Remedial Action Plan

1A & 1B Queen Street

Auburn, New South Wales

Australian Executor Trustee Limited ATF Auburn Ownership Trust

5 March 2018

TRACE Environmental
PO BOX 422, Camperdown NSW 1450

Remedial Action Plan

1A & 1B Queen Street
Auburn, NSW

Prepared for:
Australian Executor Trustee Limited ATF Auburn Ownership Trust

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Author: Ken Henderson
Principal Environmental Scientist
B.Sc (Geol, Hons)

Reviewed by Andrew Kita
Principal Engineer
B.Eng (Geol, Hons)

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Executive Summary

TRACE Environmental was engaged by Australian Executor Trustee Limited ATF Auburn Ownership Trust to prepare a Remedial Action Plan (RAP) for the properties located at 1A & 1B Queen Street, Auburn, New South Wales ('the site'). The site is proposed to be redeveloped for high density residential land-use with basement parking and open spaces.

This RAP has been prepared by TRACE Environmental to document an appropriate and cost-effective remedial strategy and validation program to render the site suitable for unrestricted high density land-use without any ongoing management requirements.

The proposed development includes demolition of the current buildings (which will be demolished in two stages: 'Stage 1 Early Works' and 'Stage 2 Early Works') and construction of residential apartment buildings in three development stages (Stages 1 to 3).

Environmental investigations undertaken at the site have identified contaminated fill material at the site. These require remediation and/or management to make the site suitable for the proposed redevelopment. However, additional environmental investigations are also required to address data gaps in previous investigations and sufficiently characterise fill materials which may remain on-site as part of the proposed redevelopment. These are proposed to be undertaken as separate investigations during the two early works stages ('Stage 1 Early Works' and 'Stage 2 Early Works'). The scope of remediation and/or management required at the site may need to be revised based on the results of the data gap investigations.

The proposed remediation strategy for the site comprises excavation and off-site disposal of impacted soils that are assessed as unsuitable to remain on-site or are in excess to site requirements and cannot be incorporated into the proposed redevelopment. As the proposed development includes a one-level basement car park (to depths of up to approximately 3 to 4 metres below ground surface (mBGS)), significant quantities of soil and rock will require excavation to facilitate this.

The remediation strategy will be supervised by a suitably qualified and experienced environmental consultant and will include the following:

- Implementation of management practices during the remedial works to minimise the potential risks to on-site workers, vicinity third parties and the environment;
- In the event of the discovery of previously unidentified soil impacts (i.e. unexpected finds) during site redevelopment works, additional validation and/or remediation of the soil may be necessary. Validation soil sample results will be compared to the guideline criteria for high density residential (with minimal access to soils) land uses to ensure the soils remaining at the site are suitable for the proposed land uses;
- If significant unexpected soil impacts are encountered during remedial works, validation of the groundwater beneath the site may become necessary;
- In the event that imported fill material is needed to backfill any excavations (i.e. for service trenches), only material certified as comprising virgin excavated natural material (VENM) or excavated natural material (ENM) should be imported onto the site; and
- The proposed development will be constructed in three stages (Stages 1 to 3), and the remediation/validation works will likely be conducted in separate phases during these development stages. Following completion of the proposed remedial/management strategy at each stage, a Validation Report specific to each development stage will be prepared for submission to Council.

It is considered that the site will be suitable for the proposed high density residential land uses following successful implementation of the above remediation/management strategy. The Validation Reports will detail the methods and results of the site remedial activities and demonstrate that the site was remediated to a condition suitable for the proposed land uses.

1 Introduction

TRACE Environmental was engaged by Australian Executor Trustee Limited ATF Auburn Ownership Trust to prepare a Remedial Action Plan (RAP) for the properties located at 1A & 1B Queen Street, Auburn, New South Wales ('the site'). The site is proposed to be redeveloped for high density residential land-use with basement parking and open spaces. A Locality Plan is presented in **Figure 1**. The site has an approximate area of approximately 2.7 hectares and is described as Lots 1 & 2 in DP1160950.

This document has been prepared in accordance with guidelines made or endorsed by the NSW Environment Protection Authority (EPA) under the *Contaminated Land Management Act 1997* (CLM Act), and in consideration of the principles of ecologically sustainable development (ESD) consistent with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.1 Site Background and Details of Proposed Development

The site is an industrial estate comprising warehouse and office buildings. The proposed development of the site is to comprise a number of high density residential towers, with open spaces and basement parking. The proposed development plans are provided in **Appendix A**. Excavation for the construction of the building basement carpark is required, with excavation depths to extend to approximately 3 to 4m below current ground levels to allow for one level of underground parking.

A Detailed Site Investigation (DSI) was conducted at the site by DLA Environmental Services in 2015 (DLA 2015)[1] which identified historical sources of contamination in fill material at the site, consisting primarily of asbestos at two locations, which requires remediation to make the site suitable for the proposed residential redevelopment of the site. The DLA (2015) report and findings are discussed below in **Section 3**.

1.2 Objective

The objective of the RAP is to outline the preferred remedial strategy at site to address identified soil impacts at the site, and to make the site suitable for the proposed land use (as shown on the plans included in **Appendix A**), without restriction or ongoing management requirements. The RAP is required by Cumberland City Council prior to the determination of a Development Application (DA) lodged for the site (DA-382/2017) as noted in correspondence provided in **Appendix B**.

1.3 Scope of Works

The following scope of works were undertaken in order to meet the objectives described above:

- Conducting a limited desktop study including available online database searches and review of historical information from the following sources:
  - Previous environmental investigations conducted at the site;
  - NSW EPA administered environment management and contaminated land registers; and
  - Geological, hydrogeological and hydrological information and identification of nearby sensitive receptors.

[1] *Detailed Site Investigation, 1A Queen Street, Auburn, NSW 2014*, DLA Environmental Services, 27 November 2015 (DLA 2015).

- Identify potential sources of contamination, assess surrounding sensitive land uses, evaluate the general condition of the site in relation to potential contamination and identify known or suspected areas of potential concern (if any);
- Identify data gaps with the existing data and provide a scope for conducting additional field investigations (where necessary) to inform the current contamination status of the site (refer to **Section 4**);
- Update the conceptual site model (CSM) for the site, outlining potential contamination sources, and exposure pathways and receptors which may be impacted, and undertake a preliminary environmental risk assessment;
- Undertake an evaluation of potential remedial strategies to address contamination impacts identified at the site, based on criteria such as feasibility, reliability, long term risk mitigation and cost, among others;
- Prepare a Validation Plan to address validation sampling requirements following the completion of the proposed remediation works, and to ensure that the residual soils at the site are suitable for the proposed land use;
- Establishment of site and environmental management strategies to minimise adverse effects to site workers, vicinity third parties and the local environment during the remediation works;
- Development of contingency plans including unexpected finds protocols; and
- Occupational health and safety planning.

1.4 Statutory and Regulatory Framework

The following NSW Acts are considered relevant to this assessment:

- Contaminated Land Management Act 1997;
- Dangerous Goods (Road and Rail Transport) Act 2008;
- Environmentally Hazardous Chemicals Act 1985;
- Environmental Planning and Assessment Act 1979;
- Local Government Act 1993;
- National Environment Protection Council (New South Wales) Act 1995;
- Protection of the Environment Administration Act 1991;
- Protection of the Environment Operations Act 1997;
- Waste Avoidance and Resource Recovery Act 2001; and
- Work Health and Safety Act 2011.

Reporting will be carried out in accordance with the following guidelines and regulations:

- NEPC (2013), National Environment Protection (*Assessment of Site Contamination*) Measure (NEPM). National Environment Protection Council (NEPC) 1999, Amendment 2013;
- National Health and Medical Research Council (2016) Australian Drinking Water Guidelines (ADWG), Updated February 2016;

- Australian and New Zealand Environment and Conservation Council (2000), *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, October 2010;
- NSW Department of Urban Affairs and Planning (1998), *Managing Land Contamination: Planning Guidelines: SEPP 55 Remediation of Land,* 1998;
- NSW EPA (1995), *Contaminated Sites Sampling Design Guidelines*. NSW EPA, September 1995;
- NSW EPA (2012), *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases,* NSW EPA, November 2012;
- NSW EPA (2014), *Waste Classification Guidelines. Part 1: Classifying Waste*. NSW EPA, November 2014;
- NSW EPA (2015), *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act*. NSW EPA, September 2015;
- NSW EPA (2017), *Contaminated Sites Guidelines for the NSW Site Auditor Scheme (3rd Edition)*. NSW EPA, October 2017;
- NSW OEH (2011), *Guidelines for Consultants Reporting on Contaminated Sites*. NSW Office of Environment & Heritage (OEH), November 1997, Reprinted September 2000 and August 2011;
- Standards Australia (2005), Australian Standard AS 4482.1-2005 – *Guide to the investigation and sampling of sites with potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds*. Standards Australia, Homebush, NSW;
- Standards Australia (1999), Australian Standard AS 4482.2-1999 - *Guide to the sampling and investigation of potentially contaminated soil. Part 2: Volatile substances*. Standards Australia, Homebush, NSW;
- NSW Work Health and Safety Regulation 2017;
- SafeWork NSW *Code of Practice: How to Manage and Control Asbestos in the Workplace* (2016); and
- SafeWork NSW *Code of Practice: How to Safely Remove Asbestos* (2016).

2 Site Description and Setting.

2.1 Site Identification

Details on the site are included in **Table 2-1** below.

Table 2-1: Summary of Site Identification Details

ID Element	Description
Site Address	1A & 1B Queen Street, Auburn, NSW
Lot/DP (**Figure 2**)	Lots 1 & 2 in DP1160950
Site Owners	Australian Executor Trustee Limited ATF Auburn Ownership Trust. The site was acquired by the current site owners in 2008.
Local Council	Cumberland City Council
Site Coordinates (GDA 94 MGA 56)	-33.854846 and 151.036204 (approx. centre of site)
Approximate Site Elevation	20m AHD (approx.)
Site Area	2.7 hectares
Zoning	R4 High Density Residential

2.2 Site Description

Details of the site are outlined in **Table 2-2** below.

Table 2-2: Site Description

Category	Observation
Current Use and Users/Occupiers	The site is currently used for light industrial purposes comprising warehouse storage (bulky goods) and administration. Five tenants currently occupy the site, with one warehouse building currently vacant.
Future Use and Users/Occupiers	It is proposed to re-develop the site to high density residential with basement parking and open space use (refer to **Appendix A**). The future users of the site include construction workers during redevelopment, future residents occupying the site, as well as visitors entering the buildings and open spaces.
Current Zoning and Permitted Uses	According to the Auburn Local Environmental Plan 2010 Land Zoning Map (Sheet LZN_002), the site is currently zoned as R4 High Density Residential.
Site features	The site is rectangular in shape and largely comprises buildings used for industrial and administrative purposes, consisting of five large warehouse buildings and three office buildings. One building is divided into two warehouses. Outdoor areas of the site comprise mostly driveway, parking and storage areas (concrete and bitumen hardstand).
Underground Services	TRACE Environmental conducted a DBYD search on 23 January 2018 which shows the approximate locations of the services on the site. DBYD search results indicated that most underground utilities (i.e. municipal sewer, natural gas) are mostly located within the Queen Street footpath/verges outside of the site. Telstra, Optus and NBN utilities were noted to be located at the central-western portion of the site from Queen Street.
Chemicals, raw materials and intermediate products storage and use	DLA 2015 reported no evidence of current or historical underground storage tanks (USTs) or above ground storage tanks (ASTs) (such as vent pipes, fill points, fuel dispensers, etc.) at the site. An electrical substation is located at the western portion of the 1A Queen Street site parcel boundary at Queen Street.
Reported spills, chemical losses, discharges to land, water and/or incidents/ accidents and Contaminated Land Records	The NSW EPA environmental register for contaminated land records was accessed online (http://www.epa.nsw.gov.au/prclmapp/searchregister.aspx) on 23 January 2018. No notices or declarations under Section 58 of the CLM Act 1997 were listed for the site. In addition, a search of the public register under section 308 of the NSW POEO Act 1997 did not identify any licenses referring to the site, and a search of the List of NSW Contaminated Sites Notified to the EPA did not identify the site.

Category	Observation
Surface covering/ Vegetation	The majority of the site is paved (concrete, bitumen) with some vegetation (mostly trees, shrubs and grass/weeds) along the western site boundary at Queen Street, along the northern site boundary at Marion Street, and at the southern site boundary. Sparse grass is also located at a small parcel of land associated with the site at the southeast corner of the site.
Topography and infilling	The site is mostly flat with some gradual slopes noted relating to site drainage. Regional topography slopes northeast towards Haslams Creek.
Surface drainage	Surface water run-off from roof and hardstand areas is anticipated to follow into on-site water drainage systems and/or to adjacent stormwater network systems in surrounding streets. It is anticipated that the site drainage and topography will also be extensively modified with the proposed development.

2.3 Surrounding Land Use

The site is located within a predominantly commercial/industrial and residential area. The surrounding land uses comprise the following:

- North: Marion Street and a railway, with mixed density (medium and high) residential properties located beyond Marion Street to the northwest, and low density residential and a mosque beyond the railway to the north/northeast;
- East: railway with a light industrial building, low density residential properties and a park with netball courts beyond;
- South: light industrial properties including a business park; and
- West: Queen Street with low density residential beyond.

2.4 Geology & Hydrogeology

The Sydney 1:100,000 Geological Series Sheet 9130 (Geological Survey of NSW) indicates that the site is underlain by the Triassic Ashfield Shale (comprising of black to dark grey shale and laminate) of the Wianamatta Group.

A summary of the lithology/geology encountered during the previous DSI (DLA 2015) at the site are detailed in **Table 2-3** below.

Table 2-3: Summary of Site-Specific Geology

Observed / Known Lithology	Approximate Encountered Depth Range
Fill Materials (consisting of clay, sand and medium gravel, with a fine ash layer (100mm) observed at the south and east of the site). Road base gravel was observed at the centre of the site, with building rubble, ACM and bricks also observed at one location at this area of the site, and two small ACM fragments also observed at one location under the slab within a driveway area.	Ranging between 0.3 and 1.0m at most areas of the site, with minimal fill observed under the building slab at the northwest portion of the site. Fill thickness increased to depths of 1.9 and 3.5m at the southern portion of the site.
Clays with gravel and clayey sand (red/grey/brown)	From beneath building slab (NW portion of the site) or beneath fill (approximately 0.3m) to the maximum boring depths or to underlying weathered bedrock
Weathered bedrock (shale)	0.4m up to 2.6m bgs

2.5 Hydrogeology / Hydrology

The nearest surface water body to the site is Haslams Creek, located approximately 350m east of the site, which discharges to Homebush Bay, located approximately 4km northeast of the site. Based on the regional topography of the site, regional groundwater is anticipated to migrate to the northeast towards Homebush Bay.

A groundwater bore search (http://waterinfo.nsw.gov.au/) was conducted on 23 January 2018 for the vicinity of the site, with no registered bores located within 500m of the site.

Three groundwater monitoring wells were installed at the site during the DLA 2015 investigation, with one monitoring well apparently dry (MW3). The depth of groundwater recorded in the remaining monitoring wells (MW1 and MW2) during the DLA investigation ranged between 1.23 to 3.13m bgs.

2.6 Acid Sulfate Soils

A review of the Auburn LEP 2010 Acid Sulfate Soils Map (Sheet ASS_002) shows the site is located in a Class 5 Acid Sulfate Soils (ASS). ASS are not typically found in Class 5 areas. Class 5 Acid Sulfate Soils require development consent for the carrying out of works within 500m of adjacent Class 1, 2, 3 or 4 land that is below 5m Australian Height Datum (AHD) and by which the water table is likely to be lowered below 1m AHD on adjacent Class 1, 2, 3 or 4 land. A review of the Auburn LEP 2010 ASS maps indicates the nearest non-Class 5 ASS category is Class 2 soils located approximately 200m east of the site (along Haslams Creek).

A search of the ASRIS databases (http://www.asris.csiro.au) indicates the site is located in an area of low probability of occurrence for ASS.

Based the groundwater elevation encountered during the DLA 2015 investigation, it is considered likely that dewatering will be required for the proposed development. However, based on elevation of the site (16 to 20m AHD, which is above 5m AHD), the elevation of the nearby Class 2 land (8 to 10m AHD), and the encountered groundwater elevation at the site (12 to 16m AHD), it is not expected that dewatering required for the proposed redevelopment will lower the water table on the nearby Class 2 land to an elevation below 1m AHD. In view of this, it is considered that development consent relating to ASS is not required.

3 Previous Investigations

TRACE Environmental was provided with a copy of three reports previously prepared for the site as follows:

- *Tank Pit Validation Report*, Fluor Daniel GTI (Australia) Pty Ltd, 1998 (FD 1998);
- *Report on Phase 1 Contamination Assessment*, Douglas Partners, April 2007 (DP 2007)[2]; and
- *Detailed Site Investigation, 1A Queen Street, Auburn, NSW 2014*, DLA Environmental Services, 27 November 2015 (DLA 2015).

The reports are summarised below.

3.1 *Tank Pit Validation Report* (FD 1998)

The FD 1998 investigation was commissioned by Mayne Nickless Logistics to conduct a tank pit validation and investigation at the site (referenced as 1A Queen Street). The works were conducted in October and November 1997 to remove potential sources of petroleum hydrocarbon impacts including three diesel USTs (and associated fuel dispensers, and fuel lines and vents), to excavate any impacted soil and to validate tank pits. Based on provided site plans, the tanks appeared to be located in a driveway at the approximate central portion of the site along the north wall of the southern warehouse (i.e. along the boundary between the 1A and 1B Queen Street site parcels).

The results of the conducted sampling were summarised as follows:

- The tanks were reported to be in good condition, and ranged in size between 16,200L and 20,600L;
- Hydrocarbon staining was observed in soil beneath the fill dispensers in the upper 0.5m of the soil profile, with all hydrocarbon impacted soil reportedly excavated from the tank pits;
- Laboratory analysis of the validation soil samples indicated that total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene and xylenes (BTEX) concentrations were either not detected or were below the site validation criteria, except for areas immediately adjacent to the fuel line and dispenser area (noting further excavation along one trench was not possible due to the presence of a stormwater pipe and warehouse building).

FD 1998 concluded the following:

- Remnant hydrocarbon impacted soil is present in the vicinity of a stormwater pipe adjacent to the warehouse; and
- The Mayne Nickless Auburn fuel storage and dispensing facility has been decommissioned and the site is suitable for continued commercial/industrial land use.

3.2 *Report on Phase 1 Contamination Assessment* (DP 2007).

The DP 2007 investigation was commissioned by OPG Pty Ltd. At the time of assessment, future land use options were being considered including continued use of the site as a commercial/industrial property or redevelopment for commercial/industrial use or residential land use with minimal access to soil.

[2] Only an Executive Summary of this report was provided for review.

At the time of investigation, the site was generally used for storage/warehousing, with one building used for paper shredding (with one compacting machine observed to be leaking oil onto the concrete pavement). Site history was reported to include the following:

- The site was developed for industrial land use (including manufacture of rolling stock for railways) in/prior to 1882;
- A number of companies subsequently occupied parts of the site with potentially contaminating activities including:
  - Storage and mixing of chemicals (including 6 USTs);
  - Vehicle maintenance (including fuel storage in approximately 4-6 USTs); and
  - Storage of various chemicals including fuels, oils, pigments, acids, resins, rubbers and xylenes.

The DP 2007 investigation included soil sampling at 15 boreholes and installation of one groundwater monitoring well, however, a site plan was not provided, and it is unclear where the investigation locations were placed.

The results of the conducted sampling were summarised as follows:

- Fill materials were encountered at all investigation locations, ranging in depth between 0.13 to 2m, and fill depth increased towards the east. Hydrocarbon odours were noted at two locations;
- TPH C10-C36, lead and/or benzo(a)pyrene were reported at levels exceeding the site acceptance criteria (SAC) for residential and/or commercial/industrial land uses at five locations in samples collected from shallow fill;
- Asbestos was identified in one fragment of fibre cement noted at the surface. No fibre cement or asbestos was detected in soils at the site; and
- Zinc was detected in the groundwater sample at a concentration exceeding the groundwater investigation level (GIL), however, this was reported to be within the expected background levels for groundwater in urban areas and were not considered a concern.

DP 2007 considered that the site remains suitable for commercial/industrial land use provided it remains capped with limited potential for exposure to detected contaminants, and a DSI was recommended as remedial work was likely required when the site is redeveloped.

3.3 DLA 2015 DSI

The DLA 2015 DSI was conducted to address the requirements of Auburn City Council[3] '*relating to a Development Approval (DA) submission, which required a comprehensive environment assessment be submitted to Council characterising potential contamination and the site, drawing conclusions on the suitability of the site for its proposed land use and making recommendations to enable such conclusions.*'

The scope of work included the following:

- Desktop study including a review of available current and historical information and previous investigations (refer to **Sections 3.1** and **3.2** above for additional detail);

[3] Currently Cumberland City Council.

- Systematic and targeted intrusive investigations including the collection of soil samples from 21 boreholes and eight test pits;
- Installation of three monitoring wells to assess the groundwater quality; and
- Assessment of whether the site is suitable, from a contamination perspective for its proposed land use.

DLA 2015 provided the following site history summary:

- Aerial photographs (commencing in 1943) show the site has consistently been for commercial land use;
- Historical title searches identified that from 1919 to 1968 the site was owned by manufacturers likely associated with manufacturing for the railway line;
- A WorkCover NSW Dangerous Goods database and microfiche records review did not identify any Dangerous Goods licences for the premises, however, several USTs were identified (as outlined in a Tank Pit Validation Report, refer to **Section 3.1** above) in which three USTs were removed from site in 1997 and the tank pits validated;
- The site is elevated compared to natural topography, particularly in the southern portion of the site. This area may contain more fill and is considered an area of potential concern along with the vehicle access roads under which it is likely the former USTs were located;
- The presence of TPH, benzo(a)pyrene and lead in concentrations above the commercial/industrial criteria (NEPM 2013) were noted during a previous assessment conducted by Douglas Partners (refer to **Section 3.2** above). The locations of these measured contaminants are unknown, noting that an executive summary was only available for review; and
- Potential contaminants of concern at this site include volatile and semi-volatile hydrocarbons, benzo(a)pyrene, lead and ACM.

Results of the investigation were reported as follows:

- Fill materials were observed at some locations at the site (refer to **Section 2.4** above for additional detail);
- No samples reported concentrations above the SAC of Residential B (NEPM 2013) for BTEX, total recoverably hydrocarbons (TRH), naphthalene, benzo(a)pyrene, total polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCB) or pesticides. No samples reported concentrations above the SAC for heavy metals with the exception of lead at one location, which after using upper confidence limit (UCL) statistical analyses complied with the Health Investigation Levels (HILs) Residential B;
- Samples in one location identified ACM fragments, and further laboratory analysis identified asbestos fines / fibrous asbestos (AF/FA) at two locations, which were reported to be localised as sampling in surrounding boreholes and test pits did not identify asbestos;
- No indication of hydrocarbons was present in the analysed soil samples. Heavy metal analysis indicated some exceedances with relation to zinc and copper, however, none are considered significant in the context of a human or ecological health risk within the urbanised area of the site; and
- Limitations of the investigation include inaccessible areas on-site due to operational facilities and tenants at the site.

DLA considered the site suitable for the intended land use consistent with NEPM 2013 Residential B (residential with minimal access to soil) with the exception of the two identified areas (i.e. due to presence of

asbestos). DLA considered that these two areas of the site can be made suitable through the removal of the fill materials and a subsequent asbestos clearance / validation report.

3.4 Summary of Data Gaps

Based on a review of the documents described above, the following comments are provided:

- Groundwater was not investigated as part of the FD 1998 tank validation works, and residual hydrocarbon impacts were noted by FD 1998 to be located in the vicinity of the former tank pit along the northern wall of the southern warehouse. It is noted that DLA 2015 investigated soil and groundwater in the general vicinity of the former USTs, however, it is unknown if the residual impacts noted in the FD 1998 report were investigated or remain at the site. As such, additional investigation of this former UST area should be conducted prior to or during validation works;
- The DP 2007 investigation referenced that, '*a number of companies have occupied parts of the site with potentially contaminating activities including storage and mixing of chemicals (including 6 USTs) and vehicle maintenance (including fuel storage in approximately 4-6 USTs)*.' It is unclear if these referenced USTs were investigated during the DLA 2015 investigation, noting that no reference to these USTs was provided in the DLA 2015 investigation. As such, it is considered likely that additional USTs may be present at the site, which should be investigated following/during removal of the hardstand areas at the site;
- The number of soil sampling points conducted across the site during the DLA 2015 DSI included 29 locations, which is less than the NSW EPA (1995) *Sampling Design Guidelines* recommendation of 35-40 locations for a site area 2.7 ha. As such, it is considered that an insufficient number of sample locations as conducted across the site to investigate potential sources of contamination. It is noted that DLA 2015 acknowledged that two site buildings were inaccessible at the time of investigation, comprising a large warehouse building at the north-eastern portion of the site, and a second large warehouse building at the southern portion of the site; and
- No assessment was conducted for the potential presence of per- and poly-fluoroalkyl substances (PFAS) or VOCs. However, DP 2007 referenced that '*an extensive variety of chemicals have been/are stored at the site including fuels, oils, pigments, acids, resins, rubbers and xylenes*.' DLA 2015 did not reference this chemical storage, and it is unclear if the materials referenced in the DP 2007 report would have included chemicals containing PFAS or VOCs (such as solvents). As such, additional assessment for PFAS and VOCs should be conducted.

In consideration of the above comments, additional soil and groundwater investigation is required at the site to assess the two building areas that were not investigated during the DLA 2015 investigation, to assess for potential remnant UST infrastructure, to assess for additional COPCs (including, but not limited to, PFAS and VOCs) and to better characterise the fill materials on-site as required for off-site disposal. Refer to **Section 5** for additional detail.

4 Conceptual Site Model and Remedial Strategy Overview

The environmental risk assessment is based on a contaminant (source) - exposure pathway - receptor methodology. This relationship allows an assessment of potential environmental risk to be determined, in accordance with the current national guidelines. Central to the requirements for the assessment of risk is the development of an initial CSM, identifying each contaminant source and the associated receptor exposures.

Generally, a CSM provides an assessment of the fate and transport of COPCs relative to site-specific subsurface conditions with regard to their potential risk to human health and the environment. The CSM takes into account site-specific factors including:

- Sources of subsurface impacts;
- Identification of COPCs derived from the sources;
- Vertical and lateral distribution of COPCs;
- Site specific lithologic information including soil type(s), depth to groundwater, effective porosity, and groundwater flow velocity; and
- Actual or potential receptors focusing on future and current land use both of the site and adjacent properties and sensitive ecological receptors.

Based on the information collected from the previous investigations (FD 1998, DP 2007 and DLA 2015), a preliminary CSM has been developed and is outlined in **Table 4-1**, below. Additional details are included in the sections that follow as necessary.

Table 4-1: Preliminary Conceptual Site Model

Conceptual Site Model Element	Description
Site History/Contaminant Sources	The site has been used for industrial purpose since the late 1800s, including manufacture of rolling stock for railways, vehicle maintenance, paper shredding and warehousing. Based on the previous investigations undertaken at the site, the likely source of identified TPH, benzo(a)pyrene and asbestos impact is likely associated with fill materials (including ash at some locations), however, historical site uses (automotive works, chemical and fuel storage) are also potential sources of contamination.
Site Current and Future Use	It is proposed to re-develop the site to high density residential with basement parking and open space use (refer to **Appendix A**). The future users of the site include construction workers during redevelopment, future residents occupying the site, as well as visitors entering the buildings and open spaces.
Site Geology	The site geology consists of fill materials at most locations (clay, sand and medium gravel) overlying residual clays and weathered bedrock (shale). Fill was not observed beneath the northwest warehouse building, however, the depths of fill materials at remaining areas of the site varied, with thickness between 0.3 and 3.5m.
Site Hydrogeology	Three groundwater monitoring wells were installed at the site during the DLA 2015 investigation. One well was dry, and the stabilised groundwater levels in the remaining two wells ranged between 1.23 to 3.13m bgs. Regional groundwater is likely situated in the residual clays and underlying bedrock, and anticipated to migrate to the northeast towards Haslams Creek.
COPCs – Soil	Asbestos, TPH and PAHs (benzo(a)pyrene) in the existing fill material. However, other COPCs were not investigated (i.e. PFAS and VOCs).
COPCs – Groundwater	Heavy metals (specifically nickel, copper and zinc). However, additional investigation is required (refer below).

Conceptual Site Model Element	Description
COPCs – Soil Vapour	No volatile constituent impacts were reported at the site, however, additional investigation is required to assess potential volatiles relating to former fuel and chemical storage (i.e. VOCs).
Extent of Impacts – Soil	Asbestos was reported at two locations during the DLA 2015 investigation. TPH and benzo(a)pyrene were also reported at levels exceeding the site acceptance criteria during the DP 2007 investigation. As the site will be excavated into natural material for the proposed basement, it is proposed that the fill material will be stockpiled and assessed for potential on-site re-use (or off-site disposal as appropriate) with validation samples collected from the underlying natural material as outlined below in **Section 8**.
Extent of Impacts - Groundwater	Heavy metal (copper and nickel) were reported in groundwater during the DLA 2015 investigation which exceeded the adopted ANZECC (2000) freshwater criteria. These reported concentrations are consistent with urban background concentrations. However, additional investigation is required to assess data gaps outlined above in **Section 3.4**.
Extent of Impacts – Soil Vapour	Given the general absence of volatile contaminants in the existing analytical data, it is unlikely that soil vapour beneath the site poses a potential vapour intrusion risk to current and future site users at present. However, additional investigation is required to assess data gaps outlined above in **Section 3.4**.
Potential Human Receptors	Current human receptors for the site may include: • Construction/Intrusive maintenance workers (dermal exposure, inhalation, ingestions); • Visitors (inhalation) Future potential human receptors may include: • Construction/Intrusive maintenance workers (dermal exposure, inhalation, ingestions); • Site resident and visitors (inhalation)
Potential Environmental Receptors	Landscaping/open space areas proposed on the development, and Haslams Creek is located approximately 350m east of the site.

4.1 Preliminary CSM Summary and Risk Assessment

The site has been used for industrial purposes since the late 1800s, including manufacture of rolling stock for railways, vehicle maintenance, paper shredding and warehousing.

The results of the investigations conducted at the site indicate TPH, benzo(a)pyrene and asbestos in fill material that may pose a potential risk to human health. As a result, this RAP has been prepared to outline measures to ensure that the site is made suitable for the proposed high density residential land-use. As outlined in NEPM (2013), the remedial/management considerations will take a risk-based approach including a consideration of the groundwater analytical data, depths of any reported impacts and final site design.

In determining a proposed remedial strategy to make the site suitable for the proposed land-use, the following are noted in relation to evaluating significant exposure pathways:

- Groundwater is considered unlikely to be extracted and used for potable use at the site, or in the vicinity of the downgradient boundary of the site;
- No or hydrocarbon staining or chemical odours and no phase separated product in groundwater were observed during the DLA (2015) DSI. However, it is unknown if additional remnant infrastructure (i.e. former tanks) or impacts remain at the site as outlined above in **Section 3.4**;
- It is anticipated that bulk excavation of soils up to 3 to 4m bgs, which would include the removal of fill material to the underlying natural material, is proposed to allow the construction of the basement; and
- Following remediation, the risk of exposure to impacted soils (and groundwater, if found to be impacted) is considered negligible, subject to the successful implementation of this RAP.

4.2 Remedial Strategy Overview

In consideration of the current CSM (which is based on existing data from previous investigations undertaken by DLA and DP), and the requirement to provide an appropriate remedial/management strategy for the site to render the site suitable for the proposed development, TRACE Environmental considers the following steps are necessary moving forward:

- Obtain additional data to inform the extent of remediation and/or management across the site, and to adequately characterise fill material on-site for off-site disposal and/or re-use options; and
- Adopt appropriate validation sampling frequencies following remediation at the site to ensure that the site will be made suitable for the proposed land-use.

Refer to **Section 5** below for additional detail relating to a Data Gap Investigation (DGI) proposed to be undertaken at the site.

5 Data Gap Investigation

Based on a review of the available information, and extent of known contamination at the site, TRACE Environmental considers the following items require addressing prior start of development works. The full scope of work outlining the sampling densities, locations and methodologies should be detailed in a Sampling Analysis and Quality Plan (SAQP) to be prepared prior to commencing the assessment works, however, a brief summary of the proposed DGI is outlined below:

- Additional investigation of the former UST area as outlined in the FD 1998 tank validation report should be conducted prior to or during validation works;
- Additional USTs (as referenced in DP 2007) may also be present at the site, which should be investigated during/following removal of the hardstand areas at the site;
- Additional soil borings should be advanced at the two site buildings that were inaccessible at the time of the DLA 2015 investigation; and
- As referenced in DP 2007, an extensive variety of chemicals have been stored at the site including fuels, oils, pigments, acids, resins, rubbers and xylenes. Additional assessment for PFAS and VOCs should be conducted.

It is noted that the proposed development plan includes demolition of the current buildings (which will be demolished in two stages: 'Stage 1 Early Works' and 'Stage 2 Early Works') and construction of the residential apartment buildings (and associated basement car parks) in three stages (Stages 1 to 3). Plans showing the proposed early works demolition stages and the proposed construction stages are provided in **Appendix A**.

It is proposed to conduct the additional DGI works in separate phases relating to the proposed staging of the early works as follows:

DGI for Stage 1 Early Works

The DGI to be conducted at the Stage 1 Early Works portion of the site (i.e. the approximate northern portion of the site comprising current Building A, Building C and associated driveways as shown in **Appendix A**) should comprise:

- Inspecting for additional USTs that may be present across the Stage 1 Early Works portion of the site, including a thorough review of suspect areas and/or conducting a ground penetrating radar (GPR) investigation. Additional monitoring wells may also be required at these locations depending on the findings. Additional investigation of these areas may also be required during/following removal of the hardstand areas at the site;
- Advancing additional soil borings at the site building that was inaccessible at the time of the DLA 2015 investigation (the large warehouse building at the northeastern portion of the site, referenced as Building C on the staging plan shown in **Appendix A**). At least three to four borings should be advanced at this building, and additional monitoring wells may be required depending if remnant infrastructure (such as USTs/ASTs) remain at these locations; and
- Additional assessment should be conducted across the Stage 1 Early Works area for PFAS and VOCs.

It is recommended that the results of the DGI at the Stage 1 Early Works area be provided in a separate report (such as a DGI report or a revised RAP which includes results of the DGI). Refer to **Section 8.12** for required reporting.

DGI for Stage 2 Early Works

The DGI to be conducted at the Stage 2 Early Works portion of the site (i.e. the approximate southern portion of the site comprising current Buildings B, D, E-1, E-2 and associated driveways as shown in **Appendix A**) should comprise:

- Additional investigation of the former UST area (as outlined in the FD 1998 tank validation report) should be conducted prior to demolition works. This should include advancing three to four soil borings to locate the former UST tank pit, and installation of at least one monitoring well at this location to determine if residual groundwater impacts remain at this area of the site;
- Inspecting for additional USTs that may be present across the Stage 2 Early Works portion of the site, including a thorough review of suspect areas and/or conducting a GPR investigation. Additional monitoring wells may also be required at these locations depending on the findings. Additional investigation of these areas may also be required during/following removal of the hardstand areas at the site;
- Advancing additional soil borings at the site building that was inaccessible at the time of the DLA 2015 investigation (the large warehouse building at the southern portion of the site). At least three to four borings should be advanced at this building, and additional monitoring wells may be required depending if remnant infrastructure (such as USTs/ASTs) remain at these locations; and
- Additional assessment should be conducted across the Stage 2 Early Works area for PFAS and VOCs.

It is recommended that the results of the DGI at the Stage 2 Early Works area be provided in a separate report (such as a DGI report or a revised RAP which includes results of the DGI). Refer to **Section 8.12** for required reporting.

6 Data Quality

6.1 Data Quality Objectives for Remediation and Validation

NSW EPA under s105 of the *Contaminated Land Management Act 1997* requires that DQOs are adopted for all assessment and remediation programs. The DQO process as adopted by the NSW EPA is described within US EPA (2000) *Guidance for the Data Quality Objectives Process and Data Quality Objectives Process for Hazardous Waste Site Investigations.*

The DQOs for site remediation, as detailed within NSW EPA (2017), are summarised below in **Table 6-1**.

Table 6-1: Data Quality Objectives for Remediation

DQO	Description
Step 1 State the Problem	The site has been used for industrial purpose since the late 1800s, including manufacture of rolling stock for railways, vehicle maintenance, paper shredding and warehousing. Based on the previous investigations undertaken at the site, the likely source of previously identified TPH, benzo(a)pyrene and asbestos impact is likely associated with fill materials (including ash at some locations), however, historical site uses (automotive works, chemical and fuel storage) are also potential sources of contamination. Additional characterisation is required to investigate these additional potential sources of contamination, and to adequately assess on-site re-use and/or off-site disposal of existing fill materials on the site.
Step 2 Identify the Decisions	The decisions that must be made are: • What is the possible extent of the soil impacts identified during the previous investigations conducted at the site? • What is the condition of the soil and groundwater beneath the areas of the site that have not been previously investigated (i.e. the two warehouse buildings)? • Do additional tanks or remnant site infrastructure that could be ongoing potential sources of contamination remain at the site, and if so, what is the condition of the soil and groundwater at these locations? • Is the site soil and/or groundwater suitable for the intended land uses from a land contamination perspective, and is remediation or management required based on the results of the previous and proposed additional environmental assessments? • What remedial/management strategy is required to address soil (and/or groundwater) impacts that are not suitable for the intended land uses? • What is the potential current and future (i.e., building occupants) risk posed to potential on-site (and off-site) receptors from the concentrations of COPCs identified at the site? • What is the waste classification (per NSW EPA (2014) *Waste Classification Guidelines*) of the of materials that are deemed unsuitable to remain on-site?

DQO	Description
Step 3 Identify Inputs to the Decision	The primary inputs to the decisions described above are: • Further assessment of fill and natural soils, with samples collected from additional sample locations at the site (refer to **Section 5** above) and ensuring a sufficient number of samples are collected, to delineate the previously identified soil impacts/address data gaps/characterise soils remaining at the site, in accordance with regulatory guidelines; • Further assessment of groundwater from additional sample locations at the site (refer to **Section 5** above) and ensuring a sufficient number of locations are investigated to address data gaps/characterise groundwater at the site, in accordance with regulatory guidelines; • Assessment of soil vapour (if necessary) depending on the results of the additional soil and groundwater investigation; • Soil validation samples collected from locations across the site, ensuring a sufficient number of samples are collected, in accordance with regulatory guidelines, to validate the previously identified impacts; • Collection of additional soil characterisation samples as necessary to classify materials not suitable to remain on-site for waste classification purposes (per EPA (2014) *Waste Classification Guidelines*); • If soil aesthetic issues (including ACM) are observed during the investigation, soil samples will also be collected to characterise the observed impacts; • Laboratory analysis of soil samples and groundwater (and soil vapour samples, if necessary) for relevant COPCs, based on historical land use and environmental assessments conducted at the site; • Assessment of the analytical results against applicable guideline criteria, based on the current and future anticipated land uses; • Assessment of the suitability of the analytical data obtained against the DQIs; • Aesthetic observations of soils, including odours, staining and waste inclusions during additional data gap investigation works and/or site remedial works; and • Aesthetic observations of groundwater, including odours, sheen and non-aqueous phase liquids (NAPL).
Step 4 Define the Study Boundaries	The site is located at 1A and 1B Queen Street, Auburn, NSW. The lateral extend of the study site is the site boundaries as shown on **Figure 2**. The vertical extent of the study extends to bedrock at depths of at least 3 to 4mbgs (the depth of the proposed building basement). Deeper investigation may be required to further investigate groundwater beneath the site.

DQO	Description
Step 5 Develop a Decision Rule	The decision rules for the additional investigation and validation include: • The number of additional sampling locations at the site will be adequate to delineate the soil impacts previously identified at the site (DLA 2015); • The number of additional sampling locations at the site will be adequate to characterise the condition of existing fill material at the site, including at areas that were not previously investigated and/or at areas where remnant former infrastructure may remain at the site; • The number of existing/newly installed wells at the site will be adequate to characterise the condition of groundwater beneath the site; • The number of soil validation sampling locations will be adequate to validate the site following remediation; • The number of soil stockpile characterisation samples will be adequate to classify materials for off-site disposal (as necessary); • If soil aesthetic issues (including ACM) are observed during the investigation, soil samples will be collected to characterise the observed impacts. Any soil aesthetic issues will be evaluated including areas of discolouration, odour and hazardous waste inclusions; • Groundwater aesthetic issues will be evaluated including odour, sheen and presence of NAPL; • Primary, duplicate and triplicate soil and groundwater samples will be analysed at NATA accredited laboratories; • Field and laboratory QA/QC results will indicate reliability and representativeness of the data set; • Laboratory LORs will be below the applicable guideline criteria for the analysed COPC, where possible; • Applicable guideline criteria will be sourced from NEPM (2013) guidelines and other NSW EPA endorsed guidelines (as necessary); • If COPCs exceed the applicable guideline criteria in any collected soil samples, the site will be deemed to potentially contain 'hot spots' of contamination. If the concentration of a soil COPC in a sample is below the applicable guideline criteria, then no further assessment/ remediation will be required with respect to that COPC; • If the 95% upper confidence limit (UCL) of a soil COPC is less than applicable guideline criteria, standard deviation is less than 50%, and no reported concentration is greater than 250% of criteria, then no further assessment/remediation will be required with respect to that COPC; and • If the concentration of a soil COPC in a sample exceeds the applicable guideline criteria, additional works (e.g. additional remediation or quantitative risk assessment) may be required to minimise the risk.
Step 6 Specify Limits on Decision Errors	To ensure the results obtained are reproducible and accurate, a QA/QC plan is incorporated into the sampling and analytical program. DQIs are used to assess the reliability of field procedures and analytical results. In particular, the DQIs within NSW EPA (2017) are used to document and quantify compliance. DQIs are described as follows, and are presented in **Table 6-2**, below: • Completeness – A measure of the amount of useable data (expressed as %) from a data collection activity; • Comparability – The confidence (expressed qualitatively) that data may be considered to be equivalent for each sampling and analytical event; • Representativeness – The confidence (expressed qualitatively) that data are representative of each media present on the site; • Precision – A quantitative measure of the variability (or reproducibility) of data; and • Accuracy (bias) – A quantitative measure of the closeness of reported data to the true value. In addition, this step should include the following considerations to quantify tolerable limits: • If 95% UCLs are adopted for a particular soil COPC, a decision can be made based on a 95% probability that the 'true' arithmetic average contaminant concentration within the sampling area will not exceed the value determined by this method. Therefore, the limit on the decision error will be that there is a 5% probability that the calculated arithmetic average contaminant concentration may be incorrect; and • If the minimum soil sampling points required for site characterisation based on detected circular hot spots by using a systematic sampling pattern is adopted (Table A of NSW EPA 1995), a decision can be made based on a 95% confidence of detecting a hot spot of a particular diameter. Therefore, the limit on the decision error will be that there is a 5% probability that a hotspot of a particular diameter may not be detected.

DQO	Description
Step 7 Optimise the Design for Obtaining Data	To achieve the DQOs and DQIs, the following sampling procedures will be implemented to optimise the design for obtaining data: • Fill and natural soil samples will be collected from additional locations at the site to characterise data gap locations/target potential areas of impact; • Groundwater samples will be collected from existing and/or newly installed monitoring wells; • Soil validation samples will be collected per procedures and frequencies outlined below in **Section 8.5.1**; • Soil stockpile samples for material requiring off-site disposal will be collected per procedures and frequencies outlined below in **Section 8.5.2**; • COPCs will be selected based on a review of historic activities at the site, and the results of the previous environmental assessments. COPCs are currently considered to comprise TRH/TPH, BTEXN, PAHs, eight heavy metals (As, Cd, Cu, Cr, Pb, Hg, Ni, Zn), phenols, PCBs, OCPs, OPPs, VOCs and/or asbestos (refer to **Section 8.6.1** below for additional detail); • Samples will be collected by suitably qualified and experienced environmental consultants/scientists/engineers; • Additional groundwater monitoring well(s) will be installed under the supervision of suitably qualified and experienced environmental consultants, and by a licensed driller; • Soil and groundwater samples will be collected and preserved in accordance with relevant standards/guidelines; • NATA accredited laboratories will be engaged for all laboratory analyses; • Soil observations including odours, staining and PID readings will assist with selection of soil samples (if required) for laboratory analysis; and • Field and laboratory QA/QC procedures will be adopted and reviewed to indicate the reliability of the results obtained.

6.2 Data Quality Indicators

The following Data Quality Indicators (DQIs), referenced in Step 6 in **Table 6-1**, have been adopted in accordance with the NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme (3rd Edition)*. The DQIs outlined in **Table 6-2** assist with decisions regarding the contamination status of the site, including the quality of the laboratory data obtained.

Table 6-2 Data Quality Indicators

Data Quality Indicator	Frequency	Data Acceptance Criteria
Completeness		
Field documentation correct	All samples	All samples
Soil bore logs complete and correct	All samples	All samples
Suitably qualified and experience sampler	All samples	All samples
Appropriate lab methods and limits of reporting (LORs)	All samples	All samples
Chain of custodies (COCs) completed appropriately	All samples	All samples
Sample holding times complied with	All samples	All samples
Proposed/critical locations sampled	-	Proposed/critical locations sampled
Comparability		
Consistent standard operating procedures for collection of each sample. Samples should be collected, preserved and handled in a consistent manner	All samples	All samples
Experienced sampler	All samples	All samples
Climatic conditions (temp, rain etc.) recorded and influence on samples quantified (if required)	All samples	All samples
Consistent analytical methods, laboratories and units	All samples	All samples

Data Quality Indicator	Frequency	Data Acceptance Criteria
Representativeness		
Sampling appropriate for media and analytes (appropriate collection, handling and storage)	All samples	All Samples
Samples homogenous	All samples	All Samples
Detection of laboratory artefacts, e.g. contamination blanks	-	Laboratory artefacts detected and assessed
Samples extracted and analysed within holding times	All samples	-
Precision		
Blind duplicates (intra-laboratory duplicates)	1 per 20 samples	<30% RPD (Inorganics) <50% RPD (Organics) No Limit RPD Result <10 × LOR
Split duplicates (inter-laboratory duplicates)	1 per 20 samples	<30% RPD (Inorganics) <50% RPD (Organics) No Limit RPD Result <10 × LOR
Laboratory duplicates	1 per 20 samples	<20% RPD Result > 20 × LOR <50% RPD Result 10-20 × LOR No Limit RPD Result <10 × LOR
Accuracy (Bias)		
Trip blanks	1 per sampling event	COPCs<LOR
Trip Spikes	1 per sampling event	70-130%
Surrogate spikes	All organic samples	50-150%
Matrix spikes	1 per 20 samples	70-130%
Laboratory control samples	1 per 20 samples	70-130%
Method blanks	1 per 20 samples	<LOR
Rinsate Samples (if reusable sampling equipment is used)	1 per day of sampling	<LOR

7 Site Acceptance Criteria

7.1 Soil Criteria

The proposed DGI analytical results and future soil validation analytical results will be compared to the following criteria:

- TRH and BTEXN:
  - NEPM (2013) Soil Health Screening Levels (HSLs) for Vapour Intrusion (VI) for low to high density residential land use (HSL A & HSL B) for sand, silt and clay.
- Heavy metals, PAHs, OCPs, OPPs, phenols and PCBs:
  - NEPM (2013) Health Investigation Level (HILs) for soil contaminants for residential land use with minimal opportunities for soil access (HIL B).
- Asbestos:
  - NEPM (2013) HSLs for asbestos contamination in soil for residential with minimal opportunities for soil access (HSL B). This includes no visible asbestos for surface soil.
- TRH and BTEXN:
  - CRC Care (2011) Soil HSLs for VI for Intrusive Maintenance Worker (Shallow Trench). As a conservative measure sand HSLs have been adopted. This criteria is relevant for workers involved in shallow trenches to a maximum trench depth of 1m; and
  - CRC Care (2011) Soil HSLs for Direct Contact for Intrusive Maintenance Workers and HSLs for Direct Contact with Soil (Residential B).

The proposed development will also include garden areas and open spaces on the site. At these areas, Ecological Screening Levels (ESLs) and Ecological Investigation Levels (EILs) outlined in Schedule B1 of NEPM 2013 will also be considered.

Aesthetic issues relating to soils (such as generation of odours and any discolouration of the soil as a result of contamination) will also need to be adequately addressed as outlined in the NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme (3rd Edition)* and in accordance with Section 3.6 of Schedule B1 of NEPM 2013.

Additional considerations relating to validation of the site to the above criteria (including ecological considerations) are outlined below in **Section 8.5.1**.

7.2 Waste Classification Samples

Fill and natural soil samples collected from the site for waste classification purposes are to be compared to the General Solid Waste (CT1) and Restricted Solid Waste (CT2) criteria presented in Table 1 of the NSW EPA (2014) *Waste Classification Guidelines: Part 1: Classifying Waste.*

7.3 Groundwater Criteria

The proposed groundwater monitoring/validation program is detailed below in **Section 8.5.5** and the adopted Groundwater Acceptance Criteria (GAC) are summarised below in **Section 7.3.1**. The adopted GAC were

based on an evaluation of potential beneficial groundwater uses both on and off-site. The results of the review are provided below in **Table 7-1**.

Table 7-1: Summary of Potential On-site and Off-site Groundwater Beneficial Uses

Beneficial Use		Likelihood of Use		Comment
		Onsite	Offsite	
Aquatic Ecosystems	Groundwater	Unlikely	Potential	There are currently no sensitive aquatic ecosystems present on-site and none are anticipated after site redevelopment. However, Haslams Creek, located approximately 350m east of the site, is an off-site aquatic ecosystem beneficial use (off-site) and will therefore be considered for protection.
Human Uses	Potable Water	Unlikely	Unlikely	The site and vicinity have an established reticulated water supply which the site will use. Therefore, it is unlikely that groundwater at the site or vicinity is extracted for potable purposes. Drinking water GILs will not be evaluated.
	Primary /Secondary Contact Recreation / Aesthetic	Unlikely	Unlikely	Haslams Creek, located approximately 350m east of the site, flows north to Homebush Bay and the Parramatta River. Primary or secondary contact for Parramatta River users is possible (i.e., boating). However, given the distance between the potential discharge point of groundwater to Homebush Bay and the Parramatta River (a distance of >2km), it is unlikely site-specific groundwater impacts would reach the Parramatta River and impact recreational users.
	Irrigation	Potential	Unlikely	Any on-site irrigation (i.e., gardens) would be from the established reticulated water supply.
	Stock Watering	Unlikely	Unlikely	Given the site location within the Sydney metropolitan area, it is unlikely that groundwater will be extracted for stock watering purposes.
	Industrial Use	Unlikely	Potential	The potential exists for off-site industrial use of groundwater.
	Aquaculture	Unlikely	Unlikely	Parramatta River (i.e. the nearest water body capable of supporting aquaculture) down-gradient of the site is not utilised for aquaculture. Given the distance to the coast, it is unlikely site-specific impacts (if they exist) would significantly impact proposed aquaculture.
Intrusive Maintenance / Trench / Excavation Worker		Potential	Potential	On-site and off-site sub-surface activities have the potential for workers to come in direct contact with impacted groundwater. This includes excavation for the on-site building basements.

7.3.1 Groundwater Acceptance Criteria

Based on **Table 7-1**, there are no on-site beneficial uses to be protected. Should groundwater analytical data be collected, it will be compared to the following criteria to account for the most conservative use of groundwater on-site and potential off-site uses:

- Maintenance of Aquatic (freshwater and marine water) Ecosystems; and
- Industrial Use.

For the purpose of evaluating groundwater conditions for the identified beneficial uses to be protected, groundwater data (if collected) will be compared against the ANZECC Guidelines (2000) 95% *Protection Level for Freshwater and Marine Water Aquatic Ecosystems*. In addition, the analytical results will be compared against the NEPM (2013) *Guidelines for Freshwater and Marine Waters.* Groundwater data will also be compared to CRC CARE HSLs for intrusive maintenance workers and the NEPM 2013 HSLs for risk of vapour intrusion at medium-high density residential land uses.

8 Remedial Action Plan

8.1 Remediation Objectives

The objective of the recommended remedial strategy is to address impacted fill material at the site that may be unsuitable to remain on-site for the proposed high density residential land-use. Remedial and/or management works relating to the hotspots of contaminated fill material are required to ensure that the site is suitable for the proposed land-use.

The specific scope of work required for remediation and/or management will also depend on the results of the proposed DGI. However, based on the previous analytical data collected from the site, the following remediation objectives have been determined:

- Remediation of the elevated TPH, benzo(a)pyrene/PAH and identified asbestos present in the existing fill material on the site;
- Removal and validation of any additional materials that may be encountered during site development works deemed not suitable for the proposed development and/or materials excess to current site requirements;
- On-site containment of the fill materials and associated management; and
- Document the validation process.

8.2 Remedial Options Hierarchy

8.2.1 Soil

The *Guidelines for the NSW Auditor Scheme (3rd Edition)* (EPA 2017) outlines the preferred order of options for site remediation and management (noting this relates to soil impacts):

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.

8.3 Remedial Options Evaluation

TRACE Environmental has evaluated potential remedial options listed in the hierarchy above to provide a recommended remedial strategy to address the fill material at the site. The evaluation process is summarised in **Table 8-1**, below.

Table 8-1: Remedial Option Evaluation

DQO	Description
Option 1 On-site treatment of soil	This option includes on-site treatment of soil through land farming to stimulate biological degradation and volatilisation of COPCs. Periodic soil sampling is undertaken during the land farming process to determine if COPCs concentrations have been reduced to levels below the applicable guideline criteria. The COPCs identified at the site are TPH, benzo(a)pyrene/PAHs and asbestos. The identified COPCs are not volatile or readily biodegradable and therefore, the identified concentrations, cannot be reduced though on-site land farming in a reliable or timely manner. This option is eliminated as a potential remedial strategy.
Option 2 Off-site treatment of excavated soil	This option includes off-site treatment of soil through land farming to stimulate biological degradation and volatilisation of COPCs. Periodic soil sampling is undertaken during the land farming process to determine if COPCs concentrations have been reduced to levels below the applicable guideline criteria. This option is considered when there is not sufficient space on-site to remediate site soils. As described above, the identified COPCs are not volatile or readily biodegradable and therefore, the identified concentrations, cannot be reduced though off-site land farming in a reliable or timely manner. This option is eliminated as a potential remedial strategy.
Option 3 Excavation and off-site disposal of impacted soil	This option includes the excavation and transportation of soil to an off-site facility licensed to accept the waste. The volume of material is tracked through waste dockets and weight tickets at the receiving facility. This remedial strategy is appropriate to address the identified COPCs at the site in a timely manner, is reliable at removing COPCs from the site at concentrations above the applicable guideline criteria and can be completed in conjunction with the site re-development works.
Option 4 Consolidation and isolation of the soil on-site by containment	This option includes the encapsulation and/or capping of impacted soils with a properly designed cap such as concrete. This remedial strategy relies on removing the completed receptor pathways to soil with COPCs at concentrations above the applicable guideline criteria. The strategy is appropriate to address the identified COPCs at the site in a timely manner, is reliable at reducing potential exposure to COPCs at the site at concentrations above the applicable guideline criteria and can be completed in conjunction with the site re-development works. However, this strategy would necessitate leaving impacted soil at the site. Therefore, a long-term Environmental Management Plan (EMP) and a notation of the Section 149 Certificate would be required. However, long-term environmental management is not currently a consideration for the proposed development, and this option is currently eliminated as a potential remedial option.

Based on the evaluation detailed above, excavation and off-site disposal of materials not suitable for the proposed high density residential land uses (including material that cannot be incorporated into the on-site development) is the recommended remedial strategy. This strategy will efficiently and reliably remove the completed receptor pathways to soil with COPCs at concentrations above the applicable guidelines at the site, minimise waste and render the site suitable for the proposed land uses.

It is also noted that the proposed development will be demolished in two stages ('Stage 1 Early Works' and 'Stage 2 Early Works') and the proposed residential buildings (and associated basement car parks) will be constructed in three separate stages (Stages 1 to 3) as shown on plans provided in **Appendix A**. As such, the additional investigation works will likely be conducted in separate phases (as outlined above in **Section 5**), and the validation works will likely be conducted in separate phases during the three proposed construction stages. It is recommended each development stage be 'cleared' and validated separately (with no contaminated materials to be returned to the validated stage following completion of remedial works), and the works be managed at each development stage per requirements of the Site Management Plan outlined in **Section 9** below.

This remedial strategy is further detailed in the following sections.

8.4 Management Strategy Details

Details of the excavation/off-site disposal strategy (and on-site re-use strategy, where appropriate), with details of any unexpected finds investigation (if required), the validation plan, analytical requirements and QA/QC measures, are included in the following sections.

The number of soil validation sampling locations at the site will be adequate to validate the soil (both laterally and vertically) following remediation.

8.4.1 Excavation and Off-site Disposal

Should excess materials be generated on-site during site construction that cannot be incorporated into the development, including materials that are unsuitable for the proposed development, and/or unexpected finds be encountered that contain materials unsuitable for remaining on-site, these materials will be excavated with a mechanical excavator and may be temporarily stockpiled on-site, and appropriate sampling will be conducted for waste classification as detailed below in **Section 8.4.2**. Ideally, the excavated soil will be loaded immediately into transport trucks or skip bins for disposal at the chosen facility. If stockpiled, the soil will be loaded onto trucks from the stockpile for transport and disposal at a facility licensed to accept the soil waste. It is proposed to undertake the soil excavation activities concurrent with the site redevelopment. Additional requirements for removal of asbestos impacted waste are detailed below in **Section 9.4**.

Post excavation soil validation sampling will also be required to ensure the residual soils are suitable for the proposed land uses. The soil validation sampling plan is detailed below in **Section 8.5**.

8.4.2 Soil Waste Classification

Additional sampling will be required for materials requiring removal from the site (such as materials surplus to the proposed development and for unexpected finds). Excess materials that will need to be classified separately will be sampled according to a proposed sampling density of 1 sample per 100m^3. Waste classification samples will be required to be analysed for the COPCs including BTEXN, TPH/TRH, PAHs, phenols, VOCs, OCPs, OPPs, PCBs and asbestos. Soil samples proposed to be collected during the DGI investigation can also be utilised for the waste classification assessment. It is noted that additional COPCs may be required during waste classification depending on the results of the proposed DGIs.

8.4.3 Waste Tracking

Soil removed from the site will be tracked through weighbridge tickets and/or waste dockets provided by the receiving facility. The amount of material documented on the waste dockets will be compared to estimates of volume of material based on the excavation dimensions. This includes tracking of material excavated for off-site disposal, such as from unexpected finds or as required for site development (i.e., footing and/or trench excavations). If significant discrepancies are found between the waste dockets and volume estimates, then the discrepancy will be investigated by the appointed environmental consultant.

On-site soil movement shall be tracked by the appointed environmental consultant with information provided by the civil contractor, including the initial area/volume of any contaminated fill excavated, volumes transported off-site for disposal, locations of on-site stockpiles, locations of backfilled excavation and volume of fill imported for backfill purposes. This includes tracking of material excavated from unexpected finds or material excavated as required for site development (i.e., footing and/or trench excavations). If significant discrepancies are found (such as between waste dockets and volume estimates for material disposed off-site, or between materials excavated from unexpected finds with virgin excavated natural material (VENM) or excavated natural material

(ENM) required to infill the finds), then the discrepancy will be investigated by the appointed environmental consultant.

Refer to **Section 8.12** below for information relating to waste classification and off-site disposal that is to be documented in the Validation Report and as required by the NSW EPA (2017) guidelines.

8.4.4 Liquid Waste

If significant volumes of water accumulate in the excavations during site remedial works, the water will be sampled to classify the liquid waste for off-site disposal, and subsequently disposed to stormwater or sewer, subject to water quality and receipt of appropriate approvals, or removed by a vacuum truck operated by a licensed liquid waste contractor and disposed at a NSW EPA licensed liquid waste treatment facility, where only small volumes of water require disposal.

8.5 Validation

The following sections provide the anticipated scope of soil sampling required for validating the site (including if unexpected finds are encountered, refer to **Section 9.5** below for additional detail), as well as including waste classification of any surplus materials that cannot be incorporated into the proposed development.

Documentation of the required containment strategy, if undertaken, is also outlined below.

8.5.1 Soil Validation Sampling

Soil validation sampling will be conducted in accordance with the regulatory guidelines outlined above in **Section 1.4**.

A PID will be used for field screening on-site to evaluate the extent of potential VOC impact in excavations. Based on the results of the undertaken environmental investigations, significant concentrations of VOCs are not anticipated at the site, however, soil vapour sampling may be required if volatiles are encountered during the proposed DGIs and/or during investigation of unexpected finds during remedial works. Should soil vapour sampling be required, this RAP should be updated prior to proceeding.

Soils identified as being potentially contaminated should be excavated. Validation soil samples will be collected from the base and sidewalls of the resulting excavation and submitted for laboratory analysis for the COPCs including TRH/TPH, BTEXN, PAHs, eight heavy metals (arsenic, cadmium, copper, chromium, lead, mercury, nickel and zinc), phenols, PCBs, OCPs, OPPs, VOCs and/or asbestos (these COPCs may be modified should additional impacts be encountered during the proposed DGIs and/or should unexpected finds be encountered during remedial works). The analytical results will be compared to the guideline criteria outlined in **Section 7.1** to determine the suitability of the residual soils for the proposed land uses. The soil validation plan, including QA/QC sampling protocols, is presented in the following sections.

Soil samples will be collected from the area following excavation per the following ratios:

- 1 per 15 linear metres of length and width of the resultant excavation wall;
- 1 per 225 m^2 of the resultant excavation base; and

- If validation relates to potentially asbestos containing material[4], these sampling ratios will be:
  - 1 per 10 linear metres of length and width of the resultant excavation wall; and
  - 1 per 100 m^2 of the resultant excavation base.

Additional Considerations

Additional considerations will be required during remedial works and validation sampling, as follows:

- Consideration must be given to potential asbestos risks in existing fill materials, noting that asbestos impact has previously been encountered in fill materials at the site (or may also be encountered during the proposed DGI). Areas of additional potential asbestos impacts not previously identified and/or not identified during the proposed DGI (if encountered) will be considered as unexpected finds (per **Section 9.5**). These areas should be visually inspected for ACM on the ground surface on a grid-based inspection pattern comprising 1m transects with a 90° direction change between each pass. If ACM is encountered that appears to be associated with a partially buried structure, or if evidence of extensive fill materials that contain ACM are observed, sub-surface sampling for asbestos analysis should be conducted at the density referenced above;
- Ecological considerations are required at the proposed deep planting and landscaped areas of the development. Soil validation samples are required to validate these areas, with comparison to the applicable ecological criteria (EILs/ESLs referenced above in **Section 7.1**). Validation sampling is proposed at these areas from the finished surface/ground level at the above referenced sampling ratios (in particular, 1 per 225m^2 of area extent of the finished ground surface). Samples should be analysed for metals and organics (i.e., TPH/TRH, PAHs) for which EILs/ESLs have been established, unless additional impacts are encountered that may require validation (such as impacts associated with any VOC impacts and/or unexpected finds, including asbestos). As referenced in Schedule B1 of NEPM 2013, EILs apply principally to contaminants in the top 2m of the soil at the finished surface/ground level, and as such, considerations of soil variability within the upper 2m zone is required, such as if fill materials overly natural materials at these areas; and
- Validation will likely occur during site redevelopment works in three separate stages (Stages 1 to 3 as referenced in **Appendix A**). As such, the validation frequencies and requirements (outlined above) and associated reported requirements (outlined below in **Section 8.12**) will apply at each validation stage.

8.5.2 Excavated Stockpile Soil Sampling

Excess materials that cannot be incorporated into the site development will require classification in general accordance with NSW EPA 2014 *Waste Classification Guidelines*. Excess materials will be sampled at a density of 1 sample per 100m^3. The additional samples will be analysed for selected COPCs including TRH/TPH, BTEXN, PAHs, eight heavy metals (arsenic, cadmium, copper, chromium, lead, mercury, nickel and zinc), phenols, PCBs, OCPs, OPPs, asbestos, electrical conductivity and/or pH. Additional COPCs may be required for validation depending on the results of the proposed DGI. Additional characterisation for ASS may also be required depending on site observations (such as observations of sulfidic odours, iron staining), however, based on current information it is not considered likely that ASS will be encountered at the site.

[4] Asbestos validation would likely relate to validation of unexpected asbestos fines that have not been identified prior to start of excavation works (i.e., following removal of previously identified asbestos hotspots). Refer to *Additional Considerations* below for detail.

Sediment/management controls as outlined below in **Section 9.1** and/or **Section 9.4.2** will be required for stockpiled material at the site.

8.5.3 Soil Sampling Methodology

The sampling methodology adopted for collection of soil validation samples, is summarised in **Table 8-2** below:

Table 8-2: Soil Sample Collection

Activities	Details
DGI and/or Validation Sampling	During the proposed DGI, soil bores will likely be utilised for investigation. Soil bores will be advanced using a combination of techniques including hand auger and a drill (Geoprobe) rig, with soil samples collected from the hand auger, push tube and/or solid stem augers at each soil boring location. Test pits may also be utilised using an excavator, with soil materials manually collected by hand, protected by a dedicated nitrile glove, directly from the centre of the excavator bucket used to excavate the site soils. Samples will be collected from each test pit or soil boring from: • the surface (0.1-0.2 m); • at changes in lithology; • at evidence of contamination (e.g. odours, staining, waste inclusions) (if any); • at areas of elevated PID readings (if any). During remedial works, an excavator will be utilised to collect soil from the sidewalls and based of the resulting excavation. Validation soil samples of the soil materials will be manually collected by hand, protected by a dedicated nitrile glove, directly from the centre of the excavator bucket used to excavate the site soils. Soil samples will be collected in 250mL jars supplied by the laboratory, labelled, and immediately stored on ice for transport to the laboratory. Samples collected for asbestos analysis will be collected in laboratory supplied 500mL plastic bags with a press ('Ziploc') seal in accordance with the NEPM 2013 requirements. For fill materials requiring additional characterisation, collection of 10L samples screened manually using a <7mm sieve or spread out for inspection on a contrasting colour fabric (per WA DoH) will also be considered where: • ACM fragments have been identified in the fill materials; • Materials requiring sampling correspond to locations where asbestos/ACM have previously been identified (i.e., materials removed from the identified 'hotspots'; and/or • Where materials can be sieved or spread out evenly (i.e., sandy materials). It is noted that natural materials requiring asbestos validation will require analysis of 500mL samples (plastic bags with a press seal) only.
Field Logging	Logging of the validation soil samples will be conducted in general accordance with the Unified Soil Classification System. Soil materials will be logged with the following information recorded in the field: soil/rock type, colour, grain size, sorting, inclusions, moisture conditions, staining and observation of any anthropogenic material (e.g. odours, and waste materials). Descriptions will be recorded on field log sheets for uniformity in descriptions, presentation and to aid in future interpretations.
Validation Sampling Density	Validation soil samples will be collected based on the densities described above.
Field QC Samples	Field duplicates and triplicates of the validation soil samples will be prepared in the field by collecting split samples of the same material from the same depth. Samples will not be mixed or homogenised during collection or splitting. Samples for duplicate analyses will be selected from sampling locations characterised by indicators of contamination, odour and/or elevated PID responses (if encountered). A trip spike and trip blank will also accompany each batch of samples transferred to the laboratories for analysis.

Activities	Details
Sample Labelling, Storage and Transport	All samples will be clearly labelled with a unique sample identification consisting of the date, sample location, depth of sample and sampler's initials. In the case of field duplicates and triplicates, sample containers will be labelled in a manner that does not reveal to which primary sample the duplicate or triplicate belonged. All samples will be kept chilled in an ice filled esky prior to dispatch and during transport to the NATA registered laboratory under chain-of-custody procedures. By prior arrangement with the laboratories, samples will be analysed as soon as practicable after receipt.
Field Screening for VOCs	Additional soil from each validation sample location will be placed in a sealed plastic bag for field screening purposes. After waiting approximately 5 minutes for the sample and the headspace to equilibrate, the headspace in the bagged samples will be assessed by a calibrated (100 ± 3 parts per million (ppm) isobutylene) PID with a lamp appropriate for detecting petroleum hydrocarbons to measure the presence of total VOCs.
Excavation Reinstatement	Imported fill material may be required to backfill the excavation and to reach construction/redevelopment levels. Any soil imported to the site will need to be validated as suitable for the proposed high density residential land uses described below in **Section 8.5.4**.
Decontamination	Reusable sampling equipment, if required during the DGI, remediation and validation works (such as a sampling trowel) will be decontaminated between each location by scrubbing in a solution of Decon 90, and a final rinse in potable water. A clean pair of disposable nitrile sampling gloves will be used between each validation sampling location. If reusable sampling equipment is used, rinsate blank samples will be collected during field decontamination procedures by rinsing decontaminated equipment with clean deionised water to enable the assessment of potential cross-contamination of the samples during the field handling.

8.5.4 Imported Fill Sampling

Materials imported to site will comprise only ENM or VENM (as defined in the POEO Act).

ENM

Resource recovery orders and resource recovery exemptions established by the NSW EPA allow some wastes to be beneficially and safely re-used independent of the usual NSW laws that control applying waste to land. This includes the *excavated natural material order 2014* and *excavated natural material exemption 2014* per the *Resource Recovery Exemption under Part 9, Clauses 91 and 92 of the Protection of the Environment Operations (Waste) Regulation 2014.*

As referenced in the *excavated natural material exemption 2014*, waste to which this exemption applies is referenced as follows:

- This exemption applies to excavated natural material that is, or is intended to be, applied to land as engineering fill or for use in earthworks;
- Excavated natural material is naturally occurring rock and soil (including but not limited to materials such as sandstone, shale, clay and soil) that has:

  a) been excavated from the ground, and

  b) contains at least 98% (by weight) natural material, and

  c) does not meet the definition of Virgin Excavated Natural Material in the Act.
- Excavated natural material does not include material located in a hotspot; that has been processed; or that contains asbestos,

The exemption is subject to the following conditions:

- At the time the excavated natural material is received at the premises, the material must meet all chemical and other material requirements for excavated natural material which are required on or before the supply of excavated natural material under '*the excavated natural material order 2014*';
- The excavated natural material can only be applied to land as engineering fill or for use in earthworks;
- The consumer must keep a written record of the following for a period of six years:
  - the quantity of any excavated natural material received; and
  - the name and address of the supplier of the excavated natural material received.
- The consumer must make any records required to be kept under this exemption available to authorised officers of the EPA on request; and
- The consumer must ensure that any application of excavated natural material to land must occur within a reasonable period of time after its receipt.

VENM

The Protection of the Environment Operations Act 1997 (POEO Act) defines VENM as:

- 'natural material (such as clay, gravel, sand, soil or rock fines):
  - (a) that has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial, mining or agricultural activities; and
  - (b) that does not contain any sulfidic ores or soils or any other waste.
- and includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved for the time being pursuant to an EPA Gazettal notice.'

Only material accompanied by a VENM certificate will be accepted. As such, any soil imported to the site for backfilling purposes should be sampled to determine its suitability for the proposed land uses. VENM sampling will comprise analysis at a NATA accredited laboratory for TPH/TRH, BTEXN, PAHs, phenols, 8 metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), OCP, OPPs, PCBs, electrical conductivity and asbestos. As part of the assessment process, if imported fill material is accompanied by a VENM certificate, one sample per 1,000m^3 should be collected. If imported fill material is not accompanied by a VENM certificate, a more robust sampling program and source site history review will need to be undertaken, including at least one sample per 250m^3 should be collected.

Laboratory analytical results will be compared to laboratory LORs for all organic analyses (TPH/TRH, BTEXN, PAHs, phenols, OCP, OPPs and PCBs) and asbestos, and to published background levels for inorganic analyses (metals).

8.5.5 Groundwater Monitoring

Previous groundwater analytical results indicate that groundwater beneath the site is not impacted with COPCs at concentrations above the applicable guideline criteria, with the exception of some metals results attributable to background conditions. However, as referenced above in **Section 5**, additional groundwater investigation is required to investigate data gaps at the site. If previously unidentified significant groundwater impacts are encountered during additional investigation and/or development works, validation of groundwater beneath the site may be necessary. Significant impacts would be indicated by the following:

- Noticeable odours in ambient air produced from the exposed soil;
- Pronounced, laterally extensive areas of soil staining;
- Elevated (>100 ppm) PID readings; and/or
- In the event of unexpected finds (refer to **Section 9.5** below) that could act as a source of subsurface impacts such as a USTs.

As part of the proposed DGIs, TRACE Environmental proposes to install and sample additional monitoring wells as necessary at appropriate locations (to be determined based on the additional required inspections).

Monitoring Well Installation and Sampling

The installation and sampling methodology adopted for the groundwater investigation (and potential groundwater validation program) to be conducted is detailed in **Table 8-3**, below.

Table 8-3: Groundwater Investigation/Validation Methodology

Activities	Details
Monitoring Well Construction	Additional groundwater monitoring wells will be constructed using Class 18 uPVC 50 mm inside diameter machine threaded casing and 0.4 mm slotted screen and casing. Well construction, including screen lengths, will be based on observations made during the drilling. Once the well screen and riser are installed, a filtered sand of 2 mm in diameter is introduced as a filter pack to reduce sediment infiltrating the well annulus. The filter pack is placed around the screened section of the well to approximately 1 m above the top of the screen. Fine-grained bentonite pellets are placed above the sand filter pack around the well to the surface and are slightly wetted to ensure an adequate seal is formed to prevent surface infiltration into the well.
Monitoring Well Development	As soon as practical following the installation of the groundwater monitoring well, the well will be developed using a bailer. The bailer is used to disturb the water column within the well annulus to remove any groundwater and well debris that may have been introduced during the installation process.
Monitoring Well Gauging, Purging and Sampling	The standing water level (SWL) in the well is measured from the top of casing using an oil/water interface probe (IP). Purging and sampling of the groundwater well will be undertaken using a peristaltic pump, with purging completed until field water quality parameters have sufficiently stabilised. Dedicated single use Teflon-lined tubing will be used during purging and sampling. Samples will be collected into appropriate laboratory provided containers. Samples for analysis for metals are first filtered through a 0.45 micron filter prior to being dispensed into the sample container. Samples will be collected using low flow sampling techniques and collected into 40mL laboratory prepared vials preserved with hydrochloric acid, 500mL plastic bottles preserved with nitric acid and or 1L unpreserved amber glass bottles. All bottles will then be sealed immediately using a Teflon lined cap, labelled and placed on ice.
Field QC Samples	Field duplicate and triplicate of the groundwater samples will be prepared in the field by collecting split samples from the same monitoring well. Samples for duplicate analyses will generally be selected from locations characterised by odours, or the presence of sheen (if any). A trip spike and trip blank will also accompany the groundwater samples (if collected).
Sample, Labelling, Storage and Transport	All samples will be clearly labelled with unique sample identification numbers consisting of the date, sample location and sampler's initials. In the case of field duplicates, sample containers will be labelled so as to not reveal their purpose or sample location to the laboratory. All samples will be kept chilled in an ice-filled esky prior to dispatch and during transport to the NATA registered laboratory under chain-of-custody procedures. By prior arrangement with the laboratories, samples will be extracted as soon as practicable after receipt by the laboratories.
Decontamination	During the gauging of groundwater monitoring wells, a water level meter will be used. The interface probe will be decontaminated between each temporary well location by scrubbing with a solution of Decon 90 (a phosphate-free detergent) followed by a rinse in potable water. New tubing and a new pair of nitrile gloves will be used at each temporary groundwater monitoring well location.

8.6 Analytical Program

8.6.1 Soil Samples

Soil samples will be submitted to a National Association of Testing Authorities (NATA) accredited laboratory for analysis. Soil validation samples will be analysed for COPCs including TRH/TPH, BTEXN, PAHs, phenols, PCBs, OCPs, OPPs and asbestos (or other COPCs if reported during the proposed DGI or during investigation of any unexpected finds).

8.6.2 Groundwater Samples

Groundwater sample will be collected from existing and the newly installed monitoring wells and will be submitted for analytical testing at a NATA accredited laboratory. Groundwater samples will be analysed for COPCs associated with the site including TRHs, BTEXN, PAHs, eight heavy metals (dissolved), phenols, PCBs, VOCs, OCPs, and OPPs (or other COPCs if reported during the proposed DGI or during investigation of any unexpected finds).

8.6.3 Laboratory Methods

Soil and groundwater samples will be analysed at NATA accredited laboratories in accordance with the analytical methods presented in **Tables 8-4** and **8-5** below.

Table 8-4: Summary of Soil Analytical Methods

Analysis	Analytical Method	LORs (mg/kg)
Metals (As, Cd, Total Cr, Cu, Pb, Hg, Ni, Zn)	US EPA 200.1	0.1 to 5
TRH Fraction F1 and F2 TPH C_6 to C_{40} BTEX	US EPA 500.2	25 to 100 0.1 to 1
Polycyclic Aromatic Hydrocarbons	US EPA 550.2	0.5
OCCs/OPPs	US EPA 550.2	0.05 to 2
PCBs	US EPA 550.2	0.1
Phenols	US EPA 550.2	0.2 to 20
Asbestos Quantification	EA200N	0.001 to 0.1%

Table 8-5: Summary of Groundwater Analytical Methods

Analysis	Analytical Method(s)	LORs
Heavy Metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn)	USEPA 6020 ICP/MS	0.001 mg/L
TRH/TPH	USEPA 8260/8015 P&T-GC/MS/FID APHA 5520F	20-100 µg/L
BTEXN	USEPA 5030/8260 P&T/GC/MS or HS/GC/MS	1-5 µg/L
PAHs	USEPA 3510/8270	0.5-1 µg/L
Volatile Organic Compounds	USEPA 5030/8260 P&T/GC/MS	5-50 µg/L
Phenols	USEPA 3510/8270	1-2 µg/L
PCBs	USEPA 3510/8270	1-2 µg/L
OCCs/OPPs	USEPA 3510/8270	1-5 µg/L

8.7 Quality Assessment/Quality Control Program

The Quality Assurance / Quality Control (QA/QC) program will be assessed by data quality indicators as set out in the *Guidelines for the NSW Site Auditor Scheme (3rd Edition)*;

- Completeness – all critical locations will be sampled, samples will be collected from borings/monitoring wells, sample documentation will be complete, sample holding times will be complied with, appropriate methods will be used, and all documentation will be included in the report to demonstrate this;
- Comparability – experienced samplers will be used and the same approach to sampling will be taken, the same standard technical operating procedures will be used in the field on each occasion, climatic conditions will be recorded, same laboratories will be used for all primary samples. All deviation from the standard technical operating procedures will be discussed in the report;
- Representativeness – samples will be collected which represent the characteristics of the media sampled, samples will be homogeneous, appropriate collection, handling, storage and preservation will take place, and laboratory artefacts will be detected by the use of contaminant blanks (the DQIs for trip blanks will be non-detect);
- Precision – standard operating procedures will be complied within the field, laboratory and inter-laboratory duplicates, field duplicates and laboratory-prepared volatile trip spikes (70-130% of the original concentration) will be used and the coefficient of variance of field duplicates by relative percent difference (RPD) will be assessed; and
- Accuracy – standard operating procedures will be complied with in the field and analysis of laboratory blanks (the DQIs for laboratory blanks will be non-detected), controls and spikes (recoveries of 70 – 130% of original concentration) will be conducted to eliminate the bias associated with cross contamination.

8.8 QA/QC Program

The quality assurance program during the validation program includes the following:

- Preservation and storage of samples upon collection and during transport to the laboratory;
- Sample holding times;
- Use of appropriate analytical and field sampling procedures;

- Required limits of reporting; and
- Frequency of conducting quality control measures.

The quality control program will include the following:

- Rinsate and field blanks;
- Field duplicates - blind duplicates and inter-laboratory duplicates (split samples);
- Trip blank samples;
- Trip spike samples; and
- Data validation to assess for and clarify the occurrence of apparent unusual or anomalous results, e.g. laboratory results that appear to be inconsistent with field observations or measurements.

8.9 Field QA/QC

The field QA/QC program implemented during the validation program will include:

- Duplicate and triplicate samples split in the field and submitted to two separate laboratories in accordance with NEPM requirements. One duplicate per 20 primary samples and one triplicate per 20 primary samples submitted to the laboratory for analysis, will be collected for analysis;
- Rinsate blanks when reusable sampling equipment is used;
- One trip blank and one trip spike per sampling event submitted to the laboratory for analysis;
- Documentation of sample collection, handling and transportation procedures, appropriate to meet the project DQOs;
- Details of:
  - the sampling team;
  - sampling method(s), including the actual methods employed for obtaining samples, type(s) of sample containers, order and degree of filling, preservation, labelling, logging, custody;
  - evidence of appropriate decontamination procedures carried out between sampling events;
  - logs for each sample collected showing time, location, initials of sampler, duplicate locations, duplicate type, chemical analyses to be performed, site observations and weather conditions;
  - COC documentation fully identifying for each sample the name of the sampler, the nature of the sample, collection date, analyses to be performed, sample preservation method, departure time from the site and dispatch courier(s) and condition of samples at dispatch;
  - sample splitting techniques;
  - a statement of duplicate frequency for intra-laboratory and inter-laboratory duplicate samples and duplicate sample results;
  - field blank results;
  - laboratory-prepared trip spike results for volatile analytes; and

- trip blank results.

8.10 Laboratory QA/QC

All analytical laboratories are required to adhere to NATA endorsed methodologies and conduct regular control checks on their analyses. TRACE Environmental requires these laboratories to regularly provide results of control/method blanks, repeat duplicates and recoveries. The validation report will include details of:

- Analytical methods used for each potential contaminant in the matrix used by laboratories accredited for those analyses by NATA or an equivalent;
- Laboratory method detection limits for the chemicals of concern for use in the assessment of risk; and
- The following information:
  - A copy of signed chain-of-custody forms acknowledging receipt date and time, conditions of samples on receipt and identity of samples including in shipments;
  - Record of holding times and a comparison with method specifications;
  - Analytical methods used;
  - Laboratory accreditation for analytical methods used; and
  - The results for blind duplicate samples collected from the field.

The project laboratory will also provide evidence of the following QA/QC procedures:

- Sample receipt and registration documentation;
- Instrument blank analyses;
- Surrogate spike and matrix spike analyses; and
- Laboratory duplicates.

Decontamination Procedures

All sampling equipment which will come into contact with the samples will be decontaminated before moving to the next location to avoid cross-contamination. A rinsate blank will be taken from the rinsate off the cleaned excavation and sampling equipment, when reusable sampling equipment is used.

Sample Storage, Preservation and Transport

Soil and groundwater samples will be stored in a cool esky containing ice immediately after they have been taken in accordance with AS4482.1-2005. Samples will be transported to the chosen laboratory within NATA recommended relevant holding times specified and with the relevant COC documentation.

Duplicate Samples (Intra-Laboratory Duplicates)

These samples identify the variation in analyte concentration between samples collected from the same sampling point and/or also the repeatability of the laboratory's analysis (AS4482.1, 2005). Blind duplicates will be collected at a ratio of 1 sample per 20 primary samples. Blind duplicates will be collected at the same time and in the same fashion as the primary sample.

Triplicate Samples (Inter-Laboratory Duplicates)

These samples provide a check on the analytical proficiency of the laboratories (AS4482.1, 2005). Triplicates will be collected at a ratio of 1 sample per 20 primary samples. Split samples will be collected at the same time and in the same fashion as the primary sample.

Rinsate Blank Samples

These samples will provide an indication of whether cross-contamination of analytes from the sampling equipment has occurred. Rinsate samples will be collected at a rate of one rinsate blank per day, per matrix, per piece of equipment (AS4482.1, 2005).

Trip Blank Samples

Trip blank samples will be prepared and transported with primary samples to ensure cross-contamination of samples has not occurred during transportation of the samples. The frequency of trip blanks will be a minimum of one per sampling event.

Trip Spike Samples

Trip blank samples will be prepared and transported with primary samples to ensure degradation of volatile components of COPCs has not occurred during transportation of the samples. The frequency of trip spikes will be a minimum of one per sampling event.

8.10.1 Laboratory Quality Assurance/Quality Control

Laboratory QA/QC will consist of the following procedures:

- Analysis and reporting of laboratory duplicates;
- Analysis and reporting of laboratory method blank samples;
- Analysis and reporting of internal laboratory standards and calibration blanks; and
- Analysis and reporting of laboratory control spikes, matrix and matrix spike duplicates (MS/MSD) and surrogate spikes.

8.10.2 Sample Holding Times

All samples will be delivered to the laboratory to ensure analysis of COPCs within holding times.

8.10.3 QA/QC Documentation

Documentation of the undertaken QA/QC program will include:

- The QA/QC checklist items in the NSW EPA (2000) *Guidelines for Consultants Reporting on Contaminated Sites* related to field quality assurance and quality control, laboratory QA/QC and data evaluation QA/QC;
- The names of the accredited laboratories used and relevant details of their accreditation for each analytical method;
- The laboratory LORs;

- The acceptance limit(s) for each QC test, such as duplicate RPDs and recoveries for laboratory quality control analyses;
- The QC results relevant to the sample analysis;
- For each sample, the highest measurement result wherever replicate measurements are taken (or all measurement results for each sample);
- Results for all data tabulated separately; and
- Analytical laboratory reports specifying compliance with the requirements of the NEPM and equivalence with the reference method or non-standard methods.

8.11 Sample Nomenclature

Soil and groundwater sample nomenclature employed throughout the investigation are provided in **Table 8-6** below.

Table 8-6 Soil and Groundwater Sample Nomenclature

Sample Recovery Method	Sample Nomenclature	Comments
Primary Soil Samples		
Soil Sample	TP#/#.# SB#/#.# SP# EW#/#.#	TP# represents the location of a test pit, and #.# denotes the depth of the sample in metres. SB# represents the location of a borehole, and #.# denotes the depth of the sample in metres. SP# denotes the location of a sample collected from a stockpile. EW# represents the location of an excavation sidewall sample, and #.# denotes the depth of the sample in metres.
Primary Groundwater Samples (if collected)		
GME Sample	MW-#	MW-# represents the location of the groundwater monitoring well
Soil QA/QC Samples		
Duplicates	QS-#	QS-# represents the duplicate sample collected
Triplicates	QS-#A	QS-#A represents the triplicate sample collected
Trip Spike	TS-#	TS-# represents the trip spike sample collected
Trip Blank	TB-#	TB-# represents the trip blank sample collected
Water QA/QC Samples		
Duplicates	QW-#	QW-# represents the duplicate sample collected (if collected)
Triplicates	QW-#A	QS-#A represents the triplicate sample collected (if collected)
Trip Spike	TS-#	TS-# represents the trip spike sample collected
Trip Blank	TB-#	TB-# represents the trip blank sample collected
Rinsate Blank	QW-#	QW-# represents the rinsate blank sample collected

8.12 Reporting

At the successful completion of the validation works, a comprehensive Validation Report for each development stage detailing the findings will be prepared in accordance with NSW EPA (2000) *Guidelines for Consultants Reporting on Contaminated Sites*. The report will include the following components:

- An executive summary;
- Scope of work;
- Site identification details;
- A summary of the site history investigation findings;
- Details of the site conditions and surrounding environment;
- Local and regional geological and hydrogeological conditions;
- A summary of the sampling and analysis plan and investigation sampling methodologies;
- Identification of the field and laboratory QA/QC performed;
- An evaluation of QA/QC data;
- Identification of regulatory criteria, assumptions and limitations associated with adopting this criteria for the investigation;
- Soil and groundwater assessment analytical results;
- Evaluation of potential risks to human health and/or the environment;
- Evaluation of potential impacts on buildings and structures from residual contaminants (if any);
- A discussion on the implementation of the RAP; and
- Conclusions and recommendations.

It is also noted that the Validation Report will also provide information required by the NSW EPA (2017) guidelines, which includes (but not limited to):

<u>For waste classification:</u>

- Waste classification document;
- Material source and description;
- Sampling density, pattern, COPCs;
- Result summary, including appropriate table with comparison to acceptance criteria; and
- Waste classification.

<u>For off-site disposal works:</u>

- Source location;
- Estimated volume (based on excavation size);

- Actual volume of disposal;
- Waste classification;
- Transporter (waste classification dependent);
- Final destination, PoEO licence;
- Reconciliation of waste dockets with actual disposal volume; and
- Reconciliation of actual disposal volume and the estimated volume of disposal (based on excavation size).

As referenced above in **Section 8.3**, the proposed development will occur in three stages (Stages 1 to 3 as shown on plans provided in **Appendix A**) and the remediation/validation works will likely be conducted in separate phases. As the site is proposed to be progressively validated in separate stages, separate Validation Reports will be required following successful completion of the remedial works and associated validation at each of the proposed stages.

It is also noted that separate DGI reports will be required following completion of the proposed DGI. As referenced above in **Section 5**, it is currently proposed that the additional investigations will be conducted in two separate stages in conjunction with the 'Stage 1 Early Works' and 'Stage 2 Early Works' demolition phases as shown on plans in **Appendix A**. As such, separate DGI reports should be prepared following completion of the investigations at each of the proposed early works stage areas. Should the results of the proposed DGIs indicate additional remediation is required, the DGI reports should also present an updated remedial strategy (if required), with a separate Validation Reports required following successful completion of the remedial works and follow-up validation.

8.13 Duty to Report

Following review of the DGI analytical results, a review of the historical data and the data obtained during the DGI will be reviewed with comparison to the requirements of the NSW EPA 2015 *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act* to make an assessment as to whether the site will need to be reported to the NSW EPA.

9 Site Management Plan

The following sections describe environmental risks and controls required to minimise the impact of works on the environment and the community. In all cases, environmental issues must be managed by the Principal Contractor in accordance with best environmental management practices and supervised by the appointed environmental consultant. The purpose of these measures is to prevent public and environmental exposure to potential health risks associated with these works.

9.1 Stockpile Management

If possible, soil to be removed from site should be loaded immediately into a truck licensed to transport contaminated soil. However, soil may require temporary stockpiling based on the availability of transport trucks. Soil placed in stockpiles around the site will be tracked according to the location of removal and location of stockpile. Stockpiles in place longer than 24 hours will be placed on an impervious base and covered by black plastic, with silt traps appropriately placed to avoid sediment loading of stormwater drains and pipes.

9.2 Excavation Water Management

Any water contained or that collects in the soil excavations will be vacuum pumped out of the excavation by a licensed liquid waste contractor and disposed at a NSW EPA licensed liquid waste treatment facility.

9.3 Air and Dust

9.3.1 Odours

Due to the nature of impact on-site, it is not anticipated that excessive odours will result from remediation works. However, qualified and experienced technical staff will be on site during all excavation works and should excessive odour be generated as a result of the process, on-site spraying of the excavated material with a suitable odour suppressant (i.e., Anotec) will be undertaken to suppress the odour. Other options that may also be employed are:

- A reduction in the size of the excavation face that is open at any one time to reduce the surface area generating the odour;
- Location of any temporary stockpiles of impacted soil as far as possible (and in the predominant down wind direction) from sensitive receptors;
- Smothering of the odours by covering the portion of the site that is generating the odour; and
- Watering the stockpiles and excavations to minimise volatile emissions.

During excavation works, a PID and a Lower Explosive Limit (LEL) meter will be used to obtain readings and document VOC concentrations during activities when soil and groundwater are being disturbed. Commercial odour suppressant will be used if PID measurements in worker breathing zones exceed 15 ppm for over 30 minutes (based on short term exposure limit of 15ppm for benzene – *National Occupational Health and Safety Commission, "Exposure Standards for Atmospheric Contaminants in the Occupational Environment", NOHSC:1003* (1995), Canberra). If the odour suppressant does not reduce vapour, the site will be evacuated until adequate mechanical or natural ventilation can be put in place to reduce vapours to safe levels.

9.3.2 Dust Control

Civil contractors will be responsible for ensuring that excavation, loading, carting, and stockpiling operations are dust free. This may include (but is not limited to):

- Stockpile protection;
- Water application on stockpiles and access roads;
- Limiting the area of exposed excavations and surfaces; and
- Wind fences around earthworks areas.

In the event that excessive dust is generated during any operations on-site, the works will cease and modifications to the process will be made before the operation is resumed. There must be no observable dust transport off-site.

9.4 Removal of Asbestos Waste

9.4.1 Methodology

Sub-Contractors working with asbestos or in asbestos affected areas of the site (if encountered) will be required to prepare and lodge a safe work method statement for the Principal Contractor's approval before commencing work. The chosen remedial contractor will be a licensed asbestos removalist.

To the extent practical, all asbestos waste and debris should be progressively removed from the site and directly transported and disposed to an appropriately licensed landfill immediately following removal in such a manner to prevent any build-up of debris that could affect access within the site or become a workplace hazard.

All removal works will be in accordance with the codes, guidelines and Standards referenced in **Section 1.4**.

9.4.2 Stockpiling

If stockpiling of asbestos waste is required, the affected material should be placed on-site in a specified asbestos waste bin, prepared in accordance with referenced codes including:

- Locate bin on-site, away from adjacent land uses and other contaminated stockpiles, ideally over a concrete or bitumen paved area;
- Bins shall be lined with minimum thickness of 200 micron heavy duty plastic sheet, formed and sealed to ensure leachate from asbestos contaminated material does not escape from the bin;
- Exposed asbestos waste within the bin shall be lightly wetted regularly to reduce dust generation while loading and prior to plastic encapsulation;
- Asbestos waste within the waste bin shall be double wrapped in minimum thickness of 200 micron heavy duty plastic sheet or bagged in specific asbestos bags to code requirements;
- Sandbag or otherwise block any drainage around the waste bin; and
- Barricade the perimeter of the stockpiled/waste bin material.

For larger volumes of fill that can be placed in skip bins, the asbestos waste stockpile should be placed on 200-micron heavy duty plastic sheets and covered with the same thickness plastic and kept moist to reduce

dust generation. Silt traps should also be appropriately placed to avoid sediment loading of stormwater drains and pipes.

9.4.3 Decontamination

Adequate decontamination facilities are to be installed onsite in accordance with the guidelines specified in the Code of Practice for the Safe Removal of Asbestos [NOHSC2002 (2005)] and the NSW Work Health and Safety Regulation 2017 and any amendments.

9.4.4 Respiratory Protection

All persons engaged in asbestos removal work or accessing a contaminated area shall wear an approved respirator conforming to the requirements of SA/NZS 1715 and 1716.

9.4.5 Warning Notices

Suitable warning signs shall be placed around the works area. These signs shall comply with all relevant acts, regulations and codes of practice, including but not limited to:

- AS 1319-1983 – Dangerous Goods Act 1985;
- Dangerous Goods (Storage & Handling) Regulations 2000; and
- Dangerous Goods (Placarding of Workplaces) Regulations 1985.

9.4.6 Loading and Transport of Asbestos-Contaminated Materials

All asbestos impacted waste, if encountered, is to be removed and disposed of in accordance with all relevant acts, regulations, standards and codes of practice.

Removal of waste materials from the site shall only be carried out by a licensed contractor holding appropriate licenses, consents and approvals from NSW EPA, SafeWork NSW and/or other Authorities to transport and dispose of the asbestos waste materials according to the classification guidelines.

Asbestos waste must be transported in a covered leak-proof vehicle to prevent any spillage or dispersal of waste. Bonded asbestos not stored in a bag must be wetted before it is transported offsite. Asbestos fibres and dust waste are classified as friable and must be covered in a manner to prevent the emission of any dust.

Details of all contaminated materials removal from the site shall be documented with copies of weighbridge slips, trip tickets and consignment disposal confirmation (where appropriate). Such information should be provided to the Site Owner for reporting purposes. A site log shall be maintained by the licensed removal contractor for all waste stockpiles (numbered locations), to enable the tracking of disposed loads against on-site origin and location of the materials.

Measures shall be implemented to ensure no asbestos contaminated material is spilled onto public roadways or tracked off-site on vehicle wheels. Such measures could include the deployment of a vehicle washing/cleaning facility, which should be placed at a location before the site egress. The facility shall be capable of handling all vehicles and plant operating on site. Residue from the cleaning facility will be deemed contaminated unless shown by validation to be below Remediation Acceptance Criteria.

The proposed waste transport route should be approved by council. Each load leaving the site shall be recorded. Any vehicle used for the transport of contaminated waste must be inspected before leaving the site to ensure that all residual waste is removed from the outside of the vehicle.

9.4.7 Asbestos Fibre Air Monitoring

To date, respirable asbestos fibres have not been detected in samples collected at the site. However, depending on the results of the proposed DGI, and/or if unexpected asbestos finds are encountered (refer to **Section 9.5** below for additional information) that indicate respirable asbestos fibres are present in the materials at the site that pose a risk to site workers, asbestos air monitoring may be required. If significant amounts of bonded asbestos are encountered, consideration would also need to be given to the nature of the encountered materials (i.e. if friable materials are present) and if extensive mechanical excavation is required that may disturb these materials and potentially generate fibres. If required, a qualified environmental consultant / occupational hygienist shall carry out appropriate air monitoring of the workplace and surrounding areas during asbestos remediation/removal works in accordance with the Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Dust [NOHSC:3003(1988)] including but not limited to:

- Air monitoring at the commencement of asbestos removal activity on the site;
- Air monitoring continuously in areas related to hazard removal work; and
- Air monitoring for clearance following removal of friable asbestos.

Air-monitoring results are to remain below control levels in designated areas and monitored by the environmental consultant / hygienist. These control levels are occupational hygiene best practice and are not health-based standards (they are below the concentration set in NES for asbestos).

The control levels shall be as follows:

Control level (airborne asbestos fibres/ml)	Control/Action
< 0.01	Continue with control measures
≥ 0.01	Review control measures
≥ 0.02	Stop removal work and find the cause

9.4.8 Clearance Inspections

Following the removal of asbestos-contaminated materials, an inspection must be carried out by a licensed asbestos assessor, in order to establish areas which may require further remediation, and an asbestos clearance certificate is to be provided following such clearance. All asbestos waste material must be removed from the work area prior to a clearance inspection.

The licensed asbestos assessor may terminate the inspection if the work area is deemed to be contaminated and reconvene the inspection after follow-up remediation works to a satisfactory standard.

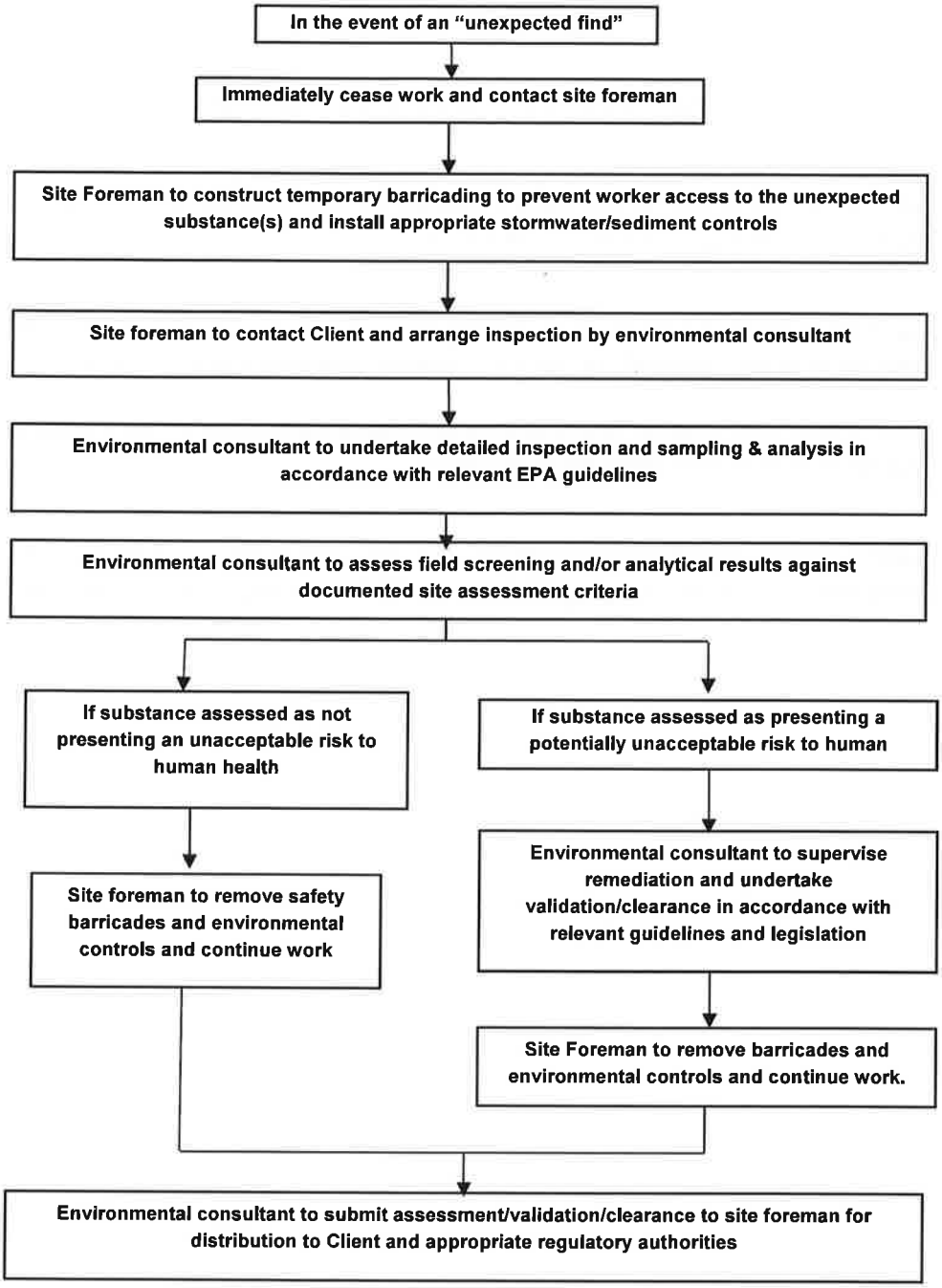
9.5 Unexpected Finds

Workers will be vigilant for hazardous materials that may be uncovered during excavations. Unexpected finds include, but are not limited to, odour, visual contamination, deleterious material inclusions, asbestos containing material, USTs, chemical storage drums or any other suspect materials. Any unexpected finds will be reported to the Contractor's on-site manager immediately. To ensure the protection of the workforce and surrounding community, should any of the substances or items listed above be identified (or any other unexpected potentially hazardous substance), the procedures summarised in the Flowchart below are to be followed. An enlarged version of the unexpected finds protocol Flowchart, suitable for use on-site, should be posted in the site office and referred to during the site-specific induction.

If hazardous materials are uncovered / discovered during excavations the Contractor shall cease all work in that vicinity (and fence the area if appropriate), investigate the nature of the risk of the materials, determine the appropriate response and document the actions in accordance with contractual obligations. The contractor will inform the site owner/occupier and the appointed environmental consultant immediately following an unexpected find. Council and the NSW EPA should also be informed in the event of a serious unexpected find which could cause harm to human and/or the environment.

If soil sample analytical results from unexpected find areas are reported at concentrations exceeding the applicable guideline criteria as noted above in **Section 7.1**, and/or aesthetically unsuitable materials (odours and any discolouration of the soil as a result of contamination) are encountered, these materials will be classified for off-site disposal per the NSW EPA (2014) *Waste Classification Guidelines*.

Flowchart - Unexpected Finds Protocol



9.6 Stormwater

9.6.1 Erosion and Sediment Control

The following erosion and sediment controls will be implemented during soil excavation works:

- Limiting the extent of cleared areas and exposed excavations;
- Backfilling of excavated areas as soon as practicable;
- Diversion of stormwater from active areas using hay bales or sediment fences;
- Covering of temporary stockpiles with plastic (HDPE) and placement of silt socks around excavations when necessary;
- Covering open stormwater grates in the vicinity of stormwater pits and excavations with silt fences or other appropriate materials;
- Placement of stockpiles away from footpaths, roadways, kerbs, access ways or drainage lines;
- Minimising translocation of contaminated soils throughout the site by ensuring excavator operators do not track over contaminated areas;
- If possible, a single vehicle entry and exit to minimise translocating soil;
- Depending on the volume of soil to be excavated, rumble strips may be required at the site access in order to prevent contaminated soil being transported off-site; and
- Depending on the volume and/or nature of asbestos impacted soils/materials encountered during the works, a truck wheel wash station may be required for trucks leaving the site to minimise potential for asbestos impacted soil to be tracked off-site.

9.6.2 Water Management

Stormwater runoff quality may be adversely affected in the event of rainfall. Hay bales will be placed near down-gradient stormwater entry points (if present) to prevent entry of contaminated sediment to stormwater, which may result from the project works.

9.7 Noise

Hours of operation will comply with Council requirements to control noise from site works.

9.8 Land Disturbance

Works include excavation, loading, carting and stockpiling operations of associated soils. These works shall be carried out in an orderly manner to minimise impact to the surrounding residences.

- Excavation - the removal of soil shall be performed by the appointed excavation contractor using an excavator. If a transport truck is not on-site during excavation and soil will need to be temporarily stockpiled, no contaminated soils should be placed on areas validated as suitable for the proposed land uses. In these locations, soil shall be excavated and placed on black plastic liners or on concrete surfaces in discrete stockpiles prior to off-site disposal. Stockpiles should be segregated for each potential contamination source; and

- Loading and Carting – the loading of the stockpile material shall occur with an appropriately sized loader. The trucks and trailers shall be covered for transport as deemed necessary, and shall meet any other statutory requirements.

9.9 General

The appointed Principal Contractor shall ensure compliance with relevant SafeWork NSW guidelines and Work Health and Safety (WHS) Regulations. The Principal Contractor shall also ensure compliance with any amendments to the Act or Regulations during the project duration.

The Principal Contractor shall monitor and control the access of all persons to the site and ensure that no unauthorised persons enter the site during remedial works (wherever practicable). All site personnel and visitors will be inducted and shall wear appropriate personal protective equipment (PPE).

The appointed Principal Contractor shall undertake additional underground and overhead service location specifically in areas surrounding the remediation location.

Any open excavation(s) are to be managed accordance with Part 6.3 of the NSW Work Health and Safety Regulation 2017.

The appointed Principal Contractor shall install warning signs on the barricades surrounding the excavations, including but not limited to: DANGER: OPEN EXCAVATIONS; DANGER: NO SMOKING.

9.9.1 Vehicles

The appointed Principal Contractor shall ensure all vehicles are suitably contained and covered in the transport of all debris, spoil, rubbish and materials to or from the site, such that spillage or contamination of adjoining and other areas or property shall be prevented.

Vehicles shall also be maintained to prevent the transfer of mud or wastes onto adjacent streets or other areas. If wheel treads contain significant quantities of site soils the contractor will manually remove and dispose in stockpiles.

9.9.2 Traffic Control

The Principal Contractor shall supply signs and safety cones; erect at the appropriate entry and exit points; and maintain these devices in good condition. Excavation works, stockpiles and other hazards, shall be individually barricaded at all times. The site will be fully fenced to exclude public.

On-site pedestrian traffic will be averted from the work areas and excavation by means of signage, fencing and safety barricading.

9.9.3 Refuse Disposal

All site refuse, including food, equipment wrappings, unused materials, etc. shall be handled and disposed of appropriately into a skip.

9.9.4 Site Security

The site shall be secured by a lockable fence around the perimeter of the site and access to the site will be restricted. All excavations and above-ground remediation equipment will be barricaded with reflective barricades, with pertinent reflective signage. Keys to the gate will be restricted to approved personnel.

9.9.5 Training

Low environmental awareness of site workers may result in environmental impact including cross contamination of soil layers and off-site movement of contaminated soil. Accordingly, staff awareness training, inductions and daily tool box meetings shall be conducted.

9.9.6 Complaints Management/Community Relations

Any complaints (if lodged) from adjoining residents or on-site workers should be directed to the Principal contractor in the first instance. Should the issue remain unresolved, the remediation consultant should then be contacted. Additional discussion between the remediation consultant and the complainant will further investigate the issue and remedy as required.

9.9.7 Roles and Responsibilities

The primary project team would consist of the appointed environmental consultant working with a remedial subcontractor to undertake the soil works. The consultant and remedial contractor have not been chosen yet, but their details will be included in the HSPs. Additionally, the appointed environmental consultant would engage an environmental analytical laboratory to analyse the validation samples in accordance with NATA standards.

10 Occupational Health and Safety

10.1 WHS Planning and Preparation

Prior to mobilising to complete the remedial works, the Principal Contractor and appointed remedial contractor will develop site and project specific Health and Safety Plans (HSPs), Safe Work Method Statements (SWMS) and Job Safety Analyses (JSAs) for the scope of works to be undertaken. In addition, the appointed environmental consultant will prepare WHS documentation (i.e., HSP, SWMS and JSAs) for environmental aspects associated with remedial works. The WHS documentation will detail measures to mitigate potential risks to site workers, third parties and the local environment during the remedial works. General, minimal WHS procedures to be implemented during the remedial works are outlined as follows:

- Most of the contaminants identified are not volatile, thus under ambient conditions there is low potential for exposure to contaminants via inhalation. Respirators and dust masks should be available on site should conditions arise that create a potential localised exposure to site staff. The additional management practices detailed in **Section 9.4** should also be followed and included in the HSPs;
- Potential exposure pathways for contaminants include dermal absorption (skin contact, ingestion) of dust. All workers should wear long sleeve trousers/shirts on-site. Gloves and safety glasses shall be worn by all workers involved in handling of potentially contaminated soils;
- Protective footwear (steel capped boots) to be worn on site at all times;
- Hearing protection should be worn during soil removal activities (or when working in the vicinity of heavy plant/machinery);
- Unauthorised access should be limited by ensuring that security gates are locked at the completion of each day's work;
- Excavations greater than 1.5m depth need to be "stepped" by the appointed civil contractor;
- Personnel are not to enter excavations (>1m depth) at any time; and
- PPE shall be provided in sufficient quantities to provide for the duties of each on-site individual.

10.2 Incident Management Plan

Emergency response includes pre-emergency planning, lines of authority and communication, emergency recognition and prevention, site control, evacuation routes, decontamination and first aid.

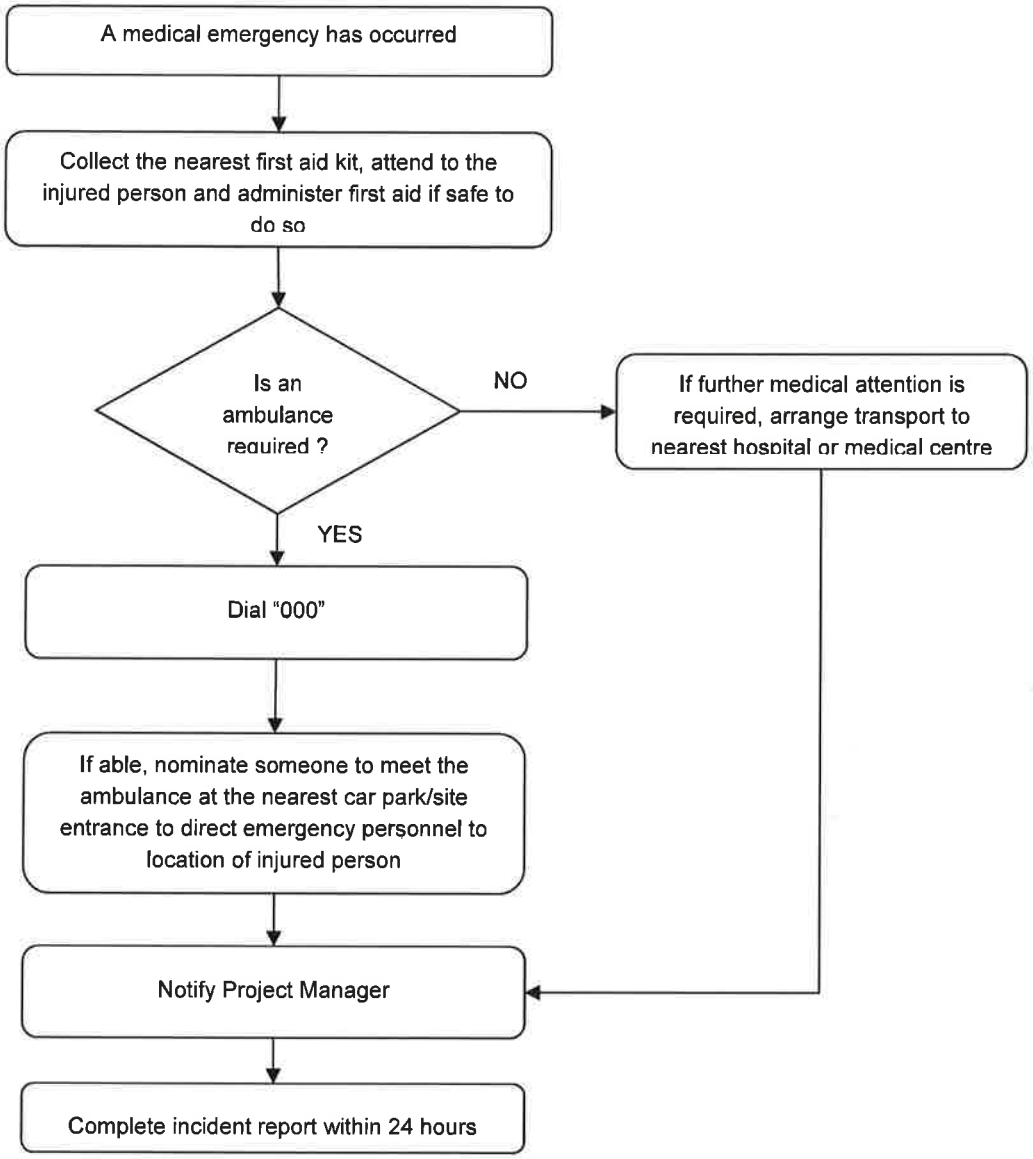
10.2.1 Medical Emergency/Serious Injury

In the event of an accident or an emergency situation involving a serious injury or medical emergency, immediate action must be taken by the first person to recognise the event (refer to flowchart below).

A portable and fully-stocked first aid kit shall be retained on site at all times.

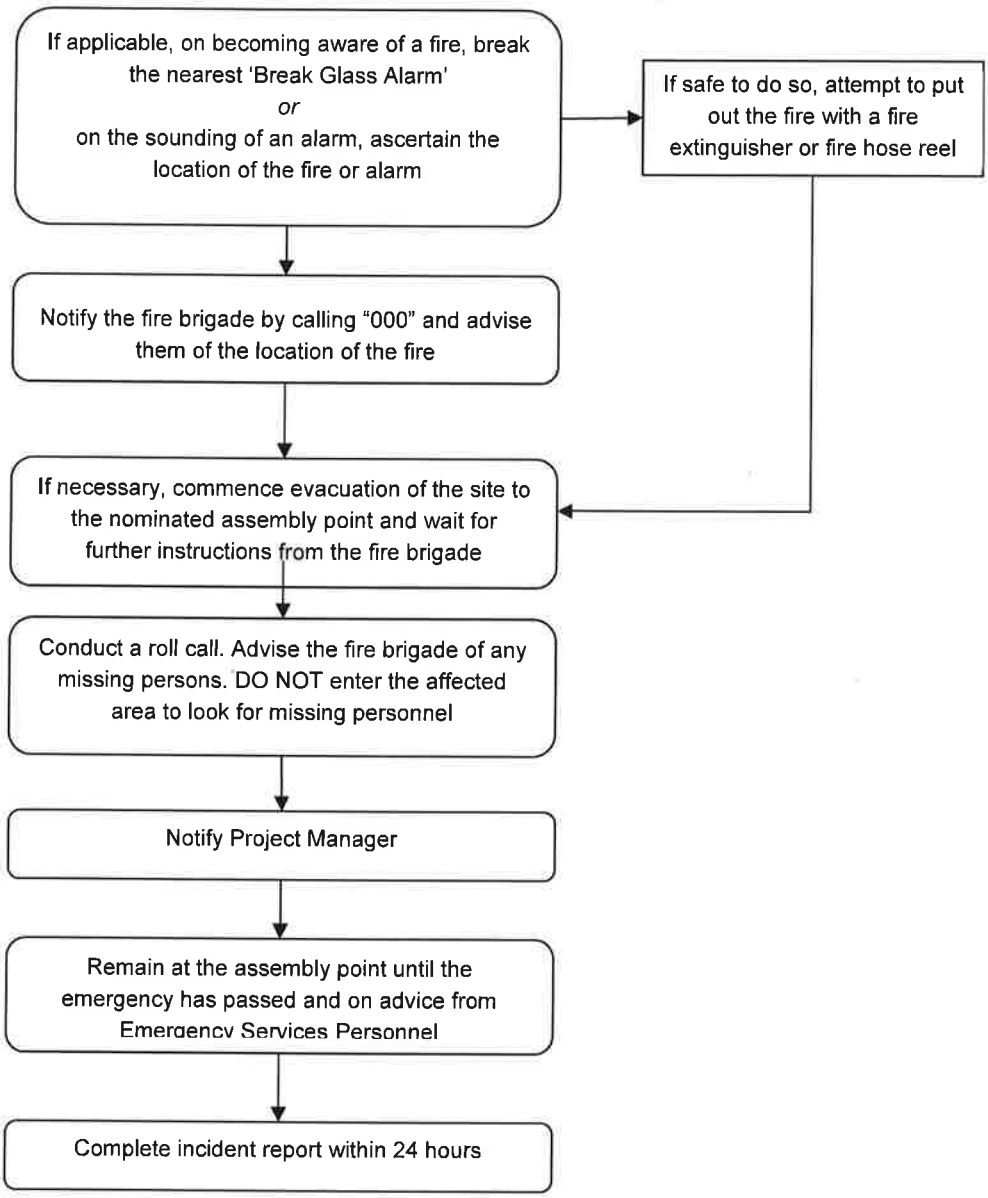
Following the occurrence of an emergency situation, the appropriate site personnel shall be contacted (contact information TBA).

In the event of a fatality, the Police and the State Manager shall be notified immediately.


A medical emergency has occurred
Collect the nearest first aid kit, attend to the injured person and administer first aid if safe to do so
Is an ambulance required ?
NO
If further medical attention is required, arrange transport to nearest hospital or medical centre
YES
Dial "000"
If able, nominate someone to meet the ambulance at the nearest car park/site entrance to direct emergency personnel to location of injured person
Notify Project Manager
Complete incident report within 24 hours

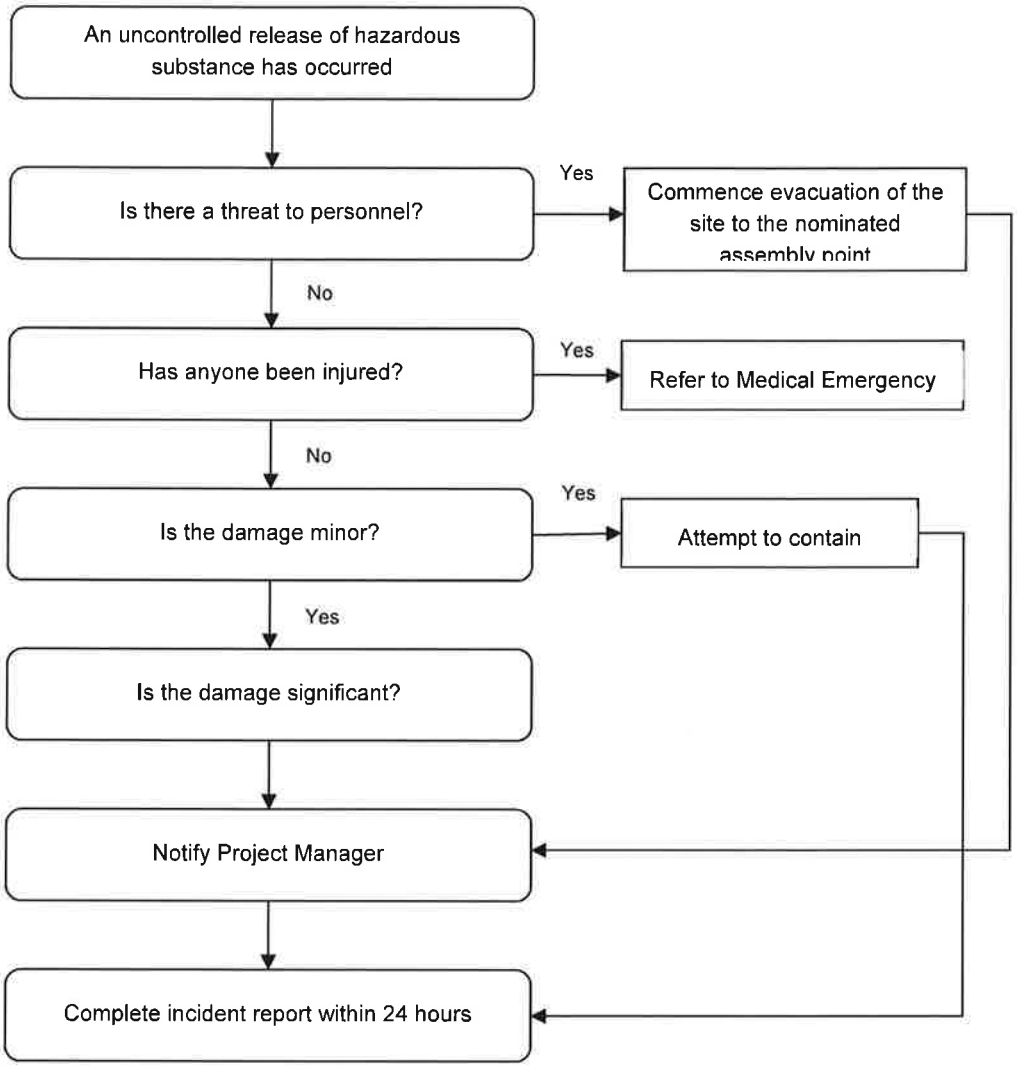
10.2.2 Fire

In the event of a fire, the actions outlined in below shall be taken:



10.2.3 Environmental Incident

In the event of an environmental incident, the actions outlined below shall be taken:



10.3 Incident Reporting

TRACE Environmental employees and sub-contractors are required to verbally report incidents, accidents and near-misses to the Project Manager immediately after an event has occurred. It is the responsibility of the Project Manger to notify the Client Representative immediately after the occurrence of an environmental incident and to forward the completed a written incident report within 24 hours. Additional investigations may be necessary should a serious incident occur.

11 Licences and Approvals

11.1 Waste Classification Guidelines (NSW EPA 2014)

All wastes generated at the site shall be assessed, classified and managed in accordance with the NSW EPA (2014) *Waste Classification Guidelines. Part 1: Classifying Waste*.

11.2 Scheduled Activities Under the Protection of the Environment Operations Act 1997

Clause 15 of the POEO Act 1997 applies to contaminated soil treatment, meaning the on-site or off-site treatment of contaminated soil. The proposed remediation/validation activities are not considered to be scheduled activities under the Protection of the Environment Operation Act 1997 (i.e., are not considered activities for which a licence is required) since the works do not:

- Incinerate more than 1,000 cubic metres per year of contaminated soil, or
- Treat (otherwise than by incineration) and store more than 30,000 cubic metres of contaminated soil originating exclusively from the site, or
- Disturb more than an aggregate area of 3 hectares of contaminated soil originating exclusively from the site.

11.3 Environmental Planning and Assessment Regulation 2000 (Sched. 3 Designated Development)

Schedule 3 of the Environmental Planning and Assessment Regulation 2000 applies to development (described in Part 1 of Schedule 3) which is declared to be designated development for the purposes of the Act unless it is declared not to be designated development by a provision of Part 2 or 3 of that Schedule. The proposed development of the site does not include development described in Part 1 of Schedule 3, and as such is not declared to be designated development.

11.4 Protection of the Environment Operations (Waste) Regulation 2014

The POEO (Waste) Regulation 2014 makes requirements relating to non-licensed waste activities and waste transporting. The proposed remediation works at the site will not require licensing. However, Part 7 of the Regulation outlines the transportation and management requirements of asbestos waste. If asbestos is encountered at the site, Part 7 of the Regulation applies to any activity that involves the transportation, disposal, re-use or recycling of any type of asbestos waste, regardless of whether the activity is required to be licensed.

11.5 Protection of the Environment Operations (UPSS) Regulation 2014

The UPSS Regulation was revised in September 2014 to clarify the statutory requirements for the management and operation of underground petroleum storage system (UPSS) infrastructure in NSW. The requirements of the UPSS Regulation 2014 will apply to the site should additional UPSS be encountered at the site.

11.6 Asbestos Removal Regulations and Code of Practice

The removal and disposal of asbestos during future site redevelopment, should it be required, will be managed in accordance with the Work Health and Safety Regulation (2017) and Work Health and Safety Act (2011),

SafeWork NSW codes of practice including *How to Manage and Control Asbestos in the Workplace Code of Practice* and *How to Safely Remove Asbestos Code of Practice*, SafeWork NSW Guidelines and the NSW *EPA Waste Classification Guidelines*.

11.7 State Environmental Planning Policy (SEPP 55) Remediation of Land

In consideration of the requirements of SEPP 55, the remediation works are understood to be included with the development approval required for the associated site development works.

The proposed remediation works are classified as 'Category 2' Remediation Works (i.e., not requiring consent). The notification requirements of SEPP 55 include notification to council 30 days before commencement of Category 2 remediation works.

The notification will provide Council with the information needed to verify the work is not Category 1. Category 1 remediation work is a remediation work that is:

- Designated development (under schedule 3 of the EPA&A Regulation or under a planning instrument), or
- Carried out or to be carried out on land declared to be a critical habitat, or
- Likely to have a significant effect on a critical habitat or a threatened species, population or ecological community, or
- Development for which another State environmental planning policy or a regional environmental plan requires development consent, or
- Carried out or to be carried out in an area or zone to which any classifications to the following effect apply under an environmental planning instrument:
  - coastal protection;
  - conservation or heritage conservation;
  - habitat area, habitat protection area, habitat or wildlife corridor;
  - environmental protection;
  - escarpment, escarpment protection or escarpment preservation;
  - floodway;
  - littoral rainforest;
  - nature reserve;
  - scenic area or scenic protection;
  - wetland, or
- Carried out or to be carried out on any land in a manner that does not comply with a policy made under the contaminated land planning guidelines by the council for any local government area in which the land is situated (or if the land is within the unincorporated area, the Western Lands Commissioner).

Notification will also include relevant contact details and a proposed remediation schedule, and notice is required to be given to Council within 30 days of completion of the remediation works.

11.8 Aquifer Interference Policy and NSW DPI Water Permit under the Water Management Act 2000

Based on observations and groundwater data collected during the DLA (2015) investigation, and with consideration of the depth of the proposed basement, the proposed extent of the excavation is likely to intersect groundwater. Subsequently, dewatering may be required during the site development, either during construction or post-construction as part of the building basement design (including potential foundation dewatering). Should building basement excavation or ongoing maintenance require dewatering, a licence will be required from NSW Department of Primary Industries (DPI) Water for the proposed works.

The remedial works may include removing relatively large volumes of soil and may require collecting and removing shallow perched groundwater, which may lead to a temporary change in the local hydrogeological conditions. If this occurs, the NSW DPI Water may need to be consulted to determine any requirements under the Aquifer Interference Policy. The standard Aquifer Interference Assessment Framework form will be used to assess the impact of the remedial activities.

11.9 Discharge of Contaminated Groundwater under Trade Waste Agreement

Groundwater, if encountered, may require collection and possible treatment prior to disposal. Should any collected groundwater be determined unsuitable for disposal to stormwater, treatment, or disposal to sewer under a specific Trade Waste Agreement with Sydney Water may be required.

11.10 Guidelines on the Duty to Report Contamination (EPA 2015)

Following review of the validation analytical results, the appointed environmental consultant will conduct a review of the historical data and the data obtained during validation to the requirements of the NSW EPA 2015 *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act* and make an assessment as to whether the site will need to be reported to the NSW EPA.

12 Remedial Action Plan Summary

Environmental investigations undertaken at the site have identified contaminated fill material across portions of the site which require remediation and/or management to make the site suitable for the proposed high density residential redevelopment.

This report has been prepared by TRACE Environmental to document the proposed remediation strategy and the validation program and provide an appropriate and cost effective remedial strategy to render the site suitable for unrestricted high density land-use, without ongoing management requirements.

The proposed development includes demolition of the current buildings (which will be demolished in two stages: 'Stage 1 Early Works' and 'Stage 2 Early Works') and construction of residential apartment buildings in three development stages (Stages 1 to 3).

Additional environmental investigations are also required to address identified data gaps in previous investigations and sufficiently characterise fill materials which may remain on-site as part of the proposed redevelopment. These are proposed to be undertaken as separate investigations during the two early works stages ('Stage 1 Early Works' and 'Stage 2 Early Works'). The scope of remediation and/or management required at the site may need to be revised based on the results of the data gap investigations.

The proposed remediation and/or management strategy for the site comprises excavation and off-site disposal of impacted soils that are unsuitable to remain on-site or are in excess to site requirements and cannot be incorporated into the proposed redevelopment. As the proposed development includes a one-level basement car park to depths of up to approximately 3-4 mBGS, significant quantities of soil and rock will require excavation to facilitate this.

The site remediation strategy will be supervised by a suitably qualified and experienced environmental consultant, will also include the following:

- Implementation of management practices during the remedial works to minimise the potential risks to on-site workers, vicinity third parties and the environment;
- In the event of the discovery of previously unidentified soil impacts (i.e. unexpected finds) during site redevelopment works, additional validation and/or remediation of the soil may be necessary. Validation soil sample results will be compared to the guideline criteria for high density residential (with minimal access to soils) land uses to ensure the soils remaining at the site are suitable for the proposed land uses;
- If significant unexpected soil impacts are encountered during remedial works, validation of the groundwater beneath the site may become necessary;
- In the event that imported fill material is needed to backfill any excavations (i.e. for service trenches), only material certified as comprising ENM or VENM should be imported onto the site; and
- The proposed development will be constructed in three stages (Stages 1 to 3), and the remediation/validation works will likely be conducted in separate phases during these development stages. Following completion of the proposed remedial/management strategy, a Validation Report specific to each development stage will be prepared for submission to Council.

It is considered that the site will be suitable for the proposed high density residential land uses following successful implementation of the above remediation/management strategy. The Validation Reports will detail the methods and results of the site remedial activities and demonstrate that the site was remediated to a condition suitable for the proposed land uses.

13 References

- Geological Survey of NSW 1:100,000 Geological Series Sheet 9130.
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- Fluor Daniel GTI (1998), *Tank Pit Validation, Mayne Nickless, 1A Queen Street, Auburn, NSW*, Fluor Daniel GTI (Australia) Pty Ltd, 27 January 1998.
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- NSW Department of Urban Affairs and Planning (1998), Managing Land Contamination: Planning Guidelines: SEPP 55 Remediation of Land, 1998.
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- NSW EPA (2015), *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act*. NSW EPA, September 2015.
- NSW EPA (2017), *Contaminated Sites Guidelines for the NSW Site Auditor Scheme (3rd Edition)*. NSW EPA, October 2017;
- NSW Land and Property Information, Six Maps https://maps.six.nsw.gov.au/.
- NSW OEH (2011), *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*. NSW Office of Environment & Heritage (OEH), November 1997, Reprinted September 2000 and August 2011.
- SafeWork NSW *Code of Practice: How to Manage and Control Asbestos in the Workplace* (2016).
- SafeWork NSW *Code of Practice: How to Safely Remove Asbestos* (2016).
- Standards Australia (2005), Australian Standard AS 4482.1-2005 – *Guide to the investigation and sampling of sites with potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds*. Standards Australia, Homebush, NSW.
- Standards Australia (1999), Australian Standard AS 4482.2-1999 - *Guide to the sampling and investigation of potentially contaminated soil. Part 2: Volatile substances*. Standards Australia.

14 Limitations

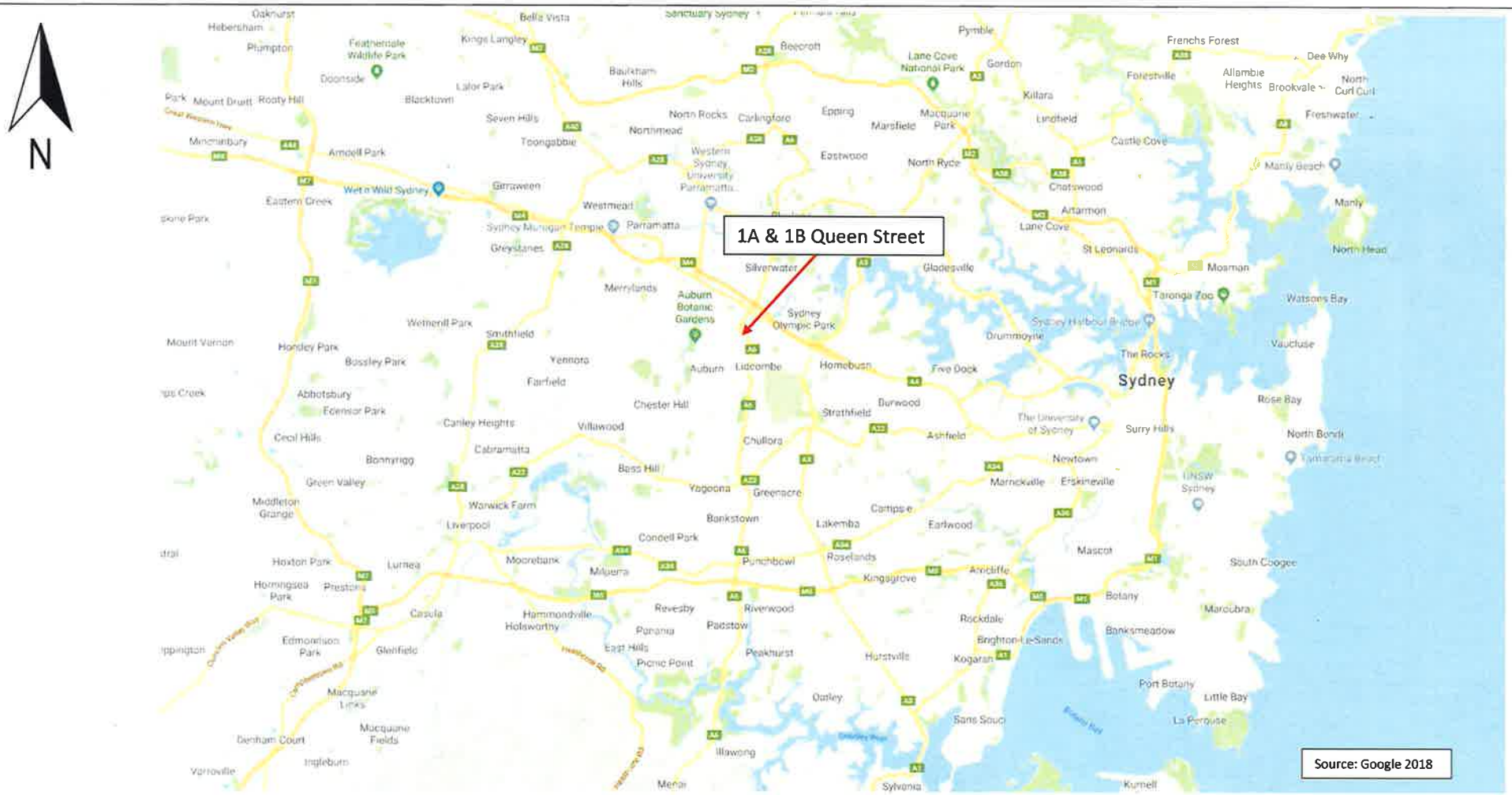
This report has been prepared for Australian Executor Trustee Limited ATF Auburn Ownership Trust and for the specific purpose to which it refers. No responsibility is accepted to any third party and neither the whole of the report or any part or reference thereto may be published in any document, statement or circular nor in any communication with third parties without our prior written approval of the form and context in which it will appear.

TRACE Environmental has used a degree of skill and care ordinarily exercised by reputable members of our profession practicing in the same or similar locality. The conclusions presented in this report are relevant to the conditions of the site and the state of legislation currently enacted as at the date of this report. We do not make any representation or warranty that the conclusions in this report were applicable in the future as there may be changes in the condition of the site, applicable legislation or other factors that would affect the conclusions contained in this report.

This report and the information contained in it is the intellectual property of TRACE Environmental. Australian Executor Trustee Limited ATF Auburn Ownership Trust is granted an exclusive licence for the use of the report for the purpose described in the report.

TRACE ENVIRONMENTAL

Figures



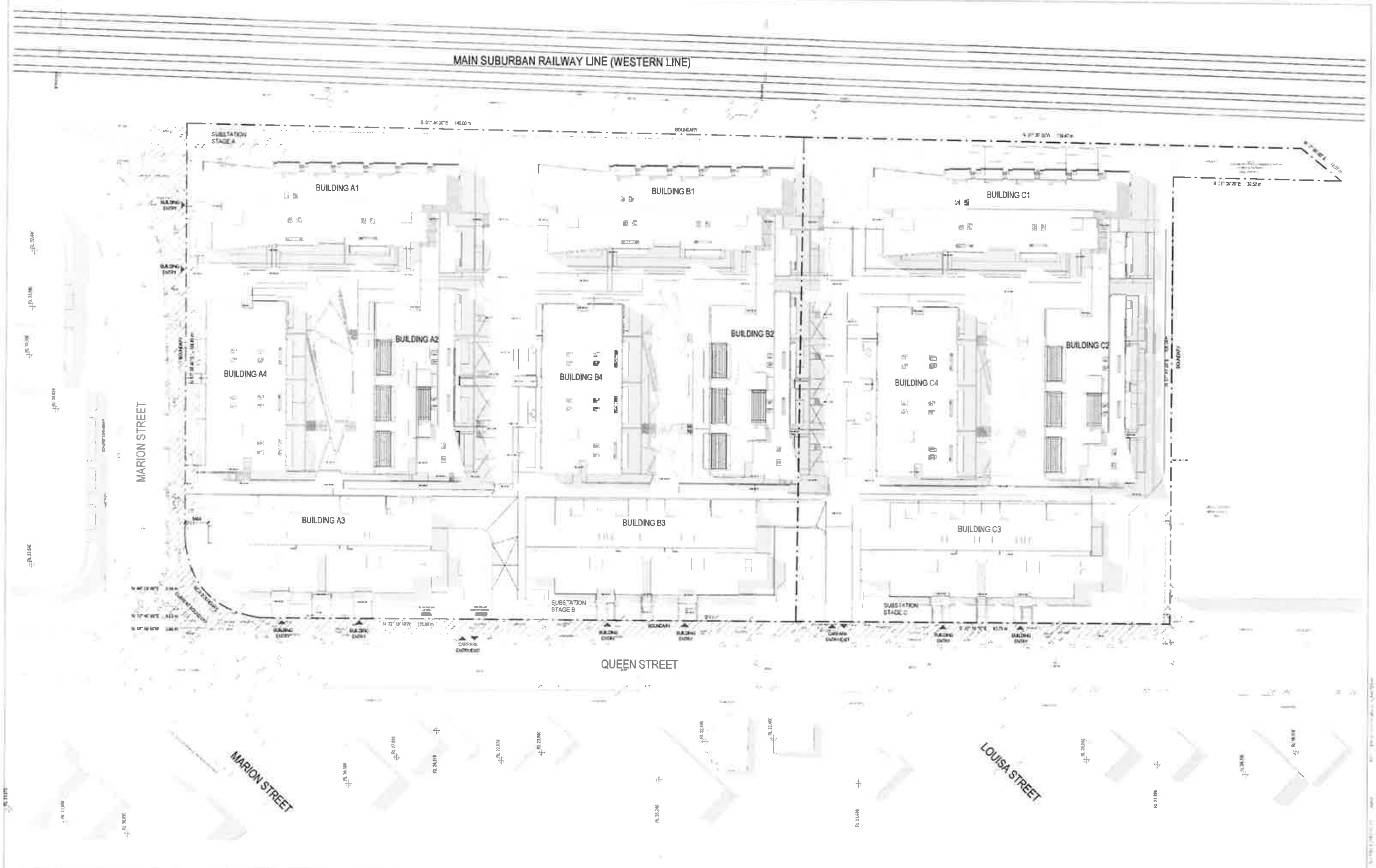
TRACE ENVIRONMENTAL	Project: **26.03 Auburn RAP**	Title: **Site Locality Plan**
	Figure: **1**	Address: **1A & 1B Queen Street, Auburn NSW**

TRACE ENVIRONMENTAL	Project: **26.03 Auburn RAP**	Title:	**Site Layout**
	Figure: **2**	Address:	**1A & 1B Queen Street, Auburn NSW**

TRACE ENVIRONMENTAL

Appendix A

Proposed Development Plans



Revisions No. Date	Description	Ver	Appd	Key	Client	Architect	Project	Drawing Title	Scale	Drawing No	Issue
					EG Level 21, 1 Farrer Place Sydney NSW 2000 AUSTRALIA	AJ+C 79 Myrtle Street Chippendale NSW 2008 AUSTRALIA ph +61 2 9311 8222 fx +61 2 9311 8200 ABN 53 003 782 250	1A Queen Street Auburn, Sydney Proj No. 15011	SITE PLAN	1 : 400 @A1	DA1000	1

Drawing Status: NOT FOR CONSTRUCTION

Revisions No	Date	Description	Vet	Appd
A	[illegible]	[illegible]		
B	[illegible]	[illegible]		
C	[illegible]	[illegible]		
D	[illegible]	[illegible]		
E	[illegible]	[illegible]		
F	[illegible]	[illegible]		
G	[illegible]	[illegible]		
H	[illegible]	[illegible]		

Client
EG
Level 21, 1 Farrer Place
Sydney NSW 2000
AUSTRALIA

Architect
AJ+C
79 Myrtle Street Chippendale NSW 2008 AUSTRALIA
ph +61 2 9311 8222 fx +61 2 9311 8200
ABN 53 003 782 250

Project
1A Queen Street
Auburn, Sydney

Proj. No. 15011

Drawing Title
GROUND FLOOR PLAN
A1,A2,A3,A4

Drawing Status
NOT FOR CONSTRUCTION

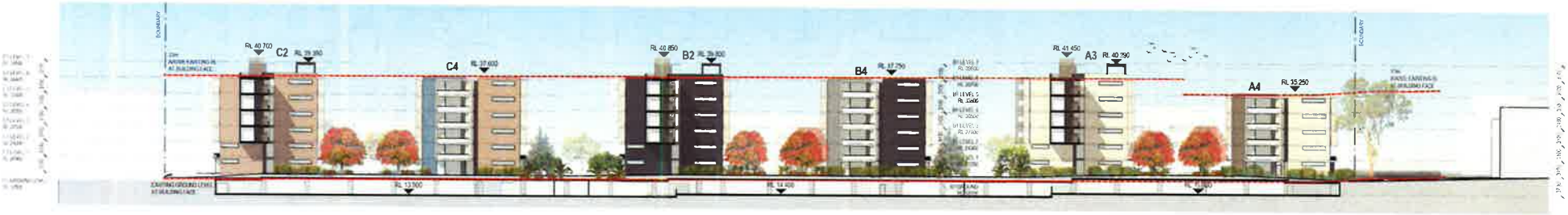
Scale
As indicated @A1

Drawing No.
DA2021

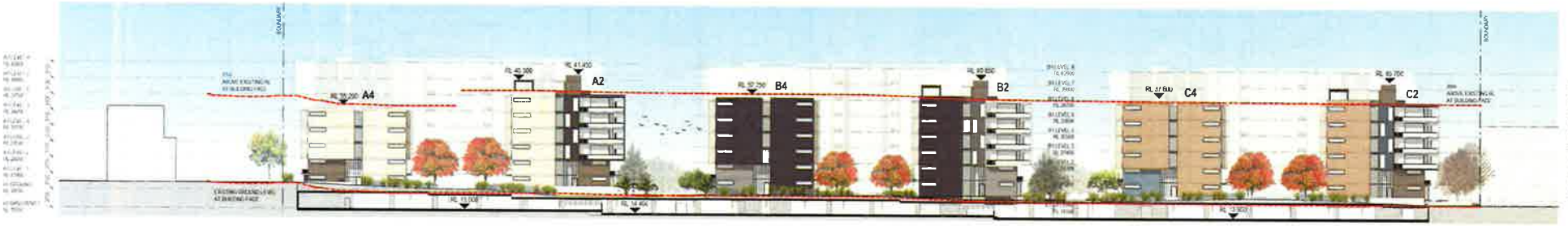
Issue
1

1 SOUTH ELEVATION - A1 B1 C1

2 NORTH ELEVATION - A3 B3 C3



3 NORTH ELEVATION - A2 A4 B2 B4 C2 C4



4 SOUTH ELEVATION - A2 A4 B2 B4 C2 C4

EG
Level 21, 1 Farrer Place
Sydney NSW 2000
AUSTRALIA

AJ+C
79 Myrtle Street Chippendale NSW 2008 AUSTRALIA
ph +61 2 9311 8222 fx +61 2 9311 8200
ABN 53 003 782 256

Project
1A Queen Street
Auburn Sydney

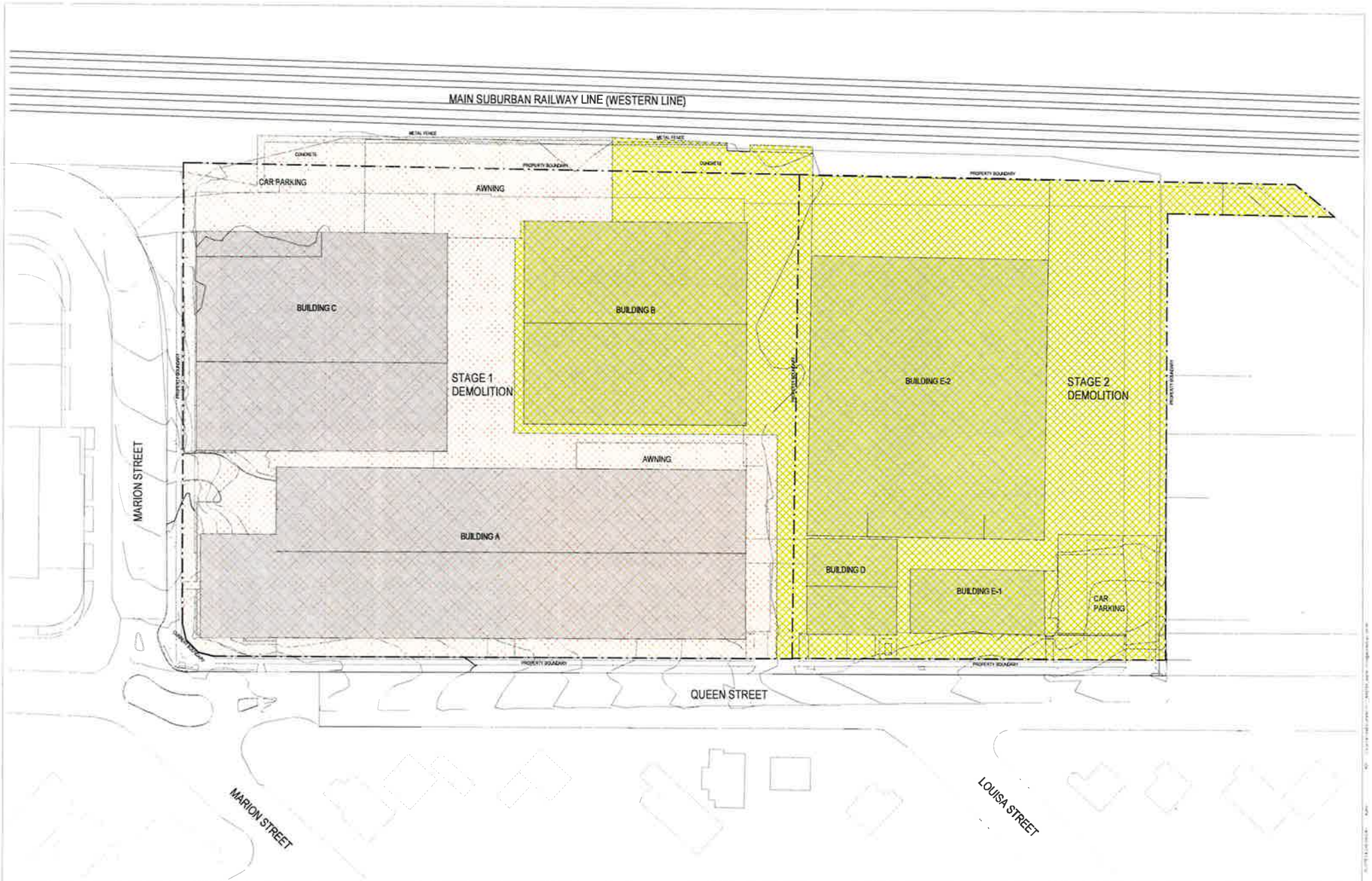
Drawing title
ALL BUILDINGS ELEVATION
SHEET 02

Scale
1 : 400 @ A1

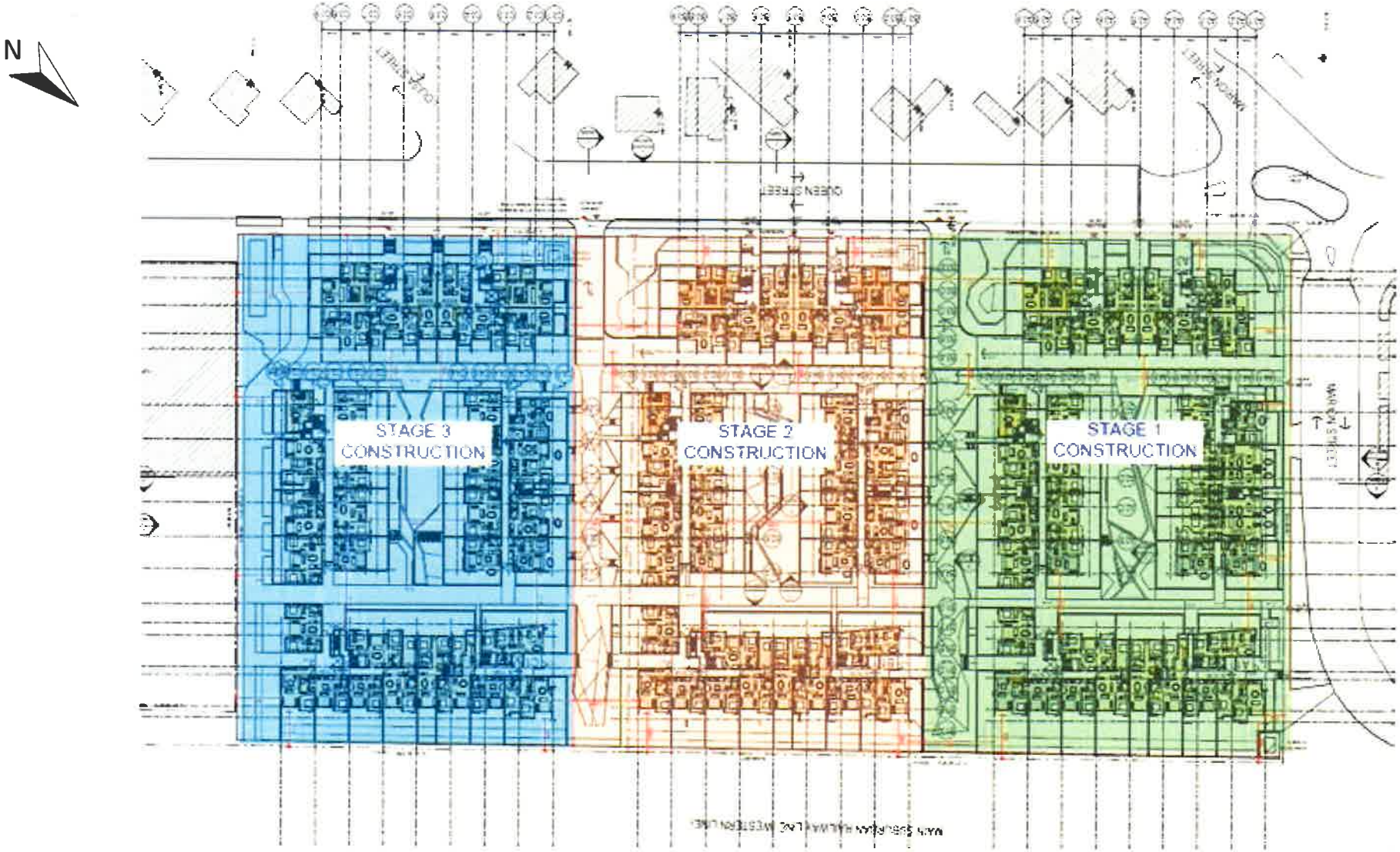
Drawing No
DA3101

Issue
1

Drawing Status
NOT FOR CONSTRUCTION



Revisions No. Date Description Ver App'd	Key	Client: EG, Level 21, 1 Farrer Place, Sydney NSW 2000 AUSTRALIA	Architect: AJ+C, 79 Myrtle Street Chippendale NSW 2008 AUSTRALIA, ph +61 2 9311 8222 fx +61 2 9311 8200, ABN 53 003 782 250	Project: 1A Queen Street, Auburn, Sydney; Proj. No. 15011	Drawing Title: DEMOLITION STAGING; Drawing Status: NOT FOR CONSTRUCTION	Scale: 1 : 400 @A1	Drawing No.: DA1002	Issue: 1


N
STAGE 3
CONSTRUCTION
STAGE 2
CONSTRUCTION
STAGE 1
CONSTRUCTION

TRACE ENVIRONMENTAL

Appendix B

Council Correspondence Relating to DA-382/2017

COMPLIANCE & ENVIRONMENT
PH 02 9840 9828

CUMBERLAND COUNCIL

MEMORANDUM - Deferral

To: Glenn Dawes – Senior Development Assessment Officer

From: Stuart Nunn – Team Leader Environmental Health

Date: 29 September 2017 File: DA-382/2017

Subject: Demolition of structures and construction of 12 residential apartment buildings, being part 3, part 6 and part 8 storey buildings containing 595 residential apartments including basement parking, landscaping, stormwater, public domain works and subdivision - Integrated Development (Water Management Act 2000)

Reference is made to the above application and additional information submitted to the EHO team for comment. Please refer to the comments below:

Contamination

A Detailed Site Investigation was prepared by DLA Environmental Services (ref: DL3724-S003777) dated August 2017. following a review of the report I am satisfied that the report was prepared in accordance with NSW EPA *Guidelines for Consultants Reporting on Contaminates Sites* and the *National Environment Protection (Assessment of Site Contamination) Measure (2013 Amendment)*.

The report identifies a series of contaminates of concern; however the author based on the identification of these items has made the following conclusion:

It is therefore the opinion of DLA that the Site assessment objectives of this report have been achieved. The DSI concludes that the Site is considered suitable for the intended land use consistent with NEPM (NEPC, 2013) Residential B – Residential with minimal access to soil, with the exception of the two identified areas. These areas of the Site can be made suitable through the removal of the fill materials and a subsequent asbestos clearance / validation report.

A remediation strategy is required to be developed for the successful removal of the fill materials, which will allow successful validation of these items. Therefore prior to the determination of the development application a Remedial Action Plan is required to be prepared and submitted to Cumberland Council for assessment and comment prior to the determination of the development application.

Deferral Condition

Prior to the determination of the development application a Remedial Action Plan is required to be prepared and submitted to Cumberland Council for assessment and comment prior to

the determination of the development application. The Remedial Action Plan is required to reference the Detailed Site Investigation was prepared by DLA Environmental Services (ref: DL3724-S003777) dated August 2017.

Noise

A Rail Noise & Vibration Intrusion Assessment was prepared by Acoustic Dynamics (ref: 3087R003.MW.170905 (rev3)) dated 5 September 2017. Following a review of the report I am satisfied that the report was prepared in accordance with the NSW EPA *Industrial Noise Policy* and the NSW State Environmental Planning Policy (Infrastructure) 2007. Whilst the report has been able to provide analysis of rail noise & vibration intrusion and subsequent attenuation measure, the author hasn't provided commentary regarding the impact of mechanical plant (basement carpark or individual units) noise from the lift shafts or basement roller doors.

In addition a supplementary advice letter was prepared by Acoustic Dynamics dated 1 September 2017; however considering the scope of the development a construction noise & vibration management plan is required to be development that will address the demolition/construction noise & vibration intrusion from the proposed development and the impact that construction noise & vibration intrusion will have on adjoining premises.

Deferral Conditions

An acoustic report is to be prepared by an appropriately qualified acoustic consultant having the technical eligibility criteria required for membership of the Association of Australian Acoustical Consultants (AAAC) and/or grade membership of the Australian Acoustical Society (MAAS). The report should also consider noise emissions from the development including but not limited to proposed mechanical plant (air conditioners, automatic roller doors, lift shaft/s, ventilation plant for the underground car park). In addition development a construction noise & vibration management plan is required to be development that will address the demolition/construction noise & vibration intrusion from the proposed development and the impact that construction noise & vibration intrusion will have on adjoining premises. The report should be prepared in accordance with the NSW Environment Protection Authority Industrial Noise Policy & NSW EPA *Interim Construction Noise Guidelines*.

General Conditions

CM051 Construction noise
CN001 Remediation and validation
CN003 Discovery of Additional information
CN005 Off-site Soil Disposal
DM001 Demolition Hours
DM002 Demolition of buildings
DM003 Sediment control
DM008 Demolition – Lead management work plan
DM009 Demolition – lead paint/dust paint disposal
DM012 Demolition – Asbestos

COMPLIANCE & ENVIRONMENT
PH 02 9840 9828

CUMBERLAND
COUNCIL

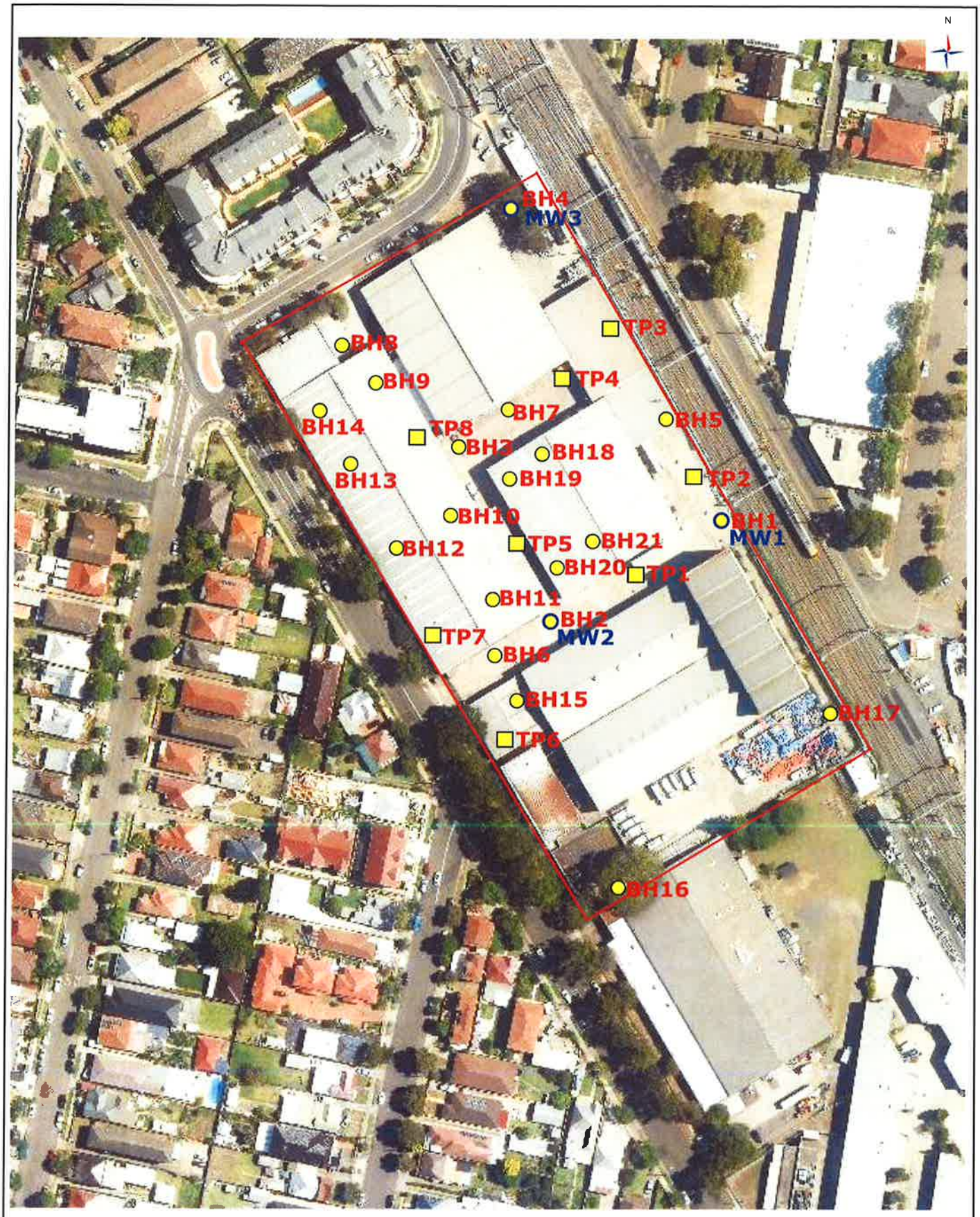
EN001 Amenity
EN002 Odour
EN003 Water Pollution
MW012 Vehicle washing – further approval
NP003 Noise and Vibration
NP006 Air conditioning – Location and noise
WM003 Waste management Plan – new works
WM007 Garbage storage and collection
WM010 waste and recyclables storage area
WM011 Ongoing waste management - residential

STUART NUNN
TEAM LEADER ENVIRONMENTAL HEALTH

TRACE ENVIRONMENTAL

Appendix C

Historical Results and Borelogs



Legend

Approximate Scale

0m 25m 50m 75m

- Borehole Locations
- Groundwater Monitoring Well Locations
- Test Pit Locations
- Approx Site Boundary

Sydney Office
Phone (02) 9476 1765
Fax (02) 9476 1557

Maitland Office
Phone (02) 4933 0001

Title: Site Layout & Sample Locations

Client	Figure No	Date
EG	2	17/11/2015

Project No.	Scale	Compiled	Revision
DL3724	As Shown	LV	R00

				NEPM (NEPC, 2013) Residential B Land Use Criteria (mg/kg)		HSL: 0.04%	HSL: 0.001%	HSL: 0.7 / ESL: 65	HSL: 480, ESL: 105	HSL: NL, ESL: 125	HSL: 110, ESL: 45	5	C6-C10 HSL: 50, ESL: 180, NAL: 800	>C10-C16 HSL: 2,800, ESL: 120, NAL: 3,500	>C16-C34 HSL: NL, ESL: 1,300, NAL: 3,500	>C34-C40 HSL: NL, ESL: 5,600, NAL: 10,000	HSL: 4, ESL: 0.7
						Asbestos		BTEX - Clay soils					TRH - Clay soils				PAH
Sample ID	Depth (m)	Date	Chemical Report	Soil Description	Comment	ACM	FA & AF	Benz	Toluen	Ethylbe	Xylene	Naph	F1	F2	F3	F4	BaP TEQ
BH1_0.5	0.50	9/11/2015	SE145945	Fill, sand and gravels		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH1_1.4	1.41	9/11/2015	SE145945	Silty clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH2_0.5	0.50	9/11/2015	SE145945	Fill with foreign materials		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH2_0.7	0.70	9/11/2015	SE145945	Clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH3_0.4	0.40	9/11/2015	SE145945	Clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH3_1.5	1.51	9/11/2015	SE145945	Clayey sand		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH4_0.3	0.30	10/11/2015	SE145945	Fill, sand and gravels		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH4_1.5	1.51	10/11/2015	SE145945	Clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	1.2
BH5_0.3	0.30	9/11/2015	SE145945	Fill, sand and gravels		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH5_0.5	0.50	9/11/2015	SE145945	Ash layer		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH5_0.6	0.60	9/11/2015	SE145945	Clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	89	310	<120	0.5
BH6_0.5	0.50	9/11/2015	SE145945	Fill, sand and gravels		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH6_1.5	1.51	9/11/2015	SE145945	Fill, sand and gravels	Light hydrocarbon odour with geofabric	--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	42	<90	<120	<0.2
BH8_2.0	2.02	9/11/2015	SE145945	Fill, sand and gravels	Moderate hydrocarbon odour	--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	41	<90	<120	<0.2
BH7_0.5	0.50	9/11/2015	SE145945	Fill, sand and gravels		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	0.5
BH7_0.7	0.70	9/11/2015	SE145945	Silty clay with gravel	Light solvent odour	--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	0.2
BH7_1.5	1.51	9/11/2015	SE145945	Clay	Strong solvent odour	--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH7_2.15	2.15	9/11/2015	SE145945	Clay	Ash present	--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH8_0.5	0.50	10/11/2015	SE145945	Sandy clay with gravel		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH8_1.0	1.01	10/11/2015	SE145945	Weathered rock		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH9_0.5	0.50	10/11/2015	SE145945	Silty clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH9_1.5	1.51	10/11/2015	SE145945	Clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH10_0.6	0.60	10/11/2015	SE145945	Silty clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH10_1.5	1.51	10/11/2015	SE145945	Clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	110	<90	<120	<0.2
BH11_0.3	0.30	9/11/2015	SE145945	Silty clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH12_0.3	0.30	9/11/2015	SE145945	Silty clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH12_1.8	1.81	9/11/2015	SE145945	Clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH13_0.5	0.50	10/11/2015	SE145945	Silty clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH14_0.5	0.50	10/11/2015	SE145945	Clay with gravel		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH14_0.6	0.60	10/11/2015	SE145945	Weathered rock		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH15_0.5	0.50	10/11/2015	SE145945	Fill, clayey sand with gravel		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	0.3
BH16_0.4	0.40	16/11/2015	SE146098/ASET47442	Fill, clay and top soil		nd	0.0016%	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	100	<120	1.7
BH16_2.3	2.30	16/11/2015	SE146098/ASET47442	Clay with gravel				<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH17_0.3	0.30	16/11/2015	SE146098/ASET47442	Fill, clay with gravel		nd	nd	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	0.3
BH17_4.0	4.00	16/11/2015	SE146098/ASET47442	Clay with gravel				<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH18_0.25	0.25	18/11/2015	SE146161	Clay with gravel				<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH19_0.2	0.20	18/11/2015	SE146161	Stabilised roadbase				<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	0.4
BH20_0.25	0.25	18/11/2015	SE146161	Fill, sand and gravels				<0.1	<0.1	<0.1	<0.3	<0.1	<20	75	190	<120	1.9
BH21_0.2	0.20	18/11/2015	SE146161	Fill, sand, clay and gravels				<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	1.1
TP1_0.2	0.20	11/11/2015	SE145945/ASET47362	Fill, sand and gravels	Concrete present	nd	nd	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP1_0.5	0.50	11/11/2015	SE145945	Clay with gravel		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP2_0.3	0.30	11/11/2015	SE145945/ASET47362	Fill, roadbase		nd	nd	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP2_1.1	1.11	11/11/2015	SE145945	Clay with gravel		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP3_0.4	0.40	11/11/2015	SE145945/ASET47362	Fill, roadbase		nd	nd	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP3_0.7	0.70	11/11/2015	SE145945	Clay with gravel		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP4_0.3	0.30	11/11/2015	SE145945/ASET47361	Fill, roadbase	Building rubble, glass and bricks present	14%	0.007%	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	140	<120	3.1
TP4_0.6	0.60	11/11/2015	SE145945/ASET47362	Fill, roadbase	Ash present	nd	0.2%	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	420	<120	0.9
TP5_0.25	0.25	11/11/2015	SE145945/ASET47362	Fill, roadbase		nd	nd	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP5_0.5	0.50	11/11/2015	SE145945	Clay with gravel		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP6_0.2	0.20	11/11/2015	SE145945/ASET47362	Fill, roadbase		nd	nd	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP6_0.4	0.40	11/11/2015	SE145945	Clay with gravel		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP7_0.2	0.20	11/11/2015	SE145945/ASET47362	Fill, sand		nd	nd	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP7_0.4	0.40	11/11/2015	SE145945	Clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP8_0.15	0.15	11/11/2015	SE145945/ASET47362	Fill, roadbase		nd	nd	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP8_0.4	0.40	11/11/2015	SE145945	Clay with gravel		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
INTRA-LABORATORY DUPLICATES																	
BH1_1.4a	1.4a	9/11/2015	SE145945	Silty clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH3_1.5a	1.5a	9/11/2015	SE145945	Clayey sand		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH4_1.5a	1.5a	10/11/2015	SE145945	Clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
BH11_0.3a	0.3a	11/11/2015	SE145945	Silty clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP7_0.4a	0.4a	11/11/2015	SE145945	Clay		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
TP8_0.4a	0.4a	11/11/2015	SE145945	Clay with gravel		--	--	<0.1	<0.1	<0.1	<0.3	<0.1	<20	<25	<90	<120	<0.2
INTER-LABORATORY DUPLICATES																	
BH1b	1.40	9/11/2015	137301	Silty clay		--	--	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5
BH11b	0.30	9/11/2015	137301	Silty clay		--	--	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5
BH14b	0.50	10/11/2015	137301	Clay with gravel		--	--	<0.2	<0.5	<1	<1	<1	<25	<50	<100	<100	<0.5
STATISTICAL ANALYSIS																	
Min						-	-	-	-	-	-	-	-	41.0	100.0	-	0.2
Max						-	-	-	-	-	-	-	-	110.0	420.0	-	3.1
Avg						-	-	-	-	-	-	-	-	73.2	232.0	-	1.0
Stdev						-	-	-	-	-	-	-	-	31.6	131.4	-	0.9
Procedure B Calculation						-	-	-	-	-	-	-	-	-	-	-	-
95% UCL																	

* Depth relative to English Below Surface Level | - Not Tested | nd = Not Detected Above Laboratory LOR | NL = Not Limiting | Bold = Detected Above Laboratory LOR | RED = Exceeds HSL Criteria | * Depth relat

				NEPM																				
					DDT+DDD+DDE 600	Aldrin+Dieldrin 10	Chlordane 70	Endosulfan 340	Endrin 10	Heptachlor 10	HCB 10	Methoxychlor 300													
Sample ID	Depth (m)	Date	Chemical Report	PAH	Pesticides										Heavy Metals									
				Total	OC								OP	PCB	As	Cd	Cr VI	Cu	Pb	Hg	Ni	Zn		
BH1_0.5	0.50	9/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	<3	0.5	11	67	5	<0.01	77	58		
BH1_1.4	1.41	9/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	16	0.4	19	20	40	0.02	13	55		
BH2_0.5	0.50	9/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	9	0.4	9.8	25	140	0.02	12	150		
BH2_0.7	0.70	9/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	130	<0.3	5.7	34	51	0.01	3.4	48		
BH3_0.4	0.40	9/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	9	<0.3	12	24	20	<0.01	13	72		
BH3_1.5	1.51	9/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	9	0.4	5.3	32	17	0.12	64	160		
BH4_0.3	0.30	10/11/2015	SE145945	13	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	14	0.4	7.1	51	360	0.07	12	67		
BH4_1.5	1.51	10/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	10	0.8	14	18	22	<0.01	2.0	19		
BH5_0.3	0.30	9/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	<3	0.6	15	61	4	<0.01	140	64		
BH5_0.5	0.50	9/11/2015	SE145945	8.9	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	11	0.8	7.0	73	340	0.02	36	350		
BH5_0.6	0.60	9/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	10	<0.3	11	19	12	0.01	12	60		
BH6_0.5	0.50	9/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	5	<0.3	8.4	14	28	0.02	11	49		
BH6_1.5	1.51	9/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	5	<0.3	9.0	35	40	0.03	13	65		
BH6_2.0	2.02	9/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	7	<0.3	6.8	29	42	0.03	10	54		
BH7_0.5	0.50	9/11/2015	SE145945	5.4	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	9	0.5	9.1	35	240	0.02	6.0	130		
BH7_0.7	0.70	9/11/2015	SE145945	3.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	4	<0.3	8.4	30	94	<0.01	4.6	85		
BH7_1.5	1.51	9/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	<3	<0.3	1.7	7.8	12	<0.01	3.7	33		
BH7_2.15	2.15	9/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	200	0.4	5.7	41	20	0.30	65	220		
BH8_0.5	0.50	10/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	6	0.7	10	46	16	0.02	120	230		
BH8_1.0	1.01	10/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	9	0.4	7.8	29	16	0.05	26	88		
BH8_0.5	0.50	10/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	4	<0.3	13	28	17	<0.01	46	120		
BH8_1.5	1.51	10/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	8	1.0	5.1	34	15	0.11	29	97		
BH10_0.6	0.60	10/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	8	<0.3	5.4	38	13	0.02	9.9	82		
BH10_1.5	1.51	10/11/2015	SE145945	1.3	--	--	--	--	--	--	--	--	--	--	3	<0.3	4.0	23	12	0.02	24	120		
BH11_0.3	0.30	9/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	10	<0.3	7.6	21	20	<0.01	2.8	44		
BH12_0.3	0.30	9/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	<3	<0.3	5.8	24	13	<0.01	6.0	59		
BH12_1.8	1.81	9/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	<3	<0.3	3.9	19	9	0.07	29	140		
BH13_0.5	0.50	10/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	5	0.4	17	35	15	0.03	51	180		
BH14_0.5	0.50	10/11/2015	SE145945	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	8	<0.3	13	25	17	0.03	21	86		
BH14_0.8	0.80	10/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	6	0.3	9.7	34	16	0.04	15	85		
BH15_0.5	0.50	10/11/2015	SE145945	1.5	--	--	--	--	--	--	--	--	--	--	6	0.5	56	44	64	0.04	73	140		
BH16_0.4	0.40	16/11/2015	SE146098/ASET47442	15	--	--	--	--	--	--	--	--	--	--	22	3.8	24	1100	950	0.23	46	550		
BH16_2.3	2.30	16/11/2015	SE146098/ASET47442	<0.8	--	--	--	--	--	--	--	--	--	--	5	<0.3	11	16	14	<0.01	1.3	13		
BH17_0.3	0.30	16/11/2015	SE146098/ASET47442	2.5	--	--	--	--	--	--	--	--	--	--	5	<0.3	14	32	45	0.05	11	120		
BH17_4.0	4.00	16/11/2015	SE146098/ASET47442	<0.8	--	--	--	--	--	--	--	--	--	--	12	<0.3	4.2	12	20	0.02	0.6	13		
BH18_0.25	0.25	16/11/2015	SE146161	<0.8	--	--	--	--	--	--	--	--	--	--	<3	0.3	5.8	22	31	<0.01	3.4	120		
BH19_0.2	0.20	16/11/2015	SE146161	3.4	--	--	--	--	--	--	--	--	--	--	5	0.3	17	29	130	0.04	16	73		
BH20_0.25	0.25	16/11/2015	SE146161	17	--	--	--	--	--	--	--	--	--	--	4	<0.3	8.7	27	150	0.05	24	88		
BH21_0.2	0.20	16/11/2015	SE146161	8.8	--	--	--	--	--	--	--	--	--	--	4	<0.3	11	33	130	0.03	23	65		
TP1_0.2	0.20	11/11/2015	SE145945/ASET47362	<0.8	--	--	--	--	--	--	--	--	--	--	9	<0.3	7.6	10	66	0.04	4.4	57		
TP1_0.5	0.50	11/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	7	0.5	20	13	15	0.03	10	43		
TP2_0.3	0.30	11/11/2015	SE145945/ASET47362	<0.8	--	--	--	--	--	--	--	--	--	--	<3	0.6	16	65	6	<0.01	160	81		
TP2_1.1	1.11	11/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	17	<0.3	9.0	8.7	15	0.02	11	64		
TP3_0.4	0.40	11/11/2015	SE145945/ASET47362	<0.8	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1	<0.1	<0.2	<1	<3	0.4	13	58	5	<0.01	120	64		
TP3-0.7	0.70	11/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	8	0.3	16	15	14	<0.01	6.8	26		
TP4_0.3	0.30	11/11/2015	SE145945/ASET47361	16	--	--	--	--	--	--	--	--	--	--	23	0.9	23	110	750	0.06	25	310		
TP4_0.6	0.60	11/11/2015	SE145945/ASET47362	6.0	--	--	--	--	--	--	--	--	--	--	25	2.1	24	98	1400	0.17	20	470		
TP5_0.25	0.25	11/11/2015	SE145945/ASET47362	<0.8	--	--	--	--	--	--	--	--	--	--	<3	0.5	110	30	14	0.01	95	78		
TP5_0.5	0.50	11/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	8	<0.3	3.5	20	12	<0.01	1.8	14		
TP6_0.2	0.20	11/11/2015	SE145945/ASET47362	<0.8	--	--	--	--	--	--	--	--	--	--	6	<0.3	18	10	3	<0.01	17	16		
TP6_0.4	0.40	11/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	7	<0.3	14	16	20	<0.01	4.8	26		
TP7_0.2	0.20	11/11/2015	SE145945/ASET47362	<0.8	--	--	--	--	--	--	--	--	--	--	5	<0.3	31	8.8	3	<0.01	29	22		
TP7_0.4	0.40	11/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	15	0.3	5.6	23	13	<0.01	1.3	49		
TP8_0.15	0.15	11/11/2015	SE145945/ASET47362	<0.8	--	--	--	--	--	--	--	--	--	--	<3	0.5	91	30	22	0.01	84	82		
TP8_0.4	0.40	11/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	3	<0.3	5.3	14	14	0.03	7.2	47		
INTRA-LABORATORY DUPLICATES																								
BH1_1.4a	1.4a	9/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	13	<0.3	16	11	12	0.04	2.9	31		
BH3_1.5a	1.5a	9/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	11	0.5	5.2	30	20	0.13	67	180		
BH4_1.5a	1.5a	10/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	9	0.6	14	19	21	<0.01	1.8	20		
BH11_0.3a	0.3a	11/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	13	<0.3	7.5	17	19	<0.01	2.7	45		
TP7_0.4a	0.4a	11/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	5	<0.3	5.1	19	11	<0.01	0.9	32		
TP8_0.4a	0.4a	11/11/2015	SE145945	<0.8	--	--	--	--	--	--	--	--	--	--	5	<0.3	7.8	20	73	0.01	11	94		
INTER-LABORATORY DUPLICATES																								
BH1b	1.40	9/11/2015	137301	NIL (+)VE	--	--	--	--	--	--	--	--	--	--	11	<0.4	19	14	12	<0.1	5	36		
BH11b	0.30	9/11/2015	137301	NIL (+)VE	--	--	--	--	--	--	--	--	--	--	8	<0.4	9	23	18	<0.1	7	58		
BH14b	0.50	10/11/2015	137301	NIL (+)VE	--	--	--	--	--	--	--	--	--	--	8	<0.4	21	24	16	<0.1	27	65		
STATISTICAL ANALYSIS																								
Min				1.3	-	-	-	-	-	-	-	-	-	-	3.0	0.3	1.7	7.6	3.0	0.0	0.8	13.0		
Max				17.0	-	-	-	-	-	-	-	-	-	-	200.0	3.8	110.0	1100.0	1400.0	0.3	160.0	550.0		
Avg				7.8	-	-	-	-	-	-	-	-	-	-	15.9	0.7	15.0	53.1	101.3	0.1	30.5	103.3		
Stdev				5.7	-	-	-	-	-	-	-	-	-	-	33.8	0.7	18.9	145.6	246.3	0.1	37.5	104.8		
Procedure B Calculation				-	-	-	-	-	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0		
95% UCL																			246.1					

* Depth relates to Depth Below Surface Level — Not Tested — as to Depth Below Surface Level — Not Tested/nd = Not Detected Above Laboratory LOR — NL = Not Limit Valid • Detected Above Laboratory LOR — Exceeds HIL Criteria

DLA Environmental Services

Groundwater Monitoring Summary Table

Sample ID	Date	Report	Depth (m)	Heavy Metals (µg/L)								PAH (µg/L)		BTEX (µg/L)				TRH (µg/L)				pH	EC (µS cm-1)
				As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	Naph	BaP	Benz	Toluen	EthylBe	Xylene	C_6-C_{10} F1	C_{10}-C_{16} F2	C_{16}-C_{34} F3	C_{34}-C_{40} F4	pH	EC
MW1	18/11/2015	137596	4.15	**1**	nd	nd	**2**	nd	nd	**8**	**11**	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	**6.4**	**1200**
MW2	18/11/2015	137596	1.72	nd	nd	nd	nd	nd	nd	**18**	**12**	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	**7.1**	**630**
MW3	23/11/2015	--		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
INTRA-LABORATORY DUPLICATES																							
MW2-A	18/11/2015	137596		nd	nd	nd	nd	nd	nd	17	12	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	7.6	680
GROUNDWATER INVESTIGATION LEVELS																							
ANZECC (2000)	Fresh Waters			13	0.2	1	1.4	3.4	0.6	11	--	16	--	950	--	--	200	--	--	--	--	--	--
HSL (NEPM2013)	Commercial/Industrial			--	--	--	--	--	--	--	--	NL	--	30,000	NL	NL	NL	NL	NL	--	--	--	--
REFERENCE LEVELS																							
Fresh - Low Reliability (ANZECC (2000)				13	--	--	--	--	--	--	--	--	0.2	--	--	--	--	--	--	--	--	--	--

Bold= Detected Above Laboratory LOR **RED =** Value Detected Above GILs nd = Not Detected above Laboratory LOR -- Not Tested NL = Not Limiting

DLA Environmental Services

Testpit Log

Location TP1

Client:	EG	Address:	1a Queen St, Auburn
Project No:	DL3724	Logged By:	Loretta Visintin
Date:	11/11/2015	Method:	Excavator
Contractor:	AWJ Civil	Hole size:	150mm

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
				Sand with gravels			X	Fill
	0.5			Clay; black with gravel				
				Clay: red with gravel		VS	X	Natural
	1							

Photo:

Notes:

Method:	**Moisture:**	**Density**	**Consistency**	
EX - Excavator	D - Dry	L - Loose	VS - Very Soft	VS - Very Stiff
	M - Moist	MD - Medium Density	S - Soft	H - Hard
	W - Wet	D - Dense	F - Firm	Friable - Fb

DLA Environmental Services

Testpit Log

Location **TP2**

Client:	EG	Address:	1a Queen St, Auburn
Project No:	DL3724	Logged By:	Loretta Visintin
Date:	11/11/2015	Method:	Excavator
Contractor:	AWJ Civil	Hole size:	150mm

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5			Roadbase			X	Fill
				Fill; black with asphalt				
	1			Clay; black with gravel				
				Clay; red with gravel		VS	X	Natural

Photo:

Notes:

Method:	**Moisture:**	**Density**	**Consistency**	
EX - Excavator	D - Dry	L - Loose	VS - Very Soft	VS - Very Stiff
	M - Moist	MD - Medium Density	S - Soft	H - Hard
	W - Wet	D - Dense	F - Firm	Friable - Fb

TP3

DLA Environmental Services

Testpit Log

Location TP3

Client:	EG	Address:	1a Queen St, Auburn
Project No:	DL3724	Logged By:	Loretta Visintin
Date:	11/11/2015	Method:	Excavator
Contractor:	AWJ Civil	Hole size:	150mm

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5			Roadbase			X	Roadbase
				Clay; red and grey mottle with gravel		D VS	X	Natural
	1							

Photo:

Notes:

Method:	**Moisture:**	**Density**	**Consistency**	
EX - Excavator	D - Dry	L - Loose	VS - Very Soft	VS - Very Stiff
	M - Moist	MD - Medium Density	S - Soft	H - Hard
	W - Wet	D - Dense	F - Firm	Friable - Fb

DLA Environmental Services

Testpit Log

Location TP4

Client:	EG	Address:	1a Queen St, Auburn
Project No:	DL3724	Logged By:	Loretta Visintin
Date:	11/11/2015	Method:	Excavator
Contractor:	AWJ Civil	Hole size:	150mm

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5			Roadbase and sand with foreign materials, greyish red	W		X	Fill with foreign materials present; bricks and building rubble, glass, asbestos fragment
				Roadbase and clayey sand, black			X	Fill, contains gravels and asphalt
	1			Clay; grey with gravel				Natural. No sample - too much water from fill layer above

Photo:

Notes:

Method:	**Moisture:**	**Density**	**Consistency**	
EX - Excavator	D - Dry	L - Loose	VS - Very Soft	VS - Very Stiff
	M - Moist	MD - Medium Density	S - Soft	H - Hard
	W - Wet	D - Dense	F - Firm	Friable - Fb

DLA Environmental Services

Testpit Log

Location **TP5**

Client:	EG	Address:	1a Queen St, Auburn
Project No:	DL3724	Logged By:	Loretta Visintin
Date:	11/11/2015	Method:	Excavator
Contractor:	AWJ Civil	Hole size:	150mm

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
				Roadbase			X	Fill, becoming blue-grey with depth
	0.5			Clay; grey and white mottle with gravel		F	X	Natural
	1							

Photo:

Notes:

Method:	**Moisture:**	**Density**	**Consistency**	
EX - Excavator	D - Dry	L - Loose	VS - Very Soft	VS - Very Stiff
	M - Moist	MD - Medium Density	S - Soft	H - Hard
	W - Wet	D - Dense	F - Firm	Friable - Fb

DLA Environmental Services

Testpit Log

Location **TP6**

Client:	EG	Address:	1a Queen St, Auburn
Project No:	DL3724	Logged By:	Loretta Visintin
Date:	11/11/2015	Method:	Excavator
Contractor:	AWJ Civil	Hole size:	150mm

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
				Sand, yellow with gravel			X	Fill
	0.5			Roadbase				
				Fill; black		VS		Very stiff may contain asphalt
				Clay; red with gravel			X	Natural
	1							

Photo:

Notes:

Method:	**Moisture:**	**Density**	**Consistency**	
EX - Excavator	D - Dry	L - Loose	VS - Very Soft	VS - Very Stiff
	M - Moist	MD - Medium Density	S - Soft	H - Hard
	W - Wet	D - Dense	F - Firm	Friable - Fb

DLA Environmental Services

Testpit Log

Location TP7

Client:	EG	Address:	1a Queen St, Auburn
Project No:	DL3724	Logged By:	Loretta Visintin
Date:	11/11/2015	Method:	Excavator
Contractor:	AWJ Civil	Hole size:	150mm

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
				Sand, yellow			X	Fill
				Roadbase				Fill
	0.5			Clay; grey and red mottle with gravel		VS	X	Natural
	1							

Photo:

Notes:

Method:	**Moisture:**	**Density**	**Consistency**	
EX - Excavator	D - Dry	L - Loose	VS - Very Soft	VS - Very Stiff
	M - Moist	MD - Medium Density	S - Soft	H - Hard
	W - Wet	D - Dense	F - Firm	Friable - Fb

DLA Environmental Services

Testpit Log

Location **TP8**

Client:	EG	Address:	1a Queen St, Auburn
Project No:	DL3724	Logged By:	Loretta Visintin
Date:	11/11/2015	Method:	Excavator
Contractor:	AWJ Civil	Hole size:	150mm

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
				Roadbase			X	Fill
				Clay; grey with gravel			X	
	0.5			Weathered rock		H		
	1							

Photo:

Notes:

Sheet 1 of 1

Method:	**Moisture:**	**Density**	**Consistency**	
EX - Excavator	D - Dry	L - Loose	VS - Very Soft	VS - Very Stiff
	M - Moist	MD - Medium Density	S - Soft	H - Hard
	W - Wet	D - Dense	F - Firm	Friable - Fb

Monitoring Well

Location **MW1**

Client:	EG	Address:	1a Queen St, Auburn
Project No:	DL3724	Logged By:	Loretta Visintin
Date:	9.11.15	Method:	Drill rig
Contractor:	FICO	Hole Size	150mm

Method	Depth (m)	Monitoring well Details	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
	0				Concrete				
	0.5				Roadbase			X	Fill
					Roadbase with ash				Fill with Ash
	1				Silty clay, greyish orange			X	Natural
	1.5								
	2				Sandy clay				Some refusal at 2.1
	2.5								
	3				Weathered rock		H		
	3.5								
	4								
	4.5								

Sheet 1 of 1

Notes:

Method:
- SS - Solid Flight Auger
- HS - Hollow Flight Auger
- CC - Concrete Core
- PT - Push Tube
- RC - Rock Coring

MW Construction
- Casing
- Screen
- Sand
- Bentonite
- Backfill
- Concrete

Consistency
- VS - Very Soft
- S - Soft
- F - Firm
- VS - Very Stiff
- H - Hard
- Friable - Fb

Plasticity
- HP - HighlyPlastic
- MP - Medium Plasticity
- LP - Low Plasticity

Density
- VL - Very Loose
- L - Loose
- MD - Medium Density
- D - Dense
- VD - Very Dense

Moisture
- D - Dry
- M - Moist
- W - Wet

Monitoring Well

Location **MW2**

Client:	EG	Address:	1a Queen St, Auburn
Project No:	DL3724	Logged By:	Loretta Visintin
Date:	9.11.15	Method:	Drill rig
Contractor:	FICO	Hole Size	150mm

Method	Depth (m)	Monitoring well Details	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
					Concrete				
	0.5				Fill			X	Foreign materials including plastic and quartz
					Clay, brown	M		X	Natural
	1				Clayey sand, yellow				
	1.5				Clayey sand, red brown				
									TC Refusal

Notes:

Method:
- SS - Solid Flight Auger
- HS - Hollow Flight Auger
- CC - Concrete Core
- PT - Push Tube
- RC - Rock Coring

MW Construction
- Casing
- Screen
- Sand
- Bentonite
- Backfill
- Concrete

Consistency
- VS - Very Soft
- S - Soft
- F - Firm
- VS - Very Stiff
- H - Hard
- Friable - Fb

Plasticity
- HP - HighlyPlastic
- MP - Medium Plasticity
- LP - Low Plasticity

Density
- VL - Very Loose
- L - Loose
- MD - Medium Density
- D - Dense
- VD - Very Dense

Moisture
- D - Dry
- M - Moist
- W - Wet

Monitoring Well

Location MW3

Client:	EG	Address:	1a Queen St, Auburn
Project No:	DL3724	Logged By:	Loretta Visintin
Date:	9.11.15	Method:	Drill rig
Contractor:	FICO	Hole Size	150mm

Method	Depth (m)	Monitoring well Details	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
					Concrete				
					Silty sand, black with gravel			X	Fill
	0.5				Silty clay, brown with gravel				
	1				Clay, red with gravel				Natural
	1.5							X	
					Clay, grey and red mottle		H		V-bit refusal
	2								
	2.5								TC refusal

Notes:

Method:
- SS - Solid Flight Auger
- HS - Hollow Flight Auger
- CC - Concrete Core
- PT - Push Tube
- RC - Rock Coring

MW Construction
- Casing
- Screen
- Sand
- Bentonite
- Backfill
- Concrete

Consistency
- VS - Very Soft
- S - Soft
- F - Firm
- VS - Very Stiff
- H - Hard
- Friable - Fb

Plasticity
- HP - HighlyPlastic
- MP - Medium Plasticity
- LP - Low Plasticity

Density
- VL - Very Loose
- L - Loose
- MD - Medium Density
- D - Dense
- VD - Very Dense

Moisture
- D - Dry
- M - Moist
- W - Wet

Borelog

Location **BH1**

Client:	EG	Project No:	DL3724
Date:	9.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Lorella Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
				Roadbase				Fill
	0.5			Roadbase with ash			X	Fill with Ash
	1			Silty clay, greyish orange			X	Natural
	1.5							
	2			Sandy clay				Some refusal at 2.1
	2.5							
	3			Weathered rock		H		
	3.5							
	4							
	4.5							

Sheet 1 of 1

Notes:

Method:
SS - Solid Flight Auger
HS - Hollow Flight Auger
CC - Concrete Core
PT - Push Tube
RC - Rock Coring

Consistency
VS - Very Soft
S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

DLA Environmental Services

Borelog

Location **BH2**

Client:	EG	Project No:	DL3724
Date:	9.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5			Fill			X	Foreign materials including plastic and quartz
	1			Clay, brown	M		X	Natural
				Clayey sand, yellow				
	1.5			Clayey sand, red brown				
	2							TC Refusal
	2.5							

Notes:

Method:
SS - Solid Flight Auger
HS - Hollow Flight Auger
CC - Concrete Core
PT - Push Tube
RC - Rock Coring

Consistency
VS - Very Soft
S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

DLA Environmental Services

Borelog

Location **BH3**

Client:	EG	Project No:	DL3724
Date:	9.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5			Clay, light brown			X	
	1							
	1.5						X	
	2			Clayey sand, brown		W		Fine grained
	2.5			Shale, brown black		H	X	
	3							

Sheet 1 of 1

Notes:

Method:
SS - Solid Flight Auger
HS - Hollow Flight Auger
CC - Concrete Core
PT - Push Tube
RC - Rock Coring

Consistency
VS - Very Soft
S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

DLA Environmental Services

Borelog

Location **BH4**

Client:	EG	Project No:	DL3724
Date:	10.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5			Silty sand, black with gravel Silty clay, brown with gravel			X	Fill
	1			Clay, red with gravel				Natural
	1.5					H	X	
	2			Clay, grey and red mottle				V-bit refusal
	2.5							TC refusal
	3							

Notes:

Method:
SS - Solid Flight Auger
HS - Hollow Flight Auger
CC - Concrete Core
PT - Push Tube
RC - Rock Coring

Consistency
VS - Very Soft
S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

Borelog

Location **BH5**

Client:	EG	Project No:	DL3724
Date:	9.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5			Fill, grey			X	
				Ash			X	
	1			Silty Clay, orange			X	Natural
	1.5			Silty clay, grey	M			Increase in silt content with depth
	2							

Notes:

Method:
SS - Solid Flight Auger
HS - Hollow Flight Auger
CC - Concrete Core
PT - Push Tube
RC - Rock Coring

Consistency
VS - Very Soft
S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

DLA Environmental Services

Borelog

Location **BH6**

Client:	EG	Project No:	DL3724
Date:	9.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5						X	
	1							
	1.5			Fill			X	Light hydrocarbon odour with Geofabric
	2				W		X	Moderate hydrocardon odour Water lable
	2.5							
	3							Refusal
	3.5							

Notes:

Method:
SS - Solid Flight Auger
HS - Hollow Flight Auger
CC - Concrete Core
PT - Push Tube
RC - Rock Coring

Consistency
VS - Very Soft
S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

DLA Environmental Services

Borelog

Location **BH7**

Client:	EG	Project No:	DL3724
Date:	9.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5			Fill			X	
	1			Silty clay with gravel, greyish red			X	Light solvent odour
	1.5			Clay, grey			X	Strong solvent odour
	2			Clay, dark grey with ash			X	TC refusal - hit steel plate using STP Sampler
	2.5							

Notes:

Method:
SS - Solid Flight Auger
HS - Hollow Flight Auger
CC - Concrete Core
PT - Push Tube
RC - Rock Coring

Consistency
VS - Very Soft
S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

Borelog

Location **BH8**

Client:	EG	Project No:	DL3724
Date:	10.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5			Sandy clay, brown with gravel		H	X	
	1			Weathered rock, yellowish brown		H	X	
	1.5							

Sheet 1 of 1

Notes:

Method:
SS - Solid Flight Auger
HS - Hollow Flight Auger
CC - Concrete Core
PT - Push Tube
RC - Rock Coring

Consistency
VS - Very Soft
S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

BH9

DLA Environmental Services

Borelog

Location BH9

Client:	EG	Project No:	DL3724
Date:	10.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5			Silty clay, brown			X	
	1			Clay, brown				
	1.5						X	
	2							

Sheet 1 of 1

Notes:

Method:
SS - Solid Flight Auger
HS - Hollow Flight Auger
CC - Concrete Core
PT - Push Tube
RC - Rock Coring

Consistency
VS - Very Soft
S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

Borelog

Location **BH10**

Client:	EG	Project No:	DL3724
Date:	10.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5			Silty clay, red and grey mottle			X	Natural
	1			Clay, grey				
	1.5			Clay, brown			X	
	2							

Notes:

Sheet 1 of 1

Method:
SS - Solid Flight Auger
HS - Hollow Flight Auger
CC - Concrete Core
PT - Push Tube
RC - Rock Coring

Consistency
VS - Very Soft
S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

Borelog

Location **BH11**

Client:	EG	Project No:	DL3724
Date:	9.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5			Silty clay, red and grey mottle			X	Natural with traces of gravel
	1			Clay, grey mottle				
	1.5							
	2			Clay, dark grey			X	
				Shale				
	2.5							

Notes:

Method:
SS - Solid Flight Auger
HS - Hollow Flight Auger
CC - Concrete Core
PT - Push Tube
RC - Rock Coring

Consistency
VS - Very Soft
S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

Borelog

Location **BH12**

Client:	EG	Project No:	DL3724
Date:	9.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Lorella Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5			Silty clay, grey red mottle			X	Natural
	1			Clay, grey with black mottle				
	1.5			Clay, dark greyish brown			X	
	2			Shale				Refusal
	2.5							

Notes:

Method:
- SS - Solid Flight Auger
- HS - Hollow Flight Auger
- CC - Concrete Core
- PT - Push Tube
- RC - Rock Coring

Consistency
- VS - Very Soft
- S - Soft
- F - Firm
- VS - Very Stiff
- H - Hard
- Friable - Fb

Plasticity
- HP - HighlyPlastic
- MP - Medium Plasticity
- LP - Low Plasticity

Moisture
- D - Dry
- M - Moist
- W - Wet

Density
- VL - Very Loose
- L - Loose
- MD - Medium Density
- D - Dense
- VD - Very Dense

Borelog

Location BH13

Client:	EG	Project No:	DL3724
Date:	10.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5			Silty clay, brown			X	
				Weathered rock, yellowish brown			X	Refusal
	1							

Sheet 1 of 1

Notes:

Method:
SS - Solid Flight Auger
HS - Hollow Flight Auger
CC - Concrete Core
PT - Push Tube
RC - Rock Coring

Consistency
VS - Very Soft
S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

Borelog

Location BH14

Client:	EG	Project No:	DL3724
Date:	10.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5			Clay, red grey mottle with gravel			X	
				Weathered rock, yellowish brown		H		Laminated
	1							

Notes:

Method:
SS - Solid Flight Auger
HS - Hollow Flight Auger
CC - Concrete Core
PT - Push Tube
RC - Rock Coring

Consistency
VS - Very Soft
S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

DLA environmental Services

Borelog

Location **BH15**

Client:	EG	Project No:	DL3724
Date:	10.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Hand Auger

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5			Fill, clayey sand with gravel				No further access
	1							

Sheet 1 of 1

Notes:

Method:
SS - Solid Flight Auger
HS - Hollow Flight Auger
CC - Concrete Core
PT - Push Tube
RC - Rock Coring

Consistency
VS - Very Soft
S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

DLA Environmental Services

Borelog

Location BH16

Client:	EG	Project No:	DL3724
Date:	16.11.15	Address:	1a Queen St, Auburn
Contractor:	Nealings Drilling	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Top soil				
	0.5			Fill: clay grey, brown and black			X	Foreign material and wire
	1						X	
	1.5			Ash, grey black				
				Fill, grey black			X	
				Fill, grey				
	2			Clay, grey red mottle			X	Natural
	2.5							
	3							

Notes:

Method:
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Consistency
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S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D = Dry
M = Moist
W = Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

Borelog

Location **BH17**

Client:	EG	Project No:	DL3724
Date:	16.11.15	Address:	1a Queen St, Auburn
Contractor:	Nealings Drilling	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
	0.5			Fill, clay with gravel			X	
	1							
	1.5							
	2				M			
	2.5			Ash, black				
	3			Fill, clay with gravel	W			
	3.5			Clay, grey with gravel				Natural
	4						X	

Sheet 1 of 1

Notes:

Method:
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Consistency
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F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

DLA Environmental Services

Borelog

Location BH18

Client:	EG	Project No:	DL3724
Date:	18.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
	0.5			Clay, grey red mottle with gravel			X X	Sand layer for 0.05m under slab Natural

Sheet 1 of 1

Notes:

Method:
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Consistency
VS - Very Soft
S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

DLA Environmental Services

Borelog

Location **BH19**

Client:	EG	Project No:	DL3724
Date:	18.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
				Stabilised roadbase			X	
	0.5			Clay, red with gravel			X	Natural
	1							

Sheet 1 of 1

Notes:

Method:
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Consistency
VS - Very Soft
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F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

Borelog

Location **BH20**

Client:	EG	Project No:	DL3724
Date:	18.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
				Fill, sand, clay and gravel, reddish brown			X	
	0.5			Clay, grey red mottle with gravel			X	Natural
	1							

Notes:

Method:
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HS - Hollow Flight Auger
CC - Concrete Core
PT - Push Tube
RC - Rock Coring

Consistency
VS - Very Soft
S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
M - Moist
W - Wet

Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense

Borelog

Location **BH21**

Client:	EG	Project No:	DL3724
Date:	18.11.15	Address:	1a Queen St, Auburn
Contractor:	FICO	Logged By:	Loretta Visintin
Hole Size	150mm	Method:	Drill rig

Method	Depth (m)	Graphic Log	USCS Classification	Material Description	Moisture	Density / Stiffness	Sampling	Comments
				Concrete				
				Fill, sand clay and gravel, reddish brown			X	
	0.5			Clay, red with gravel			X	Natural
	1							

Notes:

Method:
SS - Solid Flight Auger
HS - Hollow Flight Auger
CC - Concrete Core
PT - Push Tube
RC - Rock Coring

Consistency
VS - Very Soft
S - Soft
F - Firm
VS - Very Stiff
H - Hard
Friable - Fb

Plasticity
HP - HighlyPlastic
MP - Medium Plasticity
LP - Low Plasticity

Moisture
D - Dry
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Density
VL - Very Loose
L - Loose
MD - Medium Density
D - Dense
VD - Very Dense