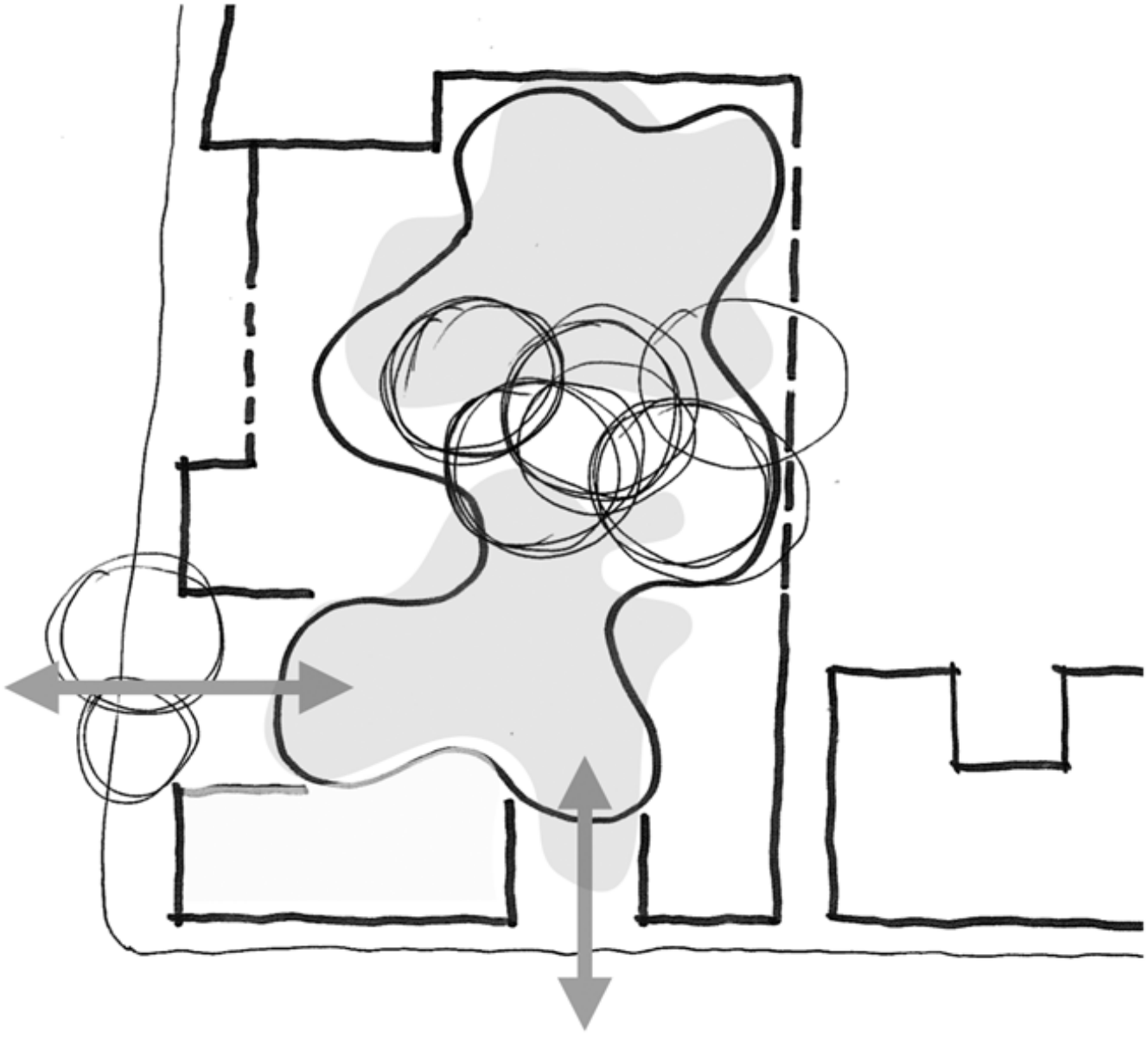
DARLINGTON PUBLIC SCHOOL REDEVELOPMENT

Appendix Q — Detailed Site Investigation

SSD-9914

Prepared by Douglas Partners

For NSW Department of Education



Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Detailed Site Investigation for Contamination

Proposed Upgrade Works
Darlington Public School, 417 Abercrombie Street,
Darlington, NSW

Prepared for
Gardner Wetherill & Associates

Project 92277.01
February 2019

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	92277.01	Document No.	R.002.Rev1
Document title	Report on Detailed Site Investigation for Contamination Proposed Upgrade Works		
Site address	Darlington Public School, 417 Abercrombie Street, Darlington, NSW		
Report prepared for	Gardner Wetherill & Associates		
File name	92277.01.R.002.Rev1		

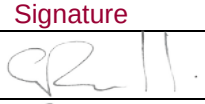
Document status and review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Grant Russell	Glyn Eade	15 February 2019
Revision 1	Grant Russell	Glyn Eade	19 February 2019

Distribution of copies

Status	Electronic	Paper	Issued to
Revision 0	1	0	Gardner Wetherill & Associates – Ms Luen Samonte
Revision 1	1	0	Gardner Wetherill & Associates – Ms Luen Samonte

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author		19 February 2019
Reviewer	 pp for GE	19 February 2019

bsi. ISO 9001 Quality Management
FS 604853

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
18 Waler Crescent
Smeaton Grange NSW 2567
Phone (02) 4647 0075
Fax (02) 4646 1886

Executive Summary

Douglas Partners Pty Ltd (DP) was commissioned by Gardner Wetherill and Associates Pty Ltd (GWA) to complete a Detailed Site Investigation for contamination (DSI) of the Darlington Public School property located at 417 Abercrombie Street, Darlington, NSW (the 'Site'). DP understands that the Site currently comprises an operational primary school and preschool and redevelopment/upgrading works are proposed for the school complex. The site covers an approximate area of 0.72 ha and is located within the Local Government Area of the City of Sydney.

In April 2018 DP completed a Preliminary Site Investigation for contamination (PSI) (ref: 92277.00) of the site for Billard Leece Partnership Pty Ltd (BLP). This PSI also included a limited programme of soil sampling and analysis. The results of the PSI identified the following Areas of Environmental Concern (AEC) and associated contaminants of concern (COC) which it was considered required further investigation to assess whether the site could be considered suitable for the proposed development:

- Total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbons (PAH) and lead impacts were variously identified in shallow filling soils at two locations (BH5 and BH6) in the north western portion of the site and one location (BH2) in the south eastern portion of the site. Concentrations of the COC were detected at levels exceeding the adopted site assessment criteria (SAC) which included human health investigation levels (HILs). Soils in the vicinity of these locations require remediation, management and/or risk assessment for the site to be considered suitable for an ongoing use as a primary/preschool. Further investigation was thus considered necessary to define the lateral and vertical extent of these identified impacted soils;
- TRH and zinc impact to shallow soils at one location (BH9) in the central eastern portion of the site at concentrations exceeding ecological investigation levels (EILs) required further investigation to establish whether the TRH and zinc concentrations are anomalous/isolated occurrences or indicative of greater widespread impact potentially requiring remediation; and
- Potential for asbestos-containing material (ACM) impact to shallow soils across the site. Whilst ACM was not identified in the PSI soil sampling, given the preliminary nature of the PSI; the historical demolition of on-site structures which anecdotally were constructed of asbestos; and importation of filling, the presence of asbestos impacted soils at the site could not be ruled out and, again was considered to require further investigation.

The objective of the DSI was therefore to delineate areas of contamination identified in the PSI and to further investigate/characterise areas of the site not previously investigated.

A DSI was completed to further investigate the above issues to update the PSI report on contamination to inform ongoing concept design for the school. DSI fieldwork was completed at the site on 15 to 18 January 2018 which included completion of the following scope:

- Completion of 16 probability based boreholes (BH10 to BH19 and BH21 to BH25) across the site on a 19.5 m grid and collection of shallow (between 0.2 and 0.5 metres below ground level [m bgl]) filling soil samples. Three of the locations (BH19, BH21 and BH24) drilled for the geotechnical investigation were utilised to collect filling samples. Grid based borehole BH20 could not be completed as the areas were inaccessible due to raised garden beds. The number of grid samples, including sample locations completed during the PSI, satisfies NSW EPA sampling requirements for the area of the property (total area of approx. 0.72 ha). The grid is sufficient to detect a 22.9 m diameter hotspot with a 95% upper confidence level. The grid was positioned so that grid locations could also investigate the lateral extent of impact to filling at locations BH2, BH5, BH6, BH7 and BH9 where COC were identified during the PSI that require some form of remediation, management and/or risk assessment;
- Completion of two targeted locations (BH26 and BH27) and collection of shallow (between 0.2 and 0.5 mbgl) filling soil samples. Targeted based borehole BH28 could not be completed as the area was inaccessible due to raised garden beds. The locations were positioned at points at a distance of approximately 5 - 7 m from previously identified impacted locations (BH2, BH5 and BH6) to further investigate the immediate lateral extent of impact at these locations where concentrations of the COC were detected at levels exceeding human health investigation levels. It should be noted that these locations were used in conjunction with grid based locations to investigate the lateral extent of impact and define either remediation, management and/or risk assessment requirements;
- Deeper filling samples (between 0.5 and 1.0 m bgl) and natural soil samples were also collected at locations BH2, BH5, BH6, BH7 and BH9 where COC were identified during the PSI to investigate the vertical extent of impact at these locations; and
- Laboratory analysis of all filling soil samples for the identified COC including TRH, BTEX, PAHs, metals and asbestos. A deeper filling sample from BH5 and native samples collected at depths of approximately 1.2 m bgl from boreholes BH7 and BH9 were also analysed for the identified COC.

The results of DSI soil sampling identified and confirmed TRH, PAH and lead impact to filling across the site at concentrations exceeding both adopted health investigation levels and ecological investigation levels. The identified impact does not appear to be limited to any particular filling type, filling depth and/or portion of the site. Given the identification of slag and charcoal type material within filling at several of the tested locations contamination of the filling is potentially associated with historic sourcing of filling from an industrial site with blast furnace activities. Given that most of the site is sealed with either asphalt, concrete or “soft-fall” safety surface material the potential for complete human health or ecological pathways to exist between impacted filling is considered limited. However, due to unsealed areas in the central eastern portions of the site there is a potential pathway to contamination. A feasibility study should be completed to assess the most practical means of limiting contact to impacted filling and should include consideration of remediation, management or risk assessment methods.

It is noted that a hazardous building materials assessment was also completed by DP at the time of the PSI to identify potential hazardous materials within the buildings so that protective measures can be implemented, if required, during redevelopment/upgrading works. It should also be noted that the northern portion (zone) of the site is subject to an AMP due to the potential for asbestos being present within shallow soils. Any work undertaken in the northern zone of the site, as described in the AMP, where there is potential for ground disturbance must be completed with reference to the procedures in the AMP and in accordance with the relevant legislation, regulations and guidance documents.

Table of Contents

Page

Report on Detailed Site Investigation for Contamination
Proposed Upgrade Works
Darlington Public School, 417 Abercrombie Street, Darlington, NSW

1. Introduction

Douglas Partners Pty Ltd (DP) was commissioned by Gardner Wetherill and Associates Pty Ltd (GWA) to complete a Detailed Site Investigation for contamination (DSI) of the Darlington Public School property located at 417 Abercrombie Street, Darlington, NSW (the 'Site') as shown on Drawing 1 (Appendix A). DP understands that the Site currently comprises an operational primary school and preschool and redevelopment/upgrading works are proposed for the school complex. The site covers an approximate area of 0.72 ha and is located within the Local Government Area of the City of Sydney.

In April 2018 DP completed a Preliminary Site Investigation for contamination (PSI) (ref: 92277.00) of the site for Billard Leece Partnership Pty Ltd (BLP). This PSI also included a limited programme of soil sampling and analysis. The results of the PSI identified the following Areas of Environmental Concern (AEC) and associated contaminants of concern (COC) which it was considered required further investigation to assess whether the site could be considered suitable for the proposed development:

- Total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbons (PAH) and lead impacts were variously identified in shallow filling soils at two locations (BH5 and BH6) in the north western portion of the site and one location (BH2) in the south eastern portion of the site. Concentrations of the COC were detected at levels exceeding the adopted site assessment criteria (SAC) which included human health investigation levels (HILs). Soils in the vicinity of these locations require remediation, management and/or risk assessment for the site to be considered suitable for an ongoing use as a primary/preschool. Further investigation was thus considered necessary to define the lateral and vertical extent of these identified impacted soils;
- TRH and zinc impact to shallow soils at one location (BH9) in the central eastern portion of the site at concentrations exceeding ecological investigation levels (EILs) required further investigation to establish whether the TRH and zinc concentrations are anomalous/isolated occurrences or indicative of greater widespread impact potentially requiring remediation; and
- Potential for asbestos-containing material (ACM) impact to shallow soils across the site. Whilst ACM was not identified in the PSI soil sampling, given the preliminary nature of the PSI; the historical demolition of on-site structures which anecdotally were constructed of asbestos; and importation of filling, the presence of asbestos impacted soils at the site could not be ruled out and, again was considered to require further investigation.

The objective of the DSI was therefore to delineate areas of contamination identified in the PSI and to further investigate/characterise areas of the site not previously investigated.

This report must be read in conjunction with the attached notes provided in Appendix H and other explanatory information, and should be kept in its entirety without separation of individual pages or sections.

2. Scope of Works

The following scope of works was undertaken for this DSI:

- Review of previous environmental investigations and results relevant to the Site;
- A site walkover to identify any additional AEC (beyond those identified from the PSI);
- Drilling at grid based and targeted locations across the site and collection of soils samples from encountered filling and from deeper filling samples at previously sampled locations;
- Laboratory analysis of selected soil samples for the identified COC associated with each AEC based on results of PSI and site walkover;
- Interpretation of results in accordance with current NSW EPA endorsed guidelines; and
- Preparation of this report detailing the methodology and results of the investigation including recommendations for future remedial/management options for the Site.

3. Site Information

3.1 Site Identification

The Site comprises the following land parcels as detailed in Table 1 below.

Table 1: Study Area Identification

Lot/Deposited Plan	Current Land Use	Approx. Area (ha)
Darlington Public School, 417 Abercrombie Street, Darlington NSW		
592 / 752049	Primary School	0.49
100 / 623500	Primary School	0.23
Total Approximate Area		**0.72**

3.2 Site Description

The following site description is based on the following:

- DP site inspection completed on 28 February 2018;
- PSI field works completed on 17 March 2018;
- DSI field works completed on 14 to 18 January 2018; and
- A review of Nearmap Imagery.

Prominent site features are presented on Drawing 2 (Appendix A). Photographic Plates showing site conditions are presented in Appendix B.

The site is located within an area which consists of undulating topography comprising low lying and gently sloping hills with shallow soil cover. The site levels slope towards the southeast from between approximately RL 41 m, relative to Australian Height Datum (AHD), in the northwest portion of the site to approximately RL 33 m AHD in the south eastern portion of the site.

The site comprises an irregular shaped property and is accessed via a driveway that leads from Golden Grove Street located to the west of the site and the School gate fronting Abercrombie Street to the south of the site. The site is comprised of two lots as described below.

Lot 592 DP 752049

This lot is roughly square shaped and comprises the majority of the school grounds and buildings. A large two storey rectangular building is located in the south western corner of the lot which comprises several school offices and classrooms. The building is constructed of brick walls, concrete slab floors and sheet metal roofing. Several interior walls and ceilings of the building appeared to be constructed of fibre cement sheeting (FCS) possibly containing asbestos. A courtyard is located to the immediate east of the building and is mostly concrete sealed with two small unsealed garden areas containing large established trees and shrubs. Another brick building is located to the immediate east of the courtyard and is also constructed of brick walls, concrete slab floor and metal sheeting roofing.

FCS interior walls and ceilings were also observed in portions of the building.

Another large rectangular shaped building is located across the central western portion of the lot and comprises the school hall and a number of classrooms. The building is constructed similarly to the other buildings onsite. An extension of the building is located to the immediate northwest. An area containing play equipment is located to the immediate east of the building. The play equipment area is sealed with a “soft-fall” safety surface material. A concrete path is located immediately adjacent east of the play area with an unsealed garden located further to the east.

Another S – shaped class room building is located across the central south eastern portion of the lot which is also constructed similarly to the other buildings onsite. The area to the immediate north of the S-shaped building is concrete sealed with unsealed gardens and a grassed area located further beyond in the north eastern portion of the lot.

Lot 100 DP 623500

This lot is roughly L – shaped and consists of a basketball court and playground area. The lot is elevated slightly above the remainder of the site (adjacent lot to the south) indicating the area has likely been historically filled. The majority of the area is sealed with asphalt and concrete. The far northern portion of the lot is elevated further above the remainder of the lot and is covered with a “soft-fall” safety surface material. Several large established trees also exist within the northern portion of the site. An unsealed garden bed is located along the eastern boundary of the lot and contains several small shrubs.

3.3 Surrounding Landuses

The site is in a residential/educational precinct area with the landuses surrounding the property comprising:

North:	A Sydney University building (residential and educational) with Darlington Lane and residential properties beyond.
East:	Sydney University student accommodation buildings (residential) with Sydney University campus buildings beyond.
South:	Abercrombie Street with residential properties beyond.
West:	Golden Grove Street with residential properties beyond.

3.4 Regional Geology, Soils, Hydrogeology and Hydrology

Reference to the Sydney 1:100 000 Geological Series Sheet indicated that the site is underlain by Ashfield Shale (Rwa) of the Wianamatta Group of Triassic age. This formation typically comprises shale, carbonaceous claystone, laminite, fine to medium grained lithic sandstone and some minor coal bands.

Reference to 1:100 000 *Sydney* Geological Series Sheet 9030 (Edition 1), published 1991 indicates that shallow soils at the site comprise Blacktown Soil Landscape (bt) which is topographically characterised by *'gently undulating rises on Wianamatta Group shales and Hawkesbury shale, with local relief to 30 m and slopes usually less than 5%'*. This is a residual landscape which the mapping indicates comprises up to two soil horizons that range from shallow to moderately deep red and brown podzolic soils on crests, upper slopes and well drained areas to yellow podzolic soils on lower slopes and in areas of poor drainage. These soils are typically of low fertility comprising moderately reactive high plasticity subsoils with poor drainage.

A search of the NSW Office of Water groundwater bore data was undertaken by DP on 1 March 2018 and identified one bore within 500 m of the site. Table 2 below provides a summary of information for the bore in question.

Table 2: Summary of Groundwater Bore Search

Bore ID	Approx. Distance (m) / Direction from Site	Date of Installation	Bore Use	Total Depth (m)	Depth of Water Bearing Zones (m)
GW110247	Northwest / 200 m	16/07/2009	Domestic Bore	210	22.0 to 23.0 74.0 to 76.0 188.0 to 188.5

Groundwater monitoring well GW110247 is located up hydraulic gradient of the site.

The nearest surface water receptor down-gradient of the site is Lake Northam located within Victoria Park approximately 850 m northeast of the site.

3.5 Sensitive Receptors and Environments

The nearest sensitive receptors and environments have been identified as follows:

- Current and future site users;
- Current and future site workers;
- The nearest residential properties located immediately adjacent to the site's northern and eastern boundaries; and nearby to the west beyond Golden Grove Street and to the south beyond Abercrombie Street;
- The primary environmental receptors down-gradient of the site is Lake Northam located approximately 850 m northeast of the site;
- Groundwater beneath the site; and
- Site flora and fauna.

4. Previous Environmental Investigations and Reports

4.1 Parsons Brinkerhoff (2014) Asbestos in Grounds, Asbestos Management Plan

BLP provided DP with an Asbestos Management Plan (AMP) produced for the site by Parsons Brinkerhoff (PB) in 2014. The AMP was an updated version of previous AMPs produced for the site by PB in 2007 and 2013. In August 2007 fragments of asbestos-containing materials (ACM) were identified by PB on ground surfaces across the northern playground area of the site. In order to manage the risk of exposure to asbestos these fragments were removed under the guidance of PB from the ground surfaces in August 2007 and July 2013. In a previous PB inspection report it was proposed that an area delineated as the asbestos zone in the northern playground be encapsulated with an appropriate surface such as hard stand or raised mulch garden beds. The AMP (PB, 2014) outlines the plan for management of the identified asbestos impacted areas (zones).

The asbestos register in Section 3 of the AMP outlines the areas requiring management as:

- The northern playground area; and
- Northern and north eastern raised garden beds adjacent to school boundary walls.

The AMP (PB, 2014) recommended that asbestos zone management should include regular inspections and maintenance. The PB AMP included a checklist (presented in Appendix A of the AMP) which it was recommended be used whenever walkover inspections or maintenance is carried out. The AMP states that "*the checklist is specific to the requirements of the grounds at the Darlington Public School and sets out the frequency of inspections required*".

4.2 DP (April 2018) Preliminary Site Investigation

DP completed a PSI of the site for BLP in April 2018 which was required as part of a master plan and concept design and to support future development applications being made to the City of Sydney. The aim of the PSI was to provide preliminary contamination, salinity and acid sulfate soil information regarding the site's suitability for the proposed redevelopment/upgrade works.

A site walkover and a desktop review of site history information were undertaken to identify AEC and COC which may have arisen from previous and current land uses and activities. The desktop investigation was limited to a review of aerial photographs, a number of NSW EPA database searches and listing of other potential site contamination issues based on DP experience with sites of a similar nature and scale.

The results of the site walkover and desktop investigation identified the following AEC that had the potential for contamination of near surface soils and/or filling at the site:

- AEC1: Presence of demolished former buildings and sheds (hazardous building materials contained within);
- AEC2: Presence of imported filling of an unknown origin;
- AEC3: Presence of former and current sheds (potential chemical storage);
- AEC4: Presence of a power pole (potential contaminants associated with pole treatment/protection); and
- AEC5: Presence of a former road/laneway.

Targeted sampling was undertaken at 10 locations (BH1 to BH9 and in the vicinity of the power pole) across the site within identified AEC in the vicinity of former/current site structures, areas of filling, the former road/laneway and a power pole onsite. The results of site inspection and soil sampling identified the following that will require remediation, management and/or risk assessment or further investigation for the site to be considered suitable for the proposed upgrading works and ongoing use as a primary/pre-school:

- TRH, PAH and lead impact was variously identified in shallow filling at two locations in the north western portion of the site (BH5 and BH6) and one location in the south eastern portion of the site (BH2). Given the identification of slag and charcoal type material within filling at these locations contamination of the filling is considered to be potentially associated with historic filling from an industrial site with blast furnace activities;
- TRH and zinc impact to shallow soils in the central eastern portion of the site; and
- Potential for ACM impact to shallow soils across the site. Whilst ACM was not identified in the PSI soil sampling, given the preliminary nature of the PSI; the historical demolition of numerous structures; and importation of filling, the presence of asbestos impacted soils at the site could not be ruled out.

The PSI sample locations and identified AEC are shown on Drawing 2 (Appendix A).

With respect to site contamination the PSI recommended further assessment should build on the information provided in the PSI report with reference to National Environment Protection Council (NEPC, 1999) National Environment Protection Council (Assessment of Site Contamination) Measure 1999 (amended 2013) (NEPC, 2013). Further assessment should include intrusive investigation, soil sampling, analysis and assessment to evaluate land use suitability.

It is noted that a hazardous building materials assessment was also completed by DP at the time of the PSI to identify potential hazardous materials within the buildings so that protective measures can be implemented, if required, during redevelopment/upgrading works (ref. DP report 92277.00.R.003.Rev0).

5. Soil Sampling

DSI field work was completed at the site between 15 and 18 January 2018 to assess the AEC identified in the PSI requiring further investigation and additional areas of the site not previously investigated.

The field investigation was designed in accordance with the seven step data quality objectives (DQO) process provided in Appendix B, Schedule B2 of the National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended 2013 (NEPC, 2013). The DQO adopted for this DSI are provided in Appendix C.

5.1 Soil Sampling Methodology and Rationale

DSI borehole and sample locations are shown on Drawing 4, Appendix A. Soil sampling was completed at the majority of locations by boring with a hand auger fitted with a 100 mm auger bit. As part of the DP geotechnical investigation, soil sampling was completed at bore holes BH19, BH21 and BH24 using a limited access bobcat fitted with a 150 mm diameter solid flight auger.

To further investigate the AEC previously identified the following scope was completed:

- Completion of 16 probability based boreholes (BH10 to BH19 and BH21 to BH25) across the site on a 19.5 m grid and collection of shallow (between 0.2 and 0.5 metres below ground level [bgl]) filling soil samples. Three of the locations (BH19, BH21 and BH24) drilled for the geotechnical investigation were utilised to collect filling samples. Grid based borehole BH20 could not be completed as the areas were inaccessible due to raised garden beds. The number of grid samples, including sample locations completed during the PSI, satisfies NSW EPA sampling requirements for the area of the property (total area of approx. 0.72 ha). The grid is sufficient to detect a 22.9 m diameter hotspot with a 95% upper confidence level. The grid was positioned so that grid locations could also investigate the lateral extent of impact to filling at locations BH2, BH5, BH6, BH7 and BH9 where COC were identified during the PSI that require some form of remediation, management and/or risk assessment;

- Completion of two targeted locations (BH26 and BH27) and collection of shallow (between 0.2 and 0.5 m bgl) filling soil samples. Targeted based borehole BH28 could not be completed as the area was inaccessible due to raised garden beds. The locations were positioned at points at a distance of approximately 5 - 7 m from previously identified impacted locations (BH2, BH5 and BH6) to further investigate the immediate lateral extent of impact at these locations where concentrations of the COC were detected at levels exceeding human health investigation levels. It should be noted that these locations were used in conjunction with grid based locations to investigate the lateral extent of impact and define either remediation, management and/or risk assessment requirements;
- Deeper filling samples (between 0.5 and 1.0 m bgl) and natural soil samples were also collected at locations BH2, BH5, BH6, BH7 and BH9 where COC were identified during the PSI to investigate the vertical extent of impact at these locations;
- Laboratory analysis of all filling soil samples for the identified COC including TRH, BTEX, PAHs, metals and asbestos. A deeper filling sample from BH5 and native samples collected at depths of approximately 1.2 m bgl from boreholes BH7 and BH9 were also analysed for the identified COC; and
- Selected samples were additionally analysed for physicochemical characteristics including pH, EC and cation exchange capacity to assist in the calculation of EILs.

5.2 Sampling Procedure and QA/QC

All sampling data was recorded on DP bore logs (Appendix D) with samples also recorded on chain-of-custody (CoC) sheets. The general sampling procedure adopted for the collection of environmental soil samples is summarised below:

- Collection of soil samples was completed using disposable sampling equipment (new nitrile gloves for each sample) from the drilling auger or the hand auger. Samples were collected taking care to not include soil that was directly in contact with either the surface of auger;
- Transfer of samples into laboratory-prepared glass jars, completely filled to ensure the headspace within the sample jar was minimised, and capping immediately to minimise loss of volatiles;
- Label sample containers with individual and unique identification details, including project number, sample location and sample depth;
- Place the glass jars, with Teflon lined lid, into a cooled, insulated and sealed container for transport to the laboratory; and
- Collection of additional replicate samples at a rate of 10% for QC requirements.

Samples designated for analysis were dispatched to NATA accredited laboratory Envirolab Services at Chatswood NSW for analysis of primary samples and intra-laboratory replicates.

5.3 Site Assessment Criteria

The Site Assessment Criteria (SAC) applied in this DSI have been informed by the proposed land use and the PSI CSM - which identified human and ecological receptors to potential contamination on the Site. Analytical results were assessed (as a Tier 1 assessment) against the investigation and screening levels presented in Schedule B1 of the ASC NEPM (NEPC, 2013).

Residential land use criteria with accessible soil (HIL A) were adopted given the site is currently a primary and pre-school (as required by the ASC NEPM). Where required, the derivation of some SAC is included in Appendix C and the adopted SAC are listed in the analytical results table (Table E1 in Appendix E).

6. Field Work Observations and Results

6.1 Geology

Relatively uniform geological conditions were encountered across most of the Site and generally included the following strata:

- Filling or Clayey Silt topsoil, comprising minor gravel inclusions encountered from surface to 0.2 m bgl; overlying;
- Filling comprising grey mottled silty clay from 0.2 to 1.5 m bgl – slag and charcoal type gravel material and/or coal wash material was observed in filling at locations BH2, BH5, BH6, BH7, BH9, BH10, BH13, BH17, BH18 and BH25; overlying
- Silty clay encountered at depths from 0.9 to 2.0 m bgl; and overlying; and
- Weathered sandstone or shale encountered at depths from 0.9 to 2.0 m bgl.

With the exception of boreholes BH1, BH5, BH11, BH12, BH22, BH23, BH24 anthropogenic material including crushed bricks, ceramics and concrete were variously encountered in filling at most locations. A piece of plywood type material was identified in BH9 at a depth of 0.5 m bgl. The piece of plywood material was collected and sent to the laboratory for asbestos identification. No asbestos was identified.

No free groundwater was observed in the bores during drilling for the short time that they were left open.

6.2 Laboratory Analytical Results

The analytical results for the soil samples collected during this DSI are summarised in Table E1 in Appendix E, together with the adopted SAC. The laboratory certificate of analysis for this DSI is provided in Appendix F.

6.2.1 TRH and BTEX

F2 fraction compounds were detected at concentrations exceeding the adopted HIL (230 mg/kg) and EIL (120 mg/kg) in the shallow filling soil sample BH5/0.5 (320 mg/kg).

F3 fraction compounds were detected at concentrations exceeding the adopted EIL of 300 mg/kg in the shallow filling soil samples BH5/0.5 (7,800 mg/kg), BH9/0.5 (440 mg/kg), BH13/0.3 (360 mg/kg), BH15/0.3 (700 mg/kg), BH16/0.3 (420 mg/kg) and BH17/0.3 (330 mg/kg), BH18/0.3 (1,600 mg/kg).

TRH and BTEX were not detected at concentrations exceeding the adopted SAC in the remaining soil samples analysed.

6.2.2 PAHs

Benzo(a)pyrene (BaP) was detected at concentrations in excess of the adopted EIL of 0.7 mg/kg in shallow filling soil samples BH5/0.5 (160 mg/kg), BH6/0.5 (3.2 mg/kg), BH7/0.5 (2.3 mg/kg), BH9/0.5 (1.7 mg/kg), BH12/0.3 (0.71 mg/kg), BH13/0.3 (6.3 mg/kg), BH15/0.3 (1.2 mg/kg), BH17/0.3 (6.6 mg/kg), BH19/0.3 (2.7 mg/kg), BH24/0.3 (2.6 mg/kg). and BH26/0.3 (2.6 mg/kg).

BaP toxic equivalent (TEQ) concentrations exceeding the adopted residential HIL of 3 mg/kg were detected in shallow filling soil samples BH5/0.5 (220 mg/kg), BH6/0.5 (4.6 mg/kg), BH7/0.5 (3.3 mg/kg), BH9/0.5 (2.5 mg/kg), BH13/0.3 (9.1 mg/kg), BH16/0.3 (11 mg/kg), BH17/0.3 (9.3 mg/kg), BH18/0.3 (42 mg/kg), BH19/0.3 (3.9 mg/kg), BH24/0.3 (3.9 mg/kg) and BH26/0.3 (3.6 mg/kg).

Naphthalene was detected at concentrations exceeding the adopted residential HIL of 4 mg/kg in the shallow filling soil sample BH5/0.5 (6 mg/kg).

Total PAHs were detected at concentrations exceeding the adopted residential HIL of 300 mg/kg in the shallow filling soil samples BH18/0.3 (390 mg/kg) and BH5/0.5 (1,800 mg/kg).

PAHs were not detected at concentrations exceeding the adopted SAC in the remaining soil samples analysed.

6.2.3 Metals

Lead was detected at concentrations in excess of the adopted residential HIL of 300 mg/kg in the shallow filling soil samples BH7/0.5 (540 mg/kg), BH9/0.5 (2200 mg/kg), BH18/0.3 (940 mg/kg) and BH19/0.3 (460 mg/kg).

Zinc was detected at a concentration in excess of the adopted EIL of 760 mg/kg in the shallow filling soil sample BH9/0.2 (2,100 mg/kg).

Heavy metals were not detected at concentrations exceeding SAC in the remaining soil samples analysed.

6.2.4 Asbestos

Chrysotile asbestos was identified in a small fragment of fibre cement sheeting in the soil sample collected from BH10/0.3.
Asbestos was not detected in any of the remaining soil samples analysed.

Material suspected of containing asbestos was not observed across the surface of the site or within any of the remaining sampling locations (despite being noted previously by other investigators and site users as outlined in Sections 4.2 and 4.3, above).

6.3 Quality Assurance/Quality Control (QA/QC)

A review of the adopted QA/QC procedures and results presented in Appendix G indicates that the data quality indicators (DQIs) have generally been met. On this basis, the sampling and laboratory methods used during the investigation were found to meet the DQO for this project (as discussed in Appendix C).

7. Discussion

7.1 TRH, PAH and Lead Soil Impact to Filling

COC including TRH (F2 and F3 fraction compounds), PAHs (BaP and BaP TEQ compounds) and lead were previously detected during the PSI at concentrations exceeding SAC in shallow filling samples (0.2 to 0.5 m bgl) collected at two locations (BH5 and BH6) in the north western portion of the site and one location (BH2) in the south eastern portion of the site.

Results of grid based and targeted soil sampling completed during this DSI have additionally detected the identified COC at concentrations exceeding the adopted SAC in:

- Shallow filling samples (collected from between 0.2 and 0.5 m bgl) at locations BH13, BH16, BH17, BH18, BH19, BH24 and BH26; and
- The deeper filling samples (collected at depths greater than0.5 m bgl) at locations BH5, BH6, BH7 and BH9.

Given that concentrations of the identified COC at the majority of these locations generally exceeded 250% of the adopted SAC's (particularly BaP in excess of HILs) these areas are considered to represent contamination hotspots. Locations of contamination hotspots and samples that exceeded SAC are presented on Drawing 5, Appendix A. It is noted that dark slag like material and flecks of dark charcoal type material was observed during the PSI and this DSI in filling samples collected at several of these locations. Given the identified contaminants (longer chain TRH, PAHs and lead) there is potential that hotspot contamination may be associated with these slag and charcoal deposits within the filling. Slag and charcoal type material are often associated with industrial blast furnace activities.

Given that hotspots and exceedances were identified at randomly spaced locations across the site and at various depths within filling the distribution of these COC does not appear to be limited to any particular filling type, filling depth and/or portion of the site. The results indicate that the majority of filling across the site is impacted with COC (TRH, PAHs, lead and zinc) at concentrations exceeding the adopted SAC and therefore requires remediation, management and/or risk assessment for the site to be considered suitable for the proposed building upgrades and ongoing use of the site as primary/pre-school.

Given that identified COC were not detected in any of the natural soils collected during this DSI indicates that the vertical extent of impact appears to be limited to filling at the site. However, this should be confirmed during any future remediation with validation sampling.

7.2 Previously Identified TRH and Zinc Impact to Filling at BH9

TRH C_{16} - C_{34} and zinc were previously detected during the PSI at concentrations (>250%) exceeding the EIL only in a shallow soil sample (0.2 m bgl) collected at location BH9 in an unsealed area in the central eastern portion of the site. Whilst further investigation of the immediate area to BH9 completed during this DSI did not identify zinc at concentrations exceeding EILs, as discussed in Section 7.1, other COC (TRH, PAHs and lead) were identified in deeper filling samples collected from BH9 and at shallow filling samples collected at a location in close vicinity to BH19 exceeding the adopted SAC and therefore the filling will require remediation, management and/or risk assessment.

7.3 Asbestos Soil Impact

Chrysotile (white) asbestos fibres were detected in a small fragment of fibre cement sheeting in the fill soil sample BH10/0.3 collected in the northern portion of the site. Bonded ACM was also identified during previous investigations (PB, 2007) on surface soils across the northern portions (zone) of the site. Removal of asbestos fragments across the site was reported as being undertaken under the guidance of PB between 2007 and 2013. An asbestos management plan (AMP) was prepared by others (PB, 2014) and suggested the encapsulation of ACM in the northern playground area and northern and north eastern raised garden beds to school boundary walls.

Whilst the PB AMP reported that observable fragments across the northern portion of the site had been removed the mostly sealed area described above is now subject to the AMP. Any work in the northern portion (zone) of the site, as described in the AMP, where there is potential for ground disturbance must be completed with reference to the procedures in the AMP and in accordance with the relevant legislation, regulations and guidance documents including:

- NSW *Work Health and Safety Act 2011*;
- NSW *Work Health and Safety Regulation 2017*;
- The Safe Work Australia (SWA) *Code of Practice: How to Manage and Control Asbestos in the Workplace, 2016; and*
- The SWA *Code of Practice: How to Safely Remove Asbestos, 2016.*

(Or revisions thereof.)

Whilst the DP PSI and DSI field observations and laboratory analysis of soil samples collected from across the remainder of the site (excluding northern portions) did not identify asbestos, the potential remains for isolated pockets of asbestos contamination to be present in other areas of the site. DP recommends the development and implementation of an Unexpected Finds Protocol (UFP) for any future soil disturbance works in the remainder of the site given:

- PSI and DSI sampling was limited to accessible areas of the site and did not investigate soils directly under any of the site's buildings;
- Historical aerial photographs suggest demolition of former buildings and sheds across the entire site;
- Anecdotal information suggests bonded ACM fragments may also be present in other portions of the site, particularly beneath current buildings; and
- Site inspection of several interior walls and ceilings of the school buildings indicated construction of FCS materials suspected of containing asbestos.

8. Revised Conceptual Site Model

8.1 Potential Sources of Contamination

Hazardous Building Materials (AEC1)

Historical aerial photographs and a site inspection identified a number of residential dwellings and associated sheds previously located across the site which have since been demolished in the period between 1961 to 1984. Review of the AMP produced by PB has identified that fragments of asbestos containing materials were previously identified in the northern portion of the site which is now a sealed area subject to an AMP. Asbestos was also detected in one fill soil sample collected during this DSI from the northern portion of the site at BH10.

Anecdotal information also suggests fragments of ACM have previously been identified beneath a building in the central western portion of the site.

There is therefore potential for contamination of shallow soils across the site to be impacted by hazardous building material related contaminants of potential concern (COPC) including:

- Asbestos; and
- Lead.

Whilst the DP PSI and DSI field observations and laboratory analysis of soil samples collected from across the remainder of the site did not identify asbestos, the potential remains for isolated pockets of asbestos contamination to be present in other areas of the site.

Areas of Filling (AEC2)

The results of the PSI and this DSI have identified and confirmed that the majority of the site has been historically filled with material from an unknown origin and also indicate the majority of the filling is impacted with the following COC at concentrations exceeding adopted SAC:

- Total Recoverable Hydrocarbons (TRH);

- Benzene, toluene, ethylbenzene and xylenes (BTEX);
- Polycyclic Aromatic Hydrocarbons (PAHs);
- Metals (Pb and Zn);

Chemical and Fuel Storage (AEC3) and Presence of a Former Road / Laneway (AEC5)

Whilst the results of the PSI identified several former sheds associated with the former residential dwellings onsite and a former road/laneway as potential contamination sources, the results of PSI and DSI sampling have not identified any localised point sources of contamination. It considered is unlikely that AEC3 and AEC4 are potential contamination source at the site. Therefore AEC3 and AEC5 have been dismissed as potential significant sources of contamination.

Power Pole (AEC4)

Results of PSI sampling at the base of the timber power pole in the southern portion of the site did not identify COC at concentrations exceeding the adopted SAC therefore AEC4 is no longer considered a potential source.

8.2 Potential Receptors

The following potential human receptors (R) have been identified for the Site:

- R1 – Construction and maintenance workers (during Site redevelopment);
- R2 – Current and future site users following development of the Site; and
- R3 – Land users in adjacent areas (residential).

The following potential ecological receptors (R) have been identified for the Site:

- R4 – Local groundwater, and receiving water bodies;
- R5 – Surface water bodies (offsite lakes or creeks); and
- R6 – Local ecology. DP notes that potential ecological receptors are usually associated with the upper 2 m (root zone and habitation zone for many species) of the soil profile.

8.3 Potential Pathways

Potential pathways for contamination include the following:

- P1 – Ingestion and dermal contact;
- P2 – Inhalation of fibres and / or dust and / or vapours;
- P3 – Leaching of contaminants and vertical migration into groundwater;
- P4 – Surface water run-off;
- P5 – Lateral migration of groundwater providing base flow to watercourses; and
- P6 – Direct contact with ecological receptors.

8.4 Summary of Potential Complete Pathways

A 'source - pathway - receptor' approach has been used to assess the potential risks of harm being caused to human or ecological receptors from contamination sources on or in the vicinity of the Sites, via exposure pathways. The possible pathways between the above sources (AEC1 - AEC2) and receptors (R1 to R6) are provided in Table 4 below. Assessment of the CSM was used to determine data gaps and the requirement for sampling and analysis to assess the suitability of the Site for the proposed continued use as a primary school and child care centre.

Table 3: Conceptual Site Model

Potential Source	Exposure Pathway	Receptor	Requirement for Additional Data and/or Management
AEC1: Presence of former buildings and sheds (Hazardous building materials) AEC2: Presence of filling	P1 – Ingestion and dermal contact. P2 – Inhalation of fibres and/or dust and/or vapours. P3 – Leaching of contaminants and vertical migration into groundwater. P4 – Surface water run-off. P5 – Lateral migration of groundwater providing baseflow to watercourses.	R1 - Construction and maintenance workers. R2 – Future site users following development of the site. R3 – Land users in adjacent areas. R5 – Surface water bodies. R6 – Local groundwater and receiving water bodies.	The results of the DSI indicate the majority of filling is impacted with COC including TRH, PAHs and metals (Pb and Zn) and is the primary source of contamination onsite. In its current state the majority of the site is sealed with either asphalt, concrete or "soft-fall" safety surface material thus limiting most onsite direct human health and ecological contact pathways (i.e. Ingestion, dermal contact and inhalation) to impacted filling. There are, however, still some areas (central eastern portions) of the site that are grass covered and unsealed therefore the potential for a complete pathway cannot be fully ruled out – It is recommended that a feasibility study be completed to assess the most practical means of limiting contact to impacted filling and this should include consideration of remediation, management or risk assessment
	P6 – Direct contact of contaminated ground with ecological receptors.	R4 – Local ecology.	

Potential Source	Exposure Pathway	Receptor	Requirement for Additional Data and/or Management
			methods. A risk assessment should also be completed to assess potential for pathways to exist in any future development works which involve soil disturbance. Leachability testing of COC in soils at the site is also recommended to assess the potential for contamination impact to groundwater.

9. Conclusions

The results of DSI soil sampling identified and confirmed TRH, PAH and lead impact to filling across the site at concentrations exceeding both adopted health investigation levels and ecological investigation levels. The identified impact does not appear to be limited to any particular filling type, filling depth and/or portion of the site. Given the identification of slag and charcoal type material within filling at several of the tested locations contamination of the filling is potentially associated with historic sourcing of filling from an industrial site with blast furnace activities. Given that most of the site is sealed with either asphalt, concrete or "soft-fall" safety surface material the potential for complete human health or ecological pathways to exist between impacted filling is considered limited. However, due to unsealed areas in the central eastern portions of the site there is a potential pathway to contamination. A feasibility study should be completed to assess the most practical means of limiting contact to impacted filling and should include consideration of remediation, management or risk assessment methods.

It is noted that a hazardous building materials assessment was also completed by DP at the time of the PSI to identify potential hazardous materials within the buildings so that protective measures can be implemented, if required, during redevelopment/upgrading works. It should also be noted that the northern portion (zone) of the site is subject to an AMP due to the potential for asbestos being present within shallow soils. Any work undertaken in the northern zone of the site, as described in the AMP, where there is potential for ground disturbance must be completed with reference to the procedures in the AMP and in accordance with the relevant legislation, regulations and guidance documents.

10. References

1. DP *Report on Preliminary Site Investigation, Darlington Public School Upgrade, 417 Abercrombie Street, Darlington NSW,* Project 92277.00.R.001.Rev0 (PSI; DP, April 2018).
2. DP *Report on Hazardous Building Materials Assessment, Darlington Public School Upgrade, 417 Abercrombie Street, Darlington NSW,* Project 92277.00.R.003.Rev0 (Hazardous Materials Assessment; DP, April 2018a).
3. National Environment Protection Council (2013), *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013*, 11 April 2013.
4. NSW EPA, Contaminated Site, *Guidelines for the NSW Site Auditor Scheme 2nd Edition*, April 2006.
5. NSW EPA, *Managing Land Contamination, Planning Guidelines, SEPP55 - Remediation of Land*, 1988.
6. NSW EPA Contaminated Sites (2011), Guidelines for Consultants Reporting on Contaminated Sites, August 2011.
7. Parson Brinkerhoff. Asbestos in Grounds, Asbestos Management Plan, Darlington Public School, Darlington NSW, (Project reference 1735_ASB_150514_AMP).

11. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at Darlington Public School, 417 Abercrombie Street, Darlington NSW in accordance with DP's proposal MAC180298 dated 23 October 2018 and acceptance received from Ross Garden dated 12 December 2018. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Gardner Wetherill and Associates Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the (geotechnical / environmental / groundwater) components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

Drawings 1 to 5

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Gardner Wetherill & Associates Pty Ltd		
OFFICE: Macarthur	DRAWN GAR	
SCALE: 1:800	DATE: 2.01.2019	

TITLE: **Site Locality Map**
Darlington Public School
417 Abercrombie Street, Darlington NSW

N
MGA

PROJECT No: 92277.01
DRAWING No: 1
REVISION: A

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Gardner Wetherill & Associates Pty Ltd		
OFFICE: Macarthur	DRAWN GAR	
SCALE: 1:600	DATE: 2.01.2019	

TITLE: **PSI (April 2018) Sampling Locations**
Darlington Public School
417 Abercrombie Street, Darlington NSW

MGA

PROJECT No: 92277.01
DRAWING No: 2
REVISION: A

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Gardner Wetherill & Associates Pty Ltd		TITLE: **Site Features Map** **Darlington Public School** **417 Abercrombie Street, Darlington NSW**	PROJECT No: 92277.01
OFFICE: Macarthur	DRAWN GAR		DRAWING No: 3
SCALE: 1:661	DATE: 2.01.2019	N MGA	REVISION: A

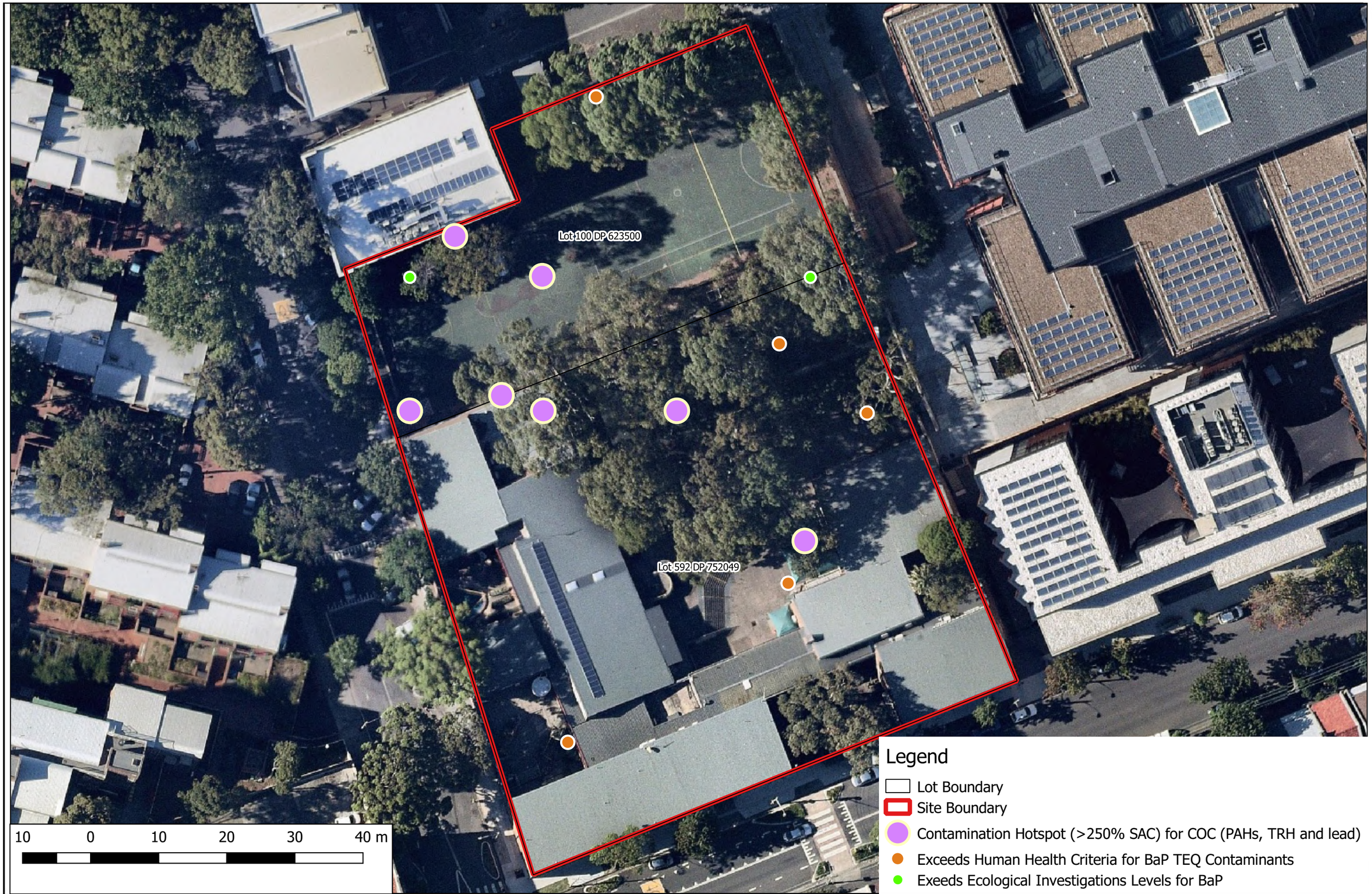
Douglas Partners
Geotechnics | Environment | Groundwater

CLIENT: Gardner Wetherill & Associates Pty Ltd		
OFFICE: Macarthur	DRAWN: GAR	
SCALE: 1:600	DATE: 2.01.2019	

TITLE: **DSI Sampling Location Map**
Darlington Public School
417 Abercrombie Street, Darlington NSW

MGA

PROJECT No: 92277.01
DRAWING No: 4
REVISION: A



Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Gardner Wetherill & Associates Pty Ltd		
OFFICE: Macarthur	DRAWN GAR	
SCALE: 1:515	DATE: 2.01.2019	

TITLE: **Contamination Hotspot and SAC Exceedance Location Map**
Darlington Public School
417 Abercrombie Street, Darlington NSW

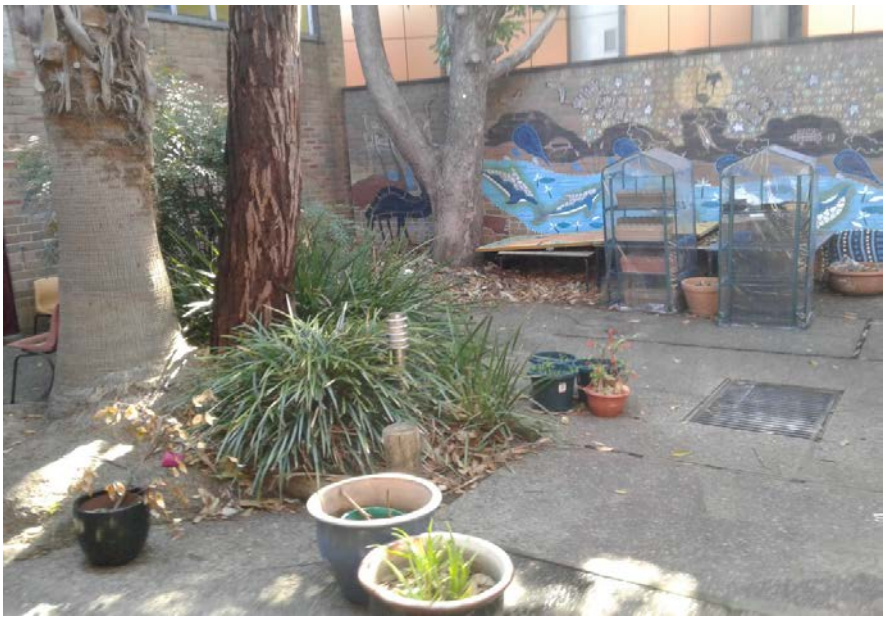
N
MGA

PROJECT No: 92277.01	
DRAWING No: 5	
REVISION: A	

Appendix B

Site Photographs

Photograph 1 - South facing school building in south western portion of site with Abercrombie Street in foreground



Photograph 2 - Court yard area in southern portion of site

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs**	PROJECT: 92277.00
	Detailed Site Investigation	PLATE No: 1
	417 Abercrombie Street, Darlington NSW	REV: 0
	CLIENT: Billard Leece Partnership Pty Ltd	DATE: 14-Feb-19

Photograph 3 - Central portion of site

Photograph 4 - Basketball court area in northern portion of site

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Detailed Site Investigation** **417 Abercrombie Street, Darlington NSW**	PROJECT: 92277.00 PLATE No: 2 REV: 0
	CLIENT: Billard Leece Partnership Pty Ltd	DATE: 14-Feb-19

Photograph 5 - Unsealed garden bed adjacent to sites eastern boundary

Photograph 6 - Far northern portion of site . Elevated area with rubber safety seal material covering majority of area.

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs**	PROJECT: 92277.00
	Detailed Site Investigation	PLATE No: 3
	417 Abercrombie Street, Darlington NSW	REV: 0
	CLIENT: Billard Leece Partnership Pty Ltd	DATE: 14-Feb-19

Photograph 7 - Central northern portion of site

Photograph 8 - Central southern portion of site

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Detailed Site Investigation** **417 Abercrombie Street, Darlington NSW**	PROJECT: 92277.00 PLATE No: 4 REV: 0
	CLIENT: Billard Leece Partnership Pty Ltd	DATE: 14-Feb-19

Photograph 9 - Playground area in central western portion of site with classroom building beyond

Photograph 10 - Golden Grove Street with Church and residential properties beyond to the west of site

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs**	PROJECT: 92277.00
	Detailed Site Investigation	PLATE No: 5
	417 Abercrombie Street, Darlington NSW	REV: 0
	CLIENT: Billard Leece Partnership Pty Ltd	DATE: 14-Feb-19

Photograph 10 - Building used by Sydney University to the immediate northwest of site

Photograph 11 - Abercrombie Street to the south of site with residential properties beyond

Douglas Partners Geotechnics / Environment / Groundwater	**Site Photographs** **Detailed Site Investigation** **417 Abercrombie Street, Darlington NSW**	PROJECT: 92277.00 PLATE No: 6 REV: 0
	CLIENT: Billard Leece Partnership Pty Ltd	DATE: 14-Feb-19

Appendix C

DQOs and SAC

Appendix C - 1 Data Quality Objectives

The DSI has been devised broadly in accordance with the seven step data quality objective (DQO) process which is provided in Appendix B, Schedule B2 of the *National Environment Protection (Assessment of Site Contamination) Measure* 1999 as amended 2013 (NEPC, 2013). The DQO process is outlined as follows:

C1.1 State the Problem

Redevelopment/upgrading works are proposed for the primary school and preschool presently located at the site.

A Preliminary Site Assessment (PSI) of the Site completed in March 2018 identified the following areas of environmental concern (AEC) which require further investigation and/or remediation for the Site to be considered suitable for the proposed development:

- Total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbons (PAH) and lead impact variously identified in shallow fill soils at two locations (BH5 and BH6) in the north western portion of the site and one location (BH2) in the south eastern portion of the site. Concentrations of the contaminants of concern (COC) were detected at levels exceeding adopted site assessment criteria (SAC) which included human health investigation levels. Soils in the vicinity of these locations require remediation, management and/or risk assessment for the site to be considered suitable for ongoing use as a primary/preschool. Further investigation was also required to define the lateral and vertical extent of impacted soils;
- TRH and zinc impact to shallow soils at one location (BH9) in the central eastern portion of the site at levels exceeding ecological investigation levels required further investigation to determine whether the TRH and zinc concentrations are anomalous/isolated occurrences or indicative of widespread impact potentially requiring remediation; and
- Potential for ACM impact to shallow soils across the site. Whilst ACM was not identified in the PSI soil sampling, given the preliminary nature of the PSI; the historical demolition of structure; and importation of filling, the presence of asbestos impacted soils at the site could not be ruled out and required further investigation.

The “problem” to be addressed is the extent and nature of potential contamination at the site and whether the site is suitable for the proposed development.

The objective of the investigation is as follows:

- Assess the contamination status of the site and the suitability of the site, from a contamination standpoint, for the proposed redevelopment/upgrading works and continued use of the site as a primary school and preschool.

C1.2 Identify the Decision/Goal of the Study

The remediation extents determined by the DSI are based upon soil samples collected within the identified AEC and a comparison of the analytical results for identified contaminants of potential concern (COPC) with the adopted SAC. The adopted SAC are provided in Section C2 below.

Based on the findings of the PSI, the main COPC are expected to be total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAH), metals and asbestos.

The following specific decisions were considered as part of the PSI:

- Did field observation and analytical results identify potential contamination sources (AEC) which were not included in the CSM?
- Were COPC present in soil at concentrations that pose a potential risk to identified receptors?
- Is the data sufficient to make a decision regarding the abovementioned risks, the suitability of the site for the proposed development?
- Does contamination at the site, if encountered, trigger the Duty to Report requirements under the CLM Act 1997?
- Are there any off-site migration issues that need to be considered?

C1.3 Identify Information Inputs

Inputs into the decisions are as follows:

- Review of regional geology, topography and hydrogeology information;
- Review of site history information;
- Completion of a site inspection;
- Soil samples were collected in the immediate vicinity of identified potential sources of contamination (AEC) across the Site from a total of nine bore locations and one surface soil sample location;
- The lithology of the Site as described in the bore logs (Appendix D);
- Field and laboratory QA/QC data to assess the suitability of the environmental data for the DSI (Appendix G);
- All analysis was undertaken at a laboratory accredited by the National Association of Testing Authorities (NATA); and
- Laboratory reported concentrations of COPC were compared with the NEPC (2013) criteria as discussed in Section C2.

C1.4 Define the Study Boundaries

The site is located at 417 Abercrombie Street, Darlington NSW within the local government area of Council of the City of Sydney. The site covers an approximate total area of 0.72 hectares and is comprised of the following two lots:

- Lot 592 Deposited Plan 752049; and
- Lot 100 Deposited Plan 623500.

The site location and boundaries are shown on Drawing 1, Appendix A.

The investigation was undertaken to a maximum depth of 3.2 m below ground level (bgl) across the Site.

Field investigations were undertaken on 14 to 18 January 2018 by a DP Environmental Scientist.

C1.5 Develop the Analytical Approach (or Decision Rule)

The information obtained during the assessment was used to characterise the Site in terms of contamination issues and risk to human health and the environment. The decision rules used in characterising the site were as follows:

- The adopted SAC was the NSW Environment Protection Authority (EPA) endorsed criteria; and
- The contaminant concentrations in soil were compared to the adopted SAC to evaluate whether further investigation or remedial action was required.

Field and laboratory test results were considered useable for the assessment after evaluation against the following data quality indicators (DQIs):

- Precision – a measure of variability or reproducibility of data;
- Accuracy – a measure of closeness of the data to the 'true' value;
- Representativeness – the confidence (qualitative) of data representativeness of media present on site;
- Completeness – a measure of the amount of usable data from a data collection activity; and
- Comparability – the confidence (qualitative) that data may be considered to be equivalent for each sampling and analytical event.

The specific limits are outlined in the data QA/QC procedures and results (Appendix G).

C1.6 Specify the Performance or Acceptable Criteria

Decision errors for the respective COPC for fill and natural soils are:

1. Deciding that fill and natural soil at the Site exceeds the adopted SAC when they truly do not; and
2. Deciding that fill and natural soil at the Site is within the adopted SAC when they truly do not.

Decision errors for the PSI were minimised and measured by the following:

- The sampling regime targeted each stratum identified to account for site variability;
- Sample collection and handling techniques were in accordance with DP's *Field Procedures Manual*;
- Samples were prepared and analysed by a NATA-accredited laboratory with the acceptance limits for laboratory QA/QC parameters based on the laboratory reported acceptance limits and those stated in the NEPC (2013);

- The analyte selection is based on the available site history, past site activities and site features. The potential for contaminants other than those proposed to be analysed is considered to be low;
- The SAC were adopted from established and NSW EPA endorsed guidelines. The SAC have risk probabilities already incorporated; and

C1.7 Optimise the design for obtaining data

Sampling design and procedures that were implemented to optimise data collection for achieving the DQOs included the following;

- A NATA accredited laboratory using NATA endorsed methods were used to perform laboratory analysis;
- Additional soil samples were collected but kept 'on hold' pending details of initial analysis so that they could be analysed if further delineation was required; and
- Adequately experienced environmental scientists/engineers were chosen to conduct field work and sample analysis interpretation.

Appendix C – 2 - Site Assessment Criteria

The SAC applied in the current investigation are informed by the preliminary CSM which identified human and environmental receptors to potential contamination on the site (refer to Section 5). Analytical results are assessed (as a Tier 1 assessment) against the SAC comprising investigation and screening levels as per Schedule B1, *National Environment Protection (Assessment of Site Contamination) Measure* 1999, as amended 2013 (NEPC, 2013).

The investigation and screening levels applied in the current investigation comprise levels adopted for a recreational land use scenario with garden/accessible soil which includes preschools and primary schools.

C2.1 Health Investigation and Screening Levels

The generic Health Investigation Levels (HILs) and Health Screening Levels (HSLs) are considered to be appropriate for the assessment of human health risk associated with contamination at the site. The adopted soil HILs and HSLs for the COPC are presented in Table C2, with inputs into their derivation shown in Table C1.

As shown in Table C2 the adopted HSLs are based on a potential vapour intrusion pathway, as identified in the CSM. Although the CSM also identifies a direct contact pathway as well as construction worker receptors, the corresponding HSLs are significantly higher than those for the vapour intrusion pathway and are therefore not drivers for further assessment and/or remediation. As such the direct contact and intrusive maintenance worker HSLs have not been listed.

Table C1: Inputs to the Derivation of HSLs

Variable	Input	Rationale
Potential exposure pathway	Inhalation of vapours	Potential exposure pathways
Soil Type	Sand and sandy clay	Dominant soil type in surface soils (see Bore Logs – Appendix D)
Depth to contamination	0 m to <1 m	Potential contamination sources likely to impact surface soils

Table C2: HIL and HSL in mg/kg Unless Otherwise Indicated

Contaminants		HIL- A	HSL- A & B
Metals	Arsenic	100	-
	Cadmium	20	-
	Chromium (VI)	100	-
	Copper	6,000	-
	Lead	300	-
	Mercury (inorganic)	40	-
	Nickel	400	-
	Zinc	7,400	-
PAH	Benzo(a)pyrene TEQ[1]	3	-
	Total PAH	300	-
	Naphthalene	-	4
TRH	F1	-	40
	F2	-	230
	F3	-	-
	F4	-	-
BTEX	Benzene	-	0.6
	Toluene	-	390
	Ethylbenzene	-	NL[3]
	Xylenes	-	95

Notes:

1 Sum of carcinogenic PAH

2 Non dioxin-like PCBs only.

3 The soil saturation concentration (Csat) is defined as the soil concentration at which the porewater phase cannot dissolve any more of an individual chemical. The soil vapour that is in equilibrium with the porewater will be at its maximum. If the derived soil HSL exceeds Csat, a soil vapour source concentration for a petroleum mixture could not exceed a level that would results in the maximum allowable vapour risk for the given scenario. For these scenarios, no HSL is presented for these chemicals and the HSL is shown as 'not limiting' or 'NL'.

C2.2 Ecological Investigation Levels

Ecological Investigation Levels (EILs) and Added Contaminant Limits (ACLs), where appropriate, have been derived in NEPC (2013) for only a short list of contaminants comprising As, Cu, Cr (III), DDT, naphthalene, Ni, Pb and Zn. The adopted EILs, derived using the *Interactive (Excel) Calculation Spreadsheet* (Standing Council on Environment and Water (SCEW) website (http://www.scew.gov.au/node/941)) are shown in the following Table F4, with inputs into their derivation shown on Table F3.

Table C3: Inputs to the Derivation of EILs

Variable	Input	Rationale
Age of contaminants	"Aged" (>2 years)	Given the potential sources of soil contamination are from historic use, the contamination is considered as "aged" (>2 years);
pH	7.2	2 selected samples were tested for pH. The average pH value has been used as an initial screening.
CEC	18 cmolc/kg	2 selected samples were tested for CEC. The average CEC value has been used as an initial screening.
Clay content	10 %	Conservative value for initial screen
Traffic volumes	high	The Site is considered to be located within a high traffic area
State / Territory	New South Wales	-

Table C4: EIL in mg/kg

Analyte		EIL
Metals	Arsenic	100
	Copper	230
	Nickel	250
	Chromium III	410
	Lead	1,100
	Zinc	760
PAH	Naphthalene	170

C2.3 Ecological Screening Levels

Ecological Screening Levels (ESLs) are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene to terrestrial ecosystems. The adopted ESLs, based on a fine soil type are shown in the following Table C5.

Table C5: ESL in mg/kg

Analyte		ESL[1]	Comments
TRH	F1	180*	All ESLs are low reliability apart from those marked with * which are moderate reliability
	F2	120*	
	F3	300	
	F4	2,800	
BTEX	Benzene	50	
	Toluene	85	
	Ethylbenzene	70	
	Xylenes	105	
PAH	Benzo(a)pyrene	0.7	

C2.4 Management Limits

In addition to appropriate consideration and application of the HSLs and ESLs, there are additional considerations which reflect the nature and properties of petroleum hydrocarbons, including:

- Formation of observable light non-aqueous phase liquids (LNAPL);
- Fire and explosion hazards; and
- Effects on buried infrastructure e.g. penetration of, or damage to, in-ground services.

The adopted management limits, based on a fine soil type (Section 11.1), are shown in the following Table C6.

Table C6: Management Limits in mg/kg

Analyte		Management Limit
TRH	$C_6 - C_{10}$ (F1) #	800
	$>C_{10}-C_{16}$ (F2) #	1,000
	$>C_{16}-C_{34}$ (F3)	3,500
	$>C_{34}-C_{40}$ (F4)	10 000

Separate management limits for BTEX and naphthalene are not available hence these have not been subtracted from the relevant fractions to obtain F1 and F2

C2.5 Asbestos in Soil

NEPC (2013) defines the various asbestos types as follows:

Bonded ACM: Asbestos containing material which is in sound condition, bound in a matrix of cement or resin, and cannot pass a 7 mm x 7 mm sieve.

FA: Fibrous asbestos material including severely weathered cement sheet, insulation products and woven asbestos material. This material is typically unbonded or was previously bonded and is now significantly degraded and crumbling.

AF: Asbestos fines including free fibres, small fibre bundles and also small fragments of bonded ACM that pass through a 7 mm x 7 mm sieve.

Health Screening Levels (HSLs) for asbestos in soil, which are based on likely exposure levels for different scenarios, have been adopted in NEPC (2013) from the Western Australian Department of Health (WA DoH) publication Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia 2009 (WA DoH 2009).

On the basis of the proposed land use, and in accordance with Table 7, Schedule B1, NEPC (2013) the following asbestos HSLs have been adopted:

Table C6: Health Screening Levels for Asbestos Contamination in Soil (% w/w)

Form of Asbestos	HSL
Bonded ACM	0.01%
FA and AF	0.001 %
All Forms of Asbestos	No visible asbestos for surface soil

Appendix D

Bore Logs

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 38.1 mAHD
EASTING: 332579
NORTHING: 6248317
DIP/AZIMUTH: 90°/--

BORE No: A
PROJECT No: 92277.01
DATE: 14/1/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
38	0.02	ASPHALTIC CONCRETE										
	0.13	CONCRETE										
		FILLING - dark grey and brown medium to coarse grained silty sand with some clay and gravel							D			
	0.8	- sandstone boulder 150mm thick							D			
37	1								S			4,4,7 N = 11
		SILTY CLAY - stiff, grey mottled yellow-brown and red silty clay with some ironstone gravel and extremely low strength, extremely weathered shale bands, MC~PL										
36	2	2.0 SHALE - very low strength, highly weathered, grey, red and yellow brown iron indurated shale										
	2.5								S			12,22,25/30mm refusal
		SHALE - very low to low strength, highly weathered, fractured, red, grey and brown shale with iron indurated bands and extremely low strength, extremely weathered bands						2.83m: fg 40mm	C	89	0	PL(A) = 0.27
35	3							3.08m: fg 40mm 3.18m: J, sh, cu, sm, fe stn				
	3.5								C	81	0	
	3.67							3.23m: Cs 20mm				PL(A) = 0.23
34	4							3.27m: fg 40mm 3.33m: Cs 20mm 3.43m: B, sh, pl, vr, fe stn 3.47m: CORE LOSS: 30mm 3.55m: B, sh, pl, ir, fe stn	C	97	0	PL(A) = 0.19
33	5							3.63m: CORE LOSS: 40mm 3.71m: J, sh, pl, ro, fe stn 3.76m: fg 40mm 3.82m: J, sh, cu, ro, clay inf 3.86m: fg 40mm 4.16m: J, sv, un, ro, fe stn 130mm	C	83	0	PL(A) = 0.02
32	6											
31	7							4.45m: J, sv, un, ro, fe stn 4.58m: B, sh, pl, sm, fe stn 4.69m: J, 45°, cu, sm, clay co	C	100	13	PL(A) = 0.03 PL(A) = 0.17
	7.86							4.83m: J, 45°, cu, ro, clay co				
30	8							4.88m: J, sv, un, ro, fe stn 120mm 5m: CORE LOSS: 250mm 5.36m: fg 50mm	C	83	61	PL(A) = 0.14 PL(A) = 0.31
		- becoming medium strength, fresh, slightly fractured, dark grey interbedded siltstone and quartz-lithic sandstone below 8.3m						5.61m: J, sh, pl, sm, fe stn 5.79m: fg 40mm 5.92m: J, sv, cu, ro, fe stn 110mm 6.08m: J, sh, cu, ro, clay co 6.32m: J, sv, cu, ro, fe stn 120mm 6.6m: B, sh, pl, sm, fe stn	C	100	100	PL(A) = 0.39 PL(A) = 0.27
29	9											
28	10											
	10.44	Bore discontinued at 10.44m - limit of investigation						6.69m: B, sh, pl, sm, fe stn 6.82m: B, sh, pl, sm, fe stn 6.84m: J, sv, cu, ro, fe stn 80mm 6.95m: Cs 50mm 7.03m: J, 45°, cu, ro, fe stn				
27	11											

RIG: Bobcat **DRILLER:** Groundtest **LOGGED:** JHB **CASING:** HW to 2.5m

TYPE OF BORING: 150mm diameter SFA to 2.5m, then NMLC coring to 10.44m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 38.1 mAHD
EASTING: 332579
NORTHING: 6248317
DIP/AZIMUTH: 90°/--

BORE No: A
PROJECT No: 92277.01
DATE: 14/1/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW, HW, MW, SW, FS, FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
26								7.13m: fg 90mm 7.26m: J, sv, cu, ro, fe stn 100mm 7.62m: CORE LOSS: 240mm 7.86m: fg 70mm 8.12m: J, sh, pl, ro, fe stn 8.2m: fg 30mm 8.31m: fg 40mm 8.5m: fg 40mm 8.57m: J, 45°, cu, sm, clay 8.74m: J, sv, cu, ro, cln 230mm 9.34m: J, 45°, cu, sm, cln 9.75m: J, sv, pl, sm, cln 50mm 9.85m: J, 45°, cu, sm, cln				
25	13											
24	14											
23	15											
22	16											
21	17											
20	18											
19	19											
18	20											
17	21											
16	22											
15	23											

RIG: Bobcat **DRILLER:** Groundtest **LOGGED:** JHB **CASING:** HW to 2.5m

TYPE OF BORING: 150mm diameter SFA to 2.5m, then NMLC coring to 10.44m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 36.0 mAHD
EASTING: 332571
NORTHING: 6248290
DIP/AZIMUTH: 90°/--

BORE No: B
PROJECT No: 92277.01
DATE: 15/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
36	0.1	ASPHALT										
		FILLING - brown silty clay with a trace of sand, MC<PL							D			
	0.7	SILTY CLAY - very stiff, grey mottled yellow brown and red silty clay with some ironstone gravel and extremely low strength, extremely weathered shale bands, MC~PL							D			
35	1								S			4,7,8 N = 15
34	2								D			
	2.6											
	2.75	SHALE - very low to low strength, highly weathered, fractured, grey, red and brown shale with iron indurated bands and extremely low strength, extremely weathered bands						2.6m: CORE LOSS: 150mm	S			11,16,25/100mm refusal
33	3							3m: fg 150mm 3.39m: B, sh, pl, ro, fe stn	C	86		PL(A) = 0.24
	3.65							3.62m: CORE LOSS: 30mm 3.65m: fg 50mm				
32	4							4.19m: B, sh, pl, ro, fe stn 4.49m: J, 45°, cu, ro, fe stn	C	97		PL(A) = 0.07
	4.92							4.56m: fg 50mm 4.73m: CORE LOSS: 190mm 4.92m: fg 100mm				
31	5							5.35m: J, 45°, cu, ro, fe stn	C	85	9	PL(A) = 0.13
30	6							5.61m: J, 45°, cu, ro, fe stn	C	100	62	PL(A) = 0.11
								5.68m: J, 45°, cu, ro, fe stn 5.88m: fg 120mm	C	33	0	
	6.63							6.24m: CORE LOSS: 390mm 6.85m: J, sv, cu, ro, cln 200mm				
29	7							7.18m: fg 50mm 7.28m: J, 60°, cu, ro, fe stn 130mm	C	100	11	
	7.78							7.4m: J, 60°, cu, ro, fe stn 130mm 7.51m: CORE LOSS: 270mm				
28	8							7.78m: J, sv, un, vr, fe stn 440mm 8.31m: J, sv, ir, ro, cln 110mm	C	92	27	PL(A) = 0.2
27	9	- becoming medium strength, fresh, unbroken, dark grey interbedded siltstone and quartz-lithic sandstone below 8.93m						8.51m: J, sv, ir, ro, cln 410mm				PL(A) = 0.51
26	10								C	100	100	PL(A) = 1.04
	10.44	Bore discontinued at 10.44m - limit of investigation										
25	11											

RIG: Bobcat **DRILLER:** Groundtest **LOGGED:** JHB **CASING:** HW to 2.5m

TYPE OF BORING: 150mm diameter SFA to 2.5m, wash boring to 2.6m, then NMLC coring to 10.44m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 34.6 mAHD
EASTING: 332592
NORTHING: 6248292
DIP/AZIMUTH: 90°/--

BORE No: C
PROJECT No: 92277.01
DATE: 16/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
34	0.2	TOPSOIL - dark brown clayey silt with some rootlets, moist										
		FILLING - dark brown silty clay with a trace of sand, MC<PL							D			
	0.8	SILTY CLAY - very stiff, red brown silty clay with a trace of ironstone gravel, MC~PL							D			
33	1	- becoming grey mottled red and brown below 1.1m							S			4,5,6 N = 11
	2	- with extremely low strength, extremely weathered shale bands below 2.2m										
32	2.7	SHALE - extremely low strength, extremely weathered, grey and red shale with very low strength, highly weathered iron indurated bands							S			3,6,10 N = 16
31	3											
	4								S			9,19,25/140mm refusal
30	4.5	SHALE - extremely low strength, extremely weathered, grey and red shale with very low strength, highly weathered iron indurated bands							C	100	0	PL(A) = 0.08
29	5							5.48m: B, sh, pl, ro, clay co 5.58m: Cs 20mm 5.6m: CORE LOSS: 50mm 5.81m: fg 80mm	C	96	18	PL(A) = 0.06
28	5.65											
	6											PL(A) = 0.05
27	7							7.03m: CORE LOSS: 190mm 7.22m: J, 60°, cu, ro, fe stn 130m 7.37m: J, 60°, cu, sm, fe stn 120mm 7.79m: J, 45°, cu, ro, fe stn	C	84	48	PL(A) = 0.21
	7.22											
26	8	- becoming fresh, unbroken, dark grey interbedded siltstone and quartz-lithic sandstone below 8.31m							C	100	89	PL(A) = 0.54
25	9							8.55m: J, 60°, cu, cm, cln 8.7m: J, 80°, cu, sm, cln 140mm 8.79m: J, 60°, pl, sm, cln 100mm 8.88m: J, 60°, pl, sm, cln 100mm 9m: J, sv, pl, sm, cln 80mm 9.45m: J, 45°, pl, sm, cln 9.81m: J, 60°, pl, sm, cln 110mm	C	100	78	PL(A) = 0.94
24	10											
	10.03	Bore discontinued at 10.03m - limit of investigation										
23	11											

RIG: Bobcat **DRILLER:** Groundtest **LOGGED:** JHB **CASING:** HW to 2.5m

TYPE OF BORING: 110mm diameter SFA to 2.5m, wash boring to 4.5m, then NMLC coring to 10.03m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 33.0 mAHD
EASTING: 332574
NORTHING: 6248260
DIP/AZIMUTH: 90°/--

BORE No: D
PROJECT No: 92277.01
DATE: 17/1/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
33	0.2	CONCRETE										
	0.6	FILLING - red brown silty clay with a trace of sand, MC~PL							D			
32	1.1	FILLING - yellow and light brown medium grained clayey sand, dry							D			
		FILLING - brown, red, grey and yellow silty clay with some sand and gravel, MC<PL - becoming dark brown below 1.7m							S			7,10,10 N = 20
31	2.4								D			
	2.8	SILTY CLAY - very stiff, grey mottled red and brown silty clay with a trace of ironstone gravel							S			3,6,10 N = 16
30		SHALE - extremely low strength, extremely weathered, grey and red shale with very low strength, highly weathered iron indurated bands										
29									S			7,11,21 N = 32
28	5.17	SHALE - extremely low strength, extremely weathered, fractured, grey and red shale with very low strength, highly weathered iron indurated bands							C	100	0	PL(A) = 0.44
27	6.25							5.74m: J, 45°, cu, ro, fe stn 5.88m: J, sh, cu, ro, fe stn 5.9m: J, sh, cu, ro, fe stn 6.05m: CORE LOSS: 200mm	C	77	0	PL(A) = 0.08
26								6.367m: B, sh, pl, ro, fe stn 6.42m: B, sh, pl, ro, fe stn 6.49m: B, sh, pl, ro, fe stn 6.73m: B, sh, pl, ro, fe stn	C	100	14	PL(A) = 0.12
25	8.27							6.87m: J, sv, ir, vr, fe stn 130mm 7.51m: fg 60mm 7.8m: J, sh, pl, ro, fe stn 7.87m: J, 45°, cu, ro, fe stn 8.08m: fg 100mm 8.19m: J, 45°, cu, ro, fe stn	C	100	55	PL(A) = 0.14 PL(A) = 0.11
24	9.55	Bore discontinued at 9.55m - limit of investigation						8.23m: CORE LOSS: 40mm 8.27m: fg 90mm 8.43m: J, sv, ir, ro, fe stn 140mm 8.67m: J, sh, cu, vr, fe stn 9.11m: J, sh, cu, sm, fe stn 9.12m: J, sh, cu, sm, fe stn 9.13m: J, sh, cu, sm, fe stn 9.14m: J, sh, cu, sm, fe				PL(A) = 0.09
23	10											
22	11											

RIG: Bobcat **DRILLER:** Groundtest **LOGGED:** JHB **CASING:** HW to 2.5m; HQ to 5.17m

TYPE OF BORING: Concrete coring to 0.2m, 110mm diameter SFA to 2.5m, wash boring to 5.17m, then NMLC coring to 9.55m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 33.0 mAHD
EASTING: 332574
NORTHING: 6248260
DIP/AZIMUTH: 90°/--

BORE No: D
PROJECT No: 92277.01
DATE: 17/1/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
21								stn 9.16m: J, sv, ir, ro, cln 60mm 9.29m: B, sh, pl, ro, fe stn 9.43m: B, sh, pl, ro, fe stn				
20	13											
19	14											
18	15											
17	16											
16	17											
15	18											
14	19											
13	20											
12	21											
11	22											
10	23											

RIG: Bobcat **DRILLER:** Groundtest **LOGGED:** JHB **CASING:** HW to 2.5m; HQ to 5.17m

TYPE OF BORING: Concrete coring to 0.2m, 110mm diameter SFA to 2.5m, wash boring to 5.17m, then NMLC coring to 9.55m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 34.1 mAHD
EASTING: 332550
NORTHING: 6248228
DIP/AZIMUTH: 90°/--

BORE No: E
PROJECT No: 92277.01
DATE: 18/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
34	0.17	CONCRETE										
		FILLING - brown, red and grey silty clay with a trace of ironstone gravel, MC~PL							D			
									D			
33	1								S			4,5,7 N = 12
	1.3	SILTY CLAY - very stiff, grey mottled red and brown silty clay with a trace of ironstone gravel, MC~PL										
32	2								D			
		- with extremely low strength, extremely weathered iron indurated shale bands below 2.7m							S			5,8,13 N = 21
31	3											
	3.5	SHALE - extremely low strength, extremely weathered, grey and red shale with very low strength, highly weathered iron indurated bands										
30	4								S			23,25/50mm,- refusal
	4.0	SHALE - extremely low strength, extremely weathered, grey and red shale with very low strength, highly weathered iron indurated bands						4.16m: J, sv, ir, vr, clay inf 40mm 4.6m: J, sh, pl, ro, clay inf 4.77m: Cs 20mm 4.86m: J, 80°, ir, ro, clay inf 100mm	C	100	0	PL(A) = 0.51 PL(A) = 0.06 PL(A) = 0.02
29	5							5.13m: J, sh, cu, ro, fe stn 5.27m: J, sh, cu, ro, fe stn 5.39m: J, sh, cu, ro, fe stn 5.43m: CORE LOSS: 520mm	C	64	0	PL(A) = 0.56
28	5.95							6.15m: Cs 20mm 6.27m: fg 60mm 6.34m: J, 60°, cu, ro, fe stn 110mm 6.57m: J, sh, cu, ro, fe stn 6.63m: J, 45°, cu, ro, fe stn 6.69m: J, sv, ir, vr, fe stn 140mm	C	73	0	PL(A) = 0.08
27	6							6.83m: CORE LOSS: 420mm 7.25m: fg 100mm 7.55m: J, 45°, cu, ro, fe stn 7.85m: J, sv, ir, vr, fe stn 20mm 8.08m: J, 45°, cu, sm, fe stn	C	92	63	PL(A) = 0.13 PL(A) = 0.48
26	7							8.09m: J, sv, ir, ro, fe stn 100mm 8.26m: fg 50mm 8.33m: CORE LOSS: 90mm 8.41m: fg 70mm 8.57m: fg 230mm 8.89m: B, sh, pl, ro, cln 9.02m: fg 30mm 9.22m: B, h, pl, sm, cln 9.25m: B, h, pl, sm, cln 9.54m: J, 45°, cu, sm, cln				
	7.25											
25	8											
	8.42											
24	9	- becoming medium strength, slightly weathered, slightly fractured interbedded siltstone and quartz lithic sandstone below 9.04m										
	9.8	- becoming fresh below 9.31m Bore discontinued at 9.8m - limit of investigation										
23	10											
	11											

RIG: Bobcat **DRILLER:** Groundtest **LOGGED:** JHB **CASING:** HW to 2.5m; HQ to 4.0m

TYPE OF BORING: Concrete coring to 0.17m, 110mm diameter SFA to 2.5m, wash boring to 4.0m, then NMLC coring to 9.8m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 34.9 mAHD
EASTING: 332545
NORTHING: 6248280
DIP/AZIMUTH: 90°/--

BORE No: F
PROJECT No: 92277.01
DATE: 17/1/2019
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
34	0.07	ASPHALTIC CONCRETE										
	0.2	FILLING - brown clayey sand with some silt and gravel, moist							D			
		FILLING - brown silty clay with some gravel and sand, MC<PL							D			
33	1	- becoming dark brown with a trace of ceramic and ash below 0.8m							S			3,6,6 N = 12
	1.9	SILTY CLAY - hard, grey mottled red and light brown silty clay with extremely low strength, extremely weathered iron indurated shale bands and a trace of gravel, MC~PL							D			
32	2.7	SHALE - extremely low strength, extremely weathered, grey and red shale with very low strength, highly weathered iron indurated bands							S			9,13,22 N = 35
31	3.74								C	100	0	PL(A) = 0.05
30	5.06							4.63m: J, sv, cu, vr, fe stn 40mm 4.86m: J, sv, cu, vr, fe stn 40mm 4.9m: CORE LOSS: 160mm 5.06m: J, sv, un, vr, fe stn 210mm	C	84	0	PL(A) = 0.17 PL(A) = 0.05
29	6.12							5.85m: fg zone 50mm 5.92m: CORE LOSS: 200mm 6.12m: fg zone 170mm	C	91	43	PL(A) = 0.54
28								6.42m: J, sh, cu, sm, fe stn 6.47m: J, 45°, cu, sm, fe stn 6.51m: J, sh, cu, sm, fe stn				PL(A) = 0.32
27								6.54m: J, sh, cu, sm, fe stn 6.59m: J, sh, cu, sm, fe stn 6.81m: J, sh, cu, sm, fe stn 6.88m: J, sh, cu, sm, fe stn	C	84	59	
26	8.29	- becoming medium strength, fresh, unbroken, dark grey interbedded siltstone and quartz lithic sandstone below 8.45m						6.97m: J, sh, cu, sm, fe stn 7.03m: J, sh, cu, sm, fe stn				PL(A) = 0.69
25								7.17m: J, sh, cu, sm, fe stn 7.32m: J, sh, cu, sm, fe stn	C	100	100	PL(A) = 0.54
24	10.23	Bore discontinued at 10.23m - limit of investigation						7.4m: J, sh, cu, sm, fe stn 7.46m: J, sh, cu, sm, fe stn 7.67m: J, sh, cu, sm, fe stn 7.81m: J, 45°, cu, sm, fe stn 7.84m: fg 50mm 7.97m: J, 45°, cu, sm, fe stn				
23												

RIG: Bobcat **DRILLER:** Groundtest **LOGGED:** JHB **CASING:** HW to 2.5m

TYPE OF BORING: 110mm diameter SFA to 2.5m, wash boring to 3.74m, then NMLC coring to 10.23m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▽	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 34.9 mAHD
EASTING: 332545
NORTHING: 6248280
DIP/AZIMUTH: 90°/--

BORE No: F
PROJECT No: 92277.01
DATE: 17/1/2019
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW, HW, MW, SW, FS, FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
22	13							8.04m: CORE LOSS: 250mm 8.29m: fg 160mm 8.47m: J, sv, pl, sm, cln 130mm 8.68m: J, 45°, cu, sm, cln				
21	14											
20	15											
19	16											
18	17											
17	18											
16	19											
15	20											
14	21											
13	22											
12	23											
11												

RIG: Bobcat **DRILLER:** Groundtest **LOGGED:** JHB **CASING:** HW to 2.5m

TYPE OF BORING: 110mm diameter SFA to 2.5m, wash boring to 3.74m, then NMLC coring to 10.23m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. MC = moisture content; PL = plastic limit

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 34.1 mAHD
EASTING: 332586
NORTHING: 6248268
DIP/AZIMUTH: 90°/--

BORE No: 2
PROJECT No: 92277.01
DATE: 16/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
34	0.15	CONCRETE		D	0.03				
	0.3	FILLING - brown sandy clayey silt with some gravel							
		Bore discontinued at 0.3m - refusal on sandstone cobble							
33	1								1
32	2								2
31	3								3

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A
TYPE OF BORING: Concrete coring to 0.15m, then hand auger to 0.3m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 34.3 mAHD
EASTING: 332545
NORTHING: 6248275
DIP/AZIMUTH: 90°/--

BORE No: 5
PROJECT No: 92277.01
DATE: 16/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
34	0.1	ASPHALTIC CONCRETE							
	0.2	CONCRETE							
	0.3	FILLING - gravel with some coalwash							
		FILLING - brown silty clay with gravel, MC<PL							
	0.5	Bore discontinued at 0.5m - refusal on cobble		D	0.5				
	1								1
33									
	2								2
32									
	3								3
31									

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A

TYPE OF BORING: Concrete coring to 0.2m, then hand auger to 0.5m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 40.5 mAHD
EASTING: 332538
NORTHING: 6248304
DIP/AZIMUTH: 90°/--

BORE No: 6
PROJECT No: 92277.01
DATE: 16/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
40	0.02	RECYCLED RUBBER							
		CONCRETE							
	0.2	FILLING - dark brown sandy silt and gravel with glass, flecks of dark charcoal and dark slag-like gravel, MC<PL							
	0.5	FILLING - red brown sandy silt with a trace of gravel and dark slag		D	0.5				
	1								1
	1.2	Bore discontinued at 1.2m - limit of investigation		D	1.2				
39	2								2
38	3								3
37									

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A

TYPE OF BORING: Concrete coring to 0.2m, then hand auger to 1.2m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 37.5 mAHD
EASTING: 332561
NORTHING: 6248325
DIP/AZIMUTH: 90°/--

BORE No: 7
PROJECT No: 92277.01
DATE: 15/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.02	RUBBER SHEETING							
		FILLING - brown sandy silty clay with gravel and crushed concrete gravel, moist							
	0.5	FILLING - dark brown silty clay with some sand, MC<PL		D	0.5				
	0.7	SILTY CLAY - brown, grey and red silty clay with some iron induration and a trace of ironstone gravel							
	1								1
	1.2	- becoming red mottled grey below 1.2m Bore discontinued at 1.2m - limit of investigation		D*	1.2				
36									
	2								2
35									
	3								3
34									

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A

TYPE OF BORING: Hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56. * Replicate sample BD1/1501019 collected

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 43.1 mAHD
EASTING: 332596
NORTHING: 6248284
DIP/AZIMUTH: 90°/--

BORE No: 9
PROJECT No: 92277.01
DATE: 16/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
43	0.05	TOPSOIL (FILLING) - organic silty sand topsoil with some rootlets, moist							
	0.1	FILLING - black (potentially a trace of ash) below 0.1m							
		FILLING - brown and grey sandy silt with some ply wood and a trace of sandstone							
	0.5	- with some gravel and a trace of crushed concrete gravel below 0.5m							
		SILTY CLAY - grey mottled red silty clay with some ironstone gravel, MC<PL							
42	1								1
	1.2	Bore discontinued at 1.2m - limit of investigation							
41	2								2
40	3								3

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A

TYPE OF BORING: Hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 38.9 mAHD
EASTING: 332551
NORTHING: 6248324
DIP/AZIMUTH: 90°/--

BORE No: 10
PROJECT No: 92277.01
DATE: 16/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	ASPHALTIC CONCRETE							
		FILLING - brown clayey silt with a trace of sandstone and dark slag gravel, MC<PL							
	0.3	Bore discontinued at 0.3m - limit of investigation		D	0.3				
38	1								
37	2								
36	3								
35									

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A

TYPE OF BORING: Concrete coring to 0.05m, then hand auger to 0.3m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 37.1 mAHD
EASTING: 332573
NORTHING: 6248321
DIP/AZIMUTH: 90°/--

BORE No: 11
PROJECT No: 92277.01
DATE: 15/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
37	0.16	CONCRETE							
	0.3	FILLING - gravel with some sand, moist							
		Bore discontinued at 0.3m - limit of investigation							
36	1								1
35	2								2
34	3								3

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A

TYPE OF BORING: Concrete coring to 0.16m, then hand auger to 0.3m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 38.7 mAHD
EASTING: 332527
NORTHING: 6248295
DIP/AZIMUTH: 90°/--

BORE No: 12
PROJECT No: 92277.01
DATE: 15/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.04	ASPHALTIC CONCRETE							
		FILLING - brown and grey sandy silt with some gravel, dry							
	0.3	Bore discontinued at 0.3m - limit of investigation		D	0.3				
38	1								1
37	2								2
36	3								3
35									

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A

TYPE OF BORING: Concrete coring to 0.04m, then hand auger to 0.3m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 40.3 mAHD
EASTING: 332562
NORTHING: 6248297
DIP/AZIMUTH: 90°/--

BORE No: 13
PROJECT No: 92277.01
DATE: 15/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
40	0.1	ASPHALTIC CONCRETE							
	0.2	CONCRETE							
	0.3	FILLING - brown fine grained sand with some dark slag-like gravel, MC<PL		D	0.3				
		Bore discontinued at 0.3m - limit of investigation							
	1								1
39									
	2								2
38									
	3								3
37									

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A
TYPE OF BORING: Concrete coring to 0.2m, then hand auger to 0.4m
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 39.3 mAHD
EASTING: 332570
NORTHING: 6248298
DIP/AZIMUTH: 90°/--

BORE No: 14
PROJECT No: 92277.01
DATE: 15/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
39	0.1	ASPHALTIC CONCRETE							
		CONCRETE - loosely placed concrete filling							
	0.3			D	0.3				
	0.4	FILLING - brown coarse grained gravelly sand, sandstone and basaltic gravel, moist							
		Bore discontinued at 0.4m - limit of investigation							
	1								1
38									
	2								2
37									
	3								3
36									

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A

TYPE OF BORING: Concrete coring to 0.3m, then hand auger to 0.4m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 44.1 mAHD
EASTING: 332602
NORTHING: 6248294
DIP/AZIMUTH: 90°/--

BORE No: 15
PROJECT No: 92277.01
DATE: 16/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
44	0.02	TOPSOIL - dark brown silty sand with some rootlets							
		FILLING - dark brown silty sand with some sandstone, rootlets, plastic and a trace of ironstone gravel							
	0.3	Bore discontinued at 0.3m - limit of investigation		D	0.3				
43	1								1
42	2								2
41	3								3

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A
TYPE OF BORING: Hand auger
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 39.9 mAHD
EASTING: 332544
NORTHING: 6248272
DIP/AZIMUTH: 90°/--

BORE No: 16
PROJECT No: 92277.01
DATE: 15/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	ASPHALTIC CONCRETE							
	0.1	CONCRETE							
		CONCRETE							
	0.3	FILLING - dark brown silty clay with a trace of sand, MC~PL		D	0.4				
	0.4	Bore discontinued at 0.4m - limit of investigation							
39	1								1
38	2								2
37	3								3
36									

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A

TYPE OF BORING: Concrete coring to 0.3m, then hand auger to 0.4m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 36.0 mAHD
EASTING: 332558
NORTHING: 6248295
DIP/AZIMUTH: 90°/--

BORE No: 17
PROJECT No: 92277.01
DATE: 15/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
36	0.03	RECYCLED RUBBER							
	0.1	FILLING - dark brown sandy clayey silt with some gravel and roots							
	0.3	FILLING - brown fine grained sand with gravel and dark slag		D	0.3				
		Bore discontinued at 0.3m - limit of investigation							
35	1								1
34	2								2
33	3								3

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A

TYPE OF BORING: Hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 34.8 mAHD
EASTING: 332597
NORTHING: 6248282
DIP/AZIMUTH: 90°/--

BORE No: 18
PROJECT No: 92277.01
DATE: 16/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.02	FILLING - dark brown silty sand with some rootlets (topsoil)							
		FILLING - brown silty sand with some gravel and a trace of anthropogenics comprising crushed bricks, gravel, dark grey slag gravel and some clinker							
	0.3	Bore discontinued at 0.3m - limit of investigation		D	0.3				
34	1								1
33	2								2
32	3								3
31									

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A

TYPE OF BORING: Hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 36.4 mAHD
EASTING: 332585
NORTHING: 6248274
DIP/AZIMUTH: 90°/--

BORE No: 22
PROJECT No: 92277.01
DATE: 16/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.02	FILLING - brown sandy silt with some rootlets (topsoil)							
		FILLING - brown sandy silt with a trace of gravel and sand							
	0.3	Bore discontinued at 0.3m - limit of investigation		D	0.3				
36									
	1								1
35									
	2								2
34									
	3								3
33									

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A

TYPE OF BORING: Hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 38.4 mAHD
EASTING: 332616
NORTHING: 6248265
DIP/AZIMUTH: 90°/--

BORE No: 23
PROJECT No: 92277.01
DATE: 15/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		CONCRETE							
	0.2								
		FILLING - brown, red and grey silty clay with a trace of sand							
	0.3								
38		SILTY CLAY - light grey silty clay, MC~PL		D	0.4				
	0.4	Bore discontinued at 0.4m - limit of investigation							
	1								1
37									
	2								2
36									
	3								3
35									

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A

TYPE OF BORING: Concrete coring to 0.2m, then hand auger to 0.4m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 34.1 mAHD
EASTING: 332551
NORTHING: 6248287
DIP/AZIMUTH: 90°/--

BORE No: 24
PROJECT No: 92277.01
DATE: 15/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
34	0.07	ASPHALTIC CONCRETE							
		FILLING - gravel							
	0.2	FILLING - gravelly sand with some basaltic gravel							
	0.3	Bore discontinued at 0.3m - limit of investigation		D	0.3				
	1								1
33									
	2								2
32									
	3								3
31									

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A

TYPE OF BORING: Concrete coring to 0.2m, then hand auger to 0.3m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 33.0 mAHD
EASTING: 332581
NORTHING: 6248251
DIP/AZIMUTH: 90°/--

BORE No: 25
PROJECT No: 92277.01
DATE: 15/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
33		CONCRETE							
	0.2	FILLING - dark brown clayey silt with a trace of sand, dark slag and ironstone, MC~PL							
	0.4	Bore discontinued at 0.4m - limit of investigation		D	0.4				
32	1								1
31	2								2
30	3								3

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A

TYPE OF BORING: Concrete coring to 0.2m, then hand auger to 0.4m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 31.6 mAHD
EASTING: 332591
NORTHING: 6248260
DIP/AZIMUTH: 90°/--

BORE No: 26
PROJECT No: 92277.01
DATE: 15/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
31	0.2	CONCRETE							
	0.4	FILLING - brown clayey sand with some gravel and crushed brick gravel and a trace of ironstone							
	1	Bore discontinued at 0.4m - refusal on heavily compacted filling							
30	2								
29	3								
28									

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A

TYPE OF BORING: Concrete coring to 0.2m, then hand auger to 0.4m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Gardner Wetherill & Associates
PROJECT: Proposed Upgrade Works
LOCATION: Darlington Public School, Cnr Golden Grove and Abercrombie Streets. Darlington, NSW

SURFACE LEVEL: 34.7 mAHD
EASTING: 332543
NORTHING: 6248286
DIP/AZIMUTH: 90°/--

BORE No: 27
PROJECT No: 92277.01
DATE: 15/1/2019
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.07	ASPHALTIC CONCRETE							
		FILLING - gravel							
	0.2	FILLING - gravelly sand with some basaltic gravel							
	0.3	Bore discontinued at 0.3m - limit of investigation		D	0.3				
34	1								1
33	2								2
32	3								3
31									

RIG: Hand auger **DRILLER:** LAR **LOGGED:** LAR **CASING:** N/A

TYPE OF BORING: Concrete coring to 0.07m, then hand auger to 0.3m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Location coordinates are in MGA94 Zone 56.

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

Appendix E

Summary Table E1

Table E1 - Summary of Soil Sampling and Chemical Analysis Results (Results in mg/kg - unless specified)

Sample Location	Sample Depth (m)	Sampling Date	Heavy Metals								PAH					TRH				BTEX				OCPs, OPPs & PCBs								
			Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	B(a)P TEQ	B(a)P	Total PAH	Naphthalene	Phenols	C6-C10 less BTEX [F1]	>C10-C16 (less Naphthalene) [F2]	>C16-C34	>C34-C40	Benzene	Toluene	Ethylbenzene	Total Xylenes	Aldrin + dieldrin	Chlordane	DDT + DDE + DDD	Endosulfan	Endrin	Heptachlor	HCB	Methoxychlor	Asbestos
Practical Quantitation Limit (PQL)			4	0.4	1	1	1	0.1	1	1	0.5	0.05	0.1	1	5	25	50	100	100	0.2	0.5	1	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Assessment Criteria																																
NEPC (2013) HIL A / HSL A & B [2]			**100**	**20**	**100**	**6000**	**300**	**40**	**400**	**7400**	**3**	**ND**	**300**	**4 #**	**3000**	**40 #**	**230 #**	**ND**	**ND**	**0.6 #**	**390 #**	**NL**	**95 #**	**6**	**50**	**240**	**270**	**10**	**6**	**10**	**300**	**ND**
NEPC (2013) EIL / ESL [2]			**100**	**ND**	**410 ###**	**230 ###**	**1100**	**ND**	**250 ###**	**760 ###**	**ND**	**0.7 ##**	**ND**	**170**	**ND**	**180 ##**	**120 ##**	**300 ##**	**2800 ##**	**50 ##**	**85 ##**	**70 ##**	**105 ##**	**ND**	**ND**	**180***	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
NEPC (2013) Management Limits			**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**800**	**1000**	**3500**	**10000**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
Analytical Results of Boring and Surface Samples - PSI (April 2018)																																
BH1	0.2	17/03/2018	<4	4	10	28	46	<0.1	7	100	<0.5	0.08	0.79	<0.1	<5	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NAD
BH2	0.5	17/03/2018	5	<0.4	16	18	96	0.2	4	210	**33**	**22**	250	1.4	<5	<25	<50	**1200**	330	<0.2	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NAD
BH3	0.2	17/03/2018	6	<0.4	18	15	170	0.1	9	82	<0.5	0.3	3.1	<0.1	<5	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NAD
BH4	0.2	17/03/2018	7	<0.4	17	10	24	<0.1	14	24	<0.5	0.1	0.85	<0.1	<5	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NAD
BH5	0.2	17/03/2018	4	<0.4	9	48	120	0.3	4	69	**57**	**37**	**550**	3.5	<5	<25	**150**	**2400**	360	<0.2	<0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	NAD
BH6	0.2	17/03/2018	10	1	54	120	**650**	0.6	42	560	**7.8**	**5.1**	66	0.3	<5	<25	<50	**360**	130	<0.2	<0.5	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NAD
BH7	0.2	17/03/2018	10	<0.4	22	37	91	0.1	6	63	2.4	**1.6**	21	0.1	<5	<25	<50	<100	<100	<0.2	<0.5	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NAD
BH8	0.2	17/03/2018	5	<0.4	11	29	59	<0.1	11	73	0.7	0.5	5.2	<0.1	<5	<25	<50	100	100	<0.2	<0.5	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NAD
BH9	0.2	17/03/2018	8	<0.4	17	21	76	<0.1	6	**2100**	<0.5	0.06	0.85	<0.1	<5	<25	<50	**1100**	620	<0.2	<0.5	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NAD
Powerpole	0.0 - 0.2	17/03/2018	-	-	-	-	-	-	-	-	<0.5	0.2	1.5	<0.1	-	<25	62	180	150	<0.2	<0.5	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-
Analytical Results of Boring Samples - DSI (January 2019)																																
BH10	0.3	16/01/2019	4	<0.4	16	12	120	0.2	6	67	<0.5	0.3	3	<0.1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	**Chry**
BH11	0.3	15/01/2019	<4	0.4	17	15	26	<0.1	10	54	<0.5	<0.05	<0.05	<0.1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH12	0.3	15/01/2019	<4	0.4	24	28	190	0.1	13	96	1	**0.71**	7.1	<0.1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH13	0.3	15/01/2019	<4	<0.4	8	15	32	<0.1	5	34	**9.1**	**6.3**	71	2.5	-	<25	<50	**360**	130	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH14	0.3	15/01/2019	<4	4	15	39	51	0.2	10	110	<0.5	0.2	1.3	<0.1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH15	0.3	16/01/2019	41	<0.4	15	49	74	0.1	6	500	1.6	**1.2**	16	<0.1	-	<25	<50	**700**	390	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH16	0.3	15/01/2019	5	<0.4	16	38	150	0.6	10	140	**11**	**7.9**	90	0.8	-	<25	<50	**420**	120	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH17	0.3	15/01/2019	5	0.5	21	52	160	1	51	180	**9.3**	**6.6**	78	0.4	-	<25	<50	**330**	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH18	0.3	16/01/2019	5	0.4	14	59	**940**	0.2	10	470	**42**	**30**	**390**	0.7	-	<25	<50	**1600**	440	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH22	0.3	16/01/2019	<4	<0.4	10	11	57	<0.1	5	44	<0.5	0.1	1.4	<0.1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH23	0.3	15/01/2019	4	<0.4	13	11	41	<0.1	11	39	<0.5	0.2	1.6	<0.1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH25	0.3	15/01/2019	5	<0.4	16	18	51	0.1	17	80	<0.5	0.3	2.4	<0.1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH26	0.3	15/01/2019	5	<0.4	18	29	100	0.1	7	180	**3.6**	**2.6**	31	0.2	-	<25	<50	120	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH27	0.3	15/01/2019	<4	0.9	13	44	49	<0.1	9	90	<0.5	0.1	0.89	<0.1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH2	0.3	15/01/2019	5	0.9	20	30	100	0.4	12	520	0.7	0.5	4.6	<0.1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH5	0.5	15/01/2019	<4	0.7	14	56	220	0.4	6	330	**220**	**160**	**1800**	**6**	-	<25	**320**	**7800**	1500	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH6	0.5	16/01/2019	7	0.5	21	83	88	0.2	24	91	**4.6**	**3.2**	40	0.2	-	<25	<50	150	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH6	1.2	16/01/2019	<4	<0.4	17	8	18	<0.1	2	16	<0.5	0.09	0.5	<0.1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH7	0.5	15/01/2019	7	0.6	21	76	**540**	0.3	6	260	**3.3**	**2.3**	21	0.1	-	<25	<50	<100	180	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH7	1.2	15/01/2019	<4	<0.4	8	4	22	<0.1	<1	18	<0.5	<0.05	<0.05	<0.1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH9	0.5	16/01/2019	<4	<0.4	12	41	**2200**	0.2	8	570	**2.5**	**1.7**	16	<0.1	-	<25	<50	**440**	270	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH9	1.2	16/01/2019	6	<0.4	22	<1	18	<0.1	<1	6	<0.5	<0.05	<0.05	<0.1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH19	0.3	16/01/2019	6	<0.4	14	41	**460**	0.2	14	180	**3.9**	**2.7**	30	0.1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH21	0.3	17/01/2019	6	<0.4	12	19	25	<0.1	8	24	<0.5	0.2	1.2	<0.1	-	<25	<50	<100	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
BH24	0.3	18/01/2019	10	<0.4	19	27	110	0.2	6	130	**3.9**	**2.6**	34	0.2	-	<25	<50	<100	<100	<0.2	<0.5	<1	<1	-	-	-	-	-	-	-	-	NAD
Analytical Results of Suspected ACM fragments																																
BH9/0.5_PACM	0.5	16/01/2019	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	NAD

Notes:

All results in mg/kg on a dry weight basis unless specified

NAD - No Asbestos Detected

ND - Not detected

HIL - Health Investigation Level

[2] The HIL A/ HSL A/EIL / ESLs were based on National Environmental Protection Measures (NEPC) 2013

HSL A and HSL B assuming sand and sandy clay (0m - <1m depth)

Bold - Concentration exceeding SAC

- Not analysed

Chry - Chrysotile asbestos detected in soil sample

Appendix F

Lab Certificates of Analysis and Chain-of-Custody Documentation

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 209723

Client Details

Client	Douglas Partners Pty Ltd Smeaton Grange
Attention	Grant Russell
Address	18 Waler Crescent, Smeaton Grange, NSW, 2567

Sample Details

Your Reference	**92277.00, Darlington Public School Contam**
Number of Samples	26 Soil, 1 Material
Date samples received	17/01/2019
Date completed instructions received	17/01/2019

Analysis Details

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

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

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

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

Report Details

Date results requested by	24/01/2019
Date of Issue	24/01/2019

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

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

Results Approved By
Giovanni Agosti, Group Technical Manager
Jeremy Faircloth, Organics Supervisor
Ken Nguyen, Senior Chemist
Lucy Zhu, Asbestos Analyst
Nick Sarlamis, Inorganics Supervisor
Steven Luong, Senior Chemist

Authorised By

Jacinta Hurst, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		209723-1	209723-2	209723-3	209723-4	209723-5
Your Reference	UNITS	BH10	BH11	BH12	BH13	BH14
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		16/01/2019	15/01/2019	15/01/2019	15/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	85	87	90	90	90

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		209723-6	209723-7	209723-8	209723-9	209723-10
Your Reference	UNITS	BH15	BH16	BH17	BH18	BH22
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		16/01/2019	15/01/2019	15/01/2019	16/01/2019	16/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	85	86	88	91	93

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		209723-11	209723-12	209723-13	209723-14	209723-15
Your Reference	UNITS	BH23	BH25	BH26	BH27	BH2
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		15/01/2019	15/01/2019	15/01/2019	15/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	88	83	87	84	80

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		209723-16	209723-17	209723-20	209723-22	209723-24
Your Reference	UNITS	BH5	BH6	BH7	BH9	D1
Depth		0.5	0.5	0.5	0.5	-
Date Sampled		15/01/2019	16/01/2019	15/01/2019	16/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	2	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	88	88	86	88	87

vTRH(C6-C10)/BTEXN in Soil				
Our Reference		209723-25	209723-26	209723-27
Your Reference	UNITS	D2	TB	TS
Depth		-	-	-
Date Sampled		16/01/2019	15/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil
Date extracted	-	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	18/01/2019	18/01/2019	18/01/2019
TRH C_6 - C_9	mg/kg	<25	<25	[NA]
TRH C_6 - C_{10}	mg/kg	<25	<25	[NA]
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	[NA]	[NA]
Benzene	mg/kg	<0.2	<0.2	98%
Toluene	mg/kg	<0.5	<0.5	97%
Ethylbenzene	mg/kg	<1	<1	96%
m+p-xylene	mg/kg	<2	<2	95%
o-Xylene	mg/kg	<1	<1	95%
naphthalene	mg/kg	<1	[NA]	[NA]
Total +ve Xylenes	mg/kg	<1	[NA]	[NA]
Surrogate aaa-Trifluorotoluene	%	90	91	75

svTRH (C10-C40) in Soil						
Our Reference		209723-1	209723-2	209723-3	209723-4	209723-5
Your Reference	UNITS	BH10	BH11	BH12	BH13	BH14
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		16/01/2019	15/01/2019	15/01/2019	15/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	19/01/2019
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	220	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	200	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	360	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	130	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	490	<50
Surrogate o-Terphenyl	%	89	89	92	99	90

svTRH (C10-C40) in Soil						
Our Reference		209723-6	209723-7	209723-8	209723-9	209723-10
Your Reference	UNITS	BH15	BH16	BH17	BH18	BH22
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		16/01/2019	15/01/2019	15/01/2019	16/01/2019	16/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	19/01/2019	19/01/2019	19/01/2019	19/01/2019	19/01/2019
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	270	280	210	1,100	<100
TRH C_{29} - C_{36}	mg/kg	610	210	160	780	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	700	420	330	1,600	<100
TRH >C_{34} -C_{40}	mg/kg	390	120	<100	440	<100
Total +ve TRH (>C10-C40)	mg/kg	1,100	550	330	2,100	<50
Surrogate o-Terphenyl	%	96	98	97	123	91

svTRH (C10-C40) in Soil						
Our Reference		209723-11	209723-12	209723-13	209723-14	209723-15
Your Reference	UNITS	BH23	BH25	BH26	BH27	BH2
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		15/01/2019	15/01/2019	15/01/2019	15/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	19/01/2019	19/01/2019	19/01/2019	19/01/2019	19/01/2019
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	120	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	120	<50	<50
Surrogate o-Terphenyl	%	88	91	93	89	96

svTRH (C10-C40) in Soil						
Our Reference		209723-16	209723-17	209723-20	209723-22	209723-24
Your Reference	UNITS	BH5	BH6	BH7	BH9	D1
Depth		0.5	0.5	0.5	0.5	-
Date Sampled		15/01/2019	16/01/2019	15/01/2019	16/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	19/01/2019	19/01/2019	19/01/2019	19/01/2019	19/01/2019
TRH C_{10} - C_{14}	mg/kg	96	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	5,400	120	130	170	<100
TRH C_{29} - C_{36}	mg/kg	3,300	<100	<100	370	<100
TRH >C_{10} -C_{16}	mg/kg	320	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	320	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	7,800	150	<100	440	<100
TRH >C_{34} -C_{40}	mg/kg	1,500	<100	180	270	<100
Total +ve TRH (>C10-C40)	mg/kg	9,700	150	180	710	<50
Surrogate o-Terphenyl	%	#	100	95	96	93

svTRH (C10-C40) in Soil		
Our Reference		209723-25
Your Reference	UNITS	D2
Depth		-
Date Sampled		16/01/2019
Type of sample		Soil
Date extracted	-	18/01/2019
Date analysed	-	19/01/2019
TRH C_{10} - C_{14}	mg/kg	<50
TRH C_{15} - C_{28}	mg/kg	<100
TRH C_{29} - C_{36}	mg/kg	110
TRH >C_{10} -C_{16}	mg/kg	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50
TRH >C_{16} -C_{34}	mg/kg	120
TRH >C_{34} -C_{40}	mg/kg	<100
Total +ve TRH (>C10-C40)	mg/kg	120
Surrogate o-Terphenyl	%	95

PAHs in Soil						
Our Reference		209723-1	209723-2	209723-3	209723-4	209723-5
Your Reference	UNITS	BH10	BH11	BH12	BH13	BH14
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		16/01/2019	15/01/2019	15/01/2019	15/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Naphthalene	mg/kg	<0.1	<0.1	<0.1	2.5	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	0.2	1.7	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	0.2	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	0.7	<0.1
Phenanthrene	mg/kg	0.2	<0.1	0.7	9.7	0.1
Anthracene	mg/kg	<0.1	<0.1	0.2	2.1	<0.1
Fluoranthene	mg/kg	0.5	<0.1	1.2	10	0.3
Pyrene	mg/kg	0.5	<0.1	1.1	9.7	0.2
Benzo(a)anthracene	mg/kg	0.3	<0.1	0.6	5.1	0.2
Chrysene	mg/kg	0.3	<0.1	0.6	4.9	0.1
Benzo(b,j+k)fluoranthene	mg/kg	0.5	<0.2	1	9.1	0.3
Benzo(a)pyrene	mg/kg	0.3	<0.05	0.71	6.3	0.2
Indeno(1,2,3-c,d)pyrene	mg/kg	0.2	<0.1	0.4	3.3	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	1	<0.1
Benzo(g,h,i)perylene	mg/kg	0.2	<0.1	0.5	4.5	<0.1
Total +ve PAH's	mg/kg	3.0	<0.05	7.1	71	1.3
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	0.9	9.1	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	1	9.1	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	0.5	<0.5	1.0	9.1	<0.5
Surrogate p-Terphenyl-d14	%	101	100	101	101	100

PAHs in Soil						
Our Reference		209723-6	209723-7	209723-8	209723-9	209723-10
Your Reference	UNITS	BH15	BH16	BH17	BH18	BH22
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		16/01/2019	15/01/2019	15/01/2019	16/01/2019	16/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Naphthalene	mg/kg	<0.1	0.8	0.4	0.7	<0.1
Acenaphthylene	mg/kg	0.4	1.8	1.6	6.0	<0.1
Acenaphthene	mg/kg	<0.1	0.6	<0.1	0.7	<0.1
Fluorene	mg/kg	0.3	1.3	0.8	4.3	<0.1
Phenanthrene	mg/kg	2.5	10	10	58	0.2
Anthracene	mg/kg	0.5	3.0	2.3	12	<0.1
Fluoranthene	mg/kg	3.3	16	14	77	0.3
Pyrene	mg/kg	2.9	15	13	68	0.3
Benzo(a)anthracene	mg/kg	1.4	8.0	6.9	33	0.1
Chrysene	mg/kg	1.2	6.8	6.0	28	0.1
Benzo(b,j+k)fluoranthene	mg/kg	2	11	9.7	45	0.2
Benzo(a)pyrene	mg/kg	1.2	7.9	6.6	30	0.1
Indeno(1,2,3-c,d)pyrene	mg/kg	0.4	3.3	2.8	12	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	0.8	0.7	2.9	<0.1
Benzo(g,h,i)perylene	mg/kg	0.6	4.1	3.4	14	<0.1
Total +ve PAH's	mg/kg	16	90	78	390	1.4
Benzo(a)pyrene TEQ calc (zero)	mg/kg	1.5	11	9.3	42	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	1.6	11	9.3	42	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	1.6	11	9.3	42	<0.5
Surrogate p-Terphenyl-d14	%	102	101	100	104	101

PAHs in Soil						
Our Reference		209723-11	209723-12	209723-13	209723-14	209723-15
Your Reference	UNITS	BH23	BH25	BH26	BH27	BH2
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		15/01/2019	15/01/2019	15/01/2019	15/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Naphthalene	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	0.7	<0.1	0.1
Acenaphthene	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	0.7	<0.1	<0.1
Phenanthrene	mg/kg	0.2	0.2	4.1	<0.1	0.4
Anthracene	mg/kg	<0.1	<0.1	1.0	<0.1	0.1
Fluoranthene	mg/kg	0.3	0.4	5.2	0.2	0.7
Pyrene	mg/kg	0.3	0.4	4.8	0.1	0.8
Benzo(a)anthracene	mg/kg	0.2	0.2	2.6	0.1	0.4
Chrysene	mg/kg	0.2	0.2	2.2	0.1	0.4
Benzo(b,j+k)fluoranthene	mg/kg	0.3	0.4	3.7	0.2	0.7
Benzo(a)pyrene	mg/kg	0.2	0.3	2.6	0.1	0.5
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	0.1	1.1	<0.1	0.2
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	0.2	1.4	<0.1	0.3
Total +ve PAH's	mg/kg	1.6	2.4	31	0.89	4.6
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	3.6	<0.5	0.6
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	3.6	<0.5	0.7
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	3.6	<0.5	0.7
Surrogate p-Terphenyl-d14	%	104	101	102	101	102

PAHs in Soil						
Our Reference		209723-16	209723-17	209723-20	209723-22	209723-24
Your Reference	UNITS	BH5	BH6	BH7	BH9	D1
Depth		0.5	0.5	0.5	0.5	-
Date Sampled		15/01/2019	16/01/2019	15/01/2019	16/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Naphthalene	mg/kg	6.0	0.2	0.1	<0.1	<0.1
Acenaphthylene	mg/kg	31	0.6	0.4	0.2	<0.1
Acenaphthene	mg/kg	4.0	0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	16	0.4	0.1	0.1	<0.1
Phenanthrene	mg/kg	200	4.4	1.2	1.1	<0.1
Anthracene	mg/kg	46	1.0	0.3	0.3	<0.1
Fluoranthene	mg/kg	320	7.6	3.0	2.6	<0.1
Pyrene	mg/kg	310	6.8	3.2	2.8	<0.1
Benzo(a)anthracene	mg/kg	160	3.9	2.0	1.5	<0.1
Chrysene	mg/kg	140	3.1	1.8	1.5	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	220	5.0	3.5	2.6	<0.2
Benzo(a)pyrene	mg/kg	160	3.2	2.3	1.7	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	66	1.3	1.1	0.8	<0.1
Dibenzo(a,h)anthracene	mg/kg	13	0.4	0.3	0.2	<0.1
Benzo(g,h,i)perylene	mg/kg	81	1.4	1.4	1.0	<0.1
Total +ve PAH's	mg/kg	1,800	40	21	16	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	220	4.6	3.3	2.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	220	4.6	3.3	2.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	220	4.6	3.3	2.5	<0.5
Surrogate p-Terphenyl-d14	%	122	106	104	101	104

PAHs in Soil		
Our Reference		209723-25
Your Reference	UNITS	D2
Depth		-
Date Sampled		16/01/2019
Type of sample		Soil
Date extracted	-	18/01/2019
Date analysed	-	18/01/2019
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	<0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	<0.1
Anthracene	mg/kg	<0.1
Fluoranthene	mg/kg	0.2
Pyrene	mg/kg	0.2
Benzo(a)anthracene	mg/kg	0.1
Chrysene	mg/kg	0.1
Benzo(b,j+k)fluoranthene	mg/kg	0.2
Benzo(a)pyrene	mg/kg	0.2
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1
Benzo(g,h,i)perylene	mg/kg	0.1
Total +ve PAH's	mg/kg	1.2
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5
Surrogate p-Terphenyl-d14	%	104

Acid Extractable metals in soil						
Our Reference		209723-1	209723-2	209723-3	209723-4	209723-5
Your Reference	UNITS	BH10	BH11	BH12	BH13	BH14
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		16/01/2019	15/01/2019	15/01/2019	15/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Arsenic	mg/kg	4	<4	<4	<4	<4
Cadmium	mg/kg	<0.4	0.4	0.4	<0.4	4
Chromium	mg/kg	16	17	24	8	15
Copper	mg/kg	12	15	28	15	39
Lead	mg/kg	120	26	190	32	51
Mercury	mg/kg	0.2	<0.1	0.1	<0.1	0.2
Nickel	mg/kg	6	10	13	5	10
Zinc	mg/kg	67	54	96	34	110

Acid Extractable metals in soil						
Our Reference		209723-6	209723-7	209723-8	209723-9	209723-10
Your Reference	UNITS	BH15	BH16	BH17	BH18	BH22
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		16/01/2019	15/01/2019	15/01/2019	16/01/2019	16/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Arsenic	mg/kg	41	5	5	5	<4
Cadmium	mg/kg	<0.4	<0.4	0.5	0.4	<0.4
Chromium	mg/kg	15	16	21	14	10
Copper	mg/kg	49	38	52	59	11
Lead	mg/kg	74	150	160	940	57
Mercury	mg/kg	0.1	0.6	1.0	0.2	<0.1
Nickel	mg/kg	6	10	51	10	5
Zinc	mg/kg	500	140	180	470	44

Acid Extractable metals in soil						
Our Reference		209723-11	209723-12	209723-13	209723-14	209723-15
Your Reference	UNITS	BH23	BH25	BH26	BH27	BH2
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		15/01/2019	15/01/2019	15/01/2019	15/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Arsenic	mg/kg	4	5	5	<4	5
Cadmium	mg/kg	<0.4	<0.4	<0.4	0.9	0.9
Chromium	mg/kg	13	16	18	13	20
Copper	mg/kg	11	18	29	44	30
Lead	mg/kg	41	51	100	49	100
Mercury	mg/kg	<0.1	0.1	0.1	<0.1	0.4
Nickel	mg/kg	11	17	7	9	12
Zinc	mg/kg	39	80	180	90	520

Acid Extractable metals in soil						
Our Reference		209723-16	209723-17	209723-20	209723-22	209723-24
Your Reference	UNITS	BH5	BH6	BH7	BH9	D1
Depth		0.5	0.5	0.5	0.5	-
Date Sampled		15/01/2019	16/01/2019	15/01/2019	16/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Arsenic	mg/kg	<4	7	7	<4	<4
Cadmium	mg/kg	0.7	0.5	0.6	<0.4	<0.4
Chromium	mg/kg	14	21	21	12	13
Copper	mg/kg	56	83	76	41	4
Lead	mg/kg	220	88	540	2,200	28
Mercury	mg/kg	0.4	0.2	0.3	0.2	<0.1
Nickel	mg/kg	6	24	6	8	<1
Zinc	mg/kg	330	91	260	570	22

Acid Extractable metals in soil			
Our Reference		209723-25	209723-28
Your Reference	UNITS	D2	BH23 - [TRIPLICATE]
Depth		-	0.3
Date Sampled		16/01/2019	15/01/2019
Type of sample		Soil	Soil
Date prepared	-	18/01/2019	18/01/2019
Date analysed	-	18/01/2019	18/01/2019
Arsenic	mg/kg	<4	<4
Cadmium	mg/kg	<0.4	<0.4
Chromium	mg/kg	10	5
Copper	mg/kg	13	3
Lead	mg/kg	40	24
Mercury	mg/kg	0.1	<0.1
Nickel	mg/kg	6	1
Zinc	mg/kg	57	9

Misc Inorg - Soil			
Our Reference		209723-1	209723-11
Your Reference	UNITS	BH10	BH23
Depth		0.3	0.3
Date Sampled		16/01/2019	15/01/2019
Type of sample		Soil	Soil
Date prepared	-	21/01/2019	21/01/2019
Date analysed	-	21/01/2019	21/01/2019
pH 1:5 soil:water	pH Units	7.9	7.0

CEC			
Our Reference		209723-1	209723-11
Your Reference	UNITS	BH10	BH23
Depth		0.3	0.3
Date Sampled		16/01/2019	15/01/2019
Type of sample		Soil	Soil
Date prepared	-	21/01/2019	21/01/2019
Date analysed	-	21/01/2019	21/01/2019
Exchangeable Ca	meq/100g	23	10
Exchangeable K	meq/100g	0.6	0.3
Exchangeable Mg	meq/100g	0.70	3.6
Exchangeable Na	meq/100g	0.26	0.26
Cation Exchange Capacity	meq/100g	25	14

Moisture						
Our Reference		209723-1	209723-2	209723-3	209723-4	209723-5
Your Reference	UNITS	BH10	BH11	BH12	BH13	BH14
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		16/01/2019	15/01/2019	15/01/2019	15/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	21/01/2019	21/01/2019	21/01/2019	21/01/2019	21/01/2019
Moisture	%	16	14	7.3	3.8	14

Moisture						
Our Reference		209723-6	209723-7	209723-8	209723-9	209723-10
Your Reference	UNITS	BH15	BH16	BH17	BH18	BH22
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		16/01/2019	15/01/2019	15/01/2019	16/01/2019	16/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	21/01/2019	21/01/2019	21/01/2019	21/01/2019	21/01/2019
Moisture	%	8.5	17	7.4	9.9	7.1

Moisture						
Our Reference		209723-11	209723-12	209723-13	209723-14	209723-15
Your Reference	UNITS	BH23	BH25	BH26	BH27	BH2
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		15/01/2019	15/01/2019	15/01/2019	15/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	21/01/2019	21/01/2019	21/01/2019	21/01/2019	21/01/2019
Moisture	%	17	18	15	13	20

Moisture						
Our Reference		209723-16	209723-17	209723-20	209723-22	209723-24
Your Reference	UNITS	BH5	BH6	BH7	BH9	D1
Depth		0.5	0.5	0.5	0.5	-
Date Sampled		15/01/2019	16/01/2019	15/01/2019	16/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	18/01/2019	18/01/2019	18/01/2019	18/01/2019	18/01/2019
Date analysed	-	21/01/2019	21/01/2019	21/01/2019	21/01/2019	21/01/2019
Moisture	%	7.5	9.8	14	11	19

Moisture		
Our Reference		209723-25
Your Reference	UNITS	D2
Depth		-
Date Sampled		16/01/2019
Type of sample		Soil
Date prepared	-	18/01/2019
Date analysed	-	21/01/2019
Moisture	%	9.6

Asbestos ID - soils						
Our Reference		209723-1	209723-2	209723-3	209723-4	209723-5
Your Reference	UNITS	BH10	BH11	BH12	BH13	BH14
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		16/01/2019	15/01/2019	15/01/2019	15/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	21/01/2019	21/01/2019	21/01/2019	21/01/2019	21/01/2019
Sample mass tested	g	44.08g	Approx. 60g	Approx. 60g	Approx. 40g	Approx. 45g
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown fine-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	Chrysotile asbestos detected Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Asbestos comments	-	YES	NO	NO	NO	NO
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Asbestos ID - soils						
Our Reference		209723-6	209723-7	209723-8	209723-9	209723-10
Your Reference	UNITS	BH15	BH16	BH17	BH18	BH22
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		16/01/2019	15/01/2019	15/01/2019	16/01/2019	16/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	21/01/2019	21/01/2019	21/01/2019	21/01/2019	21/01/2019
Sample mass tested	g	Approx. 30g	Approx. 40g	Approx. 60g	Approx. 30g	Approx. 35g
Sample Description	-	Brown fine-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown fine-grained soil & rocks	Brown fine-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Asbestos comments	-	NO	NO	NO	NO	NO
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Asbestos ID - soils						
Our Reference		209723-11	209723-12	209723-13	209723-14	209723-15
Your Reference	UNITS	BH23	BH25	BH26	BH27	BH2
Depth		0.3	0.3	0.3	0.3	0.3
Date Sampled		15/01/2019	15/01/2019	15/01/2019	15/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	21/01/2019	21/01/2019	21/01/2019	21/01/2019	21/01/2019
Sample mass tested	g	Approx. 50g	Approx. 100g	Approx. 50g	Approx. 50g	Approx. 45g
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Asbestos comments	-	NO	NO	NO	NO	NO
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Asbestos ID - soils						
Our Reference		209723-16	209723-17	209723-20	209723-22	209723-24
Your Reference	UNITS	BH5	BH6	BH7	BH9	D1
Depth		0.5	0.5	0.5	0.5	-
Date Sampled		15/01/2019	16/01/2019	15/01/2019	16/01/2019	15/01/2019
Type of sample		Soil	Soil	Soil	Soil	Soil
Date analysed	-	21/01/2019	21/01/2019	21/01/2019	21/01/2019	21/01/2019
Sample mass tested	g	Approx. 55g	Approx. 40g	Approx. 35g	Approx. 45g	Approx. 25g
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown clayey soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Asbestos comments	-	NO	NO	NO	NO	NO
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Asbestos ID - soils		
Our Reference		209723-25
Your Reference	UNITS	D2
Depth		-
Date Sampled		16/01/2019
Type of sample		Soil
Date analysed	-	21/01/2019
Sample mass tested	g	Approx. 20g
Sample Description	-	Brown fine-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Asbestos comments	-	NO
Trace Analysis	-	No asbestos detected

Asbestos ID - materials		
Our Reference		209723-18
Your Reference	UNITS	BH6/0.5_PACM
Depth		0.5
Date Sampled		16/01/2019
Type of sample		Material
Date analysed	-	21/01/2019
Mass / Dimension of Sample	-	40x28x5mm
Sample Description	-	Brown fibrous board
Asbestos ID in materials	-	No asbestos detected Organic fibres detected

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	209723-2
Date extracted	-			18/01/2019	1	18/01/2019	18/01/2019		18/01/2019	18/01/2019
Date analysed	-			18/01/2019	1	18/01/2019	18/01/2019		18/01/2019	18/01/2019
TRH C_6 - C_9	mg/kg	25	Org-016	<25	1	<25	<25	0	98	87
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	1	<25	<25	0	98	87
Benzene	mg/kg	0.2	Org-016	<0.2	1	<0.2	<0.2	0	107	94
Toluene	mg/kg	0.5	Org-016	<0.5	1	<0.5	<0.5	0	100	88
Ethylbenzene	mg/kg	1	Org-016	<1	1	<1	<1	0	91	81
m+p-xylene	mg/kg	2	Org-016	<2	1	<2	<2	0	96	85
o-Xylene	mg/kg	1	Org-016	<1	1	<1	<1	0	94	84
naphthalene	mg/kg	1	Org-014	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	91	1	85	89	5	92	82

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	209723-24
Date extracted	-			[NT]	11	18/01/2019	18/01/2019		18/01/2019	18/01/2019
Date analysed	-			[NT]	11	18/01/2019	18/01/2019		18/01/2019	18/01/2019
TRH C_6 - C_9	mg/kg	25	Org-016	[NT]	11	<25	<25	0	91	95
TRH C_6 - C_{10}	mg/kg	25	Org-016	[NT]	11	<25	<25	0	91	95
Benzene	mg/kg	0.2	Org-016	[NT]	11	<0.2	<0.2	0	99	108
Toluene	mg/kg	0.5	Org-016	[NT]	11	<0.5	<0.5	0	93	113
Ethylbenzene	mg/kg	1	Org-016	[NT]	11	<1	<1	0	84	116
m+p-xylene	mg/kg	2	Org-016	[NT]	11	<2	<2	0	89	116
o-Xylene	mg/kg	1	Org-016	[NT]	11	<1	<1	0	87	114
naphthalene	mg/kg	1	Org-014	[NT]	11	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	[NT]	11	88	82	7	88	97

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	25	18/01/2019	18/01/2019		[NT]	[NT]
Date analysed	-			[NT]	25	18/01/2019	18/01/2019		[NT]	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	[NT]	25	<25	<25	0	[NT]	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	[NT]	25	<25	<25	0	[NT]	[NT]
Benzene	mg/kg	0.2	Org-016	[NT]	25	<0.2	<0.2	0	[NT]	[NT]
Toluene	mg/kg	0.5	Org-016	[NT]	25	<0.5	<0.5	0	[NT]	[NT]
Ethylbenzene	mg/kg	1	Org-016	[NT]	25	<1	<1	0	[NT]	[NT]
m+p-xylene	mg/kg	2	Org-016	[NT]	25	<2	<2	0	[NT]	[NT]
o-Xylene	mg/kg	1	Org-016	[NT]	25	<1	<1	0	[NT]	[NT]
naphthalene	mg/kg	1	Org-014	[NT]	25	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	[NT]	25	90	89	1	[NT]	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	209723-2
Date extracted	-			18/01/2019	1	18/01/2019	18/01/2019		18/01/2019	18/01/2019
Date analysed	-			19/01/2019	1	18/01/2019	18/01/2019		18/01/2019	18/01/2019
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	1	<50	<50	0	102	99
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	1	<100	<100	0	102	100
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	1	<100	<100	0	100	120
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	1	<50	<50	0	102	99
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	1	<100	<100	0	102	100
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	1	<100	<100	0	100	120
Surrogate o-Terphenyl	%		Org-003	96	1	89	92	3	101	89

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date extracted	-			[NT]	11	18/01/2019	18/01/2019		18/01/2019	[NT]
Date analysed	-			[NT]	11	19/01/2019	19/01/2019		19/01/2019	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	[NT]	11	<50	<50	0	100	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	[NT]	11	<100	<100	0	101	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	[NT]	11	<100	<100	0	114	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	[NT]	11	<50	<50	0	100	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	[NT]	11	<100	<100	0	101	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	[NT]	11	<100	<100	0	114	[NT]
Surrogate o-Terphenyl	%		Org-003	[NT]	11	88	89	1	104	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	25	18/01/2019	18/01/2019		[NT]	[NT]
Date analysed	-			[NT]	25	19/01/2019	19/01/2019		[NT]	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	[NT]	25	<50	<50	0	[NT]	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	[NT]	25	<100	<100	0	[NT]	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	[NT]	25	110	100	10	[NT]	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	[NT]	25	<50	<50	0	[NT]	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	[NT]	25	120	110	9	[NT]	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	[NT]	25	<100	<100	0	[NT]	[NT]
Surrogate o-Terphenyl	%		Org-003	[NT]	25	95	95	0	[NT]	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	209723-2
Date extracted	-			18/01/2019	1	18/01/2019	18/01/2019		18/01/2019	18/01/2019
Date analysed	-			18/01/2019	1	18/01/2019	18/01/2019		18/01/2019	18/01/2019
Naphthalene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	97	96
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	94	94
Phenanthrene	mg/kg	0.1	Org-012	<0.1	1	0.2	0.4	67	95	94
Anthracene	mg/kg	0.1	Org-012	<0.1	1	<0.1	0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	1	0.5	0.7	33	96	96
Pyrene	mg/kg	0.1	Org-012	<0.1	1	0.5	0.7	33	94	94
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	1	0.3	0.4	29	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	1	0.3	0.4	29	111	111
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	1	0.5	0.6	18	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	1	0.3	0.4	29	118	115
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	1	0.2	0.2	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	1	0.2	0.2	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	108	1	101	101	0	124	123

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date extracted	-			[NT]	11	18/01/2019	18/01/2019		18/01/2019	[NT]
Date analysed	-			[NT]	11	18/01/2019	18/01/2019		18/01/2019	[NT]
Naphthalene	mg/kg	0.1	Org-012	[NT]	11	<0.1	<0.1	0	98	[NT]
Acenaphthylene	mg/kg	0.1	Org-012	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	[NT]	11	<0.1	<0.1	0	95	[NT]
Phenanthrene	mg/kg	0.1	Org-012	[NT]	11	0.2	<0.1	67	97	[NT]
Anthracene	mg/kg	0.1	Org-012	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	[NT]	11	0.3	0.2	40	100	[NT]
Pyrene	mg/kg	0.1	Org-012	[NT]	11	0.3	0.2	40	99	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012	[NT]	11	0.2	0.1	67	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	[NT]	11	0.2	0.1	67	113	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	[NT]	11	0.3	<0.2	40	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	[NT]	11	0.2	0.1	67	120	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	[NT]	11	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	[NT]	11	104	103	1	128	[NT]

QUALITY CONTROL: PAHs in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	25	18/01/2019	18/01/2019		[NT]	[NT]
Date analysed	-			[NT]	25	18/01/2019	18/01/2019		[NT]	[NT]
Naphthalene	mg/kg	0.1	Org-012	[NT]	25	<0.1	<0.1	0	[NT]	[NT]
Acenaphthylene	mg/kg	0.1	Org-012	[NT]	25	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	[NT]	25	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	[NT]	25	<0.1	<0.1	0	[NT]	[NT]
Phenanthrene	mg/kg	0.1	Org-012	[NT]	25	<0.1	0.2	67	[NT]	[NT]
Anthracene	mg/kg	0.1	Org-012	[NT]	25	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	[NT]	25	0.2	0.3	40	[NT]	[NT]
Pyrene	mg/kg	0.1	Org-012	[NT]	25	0.2	0.3	40	[NT]	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012	[NT]	25	0.1	0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	[NT]	25	0.1	0.1	0	[NT]	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	[NT]	25	0.2	0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	[NT]	25	0.2	0.1	67	[NT]	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	[NT]	25	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	[NT]	25	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	[NT]	25	0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	[NT]	25	104	105	1	[NT]	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	209723-2
Date prepared	-			18/01/2019	1	18/01/2019	18/01/2019		18/01/2019	18/01/2019
Date analysed	-			18/01/2019	1	18/01/2019	18/01/2019		18/01/2019	18/01/2019
Arsenic	mg/kg	4	Metals-020	<4	1	4	<4	0	116	101
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	<0.4	<0.4	0	105	94
Chromium	mg/kg	1	Metals-020	<1	1	16	15	6	114	95
Copper	mg/kg	1	Metals-020	<1	1	12	12	0	117	#
Lead	mg/kg	1	Metals-020	<1	1	120	110	9	110	77
Mercury	mg/kg	0.1	Metals-021	<0.1	1	0.2	0.2	0	92	94
Nickel	mg/kg	1	Metals-020	<1	1	6	5	18	110	109
Zinc	mg/kg	1	Metals-020	<1	1	67	53	23	112	#

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	[NT]
Date prepared	-			[NT]	11	18/01/2019	18/01/2019		18/01/2019	[NT]
Date analysed	-			[NT]	11	18/01/2019	18/01/2019		18/01/2019	[NT]
Arsenic	mg/kg	4	Metals-020	[NT]	11	4	<4	0	115	[NT]
Cadmium	mg/kg	0.4	Metals-020	[NT]	11	<0.4	<0.4	0	104	[NT]
Chromium	mg/kg	1	Metals-020	[NT]	11	13	5	89	112	[NT]
Copper	mg/kg	1	Metals-020	[NT]	11	11	3	114	116	[NT]
Lead	mg/kg	1	Metals-020	[NT]	11	41	23	56	109	[NT]
Mercury	mg/kg	0.1	Metals-021	[NT]	11	<0.1	<0.1	0	95	[NT]
Nickel	mg/kg	1	Metals-020	[NT]	11	11	1	167	109	[NT]
Zinc	mg/kg	1	Metals-020	[NT]	11	39	9	125	111	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	25	18/01/2019	18/01/2019		[NT]	[NT]
Date analysed	-			[NT]	25	18/01/2019	18/01/2019		[NT]	[NT]
Arsenic	mg/kg	4	Metals-020	[NT]	25	<4	<4	0	[NT]	[NT]
Cadmium	mg/kg	0.4	Metals-020	[NT]	25	<0.4	<0.4	0	[NT]	[NT]
Chromium	mg/kg	1	Metals-020	[NT]	25	10	10	0	[NT]	[NT]
Copper	mg/kg	1	Metals-020	[NT]	25	13	13	0	[NT]	[NT]
Lead	mg/kg	1	Metals-020	[NT]	25	40	41	2	[NT]	[NT]
Mercury	mg/kg	0.1	Metals-021	[NT]	25	0.1	0.1	0	[NT]	[NT]
Nickel	mg/kg	1	Metals-020	[NT]	25	6	6	0	[NT]	[NT]
Zinc	mg/kg	1	Metals-020	[NT]	25	57	57	0	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	[NT]
Date prepared	-			21/01/2019	1	21/01/2019	21/01/2019		21/01/2019	[NT]
Date analysed	-			21/01/2019	1	21/01/2019	21/01/2019		21/01/2019	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	1	7.9	7.9	0	103	[NT]

QUALITY CONTROL: CEC						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	[NT]
Date prepared	-			21/01/2019	[NT]	[NT]	[NT]	[NT]	21/01/2019	[NT]
Date analysed	-			21/01/2019	[NT]	[NT]	[NT]	[NT]	21/01/2019	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Exchangeable K	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	96	[NT]
Exchangeable Na	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	96	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Report Comments

TRH Soil C10-C40 NEPM - # Percent recovery for the surrogate is not possible to report as the high concentration of analytes in sample 16 has caused interference.

Sample 209723-1; Chrysotile asbestos identified embedded in a fragment of fibre cement, it is estimated to be 1.70g/kg in 44.08g of soil (i.e. > reporting limit for the method of 0.1g/kg).

Asbestos: Excessive sample volumes were provided for asbestos analysis.
A portion of the supplied samples were sub-sampled according to Envirolab procedures.
We cannot guarantee that these sub-samples are indicative of the entire sample.
Envirolab recommends supplying 40-50g (50mL) of sample in its own container as per AS4964-2004.
Note: Samples 209723-1-17, 20, 22 & 23 were sub-sampled from bags provided by the client.

Asbestos: A portion of the supplied samples were sub-sampled for asbestos analysis according to Envirolab procedures.
We cannot guarantee that these sub-samples are indicative of the entire sample.
Envirolab recommends supplying 40-50g of sample in its own container.
Note: Samples 209723-24 & 25 were sub-sampled from jars provided by the client.

Acid Extractable Metals in Soil: The laboratory RPD acceptance criteria has been exceeded for 209723-11 for Cr, Cu, Pb, Ni and Zn. Therefore a triplicate result has been issued as laboratory sample number 209723-28.

Acid Extractable Metals in Soil:
Percent recovery is not possible to report due to the inhomogeneous nature of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY

Project Name:	Darlington Public School Contam			**To:**	Envirolab Services
Project No:	92277.00	**Sampler:**	Lizbeth Rodriguez		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	Grant Russell	**Mob. Phone:**	0418 116 545	**Attn:**	Tania Notaras
Email:	Grant.Russell@Douglaspartners.com.au;			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Date Sampled	Sample Type (S - Soil W - water)	Container Type (G - Glass P - Plastic)	Analytes: Combo 3a	CEC	pH	TRH & BTEX	Asbestos ID				Hold	Notes/preservation
BH10/0.3	1	16/01/19	S	G/P	x	x	x							
BH11/0.3	2	15/01/19	S	G/P	x									
BH12/0.3	3	15/01/19	S	G/P	x									
BH13/0.3	4	15/01/19	S	G/P	x									
BH14/0.3	5	15/01/19	S	G/P	x									
BH15/0.3	6	16/01/19	S	G/P	x									
BH16/0.3	7	15/01/19	S	G/P	x									
BH17/0.3	8	15/01/19	S	G/P	x									
BH18/0.3	9	16/01/19	S	G/P	x									
BH22/0.3	10	16/01/19	S	G/P	x									

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 209723
Date Received: 17/1/2019
Time Received: 17.25
Received by: PR
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Lab Report No:			
Send Results to:	Douglas Partners Pty Ltd	**Address** 18 Waler Crescent, Smeaton Grange 2567	**Phone:** (02) 4647 0075 **Fax:** (02) 4646 1886
Relinquished by:	LAR	**Transported to laboratory by:**	
Signed:	**Date & Time:** 17/01/2019	**Received by:** PRoj	17/1/2019

Douglas Partners
Geotechnics I Environment I Groundwater

CHAIN OF CUSTODY

Project Name:	Darlington Public School Contam			**To:**	Envirolab Services
Project No:	92277.00	**Sampler:**	Lizbeth Rodriguez		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	Grant Russell	**Mob. Phone:**	0418 116 545	**Attn:**	Tania Notaras
Email:	Grant.Russell@Douglaspartners.com.au;			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Date Sampled	Sample Type (S - Soil W - water)	Container Type (G - Glass P - Plastic)	Analytes: Combo 3a	CEC	pH	TRH & BTEX	Asbestos ID				Hold	Notes/preservation
BH23/0.3	11	15/01/19	S	G/P	x	x	x							
BH25/0.3	12	15/01/19	S	G/P	x									
BH26/0.3	13	15/01/19	S	G/P	x									
BH27/0.3	14	15/01/19	S	G/P	x									
BH2/0.3	15	15/01/19	S	G	x									
BH5/0.5	16	15/01/19	S	G/P	x									
BH6/0.5	17	16/01/19	S	G/P	x									only Plastic bag for Hold
BH6/0.5 PACM	18	16/01/19	S	P					x					
BH6/1.2	19	16/01/19	S	G/P									x	
BH7/0.5	20	15/01/19	S	G/P	x									

Lab Report No:			
Send Results to:	Douglas Partners Pty Ltd	**Address** 18 Waler Crescent, Smeaton Grange 2567	**Phone:** (02) 4647 0075 **Fax:** (02) 4646 1886
Relinquished by:	LAR	**Transported to laboratory by:**	
Signed:	**Date & Time:** 17/01/2019	**Received by:**	17/1/2019

209723

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY

Project Name:	Darlington Public School Contam			**To:**	Envirolab Services
Project No:	92277.00	**Sampler:**	Lizbeth Rodriguez		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	Grant Russell	**Mob. Phone:**	0418 116 545	**Attn:**	Tania Notaras
Email:	Grant.Russell@Douglaspartners.com.au;			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Date Sampled	Sample Type (S - Soil, W - water)	Container Type (G - Glass, P - Plastic)	Analytes: Combo 3a	CEC	pH	TRH & BTEX	Asbestos ID				Hold	Notes/preservation
BH7/1.2	21	15/01/19	S	G/P									x	
BH9/0.5	22	16/01/19	S	G/P	x									
BH9/1.2	23	16/01/19	S	G/P									x	
D1	24	15/01/19	S	G	x									
D2	25	16/01/19	S	G	x									
TB	26	15/01/19	S	G				x						
TS	27	15/01/19	S	G				x						

Lab Report No:					
Send Results to:	Douglas Partners Pty Ltd	**Address** 18 Waler Crescent, Smeaton Grange 2567		**Phone:** (02) 4647 0075	**Fax:** (02) 4646 1886
Relinquished by:	LAR		**Transported to laboratory by:**		
Signed:		**Date & Time:** 17/01/2019	**Received by:**	209723	

17/1/2019

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 210158

Client Details

Client	Douglas Partners Pty Ltd Smeaton Grange
Attention	Grant Russell
Address	18 Waler Crescent, Smeaton Grange, NSW, 2567

Sample Details

Your Reference	**92277.00, Darlington Public School**
Number of Samples	3 SOIL
Date samples received	23/01/2019
Date completed instructions received	23/01/2019

Analysis Details

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

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

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

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

Report Details

Date results requested by	31/01/2019
Date of Issue	29/01/2019

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

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

Results Approved By
Giovanni Agosti, Group Technical Manager
Jeremy Faircloth, Organics Supervisor
Lucy Zhu, Asbestos Analyst
Steven Luong, Senior Chemist

Authorised By

Jacinta Hurst, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil				
Our Reference		210158-1	210158-2	210158-3
Your Reference	UNITS	BH19	BH21	BH24
Depth		0.3	0.3	0.3
Type of sample		SOIL	SOIL	SOIL
Date extracted	-	24/01/2019	24/01/2019	24/01/2019
Date analysed	-	25/01/2019	25/01/2019	25/01/2019
TRH C_6 - C_9	mg/kg	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	87	91	81

svTRH (C10-C40) in Soil				
Our Reference		210158-1	210158-2	210158-3
Your Reference	UNITS	BH19	BH21	BH24
Depth		0.3	0.3	0.3
Type of sample		SOIL	SOIL	SOIL
Date extracted	-	24/01/2019	24/01/2019	24/01/2019
Date analysed	-	24/01/2019	25/01/2019	25/01/2019
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50
Surrogate o-Terphenyl	%	100	98	99

PAHs in Soil				
Our Reference		210158-1	210158-2	210158-3
Your Reference	UNITS	BH19	BH21	BH24
Depth		0.3	0.3	0.3
Type of sample		SOIL	SOIL	SOIL
Date extracted	-	24/01/2019	24/01/2019	24/01/2019
Date analysed	-	25/01/2019	25/01/2019	25/01/2019
Naphthalene	mg/kg	0.1	<0.1	0.2
Acenaphthylene	mg/kg	0.5	<0.1	0.7
Acenaphthene	mg/kg	<0.1	<0.1	<0.1
Fluorene	mg/kg	0.3	<0.1	0.3
Phenanthrene	mg/kg	3.4	0.1	5.0
Anthracene	mg/kg	0.9	<0.1	1.2
Fluoranthene	mg/kg	5.3	0.2	6.2
Pyrene	mg/kg	5.1	0.2	5.3
Benzo(a)anthracene	mg/kg	2.6	0.1	2.8
Chrysene	mg/kg	2.4	0.1	2.5
Benzo(b,j+k)fluoranthene	mg/kg	3.9	0.2	4.1
Benzo(a)pyrene	mg/kg	2.7	0.2	2.6
Indeno(1,2,3-c,d)pyrene	mg/kg	1.3	<0.1	1.2
Dibenzo(a,h)anthracene	mg/kg	0.4	<0.1	0.4
Benzo(g,h,i)perylene	mg/kg	1.5	0.1	1.4
Total +ve PAH's	mg/kg	30	1.2	34
Benzo(a)pyrene TEQ calc (zero)	mg/kg	3.9	<0.5	3.9
Benzo(a)pyrene TEQ calc(half)	mg/kg	3.9	<0.5	3.9
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	3.9	<0.5	3.9
Surrogate p-Terphenyl-d14	%	109	106	105

Acid Extractable metals in soil				
Our Reference		210158-1	210158-2	210158-3
Your Reference	UNITS	BH19	BH21	BH24
Depth		0.3	0.3	0.3
Type of sample		SOIL	SOIL	SOIL
Date prepared	-	24/01/2019	24/01/2019	24/01/2019
Date analysed	-	24/01/2019	24/01/2019	24/01/2019
Arsenic	mg/kg	6	6	10
Cadmium	mg/kg	<0.4	<0.4	<0.4
Chromium	mg/kg	14	12	19
Copper	mg/kg	41	19	27
Lead	mg/kg	460	25	110
Mercury	mg/kg	0.2	<0.1	0.2
Nickel	mg/kg	14	8	6
Zinc	mg/kg	180	24	130

Moisture				
Our Reference		210158-1	210158-2	210158-3
Your Reference	UNITS	BH19	BH21	BH24
Depth		0.3	0.3	0.3
Type of sample		SOIL	SOIL	SOIL
Date prepared	-	24/01/2019	24/01/2019	24/01/2019
Date analysed	-	25/01/2019	25/01/2019	25/01/2019
Moisture	%	9.7	9.3	17

Asbestos ID - soils				
Our Reference		210158-1	210158-2	210158-3
Your Reference	UNITS	BH19	BH21	BH24
Depth		0.3	0.3	0.3
Type of sample		SOIL	SOIL	SOIL
Date analysed	-	24/01/2019	24/01/2019	24/01/2019
Sample mass tested	g	Approx. 35g	Approx. 40g	Approx. 40g
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Asbestos comments	-	NO	NO	NO
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	210158-2
Date extracted	-			24/01/2019	1	24/01/2019	24/01/2019		24/01/2019	24/01/2019
Date analysed	-			25/01/2019	1	25/01/2019	25/01/2019		25/01/2019	25/01/2019
TRH C_6 - C_9	mg/kg	25	Org-016	<25	1	<25	<25	0	96	97
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	1	<25	<25	0	96	97
Benzene	mg/kg	0.2	Org-016	<0.2	1	<0.2	<0.2	0	96	97
Toluene	mg/kg	0.5	Org-016	<0.5	1	<0.5	<0.5	0	92	93
Ethylbenzene	mg/kg	1	Org-016	<1	1	<1	<1	0	96	96
m+p-xylene	mg/kg	2	Org-016	<2	1	<2	<2	0	98	99
o-Xylene	mg/kg	1	Org-016	<1	1	<1	<1	0	97	96
naphthalene	mg/kg	1	Org-014	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	90	1	87	90	3	89	88

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	210158-2
Date extracted	-			24/01/2019	1	24/01/2019	24/01/2019		24/01/2019	24/01/2019
Date analysed	-			24/01/2019	1	24/01/2019	24/01/2019		24/01/2019	25/01/2019
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	1	<50	<50	0	100	107
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	1	<100	<100	0	90	106
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	1	<100	<100	0	100	100
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	1	<50	<50	0	100	107
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	1	<100	<100	0	90	106
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	1	<100	<100	0	100	100
Surrogate o-Terphenyl	%		Org-003	99	1	100	99	1	106	98

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	210158-2
Date extracted	-			24/01/2019	1	24/01/2019	24/01/2019		24/01/2019	24/01/2019
Date analysed	-			25/01/2019	1	25/01/2019	25/01/2019		25/01/2019	25/01/2019
Naphthalene	mg/kg	0.1	Org-012	<0.1	1	0.1	<0.1	0	99	100
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	1	0.5	0.2	86	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	1	0.3	<0.1	100	97	100
Phenanthrene	mg/kg	0.1	Org-012	<0.1	1	3.4	1.2	96	98	103
Anthracene	mg/kg	0.1	Org-012	<0.1	1	0.9	0.3	100	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	1	5.3	2.0	90	97	103
Pyrene	mg/kg	0.1	Org-012	<0.1	1	5.1	2.0	87	96	102
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	1	2.6	1	89	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	1	2.4	1	82	111	115
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	1	3.9	2	64	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	1	2.7	1.0	92	113	115
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	1	1.3	0.5	89	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	1	0.4	0.2	67	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	1	1.5	0.6	86	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	107	1	109	104	5	125	123

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	210158-2
Date prepared	-			24/01/2019	1	24/01/2019	24/01/2019		24/01/2019	24/01/2019
Date analysed	-			24/01/2019	1	24/01/2019	24/01/2019		24/01/2019	24/01/2019
Arsenic	mg/kg	4	Metals-020	<4	1	6	6	0	116	97
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	<0.4	<0.4	0	102	87
Chromium	mg/kg	1	Metals-020	<1	1	14	14	0	111	103
Copper	mg/kg	1	Metals-020	<1	1	41	41	0	129	120
Lead	mg/kg	1	Metals-020	<1	1	460	430	7	108	91
Mercury	mg/kg	0.1	Metals-021	<0.1	1	0.2	0.2	0	106	106
Nickel	mg/kg	1	Metals-020	<1	1	14	14	0	112	97
Zinc	mg/kg	1	Metals-020	<1	1	180	160	12	99	70

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Report Comments

Asbestos: Excessive sample volume was provided for asbestos analysis. A portion of the supplied sample was sub-sampled according to Envirolab procedures. We cannot guarantee that this sub-sample is indicative of the entire sample. Envirolab recommends supplying 40-50g (50mL) f sample in its own container as per AS4964-2004.
Note: Samples 210158-1 to 2 were sub-sampled from bags provided by the client.

PAHs in Soil - The RPD for duplicate results is accepted due to the non homogenous nature of sample 1.

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY

Project Name:	Darlington Public School Contam			**To:**	Envirolab Services
Project No:	92277.00	**Sampler:**	Lizbeth Rodriguez		12 Ashley Street, Chatswood NSW 2067
Project Mgr:	Grant Russell	**Mob. Phone:**	0418 116 545	**Attn:**	Tania Notaras
Email:	Grant.Russell@Douglaspartners.com.au;			**Phone:**	(02) 9910 6200 **Fax:** (02) 9910 6201
Date Required:	Standard			**Email:**	tnotaras@envirolabservices.com.au

Sample ID	Lab ID	Date Sampled	Sample Type (S - Soil, W - water)	Container Type (G - Glass, P - Plastic)	Analytes: Combo 3a	CEC	pH	TRH & BTEX	Asbestos ID				Hold	Notes/preservation
BH19/0.3	1	joel	S	G/P	x									
BH21/0.3	2	joel	S	G/P	x									
BH24/0.3	3	joel	S	G/P	x									

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 210158
Date Received: 23/1/19
Time Received: 18:31
Received by: TN
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Lab Report No:			
Send Results to:	Douglas Partners Pty Ltd	**Address** 18 Waler Crescent, Smeaton Grange 2567	**Phone:** (02) 4647 0075 **Fax:** (02) 4646 1886
Relinquished by:	LAR	**Transported to laboratory by:**	
Signed:	**Date & Time:** 23/01/2019	**Received by:** T.Nguyen 23/1/19 18:31	

Form COC

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 209723-A

Client Details

Client	Douglas Partners Pty Ltd Smeaton Grange
Attention	Lizbeth Rodriguez, Grant Russell
Address	18 Waler Crescent, Smeaton Grange, NSW, 2567

Sample Details

Your Reference	**92277.00, Darlington Public School Contam**
Number of Samples	26 Soil, 1 Material
Date samples received	17/01/2019
Date completed instructions received	30/01/2019

Analysis Details

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

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

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

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

Report Details

Date results requested by	01/02/2019
Date of Issue	01/02/2019

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Asbestos Approved By
Analysed by Asbestos Approved Identifier: Matt Tang
Authorised by Asbestos Approved Signatory: Matt Tang

Results Approved By
Giovanni Agosti, Group Technical Manager
Jeremy Faircloth, Organics Supervisor
Matthew Tang, Asbsestos Analyst
Steven Luong, Senior Chemist

Authorised By

Jacinta Hurst, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil				
Our Reference		209723-A-19	209723-A-21	209723-A-23
Your Reference	UNITS	BH6	BH7	BH9
Depth		1.2	1.2	1.2
Date Sampled		16/01/2019	15/01/2019	16/01/2019
Type of sample		Soil	Soil	Soil
Date extracted	-	31/01/2019	31/01/2019	31/01/2019
Date analysed	-	01/02/2019	01/02/2019	01/02/2019
TRH C_6 - C_9	mg/kg	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	97	94	88

svTRH (C10-C40) in Soil				
Our Reference		209723-A-19	209723-A-21	209723-A-23
Your Reference	UNITS	BH6	BH7	BH9
Depth		1.2	1.2	1.2
Date Sampled		16/01/2019	15/01/2019	16/01/2019
Type of sample		Soil	Soil	Soil
Date extracted	-	31/01/2019	31/01/2019	31/01/2019
Date analysed	-	31/01/2019	31/01/2019	31/01/2019
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50
Surrogate o-Terphenyl	%	91	92	94

PAHs in Soil				
Our Reference		209723-A-19	209723-A-21	209723-A-23
Your Reference	UNITS	BH6	BH7	BH9
Depth		1.2	1.2	1.2
Date Sampled		16/01/2019	15/01/2019	16/01/2019
Type of sample		Soil	Soil	Soil
Date extracted	-	31/01/2019	31/01/2019	31/01/2019
Date analysed	-	01/02/2019	01/02/2019	01/02/2019
Naphthalene	mg/kg	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.2	<0.1	<0.1
Pyrene	mg/kg	0.2	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	0.09	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	0.5	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	102	114	109

Acid Extractable metals in soil				
Our Reference		209723-A-19	209723-A-21	209723-A-23
Your Reference	UNITS	BH6	BH7	BH9
Depth		1.2	1.2	1.2
Date Sampled		16/01/2019	15/01/2019	16/01/2019
Type of sample		Soil	Soil	Soil
Date prepared	-	31/01/2019	31/01/2019	31/01/2019
Date analysed	-	31/01/2019	31/01/2019	31/01/2019
Arsenic	mg/kg	<4	<4	6
Cadmium	mg/kg	<0.4	<0.4	<0.4
Chromium	mg/kg	17	8	22
Copper	mg/kg	8	4	<1
Lead	mg/kg	18	22	18
Mercury	mg/kg	<0.1	<0.1	<0.1
Nickel	mg/kg	2	<1	<1
Zinc	mg/kg	16	18	6

Moisture				
Our Reference		209723-A-19	209723-A-21	209723-A-23
Your Reference	UNITS	BH6	BH7	BH9
Depth		1.2	1.2	1.2
Date Sampled		16/01/2019	15/01/2019	16/01/2019
Type of sample		Soil	Soil	Soil
Date prepared	-	31/01/2019	31/01/2019	31/01/2019
Date analysed	-	01/02/2019	01/02/2019	01/02/2019
Moisture	%	15	17	24

Asbestos ID - soils				
Our Reference		209723-A-19	209723-A-21	209723-A-23
Your Reference	UNITS	BH6	BH7	BH9
Depth		1.2	1.2	1.2
Date Sampled		16/01/2019	15/01/2019	16/01/2019
Type of sample		Soil	Soil	Soil
Date analysed	-	01/02/2019	01/02/2019	01/02/2019
Sample mass tested	g	Approx. 25g	Approx. 25g	Approx. 20g
Sample Description	-	Brown clayey soil & rocks	Brown clayey soil & rocks	Brown clayey soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			31/01/2019	[NT]	[NT]	[NT]	[NT]	31/01/2019	[NT]
Date analysed	-			01/02/2019	[NT]	[NT]	[NT]	[NT]	01/02/2019	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	91	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	91	[NT]
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	[NT]	[NT]	97	[NT]
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	[NT]	[NT]	92	[NT]
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	88	[NT]
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	90	[NT]
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	89	[NT]
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	95	[NT]	[NT]	[NT]	[NT]	92	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			31/01/2019	[NT]	[NT]	[NT]	[NT]	31/01/2019	[NT]
Date analysed	-			31/01/2019	[NT]	[NT]	[NT]	[NT]	31/01/2019	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	104	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	92	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	114	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	104	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	92	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	114	[NT]
Surrogate o-Terphenyl	%		Org-003	98	[NT]	[NT]	[NT]	[NT]	111	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			31/01/2019	[NT]	[NT]	[NT]	[NT]	31/01/2019	[NT]
Date analysed	-			01/02/2019	[NT]	[NT]	[NT]	[NT]	01/02/2019	[NT]
Naphthalene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Phenanthrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	113	[NT]
Pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	113	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	120	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	[NT]	[NT]	[NT]	[NT]	125	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	123	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	111	[NT]	[NT]	[NT]	[NT]	123	[NT]

QUALITY CONTROL: Acid Extractable metals in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			31/01/2019	[NT]	[NT]	[NT]	[NT]	31/01/2019	[NT]
Date analysed	-			31/01/2019	[NT]	[NT]	[NT]	[NT]	31/01/2019	[NT]
Arsenic	mg/kg	4	Metals-020	<4	[NT]	[NT]	[NT]	[NT]	98	[NT]
Cadmium	mg/kg	0.4	Metals-020	<0.4	[NT]	[NT]	[NT]	[NT]	82	[NT]
Chromium	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Copper	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Lead	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	89	[NT]
Mercury	mg/kg	0.1	Metals-021	<0.1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Nickel	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	93	[NT]
Zinc	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	80	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Report Comments

Organics analysed outside of RHT

Asbestos: A portion of the supplied samples were sub-sampled for asbestos analysis according to Envirolab procedures.
We cannot guarantee that these sub-samples are indicative of the entire sample.
Envirolab recommends supplying 40-50g of sample in its own container.
Note: Samples 209723-A-19, 21 & 23 were sub-sampled from jars provided by the client.

Andrew Fitzsimons

From: Nancy Zhang
Sent: Wednesday, 30 January 2019 3:15 PM
To: Grant Russell
Cc: Lizbeth Rodriguez; Samplereceipt
Subject: RE: Results for Registration 209723 92277.00, Darlington Public School Contam

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Grant,

No problem, when do you need the results by?

Ref: 209723-A
TAT: 2 day
Due: 1/1/19

Regards,

Nancy Zhang | Assistant Lab Manager | Envirolab Services Pty Ltd

Great Science, Great Service.

12 Ashley Street Chatswood NSW 2067
T 612 9910 6200 F 612 9910 6201
E nzhang@envirolab.com.au | W www.envirolab.com.au

From: Grant Russell [mailto:Grant.Russell@douglaspartners.com.au]
Sent: Wednesday, 30 January 2019 3:01 PM
To: Nancy Zhang <NZhang@envirolab.com.au>
Cc: Lizbeth Rodriguez <Lizbeth.Rodriguez@douglaspartners.com.au>
Subject: FW: Results for Registration 209723 92277.00, Darlington Public School Contam
Importance: High

Hi Nancy,
Also can I get the following samples (that were initially put on hold) now analysed for combo 3A:

- BH6/1.2 (Lab ID 19);
- BH7/1.2 (Lab ID 21); and
- BH9/1.2 (Lab ID 23).

Regards
Grant

Andrew Fitzsimons

From: Grant Russell <Grant.Russell@douglaspartners.com.au>
Sent: Wednesday, 30 January 2019 3:16 PM
To: Nancy Zhang
Cc: Lizbeth Rodriguez; Samplereceipt
Subject: RE: Results for Registration 209723 92277.00, Darlington Public School Contam

Hi Nancy,
It would be good to get them by this Friday so probably best to put on ~~3~~ 2 day TAT.
Regards
Grant

209723-A
Due: 1/1/19

Grant Russell | Senior Environmental Scientist
Douglas Partners Pty Ltd | ABN 75 053 980 117 | www.douglaspartners.com.au
18 Waler Crescent Smeaton Grange NSW 2567
P: 02 4647 0075 | F: 02 4646 1886 | M: 0418 116 545 | E: Grant.Russell@douglaspartners.com.au

From: Nancy Zhang [mailto:NZhang@envirolab.com.au]
Sent: Wednesday, 30 January 2019 3:15 PM
To: Grant Russell
Cc: Lizbeth Rodriguez; Samplereceipt
Subject: RE: Results for Registration 209723 92277.00, Darlington Public School Contam

Hi Grant,

No problem, when do you need the results by?

Regards,

Nancy Zhang | Assistant Lab Manager | Envirolab Services Pty Ltd

Great Science, Great Service.

12 Ashley Street Chatswood NSW 2067
T 612 9910 6200 **F** 612 9910 6201
E nzhang@envirolab.com.au | **W** www.envirolab.com.au

Appendix G

QA/QC

Appendix G
Data Quality Assurance and Quality Control Assessment

G1 Data Quality Indicators

Field and laboratory procedures were assessed against the following data quality indicators (DQIs):

Table G1: Data Quality Indicators

DQI	Performance Indicator	Acceptable Range
Precision		
Field considerations	SOPs appropriate and complied with	Field staff follow SOPs in the DP *Field Procedures Manual*
	field replicates	Precision average relative percent difference (RPD) result <5 times PQL, no limit; results >5 times PQL, 0% - 30%
Laboratory considerations	laboratory duplicates	Precision average RPD result <5 times PQL, no limit; results >5 times PQL, 0% - 50%
	laboratory-prepared volatile trip spikes	Recovery of 60 - 140%
Accuracy (bias)		
Field considerations	SOPs appropriate and complied with	Field staff to follow SOPs in the DP *Field Procedures Manual*
Laboratory considerations	Analysis of:	
	laboratory-prepared volatile trip spikes	Recovery of 60-140%
	Laboratory-prepared trip blanks (field blanks)	<PQL
	method blanks (laboratory blanks)	Recovery of 60-140%
	matrix spikes	Recovery of 70-130% (inorganics); 60 - 140% (organics)
	matrix spike duplicates	Recovery of 70-130% (inorganics); 60 - 140% (organics); Recovery 70 “low” to 130% “high” indicates interference
	surrogate spikes	Recovery of 70 - 130% (inorganics); 60 - 140% (organics)
	laboratory control samples	Recovery of 70-130% (inorganics); 60 - 140% (organics)
Completeness		
Field considerations	All critical locations sampled	All critical locations sampled in accordance with the DQO’s (Appendix D)
	SOPs appropriate and complied with	Field staff to follow SOPs in the DP *Field Procedures Manual*
	Experienced sampler	Experienced DP Environmental Engineer to conduct field work and sampling
	Documentation correct	Maintain COC documentation at all times
	Sample holding times complied with	Sample holding times complied with

DQI	Performance Indicator	Acceptable Range
Laboratory considerations	All critical samples analysed according to DQO's	All critical locations analysed in accordance with the DQO's
	Appropriate methods and PQLs	Appropriate methods and PQLs have been used by the contract laboratory
	Sample documentation complete	Maintain COC documentation at all times
Comparability		
Field considerations	Same SOPs used on each occasion	Field staff to follow SOPs in the DP *Field Procedures Manual*
	Experienced sampler	Experienced DP Environmental Scientist/Engineer to conduct field work and sampling
	Same types of samples collected	Same types of samples collected
Laboratory considerations	Sample analytical methods used (including clean-up)	Methods to be NATA accredited
	Sample PQLs (justify/quantify if different)	Consistent PQLs to be used
	Same laboratories (justify/quantify if different)	Same analytical laboratory for primary samples to be used
Representativeness		
Field considerations	Appropriate media sampled according to DQO's (Appendix D)	Appropriate media sampled according to DQO's (Appendix D)
	All media identified in DQO's sampled	All media identified in DQO's sampled
Laboratory considerations	All samples analysed according to DQO's	All samples analysed according to DQO's

Notes to Table 1: SOP – Standard Operating Procedure
DQO – Data Quality Objectives (Appendix D)

G2 Field Quality Assurance and Quality Control

The field QC procedures for sampling as prescribed in the standard operating procedures (SOPs) in the Douglas Partners *Field Procedures Manual* were followed at all times during the assessment. All sample locations and media were in accordance with the DQO (i.e. as per scope of work in DP's proposal).

G2.1 Sampling Team

Sampling was undertaken by an experienced DP Environmental Scientist.

G2.2 Sample Collection and Weather Conditions

Sample collection procedures and dispatch are reported in body of the report. Sampling was undertaken during sunny and hot conditions.

G2.3 Logs

Logs for each soil sampling location were recorded in the field. The individual samples were recorded on the field logs along with the sample identity, location, depth, initials of sampler, duplicate locations, duplicate type and site observations. Logs are presented in Appendix D.

G2.4 Chain-of-Custody

Chain-of-Custody information was recorded on the Chain-of-Custody (COC) sheets and accompanied samples to the analytical laboratory. Signed copies of COCs are presented in Appendix F, prior to the laboratory certificates.

G2.5 Sample Splitting Techniques

Replicate samples were collected in the field as a measure of precision of the results. Field replicates samples for soil were collected from the same location and an identical depth to the primary sample. Equal portions of the primary sample were placed into the sampling jars and sealed. The sample was not homogenised in a bowl to prevent the loss of volatiles from the soil. Replicate samples were labelled with a DP identification number, recorded on DP logs, so as to conceal their relationship to their primary sample from the analysing laboratory.

G2.6 Duplicate Frequency

Field sampling comprised intra-laboratory duplicate sampling, at a rate of approximately one duplicate sample for every ten primary samples.

G2.7 Relative Percentage Difference

A measure of the consistency of results for field samples is derived by the calculation of relative percentage differences (RPDs) for duplicate samples. RPDs have only been considered where a concentration is greater than five times the practical quantitation limit (PQL).

G2.7.1 Intra-Laboratory Replicate Analysis

Replicates were tested to assess data 'precision' and the reproducibility within the primary laboratory (Envirolab Pty Ltd) as a measure of consistency of sampling techniques. Two replicate samples were analysed. The Relative Percent Difference (RPD) between replicate results is used as a measure of laboratory reproducibility and is given by the following:

$$\text{RPD} = \frac{(\text{Replicate result } 1 - \text{Replicate result } 2)}{(\text{Replicate result } 1 + \text{Replicate result } 2)/2} \text{ x } 100$$

The RPD can have a value between 0% and 200%. An RPD data quality objective of up to 30% is considered to be within the acceptable range.

The comparative results of analysis between primary and duplicate samples are summarised in the table below. Where one or both results were below the PQL, an RPD was not calculated.

Table G2: RPD Results

Sample	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc
BH7/0.5	7	0.6	21	76	540	0.3	6	260
D1	<4	<0.4	13	4	28	<0.1	<1	22
Difference	-	-	8	72	512	-	-	238
RPD (%)	-	-	47 %	180 %	180 %	0 %	0 %	2 %
BH22/0.3	<4	<0.4	10	11	57	<0.1	5	44
D2	<4	<0.4	10	13	40	0.1	6	57
Difference	0	0	0	2	17	-	1	13
RPD (%)	0 %	0 %	5 %	16 %	35 %	-	18 %	25%

Notes: Bold RPD >30
Concentration of either paired duplicated not greater than five times PQL

All RPD values were within the acceptable range of ± 30 with the exception of:

- Chromium, copper and lead in intra-laboratory duplicate pair BH7/0.5 and D1; and
- Lead in intra-laboratory duplicate pair BH22/0.3 and D2.

The exceedances are considered likely due to the heterogeneity of the fill soil. The exceedance is not considered to affect the results of the investigation.

Overall, the intra-laboratory and inter-laboratory comparisons indicate that the sampling technique was consistent and repeatable and therefore acceptable precision was achieved.

G3 Laboratory Quality Assurance and Quality Control

Envirolab Services was used as the primary laboratory. Appropriate methods and PQLs were used by the laboratory. Sample methods were NATA accredited (noting the exception for fibrous asbestos (FA) and asbestos fines (AF) quantification to 0.001% w/w).

G3.1 Surrogate Spike

This sample is prepared by adding a known amount of surrogate, which behaves similarly to the analyte, prior to analysis to each sample. The recovery result indicates the proportion of the known concentration of the surrogate that is detected during analysis and is used to assess data 'accuracy'. Results within acceptance limits indicate that the extraction technique was effective.

G3.2 Reference and Daily Check Sample Results – Laboratory Control Sample (LCS)

This sample comprises spiking either a standard reference material or a control matrix (such as a blank of sand or water) with a known concentration of specific analytes. The LCS is then analysed and results compared against each other to determine how the laboratory has performed with regard to sample preparation and analytical procedure and is used to assess data 'accuracy'. LCSs are analysed at a frequency of one in 20, with a minimum of one analysed per batch.

G3.3 Laboratory Duplicate Results

These are additional portions of a sample which are analysed in exactly the same manner as all other samples and is used to assess data 'precision'. The laboratory acceptance criteria for duplicate samples is: in cases where the level is <5Xpql - any RPD is acceptable; and in cases where the level is >5xPQL - 0-50% RPD is acceptable.

G3.4 Laboratory Blank Results

The laboratory blank, sometimes referred to as the method blank or reagent blank is the sample prepared and analysed at the beginning of every analytical run, following calibration of the analytical apparatus and is used to assess data 'accuracy'. This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, it can be determined by processing solvents and reagents in exactly the same manner as for samples. Laboratory blanks are analysed at a frequency of 1 in 20, with a minimum of one per batch.

G3.5 Matrix Spike

This is a sample duplicate prepared by adding a known amount of analyte prior to analysis, and then treated exactly the same as all other samples. The recovery result indicates the proportion of the known concentration of the analyte that is detected during analysis and is used to assess data 'accuracy'. The laboratory acceptance criteria for matrix spike samples are generally 70 - 130% for inorganic/metals; and 60 - 140% for organics; and 10 - 140% for SVOC and speciated phenols.

G3.6 Results of Laboratory QC

The laboratory QC for surrogate spikes, LCS, laboratory duplicate results, laboratory blanks and matrix spikes results are reported in the laboratory certificate of analysis.

The laboratory quality control samples were within the laboratory acceptance criteria. It is considered that an acceptable level of laboratory precision and accuracy was achieved and that surrogate spikes, LCS, laboratory duplicate results, laboratory blanks and matrix spike results were of an acceptable level overall. On the basis of this assessment, the laboratory data set is considered to have complied with the DQIs.

G3.7 Overall Assessment of QA/QC

Specific limits associated with sample handling and laboratory QA/QC was assessed against the DQIs and a summary of compliance is presented in the following table.

Table G5: Data Quality Indicators

DQI	Performance Indicator	Acceptable Range	Compliance
Precision			
Field considerations	SOPs appropriate and complied with	Field staff follow SOPs in the DP *Field Procedures Manual*	C
	field replicates	Precision average relative percent difference (RPD) result <5 times PQL, no limit; results >5 times PQL, 0% - 30%	C
Laboratory considerations	laboratory duplicates	Precision average RPD result <5 times PQL, no limit; results >5 times PQL, 0 - 50%	C
	laboratory-prepared volatile trip spikes	Recovery of 60-140%	C
Accuracy (bias)			
Field considerations	SOPs appropriate and complied with	Field staff to follow SOPs in the DP *Field Procedures Manual*	C
Laboratory considerations	Analysis of:		
	laboratory-prepared volatile trip spikes	Recovery of 60 - 140%	C
	laboratory-prepared trip blanks (field blanks)	<PQL	C
	method blanks (laboratory blanks)	Recovery of 60 - 140%	C
	matrix spikes	Recovery of 70 - 130% (inorganics); 60 - 140% (organics)	C
	matrix spike duplicates	Recovery of 70 - 130% (inorganics); 60 - 140% (organics); Recovery 70 “low” to 130% “high” indicates interference	C
	surrogate spikes	Recovery of 70 - 30% (inorganics); 60 - 40% (organics)	C
	laboratory control samples	Recovery of 70 - 130% (inorganics); 60 - 140% (organics)	C
Completeness			
Field considerations	All critical locations sampled	All critical locations sampled in accordance with the SAQP	C
	SOPs appropriate and complied with	Field staff to follow SOPs in the DP *Field Procedures Manual*	C
	Experienced sampler	Experienced DP Environmental Scientist/Engineer to conduct field work and sampling	C
	Documentation correct	Maintain COC documentation at all times	C
	Sample holding times complied with	Sample holding times complied with	C

DQI	Performance Indicator	Acceptable Range	Compliance
Laboratory considerations	All critical samples analysed according to SAQP	All critical locations analysed in accordance with the SAQP	C
	Appropriate methods and PQLs	Appropriate methods and PQLs have been used by the contract laboratory	C
	Sample documentation complete	Maintain COC documentation at all times	C
Comparability			
Field considerations	Same SOPs used on each occasion	Field staff to follow SOPs in the DP *Field Procedures Manual*	C
	Experienced sampler	Experienced DP Environmental Scientist/Engineer to conduct field work and sampling	C
	Same types of samples collected (filtered)	Field filtering for metals	NA
Laboratory considerations	Sample analytical methods used (including clean-up)	Methods to be NATA accredited	C
	Sample PQLs (justify/quantify if different)	Consistent PQLs to be used	C
	Same laboratories (justify/quantify if different)	Same analytical laboratory for primary samples to be used	C
Representativeness			
Field considerations	Appropriate media sampled according to DQOs	Appropriate media sampled according to DQOs	C
	All media identified in DQOs sampled	All media identified in DQOs sampled	C
Laboratory considerations	All samples analysed according to DQOs	All samples analysed according to DQOs	C

Notes to Table 5:
C – Compliance
PC – Partial Compliance
NC – Non-Compliance
NA – Not Applicable
SOP – Standard Operating Procedure
DQO – Data Quality Objectives

A review of the adopted QA/QC procedures and results indicates that the DQIs have generally been met with compliance and a minor partial-compliance. On this basis, the sampling and laboratory methods used during the investigation were found to meet DQOs for this project.

Appendix H

About This Report

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

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

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

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

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

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 2007. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approximate Unconfined Compressive Strength MPa*
Extremely low	EL	<0.03	<0.6
Very low	VL	0.03 - 0.1	0.6 - 2
Low	L	0.1 - 0.3	2 - 6
Medium	M	0.3 - 1.0	6 - 20
High	H	1 - 3	20 - 60
Very high	VH	3 - 10	60 - 200
Extremely high	EH	>10	>200

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$. It should be noted that the UCS to $Is_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and longer sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq \text{100 mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

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

  4,6,7
  N=13

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

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Soil Descriptions

Douglas Partners

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726-1993, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Symbols & Abbreviations

Douglas Partners

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

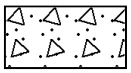
Symbols & Abbreviations

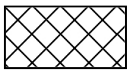
Graphic Symbols for Soil and Rock

General

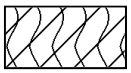

Asphalt

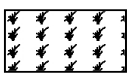

Road base

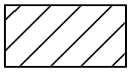

Concrete

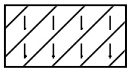

Filling

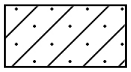
Soils


Topsoil

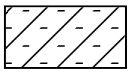

Peat

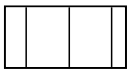

Clay

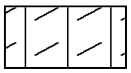

Silty clay

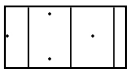

Sandy clay

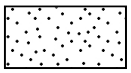

Gravelly clay

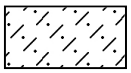

Shaly clay

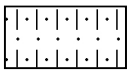

Silt


Clayey silt


Sandy silt

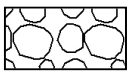

Sand

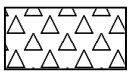

Clayey sand


Silty sand


Gravel

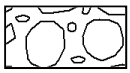

Sandy gravel


Cobbles, boulders

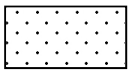

Talus

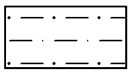
Sedimentary Rocks

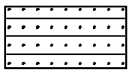

Boulder conglomerate

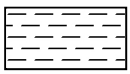

Conglomerate


Conglomeratic sandstone

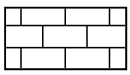

Sandstone


Siltstone

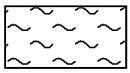

Laminite

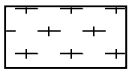

Mudstone, claystone, shale

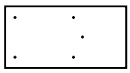

Coal


Limestone

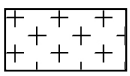
Metamorphic Rocks

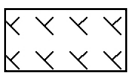

Slate, phyllite, schist

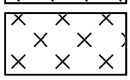

Gneiss

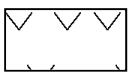

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry