<100	<100	<100	<100	<100	<100	<100	<100	<100
TPH C29 – C36	2,800			<100	<100		<100		<100	<100	<100	<100	<100	<100	<100	<100	<100
TOTAL C10 – C36	**1,000**			<250	<250		<250		<250	<250	<250	<250	<250	<250	<250	<250	<250
OTHER ANALYTES																	
PAH (non-carcinogenic)				n/d	n/d		n/d		n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
PAH (carcinogenic)	3			n/d	n/d		n/d		n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
Phenolics	**100**			<5	<5		<5		<5	<5	<5	<5	<5	<5	<5	<5	<5
Asbestos	**None**		n/d			n/d		n/d									

Concentration within adopted site assessment criterion		Concentration exceeds adopted site criterion level by less than 2.5 times		Concentration exceeds adopted site criterion level by more than 2.5 times	

ID = Insufficient data to develop a guideline n/d = not detected n/a = not available

7.11.2 Summary of Results

The results of the laboratory analyses undertaken are summarised below.

Metals & Metalloids:

Representative samples were analysed for the presence of a suite of eight metal and metalloid species typically associated with site and soil contamination. None of the eight metals or metalloids was identified in representative soil samples from the site at concentrations in excess of relevant guideline levels. Metal and metalloid concentrations were in all cases either below laboratory detection limits, or at the very low end of naturally occurring background concentrations.

The slight elevation in lead concentration indicated by the surface soil sample from location 1 (the sampling location closest to the Warriewood Road site boundary) is attributed to the historic deposition of lead along roadways during the time that lead was used as a petrol additive. The concentration detected is very comfortably below the relevant soil quality guideline applicable to residential and childcare centre applications.

The very slight elevations noted in arsenic concentration, particularly in soil samples from the north eastern or glasshouse area of the site, are attributed to past chemical use, but it is noted that these concentrations remain very significantly lower than the applicable residential soil quality criterion.

Volatile Hydrocarbons (C6 – C9) & BTEX:

Volatile hydrocarbons (vTRH) in the range C6 – C9 and the BTEXN chemicals benzene, toluene, ethyl benzene, xylene and naphthalene, which are typically indicative of contamination from light petroleum sources such as petrol, were not detected at levels above relevant laboratory detection limits in representative soil samples from the site.

Semi Volatile Hydrocarbons (C10 – C36):

Semi volatile hydrocarbons (sTRH) in the range C10 – C36, which are typically indicative of contamination from light petroleum sources such as diesel, fuel oils and lubricants, were not detected at levels above relevant laboratory detection limits in representative soil samples from the site.

Phenolic Compounds:

Phenolic compounds, which can be associated with industrially sourced contamination, were not detected at levels above relevant laboratory detection limits in representative soil samples from the site.

Polyaromatic Hydrocarbons (PAH's):

Polyaromatic hydrocarbon compounds, which can also be associated with industrially sourced contamination, were not detected at levels above relevant laboratory detection limits in representative soil samples from the site

Asbestos:

Asbestos materials and asbestos fibres were not detected in representative soil samples from the site.

7.11.3 Implications of Results

- No contaminants from a wide and representative range were detected at levels at or even approaching concentrations of potential concern in any of the soil samples from the site.

7.12 SUMMARY OF OVERALL FINDINGS

The key findings of this assessment of soil quality at the proposed development site are as follows.

- None of the 23 soil samples collected from the site provided any physical indication of contamination, either by discoloration, staining, odour or response to examination by a photoionisation detector;
- No indication of the significant introduction to or presence of contaminated fill was identified at the site;
- None of the 15 representative soil samples from the site sent to the NATA accredited laboratory of Envirolab Services for analysis indicated the presence of heavy metals, petroleum hydrocarbons, phenolic compounds or polyaromatic hydrocarbon species at levels of potential concern, or other than in the case of low background levels of heavy metals, at concentrations significantly above relevant laboratory detection limits.
- Asbestos was not detected in any of the representative soil samples from the site;
- On this basis, the soils at the site are assessed as being free of contamination, and soil quality at the site is considered appropriate for the residential land use proposed; and
- The absence of volatile contaminants in the sub surface at the site indicates that vapour intrusion from sub surface soil strata into ground floor areas, or any future basement areas that might be considered at the site, is highly unlikely to present an environmental, indoor air quality or contamination problem.

8 HAZARDOUS MATERIALS CONSIDERATIONS

8.1 SURVEY

A preliminary consideration of any hazardous materials risk or exposures applicable at the 45/49 Warriewood Road Warriewood site was undertaken during the site inspection which took place during November 2018.

The scope of this preliminary investigation did not include a detailed inspection of the dwelling currently present at the site, and accordingly this consideration of possible hazardous materials issues is based on the general external inspection of the site that was undertaken.

8.2 GENERAL GUIDANCE REGARDING HAZARDOUS MATERIALS

Notes providing general guidance regarding hazardous materials have been provided for general reference at Appendix A.

A summary of potential hazardous materials and hazardous material locations considered relevant to the 45/49 Warriewood Road Warriewood site is provided below:

Asbestos

Asbestos containing materials can be classified into the following main categories:

- Asbestos cement sheeting material (typically “fibro”);
- Sprayed or trowelled asbestos materials applied to ceilings, walls and other surfaces for fire-rating purposes. This material is commonly referred to as limpet asbestos;
- Asbestos paper products, millboard in electrical switchboards or underlaying lining for linoleum or vinyl floor coverings;
- Vinyl tiles, linoleum and vinyl flooring mastic and associated adhesives;
- Asbestos containing compounds, gaskets and mastic from mechanical fittings, and roofing membranes;
- Electrical switchboards containing compressed asbestos tar electrical boards, asbestos cement sheeting, asbestos rope to spark arresters and asbestos millboard from inside auxiliary switchboxes/fuse boards; and
- Roofing sealants, bituminous membranes, tar composites and similar materials were occasionally mixed with asbestos materials.

Management of Asbestos Hazards

The health effects associated with asbestos exposure are due to the inhalation of airborne respirable asbestos fibres. In general, the asbestos fibres cannot be released to become airborne in significant quantities unless the asbestos containing material is severely disrupted such as in the case of cutting asbestos cement products with power saws etc.

A range of control measures are available for the abatement of asbestos hazards. The selection of the appropriate control measure is based on the assessment risk for each specific location. These measures include:

- Leave and maintain in existing condition;

- Repair and maintain in good condition;
- Enclose asbestos or synthetic mineral fibre material by providing a barrier such as a box enclosure or steel cladding;
- Remove by approved methods under controlled conditions; and
- Labelling of asbestos materials that are to remain in situ should be undertaken where practical to ensure that the asbestos materials are not damaged inadvertently by maintenance contractors etc.

Synthetic Mineral Fibre (SMF)

In the late 1980's the International Agency for Research on Cancer (IARC) evaluated certain SMF materials as being possibly carcinogenic to humans. The similarity in application and appearance to asbestos has resulted in some community concern regarding the health effects associated with exposure to SMF.

Current medical research indicates that the slightly increased risk of lung cancer for workers employed in the early days of rockwool and slagwool manufacture, and workers in the glasswool sector is not anticipated under present day working conditions. However, acute health effects such as eye, skin and upper respiratory tract irritation may occur with certain SMF products.

Caution is required when handling SMF products in order to minimise disturbance of the materials and subsequent airborne SMF fibre levels. Where SMF materials are to be installed or removed, then suitable controls and appropriate personal protection are to be provided.

It is recommended that the following Code of Practice be closely adhered to for appropriate procedures when handling such materials:

- National Code of Practice for the safe use of Synthetic Mineral Fibres [NOHSC: 2006(1990)] & National Standard for Synthetic Mineral Fibres [NOHSC: 2004(1990)].

Polychlorinated Biphenyls (PCB's)

PCBs are usually identified as a colourless to darker coloured oily liquid. PCBs are considered probable carcinogens. They can be absorbed through the skin, inhaled as a vapour or ingested; therefore, contact with them should be prevented. They are often found in old transformers and metallised capacitors of fluorescent light fittings. These synthetic compounds are chemically stable, have good insulating properties and do not degrade appreciably over time or with exposure to high temperatures. It is these properties that made PCBs useful in electrical devices.

Paint Containing Lead

Lead paint, as defined by the Australian Standard AS4361.2 – 1998 Guide to Lead Paint Management – Part 2: Residential and Commercial Property's, is that which contains more than 1% Lead by weight.

Lead carbonate (white lead) was once the main white pigment in paints for houses and public properties. Paint with lead pigment was manufactured up until the late 1960's, and in 1969 the National Health and Medical Research Council's Uniform Paint Standard was amended to restrict lead content in domestic paint.

Many older Australian homes and properties still contain lead paint, even though it may be covered with layers of more recent paint. Lead paint was used mainly on exterior surfaces, and to a lesser degree on interior doors plus door and window architraves, especially in undercoats and primers, where concentrations of up to 20% lead content were used. Interior walls weren't commonly painted with paint containing white lead pigment, though some colours did contain red, orange and yellow lead pigments.

All paints manufactured for Australian dwellings from the 1970's onwards have been required to contain less than 1% lead, though higher lead-content industrial paints may have been applied since then to

housing and commercial properties. Lead in any form is toxic to humans when ingested or inhaled, with repeated transmission of particles cumulating in lead poisoning.

Lead paint removal poses two potential avenues of transmission. Firstly, by inhalation or ingestion by workers and public in the vicinity of the works, and secondly by the deposition of particles on nearby footpaths, streets or soil where they may be resuspended, tracked into houses or property's where it can be inhaled or ingested.

8.3 POSSIBLE HAZARDOUS MATERIAL LOCATIONS

Hazardous materials may be present in the following locations:

- In the form of asbestos cement sheeting incorporated in the structure of the residential dwellings and outbuildings at the site;
- In the form of asbestos cement sheeting possibly used in the eaves of the residential dwellings at the site;
- In electrical switchboards;
- In any older style vinyl floor tiles that may present in the at the site;
- Beneath any existing ceramic floor tiles hat may be present in dwellings at the site;
- Within those areas accessible only by dismantling equipment, pipework or ductwork;
- Within any service shafts, ducts etc., concealed within building structures;
- Within voids or internal areas of any plant, equipment, air-conditioning ducts etc;
- Within totally inaccessible areas such as voids and cavities created and intimately concealed within the building structure. These voids are only accessible during major demolition works; and
- In ceiling mounted light fittings.

It is considered unlikely that any significant quantities of hazardous materials other than asbestos will be present at the site, but nonetheless a precautionary approach should be adopted in relation to future site works, including demolition and site clearance works.

Should future demolition works identify the presence of asbestos or other hazardous materials at the site, further investigation and sampling of specific areas should be conducted as part of an asbestos management and abatement program as per AS 2601-2001 *'The Demolition of Structures'* prior to such demolition works proceeding.

Provision should be made, as part of any future demolition works, for the sampling and analysis of any additional hazardous or potentially hazardous materials encountered, and for the provision of appropriate advice regarding handling, removal and disposal.

8.4 HANDLING & DISPOSAL GUIDELINES

8.4.1 Demolition

Any handling, removal and disposal of hazardous materials that may be required during future construction works must be undertaken in accordance with the following guidelines, codes of practice and standards:

- WorkCover NSW How to Safely Remove Asbestos Code of Practice December 2011
- WorkCover NSW, How to Manage and Control Asbestos in the Workplace Code of Practice, December 2011

- Australian Government, National Occupational Health and Safety Commission, Code of Practice for the Safe Removal of Asbestos 2nd Edition [NOHSC: 2002 (2005)]

- Australian Government, National Occupational Health and Safety Commission, *Code of Practice for the Safe Use of Synthetic Mineral Fibres* [NOHSC: 2006 (1990)]

8.4.2 Asbestos Licences

Asbestos removal, if it is required, must be undertaken by appropriately licensed contractors. There are two licences for asbestos removal, as well as a licence to be an asbestos assessor. They are:

Licence	Actions
Class A	To remove friable asbestos
Class B	To remove bonded asbestos
Asbestos Assessor	To carry out air monitoring, clearance inspections, issue clearance certificates

8.5 OVERALL RECOMMENDATIONS

This section of the report presents a consideration of hazardous materials issues in relation to a childcare centre development proposed for 45/49 Warriewood Road Warriewood NSW.

The following recommendations are provided in case the handling, removal and disposal of hazardous materials is required during future demolition and clearance works at the subject site:

Demolition

- Prior to any demolition works, undertake a Destructive Hazardous Material Survey as per Australian Standard AS2601:2001 *The Demolition of Structures*.

- Prior to demolition works, prepare a Site Demolition Plan per Australian Standard AS2601:2001 *The Demolition of Structures*.

Asbestos

- Handle, remove and dispose of all materials containing asbestos in accordance with all relevant guidelines, codes of practice and standards including but not limited to those identified in this document.

- Should future demolition works entail possible disturbance of asbestos materials in locations not accessible during this survey, further investigation and sampling of specific areas should be conducted in accordance with the provisions of AS 2601-2001 *'The Demolition of Structures' (and any other relevant guidelines, codes of practice and standards)* prior to such demolition works proceeding.

Other

- Provision should be made, as part of any future demolition works, for the sampling and analysis of any additional hazardous or potentially hazardous materials encountered, and for the provision of appropriate advice regarding handling, removal and disposal.

9 PRELIMINARY GEOTECHNICAL ADVICE

9.1 INTRODUCTION

The primary purpose of this soil quality assessment has been to investigate the presence or otherwise of various possible contaminants, and to assess the suitability of the site for the residential development proposed on this basis, as discussed in some detail in the previous of this report.

The soil samples used in this assessment were obtained by mechanized hand augur in five locations at the site. Three of these hand augured soil bores were to a depth of 1.5 metres, and two to 2.0 metres.

NG Child & Associates has been asked, as part of this assessment report, to provide preliminary comments and observations, to the extent possible given the limited scope and depth of the hand augur based soil bores involved in this investigation, regarding the geotechnical implications provided by this soil quality investigation.

9.2 GENERAL GEOLOGICAL AND SOIL STRUCTURE CONSIDERATIONS

From a geotechnical perspective, soils can be considered as three-phase materials composed of rock or mineral particles, water and air. The voids of a soil, that is the spaces in between mineral particles, contain the water and air. Taking these phase characteristics into account, two of the important requirements of the soils and underlying strata at the site are that they are stable, and that can provide the physical characteristics and qualities required for any foundations, footings and pilings required to underpin prospective residential construction works.

The Sydney basin, specifically the Early Triassic Narrabeen Group bedded sandstones and shales and the lower parts of the overlying Middle Triassic Hawkesbury Sandstone form near-horizontal strata which outcrop along the coast

Typical geology of the northern beaches and Warriewood area is illustrated in Figure 9.1, on the following page.

9.3 GEOLOGY

The Narrabeen Group

This group has the widest distribution of any major suite of rocks in the Sydney Basin making up much of the Greater Blue Mountains and covering a vast swathe of the Central Coast and its hinterland. It reaches a maximum thickness of something like 800 m (by comparison, the Hawkesbury Sandstone reaches roughly 250 m in thickness). It could be argued that ‘Narrabeen’ is a poorly chosen type-locality name because, although the group is a collection of 21 distinct formations scattered across the basin, only two of them are present in full on the Northern Beaches, plus just an isolated seashore outcrop of a third one.

Local Formations of the Narrabeen Group

1 Bulgo Sandstone

The ‘isolated seashore outcrop’ is of the Bulgo Sandstone, the top 10 m of which just, but only just, breaks surface on the outer tip of Long Reef. However, out under the sea, deep drilling for the ocean sewage outfall passed through 200 m of Bulgo Sandstone.

Commonly a grey-green colour when fresh, the Bulgo Sandstone can carry, in addition to quartz, a high proportion of grains of volcanic rock of a type similar to those classic columnar-jointed lavas you see on the coast at Kiama; therefore it bears only passing resemblance to the (very quartz-rich) Hawkesbury Sandstone.

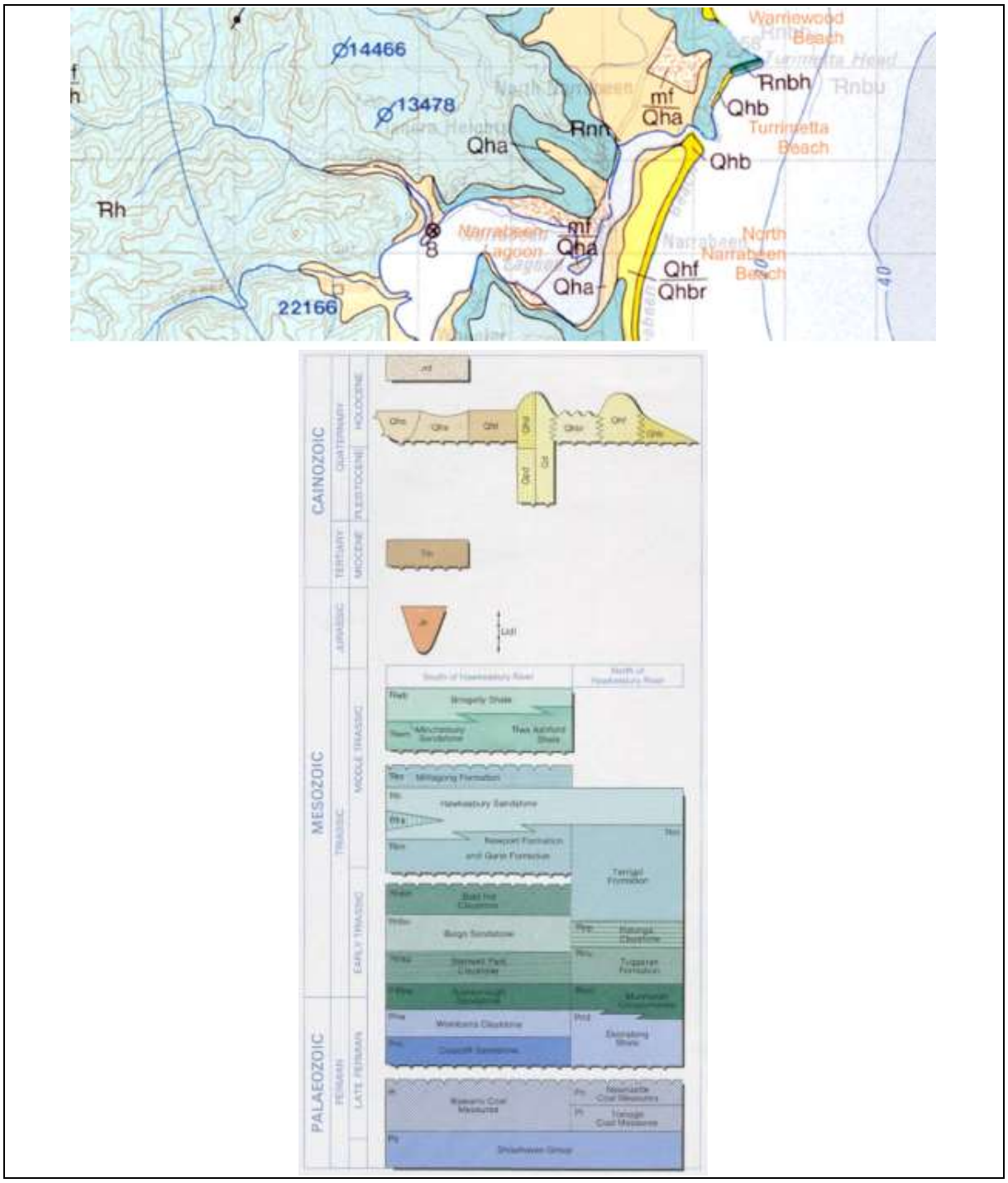


Figure 9.1 – Geology of the Warriewood Area

The Bulgo Sandstone's volcanic sand grains break down under weathering to clays leading to the common misconception that the southern slopes of the Royal are over a shale sequence. These clay-rich soils are much deeper and more fertile than those developed over quartz sandstones, and also have inherited plant nutrients from the sandstone's volcanic component, which helps in their hosting of a diverse littoral rainforest community.

2 Bald Hill Claystone

Overlying the Bulgo Sandstone, the Bald Hill Claystone is an unusual rock formation.

Like a shale and mudstone, it's made largely of clay minerals.

Its kaolinite is stained a deep, dull red-brown by hematite which, like the kaolinite, was the result of recurrent contemporary weathering of layer upon layer of fine volcanic debris some 250 million years ago in early Triassic times.

The grey-green bands of sandy or gritty debris interlayered with reddish claystones are visible in the cliff faces and platforms at Long Reef.

Bald Hill Claystone at Long Reef is also well known for its Triassic 'paleosols' or fossil soil profiles.

3 Newport Formation

The Newport Formation rests above the Bald Hill Claystone via a transitional few metres of a spotted volcanic ash deposit called the Garie Formation.

Northwards along the coastline and across Pittwater into the Hawkesbury estuary there is a thickening and coarsening of the sandstones. The sandstones are impure quartz lithic ones and locally interbedded with laminites which are exposed especially north side of Lion Island where the formation has undergone a name change to Terrigal Formation.

9.4 SLOPE STABILITY

Typically *where ground slope is less than 15%, the risk of slope instability is low to very low*

In this case, and subject to the more detailed geotechnical investigations that will need to be undertaken prior to site preparation and civil works, it is our preliminary professional opinion that there is reason to impose any restrictions other than the exercise good engineering practice, relative to the type of development at the 45/49 Warriewood Road site.

9.5 RESIDENTIAL FOOTING DESIGN IMPLICATIONS

Based on the observations made during the conduct of this preliminary site investigation, it is our preliminary professional opinion that the following considerations apply to the design of residential footings at the site:

- All topsoil should be excluded from proposed building footprints;
- Natural sites, without the adverse impact of nearby vegetation, will generally be classified as Class "M" according to AS2870-1996;
- If more than 400 mm of local clay based fill is added to any area, this may have the potential to increase the AS2870-1996 site classification to Class "H";
- If trees are allowed to remain close to a residential footing, or are planted post construction, the potential for ground movements is likely to be increased, and the site classification according to AS2870-1996 may change to Class "P"; and
- The potential of existing or newly planted trees to grow and dry out any clay based soils may pose a risk to houses, over their anticipated design lifetimes.

These preliminary observations will need to be confirmed by the more detailed geotechnical assessment that will take place prior to civil and construction works at the site.

9.6 GEOTECHNICAL OBSERVATIONS & IMPLICATIONS

As previously indicated, the soil samples used in this assessment were obtained by hand augur to limited depths at five locations at the site.

Due to the nature of soil samples obtained in this manner, no definitive inference or conclusions regarding the geotechnical condition of the soils and geological beneath the site can be drawn.

However, what can be said of the soils and sub-surface strata at the site, based on observations of soil from the five soil bores involved in this preliminary investigation is that nothing of an unusual or unexpected nature was noted.

In our professional opinion, the implication of this observation is that it can reasonably be expected that a more detailed geotechnical investigation will show the soils at the site to be essentially stable, and that subject to actual load requirements, appropriate strata for typical residential building foundations and footings will be readily available.

It is noted that the limited scope and relatively shallow hand augured soil bores involved in this preliminary site investigation intersected only surface soil and immediate sub surface clay/loams and clay strata.

It is anticipated, based on typical geology in the general area that the clays and loams encountered in this preliminary investigation may be shown to be underlain by weathered and relatively low strength shale strata, and in turn by medium strength shale strata.

10 OVERALL FINDINGS & RECOMMENDATIONS

This report presents the results of a Preliminary or Stage 1 Site Investigation undertaken in relation to a proposed childcare centre development at 45/49 Warriewood Road Warriewood NSW.

10.1 FINDINGS

The overall findings of this assessment indicate that the underlying soils at the site are not contaminated, and that soil quality at the 45/49 Warriewood Road Warriewood NSW site is appropriate for the residential land use proposed.

A review of the history and past uses of the site did not identify any issues that might have resulted in residual environmental or contamination risks or exposures.

A thorough inspection of the site did not identify any environmental issues, risks or exposures considered to be of significant concern.

Physical inspection supported by targeted soil sampling and analysis in accordance with NSW DWLC guidelines did provide any indication of soil contamination issues of actual or potential concern at the site.

Soil quality at the site has been found to be appropriate for the residential land use proposed.

However it is noted that materials containing asbestos appear to be associated with the structure of the existing dwellings and outbuildings at the site, and appropriate care will be required, as detailed in this report, in the demolition and removal of these structures during the development process.

10.2 RECOMMENDATIONS

The overall findings of this Preliminary or Stage 1 Site Investigation have established that the underlying soils at the site are free of contamination, that the site is suitable in general environmental and soil quality terms for the child-care use proposed; and that no further or more detailed assessment is considered necessary to establish this finding. These findings are made subject to the following recommendations:

1. That appropriate handling and disposal practices, in accordance with relevant hazardous material handling and disposal guidelines, are observed in relation to asbestos based materials during any future demolition and clearance works undertaken at the site;

2. That a Destructive Hazardous Material Survey per Australian Standard AS2601:2001 The Demolition of Structures and a supporting Demolition Management Plan should be prepared and implemented prior to the commencement of demolition and/or site clearance works;

3. That appropriate care is taken in respect of any other potentially hazardous or dangerous materials unexpectedly identified during any future demolition or clearance works involving the three existing dwellings at the site; and

4. That an appropriate Unexpected Finds Protocol is developed and implemented in relation to any future demolition, clearance and other works undertaken at the site.

11 LIMITATIONS

NG Child & Associates has based this report on the data, methods and sources described herein.

Within the limitations of the agreed scope of services, this assessment has been undertaken and performed in a professional manner, in accordance with generally accepted practices, using a degree of skill and care ordinarily exercised by professionally trained and experienced environmental engineers.

No other warranty, expressed or implied, is made.

This report has been prepared in accordance with the agreement between Archidrome Architects, on behalf of its client Mikara Developments Pty Ltd and NG Child & Associates and is solely for the use of the Archidrome Architects and Mikara Developments Pty Ltd. Any reliance of this report by third parties shall be at such party's sole risk and may not contain sufficient information for purposes of other parties or for other uses.

Whilst this report is accurate to the best of our knowledge and belief NG Child & Associates cannot guarantee completeness or accuracy of any descriptions or conclusions based on information supplied to it during site surveys, visits and interviews. Responsibility is disclaimed for any loss or damage, including but not limited to, any loss or damage suffered by Archidrome Architects, on behalf of its client Mikara Developments Pty Ltd, arising from the use of this report or suffered by any other person for any reason whatsoever.

While the consideration of hazardous materials undertaken as part of this investigation has attempted to address any hazardous or potentially hazardous materials present at the site it should be noted that the review was based on a general external inspection only, and that the detailed inspection of the dwellings and associated structures at the site fell outside the scope of this preliminary assessment.

For this reason and as recommended in this report a Destructive Hazardous Material Survey per Australian Standard AS2601:2001 *The Demolition of Structures* and a supporting Demolition Management Plan should be prepared and implemented prior to the commencement of demolition and/or site clearance works.

During any demolition works, further investigations and assessment may be required should any suspect material suspected of being hazardous, or potentially hazardous, be observed.

Subject to the limitations described above, it is the professional opinion of NG Child & Associates that this report presents an accurate and reliable assessment of the general environmental and contamination condition of the 45/49 Warriewood Road Warriewood NSW residential subdivision and development site.

12 AUTHORISATION

Noel Child BSc (Hons), PhD, MIEA, MRACI
Visiting Fellow, Engineering
University of Technology, Sydney
Principal, NG Child & Associates
28 February 2020

REFERENCES

1. AS4361.2 – 1998 Guide to Lead Paint Management – Part 2: Residential and Commercial Buildings
2. Australian and New Zealand Environmental and Conservation Council (ANZECC) Identification of PCB containing capacitors information booklet (1997)
3. Code of Practice for the Management and Control of Asbestos in Workplaces [NOHSC: 2018 (2005)].
4. *Code of Practice for the Safe Use of Synthetic Mineral Fibres* [NOHSC: 2006 (1990)].
5. Managing asbestos in workplaces - Compliance Code
6. Occupational Health and Safety Act 2004
7. Occupational Health and Safety Regulations 2007
8. Removing asbestos in workplaces - Compliance Code

DEFINITIONS

Approved Asbestos Analyst:	A person trained to identify asbestos and complete asbestos fibre counts.
Approved Asbestos Analyst:	A person trained to identify asbestos and complete asbestos fibre counts.
Asbestos:	Fibrous forms of mineral silicates belonging to the serpentine and amphibole groups of rock-forming minerals.
Asbestos Licence Holder:	A person licensed to remove and dispose of asbestos.
Competent Person:	A person who has acquired through training, qualification or experience, or a combination of both the knowledge and skills required to safely carry out a task.
Friable Asbestos:	Asbestos-containing materials that can be crumbled or pulverized to a powder when dry.
Hazard:	Anything with the potential to cause harm, injury, illness or loss.
Hazardous Building Materials:	Materials, in addition to asbestos, including PCBs, SMFs and lead paint.
Lead Paint:	Lead paint is paint containing lead, which is a heavy metal that was once used to create pigment in paint. All paints manufactured prior to 1978 had lead as one of the ingredients.
Non-friable Asbestos:	Asbestos-containing materials that cannot be crumbled by hand pressure alone.
Polychlorinated Biphenyls (PCBs):	The main use of PCBs in building materials is as a plasticiser. They are found predominantly in paints, specialty coatings, caulking, sealants, and other materials as well. They were used in equipment such as fluorescent light fitting capacitors, electric motors, ceiling fans and dishwashers that generally predate 1980.
Synthetic Mineral Fibres (SMFs):	SMF is a general term used to describe a number of fibrous materials made from glass, rock, alumina and silica. SMF have been widely used as alternatives to asbestos in insulation and fire-rating products and as reinforcement in cement, plaster and plastic materials
OHS Risk:	A description of the likelihood and consequence of a hazard causing injury or illness.

APPENDIX A

Information on Common Hazardous Materials

INFORMATION ON COMMON HAZARDOUS MATERIALS

Asbestos containing materials can be classified into the following main categories:

- Sprayed or trowelled asbestos materials applied to ceilings, walls and other surfaces for fire-rating purposes. This material is commonly referred to as limpet asbestos.
- Asbestos containing insulation on pipes, boilers, tanks, ducts etc. which is often referred to as asbestos lagging.
- Asbestos cement products, Cementitious or concrete like products.
- Asbestos paper products, millboard in electrical switchboards or underlaying lining for linoleum or vinyl floor coverings.
- Asbestos textiles, braided asbestos, rope, tape, gaskets etc (note that rope and millboard are potentially friable).
- Vinyl tiles, linoleum and vinyl flooring mastic and associated adhesives.
- Asbestos containing compounds, gaskets and mastic from mechanical fittings, and roofing membranes.
- Electrical switchboards containing compressed asbestos tar electrical boards, asbestos cement sheeting, asbestos rope to spark arresters and asbestos millboard from inside auxiliary switchboxes/fuse boards.
- Roofing sealants, bituminous membranes, tar composites and similar materials were occasionally mixed with asbestos materials.
- Some office furnishings such as wall partitions may contain an asbestos cement internal lining inside plaster or “Stramit” type panelling. Certain types of older vinyl covered desktops and workbenches may contain an underlying asbestos millboard lining.

Sprayed Asbestos Materials

Sprayed asbestos or limpet asbestos is most often found on structural steel members to provide a fire-rating. Limpet asbestos is a friable material. Friable materials are those which can easily be crumbled, pulverised or reduced to powder by hand pressure. Limpet asbestos tends to be the most friable of all asbestos containing materials and can contain relatively high percentage of asbestos (30% - 90%).

Limpet asbestos can slowly release fibres as the materials age, i.e. as its friability increases.

Direct mechanical damage or excessive machinery vibration can lead to more significant release of airborne asbestos fibres.

Asbestos containing Lagging Materials

Insulation such as lagging usually contains a smaller percentage of asbestos (usually 20% - 50%). Protective jackets on the insulation materials (such as metal jacketing or calico on pipe lagging) prevent asbestos fibre release. Physical damage to the protective jacket, however, may lead to the release of respirable fibres. The binding material in the insulation can deteriorate with age rendering it more friable.

Asbestos Cement Sheeting Materials

Asbestos cement products and asbestos gaskets generally do not present a significant health risk unless they are cut, sanded or otherwise disturbed so as to release asbestos dust. Fibre release due to occasional damage is negligible and thus not a significant health risk. Care must be taken therefore in the removal of asbestos cement products to avoid the release of airborne fibres. Unless analysis of “fibro” cement products indicates otherwise, these materials should be considered as containing asbestos. External asbestos cement claddings become weathered after many years by the gradual loss of cement from the exposed surface. This leaves loosely bound layers enriched with asbestos fibres. In other words, the material becomes more friable through the weathering process.

Asbestos containing Vinyl Products

Vinyl tiles and linoleum flooring manufactured before 1984 may contain asbestos in various quantities in a well-bound cohesive matrix. Asbestos containing vinyl floor and wall coverings generally do not present a significant health risk unless they are sanded or otherwise mechanically abraded so as to release asbestos dust.

Fibre release due to occasional damage is negligible and thus not a significant health risk. Care must be taken therefore, in the removal of asbestos containing vinyl tiles to avoid the release of airborne fibres. Unless analysis of vinyl tiles and linoleum flooring indicates otherwise, these materials should be considered as containing asbestos. Older bituminous adhesives may also contain asbestos and must be removed as an asbestos process in circumstance where the floor is to be renewed and re-levelled by floor sanding or grinding.

Asbestos containing Gaskets

Gaskets and sealing compounds in equipment, duct work and re-heat air conditioning boxes may contain asbestos. These should be replaced with non-asbestos equivalents during routine maintenance. In addition, asbestos containing mastic and seals in air handling duct work joints. These usually do not pose a hazard as the asbestos fibres are firmly held within the plastic resinous compound and should be replaced as part of routine maintenance or removed during the demolition of the plant equipment.

Asbestos Insulation to Re-Heat Boxes

Insulation to internal lining of ductwork sections and electrical re-heat air conditioning boxes generally contain asbestos millboard. These should be replaced with non-asbestos equivalents during routine maintenance.

Asbestos containing Mastics and Sealants

Many mastic and sealant products contain Chrysotile asbestos within the pliable, resinous matrix. The nature of the substrate is such that it does not readily dry out in situ, and therefore the fibres are well bound and pose a minimal risk.

Management of Asbestos Hazards

The health effects associated with asbestos exposure are due to the inhalation of airborne respirable asbestos fibres. In general, the asbestos fibres cannot be released to become airborne in significant quantities unless the asbestos containing material is severely disrupted such as in the case of cutting asbestos cement products with power saws etc.

A range of control measures are available for the abatement of asbestos hazards. The selection of the appropriate control measure is based on the assessment risk for each specific location. These measures include:

- **Leave and maintain** in existing condition.
- **Repair and maintain** in good condition.
- **Enclose** asbestos or synthetic mineral fibre material by providing a barrier such as a box enclosure or steel cladding.
- **Remove** by approved methods under controlled conditions.
- **Labelling** of asbestos materials that are to remain in situ should be undertaken where practical to ensure that the asbestos materials are not damaged inadvertently by maintenance contractors etc.

SYNTHETIC MINERAL FIBRE (SMF)

General

In the late 1980's the International Agency for Research on Cancer (IARC) evaluated certain SMF materials as being possibly carcinogenic to humans. The similarity in application and appearance to asbestos has resulted in some community concern regarding the health effects associated with exposure to SMF.

Current medical research indicates that the slightly increased risk of lung cancer for workers employed in the early days of rockwool and slagwool manufacture, and workers in the glasswool sector is not anticipated under present day working conditions. However, acute health effects such as eye, skin and upper respiratory tract irritation may occur with certain SMF products.

Caution is required when handling SMF products in order to minimise disturbance of the materials and subsequent airborne SMF fibre levels. Where SMF materials are to be installed or removed, then suitable controls and appropriate personal protection are to be provided.

It is recommended that the following Code of Practice be closely adhered to for appropriate procedures when handling such materials:

- *National Code of Practice for the safe use of Synthetic Mineral Fibres [NOHSC: 2006(1990)] & National Standard for Synthetic Mineral Fibres [NOHSC: 2004(1990)].*

POLYCHLORINATED BIPHENYLS (PCBS)

General

PCBs are usually identified as a colourless to darker coloured oily liquid. PCBs are considered probable carcinogens. They can be absorbed through the skin, inhaled as a vapour or ingested; therefore, contact with them should be prevented. They are often found in old transformers and metallised capacitors of fluorescent light fittings. These synthetic compounds are chemically stable, have good insulating properties and do not degrade appreciably over time or with exposure to high temperatures. It is these properties that made PCBs useful in electrical devices.

LEAD CONTAINING PAINT

General

Lead paint, as defined by the Australian Standard *AS4361.2 – 1998 Guide to Lead Paint Management – Part 2: Residential and Commercial Property's,* is that which contains more than 1% Lead by weight.

Lead carbonate (white lead) was once the main white pigment in paints for houses and public properties. Paint with lead pigment was manufactured up until the late 1960's, and in 1969 the National Health and Medical Research Council's Uniform Paint Standard was amended to restrict lead content in domestic paint.

Many older Australian homes and properties still contain lead paint, even though it may be covered with layers of more recent paint. Lead paint was used mainly on exterior surfaces, and to a lesser degree on interior doors plus door and window architraves, especially in undercoats and primers, where concentrations of up to 20% lead content were used. Interior walls weren't commonly painted with paint containing white lead pigment, though some colours did contain red, orange and yellow lead pigments.

All paints manufactured for Australian dwellings from the 1970's onwards have been required to contain less than 1% lead, though higher lead-content industrial paints may have been applied since then to housing and commercial properties.

Lead in any form is toxic to humans when ingested or inhaled, with repeated transmission of particles cumulating in lead poisoning. Lead paint removal poses two potential avenues of transmission. Firstly, by inhalation or ingestion by workers and public in the vicinity of the works, and secondly by the deposition of particles on nearby footpaths, streets or soil where they may be resuspended, tracked into houses or property's where it can be inhaled or ingested.

APPENDIX B
NSW EPA Environmental & Site Contamination Investigation Guidelines

Report sections and information to be included	Preliminary site investigation	Detailed site investigation	Remedial action plan	Validation & ongoing site monitoring
Site history (continued)	✓	✓(S)	✓(S)	✓(S)
– Inventory of chemicals and wastes associated with site use and their on-site storage location – Possible contaminant sources and potential off-site effects – Site layout plans showing present and past industrial processes – Sewer and service plans – Description of manufacturing processes – Details and locations of current and former underground and above ground storage tanks – Product spill and loss history – Discharges to land, water and air – Disposal locations – Relevant complaint history – Local site knowledge of residents and staff – both present and former – Summary of local literature about the site, including newspaper articles – Details of building and related permits, licences, approvals and trade waste agreements – Historical use of adjacent land – Local usage of ground/surface waters, and location of bores/pumps – Integrity assessment (assessment of the accuracy of information).				
Site condition and surrounding environment	✓	✓(S)	✓(S)	✓(S)
– Topography – Conditions at site boundary such as type and condition of fencing, soil stability and erosion – Visible signs of contamination such as discolouration or staining of soil, bare soil patches – both on-site and off-site adjacent to site boundary – Visible signs of plant stress – Presence of drums, wastes and fill material – Odours – Condition of buildings and roads				

✓	*Include this section*
(S)	*A summary is adequate if detailed information was included in an available referenced previous report*
(N)	*Include only if there is to be no further site investigation*
N/A	*Not applicable*

Report sections and information to be included	Preliminary site investigation	Detailed site investigation	Remedial action plan	Validation & ongoing site monitoring
Site condition and surrounding environment (continued) – Quality of surface water – Flood potential – Details of any relevant local sensitive environment – e.g. rivers, lakes, creeks, wetlands, local habitat areas, endangered flora and fauna.	✓	✓(S)	✓(S)	✓(S)
Geology and hydrogeology – Soil stratigraphy using recognised classification methods, e.g. Australian Standard 1726, Unified Soil Classification Table – Location and extent of imported and locally derived fill – Site borehole logs or test pit logs showing stratigraphy – Detailed description of the location, design and construction of on-site wells – Description and location of springs and wells in the vicinity – Depth to groundwater table – Direction and rate of groundwater flow – Direction of surface water run-off – Background water quality – Preferential water courses – Summary of local meteorology	Include readily available information	✓	✓(S)	✓(S)
Sampling and analysis plan and sampling methodology – Sampling, analysis and data quality objectives (DQOs) – Rationale for the selection of: o Sampling pattern o Sampling density including an estimated size of the residual hot spots that may remain undetected o Sampling locations including locations shown on a site map o Sampling depths o Samples for analysis and samples not analysed o Analytical methods	Include readily available information	✓	N/A	✓

✓	*Include this section*
(S)	*A summary is adequate if detailed information was included in an available referenced previous report*
(N)	*Include only if there is to be no further site investigation*
N/A	*Not applicable*

Report sections and information to be included	Preliminary site investigation	Detailed site investigation	Remedial action plan	Validation & ongoing site monitoring
Sampling and analysis plan and sampling methodology (continued)	Include readily available information	✓	N/A	✓
○ Analytes for samples – Detailed description of the sampling methods including: ○ Sample containers and type of seal used ○ Sampling devices and equipment e.g. auger type ○ Equipment contamination procedures ○ Sample handling procedures ○ Sample preservation methods and reference to recognised protocols, e.g. APHA or US EPA SW 846 – Detailed description of field screening protocols.				
Field quality assurance and quality control (QA/QC)	✓(N)	✓	N/A	✓
– Details of sampling team – Decontamination procedures carried out between sampling events – Logs for each sample collected – including time, location, initials of sampler, duplicate locations, duplicate type, chemical analyses to be performed, site observations and weather conditions – Chain of custody fully identifying – for each sample – the sampler, nature of the sample, collection date, analyses to be performed, sample preservation method, departure time from the site and dispatch courier(s) – Sample splitting techniques – Statement of duplicate frequency – Field blank results – Background sample results – Rinsate sample results – Laboratory-prepared trip spike results for volatile analytes – Trip blank results – Field instrument calibrations (when used).				

✓	*Include this section*
(S)	*A summary is adequate if detailed information was included in an available referenced previous report*
(N)	*Include only if there is to be no further site investigation*
N/A	*Not applicable*

Report sections and information to be included	Preliminary site investigation	Detailed site investigation	Remedial action plan	Validation & ongoing site monitoring
Laboratory QA/QC – A copy of signed chain-of-custody forms acknowledging receipt date and time, and identity of samples included in shipments – Record of holding times and a comparison with method specifications – Analytical methods used – Laboratory accreditation for analytical methods used – Laboratory performance in inter-laboratory trials for the analytical methods used, where available – Description of surrogates and spikes used – Per cent recoveries of spikes and surrogates – Instrument detection limit – Method detection limit – Matrix or practical quantification limits – Standard solution results – Reference sample results – Reference check sample results – Daily check sample results – Laboratory duplicate results – Laboratory blank results – Laboratory standard charts.	✓(N)	✓	N/A	✓
QA/QC data evaluation – Evaluation of all QA/QC information listed above against the stated DQOs, including a discussion of: o Documentation completeness o Data completeness o Data comparability (see next point) o Data representativeness o Precision and accuracy for both sampling and analysis for each analyte in each environmental matrix informing data users of the reliability, unreliability, or qualitative value of the data	✓(N)	✓	N/A	✓

✓	*Include this section*
(S)	*A summary is adequate if detailed information was included in an available referenced previous report*
(N)	*Include only if there is to be no further site investigation*
N/A	*Not applicable*

Report sections and information to be included	Preliminary site investigation	Detailed site investigation	Remedial action plan	Validation & ongoing site monitoring
QA/QC data evaluation (continued)	✓(N)	✓	N/A	✓
– Data comparability checks, which should include e.g. bias assessment – which may arise from various sources, including: o Collection and analysis of samples by different personnel o Use of different methodologies o Collection and analysis by the same personnel using the same methods but at different times o Spatial and temporal changes (because of the environmental dynamics) – Relative per cent differences for intra- and inter-laboratory duplicates.				
Basis for assessment criteria	✓	✓	✓	✓
– Table listing all selected assessment criteria and references – Rationale for and appropriateness of the selection of criteria – Assumptions and limitations of criteria				
Results	✓	✓	✓	✓
– Summary of previous results, if appropriate – Summary of all results, in a table that: o Shows all essential details such as sample numbers and sampling depth o Shows assessment criteria o Highlights all results exceeding the assessment criteria – Site plan showing all sample locations, sample identification numbers and sampling depths – Site plan showing the extent of soil and groundwater contamination exceeding selected assessment criteria for each sampling depth.				

✓	*Include this section*
(S)	*A summary is adequate if detailed information was included in an available referenced previous report*
(N)	*Include only if there is to be no further site investigation*
N/A	*Not applicable*

Report sections and information to be included	Preliminary site investigation	Detailed site investigation	Remedial action plan	Validation & ongoing site monitoring
Site characterisation	✓	✓	✓	✓
– Assessment of type of all environmental contamination, particularly soil and groundwater				
– Assessment of extent of soil and groundwater contamination, including off-site effects				
– Assessment of the chemical degradation products				
– Assessment of possible exposure routes and exposed populations (human, ecological).				
Remedial action plan	N/A	N/A	✓	✓(S)
– Remediation goal				
– Discussion of the extent of remediation required				
– Discussion of possible remedial options and how risk can be reduced				
– Rationale for the selection of recommended remedial option				
– Proposed testing to validate the site after remediation				
– Contingency plan if the selected remedial strategy fails				
– Interim site management plan (before remediation), including e.g. fencing, erection of warning signs, stormwater diversion				
– Site management plan (operation phase):				
o Site stormwater management plan				
o Soil management plan				
o Noise control plan				
o Dust control plan, including wheel wash (where applicable)				
o Odour control plan				
o Occupational health and safety plan				
– Remediation schedule				
– Hours of operation				
– Contingency plans to respond to site incidents, to obviate potential effects on surrounding environment and community				
– Identification of regulatory compliance requirements such as licences and approvals				
– Names and phone numbers of appropriate personnel to contact during remediation				

✓	*Include this section*
(S)	*A summary is adequate if detailed information was included in an available referenced previous report*
(N)	*Include only if there is to be no further site investigation*
N/A	*Not applicable*

Report sections and information to be included	Preliminary site investigation	Detailed site investigation	Remedial action plan	Validation & ongoing site monitoring
Remedial action plan (continued) – Community relations plans, where applicable – Staged progress reporting, where appropriate – Long-term site management plan.	N/A	N/A	✓	✓(S)
Validation – Rationale and justification for the validation strategy including: o Clean-up criteria and statistically based decision-making methodology o Validation sampling and analysis plan – Details of a statistical analysis of validation results and evaluation against the clean-up criteria – Verification of compliance with regulatory requirements set by the EPA, WorkCover and local government.	N/A	N/A	N/A	✓
Ongoing site monitoring – Ongoing site monitoring requirements (if any), including monitoring parameters and frequency – Results of monitoring analyses including all relevant QA/QC reporting requirements stated above – Ongoing site/equipment maintenance, e.g. containment cap integrity – Details of party(ies) responsible for maintenance and monitoring program.	N/A	N/A	N/A	✓
Conclusions and recommendations – Brief summary of all findings – Assumptions used in reaching the conclusions – Extent of uncertainties in the results – Where remedial action has been taken, a list summarising the activities and physical changes to the site – A clear statement that the consultant considers the subject site to be suitable for the proposed use (where applicable) – A statement detailing all limitations and constraints on the use of the site (where applicable) – Recommendation for further work, if appropriate.	✓	✓	✓	✓

✓	*Include this section*
(S)	*A summary is adequate if detailed information was included in an available referenced previous report*
(N)	*Include only if there is to be no further site investigation*
N/A	*Not applicable*

APPENDIX C

Title Details

TITLE TREE
Lot 2 DP 349085 A & B

45 – 49 Warriewood Road, Warriewood
Sub Folio Identifiers 2/349085 A & B (title's attached)
DP 349085 (plan attached)
Certificate of Title Volume 7679 Folio 21 & Certificate of Title Volume 7743 Folio 68
Certificate of Title Volume 5451 Folio 38
Certificate of Title Volume 2248 Folio 217
26th February, 2020
Registered Proprietor:
WARRIEWOOD DEVELOPERS PTY LTD

TITLE TREE
Lot 1 DP 349085

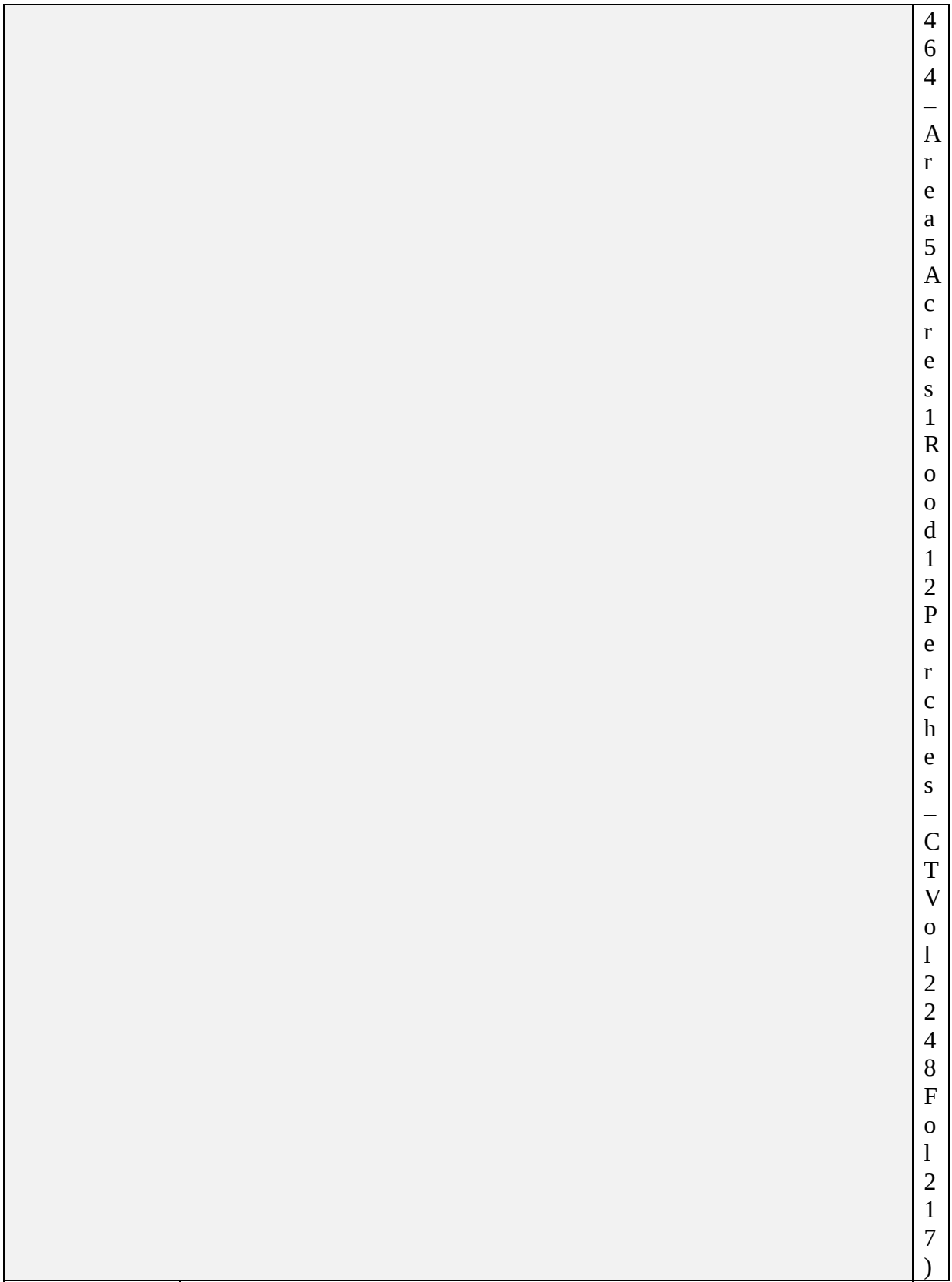
45 – 49 Warriewood Road, Warriewood
Folio Identifier 1/349085 (title attached)
DP 349085 (plan attached)
Certificate of Title Volume 5451 Folio 37
Certificate of Title Volume 2248 Folio 217
26th February, 2020
Registered Proprietor:
WARRIEWOOD DEVELOPERS PTY LTD

APPENDIX D

Summary of Proprietor(s)

SUMMARY OF PROPRIETOR(S)
Lot 2 DP 349085 A & B

Year	Proprietor(s)
(Lot 2 DP 349085 A & B)	
2018 – todate	Warriewood Developers Pty Ltd Warriewood Developers Pty Ltd
2017 - 2018	Golden Arrow International Pty Ltd
2016 - 2017	Zlatka Pikulich, widow
2005 - 2016	Zlatka Pikulich, married woman Nevenko Pikulich, market gardener
(Lot 2 DP 349085 – Area 2 Acres 2 Roods 39 Perches – CTVol 7679 Fol 21 & CTVol 7743 Fol 68)	
1959 - 2005	Zlatka Pikulich, married woman Nevenko Pikulich, market gardener
(Lot 2 DP 349085 – Area 2 Acres 2 Roods 39 Perches – CTVol 5451 Fol 38)	
1959 – 1959	Nevenko Pikulich, market gardener
1953 – 1959	Foska Pikulich, wife of George Pikulich, farmer Nevenko Pikulich, market gardener
1949 – 1953	Elsie Lorraine Nilan, married woman
1947 – 1949	Hannah Casey, married woman
1944 – 1947	Albert Farley, market gardener
(Lot 33 Section C DP 5464 – Area 5 Acres 1 Rood 12 Perches – CTVol 2248 Fol 217)	(Lot 33 Section C DP 5



1943 – 1944	Albert Farley, market gardener
1923 – 1943	Alec John Gardiner, freeholder
1921 – 1923	Annie Elizabeth Gardiner, wife of George Henry Gardiner, market gardener
1919 – 1921	Alec John Gardiner, freeholder

1912 – 1919	George Henry Gardiner, greengrocer

SUMMARY OF PROPRIETOR(S)
Lot 1 DP 349085

Year	Proprietor(s)
(Lot 1 DP 349085)	
2018 – todate	Warriewood Developers Pty Ltd
2017 – 2018	Golden Arrow International Pty Ltd
2016 – 2017	Zlatka Pikulich, widow
1988 – 2016	Nevenko Pikulich, market gardener Zlatka Pikulich, his wife
(Lot 1 DP 349085 – Area 2 Acres 2 Roods 13 Perches – CTVol 5451 Fol 37)	

(Lot 1 DP 349085 – Area

		2 Acres 2 Roods 13 Perches – CTVol 5451 Fol 37)
1959 - 2005	Zlatka Pikulich, married woman Nevenko Pikulich, market gardener	
(Lot 2 DP 349085 – Area 2 Acres 2 Roods 39 Perches – CTVol 5451 Fol 38)		
1979 – 1988	Nevenko Pikulich, market gardener Zlatka Pikulich, his wife	
1946 – 1979	Ronald Erskine Pearce, clerk Vera Florence Jean Pearce, his wife	
1944 – 1946	Albert Farley, market gardener	
(Lot 33 Section C DP 5464 – Area 5 Acres 1 Rood 12 Perches – CTVol 2248 Fol 217)		(Lot

	33 Section CDP5464 – Area 5 Acres 1 Rood 12 Perches – CT Vol 2248

		Fol217)
1943 – 1944	Albert Farley, market gardener	
1923 – 1943	Alec John Gardiner, freeholder	
1921 – 1923	Annie Elizabeth Gardiner, wife of George Henry Gardiner, market gardener	
1919 – 1921	Alec John Gardiner, freeholder	
1912 – 1919	George Henry Gardiner, greengrocer	

APPENDIX E

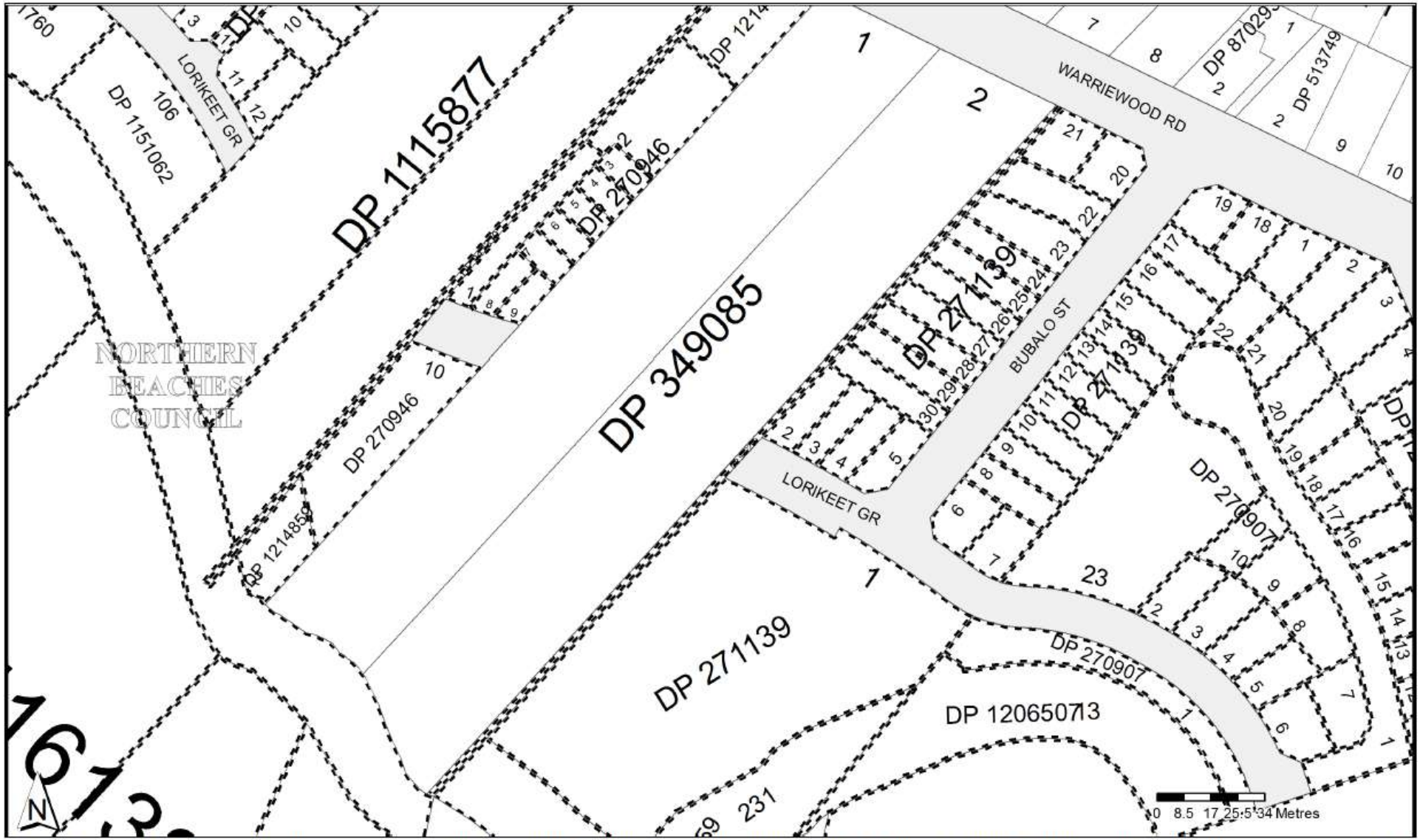
Deposited Plans

LAND REGISTRY SERVICES

Cadastral Records Enquiry Report : Lot 2 DP 349085

Ref : NOUSER

Locality : WARRIEWOOD
Parish : NARRABEEN
LGA : NORTHERN BEACHES
County : CUMBERLAND



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This information is provided as a searching aid only.Whilst every endeavour is made to ensure that current map, plan and titling information is accurately reflected, the Registrar General cannot guarantee the information provided. For ALL ACTIVITY PRIOR TO SEPTEMBER 2002 you must refer to the RGs Charting and Reference Maps

Page 1 of 4

LAND REGISTRY SERVICES

Cadastral Records Enquiry Report : Lot 2 DP 349085

Ref : NOUSER

Locality : WARRIEWOOD Parish : NARRABEEN

LGA : NORTHERN BEACHES County : CUMBERLAND

	Status	Surv/Comp	Purpose
DP5464			
Lot(s): 25 Section : C			
DP1245613	PRE-EXAM	SURVEY	REDEFINITION
Lot(s): 29 Section : C			
DP1166850	PRE-EXAM	SURVEY	CONSOLIDATION
DP1248056	PRE-ALLOCATED	UNAVAILABLE	SUBDIVISION
DP270730			
Lot(s): 1, 3, 9, 10, 11, 12			
DP345528	HISTORICAL	SURVEY	UNRESEARCHED
DP1115877	HISTORICAL	SURVEY	SUBDIVISION
DP1151062	HISTORICAL	SURVEY	SUBDIVISION
DP270907			
Lot(s): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23			
DP5464	HISTORICAL	SURVEY	UNRESEARCHED
DP1206507	HISTORICAL	SURVEY	SUBDIVISION
DP270946			
Lot(s): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10			
DP579309	HISTORICAL	COMPILATION	SUBDIVISION
DP1115877	HISTORICAL	SURVEY	SUBDIVISION
DP1214859	HISTORICAL	SURVEY	SUBDIVISION
DP271139			
Lot(s): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30			
DP5464	HISTORICAL	SURVEY	UNRESEARCHED
DP1238959	HISTORICAL	SURVEY	SUBDIVISION
DP942319			
Lot(s): 3			
DP271252	PRE-ALLOCATED	UNAVAILABLE	COMMUNITY PLAN
DP1234045	WITHDRAWN	UNAVAILABLE	CONSOLIDATION
DP972209			
Lot(s): 2			
DP271252	PRE-ALLOCATED	UNAVAILABLE	COMMUNITY PLAN
DP1234045	WITHDRAWN	UNAVAILABLE	CONSOLIDATION
DP1071760			
Lot(s): 5017			
DP345528	HISTORICAL	SURVEY	UNRESEARCHED
DP1115877			
Lot(s): 2, 3			
DP1211469	WITHDRAWN	UNAVAILABLE	SUBDIVISION
DP1234045	WITHDRAWN	UNAVAILABLE	CONSOLIDATION
DP1234191	WITHDRAWN	UNAVAILABLE	SUBDIVISION
Lot(s): 3			
DP270946	REGISTERED	SURVEY	COMMUNITY PLAN
DP271252	PRE-ALLOCATED	UNAVAILABLE	COMMUNITY PLAN
DP579309	HISTORICAL	COMPILATION	SUBDIVISION
Lot(s): 2			
DP208149	HISTORICAL	COMPILATION	SUBDIVISION
DP1151062			
Lot(s): 106			
DP345528	HISTORICAL	SURVEY	UNRESEARCHED
DP1115877	HISTORICAL	SURVEY	SUBDIVISION
DP1161389			
Lot(s): 4, 5, 6			
DP400488	HISTORICAL	SURVEY	UNRESEARCHED
Lot(s): 2, 6			
DP358765	HISTORICAL	COMPILATION	UNRESEARCHED
WARRIEWOOD BROOK RETIREMENT VILLAGE UNITS 23 TO 38, 47 TO 49, 51 TO 55, 57, 58, 65, 66, 70 TO 72, 79 TO 89 AND CARSPACES 1A TO 47A SHOWN IN PLAN WITH MEMORANDUM AG651515			

LAND REGISTRY SERVICES

Cadastral Records Enquiry Report : Lot 2 DP 349085

Ref : NOUSER

Locality : WARRIEWOOD
Parish : NARRABEEN
LGA : NORTHERN BEACHES
County : CUMBERLAND

	Status	Surv/Comp	Purpose
Lot(s): 6			
DP345528	HISTORICAL	SURVEY	UNRESEARCHED
WARRIEWOOD BROOK RETIREMENT VILLAGE UNITS 1 TO 22, 66 TO 69, 72 TO 79 AND CARSPACES 1B TO 42B SHOWN IN PLAN WITH MEMORANDUM AG651515			
Lot(s): 3, 6			
DP5464	HISTORICAL	SURVEY	UNRESEARCHED
DP208149	HISTORICAL	COMPILATION	SUBDIVISION
DP579309	HISTORICAL	COMPILATION	SUBDIVISION
DP1115877	HISTORICAL	SURVEY	SUBDIVISION
Lot(s): 2, 3, 6			
WARRIEWOOD BROOK RETIREMENT VILLAGE UNITS 49 TO 51, 55 TO 57, 61 TO 63 AND 85 TO 88 SHOWN IN PLAN WITH MEMORANDUM AG651515			
Lot(s): 3, 4, 5			
WARRIEWOOD BROOK RETIREMENT VILLAGE MACPHERSON STREET UNITS 90 TO 94, 97 TO 99 AND 134 TO 148 SHOWN IN PLAN WITH MEMORANDUM AK412799			
DP1206507			
Lot(s): 1, 2, 3, 4, 5, 6, 7, 13			
DP5464	HISTORICAL	SURVEY	UNRESEARCHED
DP1214859			
Lot(s): 1, 2			
DP579309	HISTORICAL	COMPILATION	SUBDIVISION
DP1115877	HISTORICAL	SURVEY	SUBDIVISION
DP1238959			
Lot(s): 231			
DP5464	HISTORICAL	SURVEY	UNRESEARCHED

LAND REGISTRY SERVICES

Cadastral Records Enquiry Report : Lot 2 DP 349085

Ref : NOUSER

Locality : WARRIEWOOD
Parish : NARRABEEN
LGA : NORTHERN BEACHES
County : CUMBERLAND

Plan	Surv/Comp	Purpose
DP5464	SURVEY	UNRESEARCHED
DP228171	SURVEY	SUBDIVISION
DP270730	UNRESEARCHED	COMMUNITY PLAN
DP270730	SURVEY	COMMUNITY PLAN
DP270730	SURVEY	COMMUNITY PLAN
DP270907	UNRESEARCHED	COMMUNITY PLAN
DP270907	SURVEY	COMMUNITY PLAN
DP270907	SURVEY	COMMUNITY PLAN
DP270946	SURVEY	COMMUNITY PLAN
DP270946	UNRESEARCHED	COMMUNITY PLAN
DP271139	SURVEY	COMMUNITY PLAN
DP271139	UNRESEARCHED	COMMUNITY PLAN
DP271139	SURVEY	COMMUNITY PLAN
DP349085	COMPILATION	UNRESEARCHED
DP513749	COMPILATION	SUBDIVISION
DP870293	SURVEY	SUBDIVISION
DP942319	SURVEY	UNRESEARCHED
DP972209	COMPILATION	UNRESEARCHED
DP1071760	SURVEY	SUBDIVISION
DP1071760	SURVEY	SUBDIVISION
DP1115877	SURVEY	SUBDIVISION
DP1151062	UNRESEARCHED	SUBDIVISION
DP1151062	SURVEY	SUBDIVISION
DP1151062	SURVEY	SUBDIVISION
DP1161389	UNRESEARCHED	SUBDIVISION
DP1161389	SURVEY	SUBDIVISION
DP1206507	SURVEY	SUBDIVISION
DP1206507	SURVEY	SUBDIVISION
DP1206507	UNRESEARCHED	SUBDIVISION
DP1214859	SURVEY	SUBDIVISION
DP1214859	UNRESEARCHED	SUBDIVISION
DP1214859	SURVEY	SUBDIVISION
DP1238959	SURVEY	SUBDIVISION
DP1238959	SURVEY	SUBDIVISION
DP1238959	UNRESEARCHED	SUBDIVISION

Form: 01T
Release: 6-1

TRANSFER

New South Wales
Real Property Act 1900

AM320962A

PRIVACY NOTE: Section 31B of the Real Property Act 1900 (RP Act) authorises the R … collect the information required by this form for the establishment and maintenance of the Real Property Act Register. Section 96B RP Act requires that the Register is made available to any person for search upon payment of a fee, if any.

STAMP DUTY Office of State Revenue use only

Office of State Revenue (NSW)
Client No: 133971684 4451
Duty: $20 Trans No: 9057204-001
Asst details:

(A) **TORRENS TITLE** 1/349085 and Volume 7679 Folio 21 being ~~2/349085A & 2/349085B~~ 2|349085A and ~~2/349085B~~ 2|349085B

I, Jonathan Yuill, am authorised to make this … on behalf of the … Dated: 20/4/2017 Signed:

(B) **LODGED BY**

Document Collection Box	Name, Address or DX, Telephone, and Customer Account Number if any	CODES
N	ERA Legal level 15, 45 Clarence Street SYDNEY NSW 2000 Reference: RIA : KL: 170152 Tel: 02 9324 5300	T TW

(C) **TRANSFEROR** Zlatka PIKULICH

(D) **CONSIDERATION** The transferor acknowledges receipt of the consideration of $ 12,650,000.00 and as regards

(E) **ESTATE** the abovementioned land transfers to the transferee an estate in fee simple

(F) **SHARE TRANSFERRED**

(G) Encumbrances (if applicable):

(H) **TRANSFEREE** GOLDEN ARROW INTERNATIONAL PTY LTD ACN 607 069 134

(I) **TENANCY:** OFF X AK775371

DATE

(J) I certify I am an eligible witness and that the transferor signed this dealing in my presence. [See note* below]

Signature of witness:

Name of witness: JONATHAN YUILL
Address of witness: 4/L BUNGAN LANE MONA VALE

Certified correct for the purposes of the Real Property Act 1900 by the transferor.

Signature of transferor:

Zlatka Pikulich

Certified correct for the purposes of the Real Property Act 1900 on behalf of the transferee by the person whose signature appears below.

Signature:

Signatory's name: Tracey Cameron
Signatory's capacity: licensed conveyancer

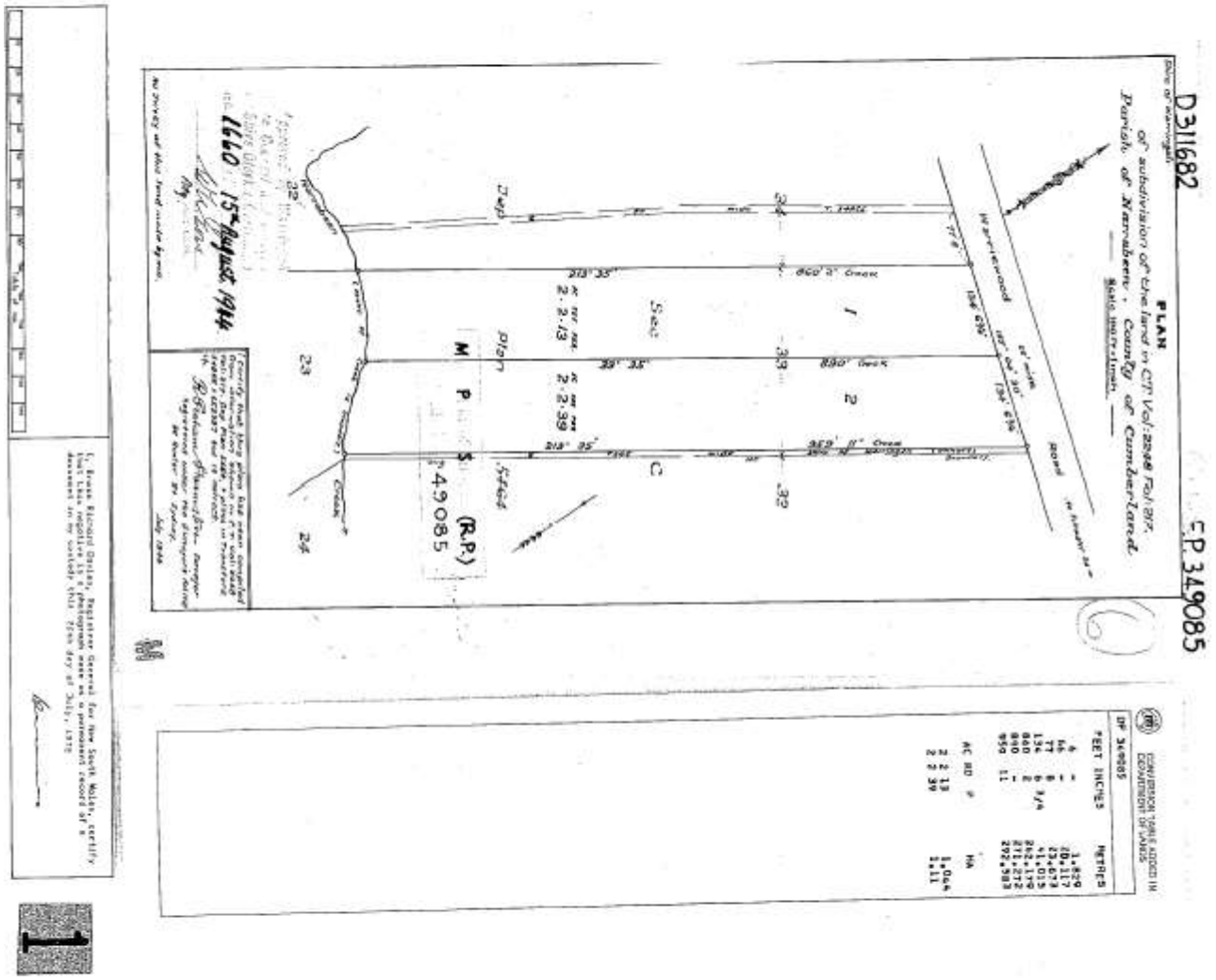
CT SIGHTED CANC. & RET.

(K) The transferee's agent certifies that the eNOS data relevant to this dealing has been submitted and stored under eNOS ID No. 1236208 1236259 1236267 Full name: Tracey Cameron Signature:

** s117 RP Act requires that you must have known the signatory for more than 12 months or have sighted identifying documentation.*

ALL HANDWRITING MUST BE IN BLOCK CAPITALS Page 1 of 1 1303

& AK775371



NEW SOUTH WALES LAND REGISTRY SERVICES - HISTORICAL SEARCH

SEARCH DATE
26/2/2020 10:42AM

FOLIO: 1/349085

First Title(s): SEE PRIOR TITLE(S)
Prior Title(s): VOL 5451 FOL 37

Recorded	Number	Type of Instrument	C.T. Issue
18/12/1988		TITLE AUTOMATION PROJECT	LOT RECORDED FOLIO NOT CREATED
13/7/1989		CONVERTED TO COMPUTER FOLIO	FOLIO CREATED CT NOT ISSUED
30/9/1994		AMENDMENT: LOCAL GOVT AREA	
29/7/2002	8815535	APPLICATION FOR REPLACEMENT CERTIFICATE OF TITLE	EDITION 1
17/2/2016	AK227392	NOTICE OF DEATH	EDITION 2
23/9/2016	AK775371	CAVEAT	
24/4/2017	AM320962	TRANSFER	
24/4/2017	AM320963	MORTGAGE	EDITION 3
8/6/2017	AM463947	CAVEAT	
16/6/2017	AM479404	CAVEAT	
20/6/2017	AM492846	WITHDRAWAL OF CAVEAT	
20/6/2017	AM492847	WITHDRAWAL OF CAVEAT	
20/6/2017	AM492848	DISCHARGE OF MORTGAGE	
20/6/2017	AM492849	MORTGAGE	EDITION 4
3/7/2017	AM533678	CAVEAT	
7/8/2017	AM620386	CAVEAT	
30/8/2017	AM688489	CAVEAT	
5/9/2017	AM701714	CAVEAT	
5/9/2017	AM703059	CAVEAT	
13/9/2017	AM715826	WITHDRAWAL OF CAVEAT	
13/9/2017	AM715827	WITHDRAWAL OF CAVEAT	
13/9/2017	AM715830	WITHDRAWAL OF CAVEAT	
13/9/2017	AM715831	WITHDRAWAL OF CAVEAT	

END OF PAGE 1 - CONTINUED OVER

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NEW SOUTH WALES LAND REGISTRY SERVICES - HISTORICAL SEARCH

SEARCH DATE
26/2/2020 10:42AM

FOLIO: 1/349085 PAGE 2

Recorded	Number	Type of Instrument	C.T. Issue
13/9/2017	AM715833	MORTGAGE	EDITION 5
13/9/2017	AM724280	CAVEAT	
15/9/2017	AM732540	CAVEAT	
18/9/2017	AM736306	CAVEAT	
21/9/2017	AM742696	CAVEAT	
21/9/2017	AM746343	CAVEAT	
19/10/2017	AM818627	CAVEAT	
4/12/2017	AM936966	CAVEAT	
13/12/2017	AM966170	CAVEAT	
30/1/2018	AN79212	WITHDRAWAL OF CAVEAT	
8/2/2018	AN105597	PRIORITY NOTICE	
13/2/2018	AN114071	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114072	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114073	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114074	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114075	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114076	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114077	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114080	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114081	DISCHARGE OF MORTGAGE	
13/2/2018	AN114082	DISCHARGE OF MORTGAGE	
13/2/2018	AN114083	TRANSFER	
13/2/2018	AN114084	MORTGAGE	EDITION 6 CORD ISSUED
11/10/2018	AN757832	DEPARTMENTAL DEALING	
27/9/2019	AP563986	CAVEAT	

*** END OF SEARCH ***

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NEW SOUTH WALES LAND REGISTRY SERVICES - HISTORICAL SEARCH

SEARCH DATE
26/2/2020 10:16AM

FOLIO: 2/349085A

Recorded	Number	Type of Instrument	C.T. Issue
15/7/2005	AB624423	DEPARTMENTAL DEALING	FOLIO CREATED CT NOT ISSUED
18/7/2005	AB624691	DEPARTMENTAL DEALING	EDITION 1
19/7/2005	AB633296	DEPARTMENTAL DEALING	
23/9/2016	AK775371	CAVEAT	
24/4/2017	AM320962	TRANSFER	
24/4/2017	AM320963	MORTGAGE	
24/4/2017	AM325492	DEPARTMENTAL DEALING	EDITION 2
8/6/2017	AM463947	CAVEAT	
16/6/2017	AM479404	CAVEAT	
20/6/2017	AM492846	WITHDRAWAL OF CAVEAT	
20/6/2017	AM492847	WITHDRAWAL OF CAVEAT	
20/6/2017	AM492848	DISCHARGE OF MORTGAGE	
20/6/2017	AM492849	MORTGAGE	EDITION 3
3/7/2017	AM533678	CAVEAT	
7/8/2017	AM620386	CAVEAT	
30/8/2017	AM688489	CAVEAT	
5/9/2017	AM701714	CAVEAT	
5/9/2017	AM703060	CAVEAT	
13/9/2017	AM715826	WITHDRAWAL OF CAVEAT	
13/9/2017	AM715829	WITHDRAWAL OF CAVEAT	
13/9/2017	AM715830	WITHDRAWAL OF CAVEAT	
13/9/2017	AM715831	WITHDRAWAL OF CAVEAT	
13/9/2017	AM715833	MORTGAGE	EDITION 4
13/9/2017	AM724280	CAVEAT	
15/9/2017	AM732540	CAVEAT	
18/9/2017	AM736306	CAVEAT	

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NEW SOUTH WALES LAND REGISTRY SERVICES - HISTORICAL SEARCH

SEARCH DATE
26/2/2020 10:16AM

FOLIO: 2/349085A PAGE 2

Recorded	Number	Type of Instrument	C.T. Issue
21/9/2017	AM742696	CAVEAT	
21/9/2017	AM746345	CAVEAT	
19/10/2017	AM818627	CAVEAT	
4/12/2017	AM936966	CAVEAT	
13/12/2017	AM966170	CAVEAT	
30/1/2018	AN79212	WITHDRAWAL OF CAVEAT	
8/2/2018	AN105597	PRIORITY NOTICE	
13/2/2018	AN114071	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114072	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114073	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114074	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114075	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114076	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114077	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114079	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114081	DISCHARGE OF MORTGAGE	
13/2/2018	AN114082	DISCHARGE OF MORTGAGE	
13/2/2018	AN114083	TRANSFER	
13/2/2018	AN114084	MORTGAGE	EDITION 5 CORD ISSUED
11/10/2018	AN757832	DEPARTMENTAL DEALING	

*** END OF SEARCH ***

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NEW SOUTH WALES LAND REGISTRY SERVICES - HISTORICAL SEARCH

SEARCH DATE
26/2/2020 5:12PM

FOLIO: 2/349085B

Recorded	Number	Type of Instrument	C.T. Issue
15/7/2005	AB624423	DEPARTMENTAL DEALING	FOLIO CREATED CT NOT ISSUED
18/7/2005	AB624691	DEPARTMENTAL DEALING	EDITION 1
19/7/2005	AB633296	DEPARTMENTAL DEALING	
21/7/2016	AK612449	TRANSMISSION APPLICATION (DEVISEE,BENEFICIARY,NEXT OF KIN)	
21/7/2016	AK613284	DEPARTMENTAL DEALING	EDITION 2
23/9/2016	AK775371	CAVEAT	
24/4/2017	AM320962	TRANSFER	
24/4/2017	AM320963	MORTGAGE	EDITION 3
8/6/2017	AM463947	CAVEAT	
16/6/2017	AM479404	CAVEAT	
20/6/2017	AM492846	WITHDRAWAL OF CAVEAT	
20/6/2017	AM492847	WITHDRAWAL OF CAVEAT	
20/6/2017	AM492848	DISCHARGE OF MORTGAGE	
20/6/2017	AM492849	MORTGAGE	EDITION 4
3/7/2017	AM533678	CAVEAT	
7/8/2017	AM620386	CAVEAT	
30/8/2017	AM688489	CAVEAT	
5/9/2017	AM701714	CAVEAT	
5/9/2017	AM703061	CAVEAT	
13/9/2017	AM715826	WITHDRAWAL OF CAVEAT	
13/9/2017	AM715828	WITHDRAWAL OF CAVEAT	
13/9/2017	AM715830	WITHDRAWAL OF CAVEAT	
13/9/2017	AM715831	WITHDRAWAL OF CAVEAT	
13/9/2017	AM715833	MORTGAGE	EDITION 5
13/9/2017	AM724280	CAVEAT	

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PRINTED ON 26/2/2020

NEW SOUTH WALES LAND REGISTRY SERVICES - HISTORICAL SEARCH

SEARCH DATE
26/2/2020 5:12PM

FOLIO: 2/349085B PAGE 2

Recorded	Number	Type of Instrument	C.T. Issue
15/9/2017	AM732540	CAVEAT	
18/9/2017	AM736306	CAVEAT	
21/9/2017	AM742696	CAVEAT	
21/9/2017	AM746344	CAVEAT	
19/10/2017	AM818627	CAVEAT	
4/12/2017	AM936966	CAVEAT	
13/12/2017	AM966170	CAVEAT	
30/1/2018	AN79212	WITHDRAWAL OF CAVEAT	
8/2/2018	AN105597	PRIORITY NOTICE	
13/2/2018	AN114071	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114072	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114073	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114074	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114075	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114076	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114077	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114078	WITHDRAWAL OF CAVEAT	
13/2/2018	AN114081	DISCHARGE OF MORTGAGE	
13/2/2018	AN114082	DISCHARGE OF MORTGAGE	
13/2/2018	AN114083	TRANSFER	
13/2/2018	AN114084	MORTGAGE	EDITION 6 CORD ISSUED
11/10/2018	AN757832	DEPARTMENTAL DEALING	

*** END OF SEARCH ***

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NEW SOUTH WALES LAND REGISTRY SERVICES - TITLE SEARCH

FOLIO: 1/349085

SEARCH DATE	TIME	EDITION NO	DATE
26/2/2020	10:13 AM	6	13/2/2018

NO CERTIFICATE OF TITLE HAS ISSUED FOR THE CURRENT EDITION OF THIS FOLIO.
CONTROL OF THE RIGHT TO DEAL IS HELD BY NATIONAL AUSTRALIA BANK LIMITED.

LAND

LOT 1 IN DEPOSITED PLAN 349085
LOCAL GOVERNMENT AREA NORTHERN BEACHES
PARISH OF NARRABEEN COUNTY OF CUMBERLAND
TITLE DIAGRAM DP349085

FIRST SCHEDULE

WARRIEWOOD DEVELOPERS PTY LTD (T AN114083)

SECOND SCHEDULE (3 NOTIFICATIONS)

1 RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
2 AN114084 MORTGAGE TO NATIONAL AUSTRALIA BANK LIMITED
* 3 AP563986 CAVEAT BY CHIEF COMMISSIONER OF STATE REVENUE

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

advlegs PRINTED ON 26/2/2020

NEW SOUTH WALES LAND REGISTRY SERVICES - TITLE SEARCH

FOLIO: 2/349085A

SEARCH DATE	TIME	EDITION NO	DATE
26/2/2020	10:12 AM	5	13/2/2018

NO CERTIFICATE OF TITLE HAS ISSUED FOR THE CURRENT EDITION OF THIS FOLIO.
CONTROL OF THE RIGHT TO DEAL IS HELD BY NATIONAL AUSTRALIA BANK LIMITED.

SUB FOLIO

LAND

1/2 SHARE IN LOT 2 IN DEPOSITED PLAN 349085
AT WARRIEWOOD
LOCAL GOVERNMENT AREA NORTHERN BEACHES
PARISH OF NARRABEEN COUNTY OF CUMBERLAND
TITLE DIAGRAM DP349085

FIRST SCHEDULE

WARRIEWOOD DEVELOPERS PTY LTD (T AN114083)

SECOND SCHEDULE (2 NOTIFICATIONS)

1 RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
2 AN114084 MORTGAGE TO NATIONAL AUSTRALIA BANK LIMITED

NOTATIONS

NOTE: DP581495 EASEMENT FOR SEWERAGE PURPOSES 5 METRES WIDE AFFECTING THE PART SHOWN AS " PROPOSED EASEMENT FOR SEWER 5 WIDE " IN DP581495

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

advlegs PRINTED ON 26/2/2020

NEW SOUTH WALES LAND REGISTRY SERVICES - TITLE SEARCH

FOLIO: 2/349085B

SEARCH DATE	TIME	EDITION NO	DATE
26/2/2020	10:13 AM	6	13/2/2018

NO CERTIFICATE OF TITLE HAS ISSUED FOR THE CURRENT EDITION OF THIS FOLIO.
CONTROL OF THE RIGHT TO DEAL IS HELD BY NATIONAL AUSTRALIA BANK LIMITED.

SUB FOLIO

LAND

1/2 SHARE IN LOT 2 IN DEPOSITED PLAN 349085
AT WARRIEWOOD
LOCAL GOVERNMENT AREA NORTHERN BEACHES
PARISH OF NARRABEEN COUNTY OF CUMBERLAND
TITLE DIAGRAM DP349085

FIRST SCHEDULE

WARRIEWOOD DEVELOPERS PTY LTD (T AN114083)

SECOND SCHEDULE (2 NOTIFICATIONS)

1 RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
2 AN114084 MORTGAGE TO NATIONAL AUSTRALIA BANK LIMITED

NOTATIONS

NOTE: DP581495 EASEMENT FOR SEWERAGE PURPOSES 5 METRES WIDE AFFECTING THE PART SHOWN AS " PROPOSED EASEMENT FOR SEWER 5 WIDE " IN DP581495

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

advlegs PRINTED ON 26/2/2020

APPENDIX F

Soil Quality Guidelines

Table F-1
NEPM (1999) Guideline Investigation Levels for Soil

Table 5-A - Soil Investigation Levels (mg/kg)

Substances	Health Investigation Levels (HILs)						Ecological Investigation Levels (EILs)		Background
	A[1]	B[2]	C[3]	D	E	F	REIL[4]	Interim Urban[5]	Ranges[6]
METALS/METALLOIDS									
Arsenic (total)	100			400	200	500		20	1 - 50
Barium								300	100 - 3000
Beryllium	20			80	40	100			
Cadmium	20			80	40	100		3	1
Chromium (III)	12%			48%	24%	60%		400	
Chromium (VI)	100			400	200	500		1	
Chromium (Total)[7]									5 - 1000
Cobalt	100			400	200	500			1 - 40
Copper	1000			4000	2000	5000		100	2 - 100
Lead	300			1200	600	1500		600	2 - 200
Manganese	1500			6000	3000	7500		500	850
Methyl mercury	10			40	20	50			
Mercury (inorganic)	15			60	30	75		1	0.03
Nickel	600			2400	600	3000		60	5 - 500
Vanadium								50	20 - 500
Zinc	7000			28000	14000	35000		200	10 - 300
ORGANICS									
Aldrin + Dieldrin	10			40	20	50			
Chlordane	50			200	100	250			
DDT + DDD + DDE	200			800	400	1000			
Heptachlor	10			40	20	50			
Polycyclic aromatic hydrocarbons (PAHs)	20			80	40	100			
Benzo(a)pyrene	1			4	2	5			
Phenol	8500			34000	17000	42500			
PCBs (Total)	10			40	20	50			
Petroleum Hydrocarbon Components (constituents): • >C16 – C35 Aromatics[8]	90			360	180	450			
• >C16 – C35 Aliphatics	5600			22400	11200	28000			
• >C35 Aliphatics	56000			224000	112000	280000			
OTHER									
Boron	3000			12000	6000	15000			
Cyanides (Complexed)	500			2000	1000	2500			
Cyanides (free)	250			1000	500	1250			
Phosphorus								2000	
Sulfur								600	
Sulfate[9]								2000	

Limited Australian data available at this time

1 Human exposure settings based on land use have been established for HILs (see Taylor and Langley 1998). These are:
- A. 'Standard' residential with garden/accessible soil (home-grown produce contributing less than 10% of vegetable and fruit intake; no poultry): this category includes children's day-care centres, kindergartens, preschools and primary schools.
- B. Residential with substantial vegetable garden (contributing 10% or more of vegetable and fruit intake) and/or poultry providing any egg or poultry meat dietary intake.
- C. Residential with substantial vegetable garden (contributing 10% or more of vegetable and fruit intake); poultry excluded.
- D. Residential with minimal opportunities for soil access: includes dwellings with fully and permanently paved yard space such as high-rise apartments and flats.
- E. Parks, recreational open space and playing fields: includes secondary schools.
- F. Commercial/Industrial: includes premises such as shops and offices as well as factories and industrial sites.

(For details on derivation of HILs for human exposure settings based on land use see Schedule B(7A)).

2 Site and contaminant specific: on site sampling is the preferred approach for estimating poultry and plant uptake. Exposure estimates may then be compared to the relevant ADIs, PTWIs and GDs.

3 Site and contaminant specific: on site sampling is the preferred approach for estimating plant uptake. . Exposure estimates may then be compared to the relevant ADIs, PTWIs and GDs.

4 These will be developed for regional areas by jurisdictions as required.

5 Interim EILs for the urban setting are based on considerations of phytotoxicity, ANZECC B levels, and soil survey data from urban residential properties in four Australian capital cities.

6 Background ranges, where HILs or EILs are set, are taken from the Field Geologist's Manual, compiled by D A Berkman, Third Edition 1989. Publisher – The Australasian Institute of Mining & Metallurgy. This publication contains information on a more extensive list of soil elements than is included in this Table. Another source of information is Contaminated Sites Monograph No. 4: Trace Element Concentrations in Soils from Rural & Urban Areas of Australia, 1995. South Australian Health Commission.

7 Valence state not distinguished – expected as Cr (III).

8 The carbon number is an 'equivalent carbon number' based on a method that standardises according to boiling point. It is a method used by some analytical laboratories to report carbon numbers for chemicals evaluated on a boiling point GC column.

9 For protection of built structures.

Schedule B (1) - Guideline on Investigation Levels for Soil and Groundwater 9

Table F-2
NEPM (1999) Guideline Investigation Levels for Soil (May 2013 Update)

Chemical	Health-based investigation levels (mg/kg)			
	Residential[1] A	Residential[1] B	Recreational[1] C	Commercial/ industrial[1] D
Metals and Inorganics				
Arsenic[2]	100	500	300	3 000
Beryllium	60	90	90	500
Boron	4500	40 000	20 000	300 000
Cadmium	20	150	90	900
Chromium (VI)	100	500	300	3600
Cobalt	100	600	300	4000
Copper	6000	30 000	17 000	240 000
Lead[3]	300	1200	600	1 500
Manganese	3800	14 000	19 000	60 000
Mercury (inorganic)[5]	40	120	80	730
Methyl mercury[4]	10	30	13	180
Nickel	400	1200	1200	6 000
Selenium	200	1400	700	10 000
Zinc	7400	60 000	30 000	400 000
Cyanide (free)	250	300	240	1 500
Polycyclic Aromatic Hydrocarbons (PAHs)				
Carcinogenic PAHs (as BaP TEQ)[6]	3	4	3	40
Total PAHs[7]	300	400	300	4000
Phenols				
Phenol	3000	45 000	40 000	240 000
Pentachlorophenol	100	130	120	660
Cresols	400	4 700	4 000	25 000
Organochlorine Pesticides				
DDT+DDE+DDD	240	600	400	3600
Aldrin and dieldrin	6	10	10	45
Chlordane	50	90	70	530
Endosulfan	270	400	340	2000
Endrin	10	20	20	100
Heptachlor	6	10	10	50
HCB	10	15	10	80
Methoxychlor	300	500	400	2500
Mirex	10	20	20	100
Toxaphene	20	30	30	160
Herbicides				
2,4,5-T	600	900	800	5000
2,4-D	900	1600	1300	9000
MCPA	600	900	800	5000
MCPB	600	900	800	5000
Mecoprop	600	900	800	5000
Picloram	4500	6600	5700	35000
Other Pesticides				
Atrazine	320	470	400	2500
Chlorpyrifos	160	340	250	2000
Bifenthrin	600	840	730	4500
Other Organics				
PCBs[8]	1	1	1	7
PBDE Flame Retardants (Br1-Br9)	1	2	2	10

NOTES TO TABLE F-2

Notes:

(1) Generic land uses are described in detail in Schedule B7 Section 3

HIL A - Residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake (no poultry), also includes childcare centres, preschools and primary schools.

HIL B - Residential with minimal opportunities for soil access; includes dwellings with fully and permanently paved yard space such as high-rise buildings and apartments.

HIL C - Public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths. This does not include undeveloped public open space where the potential for exposure is lower and where a site-specific assessment may be more appropriate.

HIL D - Commercial/industrial, includes premises such as shops, offices, factories and industrial sites.

(2) Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability may be important and should be considered where appropriate (refer Schedule B7).

(3) Lead: HIL is based on blood lead models (IEUBK for HILs A, B and C and adult lead model for HIL D where 50% oral bioavailability has been considered. Site-specific bioavailability may be important and should be considered where appropriate.

(4) Methyl mercury: assessment of methyl mercury should only occur where there is evidence of its potential source. It may be associated with inorganic mercury and anaerobic microorganism activity in aquatic environments. In addition, the reliability and quality of sampling/analysis should be considered.

(5) Elemental mercury: HIL does not address elemental mercury. A site-specific assessment should be considered if elemental mercury is present, or suspected to be present,

(6) Carcinogenic PAHs: HIL is based on the 8 carcinogenic PAHs and their TEFs (potency relative to B(a)P) adopted by CCME 2008 (refer Schedule B7). The B(a)P TEQ is calculated by multiplying the concentration of each carcinogenic PAH in the sample by its B(a)P TEF, given below, and summing these products.

Table F-3
Interim Soil Vapour Health Investigation Levels for Volatile Organic Chlorinated Compounds

(May 2013 NEPM Update - Table 1A (2))

Interim soil vapour HIL (mg/m^3)			
Residential[1] A	**Residential[1] B**	**Recreational[1] C**	**Commercial / Industrial[1] D**
0.02	0.02	0.4	0.08
60	60	1200	230
2	2	40	8
0.08	0.08	2	0.3
0.03	0.03	0.5	0.1

Notes:

1. Land use settings are equivalent to those described in Table 1A (1) Footnote 1 and Schedule B7, though secondary school buildings should be assessed using residential 'A/B' for vapour intrusion purposes.
2. Interim HILs for VOCCs are conservative soil vapour concentrations that can be adopted for the purpose of screening sites where further investigation is required on a site-specific basis. They are based on the potential for vapour intrusion using an indoor air-to-soil vapour attenuation factor of 0.1 and an outdoor air-to-soil vapour attenuation factor of 0.05.
3. Application of the interim HILs is based on a measurement of shallow (to 1 m depth) soil vapour (or deeper where the values are to be applied to a future building with a basement) or sub-slab soil vapour.
4. The applicability of the interim HILs needs to be further considered when used for other building types such as homes with a crawlspace and no slab, which may require site-specific assessment.
5. Use of the interim HILs requires comparison with data that has been collected using appropriate methods and meets appropriate data quality requirements.
6. Oral and dermal exposure should be considered on a site-specific basis where direct contact exposure is likely to occur.

Table F-4
Soil HSLs for Vapour Intrusion (mg/kg)
(May 2013 NEPM Update - Table 1A (3))

	HSL A & HSL B Low – high density residential			
CHEMICAL	**0 m to <1 m**	**1 m to <2 m**	**2 m to <4m**	**4 m+**
Toluene	160	220	310	540
Ethylbenzene	55	NL	NL	NL
Xylenes	40	60	95	170
Naphthalene	3	NL	NL	NL
Benzene	0.5	0.5	0.5	0.5
F1[9]	45	70	110	200
F2[10]	110	240	440	NL
Toluene	390	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	95	210	NL	NL
Naphthalene	4	NL	NL	NL
Benzene	0.6	0.7	1	2
F1[9]	40	65	100	190
F2[10]	230	NL	NL	NL
Toluene	480	NL	NL	NL
Ethylbenzene	NL	NL	NL	NL
Xylenes	110	310	NL	NL
Naphthalene	5	NL	NL	NL
Benzene	0.7	1	2	3
F1[9]	50	90	150	290
F2[10]	280	NL	NL	NL

Notes:

1. Land use settings are equivalent to those described in Table 1A (1) Footnote 1 and Schedule B7. HSLs for vapour intrusion for high density residential assume residential occupation of the ground floor. If communal car parks or commercial properties occupy the ground floor, HSL D should be used,
2. The key limitations of the HSLs should be referred to prior to application and are presented in Friebel and Nadebaum (2011b and 2011d).
3. Detailed assumptions in the derivation of the HSLs and information on how to apply the HSLs are presented in Friebel and Nadebaum (2011a and 2011b).
4. Soil HSLs for vapour inhalation incorporate an adjustment factor of 10 applied to the vapour phase partitioning to reflect the differences observed between theoretical estimates of soil vapour partitioning and field measurements. Refer Friebel & Nadebaum (2011a) for further information.
5. The soil saturation concentration (Csat) is defined as the soil concentration at which the porewater phase cannot dissolve any more of an individual chemical. The soil vapour that is in equilibrium with the porewater will be at its maximum. If the derived soil HSL exceeds Csat, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'.
6. The HSLs for TPH C_6-C_{10} in sandy soil are based on a finite source that depletes in less than seven years, and therefore consideration has been given to use of sub-chronic toxicity values. The >C_8-C_{10} aliphatic toxicity has been adjusted to represent sub-chronic exposure, resulting in higher HSLs than if based on chronic toxicity. For further information refer to Section 8.2 and Appendix J in Friebel and Nadebaum (2011a).
7. The figures in the above table may be multiplied by a factor to account for biodegradation of vapour. A factor of 10 may apply for source depths from 2 m to <4 m or a factor of 100 for source depths of 4 m and deeper. To apply the attenuation factor for vapour degradation, a number of conditions must be satisfied. Firstly, the maximum length of the shorter side of the concrete slab and surrounding pavement cannot exceed 15 m, as this would prevent oxygen penetrating to the centre of the slab. Secondly, measurement of oxygen in the subsurface is required to determine the potential for biodegradation. Oxygen must be confirmed to be present at >5% to use these factors.
8. For soil texture classification undertaken in accord with AS 1726, the classifications of sand, silt and clay may be applied as coarse, fine with liquid limit <50% and fine with liquid limit>50% respectively, as the underlying properties to develop the HSLs may reasonably be selected to be similar. Where there is uncertainty, either a conservative approach may be adopted, or laboratory analysis should be carried out.
9. To obtain F1 subtract the sum of BTEX concentrations from the C_6-C_{10} fraction.
10. To obtain F2 subtract naphthalene from the >C_{10}-C_{16} fraction.

Table F-5
Soil Vapour HSLs for Vapour Intrusion (mg/kg)

(May 2013 NEPM Update - Table 1A (5))

	HSL A & HSL B Low – high density residential				
CHEMICAL	**0 m to <1 m**	**1 m to <2 m**	**2 m to <4 m**	**4 m to <8 m**	**8 m+**
Toluene	1300	3800	7300	15 000	29 000
Ethylbenzene	330	1100	2200	4300	8700
Xylenes	220	750	1500	3000	6100
Naphthalene	0.8	3	6	10	25
Benzene	1	3	6	10	20
F1[8]	180	640	1,300	2600	5300
F2[9]	130	560	1200	2400	4800
Toluene	1400	14 000	32 000	69 000	140 000
Ethylbenzene	380	4200	9700	21 000	43 000
Xylenes	260	2900	6800	15 000	30 000
Naphthalene	0.9	10	25	60	120
Benzene	1	10	25	55	110
F1[8]	210	2600	6000	13 000	26 000
F2[9]	160	2300	5400	NL	NL
Toluene	1600	23 000	53 000	110 000	NL
Ethylbenzene	420	6800	16 000	35 000	NL
Xylenes	280	4800	11 000	24 000	50 000
Naphthalene	1	20	45	95	200
Benzene	1	15	40	90	180
F1[8]	230	4200	9900	21 000	44 000
F2[9]	180	3,800	NL	NL	NL

Notes:

1. Land use settings are equivalent to those described in Table 1A (1) Footnote 1 and Schedule B7. HSLs for vapour intrusion for high density residential assume residential occupation of the ground floor. If communal car parks or commercial properties occupy the ground floor, HSL D should be used,
2. The key limitations of the HSLs should be referred to prior to application and are presented in Friebel and Nadebaum (2011b and 2011d).
3. Detailed assumptions in the derivation of the HSLs and information on how to apply the HSLs are presented in Friebel and Nadebaum (2011a and 2011b).
4. The maximum possible soil vapour concentrations have been calculated based on vapour pressures of the pure chemicals. Where soil vapour HSLs exceed these values a soil-specific source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'.
5. Soil vapour HSLs should be compared with measurements taken as laterally close as possible to the soil or groundwater sources of vapour (i.e. within or above vapour sources). Consideration is required of where the sample is taken, the current condition of the site and the likely future condition of the site. Shallow gas measurements in open space (less than 1 m below ground surface) may be subject to influences of weather conditions and moisture.
6. The figures in the above table may be multiplied by a factor to account for biodegradation of vapour. A factor of 10 may apply for source depths from 2 m to <4 m or a factor of 100 for source depths of 4 m and deeper. To apply the attenuation factor for vapour degradation, a number of conditions must be satisfied. Firstly, the maximum length of the shorter side of the concrete slab and surrounding pavement cannot exceed 15 m, as this would prevent oxygen penetrating to the centre of the slab. Secondly, measurement of oxygen in the subsurface is required to determine the potential for biodegradation. Oxygen must be confirmed to be present at >5% to use these factors.
7. For soil texture classification undertaken in accord with AS 1726, the classifications of sand, silt and clay may be applied as coarse, fine with liquid limit <50% and fine with liquid limit >50% respectively as the underlying properties to develop the HSLs may reasonably be selected to be similar. Where there is uncertainty, either a conservative approach may be adopted, or laboratory analysis should be carried out.
8. To obtain F1 subtract the sum of BTEX concentrations from the C_6-C_{10} fraction.
9. To obtain F2 subtract naphthalene from the >C_{10}-C_{16} fraction

Table F-6
Soil-specific Added Contaminant Limits for Aged Chromium III and Nickel in Soil

(May 2013 NEPM Update - Table 1B (3))

CHEMICAL	Clay content (% clay)	Added contaminant limits (mg added contaminant/kg) for various land uses		
		Areas of ecological significance	Urban residential and public open space	Commercial and industrial
Chromium III	*1*	60	190	310
	2.5	80	250	420
	5	100	320	530
	≥10	130	400	660
Nickel	CEC[a] ($cmol_c/kg$)	Areas of ecological significance	Urban residential and public open space[1]	Commercial and industrial
	5	5	30	55
	10	30	170	290
	20	45	270	460
	30	60	350	600
	40	70	420	730
	60	95	560	960

Notes:

1. Urban residential/public open space is broadly equivalent to the HIL A, HIL B and HIL C land use scenarios in Table 1A (1) Footnote 1 and as described in Schedule B7.
2. Aged values apply to contamination present in soil for at least two years. For fresh contamination refer to Schedule B5c.
3. The EIL is calculated from summing the ACL and the ABC.

a = CEC measured using the silver thiourea method (Chabra et al. 1972).

Table F-7
Generic Added Contaminant Limits for Lead in Soils Irrespective of their Physicochemical Properties

(May 2013 NEPM Update - Table 1B (4))

	Pb added contaminant limit (ACL, mg added contaminant/kg) for various land uses		
CHEMICAL	Areas of ecological significance	Urban residential and public open space[1]	Commercial and industrial
Lead	470	1100	1800

Notes:

1. Urban residential/public open space is broadly equivalent to the HIL A, HIL B and HIL C land use scenarios in Table 1A (1) Footnote 1 and as described in Schedule B7.
2. Aged values are applicable to lead contamination present in soil for at least two years. For fresh contamination refer to Schedule B5c.
3. The EIL is calculated from summing the ACL and the ABC.

Table F-8
Generic EILs for Aged As, Fresh DDT and Fresh Naphthalene in Soils Irrespective of their Physicochemical Properties

(May 2013 NEPM Update - Table 1B (5))

	Ecological Investigation Levels (mg total contaminant/kg)		
CHEMICAL	**Areas of ecological significance**	**Urban residential and public open space[1]**	**Commercial and industrial**
Arsenic[2]	40	100	160
DDT[3]	3	180	640
Naphthalene[3]	10	170	370

Notes:

1. Urban residential/public open space is broadly equivalent to the HIL-A, HIL-B and HIL-C land use scenarios in Table 1A (1) Footnote 1 and as described in Schedule B7.
2. Aged values are applicable to arsenic contamination present in soil for at least two years. For fresh contamination refer to Schedule B5c.
3. Insufficient data was available to calculate aged values for DDT and naphthalene, consequently the values for fresh contamination should be used.
4. Insufficient data was available to calculate ACLs for As, DDT and naphthalene. The EIL should be taken directly from Table 1B (5).

Table F-9
ESLs for TPH Fractions F1 – F4, BTEX and Benzo(a)pyrene in Soil
(May 2013 NEPM Update - Table 1B (6))

CHEMICAL	Soil texture	ESLs (mg/kg dry soil)		
		Areas of ecological significance	Urban residential and public open space	Commercial and industrial
F1 C_6-C_{10}	*Coarse/ Fine*	125*	180*	215*
F2 >C_{10}-C_{16}		25*	120*	170*
F3 >C_{16}-C_{34}	*Coarse*	-	300	1700
	Fine	-	1300	2500
F4 >C_{34}-C_{40}	*Coarse*	-	2800	3300
	Fine	-	5600	6600
Benzene	*Coarse*	10	50	75
	Fine	10	65	95
Toluene	*Coarse*	10	85	135
	Fine	65	105	135
Ethylbenzene	*Coarse*	1.5	70	165
	Fine	40	125	185
Xylenes	*Coarse*	10	105	180
	Fine	1.6	45	95
Benzo(a)pyrene	*Coarse*	0.7	0.7	0.7
	Fine	0.7	0.7	0.7

Notes:

1. ESLs are of low reliability except where indicated by * which indicates that the ESL is of moderate reliability.
2. '-' indicates that insufficient data was available to derive a value.
3. To obtain F1, subtract the sum of BTEX concentrations from C_6-C_{10} fraction and subtract naphthalene from >C_{10}-C_{16} to obtain F2.

Table F-10
Management Limits for TPH fractions F1-F4 in Soil
(May 2013 NEPM Update - Table 1B (7))

TPH fraction	Soil texture	Management Limits[1] (mg/kg dry soil)	
		Residential, parkland and public open space	Commercial and industrial
F1[2] C_6- C_{10}	*Coarse*	700	700
	Fine	800	800
F2[2] >C_{10}-C_{16}	*Coarse*	1000	1000
	Fine	1000	1000
F3 >C_{16}-C_{34}	*Coarse*	2500	3500
	Fine	3500	5000
F4 >C_{34}-C_{40}	*Coarse*	10 000	10 000
	Fine	10 000	10 000

Notes:

1. Management limits are applied after consideration of relevant ESLs and HSLs
2. Separate management limits for BTEX and naphthalene are not available hence these should not be subtracted from the relevant fractions to obtain F1 and F2.

Table F-11 – NSW EPA Service Stations Guidelines

Table 3	Threshold concentrations for sensitive land use — soils	
Analytes	**Threshold concentrations [a] (mg/kg dry wt)**	**Sources**
TPH [b, c]: C6–C9	65	see note [d]
TPH[c]: C10–C40 (C10–C14, C15–C28, C29–C40)	1,000	see note [e]
Benzene	1 [f]	ANZECC /NHMRC 1992
Toluene	1.4 [g] / 130 [h]	Netherlands 1994
Ethyl benzene	3.1 [i] / 50 [j]	Netherlands 1994
Total Xylenes	14 [k] / 25 [j]	Netherlands 1994
Phenol	— [l]	— [l]
Total Lead	300	ANZECC /NHMRC 1992
Benzo(a)pyrene	1	ANZECC /NHMRC 1992
Total PAHs [m]	20	ANZECC /NHMRC 1992
NB. Scientifically justified alternative threshold concentrations may be acceptable. Thresholds may be reviewed as new scientific information becomes available.		

Explanatory notes for Table F-11:

(a) Refer to relevant source documents for details.

Definitions of terms used in discussion of Netherlands criteria (Denneman 1993) are:

- The maximum permissible concentration (MPC) is the 'concentration of a toxic substance that fully protects 95% of the species in an ecosystem'.
- The intervention level represents 'a level where action is needed because impermissible risks may occur. It depends on other than chemical characteristics if action should take place immediately or not'. In the case of ecological risk, the intervention level 'fully protects 50% of the species in an ecosystem'.

Further information regarding MPCs and intervention levels may be found in Denneman & van den Berg 1993.

The Netherlands sourced values in Table 2 refer to soil with 10% natural organic matter content. These threshold concentrations must be adjusted for the particular natural organic matter content of the specific site. The natural organic matter content in soil may be determined using the Walkley and Black Method, AS 1289.D1.1–1977, Determination of the Organic Matter Content of a Soil (Standard Method).

The threshold concentrations for ethyl benzene and xylenes to protect terrestrial organisms have been derived from aquatic toxicological data using equilibrium partitioning. Investigations have shown (Van Gestal & Ma 1993) that in the case of earthworms, toxicity is related to the pore water contaminant concentration. The LC50 pore water concentrations for several compounds have been favorably compared with LC50 aquatic toxicological data for fish.

The derivations of criteria adopted as threshold concentrations have not explicitly taken account of chemical mixtures.

The potential impact of mixtures of chemicals should be assessed on a site-specific basis.

The potential for the generation of odours may mean that lower thresholds than those listed in Table 2 are required for volatile compounds.

(b) Total petroleum hydrocarbons

(c) Approximate range of petroleum hydrocarbon fractions: petrol C6–C9, kerosene C10–C18, diesel C12–C18 and lubricating oils above C18.

(d) The TPH C6–C9 threshold concentration, i.e. 65 mg/kg, applies to soil containing 10% natural organic matter. This concentration has been calculated assuming the following:

- that there has been a fresh spill of petrol
- that the aromatic content of the petrol is 30%
- that the resultant BTEX soils concentrations are at their lower thresholds.

TPH C6–C9 concentrations above the relevant threshold may indicate that BTEX concentrations are above their thresholds. This threshold concentration should be interpreted as only an approximate potential indicator of contamination.

(e) The TPH C10–C40 threshold concentration is based on a consideration both of the Netherlands Intervention Level for the TPH C10–C40 range and on commonly reported analytical detection limits. The Netherlands intervention value is 5,000 mg/kg dry weight.

(f) A lower benzene threshold concentration may be needed to protect groundwater.

(g) The toluene threshold concentration is the Netherlands MPC to protect terrestrial organisms in soil. This value was obtained by applying a US EPA assessment factor to terrestrial chronic No Observed Effect Concentration (NOEC) data. The MPC is an 'indicative' value (Van de Plassche et al. 1993; Van de Plassche & Bockting 1993).

(h) Human health and ecologically based protection level for toluene. The threshold concentration presented here is the Netherlands intervention value for the protection of terrestrial organisms. Other considerations such as odours and the protection of groundwater may require a lower remediation criterion.

(i) The ethyl benzene threshold concentration is the Netherlands MPC for the protection of terrestrial organisms in soil. No terrestrial ecotoxicological data could be found for use in the Netherlands criteria derivation. Therefore, equilibrium partitioning has been applied to the MPC for water to obtain estimates of the MPC for soil. The MPC for water has been derived from aquatic ecotoxicological data (Van de Plassche et al. 1993; Van de Plassche & Bockting 1993).

(j) Human health-based protection level for ethyl benzene or total xylenes as shown. The threshold concentration presented here is the Netherlands intervention value. Other considerations such as odours and the protection of groundwater may require a lower remediation criterion

(k) The xylene threshold concentration is the Netherlands MPC for the protection of terrestrial organisms in soil. No terrestrial ecotoxicological data could be found for use in the Netherlands criteria derivation. Therefore, equilibrium partitioning has been applied to the MPC for water to obtain an estimate of the MPC for soil. The MPC for water has been derived from aquatic ecotoxicological data. The concentration shown applies to total xylenes and is based on the arithmetic average of the individual xylene MPCs (Van de Plassche et al. 1993; Van de Plassche & Bockting 1993).

(l) Phenol contamination is not expected to be significant at service station sites. Phenol has been included in the analyte list because it is a potential constituent of waste oil. The potential impact of phenol should be evaluated on a site-specific basis. Phenol may have a significant impact on waters.

Polycyclic aromatic hydrocarbons

APPENDIX G

Chain of Custody

NG Child & Associates

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Science and Engineering

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SAMPLES TO:

ENVIROLAB SERVICES
12 ASHLEY STREET
CHATSWOOD NSW 2067
PH 02 9910 6200

PROJECT: Warriewood Road Preliminary Site Investigation (Page 1 of 1)

	COLLECTION		SAMPLE DETAIL		ANALYSIS REQUIRED
SAMPLE No.	DATE	TIME	TYPE	QUANTITY	
WAR-1-SUR(A)	9/1/2020	9:15 am to 3:24 pm	Soil	1 x 500g bag	asbestos
WAR-1-SUR	9/1/2020		Soil	1 x 250g glass jar	Envirolab Combination 7
WAR-1-1000	9/1/2020		Soil	1 x 250g glass jar	Envirolab Combination 7
WAR-2-SUR(A)	9/1/2020		Soil	1 x 500g bag	asbestos
WAR-2-0500	9/1/2020		Soil	1 x 250g glass jar	Envirolab Combination 7
WAR-3-SUR(A)	9/1/2020		Soil	1 x 500g bag	asbestos
WAR-3-SUR	9/1/2020		Soil	1 x 250g glass jar	Envirolab Combination 7
WAR-3-1000	9/1/2020		Soil	1 x 250g glass jar	Envirolab Combination 7
WAR-3-1000(D)	9/1/2020		Soil	1 x 250g glass jar	Envirolab Combination 7
WAR-4-0500	9/1/2020		Soil	1 x 250g glass jar	Envirolab Combination 7
WAR-4-1000	9/1/2020		Soil	1 x 250g glass jar	Envirolab Combination 7
WAR-4-1500	9/1/2020		Soil	1 x 250g glass jar	Envirolab Combination 7
WAR-5-SUR	9/1/2020		Soil	1 x 250g glass jar	Envirolab Combination 7
WAR-5-1000	9/1/2020		Soil	1 x 250g glass jar	Envirolab Combination 7
WAR-5-1500	9/1/2020		Soil	1 x 250g glass jar	Envirolab Combination 7

COLLECTED BY: N Child	CHAIN OF CUSTODY INITIATED BY: N Child		DATE: 9/1/2020	TIME: 16:00 hrs
TO COURIER BY: N Child	DATE: 10/1/2020	TIME: 0830 hrs	RECEIVED BY:	
SUBMITTED TO LAB BY: Courier	DATE: 10/1/2020	TIME: 09:30 hrs	RECEIVED BY:	
ANALYSED BY:		CHECKED BY:		
REPORT BY:		APPROVED BY:		
REPORT TO NG CHILD & ASSOCIATES BY:		DATE:	TIME:	

APPENDIX H

Envirolab Laboratory Report

Envirolab Services Pty Ltd
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12 Ashley St Chatswood NSW 2067
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customerservice@envirolab.com.au
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CERTIFICATE OF ANALYSIS 233904

Client Details

Client	**NG** Child & Associates
Attention	Noel Child
Address	22 Britannia Road, CASTLE HILL, NSW, 2154

Sample Details

Your Reference	**45 Warriewood Road, Warriewood Site Investigation**
Number of Samples	15 Soils
Date samples received	9/1/2020
Date completed instructions received	9/1/2020

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	17/1/2020
Date of Issue	17/1/2020

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Results Approved By
Long Pham, Team Leader, Metals
Nick Sarlamis, Inorganics Supervisor
Steven Luong, Senior Chemist

Authorised By

Jacinta Hurst, Laboratory Manager

Envirolab Reference: 233904
Revision No: R00

Client Reference: 45 Warriewood Road Warriewood Site Investigation

vTRH(C6-C10)/BTEXN in Soil				
Our Reference	UNITS	233904-2	233904-3	233904-5
Your Reference		WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date extracted	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	96	98	100

Our Reference	UNITS	233904-7	233904-8	233904-
Your Reference		WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date extracted	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	99	99	97

Client Reference: 45 Warriewood Road Warriewood Site Investigation

vTRH(C6-C10)/BTEXN in Soil				
Our Reference	UNITS	233904-10	233904-11	233904-12
Your Reference		WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date extracted	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	101	100	98

Our Reference	UNITS	233904-13	233904-14	233904-15
Your Reference		WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date extracted	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	97	99	99

Client Reference: 45 Warriewood Road Warriewood Site Investigation

svTRH (C10-C40) in Soil				
Our Reference	UNITS	233904-2	233904-3	233904-5
Your Reference		WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date extracted	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50
Surrogate o-Terphenyl	%	93	90	92

Our Reference	UNITS	233904-7	233904-8	233904-9
Your Reference		WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date extracted	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50
Surrogate o-Terphenyl	%	93	93	91

Client Reference: 45 Warriewood Road Warriewood Site Investigation

svTRH (C10-C40) in Soil				
Our Reference	UNITS	233904-10	233904-11	233904-12
Your Reference		WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date extracted	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50
Surrogate o-Terphenyl	%	94	93	91

Our Reference	UNITS	233904-13	233904-14	233904-15
Your Reference		WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date extracted	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	190	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50
Surrogate o-Terphenyl	%	92	93	94

Client Reference: 45 Warriewood Road Warriewood Site Investigation

PAHs in Soil				
Our Reference		233904-2	233904-3	233904-5
Your Reference	UNITS	WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date extracted	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	89	87	90

Client Reference: 45 Warriewood Road Warriewood Site Investigation

PAHs in Soil				
Our Reference	UNITS	233904-7	233904-8	233904-9
Your Reference		WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date extracted	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	86	85	88

Client Reference: 45 Warriewood Road Warriewood Site Investigation

PAHs in Soil				
Our Reference	UNITS	233904-10	233904-11	233904-12
Your Reference		WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date extracted	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	89	87	90

Client Reference: 45 Warriewood Road Warriewood Site Investigation

PAHs in Soil				
Our Reference	UNITS	233904-13	233904-14	233904-15
Your Reference		WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date extracted	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	86	85	88

Client Reference: 45 Warriewood Road Warriewood Site Investigation

Acid Extractable metals in soil				
Our Reference	UNITS	233904-2	233904-3	233904-5
Your Reference		WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date prepared	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	16/1/2020	16/1/2020	16/1/2020
Arsenic	mg/kg	<4	5	7
Cadmium	mg/kg	<0.4	<0.4	<0.4
Chromium	mg/kg	7	9	8
Copper	mg/kg	9	8	14
Lead	mg/kg	23	10	16
Mercury	mg/kg	<0.1	<0.1	<0.1
Nickel	mg/kg	4	3	<3
Zinc	mg/kg	27	16	31

Our Reference	UNITS	233904-7	233904-8	233904-9
Your Reference		WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date prepared	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	16/1/2020	16/1/2020	16/1/2020
Arsenic	mg/kg	8	9	9
Cadmium	mg/kg	<0.4	<0.4	<0.4
Chromium	mg/kg	10	9	8
Copper	mg/kg	15	12	12
Lead	mg/kg	18	14	13
Mercury	mg/kg	<0.1	<0.1	<0.1
Nickel	mg/kg	5	4	4
Zinc	mg/kg	36	24	23

Client Reference: 45 Warriewood Road Warriewood Site Investigation

Acid Extractable metals in soil				
Our Reference	UNITS	233904-10	233904-11	233904-12
Your Reference		WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date prepared	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	16/1/2020	16/1/2020	16/1/2020
Arsenic	mg/kg	7	6	4
Cadmium	mg/kg	<0.4	<0.4	<0.4
Chromium	mg/kg	6	7	6
Copper	mg/kg	10	9	8
Lead	mg/kg	11	9	10
Mercury	mg/kg	<0.1	<0.1	<0.1
Nickel	mg/kg	5	3	<3
Zinc	mg/kg	21	16	14

Our Reference	UNITS	233904-13	233904-14	233904-15
Your Reference		WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date prepared	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	16/1/2020	16/1/2020	16/1/2020
Arsenic	mg/kg	5	4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4
Chromium	mg/kg	5	4	6
Copper	mg/kg	10	7	6
Lead	mg/kg	11	9	10
Mercury	mg/kg	<0.1	<0.1	<0.1
Nickel	mg/kg	4	<3	<3
Zinc	mg/kg	19	14	13

Client Reference: 45 Warriewood Road Warriewood Site Investigation

Misc Soil - Inorg					
Our Reference	UNITS	233904-2	233904-3	233904-5	233904-7
Your Reference		WAR	WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	16/1/2020	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	16/1/2020	16/1/2020	16/1/2020	16/1/2020
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5
Our Reference	UNITS	233904-8	233904-9	233904-10	233904-11
Your Reference		WAR	WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	16/1/2020	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	16/1/2020	16/1/2020	16/1/2020	16/1/2020
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5
Our Reference	UNITS	233904-12	233904-13	233904-14	233904-15
Your Reference		WAR	WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	16/1/2020	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	16/1/2020	16/1/2020	16/1/2020	16/1/2020
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5

Client Reference: 45 Warriewood Road Warriewood Site Investigation

Organochlorine Pesticides in soil					
Our Reference	UNITS	233904-2	233904-3	233904-5	233904-7
Your Reference		WAR	WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	17/1/2020	17/1/2020	17/1/2020	17/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020	17/1/2020
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
beta-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
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	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
Surrogate TCLMX	%	101	99	98	100

Client Reference: 45 Warriewood Road Warriewood Site Investigation

Organochlorine Pesticides in soil					
Our Reference	UNITS	233904-8	233904-9	233904-10	233904-11
Your Reference		WAR	WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	17/1/2020	17/1/2020	17/1/2020	17/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020	17/1/2020
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
beta-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
HeptachlorEpoxide	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
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1
EndosulfanII	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1
EndosulfanSulphate	mg/kg	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	99	97	99	102

Client Reference: 45 Warriewood Road Warriewood Site Investigation

Organochlorine Pesticides in soil					
Our Reference	UNITS	233904-12	233904-13	233904-14	233904-15
Your Reference		WAR	WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	17/1/2020	17/1/2020	17/1/2020	17/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020	17/1/2020
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
beta-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
HeptachlorEpoxide	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
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1
EndosulfanII	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1
EndosulfanSulphate	mg/kg	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCLMX	%	99	101	100	97

Client Reference: 45 Warriewood Road Warriewood Site Investigation

Organophosphorus Pesticides in soil					
Our Reference	UNITS	233904-2	233904-3	233904-5	233904-7
Your Reference		WAR	WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	17/1/2020	17/1/2020	17/1/2020	17/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020	17/1/2020
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1
Dimethoate	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
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1
Fenitrothion	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
Surrogate TCLMX	%	99	97	99	96

Our Reference	UNITS	233904-8	233904-9	233904-10	233904-11
Your Reference		WAR	WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	17/1/2020	17/1/2020	17/1/2020	17/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020	17/1/2020
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1
Dimethoate	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
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1
Fenitrothion	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
Surrogate TCLMX	%	97	98	96	100

Client Reference: 45 Warriewood Road Warriewood Site Investigation

Organophosphorus Pesticides in soil					
Our Reference		233904-12	233904-13	233904-14	233904-15
Your Reference	UNITS	WAR	WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	17/1/2020	17/1/2020	17/1/2020	17/1/2020
Date analysed	-	17/1/2020	17/1/2020	17/1/2020	17/1/2020
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1
Dimethoate	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
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1
Fenitrothion	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
Surrogate TCLMX	%	100	96	96	99

Client Reference: 45 Warriewood Road Warriewood Site Investigation

Moisture				
Our Reference		233904-2	233904-3	233904-5
Your Reference	UNITS	WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	06/12/2019
Type of sample		Soil	Soil	Soil
Date prepared	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	16/1/2020	16/1/2020	16/1/2020
Moisture	%	3.7	3.8	4.3

Our Reference		233904-7	233904-8	233904-9
Your Reference	UNITS	WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date prepared	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	16/1/2020	16/1/2020	16/1/2020
Moisture	%	4.1	4.4	5.2

Our Reference		233904-10	233904-11	233904-12
Your Reference	UNITS	WAR	WAR	WAR
Date Sampled		9/1/2020	9/1/2020	9/1/2020
Type of sample		Soil	Soil	Soil
Date prepared	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	16/1/2020	16/1/2020	16/1/2020
Moisture	%	5.2	5.4	4.6

Our Reference		233904-13	233904-14	233904-15
Your Reference	UNITS	WAR	WAR	WAR
Date Sampled		9/1/2020	0/12/2019	9/1/2020
Type of sample		Soil	Soil	Soil
Date prepared	-	16/1/2020	16/1/2020	16/1/2020
Date analysed	-	16/1/2020	16/1/2020	16/1/2020
Moisture	%	4.8	5.4	5.1

Client Reference: 45 Warriewood Road Warriewood Site Investigation

Asbestos ID - soils				
Our Reference	UNITS	233904-2	233904-6	233904-12
Your Reference		KIN-1-SUR(A)	KIN-2-SUR(A)	KIN-3-SUR(A)
Date Sampled		9/1/2020	9/1/2020	06/12/2019
Type of sample		Soil	Soil	Soil
Date analysed	-	9/1/2020	9/1/2020	9/1/2020
Sample mass tested	g	Approx. 500g	Approx. 500g	Approx. 500g
Sample Description	-	Brown fine-grained soil	Brown fine-grained soil	Brown fine-grained soil
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg No organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg No organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg No organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected

Client Reference: 45 Warriewood Road Warriewood Site Investigation

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.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
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).
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-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-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.

Client Reference: 45 Warriewood Road Warriewood Site Investigation

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date extracted	-			16/1/2020	[NT]	[NT]	[NT]	[NT]	16/1/2020	[NT]
Date analysed	-			17/1/2020	[NT]	[NT]	[NT]	[NT]	17/1/2020	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	89	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	89	[NT]
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	[NT]	[NT]	82	[NT]
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	[NT]	[NT]	83	[NT]
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	86	[NT]
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	97	[NT]
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	85	[NT]
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	95	[NT]	[NT]	[NT]	[NT]	90	[NT]

Client Reference: 45 Warriewood Road Warriewood Site Investigation

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date extracted	-			16/1/2020	[NT]	[NT]	[NT]	[NT]	16/1/2020	[NT]
Date analysed	-			17/1/2020	[NT]	[NT]	[NT]	[NT]	17/1/2020	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	112	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	92	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	112	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	92	[NT]
Surrogate o-Terphenyl	%		Org-003	89	[NT]	[NT]	[NT]	[NT]	94	[NT]

Client Reference: 45 Warriewood Road Warriewood Site Investigation

QUALITY CONTROL: PAHs in Soil						Duplicate Spike Recovery %				
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date extracted	-			16/1/2020	[NT]	[NT]	[NT]	[NT]	16/1/2020	[NT]
Date analysed	-			17/1/2020	[NT]	[NT]	[NT]	[NT]	17/1/2020	[NT]
Naphthalene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	87	[NT]
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	90	[NT]
Phenanthrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	90	[NT]
Anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	113	[NT]
Pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	130	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	76	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	[NT]	[NT]	[NT]	[NT]	93	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	86	[NT]	[NT]	[NT]	[NT]	114	[NT]

Client Reference: 45 Warriewood Road Warriewood Site Investigation

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date prepared	-			16/1/2020	[NT]	[NT]	[NT]	[NT]	16/1/2020	[NT]
Date analysed	-			17/1/2020	[NT]	[NT]	[NT]	[NT]	17/1/2020	[NT]
Arsenic	mg/kg	4	Metals-020	<4	[NT]	[NT]	[NT]	[NT]	113	[NT]
Cadmium	mg/kg	0.4	Metals-020	<0.4	[NT]	[NT]	[NT]	[NT]	105	[NT]
Chromium	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	110	[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]	106	[NT]
Mercury	mg/kg	0.1	Metals-021	<0.1	[NT]	[NT]	[NT]	[NT]	108	[NT]
Nickel	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Zinc	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	109	[NT]

Client Reference: 45 Warriewood Road Warriewood Site Investigation

QUALITY CONTROL: Misc Soil - Inorg						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	233904-2
Date prepared	-			16/1/2020	1	16/1/2020	16/1/2020		16/1/2020	16/1/2020
Date analysed	-			17/1/2020	1	17/1/2020	17/1/2020		17/1/2020	17/1/2020
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	1	<5	<5	0	101	107

Client Reference: 45 Warriewood Road Warriewood Site Investigation

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.

Client Reference: 23 King Street Site Investigation

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: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-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.

APPENDIX I

Noel Child
Summary of Qualifications, Capability & Experience

1 PERSONAL DETAILS

Full Name: Noel George CHILD
Profession: Consultant in Environmental Assessment and Management
Date of Birth: 6th December 1946
Nationality: Australian
Experience: > 30 Years
Address: 22 Britannia Road, Castle Hill, NSW, 2154
Contact: **Phone**: 61 2 9899 1968 **Fax**: 61 2 9899 1797 **Mobile:** 0409 393024

2 CAPABILITY AND EXPERIENCE - SHORT SUMMARY

Noel Child is a successful and experienced commercial and technical professional with over 30 years' experience in a variety of senior level appointments and assignments, within both the corporate and private sectors, with a particular focus on strategic, infrastructure and environmental applications.

Noel's experience includes senior management at both the State and National levels in the Australian petroleum industry, and a number of senior consultancies for both government and corporate clients. His record reflects the ability to develop and achieve positive commercial outcomes through effective planning and communication; critical and objective analysis; and quality task completion and delivery at both the personal and team level.

His management responsibilities have included transport, environmental, safety, and general operational activities at a national level, while his formal professional training includes strategic management, environmental, engineering and business disciplines. He has undertaken a number of senior corporate appointments with distinction and been successfully involved in the ownership and operation of a major petroleum distribution and marketing company in regional Australia. More recently, working through his own businesses Environment Australia and NG Child & Associates, he has applied his knowledge and experience in the areas of strategic management, infrastructure development, energy and the environment on a consultancy and contractual basis to a number of private and public-sector clients, both nationally and internationally.

Noel has had post-graduate training in several technical and commercial disciplines, and provides specialised teaching input, by invitation, to post graduate engineering and business management courses conducted by the Faculties of Business and Engineering at Sydney's University of Technology. He has strong affiliations with a number of international corporations and agencies and has worked closely with both the regulators and the regulated in a number of aspects of environmental management, assessment and performance. He has also been recognised as an independent expert on engineering, and environmental issues by the Land and Environment Court of NSW.

Noel has a detailed understanding of environmental engineering and associated processes and has specific experience and expertise in the fields of acoustics, air quality, electromagnetic field assessment, electrolysis and stray current assessment, contaminated site assessment, and liquid and solid waste management. He also provides post graduate teaching input on environmental engineering issues to post graduate courses at the University of Technology, Sydney, and La Trobe and Monash Universities in Melbourne.

3 EDUCATION, QUALIFICATIONS AND AFFILIATIONS

BE, PhD (Chemical Engineering), UNSW, Sydney
Master of Business Studies, University of New South Wales, Sydney
B.Sc. (Hons) Applied Chemistry (Environmental), University of Technology, Sydney
Graduate Diploma (Environmental Engineering and Management), UNSW, Sydney
Qualified Environmental Auditor, Standards Australia
Member, Royal Australian Chemical Institute, 1972/2019
Member, Institution of Engineers, Australia, 1972/2019
Member, Clean Air Society of Australia and New Zealand, 1992/2019
Member, Australian Natural Gas Vehicle Council, 1996/2004
Executive Director, Australasian Natural Gas Vehicles Council, 2003/2004
Visiting Fellow, Institute for Sustainable Futures, UTS, 1995/2002
Research Fellow, Faculty of Civil & Environmental Engineering, UTS, 1996/2019
Research Associate, New York Academy of Sciences, 2000/2019

4 RECENT ASSIGNMENTS & EXPERIENCE

Kaunitz Yeung Architecture (2016) – Electromagnetic field and air quality assessments of a child care centre development project at 60 Dickson Avenue Artarmon NSW.

Australian Consulting Architects (Current) – Electromagnetic, stray current and electrolysis assessments of development projects a Field Place Telopea; Windsor Road Vineyard; Camden Valley way Horningsea Park and others.

Futurespace/Renascent (Current) – Environmental assessment of proposed child care centre development at Waterloo Road Macquarie park and Cleveland Street Strawberry Hills, including general environmental, acoustic assessment, air quality and electromagnetic field assessment.

Thyssen Transrapid Australia (Current) – Adviser on technical and operational issues associated with the development and construction of a high-speed magnetic levitation train systems within the People's Republic of China, and elsewhere, including electrolysis, electromagnetic and stray field effects.

Trumen Corporation (Current) – Environmental assessment, including acoustic and contamination assessment and certification, of mixed use and child care centre development projects at Waine Street Freshwater, Fitzroy Street Marrickville, and at Huntley Street Alexandria, NSW.

Commonwealth Bank (Current) – Environmental assessment, including general, acoustic, air quality, electromagnetic field and wind impact assessment, of a new child care centre development to be located on Level 2 of Darling Park Power 2, Sussex Street, Sydney.

First Impressions Property – Environmental assessment of a proposed child care centre at Ralph Street Alexandria NSW, including Preliminary (Stage 1) Site Contamination Assessment, and Electromagnetic Field Assessment.

LEDA Holdings – Environmental Assessment of a proposed child care centre at 32 Cawarra Road Caringbah NSW, including general environmental, acoustic, air quality and electromagnetic field assessments.

Universal Property Group (Current) – Environmental assessment of a proposed multi building, multi-level residential development at Garfield Street, Wentworthville NSW, including general environmental, site and soil contamination and preliminary geotechnical assessments.

McCormack (Current) – Stage 2, 3 and 4 Environmental Site Assessment of 7,9 & 11 Bayard Street, Mortlake, NSW as part of the process of assessing the site for medium density residential development and obtaining a site audit statement confirming the suitability of the site for this purpose. Work inclusive of the assessment of all relevant environmental impacts.

Gundagai Meat Processors (Current) – Review and enhancement of solid and liquid waste processing and management systems at GMP's Gundagai abattoir, including the on-site treatment of waste streams from meat processing and other operations.

Campbelltown City Council (Current) – Peer review of acoustic assessments submitted to Campbelltown City Council regarding assessment of the acoustic impacts of developments including a major truck maintenance facility and the expansion of Macarthur Square shopping centre, including the conduct of noise measurements.

Brenchley Architects (2009 - Current) – Acoustic assessments of proposed residential and commercial developments at Elizabeth Street Sydney; Spit Road Mosman, Botany Road Waterloo, Cranbrook Street, Botany and Bellevue Hill Road, Bellevue Hill NSW.

BJB Design (2009 - Current) – Acoustic, air quality and odour assessments of residential and commercial developments at Botany Road, Botany and Cranbrook Street Botany.

Bovis Lend Lease (Current) – Environmental assessment of a major development site at Darling Walk, Darling Harbour NSW, including a detailed review of air quality, electromagnetic field and acoustic issues for review by the NSW Department of Planning.

Penrith City Council (2012/13) – Preparation of the Penrith City Council response to the NSW Government Long Term Transport Plan, including consideration of transport and associated environmental issues affecting the Penrith Local Government Area.

Harry Azoulay & Michael Bell Architects (2012) – Assessment of the environmental impacts on and from a proposed child care and early learning centre at Chatswood, NSW. Assessments lodged with and adopted by Willoughby City Council.

Wollondilly Shire Council (2012) – Preliminary environmental assessment and review of the development of a second Sydney airport at Wilton, including a preliminary assessment of acoustic impacts.

White Horse Coffee (2011) – Air quality and odour assessment regarding a boutique coffee roasting and drying operation at 7/3-11 Flora Street, Kirrawee, and NSW.

Sydney Skips & Galaxy Waste (Current) – Environmental assessment of a proposed waste recycling facility to be located on a potentially contaminated site at Stephen Road, Botany, NSW, including a detailed review of all relevant engineering and environmental issues, and the preparation of relevant documentation including assessment reports for review by Botany City Council.

Michael Bell Architects & Clients (2004 to Current) – Assessment of the environmental impacts, including acoustic impacts, associated with various child care centre applications in suburban Sydney, and the Sydney CBD, including the development of plans for the management and control of such impacts.

ABC Learning Centres Pty Ltd (2005 - Current) – Provision of professional services re the environmental assessment of prospective child care centre developments, including issues relating to acoustics, air quality, odour, soil, and groundwater contamination.

NSW Roads & Traffic Authority (2004 to Current) – Review of international technologies, systems & applications in relation to the treatment of motor vehicle exhaust emissions and associated air pollution within and discharged from road tunnels, in accordance with the conditions of approval for the M5 East Motorway

Federal Airports Corporation (1995/1996) – Preliminary environmental and ground transport studies for the proposed Sydney West Airport, including consideration of all relevant environmental issues.

Isuzu-GM (2003 to Current) – Representations to Environment Australia and the Department of Transport and regional Services regarding the emission performance standards of Japanese sourced medium and heavy natural gas trucks, with the aim of having the current Japanese emission standard accepted within the Australian design Rule 80 series of vehicle emission standards.

City of Sydney (2005 - 2007) – Assessment of air quality and odour issues associated with a proposed redevelopment of craft studios and associated facilities at Fox Studios, Moore Park, Sydney, and review of air quality monitoring stations in the Sydney CBD area, in part as a basis for monitoring the air quality and potential health cost impacts of transport congestion and modes.

Warren Centre for Advanced Engineering, University of Sydney (2000 to 2003) – Contribution to the report "Sustainable Transport for Sustainable Cities", a major government and private enterprise funded study into the future sustainability of transport in Sydney and adjoining regions, including in particular a review of associated environmental issues. Study received the 2003 Bradfield Award for Engineering Excellence from the Australian Institute of Engineers.

United Kingdom Department of the Environment (1994) – Contribution to the development of revised environmental guidelines for air, soil and groundwater water quality.

United States Environmental Protection Agency (1994) - Contribution to an international team developing strategies for the control and management of air pollution in seven major US cities.

5 CORPORATE EXPERIENCE

NG Child & Associates

- **1992--Present**, Managing Principal - Responsible for all aspects of the conduct of a private engineering and environmental consultancy, including administration, marketing, team coordination and technical and professional delivery.

Western Fuel Distributions Pty Limited, Australia

- **1984-92** Managing Principal. - Responsible for all aspects of the management and development of one of the largest private petroleum distributorships then operating in Australia, with a peak annual sales volume of 70 million litres, turnover of $30 million per annum, a direct staff of thirty, and a network of some 40 retail and wholesale agency outlets. This position included direct personal accountability for all aspects of storage, distribution and environmental performance.

Caltex Oil Australia Limited

- **1982-84** General Manager, Marketing and Operations. Responsible for the management and operation of Caltex Australia's marketing, storage, warehousing, distribution, environmental and safety functions, including seaboard terminal and marine operations.
- **1980-82** National Consumer Marketing Manager. Responsible for Caltex Australia's national consumer, industrial and distributor marketing activities.

Golden Fleece Petroleum Limited

- **1977 - 1980** Manager Operations, NSW. Responsible for the overall management of the distribution, warehousing, seaboard terminal and lubricant production activities of Golden Fleece Petroleum in New South Wales, including environmental, occupational health and safety matters.

Esso Australia Limited

- **1976-77** SA Manager, Marketing and Operations. Responsible for all aspects of the management of Esso's petroleum, lubricant and LPG storage, distribution and marketing throughout South Australia.
- **1975-76** Refinery Manager. Responsible for all engineering, operational and environmental aspects of the joint Esso/Mobil refinery at Port Stanvac in South Australia.
- **1975** Manager, Process Operations, Port Dixon Refinery, Malaysia. Six-month special assignment at the Esso Petroleum Refinery, Port Dixon, Malaysia.
- **1971-75** Senior Analyst, Logistics and Corporate Strategy Departments, Esso Sydney Head office.

6 SOME REPORTS & PUBLICATIONS

- **High Speed Rail – Benefits for the Nation,** Keynote address at the UNSW Institute of Environmental and Urban Studies International High-Speed Rail Seminar, August 2013.
- **High Speed Trains in Australia: Connecting Cities and Energising Regions**; with the Hon Peter Nixon AO, October 2010.
- **Sydney's High Residential Growth Areas: Averting the Risk of a Transportation Underclass**, World Transport & Environmental Forum, Reims France, June 2006.
- **The M5 East Road Tunnel: Implications for Ventilation, Air Quality and Emission Treatment Systems**, International Road Transport and Tunneling Forum, Graz Austria, May 2006.
- **Transport Fuels in Australia: The Folly of Australia's Increasing Reliance on Imported Crude Oil**, Submission to the Australian Senate Rural and Regional Affairs and Transport Committee Inquiry into Australia's Future Oil Supply and Alternative Transport Fuels, February 2006.
- **The Japan 2003 CNG Emission Standard & the Emission Performance of the Isuzu 4HF-1-CNG: The Case for Acceptance under ADR80**. Submission on behalf of Isuzu GM Australia to the Commonwealth Department of Transport and Regional Services, June 2004.
- **M5 East Freeway: A Review of Emission Treatment Technologies, Systems and Applications**, NSW RTA and NSW Department of Planning, April 2004.
- **Future Directions: Challenges & Opportunities in the Australian CNG Vehicle Industry**, ANGVC, December 2002
- **High Speed Rail in Australia: Beyond 2000** (with the Hon Peter Nixon), November 2000
- **Review of Options for the Treatment or "Filtration" of Tunnel Gases and Stack Emissions**, City of Sydney. January 2003
- **A Comparative Analysis of Energy and Greenhouse Performance: Austrans Ultras Light Rail System**, Bishop Austrans Limited, January 2003
- **Engineering and Environmental Aspects of Enclosing the Cahill Expressway Cutting**, City of Sydney, May 2001.
- **M5 East Motorway: Proposed Single Emission Stack at Turrella – Review of Air Quality Impacts and Consideration of Alternative Strategies**, Canterbury City Council, February 1999

7 PERSONAL & PROFESSIONAL REFERENCES

- The Hon Peter Nixon AO, Former Federal Transport Minister
- John Black, Professor Emeritus of Civil & Transport Engineering, University of NSW
- Mr Stephen Lye, Development Manager, Trumen Corporation, Sydney.
- Mr Peter Han, Project Director, Commonwealth Bank, Sydney
- Mr Michael Bell, Principal, Michael Bell Architects, Sydney.
- Mr Barry Babikian, Brenchley Architects
- Mr Luke Johnson, Assistant General Manager, Wollondilly Shire Council
- Mr Bernie Clark, Chief Executive, Thyssen Australia
- Mr Alan Ezzy, Former Chairperson, NSW Flood Mitigation Authority.
- Professor Vigid Vigneswaran, Faculty of Civil & Environmental Engineering, University of Technology, Sydney.
- Mr Merv Ismay, General Manager, Holroyd City Council, Sydney NSW
- Dr Jack Mundey, Past Chairman Historic Houses Trust, Environmentalist
- Alex Mitchell, Journalist

Noel G Child
28 February 2020

ATTACHMENT A
Client Reference List

Acre Woods Childcare Pty Ltd
Australian Commonwealth Environmental Protection Agency
Australian Consulting Architects
Australian Federal Airports Corporation
Australian Federal Department of Transport and Regional Development
Bovis Lend Lease
Brenchley Architects
Campbelltown City Council
Canterbury City Council, Sydney, NSW
Commonwealth Banking Corporation
Environment Protection Authority of NSW
Exxon Chemical
Fairfield City Council, Sydney, NSW
First Impressions Property
FreightCorp, Sydney, NSW
Futurespace
GM - Isuzu
Guangxi Environment Protection Bureau
Gundagai Meat Processors
Hong Kong Department of the Environment
Hornsby and Ku-ring-gai Councils, Sydney, NSW
John McCormack
Kaunitz Yeung Architecture
LEDA Holdings
Michael Bell Architects
Minter Ellison
Mobil Oil Australia Associated
NSW Roads & Traffic Authority
Ove Arup & Partners
Qantas Airways
Queensland Ports Corporation
Renascent
Salibeau Pty Ltd
Shell Australia
Sinclair Knight Merz
Skouras and Mabrokardatos
Southern Sydney Regional Organisation of Councils (SSROC)
State Rail Authority of NSW
Stephen Davidson Property Investments
Sydney Skips & Galaxy Waste
The City of Sydney
The Western Sydney Alliance of Mayors
Thyssen Krup Transrapid Australia
Tom Howard QC
Trumen Corporation
UK Department of the Environment
United States Environment Protection Agency
University of Technology, Sydney
Warren Centre for Advanced Engineering, University of Sydney
Waverley Council, Sydney, NSW
Western Sydney Parklands Trust
Wollondilly Shire Council