School Infrastructure NSW

Green Square Public School Remedial Action Plan

3 Joynton Avenue
Zetland NSW

3 September 2020

58719/129939 (Rev 1)

JBS&G Australia Pty Ltd

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Abbreviations

Term	Definition
ACM	Asbestos Containing Material
AHD	Australian Height Datum
AMP	Asbestos Management Plan
ASRIS	Australian Soil Resource Information System
ASS	Acid Sulfate Soils
AST	Aboveground Storage Tank
Bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CEC	Cation Exchange Capacity
COC	Contaminants of Concern
Council	The Council of the City of Sydney
CSM	Conceptual Site Model
DA	Development application
DO	Dissolved Oxygen
DP	Deposited Plan
DPI	Department of Primary Industry
DQI	Data Quality Indicator
DQO	Data Quality Objective
EC	Electrical Conductivity
EIL	Ecological Investigation Levels
EPA	NSW Environmental Protection Authority
ESA	Environmental Site Assessment
ESL	Ecological Screening Levels
GIL	Groundwater Investigation Levels
GME	Groundwater Monitoring Event
Ha	Hectare
HIL	Health Investigation Levels
HSL	Health Screening Levels
HW	Hazardous Waste
JBS&G	JBS&G Australia Pty Ltd
LCS	Laboratory Control Sample
LEP	Local Environmental Plan
LOR	Limit of Reporting
NAPL	Non-Aqueous Phase Liquid
NATA	National Association of Testing Authorities
OCP	Organochlorine Pesticides
OEH	Office of Environment and Heritage
PASS	Potential Acid Sulfate Soils
PAH	Polycyclic Aromatic Hydrocarbons
PARCCS	Precision, Accuracy, Representativeness, Comparability, Completeness and Sensitivity
PCB	Polychlorinated Biphenyls
PID	Photo-ionisation Detector
ppm	Parts Per Million
QA/QC	Quality Assurance / Quality Control
RAP	Remedial Action Plan
RCP	Remedial Concept Plan
RL	Relative Level
RPD	Relative Percent Difference
RSW	Restricted Solid Waste
SWL	Standing Water Level
SAS	Site Audit Statement
SAQP	Sampling, Analysis and Quality Plan
SAR	Site Audit Report
TCE	Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbons

Term	Definition
TRH	Total Recoverable Hydrocarbons
UCL	Upper Confidence Limit
UPSS	Underground Petroleum Storage System
UST	Underground Storage Tank
VOC	Volatile Organic Compounds

1. Introduction

1.1 Introduction and Background

JBS&G Australia Pty Ltd (JBS&G) was engaged by the Department of Education – School Infrastructure NSW (SINSW, the client), to prepare a Remedial Action Plan (RAP) associated with the proposed Green Square Public School Development situated within a portion of the former Royal South Sydney Hospital (RSSH) site located at 3 Joynton Avenue, Zetland NSW (the site). The site is legally identified as Part Lot 2 in Deposited Plan (DP) 1174641 and has an area of approximately 4983 m^2. The site location and layout are shown on **Figures 1** and **2**, respectively.

Previous contamination investigation activities undertaken at the former RSSH site (refer to **Section 3**) identified the presence of fill material underlying the site reported to be impacted with polycyclic aromatic hydrocarbon (PAH), heavy metals, total petroleum hydrocarbons (TPH) and asbestos to varying degrees. A remedial action plan (RAP, JBS&G 2014[1]) and RAP addendum (JBS&G 2015[2]) were prepared for the former RSSH site relating to the community centre land uses proposed at the time.

The proposed redevelopment comprises demolition of existing site structures and construction of the Green Square Public School. Ground level extent of the proposed development is identified in **Figure 3**. Additionally, a 276 m^2 parcel located within the site and currently occupied by the existing structures, is proposed to be dedicated as part of development works to the Waranara Early Education Centre located to the southeast of the site for playground use following building demolition and site remediation (**Figure 2**).

Given the time elapsed since the preparation of the previous RAP and confirmation of the proposed development scheme for the subject site, further consideration of existing site contamination assessment information as available for the broader RSSH site and development of a site specific RAP is required to support development applications for the site's proposed use.

This RAP was developed in accordance with guidelines made or approved by the NSW Environment Protection Authority (EPA) and relevant Australian Standards.

1.2 Objectives

The objectives of this RAP are to:

- Consider the available site investigation data with regard to current NSW EPA made or endorsed guidelines for the assessment of contaminated sites; the development proposal including the proposed demolition/early works and construction staging; the site context (including the adjoining community facilities); and available remedial constraints/opportunities to develop a preferred remedial/management strategy.
- Document the procedures and standards to be followed in order to address the contamination impacts at the site, ensuring the protection of human health and the surrounding environment, such that the impact is remediated/managed in a manner as to make the site suitable for the proposed land use.

[1] *City of Sydney Council Remedial Action Plan – Former South Sydney Hospital, 3 Joynton Avenue, Zetland, NSW*. JBS&G Australia Pty Ltd dated 23 September 2014 reference 50080/58831 Revision 0 (JBS&G 2014)

[2] *South Sydney Hospital Remedial Action Plan Addendum – Updated Contamination Distribution South Sydney Hospital, Joynton Avenue, Zetland, NSW*. JBS&G Australia Pty Ltd dated 10 February 2015 reference 50080/60734 Revision 0 (JBS&G 2015)

2. Site Condition & Surrounding Environment

2.1 Site Identification

The site location is shown on **Figure 1**. The extent of the site and associated cadastral boundaries are shown on **Figure 2**. The site details are summarised in **Table 2.1** and described in detail in the following sections.

Table 2.1: Summary Site Details

Lot/DP	Part Lot 2 in DP 1174641
Addresses	3 Joynton Avenue, Zetland NSW
Local Government Authority	The Council of the City of Sydney
Site Area	Proposed Green Square Public School 4707 m^2 Proposed Childcare Centre Playground: 276 m^2
Current Land-use	Community hall, rehabilitation services/hydrotherapy pool, council administrative use, children's playground
Former Land-use	Hospital use (former RSSH)
Proposed Land-use	Primary school and childcare centre playground
Current Zoning	No. 5(a) (Special Uses Zone – Hospital) under the *South Sydney Local Environmental Plan No 114*, noting the site is a Deferred Matter under the *Sydney Local Environmental Plan (Green Square Town Centre—Stage 2) 2013*
Approximate MGA Coordinates of Centre of Site (MGA 56)	E: 334175.072 N: 6246565.947

2.2 Site Description

A detailed site inspection was undertaken by one of JBS&G's trained and experienced environmental consultants on 11 June 2020. Site observations are discussed below, and a photographic log is included in **Appendix E**. The current site layout is shown in **Figure 2**.

The site comprised an irregular shaped parcel of land occupying the north western portion of the former RSSH site. The north eastern section of the site was occupied by a single storey building of brick and timber construction currently utilised as a community centre (**Photograph 1**, **Appendix E**). The building comprised a hall, associated storage rooms, kitchenette and amenities (**Photographs 2** to **4**, **Appendix E**). The northern portion of the site contained an asphalt/concrete paved carpark (**Photographs 5** to **8**, **Appendix E**). The carpark was generally level with Portman Street and the eastern extent sloped toward the community hall.

The central section of the site was occupied by a three-storey building of brick and concrete construction identified as the Naomi Wing Rehabilitation Building (**Photographs 9** and **10**, **Appendix E**). The ground floor of Naomi Wing Rehabilitation Building contained a hydrotherapy pool and associated treatment/office/storage rooms and the partial basement level contained a plant room (**Photographs 11** and **12**, **Appendix E**). Level one was observed to be utilised as an office space by construction contractors undertaking adjacent road/infrastructure construction activities whilst level two was observed to be vacant.

A substation was located immediately to the south of the south west corner of the Naomi Wing Building and this area, including the adjacent derelict yard space area was fenced off (**Photographs 13**, **14** and **16**, **Appendix E**). A brick retaining wall and concrete slab associated with former RSSH infrastructure was observed to the south of the substation covered in mulch (**Photograph 15**, **Appendix E**). The area to the south was retained at a higher level to the ground slab of Naomi Wing Rehabilitation Building and substation indicating filling had occurred in this area.

Demountable site sheds utilised by construction contractors were observed located adjacent to Portman Street to the west of the Naomi Wing Rehabilitation Building (**Photographs 17** and **18**, **Appendix E**). The site compound area was generally level with the northern carpark and was retained at a higher level to the ground slab of Naomi Wing Rehabilitation Building indicating filling had occurred in this area (**Photograph 19**, **Appendix E**).

The area to the south west of the Naomi Wing Rehabilitation Building comprised a vacant area surfaced with eucalyptus mulch and was observed to be used for carparking (**Photograph 20**, **Appendix E**) at the time of the inspection. The area to the south of the substation comprised a community playground understood to have been constructed as part of the adjacent Green Square Community and Cultural Precinct redevelopment works within the southern portion of the RSSH site. This includes a hardstand pavement area with a small basketball court and table tennis tables, surrounded by minor landscaping beds with ground covers and medium to large shrubs (**Photographs 22** and **24**, **Appendix E**).

2.3 Surrounding Land Uses

The surrounding land uses have been identified as follows:

- North – Construction site comprising new Zetland Avenue works, beyond which is a mixed use apartment building construction site with a two level basement excavation (the site was formerly a vehicle sales and maintenance premises);
- East –Joynton Avenue, across which are several construction sites proposed to be redeveloped to accommodate mixed land uses (recreational, residential and commercial land uses). These properties were formerly an Ausgrid works depot and a City of Sydney works depot respectively);
- South – Continuation of the former RSSH site redeveloped as the Green Square Community and Cultural Precinct and Waranara Early Education Centre (south east); and
- West – Portman Street, across which are several construction sites proposed to be redeveloped to accommodate mixed land uses (recreational, residential, commercial and essential infrastructure easements). This site was previously the northern most extent of the Waverley/Woollahra Council Depot.

2.4 Topography & Drainage

A review of site survey plan provided by the client (CMS 2019[3]) indicates the site lies at an elevation between 17.5-18.8 m AHD. The site is situated within an area of gently undulating rises associated with dune formations.

In the vicinity of the site, regional ground levels fall gently toward the south and west, generally toward Shea's Creek, located approximately 680 m to the northwest and the Alexandra Canal located approximately 1.4 km to the southwest of the site. CSM (2019) indicates that a stormwater retention tank is located beneath the small basketball court area in the south eastern portion of the site.

2.5 Geology & Soils

According to the 1:100 000 Sydney Geological Survey Sheet 9130 (1983[4]), the site is underlain by quaternary sediments. This unit is commonly referred to as the Botany Sand Beds (BSBs) and is comprised of unconsolidated to semi-consolidated permeable sands. The sands are fine to medium grained quartz marine sands with minor shell fragments and podzols. The sand is interspersed with lenses of layers of peat, peaty sands, silts and clays, which become more common in the lower part of the sequence. The BSBs can be up to 60 m thick and are generally underlain with Hawkesbury Sandstone.

[3] *Survey Plan Showing Detail & Levels over Lot 2 in DP 1174641, No 3 Joynton Avenue, Zetland NSW 2017*, C.M.S Surveyors Pty Ltd, First Issue, 30 May 2019 (CMS 2019)

[4] *1:100 000 Sydney Geological Map Sheet 9130 Edition 1*. Department of Mineral Resources, Published 1983 (DMR 1983)

A review of the regional soil map (DLWC 2002[5]) indicated that soil in the vicinity of the site comprises soils from the Tuggerah Soil Landscape Group. This soil group typically occurs on gently undulating to rolling coastal dune fields with local relief to 20 m and slope gradients generally in the range of 1 % to 10 % but with isolated instances of up to 35 %. The soils are noted to comprise deep podzols on dunes and podzols/humus podzols intergrades on swales. The soils are subject to extreme wind and wave erosion hazard, are non-cohesive and exhibit very low fertility and very high permeability. Natural ecosystems on this soil type have been extensively cleared.

Past assessment activities, as discussed in **Section 3**, have reported fill material to variable depths underlying the site to a maximum depth of approximately 3 m below ground surface (bgs). The fill materials were reported to be heterogeneous, brown gravelly sand and brown gravelly clayey sand with common constituents present across the majority of the site. Trace levels of bricks, concrete, tile, glass, metal, in addition to ash and slag waste inclusions were reported in fill materials.

Natural soils comprising fine to coarse grained yellow/ white sand was reported beneath the fill soil profile across the site.

A schematic cross section of the historically identified subsurface conditions is provided as **Figure 6**.

2.6 Acid Sulfate Soils

Review of the Department of Land and Water Conservation (1997) 'Acid Sulfate Soil Risk Map 2nd Edition' for Botany Bay indicates that the site is within an area classified as "… no known occurrence of acid sulfate soils (ASS)".

The nearest occurrence of identified ASS comprises the sediments of the Alexandra Canal, located approximately 1.3 km to the southwest of the site.

As reported in JBS (2012) intrusive investigations undertaken at the site did not identify natural soils at the former RSSH site exhibiting characteristics of potential ASS or potential ASS (PASS). Additionally, as reported in EIS (2018a), the ASS assessment undertaken by EIS (2014a) at the former RSSH site did not identify ASS or PASS to a depth of 4.5 m (approx. RL 14.5m).

With due consideration to the geological and soil characteristics of the site, in addition to this information, management of development activities is not required to address the potential for impact of ASS.

2.7 Hydrology

The nearest surface water receptor is Shea's Creek approximately 680 m to the northwest of the site which flows into the Alexandra Canal, located approximately 1.4 km to the southwest of the site. The Alexandra Canal flows into the Cooks River, located approximately 4.9 km to the southwest of the site which in turn discharges into Botany Bay located approximately 5.7 km to the southwest of the site.

Where the site surface is sealed (hardstand pavements) or comprises compacted soils/aggregate, it is anticipated surface water generated during periods of rainfall will be captured by the site's stormwater infrastructure and discharged to the municipality stormwater network along Joynton Avenue and/or Portman Street.

Where the site is unsealed/not compacted, it is anticipated surface water generated during periods of rainfall is likely to result in infiltration into the ground surface at a rate reflective of the underlying gravelly silty sand soil. Excess surface water within the site is expected to follow the topographic gradient and migrate off-site to stormwater infrastructure along Joynton Avenue and/or Portman Street

[5] *1:100 000 Sydney Soil Landscape Series Sheet 9130* (second edition). Department of Land and Water Conservation 2002 (DLWC 2002)

2.8 Hydrogeology

As discussed in **Section 2.5**, the site lies within the BSBs. Two main groundwater systems are anticipated to operate in the vicinity of the site and more broadly across the BSBs:

- A deeper, confined groundwater system resident in the fractures/porous Hawkesbury Sandstone which form the basement of the Botany Basin aquifer; and
- A shallow unconfined to semi-confined aquifer system resident within the unconsolidated sediments of the BSBs.

At a regional level, groundwater flow within the shallow aquifer system is through primary porosity, where water flows between the grains of sediments. The inflows, outflows and storage of the BSBs\ define the water balance. Recharge is predominantly through rainfall infiltration although some water is also imported into the basin from Sydney Water's reticulated mains supply.

Consistent with the historical extensive use of groundwater in the Botany Sands aquifer, a significant number of registered groundwater wells have previously been identified in proximity of the site. A review of the Botany Groundwater Management Zones map (DNR 2009[6]) indicates that the site is located within Zone 2 of the Botany Sands Aquifer Embargo Area. DNR (2009) indicates that the Embargo Area "incorporates localities with known or suspected contamination from past industrial activity". Residents of properties situated within this zone are advised that groundwater use is now banned, especially for drinking water, watering gardens, washing windows and cars, bathing or to fill swimming pools. Industrial users are required to test the bore water at least annually and provide the results to the Department of Primary Industry (DPI) and the Office of Environment and Heritage (OEH).

At the time of the EIS (2018) investigation, groundwater standing water levels (SWLs) within the site were reported between 3.1 m bgs to 4 m bgs, consistent with approximately 15 m AHD in the north of the site (EIS 2018 MW2 and MW5) and 14 m AHD in the south of the site (EIS 2018 MW9) indicative of groundwater movement at the time of the investigation in a southerly direction.

Regional groundwater movement in the deeper confined sandstone/shale bedrock underlying the site is expected to flow in a south westerly direction consistent with the topography to Botany Bay and Alexandra Canal system.

2.9 Meteorology

The Sydney area has a humid to temperate climate with a seasonal rainfall maximum during the summer and autumn months. The average rainfall for Sydney Airport Station is 1077.4 mm. Monthly rainfall ranges from 60.0 mm to 125.3 mm for Sydney Airport (BoM 2020[7]).

The area has a history of droughts, which are broken by periods of heavy rainfall resulting in significant recharges to groundwater resources. The 1940s and 1980s and the current decade are observed to be dry periods, while the early 1970s and 1990s were wet periods.

Summer winds are north-easterly with southerly thunderstorms common. Winter winds are westerly.

[6] Botany Groundwater Management Zones map, www.water.nsw.gov.au/water-management/water-quality/groundwater/botanysand-beds-aquifer/Botany-Sand-Aquifer/default.aspx NSW Department of Natural Resources (DNR 2009)

[7] http://www.bom.gov.au/climate/averages/tables/cw_066037.shtml. Commonwealth of Australia, 2011 Bureau of Meteorology, Product IDCJCM0028 Prepared at Thu 28 May 2020 and accessed by JBS&G on 1 June 2020.

3. Site History and Previous Investigations

The following sections provides a summary of the information and site characterisation data presented within key assessment reports. These reports include historical information relating to investigations conducted at that time.

Comments in relation to contaminants of potential concern (COPC) are provided in the following text in relation to assessment criteria adopted by the author at the time of report preparation. This comprises the range of health/ecological investigation levels presented in NEPC (1999[8]) and EPA (1994[9]) for investigation results generally up to an including the end of 2012; ANZECC (2000[10]) for groundwater thresholds and criteria in NEPC (2013[11]) for results from 2013 onwards.

Exceedances of validation criteria presented in **Section 7.5** with respect to future land uses are also discussed herein, shown in accompanying summary results tables (**Appendix A**) and on **Figure 5A** and **5B**. Relevant borehole logs are included in **Appendix D**.

3.1 Site History

It is understood the former RSSH site comprised a sand quarry and dam/swamp/creek alignment. Baseline archaeological assessment (AMAC 2018[12]) indicates that the Waterloo Dam was constructed circa 1820 and an embankment of the Upper Dam was likely situated over a small area in the northeast corner of the site. Subsequent to decommissioning of the Waterloo Dam, the site was developed as the RSSH in 1909.

Relevant information on the construction and use of RSSH buildings was provided in AMAC (2018) as summarised as follows. By 1913, the hospital was opened and comprised wings for out-patients, mortuary, kitchen and laundry buildings. Between 1919 and 1985, numerous new buildings were constructed at the subject site such as the Esme Cahill Building (nurses' quarters) in 1938, the boiler house and laundry in 1949, and lecture hall in 1953. During the course of the expansion, in 1950-1960, many of the ancillary structures such as the first morgue (1911-1913) were demolished.

As reported in DP (1998), it is understood that the RSSH ceased operations as a general hospital circa 1990 and operated as a rehabilitation centre until 1994 and subsequently as a community health centre.

As reported in DP (1998), a boiler room and an equipment lending building formerly used as a laundry were identified located in the north western section of the subject site **(Figure 2).** Above ground gasworks pipes were identified in the north eastern corner of the former RSSH site indicating the former hospital's boiler and generator were powered by gas. These buildings have since been removed.

DP (2007) further reported that three large reinforced concrete gatic covers were observed in the northern section of the former RSSH site in front of the former orthotics building in the centre of the lawn area identified as possible petrol USTs. It is understood that these features have been removed with the construction of the temporary car park circa 2018 (refer to **Figure 2**).

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8 *National Environment Protection (Assessment of Site Contamination) Measure, 1999*. National Environment Protection Council, 1999 (NEPC 1999)

9 *Contaminated Sites: Guidelines for Assessing Service Station Sites*. NSW EPA December 1994 (EPA 1994)

10 *Australian and New Zealand Guidelines for Fresh and Marine Waste Quality, Volume 1*. Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand, October 2000 (ANZECC 2000)

11 *National Environment Protection (Assessment of Site Contamination) Measure, 1999 Amendment No. 1*. National Environment Protection Council 2013 (NEPC 2013)

12 *Baseline Archaeological Assessment, Green Square Public School, Joynton Avenue, Zetland NSW*, Archaeological Management & Consulting Group, March 2018 (AMAC 2018)

By mid-2013, the majority of the former RSSH site buildings had been demolished, with the ground surface largely comprising exposed site soils with extensive ground surface contouring apparent.

A portion of the former casualty/outpatients building (single story building of brick, stone and timber construction) located to the southeast of the subject site and portions of the former Esme Cahill, Pathology and Administration Buildings located to the south of the subject site were retained due to its heritage value and were subsequently redeveloped via adaptive reuse/refurbishment along with additions/extensions circa 2018.

The former casualty/outpatients building being developed as a childcare centre (Waranara Early Education Centre). The former Esme Cahill, Pathology and Administration Buildings were developed as a community and cultural precinct to accommodate creative offices/workshops, artists' studios, tri-generation power plant, stormwater recycling facility, commercial suites and community spaces. Land surrounding these buildings has been developed to accommodate recreational land uses (play areas, walkways, parks and gardens).

Since 2014, the subject site has undergone various changes during the redevelopment of the broader RSSH site (refer to **Appendix B** for aerial photographs). Of the former RSSH site buildings, only the Naomi Wing Rehabilitation Building including hydrotherapy pool and a Community Hall are currently located within the subject site (**Figure 2**).

Temporary stockpiling was evident at the site between 2015-2016. Placement of a high visibility marker layer over the former ground surface along the western and southern site boundary was evident in the August 2017 aerial image, indicative of temporary capping activities understood to have occurred during adjacent childcare centre development works.

The northern portion of the site appeared to have been raised and developed as an asphalt/concrete paved car park circa April 2018. The south eastern extent of the site was developed as a community playground understood to have been constructed as part of the adjacent community and cultural precinct redevelopment works. CSM (2019) indicates that a stormwater retention tank is located in the playground area beneath the small basketball court area. Temporary site sheds were observed located adjacent to Portman Street to the west of the Naomi Wing Rehabilitation Building with stockpiles observed in the south western extent.

3.2 *Douglas Partners, Phase 1 Preliminary Contamination Assessment, 1998* (DP 1998[13])

The preliminary contamination assessment comprised a site inspection of the former RSSH site and near surface soil sampling at six locations. Of the six sample locations, two locations were advanced within the subject site (sample locations 2 and 3, refer to **Figure 4**).

Potential contaminants were identified by DP as asbestos containing material (ACM) in linoleum, pipe lagging and roof sheeting on several buildings and biohazard waste. Depressions in the lawn area between the former Naomi Wing Building and the former Orthotics Building in the northern portion of the former RSSH site were considered to be the location of three disused underground storage tanks (USTs) (refer to **Figure 2**). It was reported that previous attempts to remove the tanks had failed, with bedding sand being used to backfill the tank pits.

The DP analytical results were reported to indicate that the south-western portion of the former RSSH site may contain levels of heavy metals and PAHs which would require remediation under a NEPC (1999) Residential (with access to soil) Land Use scenario.

The former RSSH site was considered suitable for continued health care use and the southern portion suitable for the proposed residential use subject to:

[13] *Royal South Sydney Community Health Complex, Joynton Avenue, Zetland*. Douglas Partners Pty Ltd dated December 1998 reference 27769 (DP 1998)

- Removal of potentially friable asbestos in buildings;
- Consideration of lead based paints when renovating older buildings;
- Additional works in the proposed residential areas to address the areas in accordance with EPA guidance; and
- Removal of USTs, remediation and validation of the tank pits.

3.3 *Golder Associates, Preliminary Assessment Geotechnical Constraints and Potential Site Contamination, 2000* (Golder 2000[14])

A preliminary geotechnical and contamination assessment was conducted by Golder (2000) for due diligence purposes prior to acquisition of the former RSSH by Council.

The assessment included a review of the previous investigation (DP 1998), supplementary limited soil sampling and analysis, and a review of Golder files pertaining to groundwater contamination at nearby sites. Samples were collected from thirteen hand auger locations and two shallow test pits. Five sample locations (HA1, HA1a, HA1b, HA6, HA12 and HA13) (refer to **Figure 4**) were advanced within the subject site. Sample locations HA1a and HA1b were reported to be shallow excavations, however, no borehole logs were provided.

Contaminants in the soil were compared against health based criteria for residential use with minimal access to soils phytotoxicity based investigation levels (NEPC 1999 and EPA 1994).

Some elevated total petroleum hydrocarbon (TPH) and PAHs were identified as exceeding the adopted criteria and were anticipated to be in localised areas as hotspots rather than widespread contamination in fill material.

With respect to the subject site, COPC were all below the adopted validation criteria in **Section 7.5**.

Information from nearby Victoria Park was reported to not indicate the presence of widespread groundwater contamination up-gradient of the former RSSH site, although a localised hydrocarbon plume was identified in the southwestern corner nearest the former RSSH site.

3.4 *Douglas Partners, Phase 2 Contamination Assessment, 2007* (DP 2007[15])

A Phase 2 Contamination Assessment was undertaken to further assess the potential for contamination in subsoils and groundwater at the former RSSH site. The assessment included a review of historical documentation and previous investigations, collection of soil samples from 29 locations and groundwater samples from three newly installed wells. Seven sample locations (BH13, BH16, BH17, BH18, BH20, BH28, BH29, refer to **Figure 4**) were advanced within or in the vicinity of the subject site. Not all samples collected were submitted for analysis.

Contaminants in the soil were tested against health based criteria for residential use, parks open space and phytotoxicity based criteria adopted at the time of reporting (i.e. NEPC 1999 based assessment criteria across the broader RSSH site area).

Elevated lead concentrations were identified in one sample location (BH20) in shallow fill (0.4 m - 0.5 m), however, review of site plans indicate that BH20 is located adjacent to the northeastern boundary of the subject site. Elevated B(a)P and total PAHs were identified in shallow soils at BH17 within the subject site at concentrations above the adopted human health criteria. A discussion on exceedances with respect to the adopted criteria in **Section 7.5** and the subject site is presented below and further discussed (statistical analysis of the soil data set for the subject site) in **Section 3.14**.

[14] *Preliminary Assessment, Geotechnical Constraints and Potential Site Contamination, South Sydney Hospital Site, Joynton Avenue, Zetland*. Golder Associates, Ref: 0062311/007, July 2000 (Golder 2000)

[15] *Report on Phase 2 Contamination Assessment – 3 Joynton Avenue, Zetland*. Douglas Partners Pty Ltd dated November 2007 (DP 2007)

Benzo(a)pyrene at BH17 was attributed to building and construction works previously being conducted within this portion of the former RSSH site. Elevated PAHs at other locations were attributed to ash and slag inclusions within the fill material.

With reference to the adopted validation criteria in **Section 7.5**, the following samples (within the subject site) exceeded the adopted land use criteria:

- Benzo(a)pyrene at BH17 0.1-0.2 (14 mg/kg) and BH28 0.1-0.2 (1.2 mg/kg) exceeding the residential with accessible soil ecological criterion (0.7 mg/kg); and
- Benzo(a)pyrene toxic equivalence quotient (TEQ) at sample location BH17 0.1-0.2 (14 mg/kg) exceeding the adopted residential with accessible soil human health criterion of 3 mg/kg.

No significant contaminant concentrations were reported in the groundwater samples. Elevated heavy metals were attributed to the background levels in the Botany aquifer.

3.5 *JBS Environmental, Supplementary Contamination Assessment 2012* (JBS 2012[16])

A supplementary assessment of the former RSSH site was completed by JBS Environmental (JBS, now JBS&G) to address the data gaps remaining as identified by the then appointed Site Auditor.

A total of 50 locations were advanced across the former RSSH site, of which, 18 locations were advanced within the subject site (BH17A, BH17-E, BH17-N, BH17A-S, BH17A-W, BH20A, BH20A-S, BH20A-W, BH31, BH32, BH33, BH34, BH35, BH36, BH37, BH38, BH40, BH55, refer to **Figure 4**). Fill material was identified across the former RSSH site at depths ranging generally between 0.3 m and 3 m (average <0.5 m), but up to 6.8 m in one location in the northern corner of the former RSSH site (beyond the subject site). Fill material generally comprised gravelly sand/clayey sand with inclusion of bricks, concrete and/or road base. The gravels present in fill appeared to decrease with fill depth, with underlying fill comprising generally sand/clayey sand with occasional gravels. Anthropogenic inclusions were reported to be limited and not represent an aesthetic issue requiring remediation/management with respect to the proposed land uses.

Selected soil samples were analysed for asbestos, heavy metals, TPH, PAHs, organochlorine pesticides (OCPs), organophosphorus pesticides (OPPs), polychlorinated biphenyls (PCBs), and volatile organic compounds (VOCs). Groundwater samples were collected from three new and one existing well (MW01, MW04, MW05 and MW06) at the former RSSH site.

The following soil results were reported:

- Concentrations of benzo(a)pyrene were reported above the NEPM (1999) Health Investigation Levels (HILs) for open space use (HIL-E) at five locations, inferred to be the result of historic industrial land use impacts. Four locations exceeded the HIL-E by more than 250 % and were considered hotspots. A number of the results at sample locations across the former RSSH site exceeded the adopted ecological criteria;
- Concentrations of TPH C_{10}-C_{36} were reported to be above the EPA (1994) guidelines at two locations BH32 and BH36 within the subject site;
- Concentrations of lead were reported above the Ecological Investigation Levels (EIL) at two locations (BH10 and BH26, to the south of the subject site);
- Asbestos fragments were not reported as present in any of the sample locations; however, JBS reported that ACM fragments were present in the north western portion of the former RSSH site, at a depth of 0.3 m below ground surface (bgs), adjacent to the suspected USTs location (within the subject site);

[16] *Supplementary Contamination Assessment, Former South Sydney Hospital 3 Joynton Avenue, Zetland NSW*. JBS Environmental Pty Ltd dated October 2012 reference 42180/15361 (JBS 2012)

- Friable asbestos was reported to be present in one of the soil samples collected and submitted for analysis within the subject site (BH49 0-0.1 beneath the Joynton Avenue Creative Centre (south of the subject site)); and

No contaminants of potential concern were identified at concentrations above the adopted groundwater criteria in any of the groundwater samples collected and submitted for analysis with the exception of copper and zinc. Copper and zinc concentrations were reported to be consistent with urban areas of inner Sydney and not to require remediation/management.

Based on the results of the assessment (including historical investigation observation and analytical data), JBS reported a total of eight hotspots had been identified requiring remediation/management to make the former RSSH site suitable for its proposed use. Three locations were reported within the subject site.

Evaluation of the historical data with regard to the current land use scenario and adopted criteria as presented in **Section 7.5**, indicates data present for the following soil data locations exceeded the final adopted assessment criteria, as presented in **Figures 5A** and **5B**:

- Lead at sample locations BH20A 0.7-0.8 (380 mg/kg), BH31 0-0.1 (310 mg/kg), BH32 0.5-0.8 (990 mg/kg) exceeding the adopted residential with accessible soil human health criterion (300 mg/kg);
- Benzo(a)pyrene toxic equivalence quotient (TEQ) at sample locations BH17A 2-2.1 (4.5 mg/kg), BH32 0-0.1 (3.8 mg/kg) and BH32 0.5-0.8 (5.7 mg/kg) exceeding the adopted residential with accessible soil human health criterion of 3 mg/kg;
- Chrysotile asbestos detected in sample location BH32 0.5-0.8;
- Benzo(a)pyrene at eight locations with concentrations ranging from 1.2 to 4.1 mg/kg, exceeding the residential with accessible soil ecological criterion (0.7 mg/kg);
- TPH C6-C9 (50 mg/kg), TPH C10-C14 (1800 mg/kg) and TPH C15-C28 (8100 mg/kg) in sample location BH32 0-0.1 exceeding human health and/or ecological criteria for comparable TRH fractions (NEPC 2013); and
- TPH C15-C28 in sample location BH32 0.5-0.8 (420 mg/kg) and BH36 0.9-1.0 (820 mg/kg) exceeding ecological criteria for comparable TRH fraction (NEPC 2013).

It was concluded that the former RSSH site could be made suitable for the proposed mixed residential, commercial and open space land uses subject to remediation/ management of impacted fill materials and that the RAP previously prepared for the former RSSH site be revised to incorporate the results of this assessment.

3.6 *JBS Environmental, Remedial Action Plan, 2013* (JBS 2013[17])

A RAP (DP 2007b[18]) had previously been prepared and then updated (DP 2011[19]) based on the outcomes of previous investigations (DP 1998, Golder 2000 and DP 2007). JBS was engaged by City of Sydney Council to revise the DP (2011) RAP for the former RSSH site to reflect changes in site conditions, subsequent additional characterisation activities (JBS 2012) and inclusion of identified data gaps and proposed subdivision plans.

[17] *Remedial Action Plan Former South Sydney Hospital Site, 3 Joynton Avenue, Zetland, NSW*. JBS Environmental Pty Ltd dated January 2013 reference 42180/51532 (JBS 2013)

[18] *Remedial Action Plan Former South Sydney Hospital Site, 3 Joynton Avenue, Zetland, NSW.* Douglas Partners Pty Ltd dated November 2007 reference 44621 (DP 2007b)

[19] *Remedial Action Plan, Proposed Royal South Sydney Hospital Redevelopment, 3 Joynton Avenue, Zetland*. Douglas Partners Pty Ltd dated October 2011 reference 44621.02 (DP 2011)

The revised RAP by JBS identified a total of eight hotspots that required remediation to make the former RSSH site suitable for its proposed residential with minimum access to soil and commercial land uses.

The RAP indicated that the site could be made suitable by:

- Excavation and off-site disposal of impacted material from eight locations and validation of the resulting excavations; and
- Validation of imported fill materials to reinstate remedial excavations.

3.7 *JBS&G Australia, Remedial Action Plan, 2014* (JBS&G 2014)

JBS&G updated the JBS (2013) RAP to address new development plans which included the development of a childcare centre (more sensitive land use) within the central eastern former RSSH site and to reflect changes in site conditions and extent following subdivision.

Given the changes in land use and EPA endorsement of new national guidelines (NEPC 2013), the existing data set was also compared against revised human and ecological health criteria (where possible).

The revised RAP identified the following data gaps within the broader former RSSH site:

- Potential for up to three USTs and infrastructure to be present in the north-western portion of the former RSSH site (within the subject site, refer to **Figure 2**);
- An active substation in the central portion of the former RSSH site (within the subject site, refer to **Figure 2**);
- Building rubble spread across the former RSSH site during the previous demolition works completed including across a portion of the subject site (since 2011 investigation activities); and
- Illegal dumping of materials at the former RSSH site and identification of five stockpiles of unknown material present across the former RSSH site.

The revised RAP presented additional sampling and analysis as required to address the above data gaps and documented the remedial extents and proposed remedial methodology (hot-spot removal and off-site disposal).

The following areas proposed for remediation/management were located within the subject site;

- BH17/MW2 (depth 0.1 m) and BH17 A (depth 2.0-2.0) with B(a)P concentrations of 14 mg/kg and 3.2 mg/kg respectively.
- BH32 (depth 0-0.1) with TPH (C10-C36) (8150 mg/kg) and B(a)P (2.9 mg/kg); BH32 (depth 0.5-0.8) lead (990 mg/kg), B(a)P (4.1 mg/kg) and asbestos.
- BH36 (depth 0.9-1.0) with TPH C10-36 reported at 1190 mg/kg.

A discussion on the remedial extent is presented in **Section 3.14** below.

3.8 *Environmental Investigation Services, Environmental Site Assessment, 2014* (EIS 2014a)

An Environmental Site Assessment (ESA) was undertaken by Environmental Investigation Services (EIS) for the proposed mixed-use development of the former RSSH site. The assessment objective was to assess the potential for asbestos and heavy metal contamination associated with the spreading of building rubble across the surface of the former RSSH site by site demolition contractors.

A total of five surface samples and 25 subsurface sample locations were advanced across the former RSSH site to address one of the data gaps identified in JBS&G (2014). Sample locations TP308,

TP309, TP310, TP311, TP312, TP313, TP314, TP315 and TP316 were advanced within the subject site (**Figure 4**). It is noted that a number of sample locations were skewed due to the presence of existing structures.

EIS (2014) reported the following based on the adopted criteria at the time:

- Elevated lead concentrations exceeding the adopted health criterion were reported at five sample locations (TP318 (0-0.3 m), TP319 (0-0.3 m), TP320 (0-0.25 m), TP324 (0.3-0.5 m) and DUPM01/TP325 (0-0.3 m)).
- Fibre cement sheeting containing asbestos was reported and/or observed within the fill soil profile at sample locations TP308 (0-0.2m), TP316 (0.3-0.5), TP317 (0.3-0.5), TP319 (0-0.3) and on the ground surface at sample locations (SS2, SS3, SS4 and SS5).

Based on the results, EIS recommended that the existing RAP (JBS&G 2014) be revised to address the additional impacts.

Evaluation of the historical data with regard to the current land use scenario and adopted criteria as presented in **Section 7.5**, indicates asbestos reported at SS2 exceeded the final adopted assessment criteria, as presented in **Figure 5A.**

3.9 *JBS&G Australia, RAP Addendum, 2015* (JBS&G 2015)

Based on the results of EIS (2014) and as a result of site activities known to have occurred (stockpile relocation activities), JBS&G revised the extent of remedial works required to make the former RSSH site suitable for proposed land uses.

The proposed remedial strategy, hot-spot removal and validation was documented in a factual letter report identifying the lateral and vertical extents of impact requiring remediation.

It is noted that JBS&G (2015) identified several additional remedial extents as a result of a more sensitive land use. With respect to the subject site, EIS 2014 sample location TP308 (**Figure 4**) was identified as an additional area requiring remediation due to presence of friable asbestos in surface and near surface.

3.10 *JBS&G Australia, Childcare Centre Validation, 2017* (JBS&G 2017a[20])

A validation report was prepared by JBS&G documenting the remediation/validation activities undertaken at the childcare centre site located to the southeast of the subject site. To render the land suitable for the proposed land use (childcare centre), fulfil the development consent remedial requirements, and to remove unacceptable work, health and safety (WHS) risks associated with the presence of asbestos within fill materials (among others) during subsequent development activities, remedial works were undertaken in accordance with the requirements of the RAP (JBS&G 2014) prepared for the former RSSH site.

Remedial works broadly comprised excavation and off-site disposal of fill materials impacted with asbestos; and installation of a physical barrier (permanent concrete slab) where excavation and off-site disposal of fill materials impacted with asbestos and PAHs was not practicable such that there was not ongoing direct exposure pathway between future site users/workers and the contaminated material.

In addition to the above, it was documented that as a result of extending the remedial excavation beyond the childcare centre site boundary and remedial works to the south of the childcare centre site, approximately 100m^3 of site fill materials impacted with asbestos was temporarily placed in Areas A and G, as shown in survey plan provided in **Appendix C**. An interim cap was placed over this

[20] *Green Square Childcare Centre Validation Report, 3 Joynton Avenue, Zetland 2017*, JBS&G Australia Pty Ltd, 9 June 2017 reference 50739/109201 Rev 0 (JBS&G 2017a)

material until such time as this portion of the former RSSH site could be remediated/developed with these works to be documented in future validation reports.

The childcare centre site was considered suitable for continued construction works and future use as a childcare centre subject to implementation of ongoing management measures to address retained impacted fill materials below the site capping profile, as documented in an Environmental Management Plan (EMP) (JBS&G 2017b[21]).

3.11 *JBS&G Australia, Community and Cultural Precinct Validation, 2018* (JBS&G 2018a[22])

A validation report was prepared by JBS&G documenting the remediation/validation activities undertaken at the community and cultural precinct site. Whilst the majority of the works included in this report was situated to the south of the subject site, the northern most portion (including the current basketball court community facilities) falls within the subject site footprint.

To render the land suitable for the proposed land use (recreational and commercial land uses), fulfil the development consent remedial requirements, and to remove unacceptable work, health and safety risks associated with the presence of asbestos within fill materials (among other contaminants) during subsequent development activities, remedial works for the site were undertaken in accordance with the requirements of RAP prepared for the for the former RSSH site.

Remedial works broadly comprised the following:

- Excavation of asbestos and hydrocarbon impacted fill material from the footprints of former stockpiles SP02 to SP04 and temporarily stockpiled to the north of site pending off-site disposal and/or management;
- Excavation of asbestos, heavy metal and hydrocarbon impacted fill material from area surrounding the former Administration Building and temporarily stockpiled to the north of the site pending off-site disposal; and
- Where excavation and off-site disposal of fill material impacted with asbestos (and heavy metals and hydrocarbons) was not practicable, installation of a physical barrier such that there is not direct exposure pathway.

It was documented that at two locations within the remedial area surrounding the former Administration Building, fill removal was not possible due to site logistics/boundary stability issues at the time. It is noted that this area is located within the current subject site boundary beneath the community playground area and extending toward Portman Street (mulch covered area). Given the fill material could not be removed, a cap/marker layer strategy was implemented across the site portion shown in the survey plan provided in **Appendix C**, such that there were no remaining complete pathways to retained impacted fill materials (i.e. installation of physical barrier). Fill material in these site portions were identified to be impacted with asbestos.

Asbestos validation samples V34-V36 (**Figure 4**) were collected following remediation activities surrounding the former Administration Building with no asbestos detected at the reporting limit of 0.001% w/w in all samples.

The site was considered suitable for recreational/ commercial land uses subject to implementation of ongoing management measures to address retained impacted fill materials below the site capping profile and documented in an EMP (JBS&G 2018b[23]).

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[21] *Green Square Childcare Centre Long Term Environmental Management Plan, 3 Joynton Avenue, Zetland 2017*, JBS&G Australia Pty Ltd, 9 June 2017 reference 50739/109231 Rev 0 (JBS&G 2017b)

[22] *Green Square Community and Cultural Precinct Validation Report, 3 Joynton Avenue, Zetland NSW 2017*, JBS&G Australia Pty Ltd, 14 May 2018 reference 50739/115418 Rev 1 (JBS&G 2018a)

[23] *Green Square Community and Cultural Precinct Long Term Environmental Management Plan, 3 Joynton Avenue, Zetland NSW 2017*, JBS&G Australia Pty Ltd, 10 April 2018 reference 50739/114762 Rev 0 (JBS&G 2018b)

3.12 *Environmental Investigation Services, Review of Existing Contamination Reports, 2018 (2018a)*

As part of the proposed development of the Green Square School, EIS (2018a) completed a review of previous contamination reports (EIS 2014b[24], JBS&G 2014, JBS&G 2015, JMD Design 2015[25] and JD 2018[26]). At the time of the report, the proposed development comprised an 'L' shaped building footprint over the northern and western areas and an open space area to the south and east of the building.

Based on the findings of the review, the following primary data gaps were identified:

- Recent groundwater data was not available for the site and potential exists for groundwater conditions to have changed over time particularly as a result of altered hydrogeological regimes in the region due to development and temporary construction dewatering.
- The site had been used to dump and store soil and other material during the construction of the wider area to the south and soil previously identified as contaminated may have been moved around the site. Change in site levels in the western area since previous soil sampling was unknown.
- A detailed assessment of asbestos in soil with reference to NEPC (2013) had not been undertaken.
- Presence of USTs had not been confirmed and characterisation to the south of the USTs had been limited by the three-storey building.

Contamination from asbestos, heavy metals and hydrocarbons in fill was identified as requiring remediation as part of the future development works. A preliminary site investigation was recommended to be undertaken to further validate the findings of the review.

3.13 *Environmental Investigation Services, Preliminary Site Investigation, 2018* (EIS 2018b[27])

As recommended in EIS (2018a), a preliminary site investigation (PSI) was completed comprising soil sampling from nine new bore holes and three groundwater monitoring wells. Lead, carcinogenic PAHs and TRH (F3) were identified in fill material exceeding the adopted site assessment criteria as applicable for primary school and public open space land use consistent with residential with accessible soil land use. Asbestos was identified in one fibre cement fragment at the ground surface. Arsenic and zinc concentrations were identified in groundwater above the adopted site assessment criteria.

With reference to the adopted criteria in **Section 7.5**, the following samples exceeded the final adopted land use criteria (refer to **Figure 5A** and **5B**):

- Lead at sample locations BH4 0.5-0.95 (360 mg/kg) and BH5 1.5-1.95 (420 mg/kg) exceeding the adopted residential with accessible soil human health criterion (300 mg/kg);
- Benzo(a)pyrene at four locations ranging from 0.89 to 11 mg/kg, exceeding the residential with accessible soil ecological criterion (0.7 mg/kg);

[24] *Preliminary Waste Classification (WC) Assessment and Acid Sulfate Soil Assessment, Proposed Esme Cahill Community Centre and Green Square Childcare Centre, Portman Street and Joynton Avenue, Zetland, NSW*, EIS reference E27359KPlet, 30 April 2014 (EIS 2014a)

[25] *Public Domain Coordination Plan, City of Sydney, South Sydney Hospital Site* (Ref: Final Issue, dated 8 May 2015, JDM Design (JDM Design 2015)

[26] *Site Audit Statement No. 0301-1521 for Joynton Avenue, Zetland* (Part of Lot 2 DP1174641) (Ref 0301-1521, 20 September 2018, James Davis (JD 2018)

[27] *Review of Existing Contamination Reports for Proposed Green Square Public School at Joynton Avenue, Zetland NSW*, EIS reference E31170KPrpt Rev 1, 9 March 2018 (EIS 2018)

- Benzo(a)pyrene toxic equivalence quotient (TEQ) at sample locations BH5 1.5-1.95 (5.6 mg/kg), BH6 0.5-0.65 (17 mg/kg) and BH9 1.5-1.95 (3.7 mg/kg) exceeding the adopted residential with accessible soil human health criterion of 3 mg/kg; and
- Asbestos detected in fibre cement fragment (JF1).

Potential risks of contamination in fill/soil was identified relating to exposure from airborne asbestos fibres, and dermal contact, ingestion and inhalation of dust/soil impacted by lead and PAHs. It was noted that uncertainty existed associated with suspected USTs, the substation kiosk area and areas beneath existing buildings.

It was concluded that the site can be made suitable for the proposed Green Square School development following remediation and validation required to address identified lead, PAH and asbestos impacts and suspected UST locations.

3.14 Statistical Assessment of the Data Set and Remedial Extents

The complete historical soil sample data set is summarised in **Table A** with locations shown in **Figure 4. Table 3.1** below presents the statistical analysis of the soil data set and provides a summary of the remedial extents based on the site history review.

The following statistical criteria was adopted to assess the data set:

- The upper 95 % confidence limit on the average concentration for each analyte (calculated for samples collected from consistent soil horizons, stratigraphy or material types) must be below the adopted criterion;
- No single analyte concentration shall exceed 250 % of the adopted criterion; and
- The standard deviation of the results must be less than 50 % of the criterion.

Statistical Analyses for the data sets are provided in **Appendix F**.

Table 3.1: Statistical Assessment of the Soil Data Set

Location	Matrix	Analyte	Concentration (mg/kg)	Criteria[28] (mg/kg)	<250 %	95 % UCL	SD	Remediation Required
BH32 0.5-0.8	Fill	Lead	990	300	No	Hot Spot		Yes
BH20A (0.7-0.8)	Fill	Lead	380	300	Yes	94.82	92.01	No
BH31 (0-0.1)	Fill	Lead	310	300	Yes			
BH4 (0.5-0.95)	Fill	Lead	360	300	Yes			
BH5 (1.5-1.95)	Fill	Lead	420	300	Yes			
CPTP_W_2.5_180620	Fill	Lead	308	300	Yes			
BH17 (0.1-0.2)	Fill	B(a)P	14	0.7	No	No (Schedule B7 (Appendix A2 the derivation of PAHs and Phenols) guidance has informed that plants grown on PAH contaminated soil have only limited ability to take in and incorporate anthropogenic PAHs through their roots and into their biomass. As such, it was concluded that benzo(a)pyrene ecological exceedances did not represent an unacceptable risk requiring remediation or management).		
BH17A (2-2.1)	Fill	B(a)P	3.2	0.7	No			
BH32 (0-0.1)	Fill	B(a)P	2.9	0.7	No			
BH32 (0.5-0.8)	Fill	B(a)P	4.1	0.7	No			
BH36 (0.9-1)	Fill	B(a)P	1.8	0.7	No			
BH5 (1.5-1.95)	Fill	B(a)P	3.7	0.7	No			
BH6 (0.5-0.65)	Fill	B(a)P	11	0.7	No			
BH9 (1.5-1.95)	Fill	B(a)P	2.5	0.7	No			
BH28 (0.1-0.2)	Fill	B(a)P	1.2	0.7	Yes			
BH17A (0.1-0.2)	Fill	B(a)P	1.2	0.7	Yes			
BH31 (0-0.1)	Fill	B(a)P	1.7	0.7	Yes			
BH34 (0.3-0.4)	Fill	B(a)P	1.5	0.7	Yes			
BH40 (0.9-1)	Fill	B(a)P	1.3	0.7	Yes			
BH4 (0.5-0.95)	Fill	B(a)P	0.89	0.7	Yes			
BH17 (0.1-0.2)	Fill	B(a)P TEQ	19.7	3	No	Yes		

[28] Residential with accessible soil criteria were used in the statistical assessment as presented in **Section 7.5**

Location	Matrix	Analyte	Concentration (mg/kg)	Criteria[28] (mg/kg)	<250 %	95 % UCL	SD	Remediation Required
BH6 (0.5-0.65)	Fill	B(a)P TEQ	17	3	No	Due to the heterogeneity of the fill material, it is considered appropriate to adopt a conservative approach to identify the fill material as a whole as impacted with PAH rather than refer to the presence of hotspots.		
BH17A (2-2.1)	Fill	B(a)P TEQ	4.5	3	Yes			
BH32 (0-0.1)	Fill	B(a)P TEQ	3.8	3	Yes			
BH32 (0.5-0.8)	Fill	B(a)P TEQ	5.7	3	Yes			
BH5 (1.5-1.95)	Fill	B(a)P TEQ	5.6	3	Yes			
BH9 (1.5-1.95)	Fill	B(a)P TEQ	3.7	3	Yes			
BH32 (0-0.1)	Fill	TPH C_6-C_9	50	45	Yes	Hot Spot		Yes
BH32 (0-0.1)	Fill	TPH C_{10}-C_{14}	1800	110	No			
BH32 (0-0.1)	Fill	TPH C_{10}-C_{14}	1800	120	No			
BH32 (0-0.1)	Fill	TPH C_{15}-C_{28}	8100	300	No			
BH32 (0.5-0.8)	Fill	TPH C_{15}-C_{28}	420	300	Yes			
BH36 (0.9-1.0)	Fill	TPH C_{15}-C_{28}	820	300	No	Hot Spot		Yes
Asbestos in soil at sample locations BH32 (0.5-0.8), TP308 (0-0.3), TP316 (0.3-0.5), TP317 (0.3-0.5) and SS2 and JF1 on ground surface require remediation/management.						Yes Based on observations of ACM (or asbestos as loose fibre bundles) at a number of sample locations, the extent of asbestos impacts historically identified more broadly across the former RSSH including the cap and containment of asbestos impacted soil generated during the childcare centre and the community and cultural precinct redevelopment works within the current site boundary (**Appendix C**), fill material as a whole across the subject site is considered as asbestos impacted.		

3.15 Data Gaps

3.15.1 Potential Presence of Underground Storage Tanks

As discussed in **Section 3** above, previous investigations have reported the potential presence of up to three USTs to the north of the Naomi Wing Rehabilitation Building (**Figure 2**).

A validation and waste classification report prepared for the adjacent Green Square Town Centre (GSTC) Infrastructure Development (AECOM 2018[29]) was made available during the preparation of this RAP. The works documented in AECOM (2018) comprised validation of soil around a UST located in the proposed Zetland Avenue Mid Carpark, generally consistent with the potential UST location identified in previous reports discussed above in **Section 3**. Field observations and the soil analytical results collected and analysed from inside (UST_1.9_180622) and at depth around the UST did not identify petroleum hydrocarbon impacts (CPTP_N, CPTP_E and CPTP_W, refer to **Figure 4**). It is understood that the location of the UST has been surveyed to enable its future location and removal, however, survey was not made available.

Given the uncertainty regarding the location of the UST(s) at the site, further assessment within the potential petroleum storage area is required.

The extent of investigations to be completed will be subject to evaluation based upon visual inspection of the area following removal of on site infrastructure. As such, the details will be developed at the time of the investigation with regard to the overall remedial objectives.

The outcomes of the above will guide application of the remedial works as outlined in **Section 6**. However, should contaminant conditions be identified during implementation of the data gap

[29] *Validation Report - Joynton Avenue and Zetland Avenue Mid UST area, Package 4A, Green Square Town Centre Development, Zetland, NSW – Final*, AECOM Australia Pty Ltd, 10 July 2018 (AECOM 2018).

investigation indicate significantly different conditions to those documented herein, further consideration of remedial requirements will be undertaken via implementation of the **Section 8** contingency protocols inclusive of the Unexpected Finds Protocol (UFP).

If confirmed to be present, the(se) UST(s) require decommissioning pursuant to *Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2019* (UPSS Regulation).

3.15.2 Leachability of lead

Based on the statistical analysis of the soil data set, one lead hotspots were identified at sample location BH32 (0.5-0.8) that require remediation/management. TCLP lead concentration in sample BH32 (0.5-0.8) collected adjacent to the Naomi Wing Rehabilitation Building was reported at 48 mg/L potentially indicating the presence of lead paint, flashing or similar source of mobile lead. It is anticipated that management of this issue may potentially comprise delineation and excavation of the lead impact and subsequent off-site disposal to a licensed facility. Alternatively, this material may be retained on site by implementation of a cap and containment strategy, where it can be demonstrated the lead impacts do not present an off-site migration risk. Collection of additional data is required to define the extent of leachable lead to remain in-situ and/or define the extent of leachable lead impacted soil requiring off-site disposal.

Additional targeted assessment activities will comprise advancement of a test pit/borehole at the hotspot location and collection of samples at 0.5 m depth intervals to a maximum depth of 4 m bgs. Samples will be analysed for lead and leachable lead (TCLP and ASLP). Environmental data generated during the data gap investigations are required to be assessed by comparison with site validation criteria established in this RAP.

Should the material be proposed to be remediated by off-site disposal, following the removal of leachable lead impacted fill, the walls and base of the excavation generated by the removal of the fill would require to be validated for lead and ASLP/TCLP lead to demonstrate the successful separation of the impacted material from the balance of site fill material.

3.15.3 Existing Building Footprints

There are uncertainties associated with the condition of fill/natural material underlying existing building footprints including the Naomi Wing Rehabilitation Building, substation and Community Hall due to access constraints at the time of previous investigations. As such, the condition of fill/natural soils underlying building footprints represents a data gap which requires characterisation prior to site redevelopment to confirm consistency with the subsurface profile encountered in other parts of the site. Additional intrusive investigations are required following demolition of existing buildings prior to site development, to appropriately characterise soil underlying existing building footprints.

Additional targeted assessment activities will comprise advancement of four test pits/boreholes within the Naomi Wing Rehabilitation Building footprint, two test pits/boreholes within the community hall footprint and 1 test pit/bore hole within the substation footprint and collection of samples at 0.5 m depth intervals to a maximum depth of 4 m bgs. Of the four test pits/boreholes proposed within the Naomi Wing Rehabilitation Building footprint, one location will be placed in the proposed childcare centre playground area. Samples will be analysed for appropriate COPCs (may include but not limited to heavy metals, TRH/BTEX, PAHs, OCPs/PCBs and Asbestos (500 mL)). Environmental data generated during the data gap investigations are required to be assessed by comparison with site validation criteria established in this RAP.

4. Conceptual Site Model

4.1 Constituents of Potential Concern

The following COPCs have been identified within fill material underlying the site:

- Carcinogenic PAHs (reported as B(a)P TEQ) compounds;
- TRH;
- Individual heavy metals (namely lead); and
- Asbestos impact, occurring as fragments of ACM and free asbestos fibres in fill material (fibrous asbestos).

4.2 Impacted Media

4.2.1 Soil

Fill material encountered at the site has, in some instances concentrations of carcinogenic PAH compounds (as B(a)P TEQ), TPHs, lead and asbestos) in exceedance of NEPC (2013) ecological criteria and health investigation thresholds for primary schools and children's day care centres consistent with Residential A (residential with accessible soil) (HIL-A) land use criteria, as applicable to the proposed development scenario/land use (refer to **Section 2**) and adopted validation criteria (**Section 7.5**).

Fill material underlying the site has been found to comprise heterogeneous, brown gravelly sand and brown gravelly clayey sand. Trace levels of bricks, concrete, tile, glass, metal, in addition to ash and slag waste inclusions were reported in fill materials. Given the identification of ash and slag inclusions in fill material with elevated non-leachable PAH and metal concentrations, the ash and slag inclusions are concluded to be a significant source of these contaminants. Due to the heterogeneity of the fill material, it is considered appropriate to adopt a conservative approach to identify the fill material as a whole as impacted with PAH rather than refer to the presence of hotspots.

ACM (or asbestos as loose fibre bundles) was observed at a number of sample locations. Additionally, it is understood that asbestos impacted soil generated during the childcare centre and the community and cultural precinct redevelopment works have been placed and capped within the current site boundary (**Appendix C**). As such, it is considered appropriate to identify the fill material as a whole across the subject site as asbestos impacted.

Analysis of natural soil samples indicated contaminated material is generally limited to the fill material overlying the natural soils (where encountered).

Based on existing analytical data (**Appendix A**), the majority of constituents reported in soil have been found to be non-leachable and groundwater contamination has not been identified as an issue of concern with respect to human health and/or sensitive groundwater receptors by the previous assessments. As discussed in **Section 3.15.2**, the leachate generation potential at lead hotspot location BH32 (0.5-0.8) constitutes a data gap and requires further assessment prior to site remediation.

4.2.2 Groundwater

Groundwater has been found to be characterised with levels of a range of heavy metals above the ANZG (2018) criteria. The majority of constituents reported in soil impact have been found to be non-leachable and groundwater impact was identified as not posing a potential human health or ecological risk where beneficial use of groundwater is prevented on the site in the future, consistent with the requirements of the Embargo Area as discussed in **Section 2.8**.

General groundwater characterisation previously undertaken have not identified elevated lead concentrations in groundwater.

4.3 Potential for Migration

Contaminants generally migrate from site via a combination of windblown dusts, rainwater infiltration, groundwater migration and surface water runoff. The potential for contaminants to migrate is a combination of:

- The nature of the contaminants (solid/liquid and mobility characteristics);
- The extent of the contaminants (isolated or widespread);
- The location of the contaminants (surface soils or at depth); and
- The site topography, geology, hydrology and hydrogeology.

The potential contaminants identified as part of the site history review and previous investigations are in the solid form (i.e. lead, PAH, asbestos) or liquid form (TRH). Dependent upon concentrations, there is the potential for volatile and semi-volatile TRH compound impacts to occur in a vapour form.

As the site surface is currently predominantly sealed with crushed gravel/concrete/asphalt pavements and building footprints, the potential for windblown dust migration of contamination from the site is generally low.

Surface water is expected to primarily leave the site via local stormwater catchment system. There is potential for migration of lead and TRH impacts (relating to lead hotspot and UST infrastructure) through the soil profile and into groundwater given the high permeability nature of the sandy soil profile. However, given the depth to groundwater reported between 3.1 m bgs to 4 m bgs (EIS 2018), the potential for migration into groundwater and risk of off-site migration is considered to be low.

The potential for contamination migration via surface water movement and infiltration of water and subsequent migration through the soil profile is considered generally to be low.

4.4 Potential Exposure Pathways

The exposure pathways considered to be potentially complete for the site include:

- Potential dermal and oral contact to impacted soils as present at shallow depths and/or accessible by future service excavations; and/or
- Potential oral and dermal contact to groundwater as accessible by future service excavations; and/or
- Potential inhalation of impacted dust generated from site soil by future site occupants and visitors;
- Potential inhalation of impacted soil vapours; and/or
- Potential contaminant uptake by vegetation proposed to be established in the vegetated areas of the site, potentially including large tree plantings.

Whilst temporary dewatering may be necessary to achieve construction requirements, it is not anticipated that any ongoing groundwater extraction will occur within the completion of construction works. The site is located within the Botany Aquifer Groundwater Management Zone 2 which restricts groundwater removal and disturbance. Excavation workers in deep excavations/trenches may potentially be exposed to infiltrating seepage water during building basement excavation/construction activities.

4.5 Receptors

Potential receptors of environmental impact present within the site which will require to be addressed with the site remediation/management include:

- Future site occupants and users of the non-paved areas of the site who may potentially be exposed to COPCs through direct contact with impacted soils and/or inhalation of dusts/fibres/vapours associated with impacted soils; and/or
- Excavation/construction/maintenance workers conducting activities at or in the vicinity of the site, who may potentially be exposed to COPCs through direct contact with impacted soils present within excavations and/or inhalation of dusts/fibres/vapours associated with impacted soils; and/or
- Nearby sensitive receptors at the adjoining day care centre who may potentially be exposed to COPCs through inhalation of dusts/fibres/vapours associated with impacted soils; and/or
- Flora species to be established within landscaped/vegetated areas of the site including potential large tree plantings; and/or
- Ecological receptors within the downgradient surface water environment (Shea's Creek and Alexandria Canal).

4.6 Preferential Pathways

For the purpose of this assessment, preferential pathways have been identified as natural and/or man-made pathways that result in the preferential migration of COPCs as either liquids or gases.

Man-made preferential pathways are present throughout the site, generally associated with areas of disturbed natural/fill material, service infrastructure and stormwater easements. Fill materials are anticipated to have a high permeability. Preferential pathways can be created by the generally higher permeability backfill used to re-instate services trenches.

Preferential pathways are also important in the assessment of potential off-site sources of COPCs. Preferential pathways are potentially present in the adjoining established road network, as associated with service easements.

4.7 Conceptual Site Model Summary

Review of existing contamination investigations in the context of the proposed development has not identified any data gaps pertaining to the determination of the most suitable means to manage the identified contamination at the site.

Reference should be made to **Section 3.15** for discussion of remaining data gaps and the proposed additional characterisation activities to address the data gaps.

5. Remediation Options

Previous characterisation of site contamination conditions as outlined in **Section 4** has indicated the presence of a number of site contamination issues that will require remediation/management to address potential risks to human health, such that the site may be considered site suitable for the proposed land uses.

5.1 Remediation Objectives

The remediation objectives are outlined as follows:

- Removal of potential contamination sources, including potential fuel infrastructure;
- Management and/or removal of unacceptable risks to human health and the environment from the identified impacted (fill material and natural) soils such that the site is suitable for the propose use;
- Close out any data gaps; and
- Validation of the remedial/management works in accordance with the relevant NSW EPA Guidelines and with reference to the adopted site criteria to demonstrate the successful remediation of the site.

This RAP has been prepared with reference to the following guidelines and legislation:

- *Managing Land Contamination, Planning Guidelines, SEPP 55 – Remediation of Land.* Department of Urban Affairs and Planning. NSW Environment Protection Authority (DUAP 1998);
- *Contaminated Sites: Sampling Design Guidelines, September 1995*. NSW EPA (1995);
- *Contaminated Land Guidelines: Consultants Reporting on Contaminated Land.* NSW EPA (2020);
- *Guidelines for the NSW Site Auditor Scheme (3rd Edition).* Environment Protection Authority, 2017, EPA (2017);
- *National Environment Protection (Assessment of Site Contamination Measure) Measure 1999 (as amended 2013).* National Environment Protection council NEPC (2013);
- *Work Health and Safety Act 2011*. NSW Government Legislation, *WHS Act (2011*);
- *How to Safely Remove Asbestos - Code of Practice*. NSW Government, Safe Work NSW, 2018, SWNSW (2018);
- *How to Manage and Control Asbestos in the Workplace - Code of Practice.* NSW Government Safe Work Australia, 2018, SWNSW (2018);
- *Management of Asbestos in the Non-occupational Environment*. enHealth Council, 2005, enHealth (2005);
- *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia.* WA Department of Health, 2009, WA DoH (2009); and
- *Guidelines for the Assessment and Management of Groundwater Contamination*. NSW DEC 2007 (DEC 2007).

5.2 Extent of Remediation

The following areas have been identified as requiring remediation/management:

- Decommissioning/removal of potential USTs, any associated infrastructure, tank backfill material and any further, petroleum impacted soils.
- Carcinogenic PAH compounds (as B(a)P TEQ), lead and asbestos impacted fill at the site that is proposed to be retained as part of site redevelopment. The final extent of material capped in-situ will be dependent on conditions encountered during remediation and development works. It is noted that based on the current development plans, for planning purposes, the anticipated maximum extent of retained fill material is considered to be the entire site development area.

5.3 EPA (2017) Guidance

The *Contaminated Land Management Guidelines for the NSW Auditor Scheme (3rd edition)* (EPA, 2017) lists the following order of preference for soil remediation and management:

1. On-site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;
2. Off-site treatment of excavated soil 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;
3. Removal of contaminated soil to an approved site or facility, followed where necessary by replacement with clean fill; and
4. Consolidation and isolation of the soil on-site by containment within a properly designed barrier.

In addition, it is also a requirement that 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 are required to be considered or developed, EPA (2017).

With regard to management of the fuel infrastructure, consideration is also required with regard to the *Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2019* (UPSS Regulation) and the requirements of the *Occupational Health and Safety (Dangerous Goods) Regulation 2001* in relation to the requirement to remove abandoned fuel storage infrastructure after 2 years.

5.4 Remedial Options

Consideration of each of the available options, as defined in EPA (2017) is presented in **Table 5.1**, taking into account the proposed future reuse of the site.

Table 5.1: Remedial Options Matrix

Option of Treatment	Applicability	Assessment
Option 1: Onsite treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level.	Lead Metals are unable to be destroyed. However, there are a number of microencapsulation treatment technologies which can reduce the mobility of the identified inorganic contaminants of concern (e.g. cement stabilisation).	Lead Not a suitable option. Metals are unable to be destroyed, so this is not an option which is able to be considered. Microencapsulation is not considered necessary given the current absence of evidence of identified groundwater impacts requiring remediation.
	B(a)P TEQ PAHs present in site soils are typically restricted to heavier non-volatile constituents (i.e. B(a)P). These can be remediated by thermal processes. However, this requires substantial investment in plant and equipment and substantial energy use. Similarly, for heavy metals, there are a number of microencapsulation treatment technologies which can reduce the mobility of the identified organic contaminants of concern (e.g., cement stabilisation).	B(a)P TEQ Not the preferred option. Remediation options available for PAH contaminated fill contaminants, generally restricted to thermal treatment processes which are energy intensive. Further, given the limited available space and sensitive adjoining receptors, on-site treatment is not preferred. Microencapsulation is not considered necessary given the absence of identified groundwater impacts requiring remediation.
	Potential Fuel Infrastructure and TPH Impacted Soil Given that soil contaminants associated with petroleum storage there is a potential that they may be able to be remediated on site by a bioremediation style remediation method. Bioremediation occurs where contaminants are chemically broken-down by the metabolic processes of micro-organisms into less toxic or non-toxic forms. Recent NSW EPA guidance requires bioremediation methods to demonstrate that pollutant emissions are not discharged to the atmosphere. On this basis, the lateral extent of the bioremediation activity requires to be restricted to ensure that air emissions from remediation materials are able to be collected.	Potential Fuel Infrastructure and TPH Impacted Soil Given the nature of soils, volume of material, restricted space and time it may take to remediate fill/soils to a level that they do not represent an unacceptable risk and/or contribute to groundwater impacts, this method is feasible but may not be practicable. Not the preferred option, however bioremediation of natural site soils may be further considered, subject to evaluation of time and available space constraints given the comparably low cost when compared to off-site disposal and need for reinstatement of excavations to achieve development levels.
	Bonded ACM ACM can be removed from impacted soils by hand-picking. Hand picking of ACM within fill material is labour intensive and can be costly and time consuming but is less expensive than disposal of soils to landfill. The success of the remediation method is highly dependent upon the soil type and the amount of other building rubble present within the fill, and also on the adopted validation criterion. The more clayey the soil, or the more building rubble present, the harder it is to remove all ACM.	Given the nature of soils, volume of material, restricted space and time constraints, this method is not viable.
	Asbestos Fibres This option is not suitable for asbestos fibre contaminated soil given there is no available technology to economically remove or destroy	This option is not suitable for asbestos fibre contaminated soil given there is no available technology to economically remove or destroy asbestos fibres in soil. Similarly, while the small fragments of ACM identified in soil samples

Option of Treatment	Applicability	Assessment
	asbestos fibres in soil. Similarly, while the small fragments of ACM identified in soil samples by the laboratory may be visible, there is no available technology to economically remove or destroy the small ACM fragments in soil.	by the laboratory may be visible, there is no available technology to economically remove or destroy the small ACM fragments in soil.
Option 2: Offsite treatment of excavated soil/infrastructure 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.	Lead Metals are unable to be destroyed. However, there are a number of microencapsulation treatment technologies which can reduce the mobility of the identified inorganic contaminants of concern (e.g. cement stabilisation).	Energy/resource use associated with the transport and return of materials is not considered to be ecologically sustainable. Not a Suitable Option.
	B(a)P TEQ PAHs present in site soils are typically restricted to heavier non-volatile constituents. These can be remediated by thermal processes. However, this requires substantial investment in plant and equipment and substantial energy use. Similarly, for heavy metals, there are a number of microencapsulation treatment technologies which can reduce the mobility of the identified organic contaminants of concern (e.g., cement stabilisation).	
	Potential Fuel Infrastructure and Petroleum Hydrocarbon Impacted Soil As above (Option 1), however, additional time, energy and costs are incurred to take soils off site and return them to the site, in addition to there being no currently licensed facilities in close proximity of the site to undertake soil treatment.	
	Bonded ACM and Asbestos Fibres As above (Option 1), however, additional time, energy and costs are incurred to take soils off site and return them to the site, in addition to there being no currently licensed facilities in close proximity of the site to undertake soil treatment.	
Option 3: Removal of contaminated soil/infrastructure to an approved site or facility, followed where necessary by replacement with clean fill.	Potential Fuel Infrastructure and fill Materials impacted by TPH, B(a)P TEQ, lead and asbestos There are currently suitably licensed waste facilities in the Sydney metropolitan region capable of accepting the fill material based on a preliminary waste classification. These are generally located a significant distance from the site and there are significant costs are associated with disposal as a result of the NSW Waste Levy, cartage and landfill gate fees. This option provides for the remediation of the site without ongoing concerns with regard to monitoring/management of residual impacts.	B(a)P TEQ A potentially applicable option but inferior to on-site management (Option 4) for the majority of the impacted material. Requirements to retain excavation stability during excavation works so as to remove impacted material at depth may be significant at the site. Whilst this method is viable from a technical view point, because of disposal costs, resource consumption and waste generation volume considerations, this is not the most preferred remedial option available. However, where materials are identified as not being environmentally suitable under Option 4, or material is identified as surplus to future development levels, then this will be the preferred option.

Option of Treatment	Applicability	Assessment
	Dependent upon final development levels, where significant volumes of fill material require removal, suitable material may be required to be imported to site to reinstate resulting excavations.	<u>Lead</u> This is the preferred option for the management of the lead impacted soils should leachate data indicate material is not environmental suitable to remain onsite.
		<u>Potential Fuel Infrastructure and TPH Impacted Soil</u> Given the requirements for removal of the in-situ fuel infrastructure, space constraints associated with options to bioremediate soil on site, overall, this is considered the more favourable option with regard to hydrocarbon impacted soils present at concentrations unable to be retained on site as per Option 4. Alternatively, consideration may be given to Option 1, dependent upon evaluation outcomes as discussed above.
		<u>Bonded ACM and Asbestos Fibres</u> A potentially applicable option but inferior to on-site management (Option 4). Whilst this method is viable from a technical viewpoint, due to disposal costs, resource consumption and waste generation volume considerations, this is not the most preferred remedial option available. However, where materials are identified as surplus to future development levels, then this will be the preferred option.
4. On-site in situ management of the soil by physical separation, and ongoing management.	<u>B(a)P TEQ, Bonded ACM and Asbestos Fibres</u> Fill materials, based on existing analytical data for the site, have been found to be largely free of constituents: • That will pose a potential groundwater risk by the demonstrated low levels of leachable contaminants and the absence of significant groundwater impacts; and • That will pose a potential inhalation risk as demonstrated by the assessment of vapour impacts. On this basis, the impacted fill materials are suitable for retention on site in areas where human/ecological exposures can be restricted.	<u>B(a)P TEQ, Bonded ACM and Asbestos Fibres</u> This is the preferred option for the management of the majority of impacted fill material. The retention of the impacted fill will reduce the waste generation and resource requirements of the remediation of the site and require time and waste disposal cost inputs. Based on the preliminary site development plans, the site will be subject to filling to address flooding issues and then significant areas of hardstand pavements which will provide physical separation between site users and retained impacted fill materials. Additionally, where hardstand pavements are not proposed to be installed (landscaped areas), it is considered feasible to install an alternative physical barrier (such as non-impacted soil). This option is of highest ranking as a result of the low waste volumes, time, cost and energy use. However, consideration of the practical implications of an ongoing site management plan is required prior to implementation to

Option of Treatment	Applicability	Assessment
		ensure there are suitable available mechanisms for ongoing management of the site.
	Fill Materials Impacted by lead Leachate generation potential at lead hotspot location BH32 constitutes a data gap and requires further assessment prior to site remediation.	Fill Materials Impacted by lead On-site management of the lead impacted soils is preferred subject to leachate data to be obtained as part of the data gap assessment works.
	Potential Fuel Infrastructure and TPH Impacted Soils USTs can be retained in situ subject to decommissioning in accordance with the UPSS Regulation, however, given the potential impact on future building foundations it is not considered feasible. Aesthetic considerations in relation to odorous and/or discoloured soils would apply where material may be subject to exposure to future site users. However, where removal of additional impacted soil at depth is identified as impracticable as a result of groundwater intrusion, excavation stability or similar, consideration will be given to on-site in-situ retention of petroleum impacted soil. Given the potential infrastructure and majority of the impacted soils are likely able to be removed and the current data supports an absence of unacceptable risks to groundwater, adoption of an ongoing containment strategy, supported by the current natural attenuation processes are feasible.	Potential Fuel Infrastructure and TPH Impacted Soils Whilst on-site in-situ management of petroleum hydrocarbon impacted soil is not preferred given the aesthetic considerations, potential for contribution to groundwater impacts, etc; consideration of the potential for in-situ retention will be considered where material extends beyond the practicable depth of excavation works at the site.

5.5 Preferred Remedial Strategy

Based upon the above assessment of available remedial/management options the preferred remedial strategy for the site is:

- Excavation and off-site disposal of potential petroleum infrastructure including the USTs, associated pipework and former bowser plinths;
- Excavation of tank pit backfill and associated impacted soil (where present) to the extent practicable and (subsequent to stockpiling and characterisation in accordance with the requirements for off-site disposal), removal of the excavated material from the site to a lawful waste facility;
- Excavation and off-site disposal of lead impacted soil at BH32 if required (subsequent to stockpiling and characterisation in accordance with the requirements for off-site disposal), removal of the excavated material from the site to a lawful waste facility;
- Excavation and off-site disposal of impacted fill material as required to achieve proposed development subgrade levels; and
- On-site retention of all remaining in-situ fill material via implementation of a cap/cover remedial strategy based on physical separation, with implementation of on-going management plan.

Subject to design of the final development scheme review of the preferred strategy will be completed to confirm the appropriateness of the adopted strategy as is discussed in the following sections.

6. Remedial Action Plan

6.1 Site Establishment

The boundary of the extent of remediation will be defined (via survey) and secured as appropriate to ensure that all safety and environmental controls are implemented, including necessary contractor briefings and inductions for the remediation workforce. A summary of the controls is provided in **Section 9**.

6.1.1 Data Gap Close Out

During/following removal of the fuel infrastructure and site structures, appropriate additional intrusive investigation is required to be completed to address data gaps relating to the presence of underground fuel infrastructure, leachability of lead and existing building footprints as discussed in **Section 3.15**. Environmental data generated during the data gap investigations shall be assessed by comparison with site validation criteria established in **Section 7.5.**

6.2 Remedial Works

6.2.1 Removal and Disposal of Petroleum Infrastructure

Petroleum infrastructure shall be removed by a contractor experienced in the decommissioning and removal of fuel infrastructure. The Remediation Consultant will provide oversight during the works with regard only to management of contamination concerns.

Petroleum infrastructure present at the site requiring removal may potentially include:

- Underground storage tanks (USTs);
- Remote fill points;
- Vent points and associated vent lines;
- Fuel dispenser/bowser plinths;
- Feed pipework; and
- Tank anchors.

The procedure for undertaking this activity will in accordance with Section 5 of *The Removal and Disposal of Underground Petroleum Storage Tanks – Australian Standard 4976-2008*, Standards Australia (2008[30]) as per DECCW (2009[31]). The general procedure is detailed below:

- Documentation of work instructions and relevant permits shall be prepared and issued prior to the commencement of decommissioning works;
- Any residual product shall be removed via the dip points or other suitable fittings, using air operator pumps, suitable for hazardous areas. Care shall be taken to ensure that the pump, via hose or spear, reaches the bottom of the tanks (where accessible). Residual product shall be transferred to sealed drums or designated liquid waste trucks;
- Break up and remove concrete/asphaltic hardstand pavements overlying infrastructure;
- Ground level connections to the tanks will be isolated and sealed. All electrical cables, product pipelines, and any other services infrastructure within the vicinity of the tanks will be located and isolated prior to excavation;

[30] *The Removal and Disposal of Underground Petroleum Storage Tanks – Australian Standard 4976-2008*, AS 4976-2008, 26 November 2008, Standards Australia (2008)

[31] *Guidelines for Implementing the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2008*. NSW Department of Environment, Climate Change and Water (DECCW 2009)

- All piping servicing the tanks shall be drained and disconnected. All internal tubes shall be removed and plugged;
- The tanks shall be purged of product vapours where present;
- Any remaining pipework shall be disconnected and all openings, including vents, shall be plugged. One plug in each tank shall have a 3 mm hole to act as a pressure equalizing vent;
- The tank and pipework backfill will be excavated to expose the total width and length of the tanks with subsequent removal of concrete anchors where present, ensuring care is taken not to strike the tank with excavating equipment;
- Prior to removal, lifting lugs shall be inspected to ensure they are in good condition, and the removal equipment shall be suitably powerful to overcome potential ground suction effects;
- Once the tanks are clear of the excavations, excess soil shall be removed to facilitate inspection of the base and sides. If any holes are present, they shall be cold patched or plugged prior to loading the tanks onto the transport vehicle;
- Work shall be planned such that when the tank is fully exposed, it is able to be immediately loaded to a transport vehicle and removed from the site to an approved disposal facility;
- After removal, the tanks shall be marked with warning labels as follows, with minimum letter height of 50 mm placed to ensure visibility from each side and both ends of the tanks during transport:
    - NOT GAS FREE: NO SMOKING
    - NO NAKED LIGHTS
    - TANK HAS CONTAINED PETROL/DIESEL NOT SUITABLE FOR STORAGE OF FOOD OR LIQUIDS INTENDED FOR HUMAN OR ANIMAL CONSUMPTION.
- As per DECCW (2009), notification to SafeWork NSW of the removal of the USTs will be completed within 7 days of removal from the site.

6.2.2 Excavation and Disposal of Petroleum Impacted Soils

Following removal of the potential tank(s) and any associated infrastructure, the tank backfill material and further petroleum impacted soils shall be 'chased' out to the extent practicable under the oversight of the Remediation Consultant with regard to the contamination aspects. The procedure for undertaking this excavation activity will be by:

- Excavation and stockpiling of surrounding and underlying backfill and apparent impacted natural soils using observations including odour, staining/discolouration and/or a photo-ionisation detector (PID).
- It is noted that excavation works will only extend to the site boundary, or a prior hold point as appropriate to ensure boundary stability (as evaluated by the Remediation Contractor or their nominated personnel). Validation sampling of the excavation face at the site boundary (or final extent) will be undertaken.
- Where hydrocarbon impacted groundwater/seepage is observed within the tankpit excavation, this shall be pumped out by a licensed liquid waste contractor. The pumped pit water shall be disposed of as 'liquid waste' as per EPA (2014a).
- Excavated soils will be stockpiled with like materials (fill material, natural sand) within the site on existing pavements, durable plastic ground covers, placed in skip bins, or otherwise loaded directly onto a haulage vehicle. Representative characterisation samples will be

collected from each material type to assess the material suitability for either on-site reuse, or alternatively provide a waste classification for off-site removal.

- Validation samples will be obtained from the base and walls of the excavation as outlined in **Section 7.2.6**. Other than at the site boundary, or practically achievable excavation extent, where validation sample contaminant concentrations exceed the adopted validation criteria, the excavation will be extended until such time as the validation assessment is achieved.
- Any unexpected finds will be managed as per **Section 8**.

6.2.3 Excavation and Disposal of Lead Impacted Soil at BH32 (if required)

Should the data gap investigation identify the need for removal of the hotspot material, the lead impacted fill material identified in the vicinity of BH32 will be 'chased' out to the extent practicable under the oversight of the Remediation Consultant with regard to the contamination aspects. The procedure for undertaking this excavation activity will be by:

- Excavation and stockpiling of lead impacted fill material with guidance of the extent using historical data and an on-site x-ray fluorescence (XRF) analyser.
- It is noted that excavation works will only extend to the site boundary, or a prior hold point as appropriate to ensure boundary stability (as evaluated by the Remediation Contractor or their nominated personnel). Validation sampling of the excavation face at the site boundary (or final extent) will be undertaken.
- Excavated soils will be stockpiled with like materials within the site on existing pavements, durable plastic ground covers, placed in skip bins, or otherwise loaded directly onto a haulage vehicle. Representative characterisation samples will be collected from each material type to provide a waste classification for off-site removal.
- Validation samples will be obtained from the base and walls of the excavation as outlined in **Section 7.5**. Other than at the site boundary, or practically achievable excavation extent, where validation sample contaminant concentrations exceed the adopted validation criteria, the excavation will be extended until such time as the validation assessment is achieved.
- Any unexpected finds will be managed as per **Section 8**.

6.2.4 Excavation and Off-site Removal of Fill Materials

It is anticipated that some excavation of fill material may be required in site areas requiring excavations to allow basement construction, piling and services installation, etc.

Where excavation of fill material is required, consideration may be given to the overall cut/fill balance associated with the proposed development. Where achievable, excavated material may be placed in other areas of the subject site which require filling, alternatively following validation of the successful removal of the fill material, underlying natural sand soil may be preferentially excavated and removed from site as Virgin Excavated Natural Material (VENM) to enable retention of impacted fill material at the site. Where such a borrow pit is proposed to be completed, with consideration to the identified groundwater table elevations and the sand nature of the soil potentially necessitating excavation retention measures, the borrow pit should be designed to have a base no greater than 2 m below current ground levels, providing as a minimum a 1 m clearance of non-saturated sand above the groundwater table. Detailed design of appropriate borrow pit in relevant sections of the site may enable greater depth should specific data on groundwater levels be collected.

However, should there not be sufficient capacity to retain the fill material on-site, excess excavated material is proposed to be managed via off-site removal to an appropriately licensed facility. Following identification of the location and extent of material to be removed, a review of the existing data will be completed to identify whether a waste classification based on existing available

data may be prepared for the material, or alternatively additional sampling and laboratory analysis will be implemented to appropriately characterise the material prior to off-site disposal.

The material will be excavated under the supervision of the Remediation Consultant with the material stockpiled on hardstand/durable plastic, placed in a skip bin or alternatively directly loaded onto a haulage vehicle for off-site disposal. The material will be removed from site under a waste classification as per EPA (2014a) for disposal to a facility lawfully able to accept the material.

6.2.5 Physical Separation (Capping) of Retained Fill Materials Strategy

Subsequent to grading works required to achieve construction objectives, fill material underlying the site areas is proposed to be retained *in-situ*. It is proposed that remedial works will comprise implementation of a 'cap and containment' management protocol with the following minimum requirements:

- Permanent concrete ground slabs, asphalt surfaced pavement, mortared stone/concrete pavers or similar. The pavement base course shall be underlain by a visual marker layer; or
- A minimum soil cover thickness of 500 mm (as further discussed below) is nominated as underlain by a 'marker layer' in areas of exposed site soil. Suitable backfill material may comprise one or a combination of imported virgin excavated natural material (VENM), material sourced from the site that has been validated as suitable for beneficial reuse within the site, and/or imported material nominated via a beneficial reuse exemption as fit for the proposed purpose (eg ENM, drainage aggregate, growing media, etc); and/or
- Where underground services are required to be installed, excavation of impacted material from the services alignment will be required, followed by lining of the resulting trench with the visual marker layer, then service installation and backfilling with appropriate engineered material (typically VENM, imported recycled glass sand, aggregate or similar). Typically, the lined trench dimensions should be suitable to allow future maintenance workers space to work in non-impacted backfill material.

In vegetated/landscaped areas, the minimum soil cover depth of 500 mm is consisted appropriate for shallow rooted plants (grass, groundcover plants etc). For deep rooted plants including large shrubs and trees, a depth of growing media of up to 2 m below surrounding ground levels may be required, based upon arborist advice following consideration of individual species/specimen requirements, to facilitate a suitable zone depth for the plant(s). The underlying impacted material will be covered by a visual marker layer above which, suitable drainage/growing media will be placed within the root zone.

Material to be used above the marker layer must be demonstrated prior to placement as appropriate with respect to site contamination risks in addition to being fit for purpose for uses including growing media, engineered backfill or pavement subgrade material.

The purpose of the marker layer is to serve as a visual signal to those disturbing the capping system of the presence of potentially contaminated fill material at depth. The marker layer shall consist of a light coloured knitted HDPE constructed at least to a density greater than 300 grams per square metre (or equivalent). The marker layer should be of a distinctive bright colour such that future workers and/or site users will be alerted to conditions as documented in a site environmental management plan (EMP) prior to breaching the marker layer (see **Section 7.7** – Long term Environmental Management Plan).

The final extent of material capped in-situ will be dependent on conditions encountered during remediation and development works and as such, for planning purposes, the anticipated maximum extent of retained fill material is considered to be the entire site development area.

6.2.6 Movement of Material

It is likely that fill material/soils will require to be moved across the site during development works. Material shall be moved as per a material tracking plan (MTP).

The MTP shall be developed prior to movement of material and will address material characteristics and tracking (quantity, movement and locations). Specifically, the MTP will be required to define:

- Responsibilities of stakeholders;
- Procedures for documentation of the material via summarising existing data and/or the collection of additional data such that characterisation data is available to facilitate decision making requirements and satisfy validation data quality objectives (DQOs);
- Requirements for documenting material source, quantity and final destination (lateral and vertical extent); and
- The level of precision required with respect to data collection and reporting.

The relevant environmental, health and safety requirements of the handling of the soils within the nominated works stage will be transferred to the area of relocation of the soils. This shall at least include provisions for stockpile management, material movement design in accordance with project staging / timeframes and separation of fill materials from naturally occurring soils.

6.2.7 Off-site Disposal of Material

Any material requiring disposal shall be classified in accordance with *Waste Classification Guidelines* NSW EPA (2014a) and relevant waste regulations by the Remediation Consultant. Disposal of waste to licensed waste facilities in accordance with relevant waste regulations will be undertaken by the Remediation Contractor. All waste tracking documentation including disposal dockets must be maintained by the Remediation Contractor and must be provided to the Principal and the Remediation Consultant for inclusion in the validation report.

6.3 Validation

Validation of the remedial works will be conducted by the Remediation Consultant to demonstrate the remediation objectives have been achieved. Consideration to the requirements of the UPSS *Technical Notes: Site Validation Reporting* (DECCW 2010) will be considered in development of the validation program.

Details of the validation program are provided in **Section 7**.

6.4 Backfilling of Excavations

Upon confirmation of validation, excavations will be reinstated using validated excavated material sourced from within the site, or alternatively validated imported fill material for material to be placed above the marker layer. Imported fill material will require assessment prior to importation to confirm the material is consistent with Virgin Excavated Natural Material (VENM), Excavated Natural Material (ENM) as defined in EPA (2014b[32]) or any other suitable material, granted an applicable EPA waste exemption under the *Protection of the Environment Operations (Waste) Regulation 2015*.

Alternatively, material sourced from the site that have been demonstrated to not present an off-site migration risk, can be used for excavation reinstatement up to the base of the marker layer.

[32] *The excavated natural material exemption 2014*. NSW EPA (2014b)

6.4.1 Construction Fill/Landscaping Material Importation

Specific purpose fill materials may be required to be imported to the site as construction fill and landscaping material. Reference should be made to **Section 7.2.6** for sampling densities and analytes and compliance with relevant EPA made or endorsed guidelines.

6.4.2 Asbestos Management

Based on the available characterisation information as discussed in **Section 4**, fill materials within the site are impacted with asbestos, and are provisionally classified as asbestos contaminated soils until deemed otherwise by further assessment. Asbestos contaminated soil necessitating management for potential asbestos exposure is defined in *How to Manage and Control Asbestos in the Workplace Code of Practice*, 2018, Safe Work Australia 2018 (SWA 2018) as:

- Soil that contains visible asbestos as determined by a competent person; or
- Soil that contains asbestos fibres at quantities exceeding trace levels (considered to be the analytical detection limit in lieu of alternate guidance) as reported by analysis undertaken in accordance with AS4964:2004 *Method for the qualitative identification of asbestos in bulk samples*.

Environmental, health and safety management requirements for the handling of these materials will be documented in an Asbestos Management Plan (AMP) to be prepared based on the requirements provided for asbestos-related works in SWA (2018). This will include preparation of an asbestos register and associated asbestos removal control/management plan as outlined in SWA (2018).

Where sampling and analysis of specific fill materials is completed in conjunction with inspection by a competent person, and the results indicate the material does not fall within the “asbestos contaminated soil” definition, the requirements for management of “asbestos contaminated soils” will not be required to be implemented.

For the purposes of remediation works within site, a competent person shall be considered to be a person who holds a tertiary degree in a science of engineering discipline, has experience in contaminated site assessment and has completed a WorkSafe approved Asbestos Removal Supervisor course.

6.5 Site Disestablishment

On completion of the remediation works all plant/equipment and safety/environmental controls shall be removed from the site by the Remediation Contractor. If encountered, equipment used during asbestos remediation works will need to be appropriately decontaminated or disposed of as asbestos waste by the Remediation Contractor, in accordance with SWA (2018), EPA (2014a) and relevant waste regulations.

7. Validation Plan

7.1 Overview

Validation data is required to be collected to verify the effectiveness of the remedial works and document the final site conditions as being suitable for the proposed future use.

The following sections establish the DQOs to be adopted during validation of the site remediation works.

7.2 State the Problem

The site, which has historically been used as a health facility, is proposed to be redeveloped as a school.

Previous assessment of site conditions has identified the presence of soils impacted, to varying extents, by lead, PAHs (as B(a)P TEQ), TPH/TRH and asbestos that will require management/ remediation for the site to be considered suitable for future proposed land use. In addition, it is suspected that there is at least one UST remaining at the site that will require removal.

To appropriately demonstrate that the remedial/management works have been completed in accordance with this RAP, sufficient data in the form of observations, sample analytical data, material tracking records, survey data, disposal docket, etc. are required to be collected and assessed in a defensible manner.

7.2.1 Identify the Decision

The following decisions are required to be made during the validation works:

- Are risks to onsite or offsite receptors from any residual soil contamination, following the remedial works outlined in **Section 6.2** acceptable (subject to the proposed long term EMP)?
- If impacted materials are to remain on site, can any outstanding issues be appropriately managed by the adoption of a cap and containment strategy based on physical separation and an EMP?
- Have all aesthetic issues been addressed?
- Have excavated materials been classified and disposed of offsite to a facility licensed to accept the classified waste?
- Are imported soils (where required) environmentally suitable for their proposed use?
- Has the potential migration of contaminants from the site been mitigated?
- Have the works been completed in accordance with the RAP, or where variations to the works were required, have these met the objectives of the RAP?
- Is the site suitable for the proposed land use?

7.2.2 Identify Inputs to the Decision?

Inputs to the decisions are:

- The proposed development plan for the site;
- Field observations in relation to inspection of all excavation bases, walls and stockpiles for odours, sheen, discolouration, and other indicators of potential contamination;
- Soil validation analysis data collected from stockpiles and the base and walls of remedial excavations;

- Waste classification and/or material characterisation data obtained during assessment of fill materials;
- Observation and photographic log of marker and capping layer installation;
- Survey of marker and capping layer vertical and lateral extents;
- Materials tracking records;
- Importation assessment criteria;
- Field observations, sampling and analytical data of any unexpected finds;
- Environmental monitoring data to demonstrate that potential airborne pollutants as generated by the handling of environmentally impacted materials on the site has not impacted off-site locations;
- Assessment criteria for potentially impacted media;
- Disposal dockets and relevant documents in relation to appropriate disposal of material to be removed from the site (landfill dockets, beneficial reuse/recycling dockets); and
- Data quality indicators as assessed by quality assurance/quality control (QA/QC).

7.2.3 Define the Study Boundaries

The site is located within a portion of the former RSSH site located at 3 Joynton Avenue, Zetland NSW (the site). The site is legally identified as Part Lot 2 in Deposited Plan (DP) 1174641 and has an area of approximately 4983 m^2. The site location and layout are shown on **Figures 1** and **2**, respectively.

The vertical extent of the validation assessment will comprise the depth of impacted fill material underlying the site. In practice the lateral and vertical extent shall be determined by validation samples that satisfy the adopted validation criteria.

7.2.4 Develop a Decision Rule

The decision rules adopted to answer the decisions identified in **Table 7.1** below.

Table 7.1: Decision Rules

Decision Required to be Made	Decision Rule
1. Following the remedial works outlined in **Section 6.2,** are risks to onsite or offsite receptors from residual soil contamination, acceptable (subject to the proposed long term EMP)?	Soil analytical data will be compared to EPA endorsed criteria as established in this RAP. For each of the validation data sets, where appropriate, statistical analysis of the data will be undertaken in accordance with relevant guidance documents to facilitate the decisions. The following statistical criteria will be adopted with respect to soils: Either: the reported concentrations are all below the site criteria; Or: the average site concentration for each analyte must be below the adopted site criterion; no single analyte concentration exceeds 250 % of the adopted site criterion; and the standard deviation of the results must be less than 50 % of the site criteria. And: the 95 % upper confidence limit (UCL) of the average concentration for each analyte must be below the adopted site criterion. If the statistical criteria stated above are satisfied, the decision is Yes. If the statistical criteria are not satisfied, refer to Decision Rule 2.
2. If impacted materials are to remain on site, can any outstanding issues be appropriately managed by the	Validation/site characterisation sample contaminant data will be assessed by comparison with ANZECC (1999) and EPA endorsed documents as appropriate.

Decision Required to be Made	Decision Rule
adoption of a cap and containment strategy based on physical separation and an EMP?	If the contaminants are considered to be appropriately managed via installation of a capping system based on physical separation, the answer to the decision is Yes. If the contaminants are considered to still represent a potential risk in relation to future site users following installation of a physical separation layer, then the answer to the decision would be No.
3. Have all aesthetic issues been addressed?	If there are any remaining unacceptable inclusions or soil discolouration, the answer to the decision will be No. Otherwise, the answer to the decision will be Yes.
4. Has all excess excavated soil been classified and disposed of offsite to a facility licensed to accept the classified waste?	Soil analytical data will be compared against presented criteria in EPA Waste Classification Guidelines (2014). Statistical analyses of the data in accordance with relevant guidance documents will be undertaken, if appropriate, to facilitate the decisions (as detailed above). Appropriate waste classification and disposal documents to be obtained. If the statistical criteria stated above are satisfied, the decision is Yes, and if receipts are provided recording the disposal of material to an offsite licensed facility, the decision is Yes. If criteria or statistical assessment are not satisfied, or no disposal receipts are provided, the answer is No.
5. Are imported soils (where required) environmentally suitable for their proposed use?	Soil analytical data will be compared against the regulatory requirements for importations in addition to site land use assessment criteria. Statistical analyses of the data in accordance with relevant guidance documents will be undertaken, if appropriate, to facilitate the decisions (as detailed above). If both the regulatory requirements and the statistical criteria stated above are satisfied, or if supporting documentation from the source site is provided regarding suitability for use, the answer to the decision is Yes. If the material doesn't meet the regulatory requirements, inclusive of soil analytical data exceeding the EPA endorsed criteria or documentation from source site is not provided, the answer is No.
6. Has the potential migration of contaminants from the site been mitigated?	Where contaminants were to be retained on site, appropriate final characterisation data will be assessed in addition to existing groundwater contamination data to evaluate the potential impact on groundwater conditions at the site. If the assessment indicates any unacceptable risk then the answer to the decision will be No. Otherwise, the answer to the decision will be Yes.
7. Have all remediation works been completed in accordance with the requirements of the RAP, or where variations were required, have these been appropriate to meet the RAP objectives?	Evaluation of the RAP requirements and completed scope of works will be completed on a qualitative basis. If the completed works are inconsistent with the RAP objectives, the answer will be No. In this instance, evaluation of the works will be undertaken with consideration to the RAP objectives. If the works are inconsistent with the stated objectives, the answer is No. Otherwise the answer to the decision is Yes.
8. Is the site suitable for the proposed uses?	Is the answer to any of the above decisions No? If No, can the outstanding issues be appropriately addressed by incorporation into the proposed EMP? If the answer to the above is Yes, or if the issues can be appropriately addressed by incorporation into the proposed EMP, the answer to the above decision is Yes, subject to implementation of the EMP. Otherwise, the answer to the decision is No.

7.2.5 Specify Limits of Decision Error

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

Specific limits for this project have been adopted in accordance with the appropriate guidance from the NSW EPA, NEPC (2013), ANZG (2018), DEC (2007[33]), appropriate indicators of data quality (DQIs used to assess QA/QC) and standard JBS&G procedures for field sampling and handling.

To assess the usability of the data prior to making decisions, the data will be assessed against pre-determined DQIs for completeness, comparability, representativeness, precision and accuracy.

The pre-determined Data Quality Indicators (DQIs) established for the project are discussed below in relation to precision, accuracy, representativeness, comparability, completeness and sensitivity (PARCCS parameters), and are shown in **Table 7.2**.

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

If any of the DQIs are not met, further assessment of the data set will be required in order to determine whether the non-conformance has significant effects on the usefulness of the data. Corrective action to correct an adverse impact on the reliability of the dataset may include, but is not limited to, the request of further information from samplers and/or analytical laboratories, downgrading of the quality of the data or alternatively, re-collection of the data.

[33] *Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination*. NSW Department of Environment and Conservation 2007 (DEC 2007)

Table 7.2: Summary of Quality Assurance / Quality Control Program

Data Quality Objectives	Frequency	Data Quality Indicator
Precision		
Blind duplicates (intra laboratory)	1 / 20 samples	<50% RPD[2], asbestos in agreement
Blind duplicates (inter laboratory)	1 / 20 samples	<50% RPD[2], asbestos in agreement
Laboratory duplicates	1 / 20 samples	<50% RPD[2], asbestos in agreement
Accuracy		
Surrogate spikes	All organic samples	70-130%
Laboratory control samples	1 per lab batch	70-130%
Matrix spikes	1 per lab batch	70-130%
Representativeness		
Sampling appropriate for media and analytes		-[3]
Samples extracted and analysed within holding times.	-	Soil: organics (14 days), inorganics (6 months)
Trip spike	1 per sampling event	70-130% recovery
Storage blank	1 per sampling event	<LOR
Rinsate blank	1 per sampling data where reusable equipment is used	<LOR
Method blank (soil vapour only)[1]	1 per lab batch	<LOR
Equipment blank (soil vapour only) [1]	1 per lab batch	<LOR
Laboratory blanks	1 per lab batch	<LOR
Comparability		
Standard operating procedures for sample collection & handling	All Samples	All samples[3]
Standard analytical methods used for all analyses	All Samples	All samples[3]
Consistent field conditions, sampling staff and laboratory analysis	All Samples	All samples[3]
Limits of reporting appropriate and consistent	All Samples	All samples[3]
Completeness		
Sample description and COCs completed and appropriate	All Samples	All samples[3]
Appropriate documentation	All Samples	All samples[3]
Satisfactory frequency and result for QC samples	All QA/QC samples	-[3]
Data from critical samples is considered valid	-	Critical samples valid[3]
Sensitivity		
Analytical methods and limits of recovery appropriate for media and adopted site assessment criteria	All Samples	All samples

[1] Inclusion of soil vapour DQI in the unlikely event soil vapour data is required to be collected.

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

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

7.2.6 Optimise the Design for Obtaining Data

The purpose of this step is to identify a resource-effective field investigation sampling design that generates data that are expected to satisfy the performance criteria, as specified in the preceding steps of the DQO Process.

For these works, following the removal of potential petroleum storage infrastructure and associated impacted soil, the resultant excavation walls and base will be inspected/sampled in accordance with **Table 7.3** with the results assessed against the adopted validation criteria as discussed in **Section 7.5**. The resulting excavated material will be reviewed against site validation criteria (**Section 7.5**), to assess suitability for on-site retention or characterised based on the waste classification criteria set out in EPA (2014a) to enable off-site disposal.

Where material from beyond the fuel infrastructure excavations is required to be excavated to achieve proposed development levels, the resulting material will be characterised for the purposes of either on-site reuse (above or below a capping profile) or alternatively for off-site disposal. Where fill material is to be retained in-situ, characterisation sampling will be collected to verify the material is suitable to be retained under a capping profile. Alternatively, where excavation works result in the removal of all potentially impacted fill/natural soil material, validation sampling will be undertaken to verify that capping of these site areas will not be required for site suitability.

Imported materials (where/if required) will also require validation to ensure their appropriateness (from a contamination perspective) for use on the site. General sampling densities are outlined in Table 7.3, to be confirmed based on the specific material types to be imported at the time of the remediation works.

Table 7.3: Sampling Analytical Schedule

Item	Sampling Frequency			Analytes
	Excavation Base	Excavation Walls	Materials	
Excavation formed by the removal of petroleum storage infrastructure	1 sample per UST, or a minimum of 1/25 m^2 where one large excavation	1 sample per wall per media, with minimum spacing of one per 5 linear metres	Sampling at 1/25 m^3, with analysis at 1/100 m^3 based on PID screening	TRH/BTEX Lead PAH
Excavation formed by the removal of lead impacted soils	1/25 m^2	one per 5 linear metres	N/A	Lead ALSP/TCLP Lead
Characterisation of excavated materials requiring off-site disposal (excluding any bulk basement excavation)[1]	N/A	N/A	1/100 m^3 with a minimum of 3 samples	Heavy Metals TRH/BTEX PAHs OCPs/PCBs Asbestos (ID) TCLP Heavy Metals TCLP PAHs
Imported VENM (other than sourced from a licensed quarry)	N/A	N/A	Minimum of 5 samples per material types/source site	Heavy Metals TRH/BTEX PAHs OCPs/PCBs Asbestos (500 mL)
Imported material the subject of a resource recovery exemption	N/A	N/A	As per exemption requirements, plus minimum of 5 samples per material type/source site	Heavy Metals TRH/BTEX PAHs Asbestos (500 mL) In addition to suite as required by exemption
Growing Media	N/A	N/A	Minimum 1/70 m^3 with a minimum of three samples per source/end location	Heavy Metals TRH/VOC PAHs OCP/PCB Asbestos (500 mL) pH, cation exchange capacity (CEC) and percentage clay
Excavation formed by removal of unexpected finds	1/25 m^2 (5 m grid), minimum one per excavation	1 sample per wall per media, with minimum spacing of one per 5 linear metres	N/A	Appropriate COPC (may include but not limited to Heavy Metals TRH/BTEX, PAHs OCPs/PCBs Asbestos (500 mL) + 10L AQ
Tankpit/Excavation Water	N/A	N/A	One per excavation/ pump out event, minimum of 1/10 000L	Heavy metals, TRH/BTEX low level PAHs EC and pH

Notes:

[1] In the event bulk excavation works are proposed for a basement or similar structure, assessment of the existing site characterisation data will be undertaken for the identified footprint. Additional sampling/analysis will be undertaken as appropriate to close any data gaps to enable a defensible waste classification for fill material to be removed during such works. Validation of VENM material will be completed as appropriate following removal of the fill material with the sampling density to be decided based on statistical principles once the extent of exposure is identified.

7.3 Soil Sampling Methodology

The soil sampling method shall be determined by the Remediation Consultant as consistent with the observations of the site sub-surface and appropriate to generate representative samples. The soil sampling method shall be consistent with the data quality indicators in **Section 7.2** and EPA made or endorsed guidelines.

7.3.1 Soil Sample Containers

During the collection of soil samples, features such as seepage, discolouration, staining, odours and other indications of contamination shall be noted on field reporting sheets/field logs.

Collected soil samples shall be immediately transferred to sample containers of appropriate composition (glass jars) fitted with Teflon sealed lids. 500 mL samples shall be additionally collected and placed in new zip lock bags where asbestos analysis is required. Sample labels shall record sample identification number and date and time of sampling. Sample containers shall be transferred to a chilled ice box for sample preservation prior to and during shipment to the testing laboratory. A chain-of-custody form shall be completed and forwarded with the samples to the testing laboratory, containing the following information:

- Sample identification;
- Signature of sampler;
- Date of collection;
- Type of sample;
- Number and type of container;
- Inclusive dates of possession; and
- Signature of receiver.

7.3.2 PID Screening

Soil samples will be screened during field works using a PID to assess the potential presence of VOCs including petroleum hydrocarbons. Samples obtained for PID screening will be placed in a sealed plastic bag for approximately 5 minutes to equilibrate, prior to a PID being attached to the bag. Readings will then be monitored for a period of approximately 30 seconds or until values stabilise and the stabilise/highest reading will be recorded on the field sample forms. The PID will be calibrated prior to the commencement of field works and then check readings will be completed on a daily basis during the field program using suitable calibration gas. If required, the PID will be re-calibrated during the field program in accordance with manufacturer's instructions.

7.4 Laboratory Analysis

NATA accredited laboratories shall be used for all analysis of samples. Appropriate methods and LORs are required for comparison to relevant criteria. Laboratory methods and LORs are presented in **Table 7.4** below.

Table 7.4: Soil Laboratory Analysis Methods (all units in mg/kg unless stated)

Analyte	Limit of Reporting	Laboratory Method
Metals		
Arsenic	4.0	ICP-AES (USEPA 200.7)

Analyte	Limit of Reporting	Laboratory Method
Cadmium	1.0	ICP-AES (USEPA 200.7)
Chromium (total)	1.0	ICP-AES (USEPA 200.7)
Chromium (VI)	1.0	Alkali leach colorimetric (APHA3500-Cr/USEAP3060A)
Copper	1.0	ICP-AES (USEPA 200.7)
Lead	1.0	ICP-AES (USEPA 200.7)
Nickel	1.0	ICP-AES (USEPA 200.7)
Zinc	1.0	ICP-AES (USEPA 200.7)
Mercury (inorganic)	0.1	Cold Vapour ASS (USEPA 7471A)
TRH		
$C_6 - C_9$ Fraction	25	Purge Trap-GCMS (USEPA8260)
$C_{10} - C_{36}$ Fraction	250	Purge Trap-GCFID (USEPA8000)
BTEX		
Benzene	1.0	Purge Trap-GCMS (USEPA8260)
Toluene	1.0	Purge Trap-GCMS (USEPA8260)
Ethylbenzene	1.0	Purge Trap-GCMS (USEPA8260)
Total Xylenes	3.0	Purge Trap-GCMS (USEPA8260)
PAHs		
Benzo(a)pyrene	0.05	GCMS (USEPA8270)
Total PAHs	1.55	GCMS (USEPA8270)
PCBs		
PCBs (total)	0.7	GCECD (USEPA8140,8080)
OCPs		
Aldrin + Dieldrin	0.2	GCECD (USEPA8140,8080)
Chlordane	0.1	GCECD (USEPA8140,8080)
DDT + DDD + DDE	0.3	GCECD (USEPA8140,8080)
Endosulfan	0.3	GCECD (USEPA8140,8080)
Endrin	0.1	GCECD (USEPA8140,8080)
Methoxychlor	0.1	GCECD (USEPA8140,8080)
Heptachlor	0.1	GCECD (USEPA8140,8080)
Phenols		
Total Phenols	5	Distillation-Colorimetric (APHA 5530)
VOCs		
PCE	1.0	Purge Trap-GCMS (USEPA8260)
TCE	1.0	Purge Trap-GCMS (USEPA8260)
Cis 1,2 DCE	1.0	Purge Trap-GCMS (USEPA8260)
Trans 1,2 DCE	1.0	Purge Trap-GCMS (USEPA8260)
VC	1.0	Purge Trap-GCMS (USEPA8260)
Other		
Asbestos (offsite disposal)	Presence/ 0.1 g/kg	PLM / Dispersion Staining as per AS4964:2004
Asbestos (site validation)	0.001% w/w	Gravimetric procedures
Soil pH	0.1	5:1 leach

7.5 Validation Criteria

Based on the proposed development details, in accordance with the decision process for assessment of urban redevelopment sites (EPA 2017), concentrations of contaminants in media shall be compared against adopted criteria as presented in **Tables 7.5** and **7.6**, sourced from the following:

- Health based Investigation Levels (HILs) for residential with access to soils land use NEPC (2013) - HIL-A;
- Health Screening Levels (HSLs) for petroleum hydrocarbons considering potential for vapour intrusion, coarse grained soil for low-high density residential (HSL A & B) land use at 0.0-1.0 m depth (NEPC 2013);
- Site derived ecological investigation levels (EILs) based on NEPC 2013 for Urban Residential and public open space and Commercial Industrial (NEPC 2013);
- Ecological Screening Levels (ESLs) for TRH fractions, BTEX and benzo(a)pyrene in coarse grained soil for residential land use (NEPC 2013);

- Management Limits for TRH, coarse grained soils for residential land use – NEPC (2013); and
- Where there are no NSW EPA endorsed thresholds the laboratory LOR has been adopted as an initial screening value for the purposes of this assessment.

Table 7.5 Health Based Soil Investigation Criteria and Hydrocarbon Management Limits (all units in mg/kg)

	Laboratory Method	Health Investigation/ Screening Levels	Management Limits[5]
		HIL-A	Urban Residential, Parkland and Public Open Space
Metals			
Arsenic	ICP-AES (USEPA 200.7)	100	-
Cadmium	ICP-AES (USEPA 200.7)	20	-
Chromium	ICP-AES (USEPA 200.7)	100[1]	-
Chromium (VI)	Alkali leach colorimetric (APHA3500-Cr/USEAP3060A)	100	-
Copper	ICP-AES (USEPA 200.7)	6 000	-
Nickel	ICP-AES (USEPA 200.7)	400	-
Lead	ICP-AES (USEPA 200.7)	300	-
Zinc	ICP-AES (USEPA 200.7)	7 400	-
Mercury (inorganic)	Cold Vapour ASS (USEPA 7471A)	40[2]	-
PAHs			
Carcinogenic PAHs (as B(a)P TEQ)[3]	GCMS (USEPA8270)	3	-
Total PAHs[4]	GCMS (USEPA8270)	300	-
BTEX			
Benzene	Purge Trap-GCMS (USEPA8260)	0.5[6]	-
Toluene	Purge Trap-GCMS (USEPA8260)	160[6]	-
Ethylbenzene	Purge Trap-GCMS (USEPA8260)	55[6]	-
Total Xylenes	Purge Trap-GCMS (USEPA8260)	40[6]	-
Naphthalene	Purge Trap-GCMS (USEPA8260)	3	-
TRH			
F1 C_6-C_{10}	TPH Purge Trap-GCMS (USEPA8260)	45[6,7]	700[5]
F2 >C_{10}-C_{16}	TPH Purge Trap-GCMS (USEPA8260)	110[6]	1 000[5]
F3 >C_{16}-C_{34}	Purge Trap-GCFID (USEPA8000)	-	2 500
F4 >C_{34}-C_{40}	Purge Trap-GCFID (USEPA8000)	-	10 000
OCPs			
DDT + DDD + DDE	GCECD (USEPA8140,8080)	240	-
Aldrin + Dieldrin	GCECD (USEPA8140,8080)	6	-
Chlordane	GCECD (USEPA8140,8080)	50	-
Endosulfan	GCECD (USEPA8140,8080)	270	-
Endrin	GCECD (USEPA8140,8080)	10	-
Heptachlor	GCECD (USEPA8140,8080)	6	-
HCB	GCECD (USEPA8140,8080)	10	-
Methoxychlor	GCECD (USEPA8140,8080)	300	-

	Laboratory Method	Health Investigation/ Screening Levels	Management Limits[5]
		HIL-A	Urban Residential, Parkland and Public Open Space
HERBICIDES/PESTICIDES			
2,4,5-T	GCECD (USEPA8140,8080)	600	-
2,4-D	GCECD (USEPA8140,8080)	900	-
MCPA	GCECD (USEPA8140,8080)	600	-
MCPB	GCECD (USEPA8140,8080)	600	-
Mecoprop	GCECD (USEPA8140,8080)	600	-
Picloram	GCECD (USEPA8140,8080)	4 500	-
Atrazine	GCECD (USEPA8140,8080)	320	-
Chlorpyrifos	GCECD (USEPA8140,8080)	160	-
Bifenthrin	GCECD (USEPA8140,8080)	600	-
PCBs			
Total PCBs	GCECD (USEPA8140,8080)	1	-
Phenols			
Phenol	GCECD (USEPA8140,8080)	3 000	-
VOCs			
PCE	Purge Trap-GCMS (USEPA8260)	1[8]	-
TCE	Purge Trap-GCMS (USEPA8260)	1[8]	-
Cis 1,2 DCE	Purge Trap-GCMS (USEPA8260)	1[8]	-
Trans 1,2 DCE	Purge Trap-GCMS (USEPA8260)	1[8]	-
VC	Purge Trap-GCMS (USEPA8260)	1[8]	-
OTHER			
Asbestos	PLM / Dispersion Staining	No visible asbestos and <0.001 %W/W for AF/FA and ACM 0.01 %W/W	-

Notes:

[1.] Guideline values presented are for Chromium (VI) in absence of total Chromium values. Where total Chromium results are elevated, samples will be analysed for Chromium (VI).

[2.] Guideline values are for inorganic mercury. Where elevated mercury concentrations are encountered and/or site information suggests the potential presence of elemental mercury and/or methyl mercury, consideration of applicability would be needed.

[3.] Carcinogenic PAHs calculated as per Benzo(a)pyrene Toxicity Equivalent Factor requirements presented in NEPC (2013)

[4.] Total PAHs calculated as per requirements presented in NEPC (2013).

[5.] Management Limits are based on coarse grained soil, with F1 and F2 concentrations inclusive of naphthalene and BTEX compounds.

[6.] Soil Health Screening Levels for Vapour Intrusion: Sand Soils. Values presented are those for 0 to <1 m bgl as the most conservative level. Reference should be made to results tables for further detail of levels at greater depths. NL: Non-limiting.

[7.] Values for F1 C6-C9 are obtained by subtracting BTEX (Sum) from laboratory result for C6-C9 TRH.

8. No EPA endorsed criteria, The LOR is proposed as a screening level in the absence of endorsed site specific criteria.

Table 7.6 Ecological Screening Levels and Soil Quality Guideline Values (all units in mg/kg)

	Laboratory Method	ESLs Urban Residential and public open space	EILs (Aged)[3] Urban Residential and public open space
Metals			
Arsenic	ICP-AES (USEPA 200.7)	-	100[2]
Cadmium	ICP-AES (USEPA 200.7)	-	-
Chromium	ICP-AES (USEPA 200.7)	-	333[2]
Chromium (VI)	Alkali leach colorimetric (APHA3500-Cr/USEAP3060A)	-	-
Copper	ICP-AES (USEPA 200.7)	-	248[2]
Nickel	ICP-AES (USEPA 200.7)	-	355[2]
Lead	ICP-AES (USEPA 200.7)	-	1100[2]
Zinc	ICP-AES (USEPA 200.7)	-	1082[2]
Mercury (inorganic)	Cold Vapour ASS (USEPA 7471A)	-	-
PAHs			
Benzo(a)pyrene	GCMS (USEPA8270)	0.7	-
Naphthalene	GCMS (USEPA8270)	-	170
BTEX			
Benzene	Purge Trap-GCMS (USEPA8260)	50	-
Toluene	Purge Trap-GCMS (USEPA8260)	85	-
Ethylbenzene	Purge Trap-GCMS (USEPA8260)	70	-
Total Xylenes	Purge Trap-GCMS (USEPA8260)	105	-
TRH			
F1 C_6-C_{10}	TPH Purge Trap-GCMS (USEPA8260)	180[1]	-
F2 >C_{10}-C_{16}	TPH Purge Trap-GCMS (USEPA8260)	120	-
F3 >C_{16}-C_{34}	Purge Trap-GCFID (USEPA8000)	300	-
F4 >C_{34}-C_{40}	Purge Trap-GCFID (USEPA8000)	2 800	-
OCPs			
DDT	GCECD (USEPA8140,8080)	-	180

Notes:

[1] Values for F1 C_6-C_9 are obtained by subtracting BTEX (Sum) from laboratory result for C_6-C_9 TRH.

[2] Site specific EILs calculated in EIS (2018).

7.5.1.1 Application of Soil Assessment Criteria

For soils to be considered as meeting the health/ecological based assessment criteria (i.e., not posing an unacceptable risk), the following criteria will be adopted:

Either:

- All contaminant concentrations were less than the adopted site assessment criteria,

Or:

- The upper 95 % confidence limit on the average concentration for each analyte (calculated for samples collected from consistent soil horizons, stratigraphy or material types) was below the adopted criterion;
- No single analyte concentration exceeded 250 % of the adopted criterion; and
- The standard deviation of the results was less than 5 0% of the criterion.

In addition to the numerical criteria, the following visual observations will also supplement the assessment process:

- No visible asbestos containing material in addition to laboratory analysis results; and
- Consideration was given to odorous or discoloured soils (caused by contamination).

7.5.2 Material Characterisation for Off-site Disposal

Materials shall be classified in accordance with EPA (2014a) Waste Classification Guidelines or an appropriate exemption as created under the *Protection of the Environment Operations (Waste) Regulation 2014*.

Material will require to be removed to a facility lawfully able to receive it.

7.5.3 Imported Materials

In accordance with current EPA policy, only material that does not represent an environmental or health risk at the receiving site may be considered for resource recovery. Imported materials will only be accepted to the site if they meet the restrictions placed on these materials and meet the definition of:

- Virgin Excavated Natural Material (VENM) as defined in the *Protection of the Environment Operations Act* (1997) Schedule 1;
- Excavated Natural Material (ENM) as defined in EPA (2014b); or
- Recycled materials as per an EPA exemption.

All material imported onto the site are required to be accompanied by appropriate documentation that has been verified by the appointed site contamination (environmental) consultant.

Sampling of materials as per an EPA exemption (recycled products) is required to be undertaken by the facility in accordance with the exemption. In addition, where materials are proposed to be imported to the site under a NSW EPA exemption the material will need to be further assessed by Remediation Consultant for land use suitability in accordance with the validation requirements nominated in **Section 7.2.6**.

7.6 Validation Reporting

At the completion of remediation works, a validation report will be prepared in general accordance with EPA (2020) *Contaminated Land Guidelines: Consultants Reporting on Contaminated Land*, documenting the works as completed.

This report will contain information including:

- Details of the remediation works conducted;
- Update relevant portions of the site description and CSM as relevant to the validation assessment footprint;
- Present all sampling field notes and laboratory data including calibration certificates for field monitoring equipment, environmental monitoring etc.;
- Undertake an assessment of QA/QC for analytical data generated by the works and identify data that is reliable for use in characterising site;
- Sort data into data sets as required by the decision rules;
- Assess whether sufficient data has been obtained to meet required limits on decision error;
- Undertake assessment to the decision rules and identify any environmental data which causes decision rules to be failed;
- Provide a summary of waste disposal activities and volumes of waste removed from the site including supply of all waste disposal dockets confirming final waste disposal/landfill destination;
- Provide a summary of material importation activities (general fill soil/crushed rock, growing media, earthworks aggregates, drainage backfill etc), including material source, type, assessment of suitability, approximate quantities, date of importation and final placement location;
- Document any variations to the strategy undertaken during the implementation of the remedial works;
- Results of all environmental monitoring undertaken during the course of the remedial works;
- Details of any environmental incidents occurring during the course of the remedial works and the actions undertaken in response to these incidents;
- Identify the requirements for the long term EMP (where appropriate) including inclusion of a survey clearly identifying the extent of the retained impacted material and associated capping;
- Provide a clear statement on the suitability of the site (or portions thereof) for the proposed use and requirements for any ongoing monitoring/management (where applicable).

The report will serve to document the remediation works for future reference.

7.7 Environmental Management Plan

In addition to the requirements of the validation plan, the proposed remediation strategy for the site will more than likely result in passive long term management requirements at the completion of the final development works.

To this end, a long term EMP will be prepared to detail the ongoing management and monitoring requirements applicable to the site. The precise nature and extent of the management requirements will not be known until remediation/management works are conducted and the validation data obtained. It is anticipated that the long term EMP will be prepared for the site following the completion of the validation report such that the requirements may be reviewed and endorsed by the appointed Site Auditor.

The long term EMP shall contain the following elements:

- A statement of the objectives of the EMP – i.e., to ensure continued suitability of the site after it has been remediated;
- Identification of residual environmental contamination issues at the site that require ongoing management/monitoring to meet the EMP objectives, including the type of contamination and location within the site (including survey plans);
- Documentation of environmental management measures which have been implemented to address the identified environmental issues at the site;
- Description of management controls to limit the exposure of the site users to known areas of contamination to acceptable levels;
- Description of responsibilities for implementing various elements of the provisions contained in the EMP;
- Timeframes for implementing the various control/monitoring, etc. elements outlined in the EMP;
- Environmental monitoring and reporting requirements (if required) for the future management of environmental impact underlying the site including:
    - Appropriate monitoring locations and depth within and down-gradient of any residual contamination;
    - Relevant assessment criteria to be used in evaluating monitoring results;
    - Frequency of monitoring and reporting;
    - Process for reviewing monitoring data and how decisions will be made regarding the ongoing management strategy;
    - The length of time for which monitoring is expected to continue;
    - The regulatory authorities involved and the management inputs required from each;
    - The integration of environmental management and monitoring measures for soil and groundwater;
    - Health and safety requirements for particular activities;
    - A program of review and audits;
    - The provisions in the EMP are feasible (i.e., able to be implemented) and able to be legally enforceable (i.e., a mechanism exists, such as development consent conditions, to give the plan a basis in law); and
    - The relevant consent authority is satisfied that the inclusion of a development consent condition relating to the implementation of the EMP is acceptable;
- Corrective action procedures to be implemented where EMP assessment criteria are breached.

It is anticipated that the long term EMP will be legally enforceable by way of condition of development consent relating to the proposed remediation/development works.

With regards to the area proposed to be dedicated as part of development works to the Waranara Early Education Centre, it is the intention that following demolition of the existing structure, the underlying soil in this area will be validated as suitable for the proposed childcare centre use. If impacts are identified, it is anticipated the material would be excavated and placed within the main site, with this section subsequently validated as suitable for the childcare centre use with no ongoing

management. On this basis, a long term EMP would only be required as a contingency if contamination at depth is encountered such that it is not practical to remove due to boundary conditions. In this event, negotiation would be required with CoS as the landowner to ensure application of an EMP suitable for ongoing management of this area.

8. Contingency Plan

A review of the proposed contamination-related aspects of the works associated with development the site has been undertaken and has identified a number of potential risks, outlined in the following sections that required the development of contingencies to ensure that the objectives of this RAP are met.

Additionally, the associated remedial works health and environmental risks/hazards and their minimisation/mitigation are further discussed in **Section 9**.

8.1 Unexpected Finds

It is acknowledged that previous investigations of the site have been undertaken to assess the identified contaminants of potential concern in selected parts of the site. However, ground conditions between sampling points may vary, and further hazards may arise from unexpected sources and/or in unexpected locations during remediation. The nature of any residual hazards which may be present and which may be discovered at the site are generally detectable through visual or olfactory means, for example:

- The presence of significant aggregates of friable asbestos materials (visible) as opposed to minor occurrences of fragments or fibre bundles in soil; and/or
- Excessive quantities of Construction/Demolition Waste (visible); and/or
- Hydrocarbon impacted materials (visible/odorous); and/or
- Drums, waste pits, former pipework or USTs (visible); and/or
- Tarry like impacted soil/fill material (visible/odorous); and/or
- Potential chlorinated hydrocarbon impact (sweet odour soils).

As a precautionary measure to ensure the protection of the workforce and surrounding community, should any of the abovementioned substances (or any other unexpected potentially hazardous substance) be identified, the procedure summarised in **Figure 8.1** is to be followed.

An enlarged version of the Unexpected Finds Protocol, suitable for use onsite, should be posted in the Site Office and referred to during the site-specific induction by the Principal Contractor/ Remediation Contractor.

The sampling strategy for each “unexpected find” shall be designed by a suitably qualified environmental consultant. The strategy will, however, be aimed at determining the nature of the substance – that is, is it hazardous and, if so, is it at concentrations which pose an unacceptable risk to human health or the environment.

The sampling frequency of the identified substance/materials shall meet the minimum requirements outlined in EPA (1995) in addition to those outlined in **Section 7**.

8.1.1 Change in Development Plans

In the event that the development plans are changed from those available at the time of preparation of this RAP, consideration of the suitability of the proposed remedial strategy will be required.

8.1.2 Identification of Additional Underground Storage Tanks

There is the potential that additional USTs may be encountered during demolition of the pavements or subsequent earthworks. In the event of such an occurrence, the Unexpected Finds Protocol as discussed below (**Figure 8.1**) will be implemented and remedial actions defined with consideration to the requirements for known USTs in EPA made or endorsed guidelines.

8.1.3 Identification of Oily or Tarry Materials

In the event that oily/tarry materials are encountered, the provisions outlined in the Unexpected Finds Protocol will be implemented, comprising inspection, testing and appropriate action as advised by the Field Scientist.

Any suspected oily/tarry materials must be segregated from other excavated materials and placed in a designated area with appropriate odour and sediment controls until such time as appropriate assessment is completed and a methodology is confirmed for their appropriate management. In the event that the oily/tarry materials do not meet the Site Acceptance Criteria, then they shall be stored in a secure area for later treatment or classified and removed from the site for treatment and/or disposal at an appropriately licensed facility.

8.1.4 Identification of Chlorinated Hydrocarbon Impact

In the event that chlorinated hydrocarbon impacted materials are encountered (potentially as a result of the identification of sweet odours in soils), the provisions outlined in the Unexpected Finds Protocol will be implemented, comprising inspection, testing and appropriate action as advised by the Field Scientist (**Section 8.1**).

Any suspected chlorinated hydrocarbon impacted materials must be segregated from other excavated materials and placed in a designated area with appropriate odour and sediment controls until such time as appropriate assessment is completed and a methodology is confirmed for their appropriate management. In the event that the materials do not meet the Site Acceptance Criteria, then they shall be stored in a secure area for later treatment or classified and removed from the site for treatment and/or disposal at an appropriately licensed facility.

8.1.5 Material Storage Breach

In the event that any materials storage containment controls are breached and stockpiled materials classified as asbestos contaminated soil or otherwise have escaped (or have the potential to escape), then the management controls shall be rectified and investigations undertaken to review the adequacy of the controls and any improvements implemented. The CEMP (**Section 9.1**) shall include a documented process for identifying and responding to such incidents.

8.1.6 Emissions Complaints

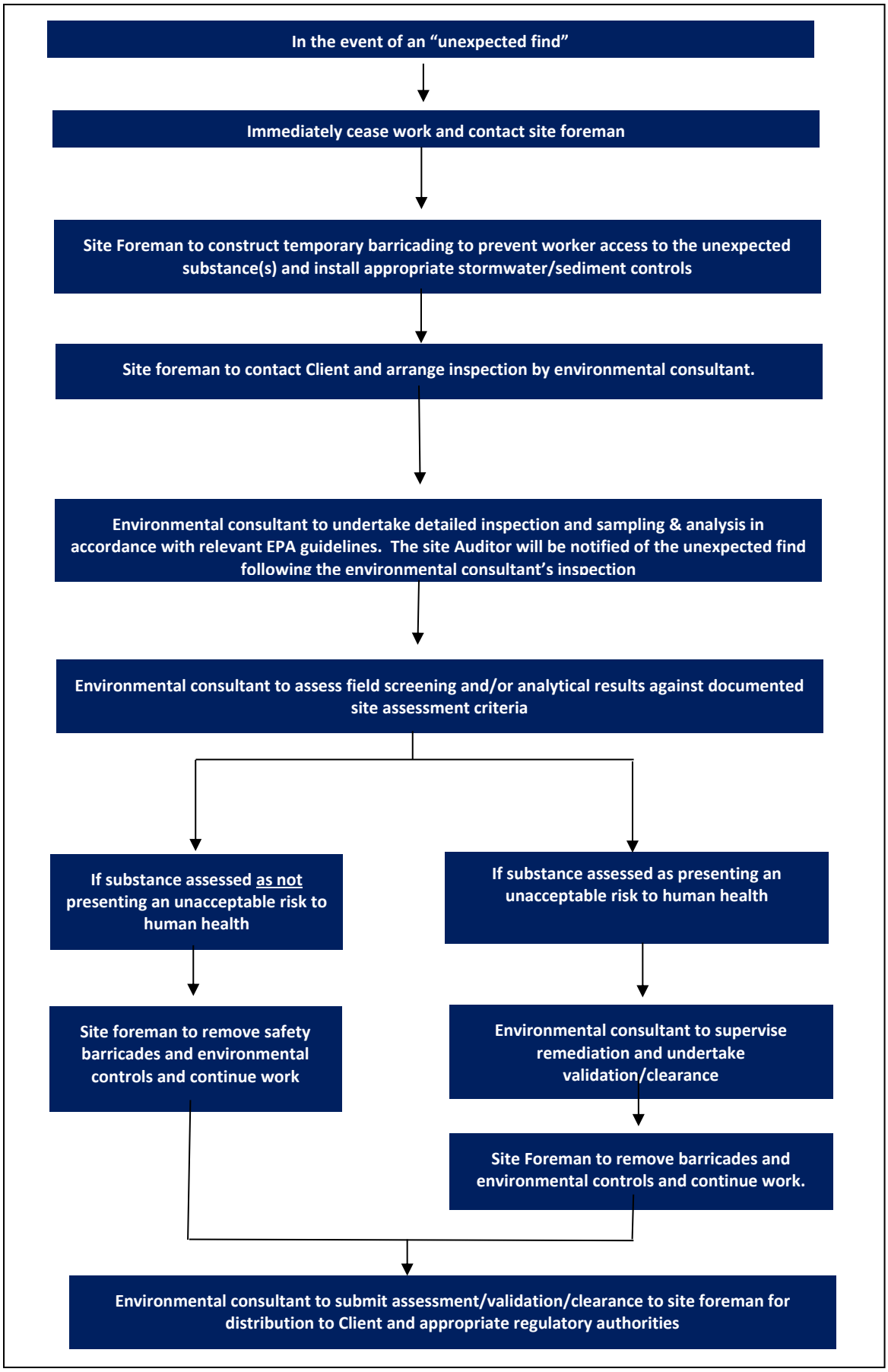
Due to the nature of the activities and type of contaminants identified at the site, there is a potential for complaints to be received from members of the public and/or occupants of surrounding properties relating to environmental emissions including:

- Odour emissions arising from handling of malodorous soil;
- Noise and vibration arising from excavation, piling and other works;
- Dust emissions arising from excavation, material handling and placement; and
- Visibly impacted water quality in surface water discharge from the site.

Monitoring of all environmental emissions shall be undertaken during the works as detailed in the CEMP (discussed in **Section 9.1**) and appropriate actions taken to further control emissions following receipt of a complaint. The CEMP shall contain provision for contingency actions where excessive emissions occur, however it is anticipated that one or more of the following actions will be considered:

- Increased application of odour screening/masking chemicals on odorous materials;
- Disturbance of soils during meteorologically favourable periods only; and/or
- Covering of impacted soils.

Figure 8.1 - Unexpected Finds Protocol



9. Other Remediation Documents

9.1 Environmental Management

9.1.1 Preparation of a Construction Environmental Management Plan

Prior to commencement of remediation works, a CEMP shall be prepared by the Principal Contractor/Remediation Contractor, which documents the environmental monitoring and management measures required to be implemented during the remediation and construction related activities associated with the construction of the site.

The CEMP shall address each of the nominated items in **Section 9.1.2** and shall include the Contingency Plan, referred to in **Section 8**, above. Additional environmental management requirements may be required as part of development consent.

9.1.2 Required Elements/Procedures

An assessment of the proposed activities and the associated elements required to be incorporated into the CEMP is provided in **Table 9.1**. The CEMP is required to address each of the required elements and procedures in full detail and to include detailed monitoring processes and procedures, corrective actions and reporting requirements.

Table 9.1 Required Elements of the CEMP

Element	Specific Minimum Requirements to be included in CEMP
1. Dust and Airborne Hazard Control	Dust and asbestos air monitoring. Provisions for dust control based on monitoring results.
2. Flora and Fauna	As appropriate.
3. Heritage/Archaeological	In accordance with relevant heritage/archaeological studies and associated permits.
4. Visual Impacts	Visual monitoring at site boundary Specific colour requirements for various controls/measures, including PPE (e.g., navy coveralls)
5. Emergency Response	As appropriate. Procedures required for spill incident response including material storage breach.
6. Noise Control	Hours of operation, consistent with the consent conditions. Boundary monitoring at commencement of work site activities with Procedures for control and management of noise emissions, as appropriate (e.g., restricted hours).
7. Traffic	Controls on vehicle movements on public roads. Controls on transport of tar impacted materials.
8. Protection of Adjoining Structures	As appropriate.
9. Odour Control	Management of all potential odour generating activities (i.e., excavation of petroleum hydrocarbon contaminated soils and treatment) with appropriate odour controls incorporating safeguards and monitoring. Daily monitoring of odour levels at site boundary during handling of malodorous materials. Procedures for addressing elevated odour monitoring results, including, but not limited to: reduction in earthworks activities within odorous material areas during adverse meteorological conditions; application of odour masking solutions at the odour source or between identified source(s) and receptor(s); review of biopile operation and covering identified potential odour sources by hydromulching or with less odorous materials.
10. Handling of Contaminated Soil and Groundwater	Soil and water management (stockpiling, site access, excavation pump out, reinstatement).
11. Soil Storage/Placement Areas	Soil and water management (stockpiling, site access, excavation pump out, reinstatement). Bunding. Heavy vehicle/personnel decontamination.

Element	Specific Minimum Requirements to be included in CEMP
	Interim storage requirements for materials requiring later treatment. Site drainage requirements, incorporating clean/dirty areas and modifications to existing surface water and drainage controls beneath retained pavements. Monitoring as required.
12. Sediment Control	Bunding. Collection/treatment/handling impacted sediments.
13. Operation of Site Office	As appropriate.
14. Decontamination of Heavy Equipment	As appropriate.
15. Environmental Monitoring	Monitoring of dusts, noise, odour and fibres. Monitoring as required for vibration and water releases. Inspection checklists and field forms.
16. Environmental Criteria	Soil and water criteria as presented in this RAP
17. Material Classification	As detailed in this RAP. Materials tracking, including QA/QC inspection and sampling.
18. Community Relations Plan	Specific communication protocols, incorporating nomination of specific contact persons & details and requirements for communications/response register.
19. Incident Reporting	As appropriate, including standard form/checklist.
20. Security and Signage	Secure site perimeter. Site boundary signage.
21. EMP Review	As appropriate.
22. Training	As appropriate.
23. Contact Details	Company/personnel details, including names/phone numbers for: - Principal Contractor/ Remediation Contractor - Site Auditor - Remediation Consultant - OH&S Compliance - Environmental Compliance
24. Stockpiling	All materials stockpiled onsite will be managed by the Remediation Contractor. Unique numbers will be provided for each stockpile, the source of the stockpile, its estimated volume, material characterisation and its location onsite (via GPS) will also be recorded in a Material Tracking Plan. The following procedures will be implemented by the Remediation Contractor: No stockpiles of soil or other materials shall be placed on footpaths or nature strips unless prior Council approval has been obtained; All stockpiles of soil or other materials shall be placed away from drainage lines gutters or stormwater pits or inlets; All stockpiles of soil or other materials likely to generate dust or odours shall be covered; All stockpiles of chemically contaminated soil shall be stored in a secure area and be covered if remaining more than 24 hours; and All stockpiles of asbestos contaminated soils shall be kept damp and covered to minimise potential fibre release, and if left for more than 24 hours, be stored in a secure area.

9.1.3 Certification

Prior to commencement of remediation works, the Remediation Contractor is required to have the CEMP endorsed as acceptable by the Environmental Consultant and Site Auditor appointed to validate the works.

A copy of the CEMP and the endorsement to the satisfaction of Environmental Consultant or Site Auditor are required to be provided by the Remediation Contractor prior to commencement of remediation works.

9.1.4 Hours of Site Operation/Duration of Works

Remediation works shall be completed in accordance with the permissible hours of work and noise as nominated in the Development Consent.

The appointed Remediation Contractor will be required to include a proposed schedule of remediation works within the CEMP submitted for endorsement as discussed above.

9.2 Health and Safety

9.2.1 Work Health and Safety Management Plan

A WHSP shall be prepared by the Remediation Contractor prior to commencement of remediation works. The Plan shall contain procedures and requirements that are to be implemented as a minimum during the works, in addition to the Contingency Plan, referred to in **Section 8**.

The objectives of the WHSP are:

- To apply standard procedures that minimises risks resulting from the works;
- To ensure all employees are provided with appropriate training, equipment and support to consistently perform their duties in a safe manner; and
- To have procedures to protect other site workers and the general public.

These objectives will be achieved by:

- Assignment of responsibilities;
- An evaluation of hazards;
- Establishment of personal protection standards, mandatory safety practices and procedures;
- Monitoring of potential hazards and implementation of corrective measures; and
- Provision for contingencies that may arise while operations are being conducted within the site.

9.2.2 Additional Site-Specific Elements/Procedures

In addition to the normal construction-related matters, the WHSP shall address the following site-specific specific hazards associated with the works relating to the management of contaminated soil and groundwater:

- Under/aboveground services, specifically potential petroleum infrastructure;
- Contact to asbestos contaminated soils, including friable asbestos;
- Contact with contaminated soil (heavy metals, TRH and PAHs), including requirements for specific Personal Protective Equipment (PPE); and
- Heat/cold stress.

9.2.3 Asbestos

During the remedial works, perimeter asbestos in air monitoring will be conducted at each applicable remedial works area boundary when soil with asbestos are being disturbed. Air monitoring will be conducted on a daily basis at relevant locations whilst disturbance of asbestos contaminated areas takes place.

Air monitoring will be conducted during any ground disturbance activities within impacted soil within the site to verify that implementation of appropriate control measures have been successful at managing the risk of air borne fibre generation. Air monitoring will be undertaken in accordance with the requirements of the National Occupational Health and Safety Commission (NOHSC)

Asbestos Code of Practice and Guidance Notes, in particular the *Guidance note for the estimation of airborne asbestos dust* [NOHSC 3002:2005].

9.2.4 Additional Consideration of Chemical Contaminants

In addition to general assessment of the potential for exposure to chemical contaminants the WHSP should also include specific consideration of additional contaminants such as lead and PAHs distributed throughout fill materials.

As a precautionary measure, the WHSP should include the requirement for the plan to be revised in the event of an unexpected find of contaminated material during remediation and/or construction.

When working with contaminated materials in general, care needs to be taken to ensure that the contamination is not introduced to the worker via ingestion, inhalation or absorption. The WHSP must detail the PPE and decontamination requirements to be followed to control the risks posed by potential exposure to chemical contaminants at the site.

10. Regulatory Approvals/Licensing

Environment Planning and Assessment Act 1979/SEPP 55

It is understood that proposed remediation works are considered to be classified as 'Category 1' Remediation Works – i.e., requiring consent due to heritage constraints present at the former RSSH site. It is understood that a development application will be submitted by the client relating to the proposed remediation works.

Environment Planning and Assessment Regulation 2000 – Schedule 3 Designated Development

It is not anticipated that the proposed remediation works will trigger the application of the regulation. However, in the event that soil is required to be pre-treated prior to off-site disposal, an assessment of potential triggers for the works to be designated development as presented in Schedule 3 – Clause 15 will be required to be completed.

Protection of the Environment Operations Act 1997

The proposed remediation/validation activities are not required to be licensed under the *Protection of the Environment Operation Act 1997*. The site is less than 3 ha in area and there is no requirement for the storage of over 30 000 m^3 of contaminated material, and hence the works do not trigger the licensing requirements or trigger application of the regulation.

Water Management Act 2000

Based on current ground levels it is anticipated that the remediation works will not require dewatering. Should the proposed works include construction of a basement, further evaluation of the potential need for temporary dewatering to facilitate construction will be required. In this event, an approval may be required from NSW Department of Primary Industry (DPI) – Water NSW.

Protection of the Environment Operations (Waste) Regulation 2014

The regulations make requirements relating to non-licensed waste activities and waste transporting. The proposed works on the site will not require to be licensed. Section 48 of the Reg. requires that wastes be stored in an environmentally safe manner. It is also stipulates that vehicles used to transport waste must be covered when loaded.

Provision is provided in the Regulation and EPA (2014a) guidelines for the NSW EPA to approve the immobilisation of contaminants in waste (if required with unexpected finds).

Waste Classification Guidelines (EPA 2014a)

All wastes generated and proposed to be disposed off-site shall be assessed, classified and managed in accordance with this guideline. Where wastes require immobilisation prior to off-site disposal (to reduce the waste classification) an immobilisation approval shall be sought in accordance with Part 2 of this guideline. Immobilisations are only anticipated to be required with unexpected finds.

Protection of the Environment Operations (Underground Petroleum Storage Systems UPSS) Regulation 2019

The removal of potential USTs and associated infrastructure will be undertaken in accordance with SafeWork NSW requirements and a validation report should be provided in accordance with the provisions of the *Protection of the Environment Operations (UPSS) Regulation 2019*. The removal of underground petroleum storage infrastructure should be undertaken in accordance with The *Removal and Disposal of Underground Petroleum Storage Tanks – Australian Standard 4976-2008*.

The validation process detailed in this RAP and the unexpected finds protocol meets the requirements of the regulation.

City of Sydney (2004) 'Contaminated Land Development Control Plan'

The Council DCP provides a number of environmental and site management provisions required to be employed during remediation works. These will require to be adopted as minimum standards for the environmental management of remediation works and requirements of on-going environmental management plans.

Development Application Requirements

In addition to the aforementioned regulatory and planning requirements, reference should be made to the development consent conditions requirements upon issue.

Green Square Town Centre Development Control Plan 2012 (as amended 2014)

The Green Square Town Centre Development Control Plan 2012 (as amended 2014) requires the following with respect to potential site contamination issues and associated remediation/management works:

- That the new development applies the principles of ESD;
- That impacts from development on the environment be reduced;
- That the use of resources in development and by development over its effective life are reduced; and
- The amount of construction and demolition waste, and waste generated in the operation of a development going to landfill is reduced.

A waste management plan detailing how waste is to be minimised during demolition and construction of a development and over its effective life is to be submitted with the DA as for each stage of works within the GSTC Development Site.

Evaluation of remedial options for the site includes consideration of the requirements noted above.

In addition, the proposed remedial strategy has been developed with consideration revised EPA made or endorsed guidelines.

Work Health and Safety Act 2011

The overarching Act for NSW setting law relating to employee health and safety and employer

responsibilities.

Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997

It is not expected that implementation of the works presented in this RAP would result in a 'Duty to Report' as defined in the guidelines. Consistent with the scope of works, no works will be permitted within the validation footprint that will potentially cause levels of site constituents to be present at points of exposure and/or the site boundary that will cause any NSW EPA published or endorsed criteria to be exceeded.

At the completion of the remediation works, obligations on 'Duty to Report' contamination should be determined with reference to the *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (EPA 2015).

11. Conclusions and Recommendations

11.1 Conclusions

Overall, it is considered that the proposed actions outlined in this RAP conform to the requirements of the *Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme (3rd Edition)* (EPA 2017) because they are: technically feasible; environmentally justifiable; and consistent with relevant laws policies and guidelines endorsed by NSW EPA.

Subject to the successful implementation of the measures described in this RAP and the recommendations below, it is concluded that the site can be made suitable for the intended uses and that the risks posed by contamination can be managed in such a way as to be adequately protective of human health and the environment.

11.2 Recommendations

It is recommended that the processes outlined in this RAP be implemented and that the following documentation be developed and implemented to ensure the risks and impacts during remediation works are controlled in an appropriate manner:

- A CEMP, to document the monitoring and management measures required to control the environmental impacts of the works and ensure the validation protocols are being addressed;
- A WHSP to document the procedures to be followed to manage the risks posed to the health of the remediation workforce;
- An MTP addressing documentation of material characteristics and tracking (quantity, movement and locations); and
- An AMP to document environmental, health and safety management requirements for the handling of asbestos impacted materials.

12. Limitations

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

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

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

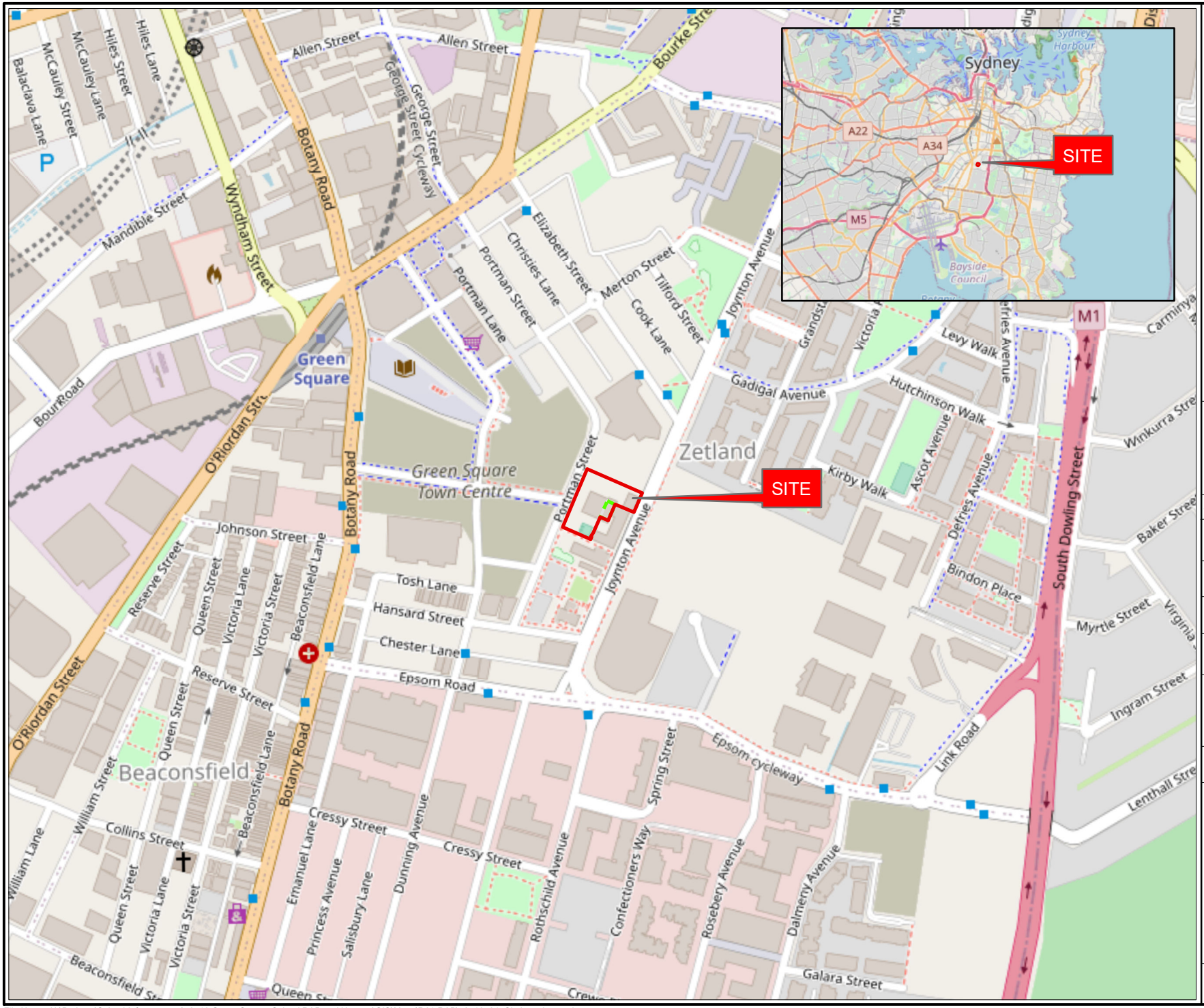
Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the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

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

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

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

Figures



Legend:

- Approximate Site Boundary
- Approximate Childcare Centre Playground Boundary

JBS&G

Job No: 58719

Client: NSW Department of Education (Schools Infrastructure)

Version: R01 Rev A	Date 21/05/2020
Drawn By: RH	Checked By: JR

Scale 1:7,000

0 90 180

metres

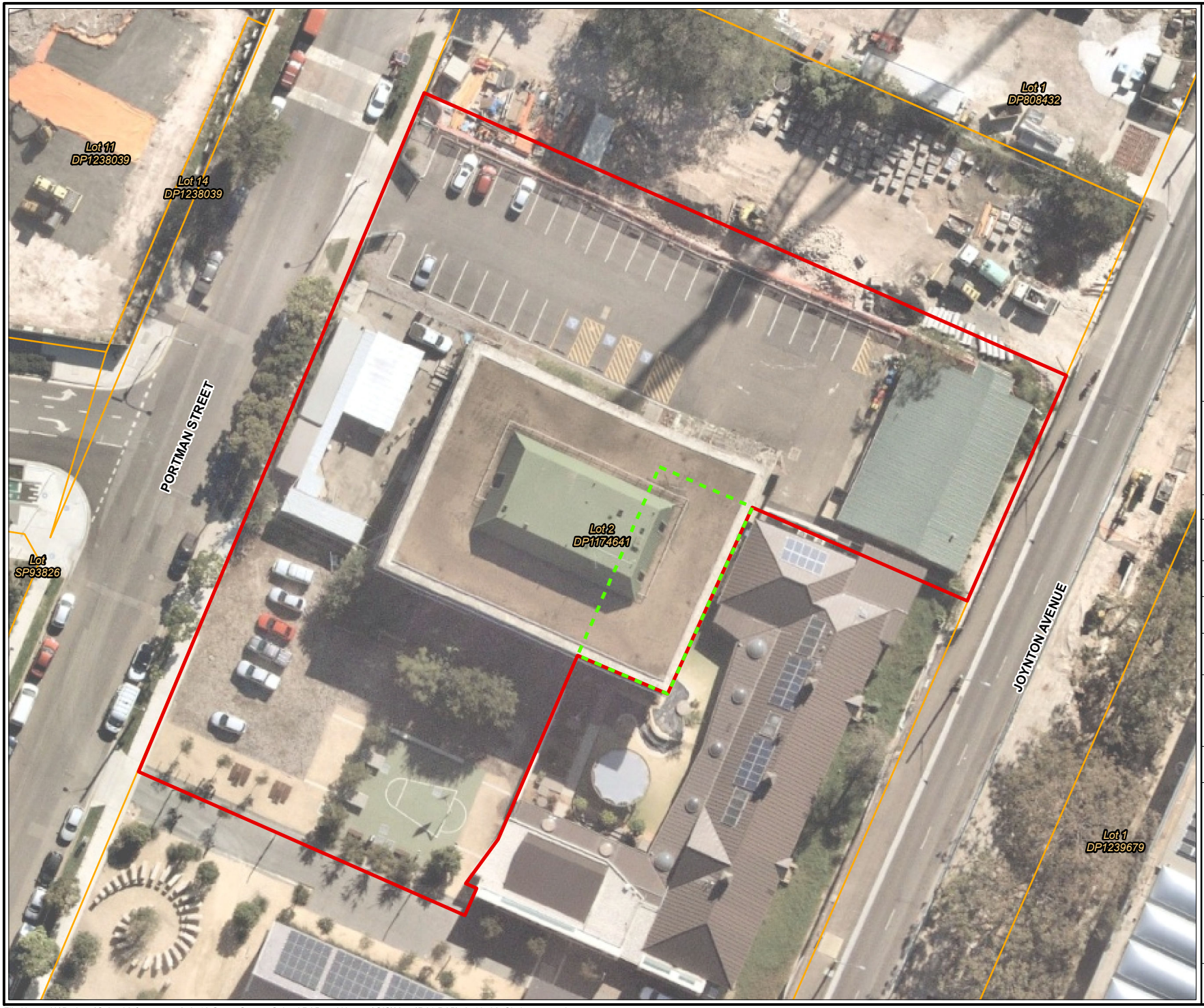
Coord. Sys. GDA 1994 MGA Zone 56

3 Joynton Avenue, Zetland, NSW

SITE LOCATION

FIGURE 1

File Name: N:\Projects\School Infrastructure\58719 Green Square School RAP and Hazmat\GIS\Maps\R01 RAP\58719_01_SiteLocation.mxd



Legend:

- Approximate Site Boundary
- Proposed Childcare Centre Playground Boundary
- Cadastre (NSW LPI, 2020)

JBS&G

Job No: 58719

Client: NSW Department of Education (Schools Infrastructure)

Version: R01 Rev A	Date 21/05/2020
Drawn By: RH	Checked By: JR

Scale 1:600

0 8 16

metres

Coord. Sys. GDA 1994 MGA Zone 56

3 Joynton Avenue, Zetland, NSW

CURRENT SITE LAYOUT

FIGURE 2

File Name: N:\Projects\School Infrastructure\58719 Green Square School RAP and Hazmat\GIS\Maps\R01 RAP\58719_02_SiteLayout.mxd
Reference: Nearmap (www.nearmap.com.au) 18-04-2020

Legend:

- Approximate Site Boundary
- Approximate Childcare Centre Playground Boundary

JBS&G

Job No: 58719	
Client: NSW Department of Education (Schools Infrastructure)	
Version: R01 Rev A	Date 1/06/2020
Drawn By: RH	Checked By: SG
Scale 1:600	

0 8 16
metres

Coord. Sys. GDA 1994 MGA Zone 56

3 Joynton Avenue, Zetland, NSW

PROPOSED DEVELOPMENT PLAN

FIGURE 3

File Name: \\JBSG-NSW-FS01\Company Data\Projects\School Infrastructure\58719 Green Square School RAP and Hazmat\06 GIS\Maps\R01 RAP\58719_03_ProposedDevelopmentPlan.mxd
Reference: Nearmap (www.nearmap.com.au) 18-04-2020

Legend:

- Approximate Site Boundary
- Approximate Childcare Centre Playground Boundary
- Site Features
- Cadastre (NSW LPI, 2020)

Historical Sample Locations

- DP 1998
- GA 2000
- DP 2007
- JBS 2012
- EIS 2014
- AECOM 2018
- EIS 2018
- JBS&G 2018

Cross Section (A-A1) (See Fig 6)

JBS&G

Job No: 58719

Client: NSW Department of Education (Schools Infrastructure)

Version: R01 Rev A	Date 18/06/2020
Drawn By: RH	Checked By: SG

Scale 1:600

0 8 16

metres

Coord. Sys. GDA 1994 MGA Zone 56

3 Joynton Avenue, Zetland, NSW

HISTORICAL SAMPLE LOCATIONS

FIGURE 4

File Name: N:\Projects\School Infrastructure\58719 Green Square School RAP and Hazmat\06 GIS\Maps\R01 RAP\58719_04_HistoricalSampleLoc.mxd
Reference: Nearmap (www.nearmap.com.au) 18-04-2020

Legend:

- Approximate Site Boundary
- Approximate Childcare Centre Playground Boundary
- Site Features
- Cadastre (NSW LPI, 2020)

Historical Sample Locations

- DP 1998
- GA 2000
- DP 2007
- JBS 2012
- EIS 2014
- AECOM 2018
- EIS 2018
- JBS&G 2018

JBS&G

Job No: 58719

Client: NSW Department of Education (Schools Infrastructure)

Version: R01 Rev A	Date 18/06/2020
Drawn By: RH/AS	Checked By: SG

Scale 1:600

0 8 16
metres

Coord. Sys. GDA 1994 MGA Zone 56

3 Joynton Avenue, Zetland, NSW

SOIL CRITERIA EXCEEDANCES (HUMAN HEALTH)

FIGURE 5A

File Name: N:\Projects\School Infrastructure\58719 Green Square School RAP and Hazmat\06 GIS\Maps\R01 RAP\58719_05A_SoilExceedances_Human.mxd
Reference: Nearmap (www.nearmap.com.au) 18-04-2020

BH5 (EIS 2018)	Depth (m)	Concentration (mg/kg)	Criteria
Analyte			
B(a)P	1.5-1.95	3.7	ESL

BH6 (EIS 2018)	Depth (m)	Concentration (mg/kg)	Criteria
Analyte			
B(a)P	0.5-0.65	11	ESL

BH36 (JBS 2012)	Depth (m)	Concentration (mg/kg)	Criteria
Analyte			
B(a)P	0.9-1.0	1.8	ESL
TPH C15-C28		820	

BH32 (JBS 2012)	Depth (m)	Concentration (mg/kg)	Criteria
Analyte			
B(a)P	0.0-0.1	1.2	ESL
TPH C10-C14		1800	
TPH C15-C28		8100	
B(a)P	0.5-0.8	4.1	
TPH C15-C28		420	

BH28 (DP 2007)	Depth (m)	Concentration (mg/kg)	Criteria
Analyte			
B(a)P	0.1-0.2	1.2	ESL

BH9 (EIS 2018)	Depth (m)	Concentration (mg/kg)	Criteria
Analyte			
B(a)P	1.5-1.95	2.5	ESL

BH34 (JBS 2012)	Depth (m)	Concentration (mg/kg)	Criteria
Analyte			
B(a)P	0.3-0.4	1.5	ESL

BH4 (EIS 2018)	Depth (m)	Concentration (mg/kg)	Criteria
Analyte			
B(a)P	0.5-0.95	0.89	ESL

BH20 (DP 2007)	Depth (m)	Concentration (mg/kg)	Criteria
Analyte			
Lead	0.4-0.5	1300	EIL

BH31(JBS 2012)	Depth (m)	Concentration (mg/kg)	Criteria
Analyte			
B(a)P	0.0-0.1	1.7	ESL

BH17A (JBS 2012)	Depth (m)	Concentration (mg/kg)	Criteria
Analyte			
B(a)P	0.1-0.2	1.2	ESL
B(a)P	2.0-2.1	3.2	

BH17 (DP 2007)	Depth (m)	Concentration (mg/kg)	Criteria
Analyte			
B(a)P	0.1-0.2	14	ESL

BH40 (JBS 2012)	Depth (m)	Concentration (mg/kg)	Criteria
Analyte			
B(a)P	0.9-1.0	1.3	ESL

Legend:

- Approximate Site Boundary
- Approximate Childcare Centre Playground Boundary
- Site Features
- Cadastre (NSW LPI, 2020)
- DP 1998
- GA 2000
- DP 2007
- JBS 2012
- EIS 2014
- AECOM 2018
- EIS 2018
- JBS&G 2018

JBS&G

Job No: 58719

Client: NSW Department of Education (Schools Infrastructure)

Version: R01 Rev A | Date 18/06/2020

Drawn By: RH/AS | Checked By: SG

Scale 1:600

0 8 16

metres

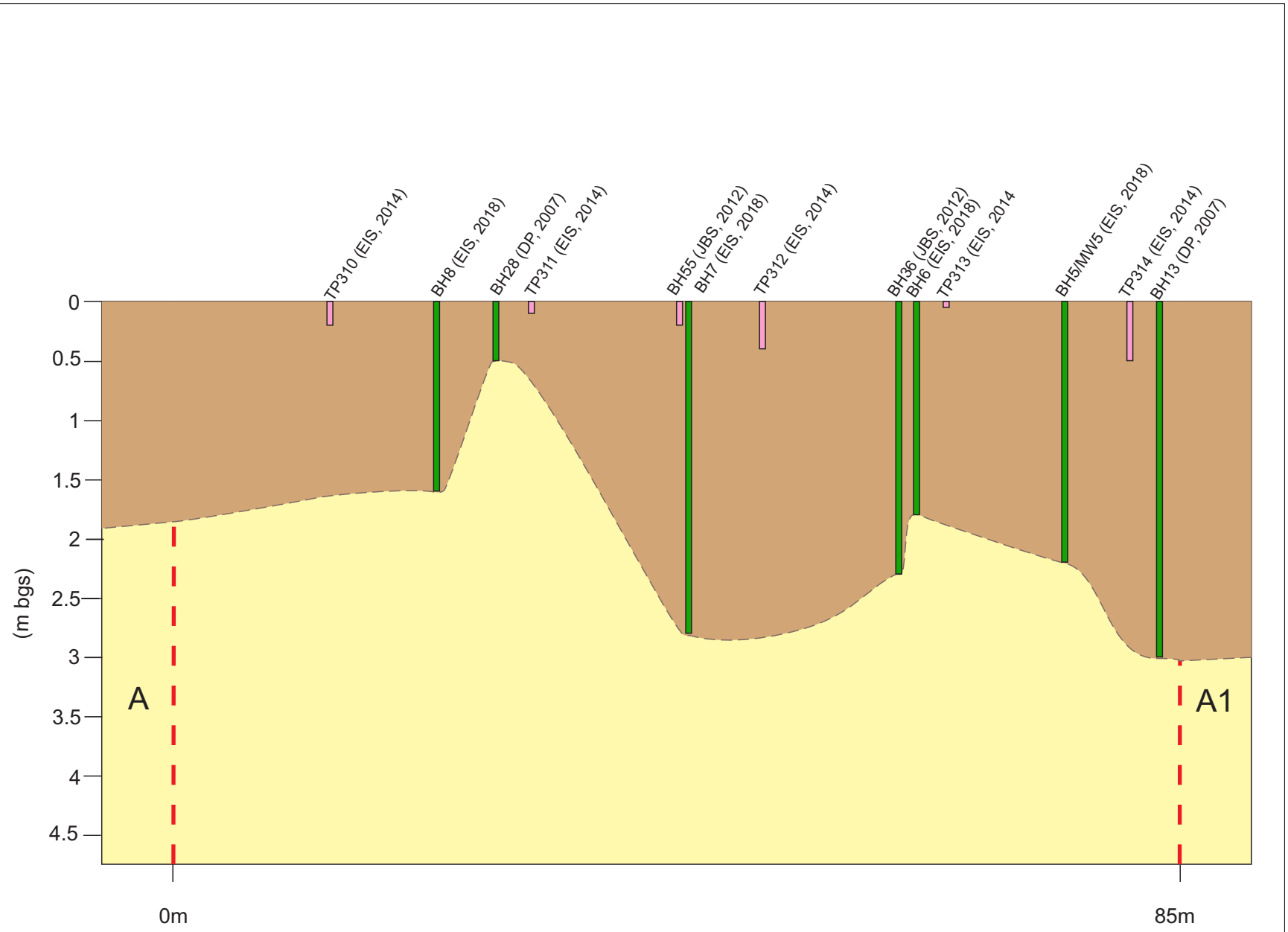
Coord. Sys. GDA 1994 MGA Zone 56

3 Joynton Avenue, Zetland, NSW

SOIL CRITERIA EXCEEDANCES (ECOLOGICAL)

FIGURE 5B

File Name: N:\Projects\School Infrastructure\58719 Green Square School RAP and Hazmat\06 GIS\Maps\R01 RAP\58719_05B_SoilExceedances_Ecological.mxd
Reference: Nearmap (www.nearmap.com.au) 18-04-2020



Legend:

- Fill
- Natural Sand

Borehole Key:

- Borehole Depth to Natural Sand
- Borehole terminated in fill

JBS&G

Job No: 58719

Client: NSW Department of Education (Schools Infrastructure)

Version: R01 Rev A	Date: 02/06/2020
Drawn By: RH	Checked By: SG

Scale Approximate

0 5 10
metres

Coord. Sys. GDA 1994 MGA Zone 56

3 Joynton Avenue, Zetland, NSW

INFERRED FILL DEPTH CROSS SECTION A-A1

FIGURE 6

File Name: 50648_01
Reference: http://maps.six.nsw.gov.au/

Appendix A Summary Tables

Table A: Historical Soil Analytical Data
Project Number: 58719
Project Name: Green Square School RAP

					BTEX				Metals									Organochlorine Pesticides							Organophosphorous Pesticides
					Benzene	Ethylbenzene	Toluene	Xylene Total	Lead	Arsenic	Cadmium	Chromium (III+VI)	Copper	Mercury	Nickel	Zinc	HCB	Indosulfan	Methoxychlor	Aldrin & Dieldrin	Chlordane	DDT, DDD & DDE	Heptachlor	Chlorpyrifos
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					0.2	1	0.5		1	4	0.5	1	1	0.1	1	1								0.1
NEPC 2013 ESL Urban Residential and Public Open Space, Coarse Soil					50	70	85	105	1100															
NEPC 2013 EIL, ElLs Aged Sediment - Site Specific Criteria										100		333	248		355	1082						180		
NEPC 2013 Soil HIL A									300	100	20	100	6000	40	400	7400	10	270	300	6	50	240	6	160
NEPC 2013 Soil HSL A and B for Vapour Intrusion - Sand 0 to <1m					0.5	55	160	40																
Sample Location	Date	Depth (m)	Investigation																					
HA1	5/07/2000	1.3-1.5	GA 2000		-	-	-	-	<0.5	<0.5	<0.1	0.70	<0.5	<0.05	<0.5	2	-	-	-	-	-	-	-	-
HA1a	12/07/2000	0.3-0.5	GA 2000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA1b	12/07/2000	0.2-0.4	GA 2000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA6	5/07/2000	0.4-0.6	GA 2000		-	-	-	-	1.20	<0	<0.1	<0.5	1.20	<0.05	<0.5	2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-
HA12	20/07/2000	0.1-0.2	GA 2000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HA13	20/07/2000	0.2-0.4	GA 2000		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH13	28/02/2007	0.2-0.3	DP 2007		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH13	28/02/2007	0.5-0.6	DP 2007		<1	<1	<1	<3	23	<4	<1	8.2	42.0	<0.1	14.0	41	-	-	-	-	-	-	-	-
BH13	28/02/2007	1.9-2.0	DP 2007		<1	<1	<1	<3	13	<4	<1	2.0	8.1	<0.1	3.7	20	-	-	-	-	-	-	-	-
BH16	28/02/2007	0.1-0.2	DP 2007		<1	<1	<1	<3	46	<4	<1	6	43	0.13	4.8	96	-	-	-	-	-	-	-	-
BH17	28/02/2007	0.1-0.2	DP 2007		<1	<1	<1	<3	62	<4	<1	5.5	35	0.13	4	140	-	-	-	-	-	-	-	-
BH17	28/02/2007	1.9-2.0	DP 2007		<1	<1	<1	<3	110	<4	<1	6.7	48	0.16	5.4	69	-	-	-	-	-	-	-	-
BH18	28/02/2007	0.1-0.2	DP 2007		-	-	-	-	7.1	<4	<1	75	55	<0.1	98	54	-	-	-	-	-	-	-	-
BH18	28/02/2007	0.9-1.0	DP 2007		-	-	-	-	41	<4	<1	6	20	<0.1	9.7	100	-	-	-	-	-	-	-	-
BH20	28/02/2007	0.1-0.2	DP 2007		<1	<1	<1	<3	130	4.8	<1	26	90	0.22	36	180	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-
BH20	28/02/2007	0.4-0.5	DP 2007		<1	<1	<1	<3	1300	<4	<1	6.2	13	<0.1	2.9	140	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-
BH20	28/02/2007	1.9-2.0	DP 2007		<1	<1	<1	<3	1.4	<4	<1	<1	<1	<0.1	<1	<1	-	-	-	-	-	-	-	-
BH28	1/03/2007	0.1-0.2	DP 2007		<1	<1	<1	<3	180	6.3	<1	7.7	110	0.41	8.3	430	-	-	-	-	-	-	-	-
BH29	1/03/2007	0.1-0.2	DP 2007		<1	<1	<1	<3	7.9	<4	<1	77	44	<0.1	95	56	-	-	-	-	-	-	-	-
BH17A	17/07/2012	0.1-0.2	JBS 2012		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH17A	17/07/2012	2-2.1	JBS 2012		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH17A	17/07/2012	3-3.1	JBS 2012		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH17A-E	17/07/2012	0.1-0.2	JBS 2012		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH17A-N	17/07/2012	0.1-0.2	JBS 2012		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH17A-S	17/07/2012	0.1-0.2	JBS 2012		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH17A-W	17/07/2012	0.1-0.2	JBS 2012		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH20A	10/07/2012	0.7-0.8	JBS 2012		-	-	-	-	380	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH20A-S	10/07/2012	-	JBS 2012		-	-	-	-	110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH20A-W	10/07/2012	-	JBS 2012		-	-	-	-	180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH31	16/07/2012	0-0.1	JBS 2012		-	-	-	-	310	9	<0.5	11	180	0.4	13	170	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH32	16/07/2012	0-0.1	JBS 2012		<0.2	<1	<0.5	<3	31	<4	<0.5	34	55	<0.1	45	120	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH32	16/07/2012	0.5-0.8	JBS 2012		<0.2	<1	<0.5	<3	990	5	1.3	10	120	0.5	11	200	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH33	17/07/2012	0.1-0.2	JBS 2012		<0.2	<1	<0.5	<3	64	<4	<0.5	7	62	0.1	7	99	-	-	-	-	-	-	-	-
BH34	17/07/2012	0.3-0.4	JBS 2012		<0.2	<1	<0.5	<3	66	<4	<0.5	4	15	<0.1	3	73	-	-	-	-	-	-	-	-
BH34	17/07/2012	1.5-1.6	JBS 2012		<0.2	<1	<0.5	<3	3	<4	<0.5	4	<1	<0.1	1	4	-	-	-	-	-	-	-	-
BH35	10/07/2012	1.9-2	JBS 2012		<0.2	<1	<0.5	<3	1	<4	<0.5	4	<1	<0.1	<1	9	-	-	-	-	-	-	-	-
BH36	10/07/2012	0.9-1	JBS 2012		<0.2	<1	<0.5	<3	29	<4	<0.5	5	20	0.1	5	60	-	-	-	-	-	-	-	-
BH37	10/07/2012	0-0.1	JBS 2012		-	-	-	-	17	<4	<0.5	3	46	<0.1	2	30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-
BH38	10/07/2012	0-0.1	JBS 2012		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH40	10/07/2012	0-0.1	JBS 2012		<0.2	<1	<0.5	<3	5	9	<0.5	18	21	<0.1	3	48	-	-	-	-	-	-	-	-
BH40	10/07/2012	0.9-1	JBS 2012		<0.2	<1	<0.5	<3	8	<4	<0.5	4	2	<0.1	2	14	<0.1	<0.1	<0.1	<0.1	0.50	<0.1	<0.1	<0.1
BH55	17/07/2012	0.1-0.2	JBS 2012		<0.2	<1	<0.5	<3	10	<4	<0.5	<1	11	<0.1	<1	16	<0.1	<0.1	<0.1	<0.1	0.50	<0.1	<0.1	<0.1
TP308	19/11/2014	0-0.3	EIS 2014		-	-	-	-	51	<4	<0.4	10	37	<0.1	10	83	-	-	-	-	-	-	-	-
TP309	19/11/2014	0-0.3	EIS 2014		-	-	-	-	47	<4	<0.4	14	55	<0.1	15	83	-	-	-	-	-	-	-	-
TP310	19/11/2014	0-0.2	EIS 2014		-	-	-	-	33	<4	<0.4	13	22	<0.1	19	79	-	-	-	-	-	-	-	-
TP310	19/11/2014	0.2-0.5	EIS 2014		-	-	-	-	4	<4	<0.4	<1	4	<0.1	<1	23	-	-	-	-	-	-	-	-
TP311	19/11/2014	0-0.1	EIS 2014		-	-	-	-	84	<4	<0.4	9	17	<0.1	4	150	-	-	-	-	-	-	-	-
TP312	19/11/2014	0-0.3	EIS 2014		-	-	-	-	48	6	<0.4	5	27	<0.1	3	96	-	-	-	-	-	-	-	-
TP313	19/11/2014	0-0.05	EIS 2014		-	-	-	-	62	4	<0.4	10	20	<0.1	5	93	-	-	-	-	-	-	-	-
TP314	19/11/2014	0-0.3	EIS 2014		-	-	-	-	78	<4	<0.4	8	13	<0.1	3	81	-	-	-	-	-	-	-	-
TP314	19/11/2014	0.3-0.5	EIS 2014		-	-	-	-	1	6	<0.4	2	<1	<0.1	<1	3	-	-	-	-	-	-	-	-
TP315	19/11/2014	0-0.3	EIS 2014		-	-	-	-	63	<4	<0.4	9	16	<0.1	5	88	-	-	-	-	-	-	-	-
TP315	19/11/2014	0.3-0.5	EIS 2014		-	-	-	-	34	5	<0.4	5	11	<0.1	3	49	-	-	-	-	-	-	-	-
TP316	19/11/2014	0-0.3	EIS 2014		-	-	-	-	66	5	<0.4	12	16	<0.1	4	75	-	-	-	-	-	-	-	-
TP316	19/11/2014	0.3-0.5	EIS 2014		-	-	-	-	43	7	<0.4	5	11	<0.1	2	48	-	-	-	-	-	-	-	-
SS2	19/11/2014	Fibre cement fragment	EIS 2014		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH1	29/01/2018	0-0.3	EIS 2018		<0.2	<1	<0.5	<1	75	<4	<0.4	17	75	0.2	16	120	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH2	29/01/2018	0.5-0.95	EIS 2018		<0.2	<1	<0.5	<1	29	<4	<0.4	6	15	<0.1	3	52	-	-	-	-	-	-	-	-
BH2	29/01/2018	1.0-1.2	EIS 2018		<0.2	<1	<0.5	<1	66	5	<0.4	10	34	0.2	15	120	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH3	29/01/2018	0-0.2	EIS 2018		<0.2	<1	<0.5	2.00	190	<4	<0.4	24	58	<0.1	23	88	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH4	29/01/2018	0-0.2	EIS 2018		<0.2	<1	<0.5	<1	49	<4	<0.4	5	34	<0.1	5	81	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH4	29/01/2018	0.5-0.95	EIS 2018		<0.2	<1	<0.5	<1	360	<4	0.8	7	58	0.2	7	490	-	-	-	-	-	-	-	-
BH5	29/01/2018	0-0.3	EIS 2018		<0.2	<1	<0.5	<1	84	<4	<0.4	8	21	<0.1	4	130	-	-	-	-	-	-	-	-
BH5	29/01/2018	0.5-0.8	EIS 2018		<0.2	<1	<0.5	<1	22	5	<0.4	4	13	<0.1	2	45	<0.1	<0.1	<0.1	<0.1	0.20	<0.1	<0.1	<0.1
BH5	29/01/2018	1.5-1.95	EIS 2018		<0.2	<1	<0.5	<1	420	<4	<0.4	9	93	0.8	7	570	-	-	-	-	-	-	-	-
BH5	29/01/2018	3.3-3.45	EIS 2018		-	-	-	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH6	29/01/2018	0-0.1	EIS 2018		<0.2	<1	<0.5	<1	13	<4	<0.4	1	210	<0.1	4	42	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH6	29/01/2018	0.5-0.65	EIS 2018		<0.2	<1	<0.5	<1	75	5	<0.4	5	46	0.1	3	71	<0.1	<0.1	<0.1	0.20	0.20	<0.1	<0.1	<0.1
BH7	30/01/2018	0-0.2	EIS 2018		<0.2	<1	<0.5	<1	13	<4	<0.4	3	140	<0.1	6	44	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH7	30/01/2018	0.5-0.95	EIS 2018		<0.2	<1	<0.5	<1	71	<4	<0.4	5	21	0.2	3	92	<0.1	<0.1	<0.1	<0.1	0.10	<0.1	<0.1	<0.1
BH7	30/01/2018	1.8-2	EIS 2018		<0.2	<1	<0.5	<1	21	<4	<0.4	6	9	<0.1	3	26	-	-	-	-	-	-	-	-
BH8	30/01/2018	0-0.2	EIS 2018		<0.2	<1	<0.5	<1	51	<4	<0.4	6	34	<0.1	4	75	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH8	30/01/2018	0.5-0.95	EIS 2018		<0.2	<1	<0.5	<1	59	<4	<0.4	3	34	0.2	3	84	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH9	30/01/2018	0-0.2	EIS 2018		<0.2	<1	<0.5	<1	14	<4	<0.4	6	120	<0.1	6	46	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH9	30/01/2018	0.5-0.95	EIS 2018		<0.2	<1	<0.5	<1	5	11	<0.4	6	8	<0.1	1	10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
BH9	30/01/2018	1.5-1.95	EIS 2018		<0.2	<1	<0.5	<1	29	<4	<0.4	3	14	<0.1	2	800	-	-	-	-	-	-	-	-
BH9	30/01/2018	3-3.45	EIS 2018		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X1	30/01/2018	stockpile sample	EIS 2018		<0.2	<1	<0.5	<1	3	<4	<0.4	1	3	<0.1	<1	7	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
X2	30/01/2018	stockpile sample	EIS 2018		<0.2	<1	<0.5	<1	62	<4	<0.4	6	31	0.2	4	91	<0.1	<0.1	<0.1	0.10	<0.1	<0.1	<0.1	<0.1
X3	30/01/2018	stockpile sample	EIS 2018		<0.2	<1	<0.5	<1	170	<4	<0.4	7	29	0.1	3	110	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Y1	30/01/2018	stockpile sample	EIS 2018		<0.2	<1	<0.5	<1	35	<4	<0.4	6	37	<0.1	4	53	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
JF1	30/01/2018	Fibre cement fragment	EIS 2018		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V34	16/01/2017		JBS&G 2018		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V35	16/01/2017		JBS&G 2018		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
V36	16/01/2017		JBS&G 2018		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CPTP_E_1.4_180620	20/06/2018	1.4	AECOM 2018		<0.2	<0.5	<0.5	<0.5	57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CPTP_N_1.2_180620	20/06/2018	1.2	AECOM 2018		<0.2	<0.5	<0.5	<0.5	122	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CPTP_N_2.5_180620	20/06/2018	2.5	AECOM 2018		<0.2	<0.5	<0.5	<0.5	144	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CPTP_W_1.2_180620	20/06/2018	1.2	AECOM 2018		<0.2	<0.5	<0.5	<0.5	49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CPTP_W_2.5_180620	20/06/2018	2.5	AECOM 2018		<0.2	<0.5	<0.5	<0.5	308	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UST_1.9_180622	20/06/2018	1.9	AECOM 2018		<0.2	<0.5	<0.5	<0.5	66	<5	<1	2	30	<0.1	3	35	-	-	-	-	-	-	-	-

EILs: site specific criteria derived in EIS 2018 using average physical parameters calculated for the site pH 9, CEC 26 cmol/kg, 3% clay

Table A: Historical Soil Analytical Data
Project Number: 58719
Project Name: Green Square School RAP

				PAH																		PCBs	TPH (NEPC 1999)					TRH (NEPC 2013)				Phenol	Asbestos
				Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b,j+k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	PAHs (Sum of Total)	Carcinogenic PAHs	PCBs (Total)	C6 - C9	C10 - C14	C15 - C28	C29-C36	+C10 - C36 (Sum of total)	(C6-C10 (F1)	>C10-C16 (F2)	>C16-C34 Fraction	>C34-C40 Fraction	Phenol	Asbestos
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.1	0.1	0.1	0.1	0.05	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1			0.1	25	50	100	100							
NEPC 2013 ESL Urban Residential and Public Open Space, Coarse Soil								0.7															180	120	300	2800		180	120	300	2800		
NEPC 2013 EIL, EILs Aged Sediment - Site Specific Criteria																	170																
NEPC 2013 Soil HIL A																				300	3	1										3000	Detected/ not detected
NEPC 2013 Soil HSL A and B for Vapour Intrusion - Sand 0 to <1m																	3						45	110				45	110				
Sample Location	**Date**	**Depth (m)**	**Investigation**																														
HA1	5/07/2000	1.3-1.5	GA 2000	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.16	-	<5	<10	<50	<50	<110	-	-	-	-	<5	-
HA1a	12/07/2000	0.3-0.5	GA 2000	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.16	-	-	-	-	-	-	-	-	-	-	<5	-
HA1b	12/07/2000	0.2-0.4	GA 2000	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.16	-	-	-	-	-	-	-	-	-	-	-	-
HA6	5/07/2000	0.4-0.6	GA 2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		<1	-	-	-	-	-	-	-	-	-	<5	ND
HA12	20/07/2000	0.1-0.2	GA 2000	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.16	-	-	-	-	-	-	-	-	-	-	-	-
HA13	20/07/2000	0.2-0.4	GA 2000	-	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-		-	<5	<10	<50	<50	<110	-	-	-	-	<5	-
BH13	28/02/2007	0.2-0.3	DP 2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	ND
BH13	28/02/2007	0.5-0.6	DP 2007	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	0.20		<25	<50	<100	<100	<250	-	-	-	-	<5	-
BH13	28/02/2007	1.9-2.0	DP 2007	<0.1	<0.1	<0.1	<0.1	0.07	<0.2	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	0.20	-	<25	<50	<100	<100	<250	-	-	-	-	-	-
BH16	28/02/2007	0.1-0.2	DP 2007	<0.1	<0.1	<0.1	0.10	0.2	0.30	-	0.10	0.20	<0.1	0.30	<0.1	0.10	<0.1	<0.1	0.30	1.6	0.35	<0.1	<25	<50	<100	<100	<250	-	-	-	-	<5	-
BH17	28/02/2007	0.1-0.2	DP 2007	0.90	0.20	5.10	15.00	14	19.00	-	5.70	14.00	1.50	31.00	0.50	6.50	0.20	16.00	33.00	162.6	19.75	-	<25	<50	<100	<100	<250	-	-	-	-	-	-
BH17	28/02/2007	1.9-2.0	DP 2007	<0.1	<0.1	<0.1	0.20	0.3	0.50	-	0.20	0.30	<0.1	0.40	<0.1	0.20	<0.1	0.10	0.40	2.6	0.50	-	<25	<50	<100	<100	<250	-	-	-	-	-	-
BH18	28/02/2007	0.1-0.2	DP 2007	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.20	<0.1	<0.5	0.20		<25	<50	<100	<100	<250	-	-	-	-	-	-
BH18	28/02/2007	0.9-1.0	DP 2007	<0.1	<0.1	<0.1	<0.1	0.07	<0.1	-	<0.1	<0.1	<0.1	0.10	<0.1	<0.1	<0.1	<0.1	0.10	<0.5	0.20		<25	<50	<100	<100	<250	-	-	-	-	-	-
BH20	28/02/2007	0.1-0.2	DP 2007	<0.1	0.10	0.10	0.60	0.6	0.90	-	0.30	0.70	<0.1	1.10	<0.1	0.30	<0.1	0.50	1.10	6.3	0.90	<0.1	<25	<50	<100	<100	<250	-	-	-	-	<5	-
BH20	28/02/2007	0.4-0.5	DP 2007	<0.1	<0.1	<0.1	<0.1	0.1	<0.2	-	<0.1	0.10	<0.1	0.10	<0.1	<0.1	<0.1	<0.1	0.10	<0.5	0.20	<0.1	<25	<50	<100	<100	<250	-	-	-	-	<5	-
BH20	28/02/2007	1.9-2.0	DP 2007	<0.1	<0.1	<0.1	<0.1	<0.05	<0.2	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	0.20	-	<25	<50	<100	<100	<250	-	-	-	-	-	-
BH28	1/03/2007	0.1-0.2	DP 2007	<0.1	0.20	0.20	1.00	1.2	1.80	-	0.70	1.10	0.10	2.10	<0.1	0.70	<0.1	1.00	2.10	12.3	1.67	<0.1	<25	<50	<100	<100	<250	-	-	-	-	<5	-
BH29	1/03/2007	0.1-0.2	DP 2007	<0.1	<0.1	<0.1	<0.1	<0.05	<0.2	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.20	0.30	<0.1	0.5	0.19	<0.1	<25	<50	<100	<100	<250	-	-	-	-	<5	-
BH17A	17/07/2012	0.1-0.2	JBS 2012	<0.1	<0.1	0.1	0.6	1.2	1.8	-	0.9	0.7	0.2	1.1	<0.1	0.8	<0.1	0.4	1.2	9.00	1.74	-	-	-	-	-	-	-	-	-	-	-	-
BH17A	17/07/2012	2-2.1	JBS 2012	<0.1	0.5	1.4	3.2	3.2	4.2	-	1.6	3.1	0.4	7.8	0.4	1.6	<0.1	7.3	7.8	42.50	4.55	-	-	-	-	-	-	-	-	-	-	-	-
BH17A	17/07/2012	3-3.1	JBS 2012	<0.1	<0.1	<0.1	0.2	0.27	0.4	-	0.2	0.3	<0.1	0.5	<0.1	0.2	<0.1	0.2	0.5	2.77	0.46	-	-	-	-	-	-	-	-	-	-	-	-
BH17A-E	17/07/2012	0.1-0.2	JBS 2012	<0.1	<0.1	<0.1	0.1	0.19	0.3	-	0.1	0.2	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.2	1.39	0.34	-	-	-	-	-	-	-	-	-	-	-	-
BH17A-N	17/07/2012	0.1-0.2	JBS 2012	<0.1	<0.1	<0.1	0.2	0.32	0.5	-	0.2	0.3	<0.1	0.4	<0.1	0.2	<0.1	<0.1	0.4	2.52	0.52	-	-	-	-	-	-	-	-	-	-	-	-
BH17A-S	17/07/2012	0.1-0.2	JBS 2012	<0.1	<0.1	<0.1	0.2	0.28	0.4	-	0.2	0.2	<0.1	0.4	<0.1	0.2	<0.1	0.1	0.4	2.38	0.46	-	-	-	-	-	-	-	-	-	-	-	-
BH17A-W	17/07/2012	0.1-0.2	JBS 2012	<0.1	<0.1	<0.1	0.2	0.24	0.4	-	0.2	0.2	<0.1	0.3	<0.1	0.1	<0.1	0.2	0.4	2.24	0.41	-	-	-	-	-	-	-	-	-	-	-	-
BH20A	10/07/2012	0.7-0.8	JBS 2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
BH20A-S	10/07/2012	-	JBS 2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
BH20A-W	10/07/2012	-	JBS 2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
BH31	16/07/2012	0-0.1	JBS 2012	<0.1	0.2	0.3	1.4	1.7	2.6	-	0.8	1.5	0.2	2.6	<0.1	0.9	<0.1	1.1	2.8	16.10	2.41	-	-	-	-	-	-	-	-	-	-	-	ND
BH32	16/07/2012	0-0.1	JBS 2012	0.3	<0.1	0.6	2.7	2.9	3.9	-	1.2	2.7	0.1	5.7	1.8	1.3	0.8	5.5	5.7	35.20	3.83	<0.1	50	1800	8100	<100	8150	-	-	-	-	-	-
BH32	16/07/2012	0.5-0.8	JBS 2012	0.2	0.7	1.3	3.8	4.1	6.1	-	2	3.6	0.3	8.4	0.4	2.4	0.2	5.8	8.2	47.50	5.69	<0.1	<25	55	420	100	520	-	-	-	-	-	Chrysotile asbestos detected
BH33	17/07/2012	0.1-0.2	JBS 2012	<0.1	<0.1	<0.1	<0.1	0.12	<0.2	-	0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.52	0.26	-	<25	<50	<100	<100	<200	-	-	-	-	-	-
BH34	17/07/2012	0.3-0.4	JBS 2012	<0.1	0.2	0.5	1.5	1.5	2.2	-	0.7	1.6	0.1	3.6	0.1	0.7	<0.1	3	3.7	19.40	2.06	-	<25	<50	<100	<100	<200	-	-	-	-	-	-
BH34	17/07/2012	1.5-1.6	JBS 2012	<0.1	<0.1	<0.1	<0.1	<0.05	<0.2	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.55	0.19	-	<25	<50	<100	<100	<200	-	-	-	-	-	-
BH35	10/07/2012	1.9-2	JBS 2012	<0.1	<0.1	<0.1	<0.1	<0.05	<0.2	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.55	0.19	-	<25	<50	<100	<100	<200	-	-	-	-	-	-
BH36	10/07/2012	0.9-1	JBS 2012	<0.1	<0.1	0.1	0.9	1.8	2.6	-	1.9	1.3	0.2	1.3	<0.1	1.5	<0.1	0.6	2.5	14.70	2.53	-	<25	<50	820	370	1190	-	-	-	-	-	-
BH37	10/07/2012	0-0.1	JBS 2012	<0.1	<0.1	<0.1	<0.1	0.07	<0.2	-	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.27	0.21	-	-	-	-	-	-	-	-	-	-	-	ND
BH38	10/07/2012	0-0.1	JBS 2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		<0.1	-	-	-	-	-	-	-	-	-	-	-
BH40	10/07/2012	0-0.1	JBS 2012	<0.1	<0.1	<0.1	<0.1	<0.05	<0.2	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1.55	0.19	-	<25	<50	<100	<100	<200	-	-	-	-	-	-
BH40	10/07/2012	0.9-1	JBS 2012	<0.1	0.1	0.3	1.2	1.3	1.7	-	0.6	1.1	0.1	2.4	<0.1	0.6	0.1	1.5	2.7	13.70	1.77	<0.1	<25	<50	<100	<100	<200	-	-	-	-	-	-
BH55	17/07/2012	0.1-0.2	JBS 2012	<0.1	<0.1	<0.1	<0.1	0.1	<0.2	-	<0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.50	0.24	-	<25	<50	<100	<100	<200	-	-	-	-	-	ND
TP308	19/11/2014	0-0.3	EIS 2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Chrysotile asbestos detected
TP309	19/11/2014	0-0.3	EIS 2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
TP310	19/11/2014	0-0.2	EIS 2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
TP310	19/11/2014	0.2-0.5	EIS 2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
TP311	19/11/2014	0-0.1	EIS 2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
TP312	19/11/2014	0-0.3	EIS 2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
TP313	19/11/2014	0-0.05	EIS 2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
TP314	19/11/2014	0-0.3	EIS 2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
TP314	19/11/2014	0.3-0.5	EIS 2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
TP315	19/11/2014	0-0.3	EIS 2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
TP315	19/11/2014	0.3-0.5	EIS 2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
TP316	19/11/2014	0-0.3	EIS 2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
TP316	19/11/2014	0.3-0.5	EIS 2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Chrysotile and amosite asbestos detcted
SS2	19/11/2014	Fibre cement fragment	EIS 2014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Chrysotile and amosite asbestos detected
BH1	29/01/2018	0-0.3	EIS 2018	<0.1	<0.1	<0.1	0.10	0.2	-	0.30	0.10	0.10	<0.1	0.30	<0.1	<0.1	<0.1	0.10	0.30	1.5	<0.5	0.20		-	-	-	-	-	<25	<50	<100	<100	-	ND
BH2	29/01/2018	0.5-0.95	EIS 2018	<0.1	<0.1	0.10	0.40	0.4	-	0.60	0.20	0.40	<0.1	0.70	<0.1	0.20	<0.1	0.40	0.80	4.2	<0.5	-	-	-	-	-	-	<25	<50	<100	<100	-	ND
BH2	29/01/2018	1.0-1.2	EIS 2018	<0.1	<0.1	<0.1	0.20	0.2	-	0.30	0.20	0.20	<0.1	0.20	<0.1	0.10	<0.1	0.10	0.20	1.7	<0.5	<0.1	-	-	-	-	-	<25	<50	180	110	-	ND
BH3	29/01/2018	0-0.2	EIS 2018	<0.1	<0.1	<0.1	0.10	0.1	-	0.30	0.10	0.10	<0.1	0.20	<0.1	<0.1	<0.1	0.10	0.20	1.2	<0.5	<0.1	-	-	-	-	-	<25	<50	<100	<100	-	ND
BH4	29/01/2018	0-0.2	EIS 2018	<0.1	<0.1	<0.1	0.10	0.1	-	<0.2	<0.1	0.10	<0.1	0.20	<0.1	<0.1	<0.1	0.20	0.20	0.9	<0.5	<0.1	-	-	-	-	-	<25	<50	<100	<100	-	ND
BH4	29/01/2018	0.5-0.95	EIS 2018	<0.1	0.10	0.30	0.90	0.89	-	1.00	0.50	0.80	0.10	1.70	<0.1	0.40	<0.1	1.00	1.80	9.5	1.30		-	-	-	-	-	<25	<50	250	<100	-	ND
BH5	29/01/2018	0-0.3	EIS 2018	<0.1	<0.1	<0.1	0.10	0.1	-	<0.2	<0.1	0.10	<0.1	0.20	<0.1	<0.1	<0.1	0.10	0.20	0.8	<0.5	-	-	-	-	-	-	<25	<50	<100	<100	-	ND
BH5	29/01/2018	0.5-0.8	EIS 2018	<0.1	<0.1	<0.1	0.40	0.4	-	0.70	0.30	0.40	0.10	0.70	<0.1	0.20	<0.1	0.20	0.80	4.2	0.70	<0.1	-	-	-	-	-	<25	<50	<100	<100	-	ND
BH5	29/01/2018	1.5-1.95	EIS 2018	0.10	1.10	7.00	3.50	3.7	-	5.60	2.00	3.50	0.60	9.60	0.70	1.70	0.30	7.40	9.00	56.6	5.60	-	-	-	-	-	-	<25	<50	150	<100	-	ND
BH5	29/01/2018	3.3-3.45	EIS 2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-
BH6	29/01/2018	0-0.1	EIS 2018	<0.1	<0.1	<0.1	<0.1	<0.05	-	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.1	-	-	-	-	-	<25	<50	<100	<100	-	ND
BH6	29/01/2018	0.5-0.65	EIS 2018	<0.1	1.60	6.60	14.00	11.0	-	16.00	0.60	11.00	1.90	29.00	0.80	4.80	0.80	30.00	29.00	162.5	17.00	<1	-	-	-	-	-	<25	<50	520	<100	-	ND
BH7	30/01/2018	0-0.2	EIS 2018	<0.1	<0.1	<0.1	<0.1	<0.05	-	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.10	0.2	<0.5	<0.1	-	-	-	-	-	<25	<50	<100	<100	-	ND
BH7	30/01/2018	0.5-0.95	EIS 2018	<0.1	<0.1	0.10	0.40	0.4	-	0.60	0.30	0.40	<0.1	0.70	<0.1	0.20	<0.1	0.40	0.80	4.3	0.50	<0.1	-	-	-	-	-	<25	<50	<100	<100	-	ND
BH7	30/01/2018	1.8-2	EIS 2018	<0.1	<0.1	0.10	0.30	0.3	-	0.50	0.20	0.30	<0.1	0.70	<0.1	0.20	<0.1	0.40	0.70	3.7	<0.5	-	-	-	-	-	-	<25	<50	<100	<100	-	ND
BH8	30/01/2018	0-0.2	EIS 2018	<0.1	<0.1	<0.1	0.30	0.3	-	0.50	0.20	0.30	<0.1	0.50	<0.1	0.20	<0.1	0.20	0.50	3.0	<0.5	<0.1	-	-	-	-	-	<25	<50	<100	<100	-	ND
BH8	30/01/2018	0.5-0.95	EIS 2018	<0.1	<0.1	<0.1	0.30	0.3	-	0.50	0.20	0.30	<0.1	0.50	<0.1	0.20	<0.1	0.20	0.50	3.0	<0.5	<0.1	-	-	-	-	-	<25	<50	<100	<100	-	ND
BH9	30/01/2018	0-0.2	EIS 2018	<0.1	<0.1	<0.1	<0.1	0.07	-	<0.2	<0.1	<0.1	<0.1	0.10	<0.1	<0.1	<0.1	<0.1	0.10	0.3	<0.5	<0.1	-	-	-	-	-	<25	<50	<100	<100	-	ND
BH9	30/01/2018	0.5-0.95	EIS 2018	<0.1	<0.1	<0.1	<0.1	<0.05	-	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.1	-	-	-	-	-	<25	<50	<100	<100	-	ND
BH9	30/01/2018	1.5-1.95	EIS 2018	0.10	0.50	1.30	2.70	2.5	-	3.50	1.30	2.40	0.40	5.40	0.20	1.10	<0.1	4.70	5.60	31.8	1.70	-	-	-	-	-	-	<25	<50	120	<100	-	ND
BH9	30/01/2018	3-3.45	EIS 2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.1	-	-	-	-	-	-	-	-	-	-	-
K1	30/01/2018	stockpile sample	EIS 2018	<0.1	<0.1	<0.1	<0.1	<0.05	-	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5	<0.1	-	-	-	-	-	<25	<50	<100	<100	-	ND
K2	30/01/2018	stockpile sample	EIS 2018	<0.1	<0.1	<0.1	0.20	0.2	-	0.30	0.10	0.20	<0.1	0.30	<0.1	<0.1	<0.1	0.20	0.40	1.9	<0.5	<0.1	-	-	-	-	-	<25	<50	<100	<100	-	ND
K3	30/01/2018	stockpile sample	EIS 2018	<0.1	<0.1	<0.1	0.30	0.3	-	0.50	0.20	0.20	<0.1	0.40	<0.1	0.20	<0.1	0.20	0.50	2.8	<0.5	<0.1	-	-	-	-	-	<25	<50	<100	<100	-	ND
F1	30/01/2018	stockpile sample	EIS 2018	<0.1	<0.1	0.10	0.60	0.6	-	1.00	0.40	0.50	<0.1	1.00	<0.1	0.30	<0.1	0.40	1.00	5.9	0.80	<0.1	-	-	-	-	-	<25	<50	<100	<100	-	ND
AF1	30/01/2018	Fibre cement fragment	EIS 2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Detected
V34	16/01/2017	-	JBS&G 2018	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No asbestos detected at the reporting limit of 0.001% w/w.*
V35	16/01/2017	-	JBS&G 2018	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No asbestos detected at the reporting limit of 0.001% w/w.*
V36	16/01/2017	-	JBS&G 2018	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No asbestos detected at the reporting limit of 0.001% w/w.*
CPTP_E_1.4_180620	20/06/2018	1.4	AECOM 2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<50	<100	<100	-	-
CPTP_N_1.2_180620	20/06/2018	1.2	AECOM 2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<50	<100	<100	-	-
CPTP_N_2.5_180620	20/06/2018	2.5	AECOM 2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<50	<100	<100	-	-
CPTP_W_1.2_180620	20/06/2018	1.2	AECOM 2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<50	<100	<100	-	-
CPTP_W_2.5_180620	20/06/2018	2.5	AECOM 2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<50	<100	<100	-	-
DST_1.9_180622	20/06/2018	1.9	AECOM 2018	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<10	<50	<100	<100	-	ND

EILs: site specific criteria derived in EIS 2018 using average physical parameters calculated fc

Table B: Historical Soil Leachate Data (TCLP)
Project Number: 58719
Project Name: Green Square School RAP

				Metals		PAH
				Lead	Nickel	Benzo(a) pyrene
				mg/L	mg/L	mg/L
EQL				1	1	0.05
Sample Location	Date	Depth (m)	Investigation			
BH17A	17/07/2012	2-2.1	JBS 2012	0.40	<0.02	<0.001
BH31	16/07/2012	0-0.1	JBS 2012	0.20	0.03	<0.001
BH32	16/07/2012	0.5-0.8	JBS 2012	48	0.03	<0.001
BH34	17/07/2012	0.3-0.4	JBS 2012	0.10	0.02	<0.001
BH3	29/01/2018	0-0.2	EIS 2018	0.03	-	-
BH4	29/01/2018	0.5-0.95	EIS 2018	0.2	-	<0.001
BH5	29/01/2018	1.5-1.95	EIS 2018	1.8	-	<0.001
BH6	29/01/2018	0.5-0.65	EIS 2018	-	-	<0.001
BH9	30/01/2018	1.5-1.95	EIS 2018	-	-	<0.001
X3	30/01/2018	stockpile sample	EIS 2018	0.06	-	-

Table B: Historical Soil Leachate Data (ACLP)
Project Number: 58719
Project Name: Green Square School RAP

				Metals	PAH															
				Lead	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a) pyrene	Indeno(1,2,3-c,d)pyrene	Dibenz(a,h)anthracene	Benzo(g,h,i)perylene
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL				1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1
Sample Location	Date	Depth (m)	Investigation																	
BH4	29/01/2018	0.5-0.95	EIS 2018	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH5	29/01/2018	1.5-1.95	EIS 2018	200	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1
BH6	29/01/2018	0.5-0.65	EIS 2018	-	<1	<1	<1	<1	0.002	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1

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		BTEX						Metals								TPH					Halogenated Benzenes
		Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Arsenic (Filtered)	Cadmium (Filtered)	Chromium (III+VI) (Filtered)	Copper (Filtered)	Lead (Filtered)	Mercury (Filtered)	Nickel (Filtered)	Zinc (Filtered)	C6 - C9	C10 - C14	C15 - C28	C29-C36	+C10 - C36 (Sum of total)	Hexachlorobenzene
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL		1	1	1	2	1		0.001	0.0001	0.001	0.001	0.001	0.00005	0.001	0.001	10	50	100	100		0.2
ANZECC 2000 MW 95%		700							0.0055		0.0013	0.0044	0.0004	0.07	0.015						
ANZECC/ARMCANZ 2000 MW 95% High Reliability											0.0013	0.0044			0.015						
ANZECC/ARMCANZ 2000 MW 95% Low Reliability			5																		
ANZECC/ARMCANZ 2000 MW 99% Bioaccum		500											0.0001	0.007							
ANZECC/ARMCANZ 2000 MW 99% High Reliability									0.0007												
ANZECC/ARMCANZ 2000 MW Indicative Interim Working Level				180		350															0.05
Sample ID	**Sample Date**																				
MW01	26/07/2012	<1	<1	<1	<2	<1	<3	<0.001	<0.0001	<0.001	0.003	<0.001	<0.00005	<0.001	0.13	<10	<50	<100	<100	<250	-
MW04	26/07/2012	<1	<1	<1	<2	<1	<3	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.00005	<0.001	0.014	<10	<50	<100	<100	<250	-
MW05	26/07/2012	<1	<1	<1	<2	<1	<3	<0.001	<0.0001	<0.001	0.001	0.001	<0.00005	<0.001	0.004	<10	<50	<100	<100	<250	-
MW05	26/07/2012	<1	<1	<1	<2	<1	<3	<0.001	<0.0001	<0.001	<0.001	0.001	<0.00005	<0.001	0.004	<10	<50	<100	<100	<250	-
MW06	26/07/2012	<1	<1	<1	<2	<1	<3	<0.001	<0.0001	<0.001	0.002	<0.001	<0.00005	<0.001	0.005	<10	<50	<100	<100	<250	-

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		Organochlorine Pesticides																			Organophosphorous Pesticides							
		4,4-DDE	a-BHC	Aldrin	b-BHC	Chlordane (cis)	Chlordane (trans)	d-BHC	DDD	DDT	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Methoxychlor	Bromophos-ethyl	Chlorpyrifos	Chlorpyrifos-methyl	Diazinon	Dimethoate	Ethion	Fenitrothion	Ronnel
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL		0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.0002	0.2	0.2	0.2	0.2	0.2
ANZECC 2000 MW 95%															0.008							0.009						
ANZECC/ARMCANZ 2000 MW 95% High Reliability																						0.009						
ANZECC/ARMCANZ 2000 MW 95% Low Reliability																	0.007											
ANZECC/ARMCANZ 2000 MW 99% Bioaccum															0.004			0.0004										
ANZECC/ARMCANZ 2000 MW 99% High Reliability																												
ANZECC/ARMCANZ 2000 MW Indicative Interim Working Level		0.0005		0.003						0.0004		0.0002	0.007							0.004				0.01	0.15		0.001	
Sample ID	**Sample Date**																											
MW01	26/07/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW04	26/07/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW05	26/07/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW05	26/07/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW06	26/07/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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		PAH/Phenols															Polychlorinated Biphenyls						
		Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	Arochlor 1016	Arochlor 1221	Arochlor 1232	Arochlor 1242	Arochlor 1248	Arochlor 1254	Arochlor 1260
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL		0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	2	2	2	2	2	2	2
ANZECC 2000 MW 95%														70									
ANZECC/ARMCANZ 2000 MW 95% High Reliability																							
ANZECC/ARMCANZ 2000 MW 95% Low Reliability																	0.009						
ANZECC/ARMCANZ 2000 MW 99% Bioaccum														50									
ANZECC/ARMCANZ 2000 MW 99% High Reliability																							
ANZECC/ARMCANZ 2000 MW Indicative Interim Working Level				0.01		0.1					1				0.6			1	0.3	0.3	0.03	0.01	
Sample ID	**Sample Date**																						
MW01	26/07/2012	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-
MW04	26/07/2012	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	-	-	-	-	-	-	-
MW05	26/07/2012	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-
MW05	26/07/2012	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-
MW06	26/07/2012	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-

TABLE J

SUMMARY OF GROUNDAWATER LABORATORY RESULTS COMPARED TO ECOLOGICAL GILs SAC

All results in µg/L unless stated otherwise.

	PQL Envirolab Services	ANZECC 2000 Marine Waters	SAMPLES		
			MW2	MW5	MW9
Inorganic Compounds and Parameters					
pH	0.1	7 - 8.5	6.6	6.7	7.1
Electrical Conductivity (µS/cm)	1	NSL	820	1300	630
Hardness (mg$CaCO_3$/L)	3	NSL	310	660	220
Metals and Metalloids					
Arsenic (As III)	1	2.3	<1	3	<1
Cadmium	0.1	0.7	<0.1	<0.1	<0.1
Chromium (SAC for Cr III adopted)	1	27	<1	<1	<1
Copper	1	1.3	<1	<1	<1
Lead	1	4.4	<1	<1	<1
Total Mercury (inorganic)	0.05	0.1	<0.05	<0.05	<0.05
Nickel	1	7	<1	<1	<1
Zinc	1	15	5	8	18
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)					
Benzene	1	500	<1	<1	<1
Toluene	1	180	<1	<1	<1
Ethylbenzene	1	5	<1	<1	<1
m+p-xylene	2	75	<2	<2	<2
o-xylene	1	350	<1	<1	<1
Total xylenes	2	NSL	<2	<2	<2
Volatile Organic Compounds (VOCs), including chlorinated VOCs					
Dichlorodifluoromethane	10	NSL	<10	<10	<10
Chloromethane	10	NSL	<10	<10	<10
Vinyl Chloride	10	100	<10	<10	<10
Bromomethane	10	NSL	<10	<10	<10
Chloroethane	10	NSL	<10	<10	<10
Trichlorofluoromethane	10	NSL	<10	<10	<10
1,1-Dichloroethene	1	700	<1	<1	<1
Trans-1,2-dichloroethene	1	NSL	<1	<1	<1
1,1-dichloroethane	1	250	<1	<1	<1
Cis-1,2-dichloroethene	1	NSL	<1	<1	<1
Bromochloromethane	1	NSL	<1	<1	<1
Chloroform	1	370	<1	<1	5
2,2-dichloropropane	1	NSL	<1	<1	<1
1,2-dichloroethane	1	1900	<1	<1	<1
1,1,1-trichloroethane	1	270	<1	<1	<1
1,1-dichloropropene	1	NSL	<1	<1	<1
Cyclohexane	1	NSL	<1	<1	<1
Carbon tetrachloride	1	240	<1	<1	<1
Benzene	1	see BTEX	<1	<1	<1
Dibromomethane	1	NSL	<1	<1	<1
1,2-dichloropropane	1	900	<1	<1	<1
Trichloroethene	1	NSL	<1	<1	<1
Bromodichloromethane	1	NSL	<1	<1	<1
trans-1,3-dichloropropene	1	NSL	<1	<1	<1
cis-1,3-dichloropropene	1	NSL	<1	<1	<1
1,1,2-trichloroethane	1	1900	<1	<1	<1
Toluene	1	see BTEX	<1	<1	<1
1,3-dichloropropane	1	1100	<1	<1	<1
Dibromochloromethane	1	NSL	<1	<1	<1
1,2-dibromoethane	1	NSL	<1	<1	<1
Tetrachloroethene	1	70	<1	<1	<1
1,1,1,2-tetrachloroethane	1	NSL	<1	<1	<1
Chlorobenzene	1	55	<1	<1	<1
Ethylbenzene	1	see BTEX	<1	<1	<1
Bromoform	1	NSL	<1	<1	<1
m+p-xylene	2	see BTEX	<2	<2	<2
Styrene	1	NSL	<1	<1	<1
1,1,2,2-tetrachloroethane	1	400	<1	<1	<1
o-xylene	1	see BTEX	<1	<1	<1
1,2,3-trichloropropane	1	NSL	<1	<1	<1
Isopropylbenzene	1	30	<1	<1	<1
Bromobenzene	1	NSL	<1	<1	<1
n-propyl benzene	1	NSL	<1	<1	<1
2-chlorotoluene	1	NSL	<1	<1	<1
4-chlorotoluene	1	NSL	<1	<1	<1
1,3,5-trimethyl benzene	1	NSL	<1	<1	<1
Tert-butyl benzene	1	NSL	<1	<1	<1
1,2,4-trimethyl benzene	1	NSL	<1	<1	<1
1,3-dichlorobenzene	1	260	<1	<1	<1
Sec-butyl benzene	1	NSL	<1	<1	<1
1,4-dichlorobenzene	1	60	<1	<1	<1
4-isopropyl toluene	1	NSL	<1	<1	<1
1,2-dichlorobenzene	1	160	<1	<1	<1
n-butyl benzene	1	NSL	<1	<1	<1
1,2-dibromo-3-chloropropane	1	NSL	<1	<1	<1
1,2,4-trichlorobenzene	1	20	<1	<1	<1
Hexachlorobutadiene	1	NSL	<1	<1	<1
1,2,3-trichlorobenzene	1	3	<1	<1	<1
Polycyclic Aromatic Hydrocarbons (PAHs)					
Naphthalene	0.2	50	<0.2	<0.2	<0.2
Acenaphthylene	0.1	NSL	<0.1	<0.1	<0.1
Acenaphthene	0.1	NSL	<0.1	<0.1	<0.1
Fluorene	0.1	NSL	<0.1	<0.1	<0.1
Phenanthrene	0.1	0.6	<0.1	<0.1	0.1
Anthracene	0.1	0.01	<0.1	<0.1	<0.1
Fluoranthene	0.1	1	<0.1	<0.1	<0.1
Pyrene	0.1	NSL	<0.1	<0.1	<0.1
Benzo(a)anthracene	0.1	NSL	<0.1	<0.1	<0.1
Chrysene	0.1	NSL	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	0.2	NSL	<0.2	<0.2	<0.2
Benzo(a)pyrene	0.1	0.1	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	0.1	NSL	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	0.1	NSL	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	0.1	NSL	<0.1	<0.1	<0.1

Concentration above the GIL — VALUE
PQL exceeds GIL — BOLD/RED

TABLE K

SUMMARY OF GROUNDAWATER LABORATORY RESULTS COMPARED TO HUMAN CONTACT GILs

All results in µg/L unless stated otherwise.

	PQL Envirolab Services	ANZECC 2000 Recreational	SAMPLES		
			MW2	MW5	MW9
Inorganic Compounds and Parameters					
pH	0.1	6.5 - 8.5	6.6	6.7	7.1
Electrical Conductivity (µS/cm)	1	NSL	820	1300	630
Hardness (mgCaCo3/L)	3	500	310	660	220
Metals and Metalloids					
Arsenic (As III)	1	50	<1	3	<1
Cadmium	0.1	5	<0.1	<0.1	<0.1
Chromium (total)	1	50	<1	<1	<1
Copper	1	1000	<1	<1	<1
Lead	1	50	<1	<1	<1
Total Mercury (inorganic)	0.05	1	<0.05	<0.05	<0.05
Nickel	1	100	<1	<1	<1
Zinc	1	5000	5	8	18
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)					
Benzene	1	10	<1	<1	<1
Toluene	1	NSL	<1	<1	<1
Ethylbenzene	1	NSL	<1	<1	<1
m+p-xylene	2	NSL	<2	<2	<2
o-xylene	1	NSL	<1	<1	<1
Total xylenes	2	NSL	<2	<2	<2
Volatile Organic Compounds (VOCs), including chlorinated VOCs					
Dichlorodifluoromethane	10	NSL	<10	<10	<10
Chloromethane	10	NSL	<10	<10	<10
Vinyl Chloride	**10**	NSL	<10	<10	<10
Bromomethane	10	NSL	<10	<10	<10
Chloroethane	10	NSL	<10	<10	<10
Trichlorofluoromethane	10	NSL	<10	<10	<10
1,1-Dichloroethene	**1**	0.3	<1	<1	<1
Trans-1,2-dichloroethene	1	NSL	<1	<1	<1
1,1-dichloroethane	1	NSL	<1	<1	<1
Cis-1,2-dichloroethene	1	NSL	<1	<1	<1
Bromochloromethane	1	NSL	<1	<1	<1
Chloroform	1	NSL	<1	<1	5
2,2-dichloropropane	1	NSL	<1	<1	<1
1,2-dichloroethane	1	10	<1	<1	<1
1,1,1-trichloroethane	1	NSL	<1	<1	<1
1,1-dichloropropene	1	NSL	<1	<1	<1
Cyclohexane	1	NSL	<1	<1	<1
Carbon tetrachloride	1	3	<1	<1	<1
Benzene	1	NSL	<1	<1	<1
Dibromomethane	1	NSL	<1	<1	<1
1,2-dichloropropane	1	NSL	<1	<1	<1
Trichloroethene	1	30	<1	<1	<1
Bromodichloromethane	1	NSL	<1	<1	<1
trans-1,3-dichloropropene	1	NSL	<1	<1	<1
cis-1,3-dichloropropene	1	NSL	<1	<1	<1
1,1,2-trichloroethane	1	NSL	<1	<1	<1
Toluene	1	NSL	<1	<1	<1
1,3-dichloropropane	1	NSL	<1	<1	<1
Dibromochloromethane	1	NSL	<1	<1	<1
1,2-dibromoethane	1	NSL	<1	<1	<1
Tetrachloroethene	1	10	<1	<1	<1
1,1,1,2-tetrachloroethane	1	NSL	<1	<1	<1
Chlorobenzene	1	NSL	<1	<1	<1
Ethylbenzene	1	NSL	<1	<1	<1
Bromoform	1	NSL	<1	<1	<1
m+p-xylene	2	NSL	<2	<2	<2
Styrene	1	NSL	<1	<1	<1
1,1,2,2-tetrachloroethane	1	NSL	<1	<1	<1
o-xylene	1	NSL	<1	<1	<1
1,2,3-trichloropropane	1	NSL	<1	<1	<1
Isopropylbenzene	1	NSL	<1	<1	<1
Bromobenzene	1	NSL	<1	<1	<1
n-propyl benzene	1	NSL	<1	<1	<1
2-chlorotoluene	1	NSL	<1	<1	<1
4-chlorotoluene	1	NSL	<1	<1	<1
1,3,5-trimethyl benzene	1	NSL	<1	<1	<1
Tert-butyl benzene	1	NSL	<1	<1	<1
1,2,4-trimethyl benzene	1	NSL	<1	<1	<1
1,3-dichlorobenzene	1	NSL	<1	<1	<1
Sec-butyl benzene	1	NSL	<1	<1	<1
1,4-dichlorobenzene	1	NSL	<1	<1	<1
4-isopropyl toluene	1	NSL	<1	<1	<1
1,2-dichlorobenzene	1	NSL	<1	<1	<1
n-butyl benzene	1	NSL	<1	<1	<1
1,2-dibromo-3-chloropropane	1	NSL	<1	<1	<1
1,2,4-trichlorobenzene	1	NSL	<1	<1	<1
Hexachlorobutadiene	1	NSL	<1	<1	<1
1,2,3-trichlorobenzene	1	NSL	<1	<1	<1
Polycyclic Aromatic Hydrocarbons (PAHs)					
Naphthalene	0.2	NSL	<0.2	<0.2	<0.2
Acenaphthylene	0.1	NSL	<0.1	<0.1	<0.1
Acenaphthene	0.1	NSL	<0.1	<0.1	<0.1
Fluorene	0.1	NSL	<0.1	<0.1	<0.1
Phenanthrene	0.1	NSL	<0.1	<0.1	0.1
Anthracene	0.1	NSL	<0.1	<0.1	<0.1
Fluoranthene	0.1	NSL	<0.1	<0.1	<0.1
Pyrene	0.1	NSL	<0.1	<0.1	<0.1
Benzo(a)anthracene	0.1	NSL	<0.1	<0.1	<0.1
Chrysene	0.1	NSL	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	0.2	NSL	<0.2	<0.2	<0.2
Benzo(a)pyrene	**0.1**	0.01	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	0.1	NSL	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	0.1	NSL	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	0.1	NSL	<0.1	<0.1	<0.1

Concentration above the GIL — VALUE
PQL exceeds GIL — BOLD/RED

Appendix B Aerial Photographs

Legend:

- Approximate Site Boundary
- Approximate Childcare Centre Playground Boundary

JBS&G

Job No: 58719

Client: NSW Department of Education (Schools Infrastructure)

Version: R01 Rev A	Date 2/06/2020
Drawn By: RH	Checked By: SG

Scale 1:2,000

0 25 50

metres

Coord. Sys. GDA 1994 MGA Zone 56

3 Joynton Avenue, Zetland, NSW

HISTORICAL AERIAL IMAGERY NOVEMBER 2014

FIGURE NOV 2014

File Name: \\JBSG-NSW-FS01\Company Data\Projects\School Infrastructure\58719 Green Square School RAP and Hazmat\06 GIS\Maps\Aerials\58719_2014.mxd
Reference: Nearmap (www.nearmap.com.au) 29-11-2014

Legend:

- Approximate Site Boundary
- Approximate Childcare Centre Playground Boundary

JBS&G

Job No: 58719

Client: NSW Department of Education (Schools Infrastructure)

Version: R01 Rev A	Date 2/06/2020
Drawn By: RH	Checked By: SG

Scale 1:2,000

0 25 50

metres

Coord. Sys. GDA 1994 MGA Zone 56

3 Joynton Avenue, Zetland, NSW

HISTORICAL AERIAL IMAGERY JULY 2015

FIGURE JUL 2015

File Name: N:\Projects\School Infrastructure\58719 Green Square School RAP and Hazmat\06 GIS\Maps\Aerials\58719_JUL2015.mxd
Reference: Nearmap (www.nearmap.com.au) 04-07-2015

Legend:

- Approximate Site Boundary
- Approximate Childcare Centre Playground Boundary

JBS&G

Job No: 58719

Client: NSW Department of Education (Schools Infrastructure)

Version: R01 Rev A	Date 2/06/2020
Drawn By: RH	Checked By: SG

Scale 1:2,000

0 25 50

metres

Coord. Sys. GDA 1994 MGA Zone 56

3 Joynton Avenue, Zetland, NSW

HISTORICAL AERIAL IMAGERY OCTOBER 2015

FIGURE OCT 2015

File Name: \\JBSG-NSW-FS01\Company Data\Projects\School Infrastructure\58719 Green Square School RAP and Hazmat\06 GIS\Maps\Aerials\58719_OCT2015.mxd
Reference: Nearmap (www.nearmap.com.au) 16-10-2015

Legend:

- Approximate Site Boundary
- Approximate Childcare Centre Playground Boundary

JBS&G

Job No: 58719

Client: NSW Department of Education (Schools Infrastructure)

Version: R01 Rev A	Date 2/06/2020
Drawn By: RH	Checked By: SG

Scale 1:2,000

0 25 50

metres

Coord. Sys. GDA 1994 MGA Zone 56

3 Joynton Avenue, Zetland, NSW

HISTORICAL AERIAL IMAGERY FEBRUARY 2016

FIGURE FEB 2016

File Name: \\JBSG-NSW-FS01\Company Data\Projects\School Infrastructure\58719 Green Square School RAP and Hazmat\06 GIS\Maps\Aerials\58719_FEB2016.mxd
Reference: Nearmap (www.nearmap.com.au) 24-02-2016

Legend:

- Approximate Site Boundary
- Approximate Childcare Centre Playground Boundary

JBS&G

Job No: 58719

Client: NSW Department of Education (Schools Infrastructure)

Version: R01 Rev A	Date 2/06/2020
Drawn By: RH	Checked By: SG

Scale 1:2,000

0 25 50

metres

Coord. Sys. GDA 1994 MGA Zone 56

3 Joynton Avenue, Zetland, NSW

HISTORICAL AERIAL IMAGERY JULY 2016

FIGURE JULY 2016

File Name: \\JBSG-NSW-FS01\Company Data\Projects\School Infrastructure\58719 Green Square School RAP and Hazmat\06 GIS\Maps\Aerials\58719_JUL2016.mxd
Reference: Nearmap (www.nearmap.com.au) 14-07-2016

Legend:

- Approximate Site Boundary
- Approximate Childcare Centre Playground Boundary

JBS&G

Job No: 58719

Client: NSW Department of Education (Schools Infrastructure)

Version: R01 Rev A	Date 2/06/2020
Drawn By: RH	Checked By: SG

Scale 1:2,000

0 25 50

metres

Coord. Sys. GDA 1994 MGA Zone 56

3 Joynton Avenue, Zetland, NSW

HISTORICAL AERIAL IMAGERY JAN 2017

FIGURE JAN 2017

File Name: \\JBSG-NSW-FS01\Company Data\Projects\School Infrastructure\58719 Green Square School RAP and Hazmat\06 GIS\Maps\Aerials\58719_JAN2017.mxd
Reference: Nearmap (www.nearmap.com.au) 16-01-2017

Legend:

- Approximate Site Boundary
- Approximate Childcare Centre Playground Boundary

JBS&G

Job No: 58719

Client: NSW Department of Education (Schools Infrastructure)

Version: R01 Rev A	Date 2/06/2020
Drawn By: RH	Checked By: SG

Scale 1:2,000

0 25 50

metres

Coord. Sys. GDA 1994 MGA Zone 56

3 Joynton Avenue, Zetland, NSW

HISTORICAL AERIAL IMAGERY AUGUST 2017

FIGURE AUG 2017

File Name: \\JBSG-NSW-FS01\Company Data\Projects\School Infrastructure\58719 Green Square School RAP and Hazmat\06 GIS\Maps\Aerials\58719_AUG2017.mxd
Reference: Nearmap (www.nearmap.com.au) 09-08-2017

Legend:

- Approximate Site Boundary
- Approximate Childcare Centre Playground Boundary

JBS&G

Job No: 58719

Client: NSW Department of Education (Schools Infrastructure)

Version: R01 Rev A	Date 2/06/2020
Drawn By: RH	Checked By: SG

Scale 1:2,000

0 25 50

metres

Coord. Sys. GDA 1994 MGA Zone 56

3 Joynton Avenue, Zetland, NSW

HISTORICAL AERIAL IMAGERY 2018

FIGURE 2018

File Name: N:\Projects\School Infrastructure\58719 Green Square School RAP and Hazmat\06 GIS\Maps\Aerials\58719_2018.mxd
Reference: Nearmap (www.nearmap.com.au) 11-04-2018

Legend:

- Approximate Site Boundary
- Approximate Childcare Centre Playground Boundary

JBS&G

Job No: 58719

Client: NSW Department of Education (Schools Infrastructure)

Version: R01 Rev A	Date 20/05/2020
Drawn By: RH	Checked By: SG

Scale 1:2,000

0 25 50

metres

Coord. Sys. GDA 1994 MGA Zone 56

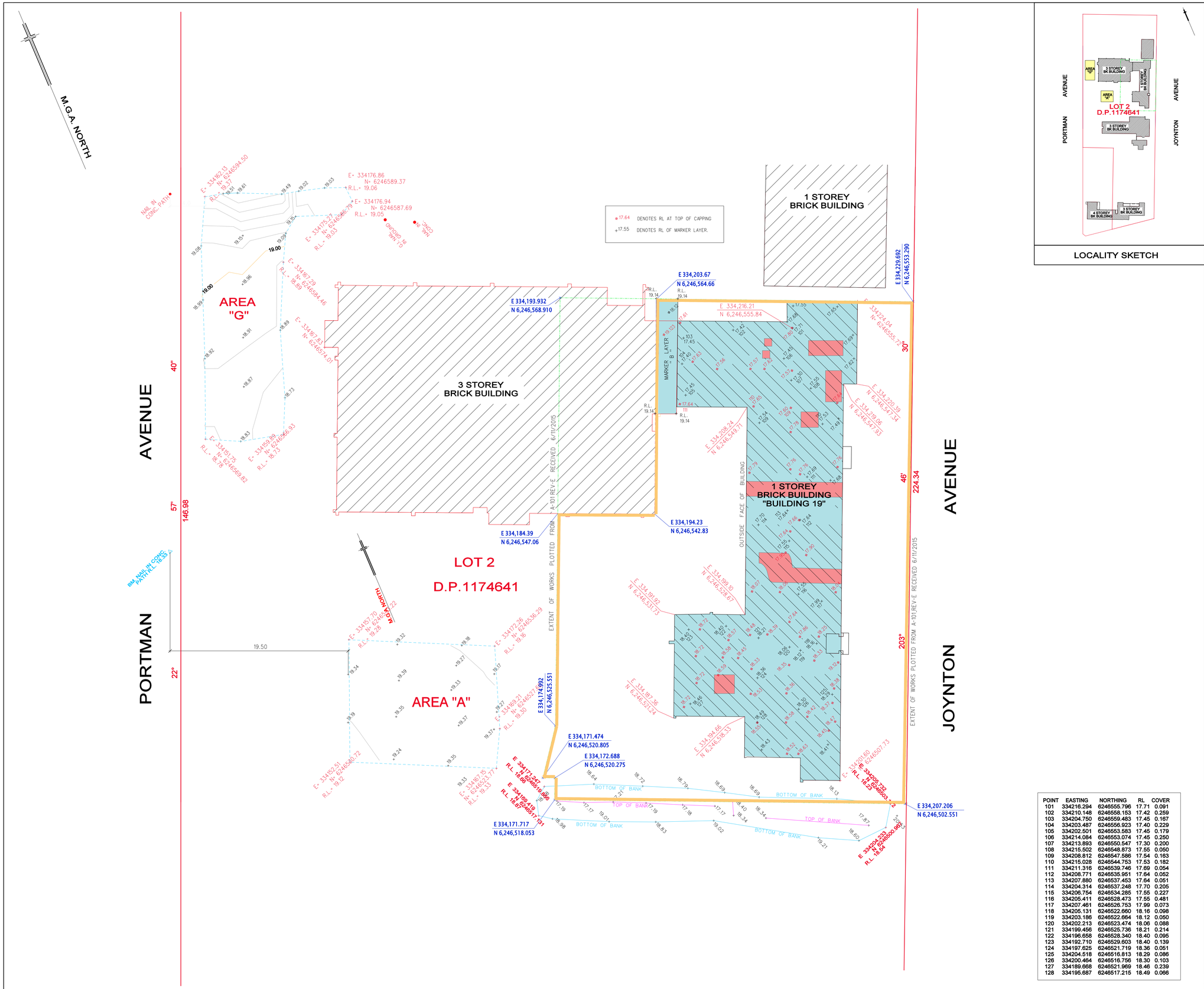
3 Joynton Avenue, Zetland, NSW

HISTORICAL AERIAL IMAGE 2020

FIGURE 2020

File Name: \\JBSG-NSW-FS01\Company Data\Projects\School Infrastructure\58719 Green Square School RAP and Hazmat\GIS\Maps\Aerials\58719_2020.mxd
Reference: Nearmap (www.nearmap.com.au) 18-04-2020

Appendix C Extent of Capped Asbestos Impacted Soil



LOCALITY SKETCH

NOTES:

- SITE EXTENT
- EXPOSED VALIDATED NATURAL SOILS
- CAPPED ASBESTOS & PAH IMPACTED FILL

REV.	DATE	AMENDMENTS
D	24/02/2017	MARKER LAYER" B "ADDED & REMEDIATION BOUNDARY AMENDED
C	16/08/2016	MARKER LAYER SURVEY (77179_D06) ADDED
B	26/01/2016	DETAIL REMOVED
A	14/12/2015	ADDITIONAL CO-ORDINATES LABELLED.

POINT	EASTING	NORTHING	RL	COVER
101	334216.294	6246555.796	17.71	0.091
102	334210.148	6246558.153	17.42	0.259
103	334204.750	6246559.483	17.45	0.167
104	334203.487	6246556.923	17.40	0.229
105	334202.501	6246553.583	17.45	0.179
106	334214.084	6246553.074	17.45	0.250
107	334213.893	6246550.547	17.30	0.200
108	334215.502	6246548.873	17.55	0.050
109	334208.812	6246547.586	17.54	0.163
110	334215.028	6246544.753	17.53	0.182
111	334211.316	6246539.746	17.69	0.054
112	334208.771	6246535.951	17.64	0.052
113	334207.880	6246537.453	17.64	0.051
114	334204.314	6246537.248	17.70	0.205
115	334206.754	6246534.285	17.55	0.227
116	334205.411	6246528.473	17.55	0.481
117	334207.461	6246526.753	17.99	0.073
118	334205.131	6246522.660	18.16	0.098
119	334203.186	6246522.664	18.12	0.050
120	334202.213	6246523.474	18.06	0.088
121	334199.456	6246525.736	18.21	0.214
122	334196.658	6246528.340	18.40	0.095
123	334192.710	6246529.603	18.40	0.139
124	334197.625	6246521.719	18.36	0.051
125	334204.518	6246516.813	18.29	0.086
126	334200.464	6246516.756	18.30	0.103
127	334189.668	6246521.969	18.46	0.239
128	334195.687	6246517.215	18.49	0.066

RYGATE SURVEYORS
Rygate & Company Pty Limited
P.W.Rygate & West
ABN 61 001 204 897
SURVEYING SINCE 1893
Suite 904 Level 9, 89 Sydney NSW 2000
P +61 2 9262 6800
F +61 2 9262 6843
e surveyors@rygate.com.au
w rygate.com.au

SUBDIVISION : STRATA PLANS : STRATUM SUBDIVISION : LEASE PLANS : TOPOGRAPHIC SURVEYS : 3D MODELLING : RACECOURSE DESIGN : PROJECT MANAGEMENT : SUN SHADOW D

SURVEYOR	DRAWN	CHECKED	APPROVED
D.I.	R.M.		

0
REDUCTION RATIO 1: 200 @ A1

DATUM : AUSTRALIAN HEIGHT DATUM

CONTOUR INTERVAL : 0.2m

ORIGIN OF LEVELS : P.M. 59537 R.L. 18.745 (A.H.D.)

THIS TITLE BLOCK AND NOTES FORM AN INTEGRAL PART OF THE PLAN AND MUST BE REPRODUCED IN ANY USE, DUPLICATION OR AMENDMENT.

CLIENT
IOON PTY. LTD.

LOCALITY
ZETLAND

L.G.A.
SYDNEY

PLAN

SHOWING DETAIL, LEVELS AND M.G.A. CO-ORDINATES AREA "A" AND "G" ON THE 4th OF DECEMBER 2015 NATURAL SURFACE LEVEL

CAD REFERENCE 77179_D02-Rev-D.DGN

REFERENCE No.	PLAN No.	DATE	SHEET No.
77179		04/12/2016	1 OF 1 SHEETS

A1

MGA NORTH

PORTMAN STREET

BOUNDARY

E 334117.627
N 6246496.291

18.55

E 334125.2
N 6246509.7
RL 18.4

E 334133.470
N 6246533.684

E 334132.6
N 6246527.2
RL 18.1

×RL 18.377 ×RL 18.323 ×RL 18.329 ×RL 18.363
×RL 18.383 ×RL 18.375 ×RL 18.335 ×RL 18.388 ×RL 18.367
×RL 18.417 ×RL 18.373 ×RL 18.432 ×RL 18.470 ×RL 18.459

MARKER LAYER

CITY WEST HOUSING BUILDING

E 334134.9
N 6246504.5
RL 18.4

E 334144.4
N 6246521.4
RL 18.4

18.13

8.45

16.9

12.0

BOUNDARY

E 334135.689
N 6246538.920
RL 18.80

APPROX RL ×16.85

APPROX RL ×16.85

E 334148.1
N 6246527.2
RL 16.8

E 334154.2
N 6246541.9
RL 16.8

E 334156.194
N 6246549.752
RL 18.90

E 334152.258
N 6246531.699
RL 18.78

APPROX RL ×16.85

DEVELOPMENT

MARKER LAYER

NOTE:
LOCATION OF MARKER LAYER DERIVED FROM MEASURED INFORMATION SUPPLIED BY LAHEY CONSTRUCTIONS ON 8th JANUARY 2018

APPROX RL ×16.85

SITE

E 334112.118
N 6246409.561

BOUNDARY

E 334148.381
N 6246482.511

NEW AWNING

AMENITIES

3 STOREY BRICK BUILDING

E 334171.548
N 6246520.768
RL 18.84

11.8

E 334169.1
N 6246519.0
RL 16.8

E 334179.6
N 6246532.4
RL 16.8

E 334177.636
N 6246531.422
RL 18.90

E 334171.800
N 6246517.988
RL 18.80

E 334172.769
N 6246520.257
RL 18.81

E 334175.102
N 6246525.546
RL 18.88

HANSARD STREET

BOUNDARY

SITE DEVELOPMENT BOUNDARY

E 334491.444
N 6246509.511
RL 19.06

E 334159.290
N 6246393.405

BOUNDARY

E 334287.484
N 6246502.625
RL 18.51

JOYNTON AVENUE

4	FOURTH ISSUE	20/02/18
3	THIRD ISSUE	09/01/18
2	SECOND ISSUE	07/12/16
1	FIRST ISSUE	29/11/16

HORIZONTAL DATUM:
CO-ORDINATE SYSTEM: MGA
MARKS ADOPTED: PM59536

LGA: CITY OF SYDNEY

VERTICAL DATUM:
DATUM: AUSTRALIAN HEIGHT DATUM (AHD)
B.M. ADOPTED: PM59536
R.L. 19.136 (2)
SOURCE: S.C.I.M.S. (31/10/16)

LAHEY CONSTRUCTIONS
16 NICHOLSON ST
SOUTH KEMPSEY
NSW 2440

SURVEY PLAN
SHOWING MARKER LAYER EXTENTS AND LEVELS
GREEN SQUARE COMMUNITY CENTRE

C.M.S. Surveyors Pty Limited
ACN: 096 240 201
PO Box 463 Dee Why NSW 2099
1/32 Campbell Avenue, Dee Why NSW 2099
Telephone: (02) 9971 4802 Facsimile: (02) 9971 4822
E-mail: info@cmssurveyors.com.au

SURVEYED AC	DRAWN CJR		
	SCALE 1:200 @ A1	DATE OF SURVEY 14/02/18	
DRAWING NAME 15434 MARKER LAYER ASBUILT 140218		SHEET 1 OF 1	ISSUE 4
CAD FILE 15434 MARKER LAYER ASBUILT 140218			

Appendix D Bore Hole Logs

BOREHOLE LOG

CLIENT: City of Sydney Council
PROJECT: Phase 2 Contamination Assessment
LOCATION: 3 Joynton Avenue, Zetland

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH13
PROJECT No: 44621
DATE: 28 Feb 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.15	CONCRETE							
		FILLING - yellow bedding sand		A	0.2 0.3		PID<1ppm		
	0.4	FILLING - black, gravelly ash, slag and sand filling		A*	0.5 0.6		PID<1ppm		
	0.7	FILLING - mottled grey and yellow crushed sandstone filling, with some clay and some orange sandstone gravel		A	0.9 1.0		PID<1ppm		
1		- as above, mottled cream, yellow and grey							1
	1.9	FILLING - sand filling with grey brown with orange sandstone gravel pieces		A	1.9 2.0		PID<1ppm		
2									2
3	3.0	SAND - grey fine to medium grained, sand, moist							3
		- as above but yellow brown with dark brown peaty sand layers, wet		A	3.4		PID<1ppm	▼	
	3.5	Bore discontinued at 3.5m - target depth reached			3.5				
4									4

RIG: Bobcat **DRILLER:** G Trippett **LOGGED:** PEN **CASING:** Uncased

TYPE OF BORING: Solid flight auger

WATER OBSERVATIONS: Free groundwater observed at 3.5m

REMARKS: *Blind field duplicate sample BD4-280207 collected

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: PB
Date: 28/2/07

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BOREHOLE LOG

CLIENT: City of Sydney Council
PROJECT: Phase 2 Contamination Assessment
LOCATION: 3 Joynton Avenue, Zetland

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH16
PROJECT No: 44621
DATE: 28 Feb 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - brown sandy clay filling (topsoil) with grass roots (grass at surface)			0.1				
				A	0.2		PID<1ppm		
	0.3	FILLING - grey brown sandy gravel filling							
				A	0.4		PID<1ppm		
	0.5	Bore discontinued at 0.5m - refusal on concrete			0.5				
	1								
	2								
	3								
	4								

RIG: Bobcat **DRILLER:** G Trippett **LOGGED:** PEN **CASING:** Uncased

TYPE OF BORING: Solid flight auger

WATER OBSERVATIONS: No free groundwater observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: PR
Date: 20/4/07

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BOREHOLE LOG

CLIENT: City of Sydney Council
PROJECT: Phase 2 Contamination Assessment
LOCATION: 3 Joynton Avenue, Zetland

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH17/MW2
PROJECT No: 44621
DATE: 28 Feb 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.0	FILLING - dark brown sandy filling (topsoil) with grass roots (grass at surface)			0.1				
				A	0.2		PID<1ppm		
					0.4				
				A	0.5		PID<1ppm		
		- some gravel at 0.5m							
	1				0.9				1
				A	1.0		PID<1ppm		Bentonite
	1.9	FILLING - sand, crushed sandstone and gravel			1.9				
	2			A	2.0		PID<1ppm		2
		- as above but mostly yellow crushed sandstone							
	2.9	PEATY SAND - dark brown and black silty peaty sand, moist			2.9				
	3			A	3.0		PID<1ppm		3
	3.2	SAND - grey brown fine to medium grained sand, wet at 3.2m						▼	Machine slotted PVC screen
	4	- as above but medium grained, saturated							4
	4.7	Bore discontinued at 4.7m - target depth reached							End cap

RIG: Bobcat **DRILLER:** G Trippett **LOGGED:** PEN **CASING:** Uncased

TYPE OF BORING: Solid flight auger

WATER OBSERVATIONS: Free groundwater observed at 3.2m

REMARKS: Monitoring well MW2 installed to 4.7m

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 20/9/07

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BOREHOLE LOG

CLIENT: City of Sydney Council
PROJECT: Phase 2 Contamination Assessment
LOCATION: 3 Joynton Avenue, Zetland

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH18
PROJECT No: 44621
DATE: 28 Feb 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	BITUMINOUS CONCRETE							
		FILLING - dark grey sandy gravel roadbase filling, humid		A	0.1 0.2		PID<1ppm		
	0.3	FILLING - dark brown sand filling, with some gravel and crushed sandstone. Piece of ceramic tile at 0.4m		A	0.4 0.5		PID<1ppm		
	1			A	0.9 1.0		PID<1ppm		1
		- mostly crushed sandstone at 1.5m, orange and cream							
	2			A	1.9 2.0		PID<1ppm		2
	2.1	SAND - yellow brown, fine to medium grained sand, with some black patches, grades to darker brown sand, moist							
	2.5	PEATY SAND - dark brown to black peaty, organic sand, wet							
	3			A	2.9 3.0		PID<1ppm	▼	3
	3.3	SAND - light grey cream medium grained sand, wet							
	3.5	Bore discontinued at 3.5m - target depth reached							
	4								4

RIG: Bobcat **DRILLER:** G Trippett **LOGGED:** PEN **CASING:** Uncased

TYPE OF BORING: Solid flight auger

WATER OBSERVATIONS: Free groundwater observed at 2.9m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 20/9/07

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BOREHOLE LOG

CLIENT: City of Sydney Council
PROJECT: Phase 2 Contamination Assessment
LOCATION: 3 Joynton Avenue, Zetland

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH20
PROJECT No: 44621
DATE: 28 Feb 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.0	FILLING - dark grey black silty sand filling (topsoil), with some grass roots and sandstone gravel (grass at surface)		A*	0.1 0.2		PID<1ppm		
	0.4	FILLING - mottled grey, orange and brown crushed sandstone filling		A	0.4 0.5		PID<1ppm		
	1			A	0.9 1.0		PID<1ppm		1
	1.3	SAND - grey brown fine to medium grained sand							
	1.6	PEATY SAND - dark grey peaty sand at 1.6-1.7m							
	1.7	- as above but light yellow brown sand		A	1.9 2.0		PID<1ppm		2
	2	- wet from 2.5m						▼	
	3	- grading to grey brown medium grained quartz sand, saturated		A	2.9 3.0		PID<1ppm		3
	3.5	Bore discontinued at 3.5m - target depth reached							
	4								4

RIG: Bobcat **DRILLER:** G Trippett **LOGGED:** PEN **CASING:** Uncased
TYPE OF BORING: Solid flight auger
WATER OBSERVATIONS: Free groundwater observed at 2.5m
REMARKS: *Blind field duplicate sample BD5-280207 collected

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 28/2/07

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BOREHOLE LOG

CLIENT: City of Sydney Council
PROJECT: Phase 2 Contamination Assessment
LOCATION: 3 Joynton Avenue, Zetland

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH28
PROJECT No: 44621
DATE: 01 Mar 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.0	FILLING - sand, crushed sandstone and gravel filling, large pieces of sandstone (grass at surface)		A	0.1 0.2		PID<1ppm		
	0.3	FILLING - grey and dark grey, sand and clay filling, moist		A	0.4 0.5		PID<1ppm		
	0.5	SAND - light grey and dark grey mottled/layered, fine to medium grained sand, moist		A	0.9 1.0		PID<1ppm		
	1.8	SILTY SAND - brown fine grained, silty sand, moist to wet		A	1.9 2.0		PID<1ppm	▼	
	2.0	SAND - light grey/white medium grained sand, with some black organic specs		A	2.9 3.0		PID<1ppm		
	3.5	Bore discontinued at 3.5m - target depth reached							

RIG: Bobcat **DRILLER:** G Trippett **LOGGED:** PEN **CASING:** Uncased

TYPE OF BORING: Solid flight auger

WATER OBSERVATIONS: Free groundwater observed at 2.5m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 20/9/07

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BOREHOLE LOG

CLIENT: City of Sydney Council
PROJECT: Phase 2 Contamination Assessment
LOCATION: 3 Joynton Avenue, Zetland

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: BH29
PROJECT No: 44621
DATE: 01 Mar 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.1	BITUMINOUS CONCRETE							
		FILLING - dark grey/black sandy gravel filling, with slag and ash, moist		A	0.1		PID<1ppm		
	0.3	FILLING - grey and dark grey sand and clay filling, with some brown sand, moist		A	0.4		PID<1ppm		
	0.5	SAND - grey brown and yellow brown fine grained sand, with minor silt content, moist			0.5				
	1			A	0.9		PID<1ppm		1
					1.0				
	2	- grading to light grey sand with dark grey and black patches at 2.0m, moist to wet		A	1.9		PID<1ppm		2
					2.0			▼	
		- grading to light grey							
	3	- grading to grey/white medium grained sand, wet		A	2.9		PID<1ppm		3
					3.0				
	3.5	Bore discontinued at 3.5m - target depth reached							
	4								4

RIG: Bobcat **DRILLER:** G Trippett **LOGGED:** PEN **CASING:** Uncased

TYPE OF BORING: Solid flight auger

WATER OBSERVATIONS: Free groundwater observed at 2.5m

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 20/4/07

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REPORT OF BOREHOLE: HA1

CLIENT: Landcom c/- Allen Jack + Cottier
PROJECT: Former South Sydney Hospital
LOCATION: Joynton Street, Zetland
JOB NO: 00623118

LOCATION: See Site Plan
SURFACE RL: 17.0 m DATUM: AHD
INCLINATION: -90°

SHEET: 1 OF 1
DRILL RIG: Hand Auger & Spade
LOGGED: AGS DATE: 5/7/00
CHECKED: DATE: 31.7.00

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
Spade			0.0	17.00					Silty SAND - grey	D		FILL - sand, rubble
				0.50								
HA			0.5	16.50				SP	SAND - fine grained, yellow, brown white			NATURAL
			1.0	1.00 16.00				SP SM	SAND - brown, some silt	D-M		
				1.30 15.70	Sample (1.3-1.5m)			SP	SAND - fine grained, dark grey and yellow	M		
		▽	1.5		Sample (1.5-1.7m)							
				1.60 15.40				SP	SAND - fine to medium grained, light grey to white	W		
				1.80 15.20					End of Borehole @ 1.80 m			
			2.0									
			2.5									
			3.0									
			3.5									

This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for Environmental purposes only, without attempt to consider geotechnical properties or the geotechnical significance of the materials encountered. As such it should not be relied upon for Geotechnical purposes.

GAP Form No. 9
RL 2

REPORT OF BOREHOLE: HA6

CLIENT: Landcom c/- Allen Jack + Cottier
PROJECT: Former South Sydney Hospital
LOCATION: Joynton Street, Zetland
JOB NO: 00623118

LOCATION: See Site Plan
SURFACE RL: 18.1 m DATUM: AHD
INCLINATION: -90°

SHEET: 1 OF 1
DRILL RIG: Hand Auger
LOGGED: AGS DATE: 5/7/00
CHECKED: DATE: 31.7.00

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA	M		0.0	18.10					SAND - fine grained, dark brown, with some silt, gravel and coal	D-M	L	TOPSOIL / FILL
				0.40 17.70	DS (0.4-0.6m)				SAND - fine grained, grey			INFERRED FILL
	L		0.5								VL	
			1.0									
				1.20 16.90	DS (1.2-1.3m) Duplicate 2			SP	SAND - very fine grained, dark brown with reddish tint, with some silt, gravel			NATURAL
	H		1.5									
				1.60 16.50				SP	SAND - fine grained, creamy white			
	L	▽	2.0							W		
			2.5									
			3.0									
				3.20 14.90					End of Borehole @ 3.20 m			
			3.5									

This report of borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for Environmental purposes only, without attempt to consider geotechnical properties or the geotechnical significance of the materials encountered. As such it should not be relied upon for Geotechnical purposes.

GAP Form No. 9
RL 2

REPORT OF BOREHOLE: HA12

CLIENT:	Landcom c/- Allen Jack + Cottier	LOCATION: See Site Plan		SHEET: 1 OF 1	
PROJECT:	Former South Sydney Hospital	SURFACE RL: 18.4 m	DATUM: AHD	DRILL RIG: Hand Auger	
LOCATION:	Joynton Street, Zetland	INCLINATION: -90°		LOGGED: GPC	DATE: 20/7/00
JOB NO:	00623118	BOREHOLE DIAMETER: 100 mm		CHECKED:	DATE: 31.7.00

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA	L	GWNE	0.0	18.40	DS (0.1-0.3m) PID= 0A DUPB				Silty SAND - fine to medium grained, grey brown	M		FILL (TOPSOIL)
				0.40 18.00					End of Borehole @ 0.40 m			Refusal on sandstone cobbles and boulders
			0.5									
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									

REPORT OF BOREHOLE: HA13

CLIENT:	Landcom c/- Allen Jack + Cottier	LOCATION: See Site Plan	SHEET: 1 OF 1
PROJECT:	Former South Sydney Hospital	SURFACE RL: 19.0 m DATUM: AHD	DRILL RIG: Hand Auger
LOCATION:	Joynton Street, Zetland	INCLINATION: -90°	LOGGED: GPC DATE: 20/7/00
JOB NO:	00623118	BOREHOLE DIAMETER: 100 mm	CHECKED: [illegible] DATE: 31.7.00

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USC Symbol	SOIL / ROCK MATERIAL DESCRIPTION	MOISTURE	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA		Groundwater not encountered	0.0	19.00					Silty SAND - fine to medium grained, brown			FILL (TOPSOIL)
					DS (0.2-0.4m) PID= 0A							
			0.30	18.70					SAND - fine to medium grained, grey, trace of silt, pieces of rock and brick	M		FILL
			0.5									
					DS (0.7-0.8m) PID= 0A							
			0.80	18.20					End of Borehole @ 0.80 m			
			1.0									
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									

JBS ENVIRONMENTAL	**Borehole No: BH17A**	**Project No:** 42180 **Client:** City of Sydney Council **Project Name:** South Sydney Hospital, NSW **Site Address:** 3 Joynton Ave, Zetland, NSW

Date: 17/07/2012
Contractor: Rockwell
Drill Rig: Geoprobe
Method: Solid Flight Auger
Total Hole Depth (mbgs): 4.5

Eastings (MGA): 334195.05
Northings (MGA): 6246576.12
Reference Level: GS
Elevation - Surface (m): 0
Bore Diameter (mm):

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
		Ground Surface				
0.0		**FILL (FL)** Bituminous covering	BH17A 0.1-0.2	0.0	D	
		FILL (FL) Gravelly SAND, black and grey, fine to coarse grained, angular to sub-angular, medium density, damp, brick gravels present.				
		FILL (FL) Gravelly SAND, brown, fine to coarse grained, angular to sub-angular, medium density, damp, brick gravels present.	BH17A 0.5-0.6	0.0	D	
1.0						
2.0			BH17A 2.0-2.1	0.0	D	
		FILL (FL) Clayey SAND, brown with grey and red clay mottles, medium density, fine and firm clay with medium plasticity, damp.				
3.0			BH17A 3.0-3.1	0.0	D	
		SAND (SP) SAND, yellow, fine to coarse grained, loose to medium density, moist.				
4.0			BH17A 4.0-4.1	0.0	D	
		End of Hole at 4.5 m bgs				
5.0						

Drilling Method	*Sample Type*	*Reference Level*	*Log Details*
HA - Hand Auger	*U - Undisturbed tube sample*	*AHD - Australian Height Datum*	*Logged By:* B. Regan
SFA - Solid Flight Auger	*D - Disturbed sample*	*BGS - Below Ground Surface*	*Project Manager:* T. Harding
HFA - Hollow Flight Auger	*CS - Core sample*		
PT - Push Tube			
AH - Air Hammer			

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

Borehole No: BH17A-E

Project No: 42180
Client: City of Sydney Council
Project Name: South Sydney Hospital, NSW
Site Address: 3 Joynton Ave, Zetland, NSW

Date: 17/07/2012
Contractor: Rockwell
Drill Rig: Geoprobe
Method: Solid Flight Auger
Total Hole Depth (mbgs): 0.2

Eastings (MGA): 334199.78
Northings (MGA): 6246574.84
Reference Level: GS
Elevation - Surface (m): 0
Bore Diameter (mm):

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
0.0		Ground Surface				
		FILL (FL) Bituminous covering	BH17A-E 0.1-0.2	0.0	D	
		FILL (FL) Gravelly SAND, dark grey, heterogeneous fine to coarse grained, angular, medium density, dry.				
		End of Hole at 0.2 m bgs				
1.0						
2.0						
3.0						
4.0						
5.0						

Drilling Method	*Sample Type*	*Reference Level*	*Log Details*
HA - Hand Auger	*U - Undisturbed tube sample*	*AHD - Australian Height Datum*	*Logged By:* B. Regan
SFA - Solid Flight Auger	*D - Disturbed sample*	*BGS - Below Ground Surface*	*Project Manager:* T. Harding
HFA - Hollow Flight Auger	*CS - Core sample*		
PT - Push Tube			
AH - Air Hammer			

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

JBS ENVIRONMENTAL	**Borehole No: BH17A-N**	**Project No:** 42180 **Client:** City of Sydney Council **Project Name:** South Sydney Hospital, NSW **Site Address:** 3 Joynton Ave, Zetland, NSW

Date: 17/07/2012
Contractor: Rockwell
Drill Rig: Geoprobe
Method: Solid Flight Auger
Total Hole Depth (mbgs): 0.3

Eastings (MGA): 334194.97
Northings (MGA): 6246578.83
Reference Level: GS
Elevation - Surface (m): 0
Bore Diameter (mm):

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
0.0		Ground Surface				
		FILL (FL) Bituminous covering.	BH17A-N 0.1-0.2	0.2	D	
		FILL (FL) Gravelly SAND, brown and grey, loose, dry to damp, minor bitumen gravels.				
		End of Hole at 0.3 m bgs				
1.0						
2.0						
3.0						
4.0						
5.0						

Drilling Method	*Sample Type*	*Reference Level*	*Log Details*
HA - Hand Auger	*U - Undisturbed tube sample*	*AHD - Australian Height Datum*	*Logged By:* B. Regan
SFA - Solid Flight Auger	*D - Disturbed sample*	*BGS - Below Ground Surface*	*Project Manager:* T. Harding
HFA - Hollow Flight Auger	*CS - Core sample*		
PT - Push Tube			
AH - Air Hammer			

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

Borehole No: BH17A-S

Project No: 42180
Client: City of Sydney Council
Project Name: South Sydney Hospital, NSW
Site Address: 3 Joynton Ave, Zetland, NSW

Date: 17/07/2012
Contractor: Rockwell
Drill Rig: Geoprobe
Method: Solid Flight Auger
Total Hole Depth (mbgs): 0.2

Eastings (MGA): 334194.94
Northings (MGA): 6246571.68
Reference Level: GS
Elevation - Surface (m): 0
Bore Diameter (mm):

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
0.0		Ground Surface				
		FILL (FL) Silty SAND with organic matter, fine grained, loose, dry, hole is located within a garden bed.	BH17A-S 0.1-0.2	0.0	D	
		End of Hole at 0.2 m bgs				
1.0						
2.0						
3.0						
4.0						
5.0						

Drilling Method	*Sample Type*	*Reference Level*	*Log Details*
HA - Hand Auger	*U - Undisturbed tube sample*	*AHD - Australian Height Datum*	*Logged By:* B. Regan
SFA - Solid Flight Auger	*D - Disturbed sample*	*BGS - Below Ground Surface*	*Project Manager:* T. Harding
HFA - Hollow Flight Auger	*CS - Core sample*		
PT - Push Tube			
AH - Air Hammer			

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

JBS ENVIRONMENTAL	**Borehole No: BH17A-W**	**Project No:** 42180 **Client:** City of Sydney Council **Project Name:** South Sydney Hospital, NSW **Site Address:** 3 Joynton Ave, Zetland, NSW

Date: 17/07/2012
Contractor: Rockwell
Drill Rig: Geoprobe
Method: Solid Flight Auger
Total Hole Depth (mbgs): 0.3

Eastings (MGA): 334191.85
Northings (MGA): 6246575.82
Reference Level: GS
Elevation - Surface (m): 0
Bore Diameter (mm):

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
0.0		Ground Surface				
		FILL (FL) Gravelly silty SAND, dark brown, loose to medium density, damp, minor gravels, grass covering.	BH17A-W 0.1-0.2	0.1	D	
		End of Hole at 0.3 m bgs				
1.0						
2.0						
3.0						
4.0						
5.0						

Drilling Method	*Sample Type*	*Reference Level*	*Log Details*
HA - Hand Auger	*U - Undisturbed tube sample*	*AHD - Australian Height Datum*	*Logged By:* B. Regan
SFA - Solid Flight Auger	*D - Disturbed sample*	*BGS - Below Ground Surface*	*Project Manager:* T. Harding
HFA - Hollow Flight Auger	*CS - Core sample*		
PT - Push Tube			
AH - Air Hammer			

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

JBS ENVIRONMENTAL	**Borehole No: BH31**	**Project No:** 42180 **Client:** Sity of Sydney Council **Project Name:** South Sydney Hospital, NSW **Site Address:** 3 Joynton Ave, Zetland, NSW

Date: 16/07/2012
Contractor: JBS Environmental
Drill Rig: -
Method: Hand Auger
Total Hole Depth (mbgs): 0.5

Eastings (MGA): 334225.97
Northings (MGA): 6246567.80
Reference Level: GS
Elevation - Surface (m): 0
Bore Diameter (mm):

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
		Ground Surface				
0.0		**FILL (FL)** Gravelly SAND, grey and black, fine to coarse grained, loose, dry	BH31 0.0-0.1	0.6	D	
		FILL (FL) Gravelly SAND, grey and black, fine to coarse grained, loose, dry, increase in gravels.	BH31 0.4-0.5	0.3	D	
		End of Hole at 0.5 m bgs. Refusal on Sandstone.				
1.0						
2.0						
3.0						
4.0						
5.0						

Drilling Method	*Sample Type*	*Reference Level*	*Log Details*
HA - Hand Auger	*U - Undisturbed tube sample*	*AHD - Australian Height Datum*	*Logged By:* B. Regan
SFA - Solid Flight Auger	*D - Disturbed sample*	*BGS - Below Ground Surface*	*Project Manager:* T. Harding
HFA - Hollow Flight Auger	*CS - Core sample*		
PT - Push Tube			
AH - Air Hammer			

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

JBS ENVIRONMENTAL

Well No: BH32/MW5

Project No: 42180
Client: City of Sydney Council
Project Name: South Sydney Hospital, NSW
Site Address: 3 Joynton Ave, Zetland, NSW

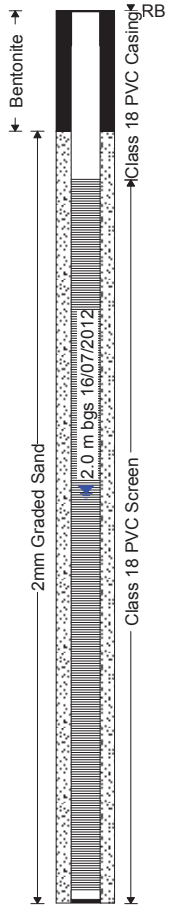
Date: 16/07/2012
Contractor: Rockwell
Drill Rig: Drilling Rig
Method: Soilid Flight Auger
Total Hole Depth (mbgs): 3.7

Eastings (MGA): 334172.81
Northings (MGA): 6246582.45
Reference Level: GS
Elevation: Surface (m) 0 **TOC (m):** 0.5
Bore Diameter (mm): 50

Water Level Initial (mbgs): 2.0
Water Level Static (mbgs):
Casing Type/Surface Finish: RB
Screen Diameter (mm): 50 **Screen Length (m):** 3
Casing Diameter (mm): 50 **Casing Length (m):** 0.7

Depth (m)	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
		Ground Surface				
0.0		**FILL (FL)** Concrete cover	0.1-0.2	30.1	D	Slight hydrocarbon odour and staining
		FILL (FL) Gravelly SAND, black, fine to coarse grained, angular to sub-angular gravels, loose, dry to damp.				
		FILL (FL) SAND, medium to coarse grained, grey to black with mottles of brown and white, loose to medium density, dry to damp.	0.5 -0.8	19.6	D	QC04/QC04A and Hydrocarbon odour
1.0		**FILL (FL)** SAND, brown and black, heterogeneous, fine to coarse grained, wet, loose to medium density.	1.0-1.1	0.1	D	
		SAND (SP) SAND, yellow, homogenous, fine to coarse grained, loose to medium density, wet.	1.5-1.6	0.1	D	
2.0		**SAND (SP)** As above, saturated.				
3.0		**End of Hole at 3.7 m bgs**				All sample ID's contain the prefix BH32/MW5
4.0						
5.0						

Well Construction



Method	*Sample Type*	*Reference Level*	*Casing Type/Surface Finish*	*Log Details*
HA - Hand Auger	*U - Undisturbed tube sample*	*AHD - Australian Height Datum*	*PVC 18 - Class 18 PVC*	*Logged By:* B. Regan
SFA - Solid Flight Auger	*D - Disturbed sample*	*BGS - Below Ground Surface*	*MT - Monument*	*Project Manager:* T. Harding
HFA - Hollow Flight Auger	*CS - Core sample*	*TOC - Top of Casing*	*RB - Roadbox*	
PT - Push Tube			*SP - Stickup/Standpipe*	
AH - Air Hammer				

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

JBS ENVIRONMENTAL	**Borehole No: BH33**	**Project No:** 42180 **Client:** City of Sydney Council **Project Name:** South Sydney Hospital, NSW **Site Address:** 3 Joynton Ave, Zetland, NSW

Date: 17/07/2012
Contractor: Rockwell
Drill Rig: Geoprobe
Method: Solid Flight Auger
Total Hole Depth (mbgs): 0.6

Eastings (MGA): 334179.13
Northings (MGA): 6246583.19
Reference Level: GS
Elevation - Surface (m): 0
Bore Diameter (mm):

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
0.0		Ground Surface				
		FILL (FL) Grass cover, silty SAND, fine to medium grained, loose, dry	BH33 0.1-0.2	0.1	D	
		End of Hole at 0.6 m bgs - Hit Water Main, hole ceased.				
1.0						
2.0						
3.0						
4.0						
5.0						

Drilling Method	*Sample Type*	*Reference Level*	*Log Details*
HA - Hand Auger	*U - Undisturbed tube sample*	*AHD - Australian Height Datum*	*Logged By:* B. Regan
SFA - Solid Flight Auger	*D - Disturbed sample*	*BGS - Below Ground Surface*	*Project Manager:* T. Harding
HFA - Hollow Flight Auger	*CS - Core sample*		
PT - Push Tube			
AH - Air Hammer			

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

Borehole No: BH34

Project No: 42180
Client: City of Sydney Council
Project Name: South Sydney Hospital, NSW
Site Address: 3 Joynton Ave, Zetland, NSW

Date: 17/07/2012
Contractor: Rockwell
Drill Rig: Geoprobe
Method: Solid Flight Auger
Total Hole Depth (mbgs): 3.0

Eastings (MGA): 334177.43
Northings (MGA): 6246587.47
Reference Level: GS
Elevation - Surface (m): 0
Bore Diameter (mm):

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
		Ground Surface				
0.0		**FILL (FL)** Concrete slab covering				
		FILL (FL) Gravelly SAND, grey and brown with black and red mottling, fine to coarse grained, loose to medium density, damp, angular to sub-angular coarse red brick gravels.	BH34 0.3-0.4	0.0	D	
1.0			BH34 1.3-1.4	0.0	D	
		FILL (FL) SAND, greyish brown, fine to coarse grained, medium density.	BH34 1.5-1.6	0.0	D	
2.0		**SAND (SP)** SAND, yellow, homogeneous, fine to coarse grained, medium density.	BH34 2.0-2.1	0.0	D	
		SAND (SP) Became saturated at 2.8 m bgs.				
3.0		**End of Hole at 3.0 m bgs**				
4.0						
5.0						

Drilling Method	*Sample Type*	*Reference Level*	*Log Details*
HA - Hand Auger	*U - Undisturbed tube sample*	*AHD - Australian Height Datum*	*Logged By:* B. Regan
SFA - Solid Flight Auger	*D - Disturbed sample*	*BGS - Below Ground Surface*	*Project Manager:* T. Harding
HFA - Hollow Flight Auger	*CS - Core sample*		
PT - Push Tube			
AH - Air Hammer			

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

JBS ENVIRONMENTAL	**Test Pit No: BH35**	**Project No:** 42180 **Client:** City of Sydney Council **Project Name:** South Sydney Hospital, NSW **Site Address:** 3 Joynton Ave, Zetland, NSW

Date: 10-07-2012
Contractor: Ken Coles
Excavation Plant: Excavator
Method: TP
Total Hole Depth (mbgs): 2.4

Eastings (MGA): 334171.99
Northings (MGA): 6246585.77
Reference Level: GS
Elevation - Surface (m): 0
Pit Dimension (m^3): 0.84

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
		Ground Surface				
0.0		**FILL (FL)** CONCRETE with re-enforced bar, and former UST pipes (electrical only).				
			BH35 0.2-0.3	0.6	D	
		FILL (FL) Gravelly SAND, yellow to brown, heterogeneous, dry, loose, fine to coarse, angular to subangular, includes bricks, plastic, wood and metal.				
			BH35 0.6-0.7	0.4	D	
		FILL (FL) Gravelly SAND, dark brown, heterogeneous, dry, loose, fine to coarse, angular, includes boulders, pipe and bricks.				
1.0						
2.0		**FILL (FL)** Gravelly SAND, orange to brown, heterogeneous, moist, loose, fine to coarse, angular to subangular.	BH35 1.9-2.0	0.3	D	Slight hydrocarbon odour.
			BH35 2.1-2.2	0.1	D	Water seepage at 2.2 m bgs.
		SAND (SW) SAND, white to grey, homogeneous, wet, loose.				
		End of Hole at 2.4 m bgs.				
3.0						
4.0						
5.0						

Method	*Sample Type*	*Reference Level*	*Log Details*
TP - Test Pit	*D - Disturbed sample*	*AHD - Australian Height Datum* *BGS - Below Ground Surface*	*Logged By:* B. Regan *Project Manager:* T. Harding

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

JBS ENVIRONMENTAL	**Test Pit No: BH36**	**Project No:** 42180 **Client:** City of Sydney Council **Project Name:** South Sydney Hospital, NSW **Site Address:** 3 Joynton Ave, Zetland, NSW

Date: 10-07-2012
Contractor: Ken Coles
Excavation Plant: Excavator
Method: TP
Total Hole Depth (mbgs): 2.3

Eastings (MGA): 334160.58
Northings (MGA): 6246587.67
Reference Level: GS
Elevation - Surface (m): 0
Pit Dimension (m^3): 0.805

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
		Ground Surface				
0.0		**CONCRETE SLAB**				
		FILL (FL) Gravelly silty SAND, brown, damp, loose, fine to coarse, includes black asphalt, brick and tile gravels.	BH36 0.3-0.4	0.2	D	
1.0		**FILL (FL)** SAND, white with black clayey inclusions, heterogeneous, damp, loose, fine to coarse.	BH36 0.9-1.0	0.0	D	
		FILL (FL) SAND, yellow to light brown, moist, fine to coarse.	BH36 1.4-1.5	0.0	D	
2.0		**End of Hole at 2.3 m bgs - Collapse, Water.**				Water seepage at 2.3 m bgs.
3.0						
4.0						
5.0						

Method	*Sample Type*	*Reference Level*	*Log Details*
TP - Test Pit	*D - Disturbed sample*	*AHD - Australian Height Datum* *BGS - Below Ground Surface*	*Logged By:* B. Regan *Project Manager:* T. Harding

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

Test Pit No: BH37

Project No: 42180
Client: City of Sydney Council
Project Name: South Sydney Hospital, NSW
Site Address: 3 Joynton Ave, Zetland, NSW

Date: 10-07-2012
Contractor: Ken Coles
Excavation Plant: Excavator
Method: TP
Total Hole Depth (mbgs): 1.2

Eastings (MGA): 334186.49
Northings (MGA): 6246559.56
Reference Level: GS
Elevation - Surface (m): 0
Pit Dimension (m^3): 0.42

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
		Ground Surface				
0.0		**FILL (FL)** SAND, dark brown, damp, loose, fine to coarse, includes minor gravels.	BH37 0.0-0.1	-	D	
		SAND (SW) SAND, yellow, homogeneous, loose, fine to coarse.	BH37 0.5-0.6	-	D	
1.0		**SAND (SW)** As above, saturated.	BH37 1.0-1.1	-	D	
		End of Hole at 1.2 m bgs - Hole Collapse.				
2.0						
3.0						
4.0						
5.0						

Method	*Sample Type*	*Reference Level*	*Log Details*
TP - Test Pit	*D - Disturbed sample*	*AHD - Australian Height Datum* *BGS - Below Ground Surface*	*Logged By:* B. Regan *Project Manager:* T. Harding

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

JBS ENVIRONMENTAL	**Test Pit No: BH38**	**Project No:** 42180 **Client:** City of Sydney Council **Project Name:** South Sydney Hospital, NSW **Site Address:** 3 Joynton Ave, Zetland, NSW

Date: 10-07-2012
Contractor: Ken Coles
Excavation Plant: Excavator
Method: TP
Total Hole Depth (mbgs): 3.1

Eastings (MGA): 334164.29
Northings (MGA): 6246553.37
Reference Level: GS
Elevation - Surface (m): 0
Pit Dimension (m^3): 2.17

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
		Ground Surface				
0.0		**FILL (FL)** Gravelly SAND, light brown, dry, loose, fine to coarse sands, includes bricks and tiles.	BH38 0.0-0.1	0.3	D	
		FILL (FL) Clayey gravelly SAND, dark brown, damp, loose, fine to coarse, includes brick gravels.	BH38 0.4-0.5	0.5	D	
		FILL (FL) Gravelly clayey SAND, black and yellow, damp, fine to medium.	BH38 0.7-0.8	0.6	D	
1.0		**FILL (FL)** SAND, light yellow, homogeneous, dry to damp, loose, fine to medium.	BH38 1.1-1.2	0.4	D	
		FILL (FL) Clayey SAND, black and yellow, fine to medium sands, includes minor gravels, medium dense.	BH38 1.8-1.9	0.8	D	
2.0		**SAND (SW)** SAND, white, homogeneous, wet, coarse to medium dense.				Water seepage at 2.8 m bgs.
3.0		**End of Hole at 3.1 m bgs - Hole Collapse to Water.**				
4.0						
5.0						

Method	*Sample Type*	*Reference Level*	*Log Details*
TP - Test Pit	*D - Disturbed sample*	*AHD - Australian Height Datum* *BGS - Below Ground Surface*	*Logged By:* B. Regan *Project Manager:* T. Harding

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

Test Pit No: BH40

Project No: 42180
Client: City of Sydney Council
Project Name: South Sydney Hospital, NSW
Site Address: 3 Joynton Ave, Zetland, NSW

Date: 10-07-2012
Contractor: Ken Coles
Excavation Plant: Excavator
Method: TP
Total Hole Depth (mbgs): 3.1

Eastings (MGA): 334174.44
Northings (MGA): 6246526.74
Reference Level: GS
Elevation - Surface (m): 0
Pit Dimension (m^3): 1.085

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
		Ground Surface				
0.0		**FILL (FL)** Gravelly SAND, yellow to grey with black and dark grey gravels, dry, loose, fine to coarse sand, includes plastic and bricks.	BH40 0.0-0.1	0.6	D	QC01/QC01/A
		FILL (FL) As above, less gravels.				
1.0		**FILL (FL)** Clayey SAND, light brown to yellow with dark brown patches of clay, dry, loose, fine to medium sand.	BH40 0.9-1.0	0.5	D	
2.0						
		SAND (SW) SAND, yellow, homogeneous, damp, loose, fine to coarse.	BH40 2.4-2.5	0.0	D	
3.0		**End of Hole at 3.4 m bgs.**				
4.0						
5.0						

Method	*Sample Type*	*Reference Level*	*Log Details*
TP - Test Pit	*D - Disturbed sample*	*AHD - Australian Height Datum* *BGS - Below Ground Surface*	*Logged By:* B. Regan *Project Manager:* T. Harding

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

Borehole No: BH55

Project No: 42180
Client: City of Sydney Council
Project Name: South Sydney Hospital, NSW
Site Address: 3 Joynton Ave, Zetland, NSW

Date: 17/07/2012
Contractor: JBS Environmental
Drill Rig: -
Method: Hand Auger
Total Hole Depth (mbgs): 0.2

Eastings (MGA): 334155.23
Northings (MGA): 6246570.87
Reference Level: GS
Elevation - Surface (m): 0
Bore Diameter (mm):

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
0.0		Ground Surface				
		FILL (FL) Silty CLAY topsoil with grass covering, brown, loose, dry.	BH55 0.1-0.2	0.0	D	
		FILL (FL) SAND, brown and grey, fine to coarse grained, medium density, damp.				
		End of Hole at 0.2 m bgs				
1.0						
2.0						
3.0						
4.0						
5.0						

Drilling Method	*Sample Type*	*Reference Level*	*Log Details*
HA - Hand Auger	*U - Undisturbed tube sample*	*AHD - Australian Height Datum*	*Logged By:* B. Regan
SFA - Solid Flight Auger	*D - Disturbed sample*	*BGS - Below Ground Surface*	*Project Manager:* T. Harding
HFA - Hollow Flight Auger	*CS - Core sample*		
PT - Push Tube			
AH - Air Hammer			

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

Test Pit No: BH20A

Project No: 42180
Client: City of Sydney Council
Project Name: South Sydney Hospital, NSW
Site Address: 3 Joynton Ave, Zetland, NSW

Date: 10-07-2012
Contractor: Ken Coles
Excavation Plant: Excavator
Method: TP
Total Hole Depth (mbgs): 2.3

Eastings (MGA): 334231.08
Northings (MGA): 6246584.16
Reference Level: GS
Elevation - Surface (m): 0
Pit Dimension (m^3): 0.805

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
		Ground Surface				
0.0		**GRASS COVER**				PID malfunction.
		FILL (FL) Silty CLAY, brown, dry, soft, low plasticity, includes tree roots.	BH20A 0.1-0.2	-	D	
			BH20A 0.2-0.3	-	D	
		FILL (FL) Silty CLAY, brown to black, dry, soft, low plasticity, includes gravels, bituminous gravels and bricks.				
		FILL (FL CLAY, red and yellow with black mottling, dry, soft, medium to high plasticity.	BH20A 0.7-0.8	-	D	QC02/QC02A
1.0		**FILL (FL)** Gravelly silty SAND, yellow and black, dry to damp, loose, fine to coarse sand, includes brick, metal, porcelain, terracotta and glass.	BH20A 1.1-1.2	-	D	
		SAND (SW) SAND, yellow, homogeneous, wet, loose, fine to coarse.				
2.0						Water seepage at 2.1 m bgs.
		End of Hole at 2.3 m bgs - Hole Collapse.				
3.0						
4.0						
5.0						

Method	*Sample Type*	*Reference Level*	*Log Details*
TP - Test Pit	*D - Disturbed sample*	*AHD - Australian Height Datum* *BGS - Below Ground Surface*	*Logged By:* B. Regan *Project Manager:* T. Harding

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

Test Pit No: BH20A-E

Project No: 42180
Client: City of Sydney Council
Project Name: South Sydney Hospital, NSW
Site Address: 3 Joynton Ave, Zetland, NSW

Date: 10-07-2012
Contractor: Ken Coles
Excavation Plant: Excavator
Method: TP
Total Hole Depth (mbgs): 0.2

Eastings (MGA): 334235.08
Northings (MGA): 6246583.68
Reference Level: GS
Elevation - Surface (m): 0
Pit Dimension (m^3): 0.07

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
		Ground Surface				
0.0		**FILL (FL)** Gravelly SAND, topsoil, brown to black, dry to damp, loose, fine to coarse, includes roots.	BH20A-E 0.1-0.2	-	D	
		End of Hole at 0.2 m bgs.				
1.0						
2.0						
3.0						
4.0						
5.0						

Method	*Sample Type*	*Reference Level*	*Log Details*
TP - Test Pit	*D - Disturbed sample*	*AHD - Australian Height Datum*	*Logged By:* B. Regan
		BGS - Below Ground Surface	*Project Manager:* T. Harding

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

Test Pit No: BH20A-N

Project No: 42180
Client: City of Sydney Council
Project Name: South Sydney Hospital, NSW
Site Address: 3 Joynton Ave, Zetland, NSW

Date: 10-07-2012
Contractor: Ken Coles
Excavation Plant: Excavator
Method: TP
Total Hole Depth (mbgs): 0.2

Eastings (MGA): 334185.94
Northings (MGA): 6246624.44
Reference Level: GS
Elevation - Surface (m): 0
Pit Dimension (m^3): 0.07

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
		Ground Surface				
0.0		**FILL (FL)** Gravelly SAND, topsoil, brown to black, heterogeneous, dry, fine to coarse, angular to subangular.	BH20A-N 0.1-0.2	-	D	
		End of Hole at 0.2 m bgs.				
1.0						
2.0						
3.0						
4.0						
5.0						

Method	*Sample Type*	*Reference Level*	*Log Details*
TP - Test Pit	*D - Disturbed sample*	*AHD - Australian Height Datum*	*Logged By:* B. Regan
		BGS - Below Ground Surface	*Project Manager:* T. Harding

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

Test Pit No: BH20A-S

Project No: 42180
Client: City of Sydney Council
Project Name: South Sydney Hospital, NSW
Site Address: 3 Joynton Ave, Zetland, NSW

Date: 10-07-2012
Contractor: Ken Coles
Excavation Plant: Excavator
Method: TP
Total Hole Depth (mbgs): 0.2

Eastings (MGA): 334231.02
Northings (MGA): 6246580.32
Reference Level: GS
Elevation - Surface (m): 0
Pit Dimension (m^3): 0.07

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
		Ground Surface				
0.0		**FILL (FL)** Gravelly SAND, topsoil, brown to black, loose, dry to damp, fine to coarse, angular to subangular.	BH20A-S 0.1-0.2	-	D	
		End of Hole at 0.2 m bgs.				
1.0						
2.0						
3.0						
4.0						
5.0						

Method	*Sample Type*	*Reference Level*	*Log Details*
TP - Test Pit	*D - Disturbed sample*	*AHD - Australian Height Datum*	*Logged By:* B. Regan
		BGS - Below Ground Surface	*Project Manager:* T. Harding

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

Test Pit No: BH20A-W

Project No: 42180
Client: City of Sydney Council
Project Name: South Sydney Hospital, NSW
Site Address: 3 Joynton Ave, Zetland, NSW

Date: 10-07-2012
Contractor: Ken Coles
Excavation Plant: Excavator
Method: TP
Total Hole Depth (mbgs): 0.2

Eastings (MGA): 334226.97
Northings (MGA): 6246584.46
Reference Level: GS
Elevation - Surface (m): 0
Pit Dimension (m^3): 0.07

SUBSURFACE PROFILE			SAMPLE			
Depth	Graphic Log	Lithologic Description	Sample ID	PID (ppm)	Sample Type	Comments
0.0		Ground Surface				
		FILL (FL) Gravelly SAND, topsoil, brown to black, heterogeneous, dry, fine to coarse, angular to subangular, includes brick fragments.	BH20A-W 0.1-0.2	-	D	
		End of Hole at 0.2 m bgs.				
1.0						
2.0						
3.0						
4.0						
5.0						

Method	*Sample Type*	*Reference Level*	*Log Details*
TP - Test Pit	*D - Disturbed sample*	*AHD - Australian Height Datum*	*Logged By:* B. Regan
		BGS - Below Ground Surface	*Project Manager:* T. Harding

NOTE: This bore log is for environmental assessment purposes only and is not intended to provide geotechnical information

ENVIRONMENTAL INVESTIGATION SERVICES

CONSULTING ENVIRONMENTAL ENGINEERS

ENVIRONMENTAL LOG

Test Pit No.
308
1/1

Environmental logs are not to be used for geotechnical purposes

Client: CITY OF SYDNEY

Project: PROPOSED COMMUNITY AND CHILDCARE CENTRES

Location: CNR. JOYNTON AVENUE & PORTMAN STREET, ZETLAND, NSW

Job No. E27359K **Method:** HAND TOOLS **R.L. Surface:** N/A

Date: 19-11-14 **Datum:**

Logged/Checked by: G.F./A.K.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ABS	SAMPLES SAL	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■			0			FILL: Silty sand, fine to medium grained, brown, trace of ash, slag, fibres cement fragments, concrete, brick and fine to medium grained igneous gravel.	D			
						0.5			END OF TEST PIT AT 0.4m				TEST PIT TERMINATED DUE TO BURIED FCF SHEET AT BASE
						1							
						1.5							
						2							
						2.5							
						3							
						3.5							

ENVIRONMENTAL INVESTIGATION SERVICES

CONSULTING ENVIRONMENTAL ENGINEERS

ENVIRONMENTAL LOG

Test Pit No. **309** **1/1**

Environmental logs are not to be used for geotechnical purposes

Client: CITY OF SYDNEY

Project: PROPOSED COMMUNITY AND CHILDCARE CENTRES

Location: CNR. JOYNTON AVENUE & PORTMAN STREET, ZETLAND, NSW

Job No. E27359K **Method:** HAND TOOLS **R.L. Surface:** N/A

Date: 19-11-14 **Datum:**

Logged/Checked by: G.F./A.K.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ABS	SAMPLES SAL	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■			0			FILL: Silty sand, fine to medium grained, brown, trace of metal, brick, concrete, tile, ash, slag and fine to medium grained igneous gravel.	D			GRASS COVER
						0.5			END OF TEST PIT AT 0.5m				
						1							
						1.5							
						2							
						2.5							
						3							
						3.5							

ENVIRONMENTAL INVESTIGATION SERVICES

CONSULTING ENVIRONMENTAL ENGINEERS

ENVIRONMENTAL LOG

Test Pit No. **310** **1/1**

Environmental logs are not to be used for geotechnical purposes

Client: CITY OF SYDNEY

Project: PROPOSED COMMUNITY AND CHILDCARE CENTRES

Location: CNR. JOYNTON AVENUE & PORTMAN STREET, ZETLAND, NSW

Job No. E27359K **Method:** HAND TOOLS **R.L. Surface:** N/A

Date: 19-11-14 **Datum:**

Logged/Checked by: G.F./A.K.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ABS	SAMPLES SAL	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION						0			FILL: Silty sand, fine to medium grained, light brown, with fine to coarse grained igneous gravel, bricks, tiles, concrete and asphalt fragments.	D			GRASS COVER
								SM	SILTY SAND: fine to medium grained, light brown.	D			
						0.5			END OF TEST PIT AT 0.5m				
						1							
						1.5							
						2							
						2.5							
						3							
						3.5							

ENVIRONMENTAL INVESTIGATION SERVICES

CONSULTING ENVIRONMENTAL ENGINEERS

ENVIRONMENTAL LOG

Test Pit No. **311** **1/1**

Environmental logs are not to be used for geotechnical purposes

Client: CITY OF SYDNEY

Project: PROPOSED COMMUNITY AND CHILDCARE CENTRES

Location: CNR. JOYNTON AVENUE & PORTMAN STREET, ZETLAND, NSW

Job No. E27359K **Method:** HAND TOOLS **R.L. Surface:** N/A

Date: 19-11-14 **Datum:**

Logged/Checked by: G.F./A.K.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ABS	SAMPLES SAL	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■			0			FILL: Silty gravelly sand, fine to medium grained, light brown, fine to coarse grained concrete, brick and tile, igneous gravel, trace of steel.	D			REFUSAL ON SUSPECTED CONCRETE SLAB
									END OF TEST PIT AT 0.1m				
						0.5							
						1							
						1.5							
						2							
						2.5							
						3							
						3.5							

ENVIRONMENTAL INVESTIGATION SERVICES

CONSULTING ENVIRONMENTAL ENGINEERS

ENVIRONMENTAL LOG

Test Pit No. **312** **1/1**

Environmental logs are not to be used for geotechnical purposes

Client: CITY OF SYDNEY

Project: PROPOSED COMMUNITY AND CHILDCARE CENTRES

Location: CNR. JOYNTON AVENUE & PORTMAN STREET, ZETLAND, NSW

Job No. E27359K **Method:** HAND TOOLS **R.L. Surface:** N/A

Date: 19-11-14 **Datum:**

Logged/Checked by: G.F./A.K.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ABS	SAMPLES SAL	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■			0			FILL: Gravelly silty sand, fine to medium grained, brown, fine to coarse grained igneous, concrete, brick, tile and glass, trace of ash and clay nodules.	D			
						0.5			END OF TEST PIT AT 0.4m				HAND TOOLS REFUSAL
						1							
						1.5							
						2							
						2.5							
						3							
						3.5							

ENVIRONMENTAL INVESTIGATION SERVICES

CONSULTING ENVIRONMENTAL ENGINEERS

ENVIRONMENTAL LOG

Test Pit No. **313** **1/1**

Environmental logs are not to be used for geotechnical purposes

Client: CITY OF SYDNEY

Project: PROPOSED COMMUNITY AND CHILDCARE CENTRES

Location: CNR. JOYNTON AVENUE & PORTMAN STREET, ZETLAND, NSW

Job No. E27359K **Method:** HAND TOOLS **R.L. Surface:** N/A

Date: 19-11-14 **Datum:**

Logged/Checked by: G.F./A.K.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ABS	SAMPLES SAL	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLET-ION	■		■			0	XXXX		FILL: Gravelly silty sand, fine to medium grained, brown, fine to coarse grained igneous, concrete, brick, tile and glass, trace of ash and clay nodules.	D			HAND TOOLS REFUSAL ON CONCRETE SLAB
									END OF TEST PIT AT 0.05m				
						0.5							
						1							
						1.5							
						2							
						2.5							
						3							
						3.5							

ENVIRONMENTAL INVESTIGATION SERVICES

CONSULTING ENVIRONMENTAL ENGINEERS

ENVIRONMENTAL LOG

Test Pit No. **314** **1/1**

Environmental logs are not to be used for geotechnical purposes

Client: CITY OF SYDNEY

Project: PROPOSED COMMUNITY AND CHILDCARE CENTRES

Location: CNR. JOYNTON AVENUE & PORTMAN STREET, ZETLAND, NSW

Job No. E27359K **Method:** HAND TOOLS **R.L. Surface:** N/A

Date: 19-11-14 **Datum:**

Logged/Checked by: G.F./A.K.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ABS	SAMPLES SAL	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■			0			FILL: Silty sandy gravel, fine to coarse grained, brick, concrete, tile and igneous gravel, red brown and brown, trace of glass and plastic.	D			
									FILL: Sand, fine to medium grained, yellow brown, trace of fine to coarse grained igneous and sandstone gravel.	M			
						0.5			END OF TEST PIT AT 0.5m				
						1							
						1.5							
						2							
						2.5							
						3							
						3.5							

ENVIRONMENTAL INVESTIGATION SERVICES

CONSULTING ENVIRONMENTAL ENGINEERS

ENVIRONMENTAL LOG

Test Pit No. **315** **1/1**

Environmental logs are not to be used for geotechnical purposes

Client: CITY OF SYDNEY

Project: PROPOSED COMMUNITY AND CHILDCARE CENTRES

Location: CNR. JOYNTON AVENUE & PORTMAN STREET, ZETLAND, NSW

Job No. E27359K **Method:** HAND TOOLS **R.L. Surface:** N/A

Date: 19-11-14 **Datum:**

Logged/Checked by: G.F./A.K.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ABS	SAMPLES SAL	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■			0			FILL: Silty sandy gravel, fine to coarse grained, brick, concrete, tile and igneous gravel, red brown and brown, trace of glass and plastic.	D			
									FILL: Sand, fine to medium grained, yellow brown, trace of fine to coarse grained igneous and sandstone gravel.	M			
						0.5			END OF TEST PIT AT 0.5m				
						1							
						1.5							
						2							
						2.5							
						3							
						3.5							

ENVIRONMENTAL INVESTIGATION SERVICES

CONSULTING ENVIRONMENTAL ENGINEERS

ENVIRONMENTAL LOG

Test Pit No. **316** **1/1**

Environmental logs are not to be used for geotechnical purposes

Client: CITY OF SYDNEY

Project: PROPOSED COMMUNITY AND CHILDCARE CENTRES

Location: CNR. JOYNTON AVENUE & PORTMAN STREET, ZETLAND, NSW

Job No. E27359K **Method:** HAND TOOLS **R.L. Surface:** N/A

Date: 19-11-14 **Datum:**

Logged/Checked by: G.F./A.K.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ABS	SAMPLES SAL	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■			0			FILL: Silty sandy gravel, fine to coarse grained, brick, concrete, tile and igneous gravel, red brown and brown, trace of glass and plastic.	D			
									FILL: Sand, fine to medium grained, yellow brown, trace of fine to coarse grained igneous and sandstone gravel.	M			
						0.5			END OF TEST PIT AT 0.5m				
						1							
						1.5							
						2							
						2.5							
						3							
						3.5							

ENVIRONMENTAL INVESTIGATION SERVICES

CONSULTING ENVIRONMENTAL ENGINEERS

ENVIRONMENTAL LOG

Test Pit No. **317** **1/1**

Environmental logs are not to be used for geotechnical purposes

Client: CITY OF SYDNEY

Project: PROPOSED COMMUNITY AND CHILDCARE CENTRES

Location: CNR. JOYNTON AVENUE & PORTMAN STREET, ZETLAND, NSW

Job No. E27359K **Method:** HAND TOOLS **R.L. Surface:** N/A

Date: 19-11-14 **Datum:**

Logged/Checked by: G.F./A.K.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ABS	SAMPLES SAL	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■			0			FILL: Silty sandy gravel, fine to coarse grained, brick, concrete, tile and igneous gravel, red brown and brown, trace of glass and plastic.	D			
									FILL: Sand, fine to medium grained, yellow brown, trace of fine to coarse grained igneous and sandstone gravel.	M			
						0.5			END OF TEST PIT AT 0.5m				
						1							
						1.5							
						2							
						2.5							
						3							
						3.5							

Environmental Investigation Services

CONSULTING ENVIRONMENTAL ENGINEERS AND SCIENTISTS

Borehole No. 2
1 / 1

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Client: TZANNES ASSOCIATES PTY LTD
Project: PROPOSED NEW SCHOOL
Location: 3 JOYNTON AVENUE (PART LOT 2 DP1174641), ZETLAND, NSW

Job No.: E31170KP **Method:** SPIRAL AUGER **R.L. Surface:** ~18.2 m
Date: 29/1/18 **Datum:** AHD
Plant Type: JK250 **Logged/Checked By:** J.D.C./B.P.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Well Details	Remarks and Well Details
DRY ON COMPLETION							18				ASPHALTIC CONCRETE: 50mm.t	M				Concrete Gatic Cover
						N = 10 6,5,5					FILL: Silty sand, fine to medium grained, brown, with fine to coarse grained igneous gravel.					
							17	1			FILL: Silty sand, fine to medium grained, brown, trace of ash.					Cuttings
											FILL: Silty sand, fine to medium grained, dark grey with ash and slag.					
						N = 7 4,3,4				SM	SILTY SAND: fine to medium grained, dark brown.	M				Bentonite Seal Bentonite
							16	2			SILTY SAND: fine to medium grained, light brown.	M				2mm Sand Sand
AFTER 24 HRS						N = 8 5,4,4	15	3			as above, but light grey.	W				
							14	4								Machine Slotted Well Screen, 2mm sand filter pack Sand
							13	5								
							12	6			END OF ENVIRONMENTAL HOLE AT 6.00 m					Bottom Cap at Base

Environmental Investigation Services

CONSULTING ENVIRONMENTAL ENGINEERS AND SCIENTISTS

Borehole No. 1
1 / 1

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Client: TZANNES ASSOCIATES PTY LTD
Project: PROPOSED NEW SCHOOL
Location: 3 JOYNTON AVENUE (PART LOT 2 DP1174641), ZETLAND, NSW

Job No.: E31170KP **Method:** SPIRAL AUGER **R.L. Surface:** ~17.7 m
Date: 29/1/18 **Datum:** AHD
Plant Type: JK250 **Logged/Checked By:** J.D.C./B.P.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	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: Silty sand, fine to medium grained, brown, with fine to coarse igneous gravel, trace of ash.	M			
						N=SPT 7/ 150mm REFUSAL	17	1			END OF ENVIRONMENTAL HOLE AT 0.65 m				BH TERMINATED DUE TO UNDERGROUND SERVICE (SUSPECTED TO BE REDUNDANT)
							16	2							
							15	3							
							14	4							
							13	5							
							12	6							
							11								

Environmental Investigation Services

CONSULTING ENVIRONMENTAL ENGINEERS AND SCIENTISTS

Borehole No. 4
1 / 1

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Client: TZANNES ASSOCIATES PTY LTD
Project: PROPOSED NEW SCHOOL
Location: 3 JOYNTON AVENUE (PART LOT 2 DP1174641), ZETLAND, NSW

Job No.: E31170KP **Method:** SPIRAL AUGER **R.L. Surface:** ~18.9 m
Date: 29/1/18 **Datum:** AHD
Plant Type: JK250 **Logged/Checked By:** J.D.C./B.P.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	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: Silty sand, fine to medium grained, brown, with fine to coarse grained igneous gravel and concrete fragments.	M			GRASS COVER
						N = 14 3,9,5	18	1							
											END OF ENVIRONMENTAL HOLE AT 1.00 m				'TC' BIT REFUSAL ON CONCRETE 3 x ATTEMPTS
							17	2							
							16	3							
							15	4							
							14	5							
							13	6							
							12								

JK 9.00.5.LIB.GLB Log JK AUGERHOLE - MASTER E31170KP ZETLAND.GPJ <<DrawingFile>> 27/02/2018 10:54 10.0.000 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.00.5 2018-01-11 Prj: JK 9.00.5 2018-01-11

Environmental Investigation Services

CONSULTING ENVIRONMENTAL ENGINEERS AND SCIENTISTS

Borehole No. 3
1 / 1

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Client: TZANNES ASSOCIATES PTY LTD
Project: PROPOSED NEW SCHOOL
Location: 3 JOYNTON AVENUE (PART LOT 2 DP1174641), ZETLAND, NSW

Job No.: E31170KP **Method:** SPIRAL AUGER **R.L. Surface:** ~18.5 m
Date: 29/1/18 **Datum:** AHD
Plant Type: JK250 **Logged/Checked By:** J.D.C./B.P.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	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: Silty sand, fine to medium grained, brown.	D			GRASS COVER
							18	1			END OF ENVIRONMENTAL HOLE AT 0.40 m				'TC' BIT REFUSAL ON CONCRETE 3 x ATTEMPTS
							17	2							
							16	3							
							15	4							
							14	5							
							13	6							
							12								

JK 9.00.5.LIB.GLB Log JK AUGERHOLE - MASTER E31170KP ZETLAND.GPJ <<DrawingFile>> 27/02/2018 10:54 10.0.000 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.00.5 2018-01-11 Prj: JK 9.00.5 2018-01-11

Environmental Investigation Services

CONSULTING ENVIRONMENTAL ENGINEERS AND SCIENTISTS

Borehole No. 6 1 / 1

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Client: TZANNES ASSOCIATES PTY LTD

Project: PROPOSED NEW SCHOOL

Location: 3 JOYNTON AVENUE (PART LOT 2 DP1174641), ZETLAND, NSW

Job No.: E31170KP **Method:** SPIRAL AUGER **R.L. Surface:** ~18.9 m

Date: 29/1/18 **Datum:** AHD

Plant Type: JK250 **Logged/Checked By:** J.D.C./B.P.

Groundwater Record	SAMPLES ES	ASS	ASB	SAL	DB	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: Gravel, medium to coarse grained, grey, angular, igneous, with fine to medium grained sand.	D			
						N=SPT 8/ 150mm REFUSAL	18	1			FILL: Silty sand, fine to medium grained, light brown, with concrete and brick fragments.	D			3 ATTEMPTS REFUSAL 0.5m 0.8m 1.8m
						N > 22 6,8,14/ 300mm REFUSAL	17	2			END OF ENVIRONMENTAL HOLE AT 1.80 m				'TC' BIT REFUSAL
							16	3							
							15	4							
							14	5							
							13	6							
							12								

JK 9.00.5 LIB.GLB Log JK AUGERHOLE - MASTER E31170KP ZETLAND.GPJ <<DrawingFile>> 27/02/2018 10:54 10.0.000 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.00.5 2018-01-11 | Prj: JK 9.00.5 2018-01-11

Environmental Investigation Services

CONSULTING ENVIRONMENTAL ENGINEERS AND SCIENTISTS

Borehole No. 5 1 / 1

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Client: TZANNES ASSOCIATES PTY LTD

Project: PROPOSED NEW SCHOOL

Location: 3 JOYNTON AVENUE (PART LOT 2 DP1174641), ZETLAND, NSW

Job No.: E31170KP **Method:** SPIRAL AUGER **R.L. Surface:** ~18.7 m

Date: 29/1/18 **Datum:** AHD

Plant Type: JK250 **Logged/Checked By:** J.D.C./B.P.

Groundwater Record	SAMPLES ES	ASS	ASB	SAL	DB	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: Silty sand, fine to medium grained, light brown, with concrete and brick fragments, trace of slag.	D			
						N > 13/ 300mm REFUSAL	18	1							
						N = 13 6,6,7	17	2		SM	SILTY SAND: fine to medium grained, grey.	M			
AFTER 24 HRS							16	3			as above, but light grey.	W			
						N = 11 10,8,3	15	4							GROUNDWATER MONITORING WELL INSTALLED TO 6.0m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 6.0m TO 3.0m. CASING 3.0m TO 0m. 2mm SAND FILTER PACK TO 2.4m. BENTONITE SEAL 2.4m TO 1.9m. BACKFILLED WITH SAND TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.
						N = 13 4,7,6	14	5							
							13	6			END OF ENVIRONMENTAL HOLE AT 6.00 m				
							12								

JK 9.00.5 LIB.GLB Log JK AUGERHOLE - MASTER E31170KP ZETLAND.GPJ <<DrawingFile>> 27/02/2018 10:54 10.0.000 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.00.5 2018-01-11 | Prj: JK 9.00.5 2018-01-11

Environmental Investigation Services

CONSULTING ENVIRONMENTAL ENGINEERS AND SCIENTISTS

Borehole No. 8 1 / 1

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Client: TZANNES ASSOCIATES PTY LTD

Project: PROPOSED NEW SCHOOL

Location: 3 JOYNTON AVENUE (PART LOT 2 DP1174641), ZETLAND, NSW

Job No.: E31170KP **Method:** SPIRAL AUGER **R.L. Surface:** ~18.3 m

Date: 30/1/18 **Datum:** AHD

Plant Type: JK250 **Logged/Checked By:** J.D.C./B.P.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	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							18				FILL: Silty sand, fine to medium grained, brown, with concrete fragments, trace of fine to medium grained igneous gravel, and ash.	M			
						N = 13 4,6,7		1			FILL: Silty sand, fine to medium grained, brown, trace of ash.				
							17			SM	SILTY SAND: fine to medium grained, grey, trace of ash.	M			
						N = 12 4,6,6		2							
							16			SP	SAND: fine to medium grained, yellow brown.				
						N = 20 6,9,11	15	3			as above, but light grey.				
											END OF ENVIRONMENTAL HOLE AT 3.45 m				
							14	4							
							13	5							
							12	6							

JK 9.00.5 LIB.GLB Log JK AUGERHOLE - MASTER E31170KP ZETLAND.GPJ <<DrawingFile>> 27/02/2018 10:54 10.0.000 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.00.5 2018-01-11 Prj: JK 9.00.5 2018-01-11

Environmental Investigation Services

CONSULTING ENVIRONMENTAL ENGINEERS AND SCIENTISTS

Borehole No. 7 1 / 1

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Client: TZANNES ASSOCIATES PTY LTD

Project: PROPOSED NEW SCHOOL

Location: 3 JOYNTON AVENUE (PART LOT 2 DP1174641), ZETLAND, NSW

Job No.: E31170KP **Method:** SPIRAL AUGER **R.L. Surface:** ~18.5 m

Date: 30/1/18 **Datum:** AHD

Plant Type: JK250 **Logged/Checked By:** J.D.C./B.P.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
							18				FILL: Sandy gravel, medium to coarse grained, grey, angular, igneous.				
						N = 12 4,6,6		1			FILL: Silty sand, fine to coarse grained, brown, with concrete and brick fragments, trace of ash.				
						N=SPT 8/ 150mm REFUSAL	17	2							
							16	3		SP	SAND: fine to medium grained, yellow brown.				
						N = 15 5,7,8	15	4		SM	SILTY SAND: fine to medium grained, light grey.				
						N = 3 2,1,2	14								
							13	5			END OF ENVIRONMENTAL HOLE AT 4.95 m				
							12	6							

JK 9.00.5 LIB.GLB Log JK AUGERHOLE - MASTER E31170KP ZETLAND.GPJ <<DrawingFile>> 27/02/2018 10:54 10.0.000 Datgel Lab and In Situ Tool - DGD | Lib: JK 9.00.5 2018-01-11 Prj: JK 9.00.5 2018-01-11

EXPLANATORY NOTES – ENVIRONMENTAL LOGS

INTRODUCTION

These notes have been provided to supplement the environmental report with regards to drilling and field logging. 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 manmade processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Environmental studies involve gathering and assimilating limited facts about these characteristics and properties in order to understand the ground on a particular site under certain conditions. These conditions 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, the SAA Site Investigation Code. 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 geotechnical practice.

Soil types are described according to the predominating particle size and behaviour as set out in the attached Unified Soil Classification Table qualified by the grading of other particles present (e.g. sandy clay) as set out below (note that unless stated in the report, the soil classification is based on a qualitative field assessment, not laboratory testing):

Soil Classification	Particle Size
Clay	less than 0.002mm
Silt	0.002 to 0.075mm
Sand	0.075 to 2mm
Gravel	2 to 60mm

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	less than 4
Loose	4 – 10
Medium dense	10 – 30
Dense	30 – 50
Very Dense	greater than 50

Cohesive soils are classified on the basis of strength (consistency) either by use of hand penetrometer, laboratory testing or engineering examination. The strength terms are defined as shown in the following table:

Environmental Investigation Services

CONSULTING ENVIRONMENTAL ENGINEERS AND SCIENTISTS

Borehole No. 9
1 / 1

ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Client: TZANNES ASSOCIATES PTY LTD
Project: PROPOSED NEW SCHOOL
Location: 3 JOYNTON AVENUE (PART LOT 2 DP1174641), ZETLAND, NSW

Job No.: E31170KP **Method:** SPIRAL AUGER **R.L. Surface:** ~19.0 m
Date: 30/1/18 **Datum:** AHD
Plant Type: JK250 **Logged/Checked By:** J.D.C./B.P.

Groundwater Record	SAMPLES ES	SAMPLES ASS	SAMPLES ASB	SAMPLES SAL	SAMPLES DB	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						N = 8 6,4,4	18	1			FILL: Silty gravelly sand, fine to medium grained, brown, fine to coarse grained igneous gravel, trace of ash. FILL: Silty sand, fine to medium grained, yellow brown, trace of igneous gravel.	D			
						N = 9 4,5,4	17	2							
						N = 20 8,10,10	16	3		SP	SAND: fine to medium grained, yellow brown.	M			
AFTER 1 HR							15	4			SAND: fine to medium gained, light grey.	W			GROUNDWATER MONITORING WELL INSTALLED TO 5.9m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 5.9m TO 2.9m. CASING 2.9m TO 0m. 2mm SAND FILTER PACK TO 3.0m. BENTONITE SEAL 3.0m TO 2.0m. BACKFILLED WITH SAND TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.
						N = 22 8,13,9	14	5							
							13	6			END OF ENVIRONMENTAL HOLE AT 6.00 m				

AECOM Australia Pty Ltd
Level 21, 420 George Street
Sydney, NSW 2000

TEST PIT LOG CPTP_E

PROJECT NUMBER 60300384 **DATE** 20 Jun 18
PROJECT NAME City of Sydney - Green Square Town Centre Package 4A
LOCATION Proposed Carpark Zetland Avenue Mid
DRILLING METHOD Excavator
SAMPLING METHOD Grab

LOGGED BY Lachlan Lewis
SITE Zetland Ave Mid Carpark, east side of UST

PID (ppm)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGS)	GRAPHIC LOG	USCS CLASS	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
		CPTP_E_0.1				FILL	FILL: Silty gravelly SAND; medium grained, grey, sub-angular gravel, trace organics (roots), trace brick and tile fragments, loose to medium dense, moist, no odour or staining. Potential asbestos fragments noted on the ground surface.	0.00
				0.5				
				1.0				
1.9		CPTP_E_1.4	✳					1.40
						CONCRETE	Refusal on concrete. End of investigation. Total Depth: 1.40 m	

60300384_TEST PITS CAR PARK UST 180620.GPJ 29/6/18

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Level 21, 420 George Street
Sydney, NSW 2000

TEST PIT LOG CPTP_N

PROJECT NUMBER 60300384 **DATE** 20 Jun 18
PROJECT NAME City of Sydney - Green Square Town Centre Package 4A
LOCATION Proposed Carpark Zetland Avenue Mid
DRILLING METHOD Excavator
SAMPLING METHOD Grab

LOGGED BY Lachlan Lewis
SITE Zetland Ave Mid Carpark, north side of UST

PID (ppm)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGS)	GRAPHIC LOG	USCS CLASS	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
				0		FILL	FILL: Silty gravelly SAND; medium grained, grey, sub-angular gravel, trace organics (roots), trace brick and tile fragments, loose to medium dense, moist, no odour or staining.	
1.5		CPTP_N_1.2	✳	1.0				
1.8		CPTP_N_2.5	✳	2.5			End of investigation (target depth). Total Depth: 2.50 m	2.50

60300384_TEST PITS CAR PARK UST 180620.GPJ 29/6/18

AECOM Australia Pty Ltd
Level 21, 420 George Street
Sydney, NSW 2000

TEST PIT LOG CPTP_W

PROJECT NUMBER 60300384 **DATE** 20 Jun 18
PROJECT NAME City of Sydney - Green Square Town Centre Package 4A
LOCATION Proposed Carpark Zetland Avenue Mid
DRILLING METHOD Excavator
SAMPLING METHOD Grab

LOGGED BY Lachlan Lewis
SITE Zetland Ave Mid Carpark, west side of UST

PID (ppm)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGS)	GRAPHIC LOG	USCS CLASS	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
		CPTP_W_0.1				FILL	FILL: Silty gravelly SAND; medium grained, grey, sub-angular gravel, trace organics (roots), trace brick and tile fragments, loose to medium dense, moist, no odour or staining. Potential asbestos fragments noted on the ground surface.	0.00
				0.5				
				1.0				
2		CPTP_W_1.2	✳					
				1.5				
				2.0				
1.8		CPTP_W_2.5	✳	2.5			End of investigation (target depth). Total Depth: 2.50 m	2.50

Appendix E Photo Log

PHOTOGRAPH 1: COMMUNITY HALL FACING EAST

PHOTOGRAPH 2: INTERIOR OF COMMUNITY HALL

PHOTOGRAPH 3: INTERIOR OF COMMUNITY HALL

PHOTOGRAPH 4: INTERIOR OF COMMUNITY HALL

JBS&G

Job No: 58719	
Client: School Infrastructure	
Version: R01 Rev 0	Date: 15/06/2020
Drawn By: SG	Checked By: JR
Not to Scale	
Coord. Sys n/a	

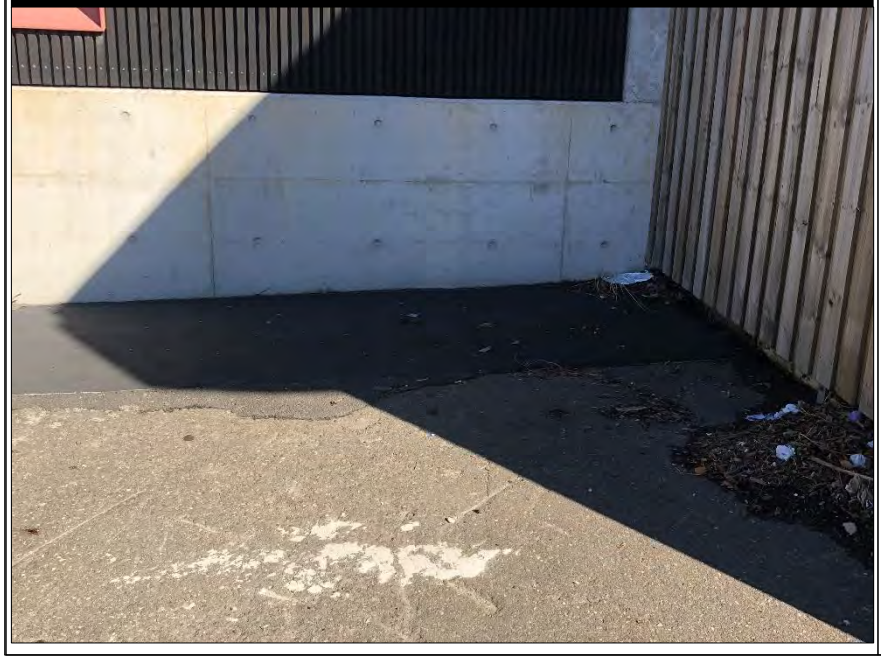
3 Joynton Avenue, Zetland NSW

APPENDIX E

PHOTOGRAPH 5: NORTHERN CARPARK POTENTIAL UST AREA

PHOTOGRAPH 6: NORTHERN CARPARK FACING WEST

PHOTOGRAPH 7: LOCATION OF GROUNDWATER MONITORING WELL MW2 (EIS 2018) IN SOUTH EASTERN EXTENT OF CARPARK



PHOTOGRAPH 8: NORTHERN CARPARK FACING EAST

JBS&G

Job No: 58719	
Client: School Infrastructure	
Version: R01 Rev 0	Date: 15/06/2020
Drawn By: SG	Checked By: JR
Not to Scale	
Coord. Sys n/a	

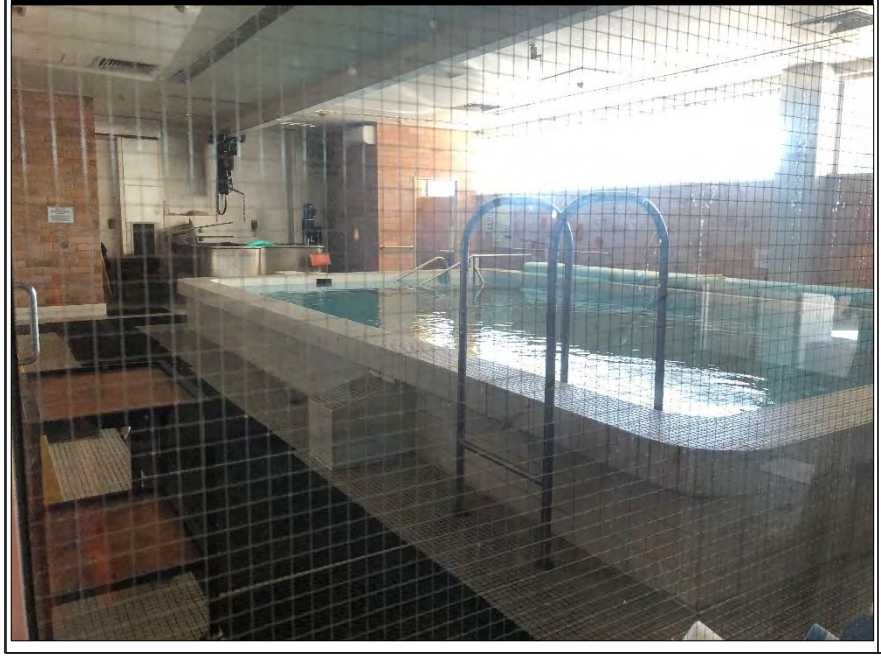
3 Joynton Avenue, Zetland NSW

APPENDIX F

PHOTOGRAPH 9: NAOMI WING REHABILITATION BUILDING VIEW FROM NORTHERN CARPARK FACING SOUTHEAST

PHOTOGRAPH 10: NAOMI WING REHABILITATION BUILDING

PHOTOGRAPH 11: NAOMI WING REHABILITATION BUILDING HYDROTHERAPY POOL LOCATED ON GROUND FLOOR



PHOTOGRAPH 12: NAOMI WING REHABILITATION BUILDING BASEMENT PLANT ROOM

JBS&G

Job No: 58719	
Client: School Infrastructure	
Version: R01 Rev 0	Date: 15/06/2020
Drawn By: SG	Checked By: JR
Not to Scale	
Coord. Sys n/a	
3 Joynton Avenue, Zetland NSW	
APPENDIX F	

PHOTOGRAPH 13: NAOMI WING REHABILITATION BUILDING VIEW FROM TEMPORARY CARPARK FACING NORTHEAST

PHOTOGRAPH 14: SUBSTATION ADJACENT TO NAOMI WING REHABILITATION BUILDING

PHOTOGRAPH 15: BRICK RETAINING WALL TO THE SOUTH OF SUBSTATION

PHOTOGRAPH 16: FENCED AREA TO THE SOUTH OF NAOMI WING REHABILITATION BUILDING INCLUDING SUBSTATION

JBS&G

Job No: 58719

Client: School Infrastructure

Version: R01 Rev 0 | Date: 15/06/2020

Drawn By: SG | Checked By: JR

Not to Scale

Coord. Sys n/a

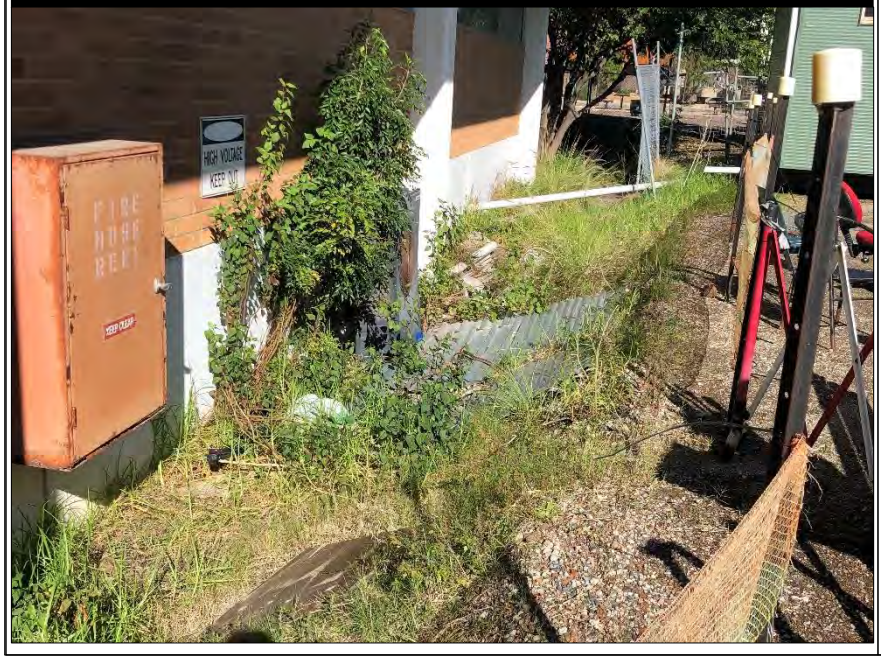
3 Joynton Avenue, Zetland NSW

APPENDIX F

PHOTOGRAPH 17: TEMPORARY SITE OFFICES TO THE WEST OF THE NAOMI WING REHABILITATION BUILDING

PHOTOGRAPH 18: TEMPORARY SITE OFFICES TO THE WEST OF THE NAOMI WING REHABILITATION BUILDING

PHOTOGRAPH 19: TEMPORARY SITE OFFICES TO THE WEST OF THE NAOMI WING REHABILITATION BUILDING



PHOTOGRAPH 20: VACANT AREA SURFACED WITH MULCH USED AS TEMPORARY CARPARK TO THE SOUTHWEST OF THE NAOMI WING REHABILITATION BUILDING

JBS&G

Job No: 58719

Client: School Infrastructure

Version: R01 Rev 0	Date: 15/06/2020
Drawn By: SG	Checked By: JR

Not to Scale

Coord. Sys n/a

3 Joynton Avenue, Zetland NSW

APPENDIX F

PHOTOGRAPH 21: SOUTH WESTERN EXTENT OF THE SITE FACING SOUTH

PHOTOGRAPH 22: BASKETBALL COURT AREA AND TABLE TENNIS TABLES SURROUNDED BY MINOR LANDSCAPING BEDS

PHOTOGRAPH 23: SOUTHERN BOUNDARY OF THE SITE FACING SOUTH EAST

PHOTOGRAPH 24: BASKETBALL COURT AREA AND TABLE TENNIS TABLES SURROUNDED BY MINOR LANDSCAPING BEDS

JBS&G

Job No: 58719	
Client: School Infrastructure	
Version: R01 Rev 0	Date: 15/06/2020
Drawn By: SG	Checked By: JR
Not to Scale	
Coord. Sys n/a	
3 Joynton Avenue, Zetland NSW	
APPENDIX F	

Appendix F Statistical Analyses

	A	B	C	D	E	F	G
1							
2	Sample Location	Sample Date	Depth	Investigation	Lead Concentration (mg/kg)		
3	HA1	5/07/2000	1.3-1.5	GA 2000	<0.5		
4	HA6	5/07/2000	0.4-0.6	GA 2000	1.2		
5	BH13	28/02/2007	0.5-0.6	DP 2007	23		
6	BH13	28/02/2007	1.9-2.0	DP 2007	13		
7	BH16	28/02/2007	0.1-0.2	DP 2007	46		
8	BH17	28/02/2007	0.1-0.2	DP 2007	62		
9	BH17	28/02/2007	1.9-2.0	DP 2007	110		
10	BH18	28/02/2007	0.1-0.2	DP 2007	7.1		
11	BH18	28/02/2007	0.9-1.0	DP 2007	41		
12	BH20	28/02/2007	0.1-0.2	DP 2007	130		
13	BH20	28/02/2007	1.9-2.0	DP 2007	1.4		
14	BH28	1/03/2007	0.1-0.2	DP 2007	180		
15	BH29	1/03/2007	0.1-0.2	DP 2007	7.9		
16	BH20A	10/07/2012	0.7-0.8	JBS 2012	380		
17	BH20A-S	10/07/2012	-	JBS 2012	110		
18	BH20A-W	10/07/2012	-	JBS 2012	180		
19	BH31	16/07/2012	0-0.1	JBS 2012	310		
20	BH32	16/07/2012	0-0.1	JBS 2012	31		
21	BH33	17/07/2012	0.1-0.2	JBS 2012	64		
22	BH34	17/07/2012	0.3-0.4	JBS 2012	66		
23	BH34	17/07/2012	1.5-1.6	JBS 2012	3		
24	BH35	10/07/2012	1.9-2	JBS 2012	1		
25	BH36	10/07/2012	0.9-1	JBS 2012	29		
26	BH37	10/07/2012	0-0.1	JBS 2012	17		
27	BH40	10/07/2012	0-0.1	JBS 2012	5		
28	BH40	10/07/2012	0.9-1	JBS 2012	8		
29	BH55	17/07/2012	0.1-0.2	JBS 2012	10		
30	TP308	19/11/2014	0-0.3	EIS 2014	51		
31	TP309	19/11/2014	0-0.3	EIS 2014	47		
32	TP310	19/11/2014	0-0.2	EIS 2014	33		
33	TP310	19/11/2014	0.2-0.5	EIS 2014	4		
34	TP311	19/11/2014	0-0.1	EIS 2014	84		
35	TP312	19/11/2014	0-0.3	EIS 2014	48		
36	TP313	19/11/2014	0-0.05	EIS 2014	62		
37	TP314	19/11/2014	0-0.3	EIS 2014	78		
38	TP314	19/11/2014	0.3-0.5	EIS 2014	1		
39	TP315	19/11/2014	0-0.3	EIS 2014	63		
40	TP315	19/11/2014	0.3-0.5	EIS 2014	34		
41	TP316	19/11/2014	0-0.3	EIS 2014	66		
42	TP316	19/11/2014	0.3-0.5	EIS 2014	43		
43	BH1	29/01/2018	0-0.3	EIS 2018	75		
44	BH2	29/01/2018	0.5-0.95	EIS 2018	29		
45	BH2	29/01/2018	1.0-1.2	EIS 2018	66		
46	BH3	29/01/2018	0-0.2	EIS 2018	190		
47	BH4	29/01/2018	0-0.2	EIS 2018	49		
48	BH4	29/01/2018	0.5-0.95	EIS 2018	360		
49	BH5	29/01/2018	0-0.3	EIS 2018	84		
50	BH5	29/01/2018	0.5-0.8	EIS 2018	22		
51	BH5	29/01/2018	1.5-1.95	EIS 2018	420		
52	BH5	29/01/2018	3.3-3.45	EIS 2018	30		
53	BH6	29/01/2018	0-0.1	EIS 2018	13		
54	BH6	29/01/2018	0.5-0.65	EIS 2018	75		
55	BH7	30/01/2018	0-0.2	EIS 2018	13		
56	BH7	30/01/2018	0.5-0.95	EIS 2018	71		
57	BH7	30/01/2018	1.8-2	EIS 2018	21		
58	BH8	30/01/2018	0-0.2	EIS 2018	51		

	A	B	C	D	E	F	G
59	BH8	30/01/2018	0.5-0.95	EIS 2018	59		
60	BH9	30/01/2018	0-0.2	EIS 2018	14		
61	BH9	30/01/2018	0.5-0.95	EIS 2018	5		
62	BH9	30/01/2018	1.5-1.95	EIS 2018	29		
63	X1	30/01/2018	stockpile sa	EIS 2018	3		
64	X2	30/01/2018	stockpile sa	EIS 2018	62		
65	X3	30/01/2018	stockpile sa	EIS 2018	170		
66	Y1	30/01/2018	stockpile sa	EIS 2018	35		
67	CPTP_E_1.4_180620	20/06/2018	1.4	AECOM 2018	57		
68	CPTP_N_1.2_180620	20/06/2018	1.2	AECOM 2018	122		
69	CPTP_N_2.5_180620	20/06/2018	2.5	AECOM 2018	144		
70	CPTP_W_1.2_180620	20/06/2018	1.2	AECOM 2018	49		
71	CPTP_W_2.5_180620	20/06/2018	2.5	AECOM 2018	308		
72	UST_1.9_180622	20/06/2018	1.9	AECOM 2018	66		

	A	B	C	D	E	F	G	H	I	J	K	L
1	**UCL Statistics for Uncensored Full Data Sets**											
2												
3	User Selected Options											
4	Date/Time of Computation	18/06/2020 2:25:49 PM										
5	From File	WorkSheet.xls										
6	Full Precision	OFF										
7	Confidence Coefficient	95%										
8	Number of Bootstrap Operations	2000										
9												
10												
11	**C4**											
12												
13	**General Statistics**											
14	Total Number of Observations	69					Number of Distinct Observations	51				
15							Number of Missing Observations	2				
16	Minimum	1					Mean	74.53				
17	Maximum	420					Median	49				
18	SD	92.01					Std. Error of Mean	11.08				
19	Coefficient of Variation	1.235					Skewness	2.281				
20												
21	**Normal GOF Test**											
22	Shapiro Wilk Test Statistic	0.705					**Shapiro Wilk GOF Test**					
23	5% Shapiro Wilk P Value	0					Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic	0.256					**Lilliefors GOF Test**					
25	5% Lilliefors Critical Value	0.107					Data Not Normal at 5% Significance Level					
26	**Data Not Normal at 5% Significance Level**											
27												
28	**Assuming Normal Distribution**											
29	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
30	95% Student's-t UCL	93					95% Adjusted-CLT UCL (Chen-1995)	96				
31							95% Modified-t UCL (Johnson-1978)	93.51				
32												
33	**Gamma GOF Test**											
34	A-D Test Statistic	0.644					**Anderson-Darling Gamma GOF Test**					
35	5% A-D Critical Value	0.79					Detected data appear Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic	0.111					**Kolmogrov-Smirnoff Gamma GOF Test**					
37	5% K-S Critical Value	0.111					Data Not Gamma Distributed at 5% Significance Level					
38	**Detected data follow Appr. Gamma Distribution at 5% Significance Level**											
39												
40	**Gamma Statistics**											
41	k hat (MLE)	0.799					k star (bias corrected MLE)	0.773				
42	Theta hat (MLE)	93.33					Theta star (bias corrected MLE)	96.36				
43	nu hat (MLE)	110.2					nu star (bias corrected)	106.7				
44	MLE Mean (bias corrected)	74.53					MLE Sd (bias corrected)	84.74				
45							Approximate Chi Square Value (0.05)	83.9				
46	Adjusted Level of Significance	0.0465					Adjusted Chi Square Value	83.47				
47												
48	**Assuming Gamma Distribution**											
49	95% Approximate Gamma UCL (use when n>=50)	94.82					95% Adjusted Gamma UCL (use when n<50)	95.31				
50												
51	**Lognormal GOF Test**											
52	Shapiro Wilk Test Statistic	0.933					**Shapiro Wilk Lognormal GOF Test**					
53	5% Shapiro Wilk P Value	0.00135					Data Not Lognormal at 5% Significance Level					
54	Lilliefors Test Statistic	0.14					**Lilliefors Lognormal GOF Test**					
55	5% Lilliefors Critical Value	0.107					Data Not Lognormal at 5% Significance Level					
56	**Data Not Lognormal at 5% Significance Level**											
57												
58	**Lognormal Statistics**											

59	Minimum of Logged Data					0	Mean of logged Data					3.568
60	Maximum of Logged Data					6.04	SD of logged Data					1.429
61												
62	**Assuming Lognormal Distribution**											
63	95% H-UCL					144.7	90% Chebyshev (MVUE) UCL					161.4
64	95% Chebyshev (MVUE) UCL					191.2	97.5% Chebyshev (MVUE) UCL					232.6
65	99% Chebyshev (MVUE) UCL					313.9						
66												
67	**Nonparametric Distribution Free UCL Statistics**											
68	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
69												
70	**Nonparametric Distribution Free UCLs**											
71	95% CLT UCL					92.75	95% Jackknife UCL					93
72	95% Standard Bootstrap UCL					92.61	95% Bootstrap-t UCL					97.21
73	95% Hall's Bootstrap UCL					96.98	95% Percentile Bootstrap UCL					92.66
74	95% BCA Bootstrap UCL					97.41						
75	90% Chebyshev(Mean, Sd) UCL					107.8	95% Chebyshev(Mean, Sd) UCL					122.8
76	97.5% Chebyshev(Mean, Sd) UCL					143.7	99% Chebyshev(Mean, Sd) UCL					184.7
77												
78	**Suggested UCL to Use**											
79	95% Approximate Gamma UCL					94.82						
80												
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
84	For additional insight the user may want to consult a statistician.											
85												

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