REPORT TO

KINCOPPAL-ROSE BAY SCHOOL

ON

REMEDIATION ACTION PLAN

FOR

PROPOSED DEVELOPMENT AT KINCOPPAL-ROSE BAY SCHOOL

AT

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

Date: 14 May 2021
Ref: E32915BArpt-RAP Rev1

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Executive Summary

Mr. Terry Mahady of Mahady Management on behalf of Kincoppal-Rose Bay, School of the Sacred Heart (KRB) ('the client') commissioned JK Environments (JKE) to prepare a Remediation Action Plan (RAP) for the proposed development at KRB situated on the corner of New South Head Road and Vaucluse Road, Vaucluse, NSW. The site location is shown on Figure 1 and the RAP applies to the proposed development areas within the wider property boundary as shown on Figure 2 (Appendix A).

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

A Preliminary Site Investigation (PSI) was previously undertaken at the site by JKE and the results are presented in a separate report with summary and key information included in this document. Due to site access constraints, the data gaps identified in the PSI have been included in the scope of works for the Data Gap Investigation (DGI) outlined in Section 4 of this RAP. Any additional information that may come to light during the DGI which may change the remediation strategy should be documented in a Remediation Works Plan (RWP) prior to the commencement of development works.

The JKE PSI identified asbestos, polycyclic aromatic hydrocarbons (PAHs), total recoverable hydrocarbons (TRHs) and heavy metals contamination in soil within areas of proposed development works (see Figure 3 in Appendix A). The source of contamination was identified as the fill material historically imported onto site. The contaminants requiring remediation include: lead and Carcinogenic PAHs contamination hotspots as well as asbestos in the northern part of the site where the new ELC building is proposed and in the southern part of the site area where the new bus/carpark is proposed which poses a human health risk, and TRH F3 identified also in northern and southern parts of the site which poses a risk to ecological receptors. Some of the TRH F3 exceedances where co-located with lead and Carcinogenic PAHs requiring remediation due to the potential risk to human health. The extent of soil impacted by the contaminants has not been confirmed and constitutes a data gap to be addressed as part of the remediation.

The JKE PSI also identified deep filling in the north-west section of the site associated with historical landuse. The filling appears to be uncontrolled and has the potential to generate hazardous ground gas (HGG). This has been identified as a data gap in Section 4. Based on the results of the DGI, the presence of HGG will require gas protection measures which may impact the design of the proposed development.

The goal of the remediation is to render the site suitable for the proposed development from a contamination viewpoint. The primary aim of the remediation at the site is to reduce the human health and environmental risks posed by the site contamination to an acceptable level. The RAP includes a methodology to remediate and validate the site. A contingency plan for remediation is included together with site management procedures and an unexpected finds protocol to be implemented during remediation.

The remediation objectives are to:

- Summarise previous investigations and historical contamination data;
- Provide a methodology to gather additional data including HGG from the areas where sampling did not occur during the JKE PSI and to increase the general sample density to ascertain the extent of the remediation required;
- Provide a methodology to remediate and validate soil contamination at the site;
- Provide a contingency plan and unexpected finds protocol for the remediation works; and
- Outline site management procedures to be implemented during remediation.

Identified data gaps, presented in this RAP, are to be addressed through data gap investigation program which is to be completed prior to site remediation taking place, with the additional data to be utilised to ascertain the specific details pertaining to remedial works via a Remedial Works Plan (RWP). Existing data gaps will also be addressed as part of the RAP protocols and waste classification assessment for off-site disposal of excavated material as part of the development.

The remediation of impacted soil includes the excavation and off-site disposal of contaminated fill associated with the proposed development works. If required, capping is to be provided for contaminated material to be left in-situ, which will require management via a long-term environmental management plan (LTEMP).

JKE are of the opinion that the site can be made suitable for the proposed development provided this RAP and any subsequent RWP are implemented accordingly. A site validation report and if required, a LTEMP should be prepared on completion of remediation activities and should be submitted to the consent authority.

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

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Attachments

Abbreviations

Asbestos Fines/Fibrous Asbestos	**AF/FA**
Ambient Background Concentrations	**ABC**
Added Contaminant Limits	**ACL**
Asbestos Containing Material	**ACM**
Area of Environmental Concern	**AEC**
Australian Height Datum	**AHD**
Acid Sulfate Soil	**ASS**
Below Ground Level	**BGL**
Benzo(a)pyrene Toxicity Equivalent Factor	**BaP TEQ**
Bureau of Meteorology	**BOM**
Benzene, Toluene, Ethylbenzene, Xylene	**BTEX**
Cation Exchange Capacity	**CEC**
Contaminated Land Management	**CLM**
Chain of Custody	**COC**
Conceptual Site Model	**CSM**
Development Application	**DA**
Data Quality Indicator	**DQI**
Data Quality Objective	**DQO**
Ecological Investigation Level	**EIL**
Environmental Investigation Services	**EIS**
Ecological Screening Level	**ESL**
Environmental Management Plan	**EMP**
Excavated Natural Material	**ENM**
Environment Protection Authority	**EPA**
Environment Protection Licence	**EPL**
Environmental Site Assessment	**ESA**
Ecological Screening Level	**ESL**
Excavated Natural Material	**ENM**
Health Investigation Level	**HILs**
Health Screening Level	**HSL**
JK Environments	**JKE**
Long Term EMP	**LTEMP**
Map Grid of Australia	**MGA**
National Association of Testing Authorities	**NATA**
National Environmental Protection Measure	**NEPM**
Organochlorine Pesticides	**OCP**
Organophosphate Pesticides	**OPP**
Polycyclic Aromatic Hydrocarbons	**PAH**
Polychlorinated Biphenyls	**PCBs**
Per-and Polyfluoroalkyl Substances	**PFAS**
Photo-ionisation Detector	**PID**
Protection of the Environment Operations	**POEO**
Practical Quantitation Limit	**PQL**
Quality Assurance	**QA**
Quality Control	**QC**
Remediation Action Plan	**RAP**
Review of Environmental Factors	**REF**
Relative Percentage Difference	**RPD**
Remedial Works Plan	**RWP**
Site Assessment Criteria	**SAC**
Sampling, Analysis and Quality Plan	**SAQP**
Source, Pathway, Receptor	**SPR**
Standing Water Level	**SWL**

Total Recoverable Hydrocarbons	**TRH**
Upper Confidence Limit	**UCL**
United States Environmental Protection Agency	**USEPA**
Underground Storage Tank	**UST**
Validation Assessment Criteria	**VAC**
Virgin Excavated Natural Material	**VENM**
Work Health and Safety	**WHS**

Units

Litres	**L**
Metres BGL	**mBGL**
Metres	**m**
Millilitres	**ml or mL**
Milligrams per Kilogram	**mg/kg**
Percentage	**%**
Percentage weight for weight	**%w/w**

1 INTRODUCTION

Mr. Terry Mahady of Mahady Management on behalf of Kincoppal-Rose Bay, School of the Sacred Heart (KRB) ('the client') commissioned JK Environments (JKE) to prepare a Remediation Action Plan (RAP) for the proposed development at KRB situated on the corner of New South Head Road and Vaucluse Road, Vaucluse, NSW. The site location is shown on Figure 1 and the RAP applies to the proposed development areas within the wider property boundary as shown on Figure 2 (Appendix A).

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

JKE have previously undertaken a Preliminary (Stage 1) Site Investigation (PSI) at the site (JKE Ref: E32915BArpt-Rev1, dated 14 March 2021)[1]. Information from the PSI is presented throughout this report (where relevant) and a summary of the findings is included in Section 2. Due to site access constraints, the data gaps identified in the PSI have been included in the scope of works for the Data Gap Investigation (DGI) outlined in Section 4 of this RAP. Any additional information that may come to light during the DGI which may change the remediation strategy should be documented in a Remediation Works Plan (RWP) prior to the commencement of development works.

The JKE PSI also identified deep filling in the north-west section of the site associated with historical landuse. The filling appears to be uncontrolled and has the potential to generate hazardous ground gas (HGG). This has been identified as a data gap in Section 4. Based on the results of the DGI, the presence of HGG will require gas protection measures which may impact the design of the proposed development.

The RAP includes a methodology to remediate and validate the impacted soil at the site. A contingency plan for remediation is included together with site management procedures and an unexpected finds protocol to be implemented during remediation.

1.1 Proposed Development Details

The proposed development includes the following:

- Construction of a new one and two-storey Early Learning Centre (ELC) building in the north-western part of the wider site. Excavation to a maximum depth of approximately 4m below ground level (BGL) will be required within the north-eastern portion of the proposed ELC building development;
- Construction of a new elevated walkway and an entry road off Vaucluse Road in central and northern parts of the wider site area. The entry road is proposed to be connected to the existing concrete driveway in the area which will be widened to accommodate a new "drop-off" zone. It is assumed that the proposed new roadways will be at, or close to, existing surface levels with anticipated soil disturbances limited to shallow depths of up to 1mBGL; and
- A new bus parking area underlain by a basement parking level is proposed in the south-eastern corner of the wider site. A driveway area and vehicle ramp are proposed off the south-western corner of the basement. Excavation to a maximum depth of approximately 6mBGL will be required along the

[1] JKE, (2021). Report to Kincoppal-Rose Bay School on Preliminary (Stage 1) Site Investigation for Proposed Development at Kincoppal-Rose Bay School at Corner New South Head Road and Vaucluse Road, Vaucluse, NSW (referred to as the 'PSI').

northern side of the proposed basement. A reconfigured on-grade car parking area have also been proposed to the west of the future basement area, with the southern extent of the car parking partially suspended over an existing heritage sandstone block retaining wall.

Outlines of the proposed ELC building, bus parking area with basement and elevated walkway and road are shown on the attached Figure 2.

1.2 Remediation Goal, Aims and Objectives

The goal of the remediation is to render the site suitable for the proposed development from a contamination viewpoint. The primary aim of the remediation at the site is to reduce the human health and environmental risks posed by site contamination to an acceptable level.

The primary objectives of the RAP are to:

- Summarise previous investigations and historical contamination data;
- Provide a methodology to gather additional data including HGG from the areas where sampling did not occur during the JKE PSI and to increase the general sample density to ascertain the extent of the remediation required;
- Provide a methodology to remediate and validate the impacted soil at the site;
- Provide a contingency plan and unexpected finds protocol for the remediation works; and
- Outline site management procedures to be implemented during remediation.

1.3 Scope of Work

The RAP was prepared generally in accordance with a JKE proposals (Ref: EP 52718BA-RAP and EP53690BA) of 23 September 2020 and 11 March 2021. The scope of work included a review of previous reports and Conceptual Site Model (CSM), and preparation of the RAP.

The scope of work was undertaken with reference to the National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended (2013)[2], State Environmental Planning Policy No.55 – Remediation of Land (1998)[3] and other guidelines made under or with regards to the Contaminated Land Management Act (1997)[4], including the Consultants Reporting on Contaminated Land (2020)[5] guidelines.

A list of reference documents/guidelines is included in the appendices.

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

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

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

[5] NSW EPA, (2020). *Consultants reporting on contaminated land, Contaminated Land Guidelines.* (referred to as Consultants Reporting Guidelines)

2 SITE INFORMATION

2.1 Background / Summary of Site History

JKE have previously undertaken a Preliminary Site Investigation (PSI) with limited sampling. The PSI included a site inspection, desktop review of historical information and sampling from 10 boreholes and one groundwater monitoring well. Key information from this report is included in Appendix C. The site history is summarised in the following table:

Table 2-1: Summary of Historical Land Uses

Year(s)	On-site - Potential Land Use / Activities	Off-site - Potential Land Use / Activities
Pre-1930 - Current	School grounds and accommodation as well as possibly for religious use.	Predominantly residential as well as some commercial/retail uses.

The potential contamination sources and contaminants of potential concern (CoPC) identified in the PSI are presented in the following table:

Table 2-2: Potential (and/or known) Contamination Sources/AEC and Contaminants of Potential Concern

Source / AEC	CoPC
<u>Fill material</u> – The site appears to have been historically filled to achieve the existing levels. The fill may have been imported from various sources and could be contaminated. Fill material extending down to 4.2-6.9m depths was identified during the course of this investigation in the vicinity of the proposed new ELC building.	Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), petroleum hydrocarbons (referred to as total recoverable hydrocarbons – TRHs), benzene, toluene, ethylbenzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs), organophosphate pesticides (OPPs), polychlorinated biphenyls (PCBs) and asbestos.
<u>Use of pesticides</u> – Pesticides may have been used beneath the buildings and/or around the site.	Heavy metals and OCPs.
<u>Hazardous Building Material</u> – Hazardous building materials may be present as a result of former building and demolition activities. These materials may also be present in the existing buildings/ structures on site.	Asbestos, lead and PCBs.

The deep fill encountered in the north-west section of the site appeared to be uncontrolled filling associated with leveling of some sections of the site. There is potential for the inclusions within the fill to generate hazardous ground gas (HGG). A screening for HGG was not undertaken for the PSI and has been identified as a data gap. JKE recommend additional HGG screening to assess the risk posed by HGG in this section of the site.

A summary of the subsurface conditions encountered during PSI is presented in the following table:

Table 2-3: Summary of Subsurface Conditions

Profile	Description
Pavement	Asphaltic Concrete (AC) pavement was encountered at the surface in BH1, BH2, BH3, BH101, BH103, BH201 and BH202 ranging in thickness between 50mm and 90mm.

Profile	Description
Fill	Fill was encountered at the surface or beneath the AC pavement in all boreholes and extended to depths of approximately 0.2 to 6.9mBGL. BH10 was terminated in the fill at a depth of approximately 0.45m. Relatively deep fill greater than 2mBGL was encountered in boreholes BH2, BH3, BH101, BH102 and BH103 located near the proposed ELC building and in BH4 near the proposed elevated walkway. The fill typically comprised gravelly silty sand, silty sand, gravelly sand or sandstone and ironstone gravel, fine to coarse grained, with inclusions comprising varying sizes and fractions of sandstone, ironstone and igneous gravel, traces of clay and silt fines, roots, brick, tile, glass, plastic and metal fragments, slag, ash and organic matter, and with occasional sandstone cobbles and boulders at depth. FCF fragments were encountered within the fill in some boreholes. The FCF was tested for asbestos.
Natural Residual Soil	Natural soil was encountered in BH2, BH6, BH7, BH8, BH101, BH103 and BH202 beneath the fill and extended down to at least between 0.4 and 11.10mBGL. Natural soil typically comprised sand, silty sand, clayey sand and gravelly sand.
Bedrock	Sandstone bedrock was encountered in most of the boreholes at depths varying from approximately 0.4-11.1mBGL. Bedrock was not encountered in BH2 only. BH2 encountered deep sands.
Groundwater	The majority of boreholes were dry on completion of augering. In BH2 and BH8 the groundwater was observed at depths 8.5mBGL and 1.8mBGL respectively on completion of augering. In BH101, BH201, BH202 and BH203 groundwater was encountered at 5.5mBGL, 0.4mBGL, 3.55mBGL and 0.9mBGL respectively on completion of coring. Groundwater monitoring wells were installed at BH2 and BH202 to allow for further groundwater monitoring.

Selected soil and groundwater samples were submitted for laboratory analysis to be assessed for any associated impacts by the CoPC identified in the CSM.

Laboratory results identified asbestos, lead and Carcinogenic PAHs concentrations in soil above the adopted site assessment criteria (SAC) in northern and southern parts of the site within areas of proposed development works. The source of contamination was identified as the fill material historically imported onto the site. The contaminants requiring remediation include: lead and Carcinogenic PAHs contamination hotspots as well as asbestos in the northern part of the site where the new ELC building is proposed and in the southern part of the site area where the new bus/carpark is proposed which poses a human health risk, and TRH F3 identified also in northern and southern parts of the site which poses a risk to ecological receptors. Some of the TRH F3 exceedances where co-located with lead and Carcinogenic PAHs requiring remediation due to the potential risk to human health. The extent of soil impacted by the contaminants has not been confirmed and constitutes a data gap to be addressed as part of the remediation. The contamination data is shown on Figure 3 attached in the appendices.

Significant contamination of groundwater was not identified. Elevated concentration of heavy metals zinc and copper were detected in groundwater samples, though were representative of groundwater conditions within an urban environment and considered to be a regional issue. A number of PAH compounds namely: phenanthrene, anthracene, fluoranthene and benzo(a)pyrene were also detected above the ecological and human health SAC in groundwater sample from MW2. However, JKE are of the opinion that slow groundwater recharge and sediment present within MW2 may have cause interference with the PAH analysis.

Based on the preliminary waste classification assessment undertaken for the PSI, the fill material from majority of tested locations around the site met the classification of General Solid Waste (non-putrescible). However, the preliminary classification of fill material at BH103 potentially falls within the Restricted Waste (non-putrescible) containing Special Waste (asbestos) category based on laboratory data. It was also noted that low concentrations of PAHs were encountered within the sample of natural soil collected from BH8 (1.6-1.8m) and as such natural soils in this area were considered unlikely to meet the definition of VENM for off-site disposal or re-use purposes, and were assigned a preliminary classification of General Solid Waste (non-putrescible). It was recommended that additional testing be undertaken of the fill material and natural soil from across the site to confirm the final classification for off-site disposal.

Based on the findings of the PSI, the report recommended that the site can be made suitable for the proposed development, subject to the implementation of the following recommendations:

- Prepare a Remediation Action Plan (RAP) to address the contamination issues identified at the site. The RAP will include the requirements for a data gap investigation (DGI) to address the data gaps identified in this assessment and for the preparation of an unexpected find protocol (UFP). Due to the presence of deep filling (approximately 6mBGL) encountered in the north-west section of the site, the DGI should include a screening for hazardous ground gas (HGG) as outlined in the NSW EPA guidelines for HGG; and
- Undertake a validation assessment documenting the remediation works.

An assessment of data gaps was undertaken for the PSI and is provided in the following table:

Table 2-4: Data Gaps from the PSI

Data Gap	Assessment
Groundwater flow direction not confirmed / groundwater assessment limited in scope	The existence of only two groundwater monitoring wells in separate parts of the site available for sampling presents limitations and creates data gaps associated with the limited scope of groundwater assessment at this stage. Groundwater flow direction could not be confirmed with great degree of accuracy and sensible assessment of groundwater quality between up-gradient and down-gradient locations at the site is also unable to be properly completed. Actual depth to groundwater table beneath the site was not ascertained in the vicinity of the proposed new ELC building. Groundwater conditions and quality could be further confirmed during the remediation/validation process.
Delineation of identified contamination hotspot.	This data gap relates to the lack of information associated with the lateral extent of the identified Carcinogenic PAHs and lead hotspots of impacted fill material in the vicinity of BH2, BH103 and BH202. In addition, Carcinogen PAHs detected in BH8 have not been adequately delineated. Given the limited scope of anticipated excavations as part of the construction works this data gap can be addressed as part of RAP protocols including during

Data Gap	Assessment
	waste classification for off-site disposal of excavated material as part of the development.
Hazardous Ground Gas (HGG) conditions not assessed.	Identified presence of up to 4.2-6.9m deep uncontrolled fill material layer in the vicinity of BH2 and BH103 presents a potential risk associated with generation of HGG. Assessment of HGG conditions at the site was outside the scope of this investigation. An assessment of HGG conditions at the site can be addressed as part of RAP protocols during the data gap investigation.
Characterisation of soils for waste classification purposes	Based on the results of the intrusive investigation, the characteristics of fill and natural soils across the site vary considerably. The waste classifications provided within this report are preliminary in nature due to the limited samples and variation encountered, and will require confirmation prior to off-site disposal of soils and bedrock.

2.2 Site Identification

Table 2-5: Site Identification

Current Site Owner:	Kincoppal-Rose Bay School
Site Address:	Corner of New South Head Road and Vaucluse Road, Vaucluse, NSW
Lot & Deposited Plan:	Lot 104 in DP1092747
Current Land Use:	Educational Establishment
Proposed Land Use:	Educational Establishment
Local Government Authority:	Woollahra Municipal Council
Current Zoning:	SP2 – Educational Establishment
Site Area (m^2) (approx.):	Approximately 4,500m^2 - the site (i.e. targeted assessment areas as part of the PSI) 60,380 m^2 – the wider site
RL (AHD in m) (approx.):	10-60 mAHD
Geographical Location (decimal degrees) (approx.):	Latitude: -33.862451 Longitude: 151.270816
Site Location & Regional Setting:	The wider site is located in a predominantly residential area of Vaucluse. The wider site is bounded by mainly residential properties to the north, east and south, Hermitage Reserve to the west, Forsyth Park to the south/south-east and St. Michael's Anglican Church which is located on the property adjoining the site to the north/north-east. The wider site is located approximately 28m to the east of Rose Bay.

Topography:	The regional topography is characterised by a west facing hillside that falls towards Rose Bay. The site area is situated across the length of the hillside which has slope towards the west at an approximate average of 10.5°. Parts of the site appear to have been levelled to account for the slope and accommodate the existing buildings and infrastructure across the wider site area.
Geology & Hydrogeology:	Regional geological information presented in the JKE PSI indicated that the site is underlain by Hawkesbury Sandstone, which typically consists of medium to coarse grained quartz sandstone with minor shale and laminite lenses. The geological map also indicates an igneous dyke to pass through the site. The subsurface conditions within, and adjacent to a dyke can be extremely variable. The bedrock in contact with the dyke can vary considerably in terms of its depth below the surface. The information reviewed for the PSI indicated that the subsurface conditions at the site are expected to consist of moderate to high permeability residual sandy soils overlying sandstone bedrock which is typically encountered at moderate to shallow depths. Abstraction and use of groundwater at the site may be viable under these conditions, however the use of groundwater is not proposed as part of the development. There is a reticulated water supply in the area and consumption of groundwater is not expected to occur. Considering the local topography and surrounding land features, JKE anticipate groundwater to flow east through the site towards Rose Bay.
Acid Sulfate Soil (ASS) Risk and Planning	The site is not located in an acid sulfate soil (ASS) risk area according to the risk maps prepared by the Department of Land and Water Conservation. ASS information reviewed for the PSI indicated that the site is located within a Class 5 risk area in accordance with the Woollahra Local Environmental Plan (LEP 2014). Works in Class 5 areas that could pose an environmental risk in terms of ASS include works within 500m of adjacent Class 1,2,3,4 land which are likely to lower the water table below 1m AHD on the adjacent Class 1,2,3,4 land. This is unlikely to be the case due to site's elevation above the sea level (i.e. 10-60 mAHD) and the anticipated depth of soil disturbance as part of the proposed development works.
Surrounding Land Use:	During our inspection, JKE observed the following land uses in the immediate surrounds: • North – residential and St. Michaels Anglican Church; • South – residential and Forsyth Park recreational area; • East – school playing fields and sporting grounds further across Vaucluse Road and residential further across New South Head Road; and • West – Hermitage Foreshore Reserve area and Rose Bay.
Site Location Plan:	Figure 1
Sample Location Plan:	Figure 2
Contamination Location Plan:	Figure 3

2.2.1 Site Inspection

At the time of the inspection completed during PSI, the wider site was occupied by Kincoppal-Rose Bay School which was originally founded in 1882. Numerous single and multi-storey buildings and structures including accessing roads, footpaths and landscaping areas were identified across the wider property, including on or within close proximity to the proposed development areas. Based on the age of some of the buildings and structures on site, it was considered likely that hazardous building materials including asbestos may potentially be present at the site.

Fill soils were encountered within all boreholes drilled during fieldworks. Deeper fill was also identified in some parts of the site extending down to 6.9m depth (i.e. in the vicinity of the proposed new ELC building), and is indicative of cut/fill activities which historically took place across the site for levelling purposes. No information regarding potential source of identified fill material was provided.

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

3 SITE CHARACTERISATION AND CONCEPTUAL SITE MODEL

NEPM (2013) defines a CSM as a representation of site related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM for the site is presented in the following sub-sections and is based on the previous investigation data, site history and site information presented in Section 2.

3.1 Summary of Contamination (Site Characterisation)

3.1.1 Soil

The PSI identified friable and bonded asbestos above the human health SAC throughout the fill material in BH103 in the vicinity of the proposed new ELC Building. Identified asbestos occurrence is considered to be associated with historical demolition of structures or the importation of contaminated fill material from unknown origins. Asbestos was detected throughout the fill profile (i.e. extending down to approximately 6.9mBGL in BH103) which will potentially be disturbed during the course of the proposed development works at this part of the site.

Heavy metal lead was detected at concentrations which exceeded the HIL SAC in fill soil samples collected from BH2 and BH103. Both of these locations are in close proximity to each other and located in the vicinity of the proposed new ELC building (see Figure 3). Detected concentrations were greater than 250% of the SAC and the area of these two locations was considered to be a hotspot which will require further investigation (i.e. delineation) and remediation. The source of the lead is considered to be associated with the fill material, with further testing of underlying natural material confirming lead concentration below the SAC. Laboratory analysis of groundwater at this location indicate low concentration of dissolved heavy metal lead within samples tested. In addition, leachability analysis which was undertaken on fill samples from this area for waste classification purposes revealed low concentrations of dissolved lead. Based on this, it was considered unlikely for lead to migrate into the groundwater at this location.

Carcinogenic PAHs were detected at concentration which exceeded the HIL SAC in fill soil samples collected from BH103 (0.06-0.2), BH8 (0.6-0.7m) and BH202 (0.12-0.3). BH103 in next to the proposed new ELC Building whilst BH8 and BH202 were located within the southern part of the site where new bus/carpark is being proposed (see Figure 3). Detected concentrations in BH103 and BH202 were greater than 250% of the SAC and considered to be hotspots which will require further investigation (i.e. delineation) and remediation. The source of Carcinogenic PAHs is considered to be associated with the fill material, with further testing of underlying natural material confirming concentration of Carcinogenic PAHs below the SAC. Analysis of groundwater at BH202/MW202 indicated absence of dissolved PAHs within the samples tested. In addition, leachability analysis which was undertaken on fill samples from both of these areas for waste classification purposes revealed the PAHs were generally immobile and unlikely to migrate into the groundwater beneath the site.

The concentration of TRH F3 in BH1 (0.05-0.15m), BH103 (0.06-0.2), BH8 (0.6-0.7m) and BH202 (0.06-0.2) exceeded the EIL SAC. BH1 and BH103 were located within the northern part of the site where new ELC building is being proposed, whilst BH8 and BH202 were located within the southern part of the site where the new two-storey bus/carpark is proposed to be developed (see Figure 3). The source of the TRHs is considered to be associated with the fill material, with further testing of underlying natural material confirming TRH concentrations below the SAC. It was noted that impacts in BH103 (0.06-0.2), BH8 (0.6-0.7m) and BH202 (0.06-0.2) are co-located with a human health risk, as identified in Section 10.2.1.2 and 10.2.1.3 and can be remediation in conjunction with the impacted material.

3.1.2 Groundwater

Zinc concentration in excess of the ecological (GIL marine) SAC was reported in samples from MW2 and MW202. Samples from MW202 also reported copper concentration in excess of the adopted ecological SAC. Zinc and copper in groundwater are considered to be a regional issue which is common in urban environments due to runoff and leaking water infrastructure.

PAHs compounds phenanthrene, anthracene, fluoranthene and benzo(a)pyrene were detected above the ecological and human health SAC in sample from MW2. In addition, trace concentrations of other PAHs were also identified within the groundwater sample.

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

3.2 CSM

The table below includes a review of the CSM which has been used to design the remediation strategy. The CSM will require further review if additional site data becomes available.

Table 3-1: CSM

Contaminant source(s) and contaminants of concern	Potential contamination sources: fill soil. Contaminants of concern: heavy metal lead, asbestos, carcinogenic PAHs and TRH F3 fraction.
Affected media	Soil/fill has been identified as the affected medium for remediation in this RAP. Groundwater remediation is not deemed necessary and is not being captured under this RAP at this stage. Groundwater conditions and quality could be further confirmed during the remediation/validation process. Any seepage encountered during excavations will be captured and managed under dewatering requirements. Long-term use or exposure to groundwater is not anticipated.

	The potential for soil vapour or HGG impacts is considered to be relatively low. However, soil vapour would need to be considered in the event significant contamination is identified in soil and/or groundwater. Screening for HGG in the north-west section of the site is required and has been identified as a data gap.
Receptor identification	Human receptors include site occupants/users (including adults and children), construction workers and intrusive maintenance workers. Off-site human receptors include adjacent land users, and recreational water users within Rose Bay. Ecological receptors include terrestrial organisms and plants within unpaved areas (including the proposed landscaped areas), and marine ecology in Rose Bay.
Exposure pathways and mechanisms	Potential exposure pathways relevant to the human receptors include ingestion, dermal absorption and inhalation of dust (all contaminants) and vapours (volatile TRH, naphthalene and BTEX). The potential for exposure would typically be associated with the construction and excavation works, and future use of the site. Potential exposure pathways for ecological receptors include primary contact and ingestion. Exposure during future site use could occur via direct contact with soil in unpaved areas such as gardens, inhalation of airborne asbestos fibres during soil disturbance, or inhalation of vapours within enclosed spaces such as buildings and basements. Exposure to groundwater may potentially occur through direct migration and potential exposure to groundwater seepage through sandstone outcrops within Hermitage Reserve area and in Rose Bay.
Evaluation of data gaps	• **Delineation of identified contamination hotspot.** This data gap relates to the lack of information associated with the lateral extent of the identified Carcinogenic PAHs and lead hotspots of impacted fill material in the vicinity of BH2, BH103 and BH202. In addition, Carcinogen PAHs detected in BH8 have not been adequately delineated. Given the limited scope of anticipated excavations as part of the construction works this data gap can be addressed as part of RAP protocols including during waste classification for off-site disposal of excavated material as part of the development. • **Groundwater flow direction not confirmed / groundwater assessment limited in scope.** The existence of only two groundwater monitoring wells in separate parts of the site available for sampling presents limitations and creates data gaps associated with the limited scope of groundwater assessment at this stage. Groundwater flow direction could not be confirmed with great degree of accuracy and sensible assessment of groundwater quality between up-gradient and down-gradient locations at the site is also unable to be properly completed. Actual depth to groundwater table beneath the site was not ascertained in the vicinity of the proposed new ELC building. Groundwater conditions and quality could be further confirmed during the remediation/validation process. • **Hazardous Ground Gas (HGG) conditions not assessed.** Identified presence of up to 4.2-6.9m deep uncontrolled fill material layer in the vicinity of BH2 and BH103 presents a potential risk associated with generation of HGG. Assessment of HGG conditions at the site was outside the scope of the PSI. An assessment of HGG conditions at the site can be addressed as part of RAP protocols during the data gap investigation. • **Characterisation of soils for waste classification purposes.** Based on the results of the PSI, the characteristics of fill and natural soils across the site vary considerably. The waste classifications provided as part of the PSI was preliminary in nature and will require confirmation prior to off-site disposal of soils and bedrock. The procedure for this is addressed as part of RAP protocols.

3.3 Soil Remediation Extent

Remediation is anticipated to be focussed at the areas of proposed development works being the northern part of the site where the new ELC building is proposed and in the southern part of the site area where the new bus/carpark is proposed as shown on Figure 2 (Appendix A). It is anticipated that the required earthworks include excavations to a maximum depth of approximately 4mBGL within the north-eastern portion of the proposed ELC building development and to a maximum depth of approximately 6mBGL along the northern side of the proposed basement part of the new bus/carpark development in the southern part of the site area.

It should be noted that BH1 was located outside the footprint of the proposed ELC building within paved internal access road and remediation of associated ecological impact in this location is not considered to be necessary and is not captured under the RAP at this point in time.

Extent of known soil remediation works includes fill across the areas listed above which is proposed to be disturbed/excavated as part of the earthworks. The extent of remediation (horizontal and vertical) associated with the fill material will be guided by the validation as well as the results of data gap investigation (DGI) described further in Section 4 of this document.

The exact extent of remediation is to be revised following completion of the final design and DGI. It is further acknowledged that the remediation extent may change depending on the outcome of the DGI as described in Section **Error! Reference source not found.**. A Remediation Work Plan (RWP) should be prepared on completion of the final design and the DGI to address the extent of remedial works required for the proposed development.

4 DATA GAP INVESTIGATION (DGI)

Data gap investigation will occur in order to provide additional data from the areas beneath the current structures (i.e. pavements/access ways etc.) where no data was able to be obtained and where excavations are proposed (i.e. where sampling did not occur during the PSI). This investigation will also aim at assessing the risk posed by HGG in the north port of the site where deep filling was encountered in vicinity of the proposed new ELC building. This DGI is to occur following the establishment of a construction site areas, removal of pavements/access ways, and prior to any excavation/off-site disposal of the fill.

4.1 Objectives

The objectives of the DGI are to:

- Further characterise the fill/soil contamination conditions in areas where no data was able to be obtained during the PSI in order to further inform and refine the remedial strategy for the areas on site which require remedial works;
- Assess the HGG conditions via implementation of a preliminary sampling and analysis program around the areas of deep fill where new ELC building development is being proposed;
- Further confirm waste classification for the fill to be disposed off-site;
- Assess if any CoPC occur at concentrations that require further remediation and/or variation to the validation plan outlined in this RAP; and
- Facilitate the preparation of a Remedial Works Plan (RWP) in the event that additional or alternative remediation/validation strategies are required.

4.2 Additional Sampling

- The sampling density will depend on the areas to be disturbed during the development which is to be confirmed following completion of the final design. In general, a minimum density for soil sampling is one sampling location should be targeted within an area of disturbance less than $10m^2$. Soil/fill samples are to be collected from excavated test pits targeting proposed soil disturbance areas as part of the development;
- Sampling is to occur using an excavator or hand tools where an excavator cannot be used. Samples are to be collected from each fill profile and from the top (~0.5m) of the natural soil/bedrock beneath the fill. One sample per fill profile at each location will be collected for analysis;
- All soil samples will be screened using a photo-ionisation detector (PID); and
- The preliminary HGG screening will be undertaken at a density of approximately one sampling location per $25m^2$ or a minimum of 3 HGG wells. For the HGG screening, gas monitoring wells will be installed and left in-situ for the duration of the monitoring program. Spot monitoring of selected underground services and enclosed spaces will also be undertaken using a landfill gas analyser.

4.3 Decontamination and Sample Preservation

Any re-usable equipment should be decontaminated using a scrubbing brush and potable water and Decon 90 solution (phosphate free detergent) followed by rinsing with potable water.

Samples will be preserved by immediate storage in an insulated sample container with ice. Any additional sample preservation requirements for specific analytes should also be adopted as required. On completion of the fieldwork, the samples should be delivered in the insulated sample container to a NATA registered laboratory for analysis under standard chain of custody (COC) procedures.

One sample per fill profile at each location will be submitted for analysis of the CoPC identified for fill (see Table 2-2). Leachate testing (TCLP) will also be undertaken for waste classification purposes. Additional analysis should also be scheduled as required based on any observations of odours, staining and/or elevated PID results.

4.4 Quality Assurance/Quality Control (QA/QC)

Inter and intra-laboratory duplicates will be collected and analysed for the soil assessment at a rate of 5% for inter-laboratory and 5% for intra-laboratory analysis. A trip spike and trip blank will also be submitted and analysed with each batch of samples.

4.5 Data Assessment

The soil data for the site should be assessed using the validation assessment criteria (VAC) outlined in Section 7.2 which are based on a 'residential with accessible soils' exposure setting. For waste classification purposes, the soil data should be assessed against the NSW Waste Classification Guidelines, Part 1: Classifying Waste (2014)[6].

HGG data should be assessed against the Level 2 assessment criteria outlined in NSW EPA HGG guidelines, 2020. The Level 2 risk-based approach includes calculation of Gas Screening Value (GSV) for each monitoring location and each monitoring round for methane and carbon dioxide. HGG other than methane and carbon dioxide (i.e. carbon monoxide, hydrogen sulphide etc.) should be assessed in accordance with The Safe Work Australia (2019)[7] and Time Weighted Average (TWA)[8] workplace exposure standards.

4.6 Reporting

On completion of the data gap investigation assessment, an interim validation and waste classification assessment report should be completed presenting the results of the investigation. The report is to document/confirm the extent of remediation and the validation plan.

A RWP should be prepared following completion of the data gap investigation outlining the extent of remedial works required for the proposed development. RWP should also document any additional contamination encountered that requires remedial measures to be implemented outside the scope of this RAP.

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

[7] Safe Work Australia (2019), *Work Place Exposure Standards for Airborne Contaminates (referred to as Safe Work Australia 2019)*

[8] Time Weighted Average, means the maximum average airborne concentration of a substance when calculated over an eight-hour working day, for a five-day working week.

The RWP should be submitted to the consent authority and the client is to take steps to notify council and other relevant authorities as required.

5 REMEDIATION OPTIONS

5.1 Soil Remediation

The NSW EPA follows the hierarchy set out in NEPM 2013 for the remediation of contaminated sites. The preferred order for soil remediation and management is as follows:

1. On-site treatment of soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;
2. Off-site treatment of excavated material so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site;

Or if the above are not practicable:

3. Consolidation and isolation of the soil by on-site containment within a properly designed barrier; and
4. Removal of contaminated material to an approved site or facility, followed where necessary by replacement with clean material; or
5. Where the assessment indicates that remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy.

For simplicity herein, the above hierarchy are respectively referred to as Option 1, Option 2, Option 3 etc.

The NEPM 2013 and Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (2009)[9] prefer the following asbestos remediation hierarchy:

1. Minimisation of public risk;
2. Minimisation of contaminated soil disturbance; and
3. Minimisation of contaminated material/soil moved to landfill.

The NSW EPA Contaminated Land Management Guidelines for the NSW Site Auditor Scheme (3rd Edition) (2017)[10] provides the following additional requirements to be taken into consideration:

- Remediation should not proceed in the event that it is likely to cause a greater adverse effect than leaving the site undisturbed; and
- Where there are large quantities of soil with low levels of contamination, alternative strategies should be considered or developed.

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[9] Western Australian (WA) Department of Health (DoH), (2009). Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia. (referred to as WA DoH 2009)

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

5.2 Remediation Options Assessment

The table below discusses and assesses a range of remediation options:

Table 5-1: Consideration of Remediation Options

Option	Discussion	Assessment/Applicability
Option 1 **On-site treatment of contaminated soil**	On-site treatment can provide a mechanism to reuse the processed material, and in some instances, avoid the need for large scale earthworks. Treatment options are contaminant-specific and can include bio-remediation, soil washing, air sparging and soil vapour extraction, thermal desorption and physical removal of bonded ACM fragments. Depending on the treatment option, licences may be necessary for specific individual waste streams due to the potential for air pollution and the formation of harmful by-products during incineration processes. Licences for re-use of treated material/waste may also be required.	Not technically feasible or economically viable based on the combination of contaminants present in the fill.
Option 2 **Off-site treatment of contaminated soil**	Contaminated soils are excavated, transported to an approved/licensed treatment facility, treated to remove/stabilise the contaminants then returned to the subject site, transported to an alternative site or disposed to an approved landfill facility. This option is also contaminant-specific. The cost per tonne for transport to and from the site and for treatment is considered to be relatively high. The material would also have to be assessed in terms of suitability for reuse as part of the proposed development works under the waste and resource recovery regulatory framework.	As above.
Option 3 **Consolidation and isolation of impacted soil by cap and containment**	This would include the consolidation of impacted soil within an appropriately designed cell, followed by the placement of an appropriate barrier over the material to reduce the potential for future disturbance. The capping and/or containment must be appropriate for the specific contaminants of concern. Depending on the concentrations of contaminants being encapsulated, an ongoing environmental management plan (EMP) will be required and will need to be publicly notified and made to be legally enforceable (e.g. via listings in the Section 10.7 planning certificate and on the land title).	This option will be considered if soil contamination extends beyond the proposed excavation footprint and where contaminated material may be retained in-situ (to be confirmed by validation sampling).

Option	Discussion	Assessment/Applicability
Option 4 **Removal of contaminated material to an appropriate facility and reinstatement with clean material**	Contaminated soils would be classified in accordance with NSW EPA guidelines for waste disposal, excavated and disposed of off-site to a licensed landfill. The material would have to meet the requirements for landfill disposal. Landfill gate fees (which may be significant) would apply in addition to transport costs.	Most applicable option for this project considering the contaminants of concern and the extent of proposed development works which will necessitate excavations to maximum depths of approximately 4-6mBGL for the proposed new ELC building and a new bus/carpark and off-site material removal for the construction. This option is considered to be the most practical, technically achievable and economically viable for this project.
Option 5 **Implementation of management strategy**	Contaminated soils would be managed in such a way to reduce risks to the receptors and monitor the conditions over time so that there is an on-going minimisation of risk. This may occur via the implementation of monitoring programs.	This will be applicable for the long-term management of contamination if Option 3 is triggered.

5.3 Rationale for the Preferred Option for Soil Remediation

The preferred option for soil remediation is option 4 which includes excavation and off-site disposal of contaminated soil. In the unlikely event that soil contamination extends beyond the proposed excavation footprint (to be confirmed by validation sampling), the option for capping the contamination on site as outlined in option 3 may be required. A long-term Environmental Management Plan (LTEMP) will be required to manage the contamination remaining on site which would trigger option 5.

The preferred option for remediation is considered to be appropriate on the basis that:

- Treatment options are not technically achievable or economically viable on such a small site and based on the combination of contaminants of concern;
- Some excavation is expected to occur to create the desired site levels for the development;
- The strategy is technically achievable to implement concurrently with the proposed development works; and
- An alternative strategy such as 'cap and contain' and implementation of an EMP is undesirable on high sensitivity use site such as schools. However, we note that this option has been outlined as a precautionary measure at this stage and is also included as part of the contingency plan in this RAP.

6 REMEDIATION DETAILS

6.1 Roles and Responsibilities

Table 6-1: Roles and Responsibilities

Role	Responsibility
Developer	Mahady Management Contact: Terry Mahady The developer is required to appoint the project team for the remediation and must provide all investigation reports including this RAP to the project manager, remediation contractor, consent authority and any other relevant parties involved in the project.
Project Manager	Mahady Management Contact: Terry Mahady The project manager is required to review all documents prepared for the project and manage the implementation of the procedures outlined in this RAP. The project manager is to take reasonable steps so that the remediation contractor and others have understood the RAP and will implement it in its totality. The project manager will review the RAP and other documents and will update the parties involved of any changes to the development or remediation sequence (in consultation with the validation consultant).
Remediation Contractor	To be appointed. The remediation contractor is required to review all documents prepared for the project, apply for any relevant removal licences or permits and implement the remediation requirements outlined in this RAP. The remediation contractor may also be the construction contractor. The remediation contractor is required to collect all necessary documentation associated with the remediation activities and forward this documentation onto the client, project manager and validation consultant as they become available. The remediation contractor is required to advise the validation consultant at key points in the remediation and validation programme, and implement various aspects of the validation plan assigned to them.
Validation Consultant	JKE – subject to formal engagement. The validation consultant[11] provides consulting advice and validation services in relation to the remediation, prepares the site validation report and any other associated documentation such as the Asbestos Management Plan (AMP). The validation is required to review any deviation to this RAP or in the event of unexpected finds if and when encountered during the site work. It is recommended that the validation consultant has a Licensed Asbestos Assessor on staff. The validation consultant is required to liaise with the client, project manager and remediation contractor on all matters pertaining to the site contamination, remediation and validation, carry out the required site inspections during excavation, capping and collect validation samples including for any imported materials.

[11] It is recommended that the consultant be a certified practitioner (specialising in site contamination), under one of the NSW EPA endorsed certification schemes

6.2 Pre-commencement

The project team is to have a pre-commencement meeting to discuss the sequence of remediation, and the remediation and validation tasks. RWP will be required for the proposed remediation works when the concept designs and pre remediation validation have been finalised.

The site management plan for remediation works (see Section 9) should be reviewed by the project manager and remediation contractor, and appropriate steps are to be taken to ensure the adequate implementation of the plan.

The remediation contractor should be engaged to carry out the remediation tasks required under this RAP/RWP. The role of the contractor is to:

- Remediate the site in accordance with the remediation methods and the validation consultant's advice;
- Apply for any necessary permits/licenses required for remediation;
- Retain all necessary documentation for waste disposal, imported materials etc; and
- Keep the validation consultant informed regarding the progress of the site works and any unexpected finds.

6.3 Remediation and Associated Tasks

The following general sequence of works is anticipated:

- Site establishment, removal of all existing structures including any buildings and pavements/access ways as required. Due to the potential presence of friable asbestos in fill material an Asbestos Management Plan (AMP) (prepared separately) is to be reviewed and implemented for the proposed works;
- **Hold Point -** Completion of the Data Gap Investigation outlined in Section **Error! Reference source not found.** and prepare a RWP;
- Remediation/excavation and off-site disposal of contaminated fill from beneath the areas of proposed development works or as required (i.e. exact extent to be confirmed);
- Remediation/capping of the site concurrently with the proposed development works (if required);
- Validation of capping areas (if required); and
- Validation of imported soil materials. This includes materials imported to reinstate the remedial excavations, together with engineering material such as sub-base, landscaping materials or any other materials imported onto site, to the point in time that the validation report is issued.

Validation of the works would occur progressively throughout the remediation program.

Details in relation to the above are outlined in the following subsections:

6.3.1 Site Establishment, Removal of Pavements/Access Ways

The remediation contractor is to establish on site as required to facilitate the remediation. Consideration must be given to the work sequence and extent of remediation so that the site establishment (e.g. site sheds, fencing, access points etc) does not inhibit the remediation works. An AMP (prepared separately) is to be reviewed and implemented for the proposed development works.

All structures including any buildings, pavements and access ways are to be removed from areas of proposed development works/remediation areas (i.e. areas where the new ELC building and a new bus/carpark are proposed and associated earthwork are to take place).

6.3.2 Addressing Data Gaps

The identified data gaps presented in Table 3.1 shall be addressed in order to ensure that the remediation works to be undertaken at the site are based on the most current, appropriate and reliable data. The proposed manner of addressing the identified data gaps is outlined in Section 4 of this RAP.

6.3.3 Remediation Details – Excavation and Disposal of Contaminated Fill

The procedure for excavation of fill soil is outlined below:

Table 6-2: Remediation Details – Excavation and disposal of contaminated fill

Step	Primary Role/ Responsibility	Procedure
1.	Remediation contractor	Address Stability Issues and Underground Services: Geotechnical advice must be sought regarding the stability of the adjacent structures and/or adjacent areas prior to commencing remediation (as required). Stability issues are to be addressed to the satisfaction of a suitably qualified geotechnical engineer. This may require the installation of temporary shoring, if specified by the engineer. All underground services are to be appropriately disconnected or rerouted to facilitate the works.
2.	Remediation contractor	Personal Protective Equipment (PPE) and Work Health and Safety (WHS): Check PPE and WHS requirements prior to commencement of remediation works. The minimum PPE required for the remediation at the site includes covered clothing, gloves, dust masks and steel cap boots. Other site/project specific PPE may be required including hard hat, eye protection, steel toed boots, masks, coveralls etc and will be dependent on the requirements of the contractor for the site and provisions outlined with the AMP.
3.	Project manager and Remediation Contractor	Removal of contaminated fill: Excavation of the remediation area will be undertaken as follows: • Classification of the fill material for waste disposal in areas of the proposed development is to be confirmed via additional testing and a waste classification advice must be prepared in accordance with relevant guidelines and provided to the remediation contractor prior to the fill material being taken off-site; • Submit an application to dispose the fill (in accordance with the assigned waste classification) to a landfill licensed by the NSW EPA to receive the waste and obtain authorisation to dispose; • Part 7 of the POEO Waste Regulation set outs the requirements for the transportation and management of asbestos waste and Clause 79 of the POEO Waste Regulation requires waste transporters to provide information to the NSW EPA regarding the movement of any load in NSW of more than 10m2 of asbestos sheeting, or 100 kilograms of asbestos waste. To fulfil these legal obligations, asbestos waste transporters must use WasteLocate;

Step	Primary Role/ Responsibility	Procedure
		• A water system will need to be in place to spray the excavated soil during excavation/ remediation works and to decontaminate trucks entering the work area. The general site area should be kept damp during remediation works to minimise the generation of dust; • The remediation area should be excavated to the base of the fill and down to the surface of the underlying natural soil (or bedrock, whichever is encountered first). The details of the excavation works will need to be agreed with the remediation contractor. The works should be done in the most efficient manner that minimises cross contamination. We note that the natural soil/rock levels may vary across the site and provisions will need to be made for careful, detailed excavation and removal of all fill. Even minor amount of fill, if left present at the surface, will result in validation failure and the need for further excavation; • Load the fill onto trucks and dispose in accordance with the assigned waste classification. The receiving licenced landfill facility; and • All documents including landfill dockets should be retained and forwarded to the client and validation consultant for inclusion into the validation report.
4.	Validation Consultant	<u>Validation of Excavation Base:</u> • Once all fill is removed, the base of the excavation should be validated (by the validation consultant) in accordance with Section 7; • If the validation fails, the contaminated area should be chased out until the validation is successful; and • If the validation is successful, the excavation can be continued to achieve the finished levels of the basement (additional waste classification documentation will be required to dispose or reuse the underlying natural soil/bedrock). Alternatively, the excavation can be re-instated using clean validated materials. Imported materials used to reinstate the site/remedial excavation must be validated in accordance with Section 6

The detailed validation plan relevant to the above items is provided in Section 6.

6.3.4 Capping of Contaminated Fill (if required)

The premise for remediating the site is based around capping the contaminated fill/soil beneath appropriate (clean) capping layers. The proposed capping system requires consideration during the design of the buildings, pavements and landscaping. A summary of the proposed capping strategy is provided in the following table. These requirements should be reviewed by the project team prior to finalising the design, and all relevant design drawings must include the capping specification details.

Table 6-3: Capping Specification

Area	Capping Specification^
New buildings / structures and paved areas	Installation of: • Geotextile marker layer (hi-vis) over the contaminated fill; • >50mm clean imported (validated) basecourse, as required for engineering specification; and • >150mm (minimum) of concrete.
Turfed areas / unpaved areas	Installation of: • Geotextile marker layer over the contaminated fill; • >500mm clean imported (validated) topsoil/growing medium; and

Area	Capping Specification^
	• Surface finish to required development design.
Existing pavements being retained	No additional capping required. The horizontal extent of pavements being retained are to be surveyed.
Service trenches	Excavation of the service trench below the design level and greater than the required width of the conduit/service, then installation of: • Geotextile marker layer lining the trench and over the contaminated fill (this must be secured to the geotextile marker in the area adjoining the trench – a >0.2m overlap and use of soil 'U' nails to pin down the geotextile would be acceptable); • Backfill with clean imported (validated) material; and • Surface finish to required development design.

^ The capping specification relates to the remediation only and has not considered engineering design requirements for the site.

It is recommended that once the proposed development design is finalised and DGI has been completed, a RWP is prepared to identify the areas of the site where the various capping strategies should be implemented. If any amendments to the capping specification are required as a result of consultation during the design process, or due to specific engineering requirements for the site, these changes must also be reflected in the RWP.

The RWP is to be prepared by the validation consultant (or by JKE) and approved by the client/Woollahra Municipal Council and the site auditor (if an auditor is engaged for the project).

The remediation steps for capping the site are provided below. The detailed validation plan relevant to this aspect of the remediation is provided in Section 7.

Table 6-4: Remediation – Areas to be Capped

Step	Primary Role/ Responsibility	Procedure
1.	Validation consultant	Asbestos Management Plan (AMP): The AMP is to be implemented by the remediation contractor (and their nominated subcontractors where relevant) throughout the subsequent steps.
2.	Remediation contractor	Implementation of Asbestos/Management Controls: The site management and AMP controls are to be established by the remediation contractor. The site management plan for remediation works are presented in Section 9.
3.	Remediation contractor Validation Consultant	Earthworks/site preparations: The remediation contractor is to complete the earthworks required to facilitate the proposed capping of the remediation area. Where piling is required, it would also be preferable for this to occur prior to capping to minimise the potential for cross-contamination. Any imported materials used are to be validated by the validation consultant in accordance with Section 7. This may include but is not limited to coarse gravels (e.g. 40/70) for driveways, DGB, material used to create a piling platform etc.

Step	Primary Role/ Responsibility	Procedure
4.	Remediation contractor (or the nominated construction contractor)	Survey of site levels: A pre-capping levels survey is to be completed by the relevant contractor. This should occur after the installation of the geotextile marker layer, but before the installation of any overlying capping layers. The purpose of the survey is to provide a record of the site levels across the top of the geotextile marker layer. It is recommended that the survey points are recorded with a spacing of not more than 5m between adjacent points. Additional survey points will be required in the vicinity of changes in surface slope and for specific features such as service trenches.
5.	Remediation contractor (or the nominated construction contractor) Validation consultant	Capping: The cap is to be constructed in accordance with the capping specification. Any imported materials used are to be validated by the validation consultant in accordance with Section 7. The validation consultant is required to inspect the capping works and imported materials in accordance with the validation plan.

The detailed validation plan relevant to the above items is provided in Section 7.

6.4 Remediation Documentation

The remediation contractor must retain all documentation associated with the remediation, including but not limited to:

- Waste register (see below);
- Asbestos management documentation, including all relevant notifications, licences, clearance certificates and air monitoring reports (additional details in this regard are to be outlined in the AMP);
- Photographs of remediation works;
- Waste tracking documentation (where applicable); and
- Imported materials documentation from suppliers, including any routine analysis reports, product specifications and dockets for imported materials.

Copies of these documents must be forwarded to the project manager and the validation consultant on completion of the remediation for inclusion in the validation report.

6.4.1 Waste Register

All excavated fill/natural soil/bedrock must be disposed of to a waste facility licensed by the NSW EPA to receive the waste stream. The final waste classification advice must be used to facilitate the lawful disposal of the waste. A separate waste classification assessment will be required for the material resulting from the proposed excavation works as part of the development as outlined in Table 5.2 above.

All waste removed from the site is to be appropriately tracked and managed in accordance with the relevant regulations. The remediation contractor (and/or their nominated construction contractor) is to maintain adequate records and retain all documentation for waste disposal activities including:

- A summary register including details such as waste disposal dates, waste materials descriptions, disposal locations (i.e. facility details) and reconciliation of this information with waste disposal docket numbers; and
- Waste tracking records and transport certificates (where waste is required to be tracked/transported in accordance with the regulations); and
- Disposal dockets for the waste. Legible dockets are to be provided for all waste materials so they can be reconciled with the register.

Any soil waste classification documentation is to be prepared in accordance with the reporting requirements specified by the NSW EPA. Reports are to include:

- The full name, address, Australian Company Number (ACN) or Australian Business Number (ABN) of the organisation and person(s) providing the waste classification;
- Location of the site where the waste was generated, including the source site address;
- History of the material and the processes and activities that have taken place to produce the waste;
- Potential contaminating activities that may have occurred at the site where the waste was generated;
- Description of the waste, including photographs, visible signs of contamination, such as discolouration, staining, odours, etc;
- Quantity of the waste;
- Number of samples collected and analysed;
- Sampling method including pattern, depth, locations, sampling devices, procedures, and photos of the sample locations and samples;
- Contaminants tested;
- Laboratory documentation – chain-of-custody (COC), sample receipt, laboratory report;
- All results regardless of whether they are not used in the classification process;
- Results of sample mean, sample standard deviation and the 95% upper confidence limit (UCL) where relevant;
- Brief summary of findings including discussion of results; and
- A clear statement of the classification of the waste as at the time of the report.

A soil volume analysis should be undertaken on completion of remediation and reconciled with the quantities shown on the soil disposal dockets. This information is to be reviewed by the validation consultant on completion of the works and an assessment of the quantities of soil disposed off-site (e.g. comparison with the estimated and actual volumes) is to be included in the validation report. A review of the disposal facility's licence issued under the Protection of the Environment Operations (POEO) Act (1997)[12] should also be undertaken to assess whether the facility is appropriately licensed to receive the waste.

[12] NSW Government, (1997)). *Protection of Environment Operations Act.*(referred to as POEO Act 1997)

6.4.2 Imported Materials Register

The remediation contractor (and/or their nominated construction contractor) is to maintain for the duration of the project an imported material register. This must include a register (preferably in Microsoft Excel format) with details of each imported material type, supplier details, summary record of where the imported materials were placed on site, and importation docket numbers and a tally of quantities (separated for each import stream). Legible dockets for imported materials are to be provided electronically so these can be reconciled with the register.

The above information is to be provided to the validation consultant for inclusion in the validation report. It is recommended that the register be set up at the beginning of the project and provided to the validation consultant regularly (say on a monthly or two-monthly basis) so the details can be checked and any rectification of the record keeping process can occur in a timely manner.

7 VALIDATION PLAN

Validation is necessary to demonstrate that remedial measures described in the RAP have been successful and that the site is suitable for the intended land use. The sampling program for the validation is outlined in Section 7.1. This is the minimum requirement based on the remedial strategies provided. Additional validation sampling may be required based on observations made during remediation or in the event of an unexpected find.

7.1 Validation Sampling and Documentation

The table below outlines the validation requirements for the site:

Table 7-1: Validation Requirements

Aspect	Sampling	Analysis	Observations and Documentation
Remediation/excavation of Contaminated Fill (Section 6.3.2)			
Excavation walls	One sample per 5m lineal, from each observed soil stratum. Additional sampling is also to target obvious indicators of contamination and changes in soil/bedrock profile.	TRHs, PAHs, lead and asbestos (500mL) On-site 10L screening of exposed fill will be required for the validation works. Any FCF encountered will be sampled and analysed for asbestos.	The **validation consultant** is to: - Samples to be screened using PID; - Observations of staining and odour to be recorded. - Photographs to be taken and documented; and - Document the occurrence (or otherwise) of any unexpected finds. The **remediation contractor** is to keep records in relation to waste disposal (i.e. disposal dockets).
Excavation surface (base) following removal of fill	5m grid (one sample per 25m^2), with additional samples targeting any potentially impacted areas identified during the visual/olfactory assessment.		The **validation consultant** is to: - Samples to be screened using PID; - Observations of staining and odour to be recorded. - Photographs to be taken and documented; - Visual observations to confirm natural material at base (i.e. no fill); and - Document the occurrence (or otherwise) of any unexpected finds. The **remediation contractor** is to keep records in relation to waste disposal (i.e. disposal dockets).
Capping (if required)			
Survey of site levels.	NA	NA	**Remediation contractor** to obtain the survey as required in Section **Error! Reference source not found.**. It is also expected that the remediation contractor or their nominated construction contractor will provide as-built drawings for the

Aspect	Sampling	Analysis	Observations and Documentation
			project which document the capping layers. Pre-capping and post-capping levels surveys (post-capping survey only required for unpaved areas).
Capping	Refer to imported materials validation requirements in the following sections of this table.	Refer to imported materials validation requirements in the following sections of this table.	**Validation consultant** to carry out inspections to document the installation of the cap. Key hold points for inspections include: - Geotextile/geogrid installation; - During importation of materials used to construct the cap; and - Finished surface levels. Asbestos clearance certificates (as required under the AMP). Documentation of capping materials and thickness of capping layers (as-built) by the contractors. Validation of imported materials used as capping. Asbestos management documentation, as outlined in the AMP (including any waste disposal and tracking documentation). A photographic record is to be maintained by the **remediation contractor** and **validation consultant**.
Imported Materials – validation of imported materials is required for any materials imported onto the site during the remediation and to the point in time that the site validation report is prepared (e.g. general fill to raise the site levels or reinstate remedial excavations, imported materials to create piling platform, gravels for site preparation, material used for capping layers etc).			
Imported VENM backfill (if required) Imported garden mix/topsoil and mulches	Minimum of three samples per source	Heavy metals (as above), TRHs, BTEX, PAHs, OCPs, PCBs and asbestos (500ml). Additional analysis may be required depending on the site history of the source property. Analysis of mulch can be limited to visual observations to confirm there is limited	**Remediation contractor** to supply existing VENM documentation/report (report to be prepared in accordance with the NSW EPA waste classification reporting requirements). A hold point remains until the **validation consultant** approves the material for importation or advises on the next steps. Material is to be inspected upon importation by the **validation consultant** to confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation. Photographic documentation and an inspection log are to be maintained.

Aspect	Sampling	Analysis	Observations and Documentation
		anthropogenic material and no visible asbestos materials.	Where check sampling occurs by the **validation consultant** due to deficiencies or irregularities in existing VENM documentation, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; - Sample location plan; and - Analytical reports and tabulated results with comparison to the Validation Assessment Criteria (VAC).
Imported engineering materials such as recycled aggregate, road base etc or ENM	Minimum of three samples per source/material type. Additional testing may be required for ENM to meet the specification within the ENM Order.	Heavy metals (as above), TRHs, BTEX, PAHs, OCPs, PCBs and asbestos (500ml quantification). Additional testing may be required for ENM (e.g. foreign materials, pH and electrical conductivity) depending on available documentation.	**Remediation contractor** to provide product specification and documentation to confirm the material has been classified with reference to a relevant Resource Recovery Order/Exemption. A hold point remains until the **validation consultant** approves the material for importation or advises on the next steps. Review of the facility's Environment Protection Licence (EPL). Material is to be inspected by the **validation consultant** upon importation to confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation. Where check sampling occurs by the **validation consultant** due to deficiencies or irregularities in existing documentation, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; - Sample location plan; and - Analytical reports and tabulated results with comparison to the VAC.
Imported engineering materials comprising only natural quarried products.	At the validation consultant's discretion based on robustness of supplier documentation.	At the validation consultant's discretion based on robustness of supplier documentation.	**Remediation contractor** to provide documentation from the supplier confirming the material is a product comprising only VENM (i.e. natural quarried product). A hold point remains until the **validation consultant** approves the material for importation or advises on the next steps. Review of the quarry's EPL.

Aspect	Sampling	Analysis	Observations and Documentation
			Material is to be inspected by the **validation consultant** upon importation to confirm it is free of anthropogenic materials, visible and olfactory indicators of contamination, and is consistent with documentation. Where check sampling occurs by the **validation consultant** due to deficiencies or irregularities in existing documentation, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; - Sample location plan; and - Analytical reports and tabulated results with comparison to the VAC.

7.2 Validation Assessment Criteria and Data Assessment

The VAC to be adopted for the validation assessment are outlined in the table below:

Table 7-2: VAC

Validation Aspect	VAC
Waste classification (Sections 5.3.2)	In accordance with the procedures and criteria outlined in Part 1 of the Waste Classification Guidelines 2014 and any other exemptions/approvals as required.
Fill removal and remaining material validation	The soil validation criteria to be adopted will be the health-based criteria for contaminants in soil and land use type A (residential with accessible soils including preschools and primary schools and low-high density residential HSL-A & HSL-B) and ESL for Urban Residential and Public Open Space (where applicable). It is noted that additional criteria will also need to be considered in the context of waste depending on the waste classification assessment process for the site.
Validation of capping (if required)	Validation of capping will occur via a review of survey information, as-built drawings and via the inspection process. The validation report is to include cross-sections documenting the completed capping details for the various areas of the site. Post-capping survey for unpaved areas is to demonstrate there is at least 500mm of clean VENM cap above the marker layer.
Imported materials	Material imported as general fill must only be VENM or ENM. VENM is defined in the Protection of the Environment Operations Act (1997)[13] as material: • That has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial mining or agricultural activities; • That does not contain sulfidic ores or other waste; and

[13] Protection of Environment Operations Act 1997 (NSW) (POEO Act 1997)

Validation Aspect	VAC
	• Includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved from time to time by a notice published in the NSW Government Gazette. ENM and recycled materials are to meet the criteria of the relevant exemption/order under which they are produced. Analytical results for VENM and other imported materials will need to be consistent with expectations for those materials. For VENM, it is expected that: - Heavy metal concentrations are to be less than the most conservative Added Contaminant Limit (ACL) concentrations for an URPOS exposure setting presented in Schedule B1 of the NEPM 2013; and - Organic compounds are to be less than the laboratory PQLs and asbestos to be absent. All materials imported onto the site must also be adequately assessed as being appropriate for the final use of the site. A risk-based assessment approach is to be adopted with regards to the tier 1 screening criteria presented in Schedule B1 of NEPM 2013. Recycled materials are to meet the criteria of the relevant exemption/order under which they are produced. Aesthetics: all imported materials are to be free of staining and odours.

Data should initially be assessed as above or below the VAC. Statistical analysis may be applied if deemed appropriate by the consultant and undertaken in accordance with the NEPM 2013.

7.3 Validation Sampling, Analysis and Quality Plan (SAQP)

Appropriate QA/QC samples should be obtained during the validation (where applicable) and analysed for the same suite of contaminants as the primary samples. As a minimum, QA/QC sampling should include duplicates (5% inter-laboratory and 5% intra-laboratory), trip spikes and trip blanks. Rinsate samples should be obtained if re-usable sampling equipment is utilised.

Data Quality Objectives (DQOs) and Data Quality Indicators (DQIs) should be clearly outlined and assessed as part of the validation process. A framework for the DQO and DQI process is outlined below and should be reflected in the validation report.

DQOs have been broadly established for the validation with regards to the seven-step process outlined NEPM (2013). The seven steps include the following which are detailed further in the following subsections:

- State the problem;
- Identify the decisions/goal of the study;
- Identify information inputs;
- Define the study boundary;
- Develop the analytical approach/decision rule;

- Specify the performance/acceptance criteria; and
- Optimise the design for obtaining the data.

DQIs are to be assessed based on field and laboratory considerations for precision, accuracy, representativeness, completeness and comparability.

7.3.1 Step 1 - State the Problem

Validation data is required to demonstrate that the remediation is successful and that the site is suitable for the proposed land use described in Section 1.1.

7.3.2 Step 2 - Identify the Decisions of the Study

The remediation goal, aims and objectives are defined in Section 1.2. The decisions to be made reflect these objectives and are as follows:
- Was the remediation undertaken in accordance with the RAP?
- If there were any deviations, what were these and how do they impact the outcome of the validation?
- Are any of the validation results above the VAC?
- Is the site suitable for the proposed development from a contamination viewpoint?
- Will a long-term EMP be required for the site?

7.3.3 Step 3 - Identify Information Inputs

The primary information inputs required to address the decisions outlined in Step 2 include the following:
- Existing relevant data from previous reports;
- Site information, including site observations, inspections, survey information, as-built drawings, waste and imported materials registers;
- Validation sampling of imported materials; and
- Field and laboratory QA/QC data.

7.3.4 Step 4 - Define the Study Boundary

The remediation and validation will be confined to the footprint areas of new proposed ELC building and bus/carpark as shown in Figure 2 in Appendix A and will be limited vertically to the approximate depth of fill.

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

7.3.5.1 VAC

The validation data will be assessed in accordance with the requirements outlined in Section 7.2.

7.3.5.2 Field and Laboratory QA/QC

Field QA/QC is to include analysis of inter-laboratory duplicates (5% frequency), intra-laboratory duplicates (5% frequency), trip spike, trip blank and rinsate samples (one each for the assessment to demonstrate adequacy of standard sampling/handling procedures). Field QA/QC samples are to be analysed for the contaminants of concern, except asbestos. The trip spike will only be analysed for BTEX as BTEX will be considered a surrogate to assess potential loss of volatiles from TRH fractions if present.

DQIs for field and laboratory QA/QC samples are defined below:

Field Duplicates
Acceptable targets for precision of field duplicates will be 30% or less, consistent with NEPM (2013). RPD failures will be considered qualitatively on a case-by-case basis taking into account factors such as the concentrations used to calculate the RPD (i.e. RPD exceedance where concentrations are close to the PQL are typically not as significant as those where concentrations are reported at least five or 10 times the PQL), sample type, collection methods and the specific analyte where the RPD exceedance was reported.

Trip Blanks
Acceptable targets for trip blank samples will be less than the PQL for organic analytes. Metals will be considered on a case-by-case basis with regards to the reference material used as the blank medium.

Trip Spikes
Acceptable targets for trip spike samples will be 70% to 130%.

Laboratory QA/QC
The suitability of the laboratory data will be assessed against the laboratory QA/QC criteria. These criteria are developed and implemented in accordance with the laboratory's NATA accreditation and align with the acceptable limits for QA/QC samples as outlined in NEPM (2013) and other relevant guidelines.

A summary of the typical limits is provided below:

RPDs

- Results that are <5 times the PQL, any RPD is acceptable; and
- Results >5 times the PQL, RPDs between 0-50% are acceptable.

Laboratory Control Samples (LCS) and Matrix Spikes

- 70-130% recovery acceptable for metals and inorganics; and
- 60-140% recovery acceptable for organics.

Surrogate Spikes

- 60-140% recovery acceptable for general organics.

Method Blanks

- All results less than PQL.

In the event that acceptable limits are not met by the laboratory analysis, other lines of evidence will be reviewed (e.g. field observations of samples, preservation, handling etc) and, where required, consultation with the laboratory is to be undertaken in an effort to establish the cause of the non-conformance. Where uncertainty exists, the validation consultant is to adopt the most conservative concentration reported.

7.3.5.3 Appropriateness of PQLs

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

7.3.6 Step 6 – Specify Limits on Decision Errors

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

7.3.7 Step 7 - Optimise the Design for Obtaining Data

The design is to be optimised via the collection of validation data to demonstrate the success of the key aspects of the remediation. Data collection will be via various methods including inspections and sampling.

7.3.8 Sampling Plan

The proposed sampling plan for the validation of imported materials is described in Section 7.1.

7.4 Validation Report and Long Term EMP

As part of the site validation process, a validation report will be prepared on completion of remediation and validation by the validation consultant. The report will outline the remediation work undertaken at the site and any deviations to the remediation strategy. The report will present the results of the validation assessment and will be prepared in accordance with the Consultants Reporting on Contaminated Land (2020)[14] guidelines. The report should draw conclusions regarding the success of the remediation/validation and the suitability of the site for the proposed development (from a contamination viewpoint).

A long-term EMP will be required to manage the contamination that is to be capped at the site (if required) and the long-term EMP will be documented as part of the overall validation process. In the even capping is required for the site a public notification and enforcement mechanisms for the long-term EMP should be

[14] NSW EPA, (2020). *Consultants reporting on contaminated land, Contaminated Land Guidelines.* (referred to as Consultants Reporting Guidelines)

arranged and Woollahra Municipal Council is to be provided with a draft copy of the long-term EMP for consultation prior to finalisation of the document.

The notification and enforcement mechanisms are to include notation on the planning certificate under Section 10.7 of the Environmental Planning and Assessment Act (1979) and a covenant registered on the title to land under Section 88B of the Conveyancing Act (1919).

The long-term EMP will include requirements for passive management of the capping system that will focus on maintaining the capping layers to minimise the potential of exposure to the underlying fill. The long-term EMP will also include contingencies for managing intrusive works in the event that the capping system is breached.

8 CONTINGENCY PLAN

A review of the proposed remediation works has indicated that the greatest risks that may affect the success of the remediation include identification of unexpected finds. Contingency plans to address these risks are outlined below, in conjunction with a selection of other contingencies that may apply to this project.

8.1 Unexpected Finds

Residual hazards that may exist at the site would generally be expected to be detectable through visual or olfactory means. At this site, these types of hazards may include: underground storage tanks (USTs); soils impacted by asbestos as well as asbestos containing material (ACM); Hazardous Ground Gases (HGG); or odorous/stained hydrocarbon impacted soils.

The procedure to be followed in the event of an unexpected find is presented below:

- In the event of an unexpected find, all work in the immediate vicinity should cease and the client/remediation contractor should contact the validation consultant and the project manager immediately;
- Temporary barricades should be erected to isolate the area from access to the public and workers;
- The client/remediation contractor should engage the validation consultant to attend the site and assess the extent of remediation that may be required and/or adequately characterise the contamination in order to allow for remediation of the material;
- The validation consultant is to attend the site, adequately characterise the contamination and provide advice in relation to site management and remediation. In the event that remediation differs from the procedures outlined in this RAP, an addendum RAP or RWP must be prepared in consultation with the project stakeholders and submitted to the determining authority; and
- An additional sampling and analytical rationale should be established by the consultant and should be implemented with reference to the relevant guideline documents; and
- Appropriate validation sampling should be undertaken and the results should be included in the validation report.

8.2 Continual Validation Failure (after fill/soil removal)

In the event of a soil validation failure when validating fill/soil removal, the client should be advised then the excavation should be extended in the direction of the failure (in consultation with the validation consultant, client and other relevant stakeholders) and the area re-validated.

8.3 Importation Failure for VENM or other Imported Materials

Where material to be imported onto the site does not meet the importation acceptance criteria detailed in Section 0, the material should not be accepted/imported. Alternative material must be sourced that meets the importation requirements.

8.4 Alternative Strategy / Contingency for Failure of Remediation Strategy

Considering the contaminants of concern and the simplicity of the proposed remediation strategy, the potential for the remediation strategy to fail is considered to be negligible. We note that based on the results of the pre-remediation validation assessment, it may be possible to limit the extent of remediation (i.e. removal of fill). However, this will need to be evaluated in detail in the pre-remediation validation report via a risk-based assessment of the additional data.

In the event of a soil validation failure when validating fill removal, the client should be advised that the excavation should be extended in the direction of the failure (in consultation with the validation consultant, client and other relevant stakeholders) and the area re-validated.

JKE consider that a possible contingency option for the site remediation could include a 'cap and contain' strategy whereby the fill is buried in a cell within the footprint of proposed buildings/structures. The feasibility of this option would require careful consideration and Council would need to endorse a strategy that requires an on-going EMP for the site. JKE recommend that the client carefully consider the feasibility of this option after the pre-remediation validation.

8.5 Fill Remaining On-site

In the unexpected event that 'pockets' of fill cannot be excavated and disposed off-site, this material must be validated to assess its suitability to remain on site and the potential risks posed by this soil in the context of the future land use. Sampling of any remnant fill should occur at a rate outlined in Section 7.1. Validation samples are to be analysed for the contaminants outlined in Section 7.1.

9 SITE MANAGEMENT PLAN FOR REMEDIATION WORKS

The information outlined in this section of the RAP is for the remediation work only. The client should make reference to the development consent for specific site management requirements for the overall development of the site.

9.1 Asbestos Management Plan

Prior to the commencement of any soil disturbance in the remediation areas, an asbestos management plan (AMP) is to be prepared by the validation consultant (or the remediation contractor) to document the asbestos-related management requirements for the remediation. The AMP is to be implemented by the remediation contractor (and their nominated subcontractors where relevant) throughout the remediation.

9.2 Interim Site Management

All demolition works are to occur in accordance with the relevant codes, guidelines and standards, and with reference to the findings of the hazardous building materials assessment report.

9.3 Project Contacts

Emergency procedures and contact telephone numbers should be displayed in a prominent position at the site entrance gate and within the main site working areas. The available contact details are summarised in the following table:

Table 9-1: Project Contacts

Role	Company	Contact Details
Client/developer	Mahady Management	Terry Mahady P: 0411 510 073
Project Manager	Mahady Management	Terry Mahady P: 0411 510 073
Remediation Contractor	To be appointed	-
Validation Consultant	JK Environments – subject to being formally engaged	Vittal Boggaram JK Environments P: 9888 5000
Certifier	To be appointed	-
NSW EPA	Pollution Line	131 555
Emergency Services	Ambulance, Police, Fire	000

9.4 Security

Appropriate fencing should be installed as required to secure the site. Warning signs should be erected, which outline the personal protective equipment (PPE) required for remediation work.

9.5 Timing and Sequencing of Remediation Works

The anticipated sequence of remediation works is outlined in Section 6.3. Based on the current strategy, remediation can occur prior to the commencement of any construction. The client is to review the development consent conditions in this regard to check that the sequence of works is in compliance with the consent. If any inconsistencies are identified between the development consent and the RAP, these must be resolved with the certifying authority prior to the commencement of remediation.

9.6 Site Soil and Water Management Plan

The remediation contractor is to prepare a detailed soil and water management plan prior to the commencement of site works. Silt fences should be used to control the surface water runoff at all appropriate locations of the site and appropriate measures are to be implemented to manage soil/water disturbance to the satisfaction of the regulator/determining authority. Reference should be made to the consent conditions for further details.

All stockpiled materials should be placed within an erosion containment boundary with silt fences and sandbags employed to limit sediment movement. The containment area should be located away from drainage lines/low-points, gutters, stormwater pits and inlets and the site boundary. No liquid waste or runoff should be discharged to the stormwater or sewerage system without the approval of the appropriate authorities.

9.7 Noise and Vibration Control Plan

The guidelines for minimisation of noise on construction sites outlined in AS-2460 (2002)[15] should be adopted. Other measures specified in the consent conditions should also be complied with. Noise producing machinery and equipment should only be operated between the hours approved by the determining authority (refer to consent documents).

All practicable measures should be taken to reduce the generation of noise and vibration to within acceptable limits. In the event that short-term noisy operations are necessary, and where these are likely to affect residences, notifications should be provided to the relevant authorities and the residents by the project manager, specifying the expected duration of the noisy works.

9.8 Dust Control Plan

All practicable measures should be taken to reduce dust emanating from the site. Factors that contribute to dust production are:

[15] Australian Standard, (2002). *AS2460: Acoustics - Measurement of the Reverberation Time in Rooms.*

- Wind over a cleared surface;
- Wind over stockpiled material; and
- Movement of machinery in unpaved areas.

Visible dust should not be present at the site boundary. Measures to minimise the potential for dust generation include:

- Use of water sprays on unsealed or exposed soil surfaces;
- Covering of stockpiled materials and excavation faces (particularly during periods of site inactivity and/or during windy conditions) or alternatively the erection of hessian fences around stockpiled soil or large exposed areas of soil;
- Establishment of dust screens consisting of a 2m high shade cloth or similar material secured to a chain wire fence;
- Maintenance of dust control measures to keep the facilities in good operating condition;
- Concrete surfaces brushed or washed to remove dust;
- Stopping work during strong winds;
- Loading or unloading of dry soil as close as possible to stockpiles to prevent spreading of loose material around the development area; and
- Geofabric/geotextile could be placed over exposed soils in the event that excavation is staged.

If stockpiles are to remain on-site or soil remains exposed for a period of longer than several days, dust monitoring should be undertaken at the site. If excessive dust is generated all site activities should cease until either wind conditions are more acceptable or a revised method of excavation/remediation is developed.

Dust is also produced during the transfer of material to and from the site. All material should be covered during transport and should be properly disposed of on delivery. No material is to be left in an exposed, un-monitored condition.

All equipment and machinery should be brushed or washed down before leaving the site to limit dust and sediment movement off-site. In the event of prolonged rain and lack of paved areas all vehicles should be washed down prior to exit from the site, and any soil or dirt on the wheels of the vehicles removed. Water used to clean the vehicles should be collected and tested prior to appropriate disposal under the relevant Waste Classification Guidelines.

9.9 Air Monitoring

Reference is to be made to the AMP for details regarding asbestos air fibre monitoring. Daily asbestos air fibre monitoring should be considered during remediation works given that the site is occupied by a school. If undertaken, air monitoring must only be carried out by personnel registered and accredited by NATA (National Association of Testing Authorities). Filter analysis must only be carried out within a NATA certified laboratory. The monitoring results must conform to the requirements of the NOHSC Guidance note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition [NOHSC:3003 (2005)].

A monitoring program will be used to assess whether the control procedures being applied are satisfactory and that criteria for airborne asbestos fibre levels are not being exceeded. The following levels will be used as action criteria during the air monitoring:

- <0.01 Fibres/ml: Work procedures deemed to be successful;
- 0.01 to 0.02 Fibres/ml: Inspection of the site and review of procedures; and
- >0.02 Fibres/ml: Stop work, inspection of the site, review of procedures, clean-up, rectification works where required and notify the relevant regulator.

9.10 Dewatering

Temporary dewatering is not anticipated to be required at this stage. If a rain event occurs during the construction of the cell, this water should be managed appropriately on site in accordance with the remediation contractor's soil and water management plan. This water should not be pumped to stormwater or sewer unless a prior application is made and this is approved by the relevant authorities.

9.11 Odour Control Plan

All activities undertaken at the site should be completed in a manner that minimises emissions of smoke, fumes and vapour into the atmosphere and any odours arising from the works or stockpiled material should be controlled. Control measures may include:

- Maintenance of construction equipment so that exhaust emissions comply with the Clean Air Regulations issued under the Protection of the Environment Operations Act (1997) (POEO);
- Demolition materials and other combustible waste should not be burnt on site;
- The spraying of a suitable proprietary product to suppress any odours that may be generated by excavated materials; and
- Use of protective covers (e.g. builder's plastic).

All practicable measures should be taken to reduce fugitive emissions emanating from the site so that associated odours do not constitute a nuisance and that the ambient air quality is not adversely impacted.

The following odour management plan should be implemented to limit the exposure of site personnel and surrounding residents to unpleasant odours:

- Excavation and stockpiling of material should be scheduled during periods with low winds if possible;
- A suitable proprietary product could be sprayed on material during excavation and following stockpiling to reduce odours (subject to an appropriate assessment of the product by the validation consultant);
- All complaints from workers and neighbours should be logged and a response provided. Work should be rescheduled as necessary to minimise odour problems;
- The site foreman should consider the following odour control measures:
  - reduce the exposed surface of the odorous materials;
  - time excavation activities to reduce off-site nuisance (particularly during strong winds); and
  - cover exposed excavation faces overnight or during periods of low excavation activity.

- If continued complaints are received, alternative odour management strategies should be considered and implemented.

9.12 Work Health and Safety (WHS) Plan

A site specific WHS plan should be prepared by the remediation contractor for all work to be undertaken at the site. The WHS plan should meet all the requirements outlined in SafeWork NSW WHS regulations.

As a minimum requirement, personnel must wear appropriate protective clothing, including long sleeve shirts, long trousers, steel cap boots and hard hats. Washroom and lunchroom facilities should also be provided to allow workers to remove potential contamination from their hands and clothing prior to eating or drinking.

9.13 Waste Management

Prior to commencement of remedial works and excavation for the proposed development, the remediation contractor should develop a waste management or recycling plan to minimise the amount of waste produced by the site. This should, as a minimum, include measures to recycle and re-use natural excavated material wherever possible.

9.14 Incident Management Contingency

The validation consultant should be contacted if any unexpected conditions are encountered at the site. This should enable the scope of remedial/validation works to be adjusted as required. Similarly, if any incident occurs at the site, the validation consultant should be advised to assess potential impacts on contamination conditions and the remediation/validation timetable.

9.15 Hours of Operation

Hours of operation should be between those approved by the determining authority under the development approval process.

9.16 Community Consultation and Complaints

The remediation contractor should provide details for managing community consultation and complaints within their Construction Environmental Management Plan or other site management plans developed for construction.

10 CONCLUSIONS

JKE have previously undertaken a PSI at the site which identified historically imported fill (soil) impacted by asbestos, PAHs, TRHs and heavy metals. For the purpose of this RAP, the fill is considered to be impacted by asbestos, carcinogenic PAHs and lead above the human health-based SAC applicable to 'residential with accessible soils' (Type A) land use scenario, and TRH F3 above the ecological SAC applicable to 'urban residential and public open space' exposure scenario. Fill is present at the surface and extends to depths of approximately 0.2mBGL to 6.9mBGL.

A DGI report is to be prepared following completion of the assessment as outlined in Section 4 of this RAP which is to be undertaken following site establishment and removal of all pavements/access way etc. RWP is to be prepared and implemented and should be based on the outcomes of the DGI.

The soil remediation strategy includes excavation and off-site disposal of contaminated fill. If required, capping is to be provided for contaminated material to be left in-situ, which should be managed via a long-term EMP. This remediation method was assessed to be technically achievable to implement concurrently with the proposed development works. On this basis, JKE are of the opinion that the site can be made suitable for the proposed development provided this RAP is implemented.

A site validation report and if required a long term EMP is to be prepared on completion of remediation activities and submitted to the determining authority/Woollahra Municipal Council to demonstrate that the site is suitable for the proposed development.

The RAP has met the objectives outlined in Section **Error! Reference source not found.**1.2.

10.1 Remediation Category

Site remediation can fall under the following two categories outlined in SEPP55:

Table 10-1: Remediation Category

Category	Details
Category 1	Category 1 remediation works are those undertaken in the following areas specified under Clause 9 of SEPP55: • A designated development; • Carried out on land declared to be a critical habitat; • Development for which another SEPP or REP requires a development consent; or • Carried out in an area or zone classified as: ➢ Coastal Protection; ➢ Conservation or heritage conservation; ➢ Habitat protection, or habitat or wildlife corridor; ➢ Environmental protection; ➢ Escarpment, escarpment protection or preservation; ➢ Floodway or wetland; ➢ Nature reserve, scenic area or scenic protection; etc. • Work that is not carried out in accordance with the site management provisions contained in the consent authority Development Control Plan (DCP)/Local Environmental Plan (LEP) etc.

Category	Details
	Approval is required from the consent authority for Category 1 remediation work. The RAP needs to be assessed as part of the development consent. Category 1 remediation work is identified as advertised development work unless the remediation work is a designated development or a state significant development (Clause 13 of SEPP55).
Category 2	Remediation works which do not fall under the above category are classed as Category 2. Development consent is not required for Category 2 remediation works, however the consent authority should **be given 30 days' notice prior to commencement of works**.

In the context of the proposed remediation at the site, the remediation works would fall within Category 2 under the draft Remediation of Land SEPP. However, this should be confirmed by the client's planner following finalisation of the design.

10.2 Regulatory Requirements

The regulatory requirements applicable for the remediation are discussed in the following table:

Table 10-2: Regulatory Requirement

Guideline / Legislation / Policy	Applicability
SEPP55	At least a 30-day notice of Category 2 remediation work is to be provided to the consent authority in accordance with Clause 16 of SEPP55. Under Clause 17 of SEPP55, a notice of completion of remediation work is to be given to council within 30 days of completion of the work. The notice of completion of remediation works must be in accordance with Clause 18 of SEPP55.
POEO Act 1997	Section 143 of the POEO Act 1997 states that if waste is transported to a place that cannot lawfully be used as a waste facility for that waste, then the transporter and owner of the waste are each guilty of an offence. The transporter and owner of the waste have a duty to ensure that the waste is disposed of in an appropriate manner. Appropriate waste tracking is required for all waste that is disposed off-site. Activities should be carried out in a manner which does not result in the pollution of waters.
POEO (Waste) Regulation 2014	Part 7 of the POEO Waste Regulation 2014 set outs the requirements for the transportation and management of asbestos waste and Clause 79 of the POEO Waste Regulation requires waste transporters to provide information to the NSW EPA regarding the movement of any load in NSW of more than 10 square meters of asbestos sheeting, or 100 kilograms of asbestos waste. To fulfil these legal obligations, asbestos waste transporters must use WasteLocate. Clause 78 of the POEO Waste Regulation requires that a person who transport asbestos waste must ensure that: • Any part of any vehicle in which the person transports the waste is covered, and leak-proof, during the transportation; and • If the waste consists of bonded asbestos material—it is securely packaged during the transportation; and • If the waste consists of friable asbestos material—it is kept in a sealed container during transportation; and

Guideline / Legislation / Policy	Applicability
	• If the waste consists of asbestos-contaminated soils—it is wetted down. Asbestos waste in any form cannot be re-used or recycled.
SafeWork NSW Code of Practice: How to manage and control asbestos in the workplace (2019)	Sites with asbestos become a 'workplace' when work is carried out there and require a register and AMP. Appropriate SafeWork NSW notification will be required for licensed (e.g. Class A) asbestos removal works or handling.

11 LIMITATIONS

The report limitations are outlined below:

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

Important Information About This Report

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

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

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

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

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

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

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

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

Misinterpretation of Site Assessments by Design Professionals

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

Logs Should not be Separated from the Assessment Report

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

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

Read Responsibility Clauses Closely

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

Appendix A: Report Figures

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

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

Title:	SITE LOCATION PLAN
Location:	CORNER NEW SOUTH HEAD ROAD AND VAUCLUSE ROAD, VAUCLUSE, NSW
Project No:	E32915BA2
Figure:	1

JKEnvironments

PLOT DATE: 10/05/2021 10:34:35 AM DWG FILE: Z:\5 EIS\5C EIS JOBS\32000'S\E32915BD VAUCLUSE\CAD\E32915BA2.DWG

LEGEND

(red dashed line)	APPROXIMATE SITE BOUNDARY
(yellow line)	APPROXIMATE WIDER PROPERTY BOUNDARY
BH(Fill depth)	BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m)
BH/MW(Fill depth)	BOREHOLE AND GROUNDWATER MONITORING WELL LOCATION, NUMBER AND DEPTH OF FILL (m)

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

0 13 26 39 52 65

SCALE 1:1300 @A3 METRES

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

Title: **SAMPLE LOCATION PLAN**

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

Project No: E32915BA2

Figure: 2

JKEnvironments

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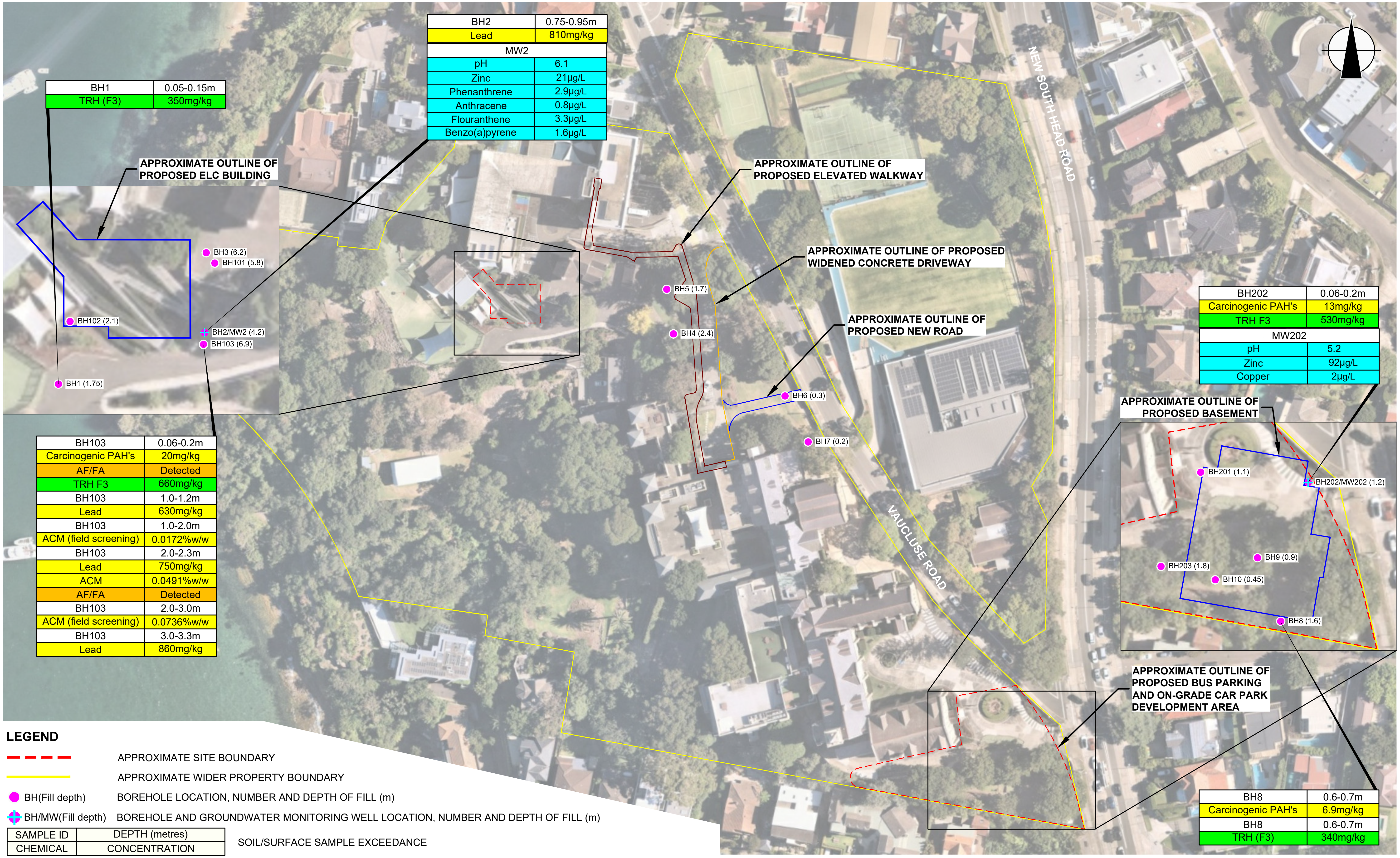


BH1	0.05-0.15m
TRH (F3)	350mg/kg

BH2	0.75-0.95m
Lead	810mg/kg

MW2	
pH	6.1
Zinc	21µg/L
Phenanthrene	2.9µg/L
Anthracene	0.8µg/L
Flouranthene	3.3µg/L
Benzo(a)pyrene	1.6µg/L

BH103	0.06-0.2m
Carcinogenic PAH's	20mg/kg
AF/FA	Detected
TRH F3	660mg/kg
BH103	1.0-1.2m
Lead	630mg/kg
BH103	1.0-2.0m
ACM (field screening)	0.0172%w/w
BH103	2.0-2.3m
Lead	750mg/kg
ACM	0.0491%w/w
AF/FA	Detected
BH103	2.0-3.0m
ACM (field screening)	0.0736%w/w
BH103	3.0-3.3m
Lead	860mg/kg

BH202	0.06-0.2m
Carcinogenic PAH's	13mg/kg
TRH F3	530mg/kg

MW202	
pH	5.2
Zinc	92µg/L
Copper	2µg/L

BH8	0.6-0.7m
Carcinogenic PAH's	6.9mg/kg
BH8	0.6-0.7m
TRH (F3)	340mg/kg

LEGEND

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

SAMPLE ID	DEPTH (metres)
CHEMICAL	CONCENTRATION

SOIL/SURFACE SAMPLE EXCEEDANCE

SAMPLE ID	-
CHEMICAL	CONCENTRATION (µg/L)

GROUNDWATER SAMPLE EXCEEDANCE

- SOIL/SURFACE CONTAMINATION ABOVE SAC FOR HUMAN HEALTH RISK
- SOIL CONTAMINATION ABOVE SAC FOR ECOLOGICAL RISK
- GROUNDWATER CONTAMINATION ABOVE SAC
- ASBESTOS DETECTED BUT BELOW SAC FOR HUMAN HEALTH RISK

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

0 13 26 39 52 65

SCALE 1:1300 @A3 METRES

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

Title: **CONTAMINATION LOCATION PLAN**

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

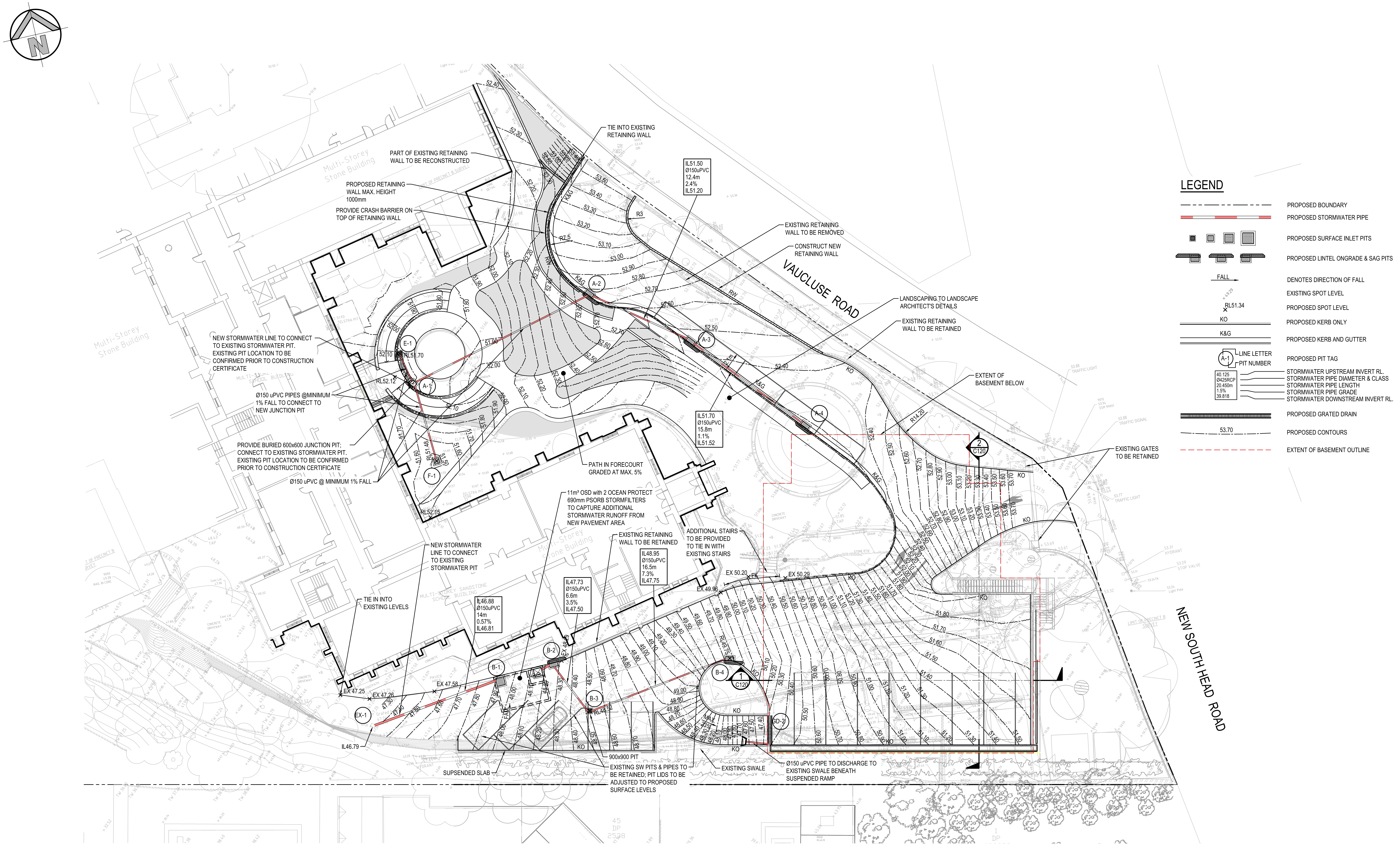
Project No: E32915BA2

Figure: 3

JKEnvironments

PLOT DATE: 10/05/2021 2:16:54 PM DWG FILE: Z:\5 EIS\5C EIS JOBS\32000'S\E32915BD VAUCLUSE\CAD\E32915BA2.DWG

Appendix B: Selected Proposed Development Plans



SENIOR SCHOOL - INTERNAL ROADWAY DESIGN PLAN - GROUND LEVEL

SCALE: 1:200

0 4 8 12 16 20m
4 3 2 1

SCALE 1:200

FOR DEVELOPMENT APPLICATION

SURVEY INFORMATION
SURVEYED BY:
CRUX SURVEYING AUSTRALIA
DATUM: AHD
ORIGIN OF LEVELS: SSM 99001, RL 53.939 (AHD)

REVISION	AMENDMENT	DRAWN	DESIGNED	DATE	REVISION	AMENDMENT	DRAWN	DESIGNED	DATE
02	ISSUED FOR SSDA	MS	AF	25.08.2020					
01	ISSUED FOR INFORMATION ONLY	KR	AF	07.04.2020					

Client: KINCOPPAL ROSE BAY SCHOOL
Architect: BVN Architects

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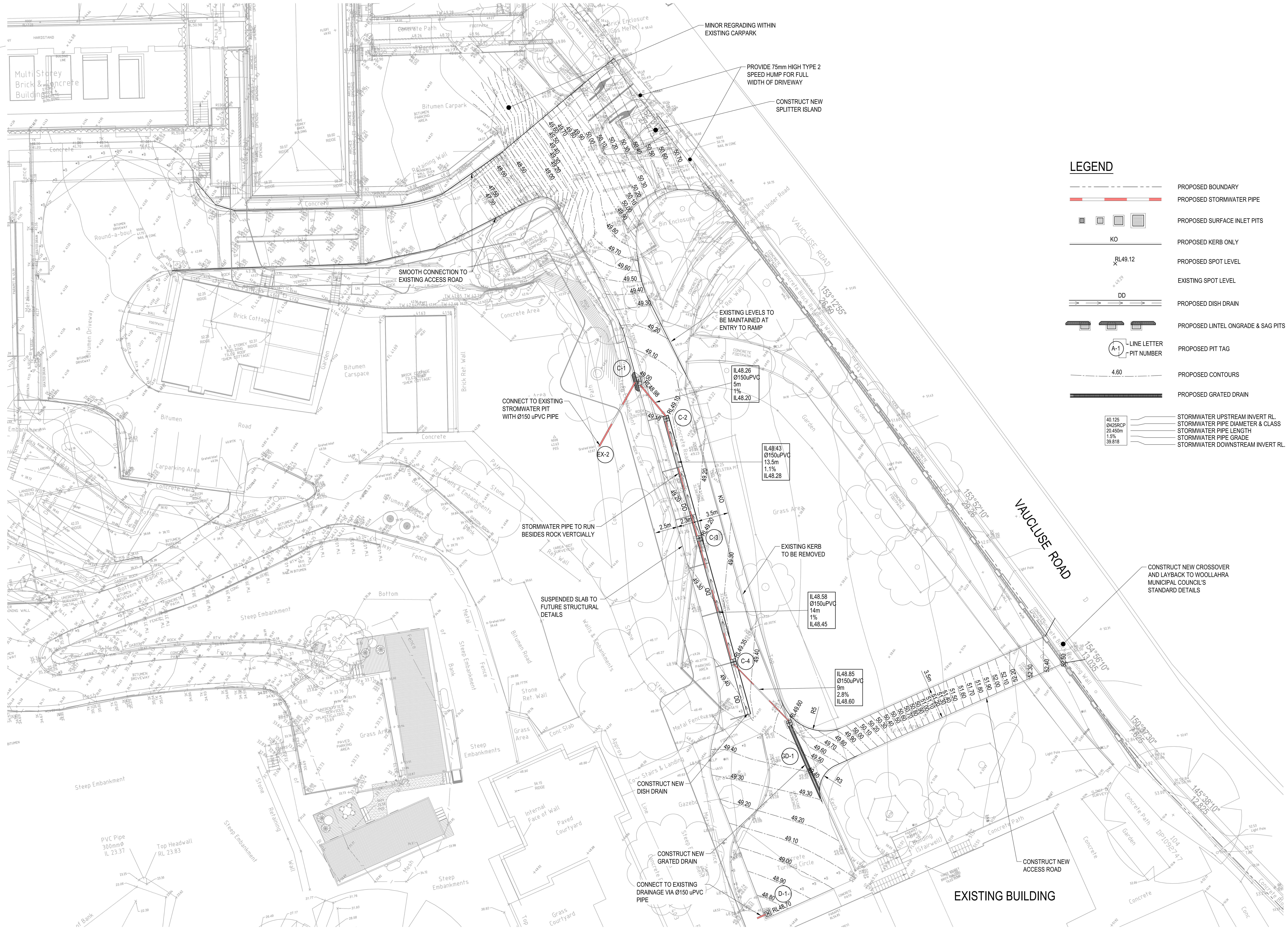
Facsimile +61 2 9417 8337
Email email@hhconsult.com.au
Web www.henryandhymas.com.au
henry&hymas

Project: KINCOPPAL ROSE BAY SCHOOL, NEW SOUTH HEAD ROAD, ROSE BAY, NSW

Title: SENIOR SCHOOL - INTERNAL ROADWAY DESIGN PLAN - GROUND LEVEL

Drawn	Designed	Date
J.Knight	A.Francis	JAN 2020
Checked	**Approved**	**Scale @A1**
A.Francis	A.Francis	1:200

Drawing number: 19949_DA_C101
Revision: 02



LEGEND

- PROPOSED BOUNDARY
- PROPOSED STORMWATER PIPE
- PROPOSED SURFACE INLET PITS
- KO — PROPOSED KERB ONLY
- RL49.12 — PROPOSED SPOT LEVEL
- EXISTING SPOT LEVEL
- DD — PROPOSED DISH DRAIN
- PROPOSED LINTEL ONGRADE & SAG PITS
- A-1 (LINE LETTER, PIT NUMBER) — PROPOSED PIT TAG
- 4.60 — PROPOSED CONTOURS
- PROPOSED GRATED DRAIN
- 40.125 — STORMWATER UPSTREAM INVERT RL.
- Ø425RCP — STORMWATER PIPE DIAMETER & CLASS
- 20.450m — STORMWATER PIPE LENGTH
- 1.5% — STORMWATER PIPE GRADE
- 39.818 — STORMWATER DOWNSTREAM INVERT RL.

SCALE 1:200 (0, 4, 8, 12, 16, 20m; 4 3 2 1)

SENIOR SCHOOL - INTERNAL ROADWAY DESIGN PLAN - GROUND LEVEL

SCALE: 1:200

FOR DEVELOPMENT APPLICATION

SURVEY INFORMATION
SURVEYED BY: CRUX SURVEYING AUSTRALIA
DATUM: AHD
ORIGIN OF LEVELS: SSM 99001, RL 53.939 (AHD)

REVISION	AMENDMENT	DRAWN	DESIGNED	DATE
02	ISSUED FOR SSDA	MS	AF	25.08.2020
01	ISSUED FOR INFORMATION ONLY	KR	AF	07.04.2020

Client: KINCOPPAL ROSE BAY SCHOOL

Architect: BVN Architects

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Web www.henryandhymas.com.au
henry&hymas

Project: KINCOPPAL ROSE BAY SCHOOL
NEW SOUTH HEAD ROAD, ROSE BAY, NSW

Title: SENIOR SCHOOL - INTERNAL ROADWAY DESIGN PLAN - GROUND LEVEL

Drawn	Designed	Date
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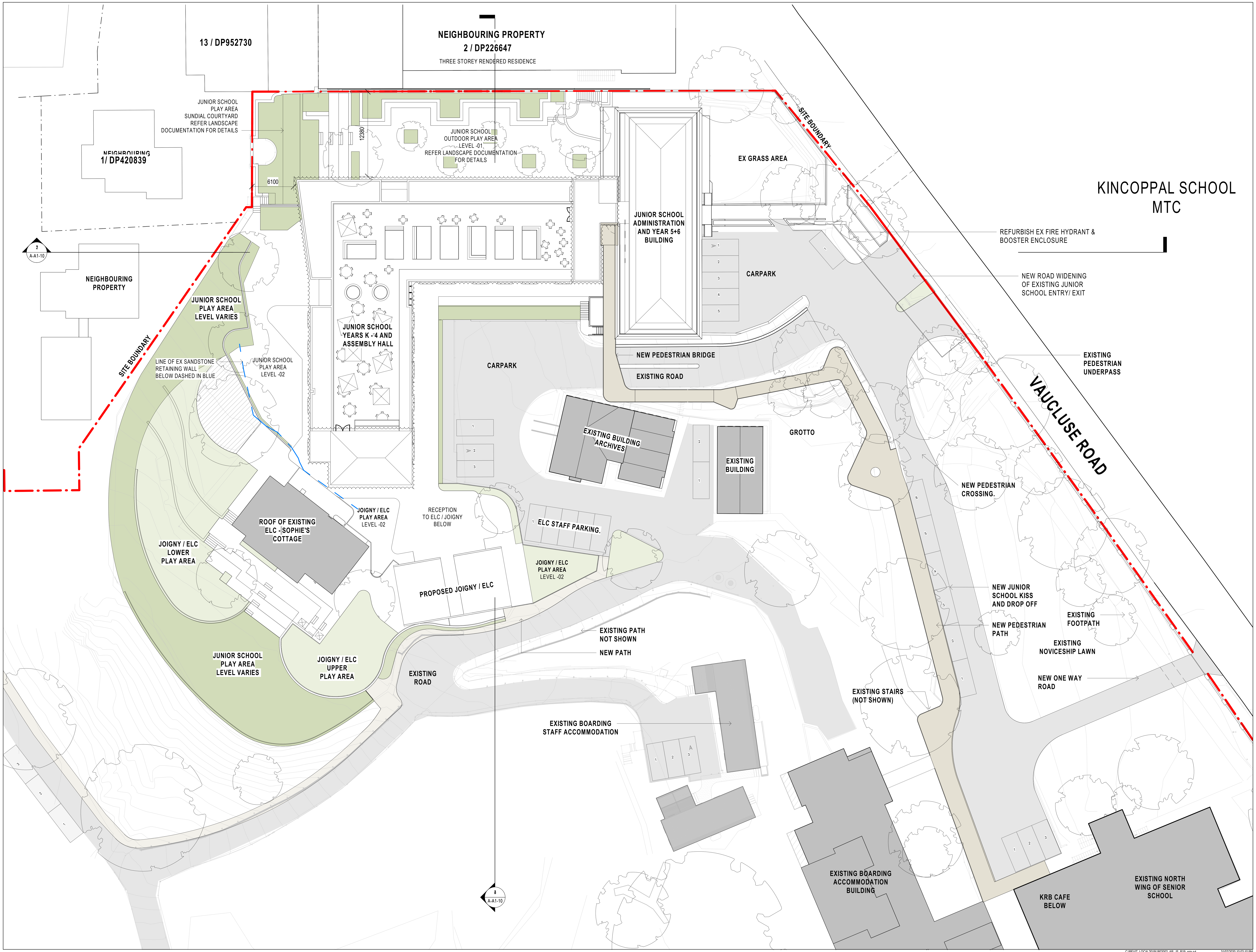
Checked	Approved	Scale @A1
A.Francis	A.Francis	1:200

Drawing number: 19949_DA_C110
Revision: 02



BVN

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NOTE

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ISSUE	DATE	FOR
1	09.12.19	FOR SEM SIGN OFF
2	27.03.20	FOR COORDINATION
3	05.06.20	FOR COORDINATION
4	17.06.20	FOR COORDINATION
5	31.07.20	SSDA SUBMISSION

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DESIGN 5
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LANDSCAPE ARCHITECT
CAB CONSULTING
TEL 02 9997 1085

PROJECT MANAGER
MAHADY MANAGEMENT
MOB. 0411 510 073

CLIENT

STATE SIGNIFICANT DEVELOPMENT APPLICATION

PRECINCT A

PROJECT

JUNIOR SCHOOL AND ELC

CNR NEW SOUTH HEAD ROAD & VAUCLUSE RD, VAUCLUSE NSW 2030

BVN PROJECT NUMBER

1802002

DRAWING KEY

TRUE NORTH PROJECT NORTH

GRAPHIC SCALE

0 2000 5000

SCALE

1 : 250@A1

STATUS

FOR COORDINATION

DRAWING

SITE - PROPOSED SITE PLAN

ISSUE

AR-A-A1-00 5

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4	27.03.20	FOR COORDINATION
5	05.06.20	FOR COORDINATION
6	17.06.20	FOR COORDINATION
7	31.07.20	SSDA SUBMISSION

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DESIGN 5
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PROJECT MANAGER
MAHADY MANAGEMENT
MOB. 0411 510 073
CLIENT

STATE SIGNIFICANT DEVELOPMENT APPLICATION

PRECINCT A
PROJECT
JUNIOR SCHOOL AND ELC
CNR NEW SOUTH HEAD ROAD & VAUCLUSE RD, VAUCLUSE NSW 2030
BVN PROJECT NUMBER
1802002
DRAWING KEY

TRUE NORTH PROJECT NORTH
GRAPHIC SCALE
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SCALE
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STATUS
FOR COORDINATION
DRAWING
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ISSUE
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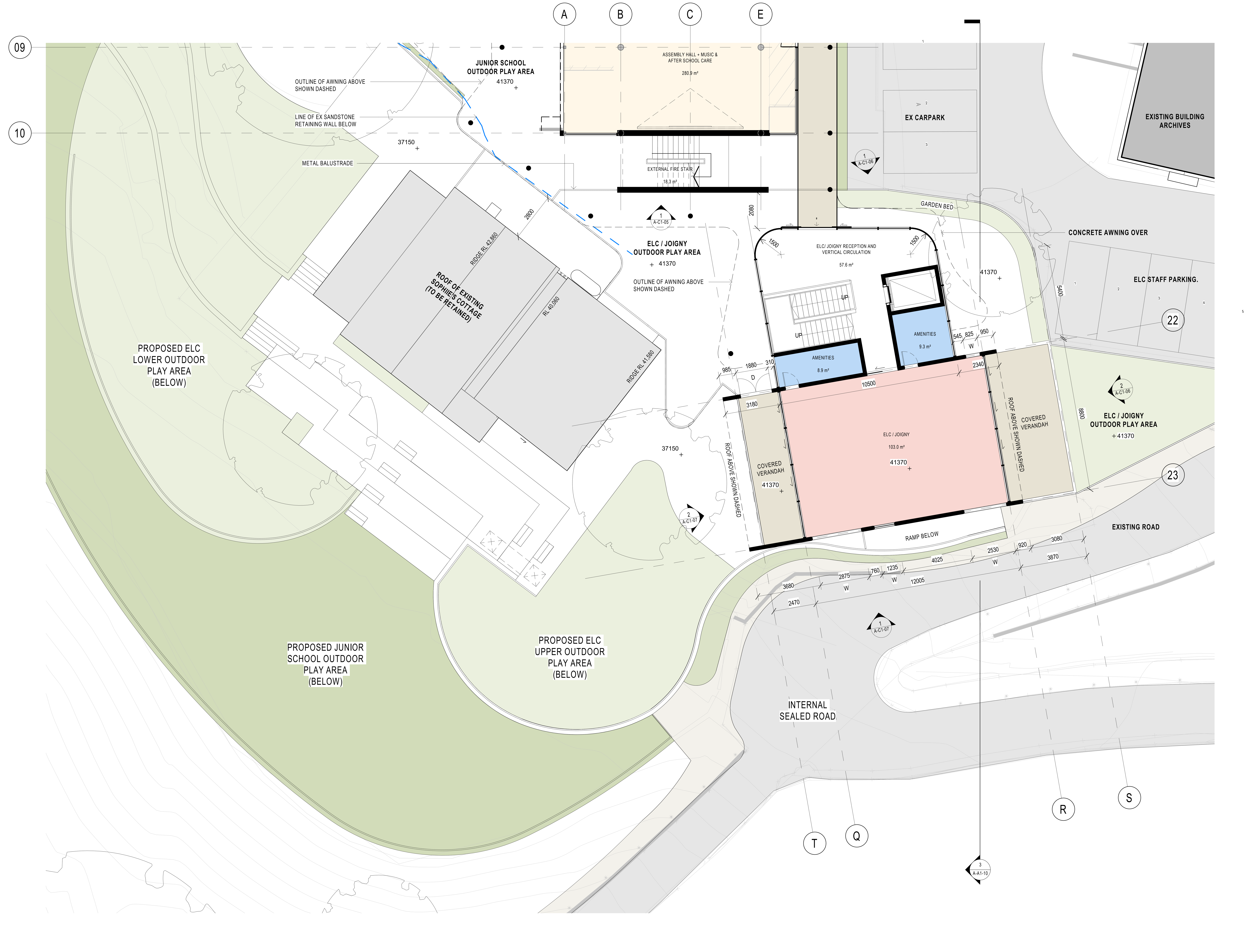

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ISSUE	DATE	FOR
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2	09.12.19	FOR SEM SIGN OFF
3	27.03.20	FOR COORDINATION
4	05.06.20	FOR COORDINATION
5	17.06.20	FOR COORDINATION
6	31.07.20	SSDA SUBMISSION

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CLIENT

STATE SIGNIFICANT DEVELOPMENT APPLICATION

PRECINCT A

PROJECT

JUNIOR SCHOOL AND ELC

CNR NEW SOUTH HEAD ROAD & VAUCLUSE RD, VAUCLUSE NSW 2030

BVN PROJECT NUMBER

1802002

DRAWING KEY

TRUE NORTH PROJECT NORTH

GRAPHIC SCALE

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SCALE

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STATUS

FOR COORDINATION

DRAWING

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ISSUE

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NOTE

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2	17.06.20	FOR COORDINATION
3	31.07.20	FOR INFORMATION
4	26.08.20	AMDT - FOR INFORMATION

LEGEND

CON	CONCRETE
EX	EXISTING
TM	TIMBER

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URBAN PLANNER AND HERITAGE SPECIALIST
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LANDSCAPE ARCHITECT
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URBIS
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ABE CONSULTING
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BCA CONSULTANT
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TEL 02 9211 7777

LAND SURVEYOR
CRUX SURVEYING
TEL 04 1587 7937

CLIENT
KINCOPPAL - ROSE BAY

PROJECT MANAGER
MAHADY MANAGEMENT
MOB. 0411 510 073

PROJECT
PRECINCT A, B, C
CNR NEW SOUTH HEAD ROAD & VAUCLUSE RD, VAUCLUSE, NSW 2030

BVN PROJECT NUMBER
1802002

TRUE NORTH
PROJECT NORTH

GRAPHIC SCALE
0 2000 5000

SCALE
1 : 100 @ A1

STATUS
STATE SIGNIFICANT DEVELOPMENT APPLICATION

DRAWING
PROPOSED PLAN - LEVEL G - EAST

DRAWING NUMBER
AR-B13-B1-00

ISSUE
4

C:\REVIT_LOCAL2019\1802002_AR_SITE_R19_rqin.rvt 27/08/2020 11:28:07 AM

BVN

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ISSUE	DATE	FOR
1	13.03.20	FOR COORDINATION
2	17.06.20	FOR COORDINATION
3	31.07.20	FOR INFORMATION

LEGEND

CON	CONCRETE
EX	EXISTING
TM	TIMBER

TRAFFIC ENGINEER
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CIVIL AND STRUCTURAL ENGINEERS
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CLIENT
KINCOPPAL - ROSE BAY

PROJECT MANAGER
MAHADY MANAGEMENT
MOB. 0411 510 073

PROJECT
PRECINCT A, B, C
CNR NEW SOUTH HEAD ROAD & VAUCLUSE RD, VAUCLUSE, NSW 2030

BVN PROJECT NUMBER
1802002

TRUE NORTH PROJECT NORTH

GRAPHIC SCALE
0 2000 5000

SCALE
1 : 100 @ A1

STATUS
STATE SIGNIFICANT DEVELOPMENT APPLICATION

DRAWING
PROPOSED PLAN - LEVEL LG - EAST

DRAWING NUMBER	ISSUE
AR-B13-B1-01	3

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NOTE
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ISSUE	DATE	FOR
1	31.07.20	FOR INFORMATION
2	26.08.20	AMDT - FOR INFORMATION

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ACCESSIBILITY CONSULTANT
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LAND SURVEYOR
CRUX SURVEYING
TEL 04 1587 7937

CLIENT
KINCOPPAL - ROSE BAY

PROJECT MANAGER
MAHADY MANAGEMENT
MOB. 0411 510 073

PROJECT
PRECINCT A, B, C
CNR NEW SOUTH HEAD ROAD & VAUCLUSE RD, VAUCLUSE, NSW 2030

BVN PROJECT NUMBER
1802002

TRUE NORTH
PROJECT NORTH

GRAPHIC SCALE
0 2000 5000

SCALE
1 : 100 @ A1

STATUS
STATE SIGNIFICANT DEVELOPMENT APPLICATION

DRAWING
PROPOSED PLAN - LEVEL G - WEST

DRAWING NUMBER
AR-B13-B1-02

ISSUE
2

Appendix C: JKE PSI Attachments

Sub-surface Record

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BOREHOLE LOG

Borehole No.
1
1 / 1

PROPOSED ELC BUILDING

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH1 **Method:** SPIRAL AUGER **R.L. Surface:** 35.1 m
Date: 28/1/20 **Datum:** AHD
Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

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

JKGeotechnics

BOREHOLE LOG

Borehole No.
2
1 / 2

PROPOSED ELC BUILDING

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH1 **Method:** SPIRAL AUGER **R.L. Surface:** 38.6 m
Date: 28/1/20 **Datum:** AHD
Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

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

JK 9.02.4 LIB.GLB Log JK AUGERHOLE - MASTER 32915PH1 VAUCLUSE.GPJ <<DrawingFile>> 25/02/2020 11:45 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

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BOREHOLE LOG

Borehole No.
2

PROPOSED ELC BUILDING

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH1 **Method:** SPIRAL AUGER **R.L. Surface:** 38.6 m
Date: 28/1/20 **Datum:** AHD
Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

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

JK 9.02.4 LIB.GLB Log JK AUGERHOLE - MASTER 32915PH1 VAUCLUSE.GPJ <<DrawingFile>> 25/02/2020 11:45 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

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BOREHOLE LOG

Borehole No.
3
1 / 2

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH1 **Method:** SPIRAL AUGER **R.L. Surface:** 40.6 m
Date: 28/1/20 **Datum:** AHD
Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	Field Tests	Depth (m)	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION		0	-	ASPHALTIC CONCRETE: 50mm.t	M			
				FILL: Silty sand, fine grained, brown, trace of clay.				APPEARS WELL COMPACTED
				FILL: Silty sand, fine to medium grained, brown and light brown.				
	N = 21 10,11,10			FILL: Silty sand, fine to coarse grained, brown and dark brown, trace of igneous gravel and brick fragments.				
	N = 6 5,4,2							APPEARS POORLY COMPACTED
	N = 15 7,4,11							APPEARS WELL COMPACTED
				as above, but with sandstone boulders and cobbles.				BANDS OF LOW 'TC' BIT RESISTANCE
	Nc = 12 15 11 /100mm REFUSAL		-	SANDSTONE: fine to coarse grained, light grey, grey and red brown, with occasional medium strength bands.	XW - DW	Hd - VL		HAWKESBURY SANDSTONE VERY LOW RESISTANCE WITH MODERATE BANDS

SAMPLES: ES, U50, DB, DS. RL (m AHD): 40, 39, 38, 37, 36, 35, 34. Depth (m): 1, 2, 3, 4, 5, 6. Graphic Log.

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BOREHOLE LOG

Borehole No.
3
2 / 2

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH1 **Method:** SPIRAL AUGER **R.L. Surface:** 40.6 m
Date: 28/1/20 **Datum:** AHD
Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

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

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BOREHOLE LOG

Borehole No.
4

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH2 **Method:** SPIRAL AUGER **R.L. Surface:** N/A
Date: 28/1/20 **Datum:** AHD
Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	Field Tests	Depth (m)	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION		0		FILL: Silty sand, fine to coarse grained, brown and light brown, trace of root fibres.	M			GRASS COVER APPEARS POORLY COMPACTED
	N = 7 3,4,3	1						
	N = 2 5,1,1			as above, but light orange brown.				
		2	-	SANDSTONE: fine to coarse grained, orange brown.	XW - DW	Hd - VL		HAWKESBURY SANDSTONE VERY LOW 'TC' BIT RESISTANCE
		3		as above, but light grey.	SW	M - H		MODERATE TO HIGH RESISTANCE
				END OF BOREHOLE AT 3.20 m				'TC' BIT REFUSAL
		4						
		5						
		6						

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BOREHOLE LOG

Borehole No.
5

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH2 **Method:** SPIRAL AUGER **R.L. Surface:** N/A
Date: 28/1/20 **Datum:** AHD
Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	Field Tests	Depth (m)	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	N > 13 6,13/ 150mm REFUSAL	0–1.7		FILL: Silty sand, fine to coarse grained, brown and dark brown, with sandstone cobbles and boulders, trace of root fibres.	M			GRASS COVER APPEARS MODERATELY COMPACTED
		1.7–2.5	-	SANDSTONE: fine to coarse grained, light brown.	DW	M		HAWKESBURY SANDSTONE MODERATE TO HIGH 'TC' BIT RESISTANCE
		2.5		END OF BOREHOLE AT 2.50 m				'TC' BIT REFUSAL

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BOREHOLE LOG

Borehole No.
6
1 / 1

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH2 **Method:** HAND AUGER **R.L. Surface:** 51.4 m
Date: 3/2/20 **Datum:** AHD
Plant Type: **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES (ES, U50, DB, DS)	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION		REFER TO DCP TEST RESULTS					FILL: Silty sand, fine to coarse grained, dark brown, trace of roots and root fibres.	M			GRASS COVER
			51			SM	Silty SAND: fine to medium grained, orange brown, trace of clay.	M	MD		RESIDUAL
							END OF BOREHOLE AT 0.50 m				HAND AUGER REFUSAL ON INFERRED SANDSTONE BEDROCK
				1							
			50								
				2							
			49								
				3							
			48								
				4							
			47								
				5							
			46								
				6							
			45								

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BOREHOLE LOG

Borehole No. **7**

1 / 1

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH2 **Method:** HAND AUGER **R.L. Surface:** 51.8 m
Date: 3/2/20 **Datum:** AHD
Plant Type: **Logged/Checked By:** D.A.F./A.J.H.

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

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BOREHOLE LOG

Borehole No.
8
1 / 2

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH3 **Method:** HAND AUGER **R.L. Surface:** N/A
Date: 3/2/20 **Datum:**
Plant Type: **Logged/Checked By:** D.A.F./A.J.H.

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

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CORED BOREHOLE LOG

Borehole No.
8

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH3 | **Core Size:** TT56 | **R.L. Surface:** N/A
Date: 3/2/20 | **Inclination:** VERTICAL | **Datum:**
Plant Type: MELVELLE | **Bearing:** N/A | **Logged/Checked By:** D.A.F./A.J.H.

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

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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BOREHOLE LOG

Borehole No. 9

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH3 **Method:** HAND AUGER **R.L. Surface:** N/A
Date: 3/2/20 **Datum:**
Plant Type: **Logged/Checked By:** D.A.F./A.J.H.

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

JK 9.02.4 LIB.GLB Log JK AUGERHOLE - MASTER 32915PH3 VAUCLUSE.GPJ <<DrawingFile>> 25/02/2020 12:42 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

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CORED BOREHOLE LOG

Borehole No.
9
2 / 2

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH3 | **Core Size:** TT56 | **R.L. Surface:** N/A
Date: 3/2/20 | **Inclination:** VERTICAL | **Datum:**
Plant Type: MELVELLE | **Bearing:** N/A | **Logged/Checked By:** D.A.F./A.J.H.

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

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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BOREHOLE LOG

Borehole No.
10
1 / 1

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH3 **Method:** HAND AUGER **R.L. Surface:** N/A
Date: 3/2/20 **Datum:**
Plant Type: **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	U50	DB	DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION					REFER TO DCP TEST RESULTS				FILL: Silty sand, fine to coarse grained, dark brown, trace of fine to coarse grained sandstone gravel.	M			APPEARS POORLY COMPACTED
									END OF BOREHOLE AT 0.45 m				HAND AUGER REFUSAL ON INFERRED SANDSTONE BEDROCK
						1							
						2							
						3							
						4							
						5							
						6							

JK 9.02.4 LIB.GLB Log JK AUGERHOLE - MASTER 32915PH3 VAUCLUSE.GPJ <<DrawingFile>> 25/02/2020 12:43 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

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BOREHOLE LOG

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED ELC BUILDING
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915SH1 **Method:** SPIRAL AUGER **R.L. Surface:** ~40.6 m
Date: 14/3/21 **Datum:** AHD
Plant Type: JK205 **Logged/Checked By:** B.A./A.J.H.

Groundwater Record	SAMPLES (ES, U50, DB, DS)	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING							ASPHALTIC CONCRETE: 50mm.t				
						-	FILL: Silty sand, fine to medium grained, brown, trace of fine to medium grained sandstone, ironstone and igneous gravel.	M			APPEARS WELL COMPACTED
		N = 23 10,10,13	40				FILL: Silty sand, fine to medium grained, brown and light grey, trace of fine to coarse grained sandstone, ironstone gravel, trace of brick and glass framents and ash.				
				1							
		N = 8 5,5,3	39								APPEARS POORLY COMPACTED
				2							
			38								
		N = 29 6,17,12		3							APPEARS WELL COMPACTED
			37								
				4							
		N = 5 5,2,3	36								APPEARS POORLY COMPACTED
AFTER COMPLETION OF CORING				5							
			35								
						SP	SAND: fine to medium grained, brown, with silt fines.	M	VL		AEOLIAN
		N = 2 2,1,1		6							
			34								

JK 9.02.4 LIB.GLB Log JK AUGERHOLE - MASTER 32915SH1 VAUCLUSE.GPJ <<DrawingFile>> 15/04/2021 15:46 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

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BOREHOLE LOG

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED ELC BUILDING
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915SH1 **Method:** SPIRAL AUGER **R.L. Surface:** ~40.6 m
Date: 14/3/21 **Datum:** AHD
Plant Type: JK205 **Logged/Checked By:** B.A./A.J.H.

Groundwater Record	SAMPLES ES	U50	DB	DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
									SP	SAND: fine to medium grained, brown, with silt fines. *(continued)*	M	VL		AEOLIAN
						33			-	Extremely Weathered sandstone: Sandy CLAY, low plasticity, brown, fine to medium grained sand, with silt fines.	XW	(Hd)		HAWKESBURY SANDSTONE VERY LOW 'TC' BIT RESISTANCE
						32	8							
						31	9			REFER TO CORED BOREHOLE LOG				
						30	10							
						29	11							
						28	12							
						27	13							

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CORED BOREHOLE LOG

Borehole No.
101

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED ELC BUILDING
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915SH1	**Core Size:** NMLC	**R.L. Surface:** ~40.6 m
Date: 14/3/21	**Inclination:** VERTICAL	**Datum:** AHD
Plant Type: JK205	**Bearing:** N/A	**Logged/Checked By:** B.A./A.J.H.

Water Loss\Level	Barrel Lift	RL (m AHD)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components. START CORING AT 9.00m	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	SPACING (mm) (600, 200, 60, 20)	DEFECT DETAILS – DESCRIPTION: Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness (Specific / General)	Formation
0% RETURN		31			SANDSTONE: fine to medium grained, light grey with occassional grey laminae, bedded at 0-10°.	FR	M - H	0.80, 0.40		(9.85m) XWS, 0°, 60 mm.t	Hawkesbury Sandstone
		30, 29	10, 11		SANDSTONE: medium to coarse grained, light grey, yellow brown and dark brown, with quartz gravel, trace of occassional carbonaceous lenses, bedded at 0-15°.	HW	M - H	0.90, 1.1, 0.70		(10.86m) Be, 10°, P, R, Clay Ct (11.16m) Be, 3°, Ir, R, Fe Sn (11.75m) Be, 2°, Ir, R, Fe Sn (11.78m) Be, 3°, Ir, R, Fe Sn	
			12				H	1.4, 1.6			
		28, 27, 26, 25	13, 14, 15		END OF BOREHOLE AT 12.44 m						

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

BOREHOLE LOG

Borehole No. 102

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED ELC BUILDING
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915SH1 **Method:** SPIRAL AUGER **R.L. Surface:** ~37.0 m
Date: 14/3/21 **Datum:** AHD
Plant Type: JK205 **Logged/Checked By:** B.A./A.J.H.

Groundwater Record	Samples (ES, U50, DB, DS)	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION							FILL: Gravelly sand, fine to medium grained, brown, fine to medium grained ironstone, sandstone and igneous gravel.	M			APPEARS WELL COMPACTED
		N = 21 9,15,6	36	1			FILL: Sandstone and ironstone gravel, fine to coarse grained, light grey and orange brown.				
		N = 15 7,11,4	35	2							
			34	3		-	SANDSTONE: fine to medium grained, light grey.	DW	M - H		HAWKESBURY SANDSTONE MODERATE TO HIGH 'TC' BIT RESISTANCE
							as above, but yellow brown and orange brown.		H		HIGH RESISTANCE
			33	4			END OF BOREHOLE AT 3.40 m				'TC' BIT REFUSAL
			32	5							
			31	6							

JK 9.02.4 LIB.GLB Log JK AUGERHOLE - MASTER 32915SH1 VAUCLUSE.GPJ <<DrawingFile>> 15/04/2021 15:46 10.01.00.01 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.02.4 2019-05-31 Prj: JK 9.01.0 2018-03-20

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BOREHOLE LOG

Borehole No.
103
1 / 2

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED ELC BUILDING
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915SH1 **Method:** SPIRAL AUGER **R.L. Surface:** ~38.6 m
Date: 29/3/21 **Datum:** AHD
Plant Type: JK205 **Logged/Checked By:** B.A./A.J.H.

Groundwater Record	Field Tests	RL (m AHD)	Depth (m)	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION			0		ASPHALTIC CONCRETE: 60mm.t				
				-	FILL: Silty sand, fine to medium grained, brown, trace of fine to coarse grained sandstone gravel, brick, tile and metal fragments, slag and ash.	M			APPEARS POORLY COMPACTED
	N = 7 7,2,5	38							
			1						
	N = 5 3,2,3	37							
			2						
		36							
	N = 3 1,2,1		3						
		35							
			4		FILL: Silty sand, fine to medium grained, brown, trace of fine to coarse grained sandstone gravel, with clay fines, trace of ash.				
	N = 5 1,3,2	34							
			5						
		33							
	N = 11 2,4,7		6						APPEARS MODERATELY COMPACTED
		32							

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BOREHOLE LOG

Borehole No.
103
2 / 2

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED ELC BUILDING
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915SH1 **Method:** SPIRAL AUGER **R.L. Surface:** ~38.6 m
Date: 29/3/21 **Datum:** AHD
Plant Type: JK205 **Logged/Checked By:** B.A./A.J.H.

Groundwater Record	SAMPLES ES	U50	DB	DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
									SM	Silty SAND: fine to medium grained, dark brown, with clay fines. *(continued)*	M	(L)		AEOLIAN
						31	8		CL	Sandy CLAY: low plasticity, light grey.	w>PL	(St - VSt)		RESIDUAL POSSIBLE WEATHERED DYKE? NOTE: CONTINUOUS SPIRAL AUGER DRILLING (i.e. NO IN-SITU TESTING) BELOW 6.95m DEPTH IN ORDER TO PROVE BEDROCK
						30, 29, 28	9, 10, 11							
									-	INFERRED BEDROCK?	DW	M - H		MODERATE TO HIGH 'TC' BIT RESISTANCE
						27, 26, 25	12, 13			END OF BOREHOLE AT 11.50 m				'TC' BIT REFUSAL

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BOREHOLE LOG

Borehole No.
201

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED CAR / BUS PARKING STRUCTURE
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915SH3 **Method:** SPIRAL AUGER **R.L. Surface:** ~51.6 m
Date: 25/3/21 **Datum:**
Plant Type: JK205 **Logged/Checked By:** B.A./A.J.H.

Groundwater Record	SAMPLES ES U50 DB DS	Field Tests	RL (m)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
ON COMPLETION OF CORING / DRY ON COMPLETION OF AUGERING				0			CONCRETE: 100mm.t				3 x 7mm DIA. REINFORCEMENT 25, 50 & 80mm TOP COVER
	DS	N = 12 6,6,6	51			-	FILL: Sand, fine to medium grained, brown, with fine to coarse grained sandstone gravel, trace of silt fines.	M			APPEARS MODERATELY COMPACTED
				1		-	SANDSTONE: fine to medium grained, brown.	DW	M - H		HAWKESBURY SANDSTONE
			50				REFER TO CORED BOREHOLE LOG				HIGH 'TC' BIT RESISTANCE
				2							
			49								
				3							
			48								
				4							
			47								
				5							
			46								
				6							
			45								

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CORED BOREHOLE LOG

Borehole No.
201
2 / 2

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED CAR / BUS PARKING STRUCTURE
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915SH3 | **Core Size:** NMLC | **R.L. Surface:** ~51.6 m
Date: 25/3/21 | **Inclination:** VERTICAL | **Datum:**
Plant Type: JK205 | **Bearing:** N/A | **Logged/Checked By:** B.A./A.J.H.

Water Loss\Level	Barrel Lift	RL (m)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ (VL-0.1, L-0.3, M-1, H-3, VH-10, EH)	SPACING (mm) (600, 200, 60, 20)	DEFECT DETAILS DESCRIPTION: Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness — Specific / General	Formation
					START CORING AT 1.18m						
50% RETURN		50, 49, 48	2, 3		SANDSTONE: fine to medium grained, dark brown, and brown and red brown, bedded at 0-10°.	MW	M - H	1.7, 0.80, 1.4, 0.90		(2.68m) Be, 20°, Ir, R, Fe Sn (2.70m) Be, 15°, P, R, Clay Ct (2.85m) Be, 9°, P, R, Clay Ct	Hawkesbury Sandstone
		48	4		as above, but light brown.	SW		0.50, 0.50, 1.2		(3.13m) Be, 3°, Ir, R, Fe Sn (3.87m) Be, 20°, P, R, Fe Sn (3.89m) Jh, 10°, P, R	
		47, 46	5, 6		SANDSTONE: fine to medium grained, light grey, with grey laminae, bedded at 0-15°.	FR		0.90, 0.80, 0.70		(4.71m) Be, 8°, P, R, Clay Ct	
		45, 44	7		END OF BOREHOLE AT 6.06 m						

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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BOREHOLE LOG

Borehole No.
202

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED CAR / BUS PARKING STRUCTURE
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915SH3 **Method:** SPIRAL AUGER **R.L. Surface:** ~53.2 m
Date: 25/3/21 **Datum:**
Plant Type: JK205 **Logged/Checked By:** B.A./A.J.H.

Groundwater Record	SAMPLES (ES, U50, DB, DS)	Field Tests	RL (m)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING							CONCRETE: 120mm.t				7mm DIA. REINFORCEMENT 65mm TOP COVER
		N = 4 3,2,2	53	1		-	FILL: Sand, fine to medium grained, brown, with fine to coarse grained sandstone gravel, trace of silt fines.	M			APPEARS POORLY COMPACTED
			52			SM	Silty SAND: fine to medium grained, brown.	M	L		AEOLIAN
ON 29/3/21		N = 18 4,11,7	51	2		SC	Clayey SAND: fine to medium grained, light grey and red brown, trace of ironstone gravel, and silt fines.		MD		RESIDUAL
						-	SANDSTONE: fine to medium grained, brown.	DW	M - H		HAWKESBURY SANDSTONE
			50 49 48 47	3 4 5 6			REFER TO CORED BOREHOLE LOG				HIGH 'TC' BIT RESISTANCE GROUNDWATER MONITORING WELL INSTALLED TO 9.08m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 3.08m TO 9.08m. CASING 0.1m TO 3.08m. 2mm SAND FILTER PACK 0.5m TO 9.08m. BENTONITE SEAL 0.1m TO 0.5m. BACKFILLED WITH SAND TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.

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CORED BOREHOLE LOG

Borehole No.
202

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED CAR / BUS PARKING STRUCTURE
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915SH3 | **Core Size:** NMLC | **R.L. Surface:** ~53.2 m
Date: 25/3/21 | **Inclination:** VERTICAL | **Datum:**
Plant Type: JK205 | **Bearing:** N/A | **Logged/Checked By:** B.A./A.J.H.

Water Loss\Level	Barrel Lift	RL (m)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	SPACING (mm) (600, 200, 60, 20)	DEFECT DETAILS DESCRIPTION: Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness — Specific / General	Formation
					START CORING AT 2.87m						
ON COMPLETION OF CORING		50	3		SANDSTONE: fine to medium grained, grey, brown and yellow brown, cross bedded at up to 22°.	MW	M - H	1.5 1.0 1.0		(3.16m) Be, 0°, P, R, Cn	Hawkesbury Sandstone
		49	4		SANDSTONE: fine to medium grained, light brown and brown, bedded at 0-10°.	SW		0.80 1.0 0.90 1.2		(4.82m) J, 90°, Ir, R, Clay FILLED (5.10m) Be, 15°, St, R, Clay Ct (5.11m) Be, 17°, C, R, Clay Ct (5.33m) Be, 15°, P, R, Fe Sn (5.55m) Be, 5°, P, R, Fe Sn	
100% RETURN		48	5								
		47	6		SANDSTONE: fine to medium grained, light grey and yellow brown, bedded at 0-15°.			0.80	600 200 60 20		
		46	7		as above, but light grey and light yellow brown, with occasional carbonaceous lenses.	FR		1.0 0.70 0.60 1.0 0.90 1.1		(6.94m) Be, 15°, P, R, Clay Ct (6.95m) Be, 15°, P, R, Clay Ct (6.96m) Be, 15°, P, R, Clay Ct (7.55m) Be, 3°, Ir, R, Clay Ct (7.77m) Be, 15°, P, R, Clay Ct (8.48m) Be, 2°, P, R, Clay Ct (8.77m) Be, 4°, P, R, Clay Ct	
		45	8								
			9								
		44			END OF BOREHOLE AT 9.08 m				600 200 60 20		

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

JKGeotechnics

BOREHOLE LOG

Borehole No.
203
1 / 2

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED CAR / BUS PARKING STRUCTURE
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915SH3 **Method:** SPIRAL AUGER **R.L. Surface:** ~49.4 m
Date: 25/3/21 **Datum:**
Plant Type: JK205 **Logged/Checked By:** B.A./A.J.H.

Groundwater Record	Field Tests	RL (m)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING						CONCRETE: 90mm.t				NO OBSERVED REINFORCEMENT
		49			-	FILL: Gravelly sand, fine to medium grained, brown, fine to coarse grained igneous, ironstone and sandstone gravel.	M			APPEARS POORLY COMPACTED
ON COMPLETION OF CORING	N = 3 3,1,2		1			FILL: Silty sand, fine to medium grained, dark brown, trace of fine to coarse grained ironstone and sandstone gravel, trace of plastic and glass fragments, slag and organic matter.				
	N > 8 1,1,7/ 100mm REFUSAL	48								
			2		-	Extremely Weathered sandstone: clayey SAND, fine to medium grained, brown and yellow brown, trace of silt.	XW	D		HAWKESBURY SANDSTONE
		47				SANDSTONE: fine to medium grained, light grey and orange brown.	DW	M		MODERATE TO HIGH 'TC' BIT RESISTANCE
		46	3			REFER TO CORED BOREHOLE LOG				
		45	4							
		44	5							
		43	6							

SAMPLES: ES, U50, DB, DS

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CORED BOREHOLE LOG

Client: KINCOPPAL - ROSE BAY SCHOOL
Project: PROPOSED CAR / BUS PARKING STRUCTURE
Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915SH3 | **Core Size:** NMLC | **R.L. Surface:** ~49.4 m
Date: 25/3/21 | **Inclination:** VERTICAL | **Datum:**
Plant Type: JK205 | **Bearing:** N/A | **Logged/Checked By:** B.A./A.J.H.

Water Loss\Level	Barrel Lift	RL (m)	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$	DEFECT DETAILS: SPACING (mm)	DEFECT DETAILS: DESCRIPTION (Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness) Specific / General	Formation
		47			START CORING AT 2.84m						
20% RETURN		46	3		SANDSTONE: fine to medium grained, brown and light brown, bedded at 0-5°	HW	M	0.50, 0.40			Hawkesbury Sandstone
		45	4		as above, but light grey and light yellow brown.	SW		0.70, 0.60		(4.02m) XWS, 0°, 15mm.t (4.06m) Be, 0°, P, S, Fe, Sn (4.41m) Be, 4°, Ir, R, Fe, Sn (4.51m) Be, 0°, P, R, Fe, Sn (4.62m) J, 32°, P, R, Cn (4.65m) Jh, 22°,Ir (4.71m) XWS, 0°, 20-30mm.t	
		44	5			FR	M - H	0.90, 1.1, 0.90			
		43, 42, 41	6, 7, 8		END OF BOREHOLE AT 5.91 m						

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

ENVIRONMENTAL LOGS EXPLANATION NOTES

INTRODUCTION

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

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

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

DESCRIPTION AND CLASSIFICATION METHODS

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

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

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

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

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

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

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

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

INVESTIGATION METHODS

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

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the insitu soils and 'weaker' bedrock if it is safe to descend into the pit. The depth of penetration is limited to about 3m for a backhoe and up to 6m for a large excavator. Limitations of test pits are the problems associated with disturbance and difficulty of reinstatement and the consequent effects on close-by structures. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction or to design and construct the structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

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

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

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

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

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

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

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

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

The test results are reported in the following form:

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

  N = 13
  4, 6, 7

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

  N > 30
  15, 30/40mm

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

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

LOGS

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

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

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

GROUNDWATER

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

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

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

FILL

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

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

LABORATORY TESTING

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

SYMBOL LEGENDS

SOIL

- FILL
- TOPSOIL
- CLAY (CL, CI, CH)
- SILT (ML, MH)
- SAND (SP, SW)
- GRAVEL (GP, GW)
- SANDY CLAY (CL, CI, CH)
- SILTY CLAY (CL, CI, CH)
- CLAYEY SAND (SC)
- SILTY SAND (SM)
- GRAVELLY CLAY (CL, CI, CH)
- CLAYEY GRAVEL (GC)
- SANDY SILT (ML, MH)
- PEAT AND HIGHLY ORGANIC SOILS (Pt)

ROCK

- CONGLOMERATE
- SANDSTONE
- SHALE/MUDSTONE
- SILTSTONE
- CLAYSTONE
- COAL
- LAMINITE
- LIMESTONE
- PHYLLITE, SCHIST
- TUFF
- GRANITE, GABBRO
- DOLERITE, DIORITE
- BASALT, ANDESITE
- QUARTZITE

OTHER MATERIALS

- BRICKS OR PAVERS
- CONCRETE
- ASPHALTIC CONCRETE

CLASSIFICATION OF COARSE AND FINE GRAINED SOILS

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

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

Laboratory Classification Criteria

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

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

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

NOTES:

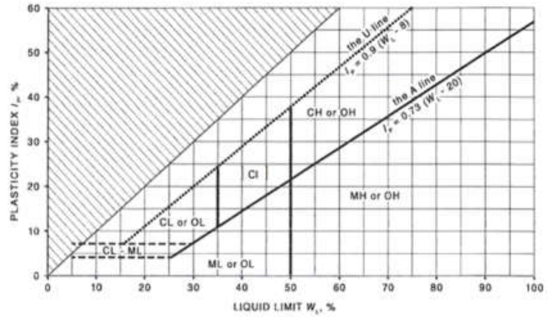
1 For a coarse grained soil with a fines content between 5% and 12%, the soil is given a dual classification comprising the two group symbols separated by a dash; for example, for a poorly graded gravel with between 5% and 12% silt fines, the classification is GP-GM.

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

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

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

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



LOG SYMBOLS

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

Log Column	Symbol		Density Index (I_D) Range (%)	SPT 'N' Value Range (Blows/300mm)
Density Index/ Relative Density (Cohesionless Soils)	VL	VERY LOOSE	≤ 15	0 – 4
	L	LOOSE	> 15 and ≤ 35	4 – 10
	MD	MEDIUM DENSE	> 35 and ≤ 65	10 – 30
	D	DENSE	> 65 and ≤ 85	30 – 50
	VD	VERY DENSE	> 85	> 50
	( )	Bracketed symbol indicates estimated density based on ease of drilling or other assessment.		

Log Column	Symbol	Definition
Hand Penetrometer Readings	300 250	Measures reading in kPa of unconfined compressive strength. Numbers indicate individual test results on representative undisturbed material unless noted otherwise.
Remarks	'V' bit	Hardened steel 'V' shaped bit.
	'TC' bit	Twin pronged tungsten carbide bit.
	T_{60}	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.
	Soil Origin	The geological origin of the soil can generally be described as: RESIDUAL – soil formed directly from insitu weathering of the underlying rock. No visible structure or fabric of the parent rock. EXTREMELY WEATHERED – soil formed directly from insitu weathering of the underlying rock. Material is of soil strength but retains the structure and/or fabric of the parent rock. ALLUVIAL – soil deposited by creeks and rivers. ESTUARINE – soil deposited in coastal estuaries, including sediments caused by inflowing creeks and rivers, and tidal currents. MARINE – soil deposited in a marine environment. AEOLIAN – soil carried and deposited by wind. COLLUVIAL – soil and rock debris transported downslope by gravity, with or without the assistance of flowing water. Colluvium is usually a thick deposit formed from a landslide. The description 'slopewash' is used for thinner surficial deposits. LITTORAL – beach deposited soil.

Classification of Material Weathering

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

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

Rock Material Strength Classification

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

Summary Results Tables

ABBREVIATIONS AND EXPLANATIONS

Abbreviations used in the Tables:

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

Table Specific Explanations:

HIL Tables:

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

EIL/ESL Table:

- ABC Values for selected metals have been adopted from the published background concentrations presented in Olszowy et. al., (1995), Trace Element Concentrations in Soils from Rural and Urban New South Wales (the 25th percentile values for old suburbs with high traffic have been quoted).

Waste Classification and TCLP Table:

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

QA/QC Table:

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

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

All data in mg/kg unless stated otherwise			HEAVY METALS								PAHs		ORGANOCHLORINE PESTICIDES (OCPs)							OP PESTICIDES (OPPs)		
			Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	Carcinogenic PAHs	HCB	Endosulfan	Methoxychlor	Aldrin & Dieldrin	Chlordane	DDT, DDD & DDE	Heptachlor	Chlorpyrifos	TOTAL PCBs	ASBESTOS FIBRES
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	100
Site Assessment Criteria (SAC)			100	20	100	6000	300	40	400	7400	300	3	10	270	300	6	50	240	6	160	1	Detected/Not Detected
Sample Reference	**Sample Depth**	**Sample Description**																				
BH1	0.05-0.15	F: Gravelly silty sand	<4	<0.4	**12**	**54**	**17**	<0.1	**8**	**39**	**11**	**1.1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH2	0.1-0.2	F: Silty sand	**9**	<0.4	**84**	**51**	**250**	**0.2**	**15**	**91**	**1.2**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH2	0.2-0.5	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH2	0.75-0.95	F: Silty sand	**12**	<0.4	**9**	**25**	**810**	**2.4**	**3**	**330**	**0.72**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH2	4.8-4.95	Silty sand	<4	<0.4	**8**	<1	**6**	<0.1	<1	**6**	<0.05	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH3	0.4-0.5	F: Silty sand	**34**	<0.4	**8**	**9**	**69**	**0.2**	**5**	**39**	**0.5**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH4	0-0.1	F: Silty sand	<4	<0.4	**5**	**10**	**45**	<0.1	**1**	**42**	**3.9**	**0.7**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH4	0.1-0.3	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH4	0.5-0.6	F: Silty sand	<4	<0.4	**7**	**3**	**16**	<0.1	**1**	**13**	**0.1**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH5	0-0.1	F: Silty sand	<4	<0.4	**6**	**14**	**49**	<0.1	**2**	**55**	**15**	**1.6**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH5	1.7-1.8	Sanstone	<4	<0.4	**17**	**2**	**19**	<0.1	**1**	**31**	<0.05	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH5	0-0.3	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH6	0-0.1	F: Silty sand	**6**	<0.4	**8**	**23**	**81**	<0.1	**3**	**61**	**5.4**	**1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH6 - [LAB_DUP]	0-0.1	F: Silty sand	**7**	<0.4	**12**	**21**	**83**	**0.1**	**3**	**59**	**3.5**	**0.7**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH7	0-0.1	F: Silty sand	**6**	<0.4	**6**	**20**	**86**	<0.1	**3**	**53**	**9.6**	**1.7**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH7	0.2-0.3	Silty sand	<4	<0.4	**3**	**6**	**32**	<0.1	<1	**15**	**0.6**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH8	0-0.1	F: Silty sand	**9**	**0.4**	**11**	**36**	**160**	**0.1**	**4**	**130**	**1.3**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH8	0.6-0.7	F: Silty sand	**6**	<0.4	**10**	**80**	**160**	**0.1**	**7**	**190**	**40**	**6.9**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH8	1.6-1.8	Clayey Sand	**5**	<0.4	**15**	**10**	**29**	<0.1	**1**	**20**	**1.3**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH9	0-0.1	F: Silty sand	**33**	**0.4**	**13**	**43**	**190**	**0.1**	**4**	**150**	**6.1**	**0.9**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH10	0-0.1	F: Silty sand	**24**	<0.4	**9**	**34**	**200**	**0.1**	**4**	**160**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH101	0.05-0.35	F: Silty Sand	**17**	<0.4	**10**	**47**	**110**	**0.4**	**27**	**71**	**1.2**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH101	0.7-0.9	F: Silty Sand	<4	<0.4	**8**	**5**	**37**	<0.1	**1**	**21**	**2.4**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH102	0-0.1	F: Gravelly Sand	<4	<0.4	**8**	**11**	**23**	<0.1	**6**	**29**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH102	0.5-0.6	F: Gravel	**6**	<0.4	**10**	**29**	**61**	<0.1	**17**	**66**	**1.7**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH103	0.06-0.2	F: Silty Sand	**7**	<0.4	**79**	**44**	**150**	**0.2**	**18**	**75**	**200**	**20**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Detected
BH103	1.0-1.2	F: Silty Sand	**9**	<0.4	**9**	**19**	**630**	**0.2**	**3**	**140**	**2.1**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH103	2.0-2.3	F: Silty Sand	**7**	<0.4	**12**	**16**	**750**	**0.1**	**3**	**310**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
BH103	3.0-3.3	F: Silty Sand	**6**	**0.5**	**16**	**25**	**860**	**0.1**	**4**	**440**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH201	0.1-0.3	F: Silty Sand	**8**	<0.4	**16**	**9**	**26**	<0.1	**2**	**18**	**0.3**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH201 - [LAB_DUP]	0.1-0.3	F: Silty Sand	**8**	<0.4	**14**	**11**	**23**	<0.1	**1**	**13**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH201	1.1-1.3	Sandstone	<4	<0.4	**9**	<1	**11**	<0.1	**2**	**8**	<0.05	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH202	0.12-0.3	F: Silty Sand	**4**	<0.4	**6**	**17**	**10**	<0.1	**1**	**11**	**110**	**13**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH202	1.1-1.2	F: Silty Sand	**6**	<0.4	**9**	**4**	**20**	<0.1	<1	**14**	**1.8**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH203	0.09-0.4	F: Silty Sand	<4	<0.4	**23**	**22**	**18**	<0.1	**20**	**44**	**1.5**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH203	0.9-1.0	F: Silty Sandy Clay	**14**	<0.4	**8**	**26**	**89**	**0.1**	**4**	**79**	**1.6**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH203	1.8-2.0	Sandstone	<4	<0.4	**6**	**9**	**9**	<0.1	**1**	**10**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SDUP2	-	Field Duplicate	**6**	<0.4	**62**	**51**	**170**	**0.1**	**12**	**130**	**0.73**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SDUP6	-	Field Duplicate	**32**	<0.4	**10**	**43**	**160**	**0.1**	**3**	**140**	**5.7**	**0.9**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SDUP1	-	Field Duplicate	**13**	<0.4	**9**	**28**	**140**	**0.2**	**24**	**72**	**1.1**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SDUP201	-	Field Duplicate	<4	<0.4	**6**	**9**	**9**	<0.1	**1**	**10**	**90**	**11**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SDUP203	-	Field Duplicate	<4	<0.4	**27**	**17**	**21**	<0.1	**19**	**50**	**5.2**	**0.6**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SDUP203 - [LAB_DUP]	-	Field Duplicate	NA	NA	NA	NA	NA	NA	NA	NA	**4.3**	**0.6**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH103-FCF1	1.0-2.0	Fibre Cement Material	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
BH103-FCF1	2.0-3.0	Fibre Cement Material	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
BH103-FCF2-3	2.0-3.0	Fibre Cement Material	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
Total Number of Samples			39	39	39	39	39	39	39	39	37	37	17	17	17	17	17	17	17	17	17	17
Maximum Value			34	0.5	84	80	860	2.4	27	440	200	20	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	Detected

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

Standard deviation exceeds data assessment criteria **VALUE**

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

					C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	Field PID Measurement
PQL - Envirolab Services					25	50	0.2	0.5	1	1	1	ppm
NEPM 2013 HSL Land Use Category					HSL-A/B: LOW/HIGH DENSITY RESIDENTIAL							
Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**								
BH1	0.05-0.15	F: Gravelly silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.4
BH2	0.1-0.2	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.3
BH2	0.75-0.95	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.6
BH2	4.8-4.95	Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	1.9
BH3	0.4-0.5	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	1.1
BH4	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.5
BH4	0.5-0.6	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	2.2
BH5	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	3.4
BH5	1.7-1.8	Sanstone	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	7.7
BH6	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH6 - [LAB_DUP]	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH7	0-0.1	F: Silty sand	0m to <1m	Sand	<25	**51**	<0.2	<0.5	<1	<3	<1	1.1
BH7	0.2-0.3	Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	6.2
BH8	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.9
BH8	0.6-0.7	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH8	1.6-1.8	Clayey Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH9	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH10	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.1
BH101	0.05-0.35	F: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.1
BH101	0.7-0.9	F: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.1
BH102	0-0.1	F: Gravelly Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.1
BH102	0.5-0.6	F: Gravel	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH103	0.06-0.2	F: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH103	1.0-1.2	F: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH201	0.1-0.3	F: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH201 - [LAB_DUP]	0.1-0.3	F: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	-
BH201	1.1-1.3	Sandstone	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH202	0.12-0.3	F: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH202	1.1-1.2	F: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH203	0.09-0.4	F: Silty Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	1
BH203	0.9-1.0	F: Silty Sandy Clay	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
SDUP2	-	Field Duplicate	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	-
SDUP6	-	Field Duplicate	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	-
SDUP1	-	Field Duplicate	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	-
SDUP201	-	Field Duplicate	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	-
SDUP203	-	Field Duplicate	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	-
SDUP203 - [LAB_DUP]	-	Field Duplicate	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	-
Total Number of Samples					37	37	37	37	37	37	37	30
Maximum Value					<PQL	51	<PQL	<PQL	<PQL	<PQL	<PQL	7.7

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

HSL SOIL ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene
BH1	0.05-0.15	F: Gravelly silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH2	0.1-0.2	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH2	0.75-0.95	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH2	4.8-4.95	Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH3	0.4-0.5	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH4	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH4	0.5-0.6	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH5	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH5	1.7-1.8	Sanstone	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH6	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH6 - [LAB_DUP]	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH7	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH7	0.2-0.3	Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH8	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH8	0.6-0.7	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH8	1.6-1.8	Clayey Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH9	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH10	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH101	0.05-0.35	F: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH101	0.7-0.9	F: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH102	0-0.1	F: Gravelly Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH102	0.5-0.6	F: Gravel	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH103	0.06-0.2	F: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH103	1.0-1.2	F: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH201	0.1-0.3	F: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH201 - [LAB_DUP]	0.1-0.3	F: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH201	1.1-1.3	Sandstone	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH202	0.12-0.3	F: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH202	1.1-1.2	F: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH203	0.09-0.4	F: Silty Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH203	0.9-1.0	F: Silty Sandy Clay	0m to <1m	Sand	45	110	0.5	160	55	40	3
SDUP2	-	Field Duplicate	0m to <1m	Sand	45	110	0.5	160	55	40	3
SDUP6	-	Field Duplicate	0m to <1m	Sand	45	110	0.5	160	55	40	3
SDUP1	-	Field Duplicate	0m to <1m	Sand	45	110	0.5	160	55	40	3
SDUP201	-	Field Duplicate	0m to <1m	Sand	45	110	0.5	160	55	40	3
SDUP203	-	Field Duplicate	0m to <1m	Sand	45	110	0.5	160	55	40	3
SDUP203 - [LAB_DUP]	-	Field Duplicate	0m to <1m	Sand	45	110	0.5	160	55	40	3

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

			C_6-C_{10} (F1) plus BTEX	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)
PQL - Envirolab Services			25	50	100	100
NEPM 2013 Land Use Category			**RESIDENTIAL, PARKLAND & PUBLIC OPEN SPACE**			
Sample Reference	**Sample Depth**	**Soil Texture**				
BH1	0.05-0.15	Coarse	<25	<50	**350**	**360**
BH2	0.1-0.2	Coarse	<25	<50	**190**	**350**
BH2	0.75-0.95	Coarse	<25	<50	<100	<100
BH2	4.8-4.95	Coarse	<25	<50	<100	<100
BH3	0.4-0.5	Coarse	<25	<50	<100	<100
BH4	0-0.1	Coarse	<25	<50	<100	<100
BH4	0.5-0.6	Coarse	<25	<50	<100	<100
BH5	0-0.1	Coarse	<25	<50	**160**	<100
BH5	1.7-1.8	Coarse	<25	<50	<100	<100
BH6	0-0.1	Coarse	<25	<50	<100	<100
BH6 - [LAB_DUP]	0-0.1	Coarse	<25	<50	**100**	<100
BH7	0-0.1	Coarse	<25	**51**	**110**	<100
BH7	0.2-0.3	Coarse	<25	<50	<100	<100
BH8	0-0.1	Coarse	<25	<50	<100	<100
BH8	0.6-0.7	Coarse	<25	<50	**340**	**100**
BH8	1.6-1.8	Coarse	<25	<50	<100	<100
BH9	0-0.1	Coarse	<25	<50	<100	<100
BH10	0-0.1	Coarse	<25	<50	<100	<100
BH101	0.05-0.35	Coarse	<25	<50	<100	<100
BH101	0.7-0.9	Coarse	<25	<50	<100	<100
BH102	0-0.1	Coarse	<25	<50	<100	<100
BH102	0.5-0.6	Coarse	<25	<50	<100	<100
BH103	0.06-0.2	Coarse	<25	<50	**660**	**350**
BH103	1.0-1.2	Coarse	<25	<50	<100	<100
BH201	0.1-0.3	Coarse	<25	<50	<100	<100
BH201 - [LAB_DUP]	0.1-0.3	Coarse	<25	<50	<100	<100
BH201	1.1-1.3	Coarse	<25	<50	<100	<100
BH202	0.12-0.3	Coarse	<25	<50	**430**	**150**
BH202	1.1-1.2	Coarse	<25	<50	<100	<100
BH203	0.09-0.4	Coarse	<25	<50	<100	<100
BH203	0.9-1.0	Coarse	<25	<50	<100	<100
SDUP2	-	Coarse	<25	<50	**230**	**400**
SDUP6	-	Coarse	<25	<50	<100	<100
SDUP1	-	Coarse	<25	<50	<100	<100
SDUP201	-	Coarse	<25	<50	**530**	**160**
SDUP203	-	Coarse	<25	<50	<100	<100
SDUP203 - [LAB_DUP]	-	Coarse	<25	<50	<100	<100
Total Number of Samples			37	37	37	37
Maximum Value			<PQL	51	660	400

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

MANAGEMENT LIMIT ASSESSMENT CRITERIA

Sample Reference	Sample Depth	Soil Texture	C_6-C_{10} (F1) plus BTEX	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)
BH1	0.05-0.15	Coarse	700	1000	2500	10000
BH2	0.1-0.2	Coarse	700	1000	2500	10000
BH2	0.75-0.95	Coarse	700	1000	2500	10000
BH2	4.8-4.95	Coarse	700	1000	2500	10000
BH3	0.4-0.5	Coarse	700	1000	2500	10000
BH4	0-0.1	Coarse	700	1000	2500	10000
BH4	0.5-0.6	Coarse	700	1000	2500	10000
BH5	0-0.1	Coarse	700	1000	2500	10000
BH5	1.7-1.8	Coarse	700	1000	2500	10000
BH6	0-0.1	Coarse	700	1000	2500	10000
BH6 - [LAB_DUP]	0-0.1	Coarse	700	1000	2500	10000
BH7	0-0.1	Coarse	700	1000	2500	10000
BH7	0.2-0.3	Coarse	700	1000	2500	10000
BH8	0-0.1	Coarse	700	1000	2500	10000
BH8	0.6-0.7	Coarse	700	1000	2500	10000
BH8	1.6-1.8	Coarse	700	1000	2500	10000
BH9	0-0.1	Coarse	700	1000	2500	10000
BH10	0-0.1	Coarse	700	1000	2500	10000
BH101	0.05-0.35	Coarse	700	1000	2500	10000
BH101	0.7-0.9	Coarse	700	1000	2500	10000
BH102	0-0.1	Coarse	700	1000	2500	10000
BH102	0.5-0.6	Coarse	700	1000	2500	10000
BH103	0.06-0.2	Coarse	700	1000	2500	10000
BH103	1.0-1.2	Coarse	700	1000	2500	10000
BH201	0.1-0.3	Coarse	700	1000	2500	10000
BH201 - [LAB_DUP]	0.1-0.3	Coarse	700	1000	2500	10000
BH201	1.1-1.3	Coarse	700	1000	2500	10000
BH202	0.12-0.3	Coarse	700	1000	2500	10000
BH202	1.1-1.2	Coarse	700	1000	2500	10000
BH203	0.09-0.4	Coarse	700	1000	2500	10000
BH203	0.9-1.0	Coarse	700	1000	2500	10000
SDUP2	-	Coarse	700	1000	2500	10000
SDUP6	-	Coarse	700	1000	2500	10000
SDUP1	-	Coarse	700	1000	2500	10000
SDUP201	-	Coarse	700	1000	2500	10000
SDUP203	-	Coarse	700	1000	2500	10000
SDUP203 - [LAB_DUP]	-	Coarse	700	1000	2500	10000

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

Analyte		C_6-C_{10}	>C_{10}-C_{16}	>C_{16}-C_{34}	>C_{34}-C_{40}	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	PID
PQL - Envirolab Services		25	50	100	100	0.2	0.5	1	1	1	
CRC 2011 -Direct contact Criteria		4,400	3,300	4,500	6,300	100	14,000	4,500	12,000	1,400	
Site Use		**RESIDENTIAL WITH ACCESSIBLE SOIL- DIRECT SOIL CONTACT**									
Sample Reference	**Sample Depth**										
BH1	0.05-0.15	<25	<50	**350**	**360**	<0.2	<0.5	<1	<3	<1	**0.4**
BH2	0.1-0.2	<25	<50	**190**	**350**	<0.2	<0.5	<1	<3	<1	**0.3**
BH2	0.75-0.95	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.6**
BH2	4.8-4.95	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**1.9**
BH3	0.4-0.5	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**1.1**
BH4	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.5**
BH4	0.5-0.6	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**2.2**
BH5	0-0.1	<25	<50	**160**	<100	<0.2	<0.5	<1	<3	<1	**3.4**
BH5	1.7-1.8	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**7.7**
BH6	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH6 - [LAB_DUP]	0-0.1	<25	<50	**100**	<100	<0.2	<0.5	<1	<3	<1	0
BH7	0-0.1	<25	**51**	**110**	<100	<0.2	<0.5	<1	<3	<1	**1.1**
BH7	0.2-0.3	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**6.2**
BH8	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.9**
BH8	0.6-0.7	<25	<50	**340**	**100**	<0.2	<0.5	<1	<3	<1	0
BH8	1.6-1.8	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH9	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH10	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.1**
BH101	0.05-0.35	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.1**
BH101	0.7-0.9	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.1**
BH102	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.1**
BH102	0.5-0.6	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH103	0.06-0.2	<25	<50	**660**	**350**	<0.2	<0.5	<1	<3	<1	0
BH103	1.0-1.2	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH103	3.0-3.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH201	0.1-0.3	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH201 - [LAB_DUP]	0.1-0.3	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	-
BH201	1.1-1.3	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH202	0.12-0.3	<25	<50	**430**	**150**	<0.2	<0.5	<1	<3	<1	0
BH202	1.1-1.2	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH203	0.09-0.4	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**1**
BH203	0.9-1.0	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
SDUP2	-	<25	<50	**230**	**400**	<0.2	<0.5	<1	<3	<1	-
SDUP6	-	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	-
SDUP1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	-
SDUP201	-	<25	<50	**530**	**160**	<0.2	<0.5	<1	<3	<1	-
SDUP203	-	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	-
SDUP203 - [LAB_DUP]	-	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	-
Total Number of Samples		37	37	37	37	37	37	37	37	37	30
Maximum Value		<PQL	51	660	400	<PQL	<PQL	<PQL	<PQL	<PQL	7.7

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

JKEnvironments

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

FIELD DATA															LABORATORY DATA											
Date Sampled	Sample reference	Sample Depth	Visible ACM in top 100mm	Approx. Volume of Soil (L)	Soil Mass (g)	Mass ACM (g)	Mass Asbestos in ACM (g)	[Asbestos from ACM in soil] (%w/w)	Mass ACM <7mm (g)	Mass Asbestos in ACM <7mm (g)	[Asbestos from ACM <7mm in soil] (%w/w)	Mass FA (g)	Mass Asbestos in FA (g)	[Asbestos from FA in soil] (%w/w)	Lab Report Number	Sample refeference	Sample Depth	Sample Mass (g)	Asbestos ID in soil (AS4964) >0.1g/kg	Trace Analysis	Total Asbestos (g/kg)	Asbestos ID in soil <0.1g/kg	ACM >7mm Estimation (g)	FA and AF Estimation (g)	ACM >7mm Estimation %(w/w)	FA and AF Estimation %(w/w)
SAC			**No**					**0.01**			**0.001**			**0.001**											**0.01**	**0.001**
28/01/2020	BH1	0.05-0.15	No	–	9,700	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	235671	BH1	0.05-0.15	961.42	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
28/01/2020	BH2	0.2-0.5	No	–	11,400	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	235671	BH2	0.2-0.5	766.54	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
28/01/2020	BH4	0.1-0.3	No	–	9,700	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	235671	BH4	0.1-0.3	988.25	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
28/01/2020	BH5	0-0.3	No	–	7,650	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	235671	BH5	0-0.3	773.5	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	236009	BH7	0-0.1	15	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	–	–	–	–	–	–
3/02/2020	BH8	0-0.1	No	–	10,100	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	236009	BH8	0-0.1	597.78	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
3/02/2020	BH9	0-0.1	No	–	9,200	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	236009	BH9	0-0.1	631.41	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected: Synthetic mineral fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
14/03/2021	BH101	0.05-1.9	No	–	8,230	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	264278	BH101	0.05-0.35	984.05	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
14/03/2021	BH102	0-0.8	No	–	8,630	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	264278	BH102	0-0.1	326.88	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
25/03/2021	BH201	0.1-1.0	No	–	10,500	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	265221	BH201	0.1-0.3	948.43	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
25/03/2021	BH202	0.12-1.1	No	–	2,600	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	265221	BH202	0.12-0.3	783.52	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	265221	BH203	0.09-0.4	699.74	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
29/03/2021	BH103	0.06-1.0	No	–	3,600	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	265348	BH103	0.06-0.2	728.48	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	Chrysotile	–	0.0012	<0.01	<0.001
29/03/2021	BH103	1.0-2.0	Yes		5,100	5.8	0.876	0.0172	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
29/03/2021	BH103	2.0-3.0	Yes		2,600	12.8	1.914	0.0736	No ACM <7mm observed	--	--	No FA observed	--	--	265348	BH103	2.0-2.3	678.95	Chrysotile asbestos detected: Organic fibres detected	No asbestos detected	0.4982	Chrysotile	0.3332	0.005	0.0491	<0.001
29/03/2021	BH103	3.0-4.0	No	–	5,700	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	265348-A	BH103	3.0-3.3	613.18	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
29/03/2021	BH103	4.0-5.0	No	–	5,000	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	–	–	–	–	–	–	–
29/03/2021	BH103	5.0-6.0	No	–	4,800	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	–	–	–	–	–	–	–
29/03/2021	BH103	6.0-6.9	No	–	3,700	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	265348	BH103-FCF1	1.0-2.0	30x20x5mm	ID in material - Chrysotile asbestos detected	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	265348	BH103-FCF1	2.0-3.0	50x20x5mm	ID in material - Chrysotile asbestos detected	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	265348	BH103-FCF2-3	2.0-3.0	25x15x5mm	ID in material - Chrysotile asbestos detected	--	--	--	--	--	--	--

Concentration above the SAC **VALUE**

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

Land Use Category				URBAN RESIDENTIAL AND PUBLIC OPEN SPACE																			
							AGED HEAVY METALS-EILs						EILs		ESLs								
				pH	CEC (cmolc/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
PQL - Envirolab Services				-	1	-	4	1	1	1	1	1	1	0.1	25	50	100	100	0.2	0.5	1	1	0.05
Ambient Background Concentration (ABC)				-	-	-	NSL	13	28	163	5	122	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL
Sample Reference	**Sample Depth**	**Sample Description**	**Soil Texture**																				
BH1	0.05-0.15	F: Gravelly silty sand	Coarse	NA	NA	NA	<4	**12**	**54**	**17**	**8**	**39**	<1	<0.1	<25	<50	**350**	**360**	<0.2	<0.5	<1	<3	**0.8**
BH2	0.1-0.2	F: Silty sand	Coarse	NA	NA	NA	**9**	**84**	**51**	**250**	**15**	**91**	<1	<0.1	<25	<50	**190**	**350**	<0.2	<0.5	<1	<3	**0.2**
BH2	0.75-0.95	F: Silty sand	Coarse	**10.2**	**45**	**9**	**12**	**9**	**25**	**810**	**3**	**330**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.1**
BH2	4.8-4.95	Silty sand	Coarse	NA	NA	NA	<4	**8**	<1	**6**	<1	**6**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH3	0.4-0.5	F: Silty sand	Coarse	NA	NA	NA	**34**	**8**	**9**	**69**	**5**	**39**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH4	0-0.1	F: Silty sand	Coarse	NA	NA	NA	<4	**5**	**10**	**45**	**1**	**42**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.4**
BH4	0.5-0.6	F: Silty sand	Coarse	NA	NA	NA	<4	**7**	**3**	**16**	**1**	**13**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH5	0-0.1	F: Silty sand	Coarse	NA	NA	NA	<4	**6**	**14**	**49**	**2**	**55**	<1	<0.1	<25	<50	**160**	<100	<0.2	<0.5	<1	<3	**1.2**
BH5	1.7-1.8	Sanstone	Coarse	NA	NA	NA	<4	**17**	**2**	**19**	**1**	**31**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH6	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**6**	**8**	**23**	**81**	**3**	**61**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.66**
BH6 - [LAB_DUP]	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**7**	**12**	**21**	**83**	**3**	**59**	<1	<0.1	<25	<50	**100**	<100	<0.2	<0.5	<1	<3	**0.4**
BH7	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**6**	**6**	**20**	**86**	**3**	**53**	<1	<0.1	<25	**51**	**110**	<100	<0.2	<0.5	<1	<3	**1.2**
BH7	0.2-0.3	Silty sand	Coarse	NA	NA	NA	<4	**3**	**6**	**32**	<1	**15**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.1**
BH8	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**9**	**11**	**36**	**160**	**4**	**130**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.2**
BH8	0.6-0.7	F: Silty sand	Coarse	NA	NA	NA	**6**	**10**	**80**	**160**	**7**	**190**	<1	NA	<25	<50	**340**	**100**	<0.2	<0.5	<1	<3	**4.7**
BH8	1.6-1.8	Clayey Sand	Coarse	NA	NA	NA	**5**	**15**	**10**	**29**	**1**	**20**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.2**
BH9	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**33**	**13**	**43**	**190**	**4**	**150**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.63**
BH10	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**24**	**9**	**34**	**200**	**4**	**160**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH101	0.05-0.35	F: Silty Sand	Coarse	NA	NA	NA	**17**	**10**	**47**	**110**	**27**	**71**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.2**
BH101	0.7-0.9	F: Silty Sand	Coarse	NA	NA	NA	<4	**8**	**5**	**37**	**1**	**21**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.2**
BH102	0-0.1	F: Gravelly Sand	Coarse	NA	NA	NA	<4	**8**	**11**	**23**	**6**	**29**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH102	0.5-0.6	F: Gravel	Coarse	NA	NA	NA	**6**	**10**	**29**	**61**	**17**	**66**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.2**
BH103	0.06-0.2	F: Silty Sand	Coarse	NA	NA	NA	**7**	**79**	**44**	**150**	**18**	**75**	<1	<0.1	<25	<50	**660**	**350**	<0.2	<0.5	<1	<3	**14**
BH103	1.0-1.2	F: Silty Sand	Coarse	NA	NA	NA	**9**	**9**	**19**	**630**	**3**	**140**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.2**
BH103	2.0-2.3	F: Silty Sand	Coarse	**10.2**	**45**	**9**	**7**	**12**	**16**	**750**	**3**	**310**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH103	3.0-3.3	F: Silty Sand	Coarse	**10.2**	**45**	**9**	**6**	**16**	**25**	**860**	**4**	**440**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH201	0.1-0.3	F: Silty Sand	Coarse	NA	NA	NA	**8**	**16**	**9**	**26**	**2**	**18**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.08**
BH201 - [LAB_DUP]	0.1-0.3	F: Silty Sand	Coarse	NA	NA	NA	**8**	**14**	**11**	**23**	**1**	**13**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH201	1.1-1.3	Sandstone	Coarse	NA	NA	NA	<4	**9**	<1	**11**	**2**	**8**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH202	0.12-0.3	F: Silty Sand	Coarse	NA	NA	NA	**4**	**6**	**17**	**10**	**1**	**11**	<1	<0.1	<25	<50	**430**	**150**	<0.2	<0.5	<1	<3	**8.8**
BH202	1.1-1.2	F: Silty Sand	Coarse	NA	NA	NA	**6**	**9**	**4**	**20**	<1	**14**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.2**
BH203	0.09-0.4	F: Silty Sand	Coarse	NA	NA	NA	<4	**23**	**22**	**18**	**20**	**44**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.2**
BH203	0.9-1.0	F: Silty Sandy Clay	Coarse	NA	NA	NA	**14**	**8**	**26**	**89**	**4**	**79**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.2**
BH203	1.8-2.0	Sandstone	Coarse	NA	NA	NA	<4	**6**	**9**	**9**	**1**	**10**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SDUP2	-	Field Duplicate	Coarse	NA	NA	NA	**6**	**62**	**51**	**170**	**12**	**130**	<1	NA	<25	<50	**230**	**400**	<0.2	<0.5	<1	<3	<0.05
SDUP6	-	Field Duplicate	Coarse	NA	NA	NA	**32**	**10**	**43**	**160**	**3**	**140**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.62**
SDUP1	-	Field Duplicate	Coarse	NA	NA	NA	**13**	**9**	**28**	**140**	**24**	**72**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.1**
SDUP201	-	Field Duplicate	Coarse	NA	NA	NA	<4	**6**	**9**	**9**	**1**	**10**	<1	NA	<25	<50	**530**	**160**	<0.2	<0.5	<1	<3	**7.1**
SDUP203	-	Field Duplicate	Coarse	NA	NA	NA	<4	**27**	**17**	**21**	**19**	**50**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.4**
SDUP203 - [LAB_DUP]	-	Field Duplicate	Coarse	NA	NA	NA	NA	NA	NA	NA	NA	NA	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.34**
Total Number of Samples				3	3	3	39	39	39	39	39	39	37	17	37	37	37	37	37	37	37	37	37
Maximum Value				10.2	45	9	34	84	80	860	27	440	<PQL	<PQL	<PQL	51	660	400	<PQL	<PQL	<PQL	<PQL	14

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

EIL AND ESL ASSESSMENT CRITERIA

Sample Reference	Sample Depth	Sample Description	Soil Texture	pH	CEC (cmolc/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
BH1	0.05-0.15	F: Gravelly silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH2	0.1-0.2	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH2	0.75-0.95	F: Silty sand	Coarse	10.2	45	9	100	410	260	1300	560	1400	170	--	180	120	300	2800	50	85	70	105	20
BH2	4.8-4.95	Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH3	0.4-0.5	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH4	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH4	0.5-0.6	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH5	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH5	1.7-1.8	Sanstone	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH6	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH6 - [LAB_DUP]	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH7	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH7	0.2-0.3	Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH8	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH8	0.6-0.7	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH8	1.6-1.8	Clayey Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH9	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH10	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH101	0.05-0.35	F: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH101	0.7-0.9	F: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH102	0-0.1	F: Gravelly Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH102	0.5-0.6	F: Gravel	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH103	0.06-0.2	F: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH103	1.0-1.2	F: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH103	2.0-2.3	F: Silty Sand	Coarse	10.2	45	9	100	410	260	1300	560	1400	--	--	--	--	--	--	--	--	--	--	--
BH103	3.0-3.3	F: Silty Sand	Coarse	10.2	45	9	100	410	260	1300	560	1400	--	--	--	--	--	--	--	--	--	--	--
BH201	0.1-0.3	F: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH201 - [LAB_DUP]	0.1-0.3	F: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH201	1.1-1.3	Sandstone	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH202	0.12-0.3	F: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH202	1.1-1.2	F: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH203	0.09-0.4	F: Silty Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH203	0.9-1.0	F: Silty Sandy Clay	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH203	1.8-2.0	Sandstone	Coarse	NA	NA	NA	100	200	90	1300	35	190	--	--	--	--	--	--	--	--	--	--	--
SDUP2	-	Field Duplicate	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
SDUP6	-	Field Duplicate	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
SDUP1	-	Field Duplicate	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
SDUP201	-	Field Duplicate	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
SDUP203	-	Field Duplicate	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
SDUP203 - [LAB_DUP]	-	Field Duplicate	Coarse	NA	NA	NA	--	--	--	--	--	--	170	--	180	120	300	2800	50	85	70	105	20

JKEnvironments

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

			HEAVY METALS								PAHs		OC/OP PESTICIDES				Total PCBs	TRH					BTEX COMPOUNDS				ASBESTOS FIBRES
			Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	B(a)P	Total Endosulfans	Chloropyrifos	Total Moderately Harmful	Total Scheduled		C_6-C_9	C_{10}-C_{14}	C_{15}-C_{28}	C_{29}-C_{36}	Total C_{10}-C_{36}	Benzene	Toluene	Ethyl benzene	Total Xylenes	
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.05	0.1	0.1	0.1	0.1	0.1	25	50	100	100	50	0.2	0.5	1	1	100
General Solid Waste CT1			100	20	100	NSL	100	4	40	NSL	200	0.8	60	4	250	50	50	650		NSL		10,000	10	288	600	1,000	-
General Solid Waste SCC1			500	100	1900	NSL	1500	50	1050	NSL	200	10	108	7.5	250	50	50	650		NSL		10,000	18	518	1,080	1,800	-
Restricted Solid Waste CT2			400	80	400	NSL	400	16	160	NSL	800	3.2	240	16	1000	50	50	2600		NSL		40,000	40	1,152	2,400	4,000	-
Restricted Solid Waste SCC2			2000	400	7600	NSL	6000	200	4200	NSL	800	23	432	30	1000	50	50	2600		NSL		40,000	72	2,073	4,320	7,200	-
Sample Reference	**Sample Depth**	**Sample Description**																									
BH1	0.05-0.15	F: Gravelly silty sand	<4	<0.4	12	54	17	<0.1	8	39	11	0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	170	280	450	<0.2	<0.5	<1	<3	Not Detected
BH2	0.1-0.2	F: Silty sand	9	<0.4	84	51	250	0.2	15	91	1.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	200	200	<0.2	<0.5	<1	<3	NA
BH2	0.2-0.5	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH2	0.75-0.95	F: Silty sand	12	<0.4	9	25	810	2.4	3	330	0.72	0.1	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH2	4.8-4.95	Silty sand	<4	<0.4	8	<1	6	<0.1	<1	6	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH3	0.4-0.5	F: Silty sand	34	<0.4	8	9	69	0.2	5	39	0.5	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH4	0-0.1	F: Silty sand	<4	<0.4	5	10	45	<0.1	1	42	3.9	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH4	0.1-0.3	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH4	0.5-0.6	F: Silty sand	<4	<0.4	7	3	16	<0.1	1	13	0.1	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH5	0-0.1	F: Silty sand	<4	<0.4	6	14	49	<0.1	2	55	15	1.2	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH5	1.7-1.8	Sanstone	<4	<0.4	17	2	19	<0.1	1	31	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH5	0-0.3	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH6	0-0.1	F: Silty sand	6	<0.4	8	23	81	<0.1	3	61	5.4	0.66	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH6 - [LAB_DUP]	0-0.1	F: Silty sand	7	<0.4	12	21	83	0.1	3	59	3.5	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH7	0-0.1	F: Silty sand	6	<0.4	6	20	86	<0.1	3	53	9.6	1.2	<0.1	<0.1	<0.1	<0.1	<0.1	<25	52	<100	<100	52	<0.2	<0.5	<1	<3	NA
BH7	0.2-0.3	Silty sand	<4	<0.4	3	6	32	<0.1	<1	15	0.6	0.1	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH8	0-0.1	F: Silty sand	9	0.4	11	36	160	0.1	4	130	1.3	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	Not Detected
BH8	0.6-0.7	F: Silty sand	6	<0.4	10	80	160	0.1	7	190	40	4.7	NA	NA	NA	NA	NA	<25	<50	190	190	380	<0.2	<0.5	<1	<3	NA
BH8	1.6-1.8	Clayey Sand	5	<0.4	15	10	29	<0.1	1	20	1.3	0.2	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH9	0-0.1	F: Silty sand	33	0.4	13	43	190	0.1	4	150	6.1	0.63	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	Not Detected
BH10	0-0.1	F: Silty sand	24	<0.4	9	34	200	0.1	4	160	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH101	0.05-0.35	F: Silty Sand	17	<0.4	10	47	110	0.4	27	71	1.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	Not Detected
BH101	0.7-0.9	F: Silty Sand	<4	<0.4	8	5	37	<0.1	1	21	2.4	0.2	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH102	0-0.1	F: Gravelly Sand	<4	<0.4	8	11	23	<0.1	6	29	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	Not Detected
BH102	0.5-0.6	F: Gravel	6	<0.4	10	29	61	<0.1	17	66	1.7	0.2	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH103	0.06-0.2	F: Silty Sand	7	<0.4	79	44	150	0.2	18	75	200	14	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	450	340	790	<0.2	<0.5	<1	<3	Detected
BH103	1.0-1.2	F: Silty Sand	9	<0.4	9	19	630	0.2	3	140	2.1	0.2	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH103	2.0-2.3	F: Silty Sand	7	<0.4	12	16	750	0.1	3	310	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
BH103	3.0-3.3	F: Silty Sand	6	0.5	16	25	860	0.1	4	440	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH201	0.1-0.3	F: Silty Sand	8	<0.4	16	9	26	<0.1	2	18	0.3	0.08	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	Not Detected
BH201 - [LAB_DUP]	0.1-0.3	F: Silty Sand	8	<0.4	14	11	23	<0.1	1	13	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	Not Detected
BH201	1.1-1.3	Sandstone	<4	<0.4	9	<1	11	<0.1	2	8	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH202	0.12-0.3	F: Silty Sand	4	<0.4	6	17	10	<0.1	1	11	110	8.8	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	290	230	520	<0.2	<0.5	<1	<3	Not Detected
BH202	1.1-1.2	F: Silty Sand	6	<0.4	9	4	20	<0.1	<1	14	1.8	0.2	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH203	0.09-0.4	F: Silty Sand	<4	<0.4	23	22	18	<0.1	20	44	1.5	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	Not Detected
BH203	0.9-1.0	F: Silty Sandy Clay	14	<0.4	8	26	89	0.1	4	79	1.6	0.2	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH203	1.8-2.0	Sandstone	<4	<0.4	6	9	9	<0.1	1	10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SDUP2	-	Field Duplicate	6	<0.4	62	51	170	0.1	12	130	0.73	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	220	220	<0.2	<0.5	<1	<3	NA
SDUP6	-	Field Duplicate	32	<0.4	10	43	160	0.1	3	140	5.7	0.62	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
SDUP1	-	Field Duplicate	13	<0.4	9	28	140	0.2	24	72	1.1	0.1	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
SDUP201	-	Field Duplicate	<4	<0.4	6	9	9	<0.1	1	10	90	7.1	NA	NA	NA	NA	NA	<25	<50	370	250	620	<0.2	<0.5	<1	<3	NA
SDUP203	-	Field Duplicate	<4	<0.4	27	17	21	<0.1	19	50	5.2	0.4	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
SDUP203 - [LAB_DUP]	-	Field Duplicate	NA	NA	NA	NA	NA	NA	NA	NA	4.3	0.34	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH103-FCF1	1.0-2.0	Fibre Cement Material	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
BH103-FCF1	2.0-3.0	Fibre Cement Material	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
BH103-FCF2-3	2.0-3.0	Fibre Cement Material	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
Total Number of Samples			39	39	39	39	39	39	39	39	37	37	17	17	17	17	17	37	37	37	37	37	37	37	37	37	17
Maximum Value			34	0.5	84	80	860	2.4	27	440	200	14	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	52	450	340	790	<PQL	<PQL	<PQL	<PQL	Detected

Concentration above the CT1	VALUE	Standard deviation exceeds data assessment criteria	VALUE
Concentration above SCC1	VALUE		
Concentration above the SCC2	VALUE		
Concentration above PQL	**Bold**		

TABLE S8
SOIL LABORATORY TCLP RESULTS
All data in mg/L unless stated otherwise

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

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

TABLE S9
SOIL QA/QC SUMMARY

			TRH C6 - C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Benzene	Toluene	Ethylbenzene	m+p-xylene	o-Xylene	Naphthalene	Acenaphthylene	Acenaph-thene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthra-cene	Benzo(g,h,i)perylene
	PQL Envirolab SYD		25	50	100	100	0.2	0.5	1	2	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.05	0.1	0.1	0.1
	PQL Envirolab VIC		25	50	100	100	0.2	0.5	1.0	2.0	1.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1
Intra	BH2	0.1-0.2	<25	<50	190	350	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.2	0.3	<0.1	<0.1	0.2	0.2	<0.1	<0.1	0.1
laboratory	SDUP2	-	<25	<50	230	400	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.2	0.2	0.1	0.2	<0.2	<0.05	<0.1	<0.1	<0.1
duplicate	MEAN		nc	nc	210	375	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.1	nc	0.2	0.25	0.075	0.125	0.15	0.1125	nc	nc	0.075
	RPD %		nc	nc	19%	13%	nc	nc	nc	nc	nc	nc	nc	nc	nc	0%	nc	0%	40%	67%	120%	67%	156%	nc	nc	67%
Intra	BH9	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	0.4	<0.1	1	1	0.6	0.7	1	0.63	0.4	0.1	0.4
laboratory	SDUP6	-	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.8	0.9	0.6	0.7	1	0.62	0.3	0.1	0.4
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.3	nc	0.9	0.95	0.6	0.7	1	0.625	0.35	0.1	0.4
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	67%	nc	22%	11%	0%	0%	0%	2%	29%	0%	0%
Intra	BH101	0.05-0.35	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.3	0.2	0.2	<0.2	0.2	<0.1	<0.1	0.1
laboratory	SDUP1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.1	0.1	0.2	0.1	<0.1	<0.1	<0.1
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.2	0.25	0.15	0.15	0.15	0.15	nc	nc	0.075
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0%	40%	67%	67%	67%	67%	nc	nc	67%
Intra	BH202	0.12-0.3	<25	<50	430	150	<0.2	<0.5	<1	<2	<1	<0.1	0.5	0.2	0.1	7.4	3.2	23	21	11	11	15	8.8	4	0.8	4
laboratory	SDUP201	-	<25	<50	530	160	<0.2	<0.5	<1	<2	<1	0.1	0.9	0.2	0.1	5.2	2.1	18	17	9.3	8.6	12	7.1	4.5	0.9	4.5
duplicate	MEAN		nc	nc	480	155	nc	nc	nc	nc	nc	0.075	0.7	0.2	0.1	6.3	2.65	20.5	19	10.15	9.8	13.5	7.95	4.25	0.85	4.25
	RPD %		nc	nc	21%	6%	nc	nc	nc	nc	nc	67%	57%	0%	0%	35%	42%	24%	21%	17%	24%	22%	21%	12%	12%	12%
Inter	BH203	0.09-0.4	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.3	0.3	0.2	0.2	0.2	0.2	<0.1	<0.1	<0.1
laboratory	SDUP203	-	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1	<0.1	<0.1	<0.1	<0.1	0.5	0.4	0.8	1	0.4	0.4	0.7	0.4	0.3	<0.1	0.3
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0.3	0.225	0.55	0.65	0.3	0.3	0.45	0.3	0.175	nc	0.175
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	133%	156%	91%	108%	67%	67%	111%	67%	143%	nc	143%
Field Blank	STB1 3/02/20		<25	NA	NA	NA	<0.2	<0.5	<1	<2	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Field Blank	TB-S1 25/03/21		NA	NA	NA	NA	<0.2	<0.5	<1	<2	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trip Spike	STS1 3/02/20		-	-	-	-	103%	102%	108%	101%	113%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trip Spike	TS-S1 25/03/21		-	-	-	-	71%	74%	79%	77%	76%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Field Rinsate	SFR1 3/02/20	µg/L	NA	NA	NA	NA	<1	<1	<1	<2	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Field Rinsate	FR-SPT1 25/03/21	µg/L	NA	NA	NA	NA	<1	<1	<1	<2	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			HCB	alpha- BHC	gamma- BHC	beta- BHC	Heptachlor	delta- BHC	Aldrin	Heptachlor Epoxide	Gamma- Chlordane	alpha- chlordane	Endosulfan I	pp- DDE	Dieldrin	Endrin	pp- DDD	Endosulfan II	pp- DDT	Endrin Aldehyde	Endosulfan Sulphate	Methoxychlor
	PQL Envirolab SYD		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	PQL Envirolab VIC		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Intra	BH2	0.1-0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
laboratory	SDUP2	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Intra	BH9	0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
laboratory	SDUP6	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Intra	BH101	0.05-0.35	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
laboratory	SDUP1	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Intra	BH202	0.12-0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
laboratory	SDUP201	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Inter	BH203	0.09-0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
laboratory	SDUP203	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Field Blank	STB1 3/02/20		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Field Blank	TB-S1 25/03/21		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trip Spike	STS1 3/02/20		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trip Spike	TS-S1 25/03/21		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Field Rinsate	SFR1 3/02/20	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Field Rinsate	FR-SPT1 25/03/21	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Azinphos-methyl (Guthion)	Bromophos-ethyl	Chlorpyriphos	Chlorpyriphos-methyl	Diazinon	Dichlorvos	Dimethoate	Ethion	Fenitrothion	Malathion	Parathion	Ronnel	Total PCBS	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
	PQL Envirolab SYD		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	4	0.4	1	1	1	0.1	1	1
	PQL Envirolab VIC		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	4.0	0.4	1.0	1.0	1.0	0.1	1.0	1.0
Intra	BH2	0.1-0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	9	<0.4	84	51	250	0.2	15	91
laboratory	SDUP2	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	<0.4	62	51	170	0.1	12	130
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	7.5	nc	73	51	210	0.15	13.5	110.5
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	40%	nc	30%	0%	38%	67%	22%	35%
Intra	BH9	0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	33	0.4	13	43	190	0.1	4	150
laboratory	SDUP6	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	32	<0.4	10	43	160	0.1	3	140
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	32.5	0.3	11.5	43	175	0.1	3.5	145
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	3%	67%	26%	0%	17%	0%	29%	7%
Intra	BH101	0.05-0.35	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	17	<0.4	10	47	110	0.4	27	71
laboratory	SDUP1	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	13	<0.4	9	28	140	0.2	24	72
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	15	nc	9.5	37.5	125	0.3	25.5	71.5
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	27%	nc	11%	51%	24%	67%	12%	1%
Intra	BH202	0.12-0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	4	<0.4	6	17	10	<0.1	1	11
laboratory	SDUP201	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4	<0.4	6	9	9	<0.1	1	10
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	3	nc	6	13	9.5	nc	1	10.5
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	67%	nc	0%	62%	11%	nc	0%	10%
Inter	BH203	0.09-0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<4	<0.4	23	22	18	<0.1	20	44
laboratory	SDUP203	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4	<0.4	27	17	21	<0.1	19	50
duplicate	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	25	19.5	19.5	nc	19.5	47
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	16%	26%	15%	nc	5%	13%
Field Blank	STB1 3/02/20		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Field Blank	TB-S1 25/03/21		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trip Spike	STS1 3/02/20		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trip Spike	TS-S1 25/03/21		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Field Rinsate	SFR1 3/02/20	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Field Rinsate	FR-SPT1 25/03/21	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Result outside of QA/QC acceptance criteria

ABBREVIATIONS AND EXPLANATIONS

Abbreviations used in the Tables:

ADWG:	AustralianDrinking Water Guidelines
ANZG	Australian and New Zealand Guidelines
B(a)P:	Benzo(a)pyrene
CRC:	Cooperative Research Centre
ESLs:	Ecological Screening Levels
GIL:	Groundwater Investigation Levels
HILs:	Health Investigation Levels
HSLs:	Health Screening Levels
HSL-SSA:	Health Screening Level-SiteSpecific Assessment
NA:	Not Analysed
NC:	Not Calculated
NEPM:	National Environmental Protection Measure
NHMRC:	National Health and Medical Research Council
NL:	Not Limiting
NSL:	No Set Limit
OCP:	Organochlorine Pesticides
OPP:	Organophosphorus Pesticides
PAHs:	Polycyclic Aromatic Hydrocarbons
ppm:	Parts per million
PCBs:	Polychlorinated Biphenyls
PCE:	Perchloroethylene (Tetrachloroethylene or Tetrachloroethene)
PQL:	Practical Quantitation Limit
RS:	Rinsate Sample
RSL:	Regional Screening Levels
SAC:	Site Assessment Criteria
SSA:	Site Specific Assessment
SSHSLs	Site Specific Health Screening Levels
TB:	Trip Blank
TCA:	1,1,1 Trichloroethane (methyl chloroform)
TCE:	Trichloroethylene (Trichloroethene)
TS:	Trip Spike
TRH:	Total Recoverable Hydrocarbons
UCL:	Upper Level Confidence Limit on Mean Value
USEPA	United States Environmental Protection Agency
VOCC:	Volatile Organic Chlorinated Compounds
WHO:	World Health Organisation

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

	PQL Envirolab Services	ANZG 2018 Marine Waters	SAMPLES					
			MW2	MW2 - [LAB_DUP]	MW202	MW202 - [LAB_DUP]	WDUP1	WDUP100
Inorganic Compounds and Parameters								
pH		7 - 8.5	6.1	NA	5.2	NA	NA	NA
Electrical Conductivity (µS/cm)	1	NSL	**450**	NA	**460**	NA	NA	NA
Turbidity (NTU)		NSL	NA	NA	NA	NA	NA	NA
Metals and Metalloids								
Arsenic (As III)	1	2.3	<1	<1	<1	<1	<1	<1
Cadmium	0.1	0.7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (SAC for Cr III adopted)	1	27	**6**	**6**	<1	<1	**6**	<1
Copper	1	1.3	<1	<1	**2**	**2**	**1**	**2**
Lead	1	4.4	**1**	**1**	**1**	**1**	**1**	**1**
Total Mercury (inorganic)	0.05	0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel	1	7	**3**	**3**	**3**	**3**	**3**	**3**
Zinc	1	15	**19**	**20**	**91**	**92**	**21**	**92**
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)								
Benzene	1	500	<1	<1	<1	<1	<1	<1
Toluene	1	180	<1	<1	<1	<1	<1	<1
Ethylbenzene	1	5	<1	<1	<1	<1	<1	<1
m+p-xylene	2	75	<2	<2	<2	<2	<2	<2
o-xylene	1	350	<1	<1	<1	<1	<1	<1
Total xylenes	2	NSL	<2	<2	<2	<2	<2	<2
Volatile Organic Compounds (VOCs), including chlorinated VOCs								
Dichlorodifluoromethane	10	NSL	<10	<10	<10	<10	NA	NA
Chloromethane	10	NSL	<10	<10	<10	<10	NA	NA
Vinyl Chloride	10	100	<10	<10	<10	<10	NA	NA
Bromomethane	10	NSL	<10	<10	<10	<10	NA	NA
Chloroethane	10	NSL	<10	<10	<10	<10	NA	NA
Trichlorofluoromethane	10	NSL	<10	<10	<10	<10	NA	NA
1,1-Dichloroethene	1	700	<1	<1	<1	<1	NA	NA
Trans-1,2-dichloroethene	1	NSL	<1	<1	<1	<1	NA	NA
1,1-dichloroethane	1	250	<1	<1	<1	<1	NA	NA
Cis-1,2-dichloroethene	1	NSL	<1	<1	<1	<1	NA	NA
Bromochloromethane	1	NSL	<1	<1	<1	<1	NA	NA
Chloroform	1	370	<1	<1	**2**	**2**	NA	NA
2,2-dichloropropane	1	NSL	<1	<1	<1	<1	NA	NA
1,2-dichloroethane	1	1900	<1	<1	<1	<1	NA	NA
1,1,1-trichloroethane	1	270	<1	<1	<1	<1	NA	NA
1,1-dichloropropene	1	NSL	<1	<1	<1	<1	NA	NA
Cyclohexane	1	NSL	<1	<1	<1	<1	NA	NA
Carbon tetrachloride	1	240	<1	<1	<1	<1	NA	NA
Benzene	1	500	<1	<1	<1	<1	NA	NA
Dibromomethane	1	NSL	<1	<1	<1	<1	NA	NA
1,2-dichloropropane	1	900	<1	<1	<1	<1	NA	NA
Trichloroethene	1	330	<1	<1	<1	<1	NA	NA
Bromodichloromethane	1	NSL	<1	<1	<1	<1	NA	NA
trans-1,3-dichloropropene	1	NSL	<1	<1	<1	<1	NA	NA
cis-1,3-dichloropropene	1	NSL	<1	<1	<1	<1	NA	NA
1,1,2-trichloroethane	1	1900	<1	<1	<1	<1	NA	NA
Toluene	1	180	<1	<1	<1	<1	NA	NA
1,3-dichloropropane	1	1100	<1	<1	<1	<1	NA	NA
Dibromochloromethane	1	NSL	<1	<1	<1	<1	NA	NA
1,2-dibromoethane	1	NSL	<1	<1	<1	<1	NA	NA
Tetrachloroethene	1	70	<1	<1	<1	<1	NA	NA
1,1,1,2-tetrachloroethane	1	NSL	<1	<1	<1	<1	NA	NA
Chlorobenzene	1	55	<1	<1	<1	<1	NA	NA
Ethylbenzene	1	5	<1	<1	<1	<1	NA	NA
Bromoform	1	NSL	<1	<1	<1	<1	NA	NA
m+p-xylene	2	75	<2	<2	<2	<2	NA	NA
Styrene	1	NSL	<1	<1	<1	<1	NA	NA
1,1,2,2-tetrachloroethane	1	400	<1	<1	<1	<1	NA	NA
o-xylene	1	350	<1	<1	<1	<1	NA	NA
1,2,3-trichloropropane	1	NSL	<1	<1	<1	<1	NA	NA
Isopropylbenzene	1	30	<1	<1	<1	<1	NA	NA
Bromobenzene	1	NSL	<1	<1	<1	<1	NA	NA
n-propyl benzene	1	NSL	<1	<1	<1	<1	NA	NA
2-chlorotoluene	1	NSL	<1	<1	<1	<1	NA	NA
4-chlorotoluene	1	NSL	<1	<1	<1	<1	NA	NA
1,3,5-trimethyl benzene	1	NSL	<1	<1	<1	<1	NA	NA
Tert-butyl benzene	1	NSL	<1	<1	<1	<1	NA	NA
1,2,4-trimethyl benzene	1	NSL	<1	<1	<1	<1	NA	NA
1,3-dichlorobenzene	1	260	<1	<1	<1	<1	NA	NA
Sec-butyl benzene	1	NSL	<1	<1	<1	<1	NA	NA
1,4-dichlorobenzene	1	60	<1	<1	<1	<1	NA	NA
4-isopropyl toluene	1	NSL	<1	<1	<1	<1	NA	NA
1,2-dichlorobenzene	1	160	<1	<1	<1	<1	NA	NA
n-butyl benzene	1	NSL	<1	<1	<1	<1	NA	NA
1,2-dibromo-3-chloropropane	1	NSL	<1	<1	<1	<1	NA	NA
1,2,4-trichlorobenzene	1	20	<1	<1	<1	<1	NA	NA
Hexachlorobutadiene	1	NSL	<1	<1	<1	<1	NA	NA
1,2,3-trichlorobenzene	1	3	<1	<1	<1	<1	NA	NA
Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	0.2	50	<0.2	<0.2	<0.2	NA	<0.2	<0.2
Acenaphthylene	0.1	NSL	<0.1	<0.1	<0.1	NA	**0.3**	<0.1
Acenaphthene	0.1	NSL	<0.1	<0.1	<0.1	NA	**0.2**	<0.1
Fluorene	0.1	NSL	<0.1	<0.1	<0.1	NA	**0.3**	<0.1
Phenanthrene	0.1	0.6	**0.8**	**0.8**	<0.1	NA	**2.9**	<0.1
Anthracene	0.1	0.01	**0.2**	**0.3**	<0.1	NA	**0.8**	<0.1
Fluoranthene	0.1	1	**0.9**	**0.9**	<0.1	NA	**3.3**	<0.1
Pyrene	0.1	NSL	**0.9**	**0.9**	<0.1	NA	**3.4**	<0.1
Benzo(a)anthracene	0.1	NSL	**0.5**	**0.5**	<0.1	NA	**1.9**	<0.1
Chrysene	0.1	NSL	**0.5**	**0.5**	<0.1	NA	**1.6**	<0.1
Benzo(b,j+k)fluoranthene	0.2	NSL	**0.6**	**0.6**	<0.2	NA	**2**	<0.2
Benzo(a)pyrene	0.1	0.1	**0.4**	**0.5**	<0.1	NA	**1.6**	<0.1
Indeno(1,2,3-c,d)pyrene	0.1	NSL	**0.2**	**0.2**	<0.1	NA	**0.6**	<0.1
Dibenzo(a,h)anthracene	0.1	NSL	<0.1	<0.1	<0.1	NA	**0.2**	<0.1
Benzo(g,h,i)perylene	0.1	NSL	**0.2**	**0.2**	<0.1	NA	**0.6**	<0.1

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

JKEnvironments

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

	PQL Envirolab Services	Recreational (10 x NHMRC ADWG)	SAMPLES					
			MW2	MW2 - [LAB_DUP]	MW202	MW202 - [LAB_DUP]	WDUP1	WDUP100
Inorganic Compounds and Parameters								
pH		6.5 - 8.5	6.1	NA	5.2	NA	NA	NA
Electrical Conductivity (µS/cm)	1	NSL	**450**	NA	**460**	NA	NA	NA
Turbidity (NTU)		NSL	NA	NA	NA	NA	NA	NA
Metals and Metalloids								
Arsenic (As III)	1	100	<1	<1	<1	<1	<1	<1
Cadmium	0.1	20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (total)	1	500	**6**	**6**	<1	<1	**6**	<1
Copper	1	20000	<1	<1	**2**	**2**	**1**	**2**
Lead	1	100	**1**	**1**	**1**	**1**	**1**	**1**
Total Mercury (inorganic)	0.05	10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel	1	200	**3**	**3**	**3**	**3**	**3**	**3**
Zinc	1	30000	**19**	**20**	**91**	**92**	**21**	**92**
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)								
Benzene	1	10	<1	<1	<1	<1	<1	<1
Toluene	1	8000	<1	<1	<1	<1	<1	<1
Ethylbenzene	1	3000	<1	<1	<1	<1	<1	<1
m+p-xylene	2	NSL	<2	<2	<2	<2	<2	<2
o-xylene	1	NSL	<1	<1	<1	<1	<1	<1
Total xylenes	2	6000	<2	<2	<2	<2	<2	<2
Volatile Organic Compounds (VOCs), including chlorinated VOCs								
Dichlorodifluoromethane	10	NSL	<10	<10	<10	<10	NA	NA
Chloromethane	10	NSL	<10	<10	<10	<10	NA	NA
Vinyl Chloride	10	3	<10	<10	<10	<10	NA	NA
Bromomethane	10	NSL	<10	<10	<10	<10	NA	NA
Chloroethane	10	NSL	<10	<10	<10	<10	NA	NA
Trichlorofluoromethane	10	NSL	<10	<10	<10	<10	NA	NA
1,1-Dichloroethene	1	300	<1	<1	<1	<1	NA	NA
Trans-1,2-dichloroethene	1	600	<1	<1	<1	<1	NA	NA
1,1-dichloroethane	1	NSL	<1	<1	<1	<1	NA	NA
Cis-1,2-dichloroethene	1	600	<1	<1	<1	<1	NA	NA
Bromochloromethane	1	2500	<1	<1	<1	<1	NA	NA
Chloroform	1		<1	<1	2	2	NA	NA
2,2-dichloropropane	1	NSL	<1	<1	<1	<1	NA	NA
1,2-dichloroethane	1	30	<1	<1	<1	<1	NA	NA
1,1,1-trichloroethane	1	NSL	<1	<1	<1	<1	NA	NA
1,1-dichloropropene	1	NSL	<1	<1	<1	<1	NA	NA
Cyclohexane	1	NSL	<1	<1	<1	<1	NA	NA
Carbon tetrachloride	1	30	<1	<1	<1	<1	NA	NA
Benzene	1	10	<1	<1	<1	<1	NA	NA
Dibromomethane	1	NSL	<1	<1	<1	<1	NA	NA
1,2-dichloropropane	1	NSL	<1	<1	<1	<1	NA	NA
Trichloroethene	1	NSL	<1	<1	<1	<1	NA	NA
Bromodichloromethane	1	NSL	<1	<1	<1	<1	NA	NA
trans-1,3-dichloropropene	1	1000	<1	<1	<1	<1	NA	NA
cis-1,3-dichloropropene	1	1000	<1	<1	<1	<1	NA	NA
1,1,2-trichloroethane	1	NSL	<1	<1	<1	<1	NA	NA
Toluene	1	8000	<1	<1	<1	<1	NA	NA
1,3-dichloropropane	1	NSL	<1	<1	<1	<1	NA	NA
Dibromochloromethane	1	NSL	<1	<1	<1	<1	NA	NA
1,2-dibromoethane	1	NSL	<1	<1	<1	<1	NA	NA
Tetrachloroethene	1	500	<1	<1	<1	<1	NA	NA
1,1,1,2-tetrachloroethane	1	NSL	<1	<1	<1	<1	NA	NA
Chlorobenzene	1	3000	<1	<1	<1	<1	NA	NA
Ethylbenzene	1	3000	<1	<1	<1	<1	NA	NA
Bromoform	1	NSL	<1	<1	<1	<1	NA	NA
m+p-xylene	2	NSL	<2	<2	<2	<2	NA	NA
Styrene	1	300	<1	<1	<1	<1	NA	NA
1,1,2,2-tetrachloroethane	1	NSL	<1	<1	<1	<1	NA	NA
o-xylene	1	NSL	<1	<1	<1	<1	NA	NA
1,2,3-trichloropropane	1	NSL	<1	<1	<1	<1	NA	NA
Isopropylbenzene	1	NSL	<1	<1	<1	<1	NA	NA
Bromobenzene	1	NSL	<1	<1	<1	<1	NA	NA
n-propyl benzene	1	NSL	<1	<1	<1	<1	NA	NA
2-chlorotoluene	1	NSL	<1	<1	<1	<1	NA	NA
4-chlorotoluene	1	NSL	<1	<1	<1	<1	NA	NA
1,3,5-trimethyl benzene	1	NSL	<1	<1	<1	<1	NA	NA
Tert-butyl benzene	1	NSL	<1	<1	<1	<1	NA	NA
1,2,4-trimethyl benzene	1	NSL	<1	<1	<1	<1	NA	NA
1,3-dichlorobenzene	1	200	<1	<1	<1	<1	NA	NA
Sec-butyl benzene	1	NSL	<1	<1	<1	<1	NA	NA
1,4-dichlorobenzene	1	400	<1	<1	<1	<1	NA	NA
4-isopropyl toluene	1	NSL	<1	<1	<1	<1	NA	NA
1,2-dichlorobenzene	1	15000	<1	<1	<1	<1	NA	NA
n-butyl benzene	1	NSL	<1	<1	<1	<1	NA	NA
1,2-dibromo-3-chloropropane	1	NSL	<1	<1	<1	<1	NA	NA
1,2,4-trichlorobenzene	1	300	<1	<1	<1	<1	NA	NA
1,2,3-trichlorobenzene	1		<1	<1	<1	<1	NA	NA
Hexachlorobutadiene	1	7	<1	<1	<1	<1	NA	NA
Polycyclic Aromatic Hydrocarbons (PAHs)								
Naphthalene	0.2	NSL	<0.2	<0.2	<0.2	NA	<0.2	<0.2
Acenaphthylene	0.1	NSL	<0.1	<0.1	<0.1	NA	**0.3**	<0.1
Acenaphthene	0.1	NSL	<0.1	<0.1	<0.1	NA	**0.2**	<0.1
Fluorene	0.1	NSL	<0.1	<0.1	<0.1	NA	**0.3**	<0.1
Phenanthrene	0.1	NSL	**0.8**	**0.8**	<0.1	NA	**2.9**	<0.1
Anthracene	0.1	NSL	**0.2**	**0.3**	<0.1	NA	**0.8**	<0.1
Fluoranthene	0.1	NSL	**0.9**	**0.9**	<0.1	NA	**3.3**	<0.1
Pyrene	0.1	NSL	**0.9**	**0.9**	<0.1	NA	**3.4**	<0.1
Benzo(a)anthracene	0.1	NSL	**0.5**	**0.5**	<0.1	NA	**1.9**	<0.1
Chrysene	0.1	NSL	**0.5**	**0.5**	<0.1	NA	**1.6**	<0.1
Benzo(b,j+k)fluoranthene	0.2	NSL	**0.6**	**0.6**	<0.2	NA	**2**	<0.2
Benzo(a)pyrene	0.1	0.1	**0.4**	**0.5**	<0.1	NA	**1.6**	<0.1
Indeno(1,2,3-c,d)pyrene	0.1	NSL	**0.2**	**0.2**	<0.1	NA	**0.6**	<0.1
Dibenzo(a,h)anthracene	0.1	NSL	<0.1	<0.1	<0.1	NA	**0.2**	<0.1
Benzo(g,h,i)perylene	0.1	NSL	**0.2**	**0.2**	<0.1	NA	**0.6**	<0.1

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

TABLE G3
GROUNDWATER LABORATORY RESULTS COMPARED TO SITE SPECIFIC HSLs - RISK ASSESSMENT
All results in µg/L unless stated otherwise.

	PQL Envirolab Services	NHMRC ADWG 2011 (v3.5 2018)	WHO 2008	USEPA RSL Tapwater 2017	SAMPLES					
					MW2	MW2 - [LAB_DUP]	MW202	MW202 - [LAB_DUP]	WDUP1	WDUP100
Total Recoverable Hydrocarbons (TRH)										
C_6-C_9 Aliphatics (assessed using F1)	10	-	15000	-	<10	<10	<10	<10	<10	<10
>C_9-C_{14} Aliphatics (assessed using F2)	50	-	100	-	<50	<50	<50	NA	<50	<50
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)										
Benzene	1	1	-	-	<1	<1	<1	<1	<1	<1
Toluene	1	800	-	-	<1	<1	<1	<1	<1	<1
Ethylbenzene	1	300	-	-	<1	<1	<1	<1	<1	<1
Total xylenes	2	600	-	-	<2	<2	<2	<2	<2	<2
Polycyclic Aromatic Hydrocarbons (PAHs)										
Naphthalene	1	-	-	6.1	<1	<1	<1	<1	<1	<1
Volatile Organic Compounds (VOCs), including chlorinated VOCs										
Dichlorodifluoromethane	10	-	-	-	<10	<10	<10	<10	NA	NA
Chloromethane	10	-	-	-	<10	<10	<10	<10	NA	NA
Vinyl Chloride	10	0.3	-	-	<10	<10	<10	<10	NA	NA
Bromomethane	10	-	-	-	<10	<10	<10	<10	NA	NA
Chloroethane	10	-	-	-	<10	<10	<10	<10	NA	NA
Trichlorofluoromethane	10	-	-	-	<10	<10	<10	<10	NA	NA
1,1-Dichloroethene	1	30	-	-	<1	<1	<1	<1	NA	NA
Trans-1,2-dichloroethene	1	60	-	-	<1	<1	<1	<1	NA	NA
1,1-dichloroethane	1	-	-	-	<1	<1	<1	<1	NA	NA
Cis-1,2-dichloroethene	1	60	-	-	<1	<1	<1	<1	NA	NA
Bromochloromethane	1	250	-	-	<1	<1	<1	<1	NA	NA
Chloroform	1		-	-	<1	<1	**2**	**2**	NA	NA
2,2-dichloropropane	1	-	-	-	<1	<1	<1	<1	NA	NA
1,2-dichloroethane	1	3	-	-	<1	<1	<1	<1	NA	NA
1,1,1-trichloroethane	1	-	-	-	<1	<1	<1	<1	NA	NA
1,1-dichloropropene	1	-	-	-	<1	<1	<1	<1	NA	NA
Cyclohexane	1	-	-	-	<1	<1	<1	<1	NA	NA
Carbon tetrachloride	1	3	-	-	<1	<1	<1	<1	NA	NA
Benzene	1	1	-	-	<1	<1	<1	<1	NA	NA
Dibromomethane	1	-	-	-	<1	<1	<1	<1	NA	NA
1,2-dichloropropane	1	-	-	-	<1	<1	<1	<1	NA	NA
Trichloroethene	1	-	-	-	<1	<1	<1	<1	NA	NA
Bromodichloromethane	1	-	-	-	<1	<1	<1	<1	NA	NA
trans-1,3-dichloropropene	1	100	-	-	<1	<1	<1	<1	NA	NA
cis-1,3-dichloropropene	1	100	-	-	<1	<1	<1	<1	NA	NA
1,1,2-trichloroethane	1	-	-	-	<1	<1	<1	<1	NA	NA
Toluene	1	800	-	-	<1	<1	<1	<1	NA	NA
1,3-dichloropropane	1	-	-	-	<1	<1	<1	<1	NA	NA
Dibromochloromethane	1	-	-	-	<1	<1	<1	<1	NA	NA
1,2-dibromoethane	1	-	-	-	<1	<1	<1	<1	NA	NA
Tetrachloroethene	1	50	-	-	<1	<1	<1	<1	NA	NA
1,1,1,2-tetrachloroethane	1	-	-	-	<1	<1	<1	<1	NA	NA
Chlorobenzene	1	300	-	-	<1	<1	<1	<1	NA	NA
Ethylbenzene	1	300	-	-	<1	<1	<1	<1	NA	NA
Bromoform	1	-	-	-	<1	<1	<1	<1	NA	NA
m+p-xylene	2	-	-	-	<2	<2	<2	<2	NA	NA
Styrene	1	30	-	-	<1	<1	<1	<1	NA	NA
1,1,2,2-tetrachloroethane	1	-	-	-	<1	<1	<1	<1	NA	NA
o-xylene	1	-	-	-	<1	<1	<1	<1	NA	NA
1,2,3-trichloropropane	1	-	-	-	<1	<1	<1	<1	NA	NA
Isopropylbenzene	1	-	-	-	<1	<1	<1	<1	NA	NA
Bromobenzene	1	-	-	-	<1	<1	<1	<1	NA	NA
n-propyl benzene	1	-	-	-	<1	<1	<1	<1	NA	NA
2-chlorotoluene	1	-	-	-	<1	<1	<1	<1	NA	NA
4-chlorotoluene	1	-	-	-	<1	<1	<1	<1	NA	NA
1,3,5-trimethyl benzene	1	-	-	-	<1	<1	<1	<1	NA	NA
Tert-butyl benzene	1	-	-	-	<1	<1	<1	<1	NA	NA
1,2,4-trimethyl benzene	1	-	-	-	<1	<1	<1	<1	NA	NA
1,3-dichlorobenzene	1	20	-	-	<1	<1	<1	<1	NA	NA
Sec-butyl benzene	1	-	-	-	<1	<1	<1	<1	NA	NA
1,4-dichlorobenzene	1	40	-	-	<1	<1	<1	<1	NA	NA
4-isopropyl toluene	1	-	-	-	<1	<1	<1	<1	NA	NA
1,2-dichlorobenzene	1	1500	-	-	<1	<1	<1	<1	NA	NA
n-butyl benzene	1	-	-	-	<1	<1	<1	<1	NA	NA
1,2-dibromo-3-chloropropane	1	-	-	-	<1	<1	<1	<1	NA	NA
1,2,4-trichlorobenzene	1	30	-	-	<1	<1	<1	<1	NA	NA
1,2,3-trichlorobenzene	1		-	-	<1	<1	<1	<1	NA	NA
Hexachlorobutadiene	1	7	-	-	<1	<1	<1	<1	NA	NA

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

JKEnvironments

TABLE G4
GROUNDWATER QA/QC SUMMARY

		TRH C6 - C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Benzene	Toluene	Ethylbenzene	m+p-xylene	o-Xylene	Naphthalene	Acenaphthylene	Acenaph-thene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthra-cene	Benzo(g,h,i)perylene	Arsenic	Cadmium	Chromium VI	Copper	Lead	Mercury	Nickel	Zinc
	PQL Envirolab SYD	*10*	*50*	*100*	*100*	*1*	*1*	*1*	*2*	*1*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*	*1*	*0.1*	*1*	*1*	*1*	*0.05*	*1*	*1*
	PQL Envirolab VIC	*10*	*50*	*100*	*100*	*1.0*	*1.0*	*1.0*	*2.0*	*1.0*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*	*1*	*0.1*	*1*	*1*	*1*	*0.05*	*1*	*1*
Intra	MW2	<10	<50	110	<100	<1	<1	<1	<2	<1	<0.2	<0.1	<0.1	<0.1	0.8	0.2	0.9	0.9	0.5	0.5	0.6	0.4	0.2	<0.1	0.2	<1	<0.1	6	<1	1	<0.05	3	19
laboratory	WDUP1	<10	<50	290	110	<1	<1	<1	<2	<1	<0.2	0.3	0.2	0.3	2.9	0.8	3.3	3.4	1.9	1.6	2	1.6	0.6	0.2	0.6	<1	<0.1	6	1	1	<0.05	3	21
duplicate	MEAN	nc	nc	200	80	nc	nc	nc	nc	nc	nc	0.175	0.125	0.175	1.85	0.5	2.1	2.15	1.2	1.05	1.3	1	0.4	0.125	0.4	nc	nc	6	0.75	1	nc	3	20
	RPD %	nc	nc	90%	75%	nc	nc	nc	nc	nc	nc	143%	120%	143%	114%	120%	114%	116%	117%	105%	108%	120%	100%	120%	100%	nc	nc	0%	67%	0%	nc	0%	10%
Intra	MW202	<10	<50	<100	<100	<1	<1	<1	<2	<1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<1	2	1	<0.05	3	91
laboratory	WDUP100	<10	<50	<100	<100	<1	<1	<1	<2	<1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<1	2	1	<0.05	3	92
duplicate	MEAN	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	2	1	nc	3	91.5
	RPD %	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	0%	0%	nc	0%	1%
Field	TB-W1	NA	NA	NA	NA	<1	<1	<1	<2	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Blank	1/04/2021																																
Trip	TS-W1	-	-	-	-	102%	103%	116%	109%	114%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Spike	1/04/2021																																

Result outside of QA/QC acceptance criteria — Value

Appendix D: Guidelines and Reference Documents

Acid Sulfate Soils Management Advisory Committee (ASSMAC), (1998). Acid Sulfate Soils Manual

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