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Integrated Practical Solutions

Remediation Action Plan

Hurlstone Agricultural High School (Hawkesbury)
Londonderry Road, Richmond

Prepared for
NSW Department of Education

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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.

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Report on Remediation Action Plan
Hurlstone Agricultural High School (Hawkesbury)
Londonderry Road, Richmond

1. Introduction

Douglas Partners Pty Ltd (DP) was commissioned by Conrad Gargett Pty Ltd on behalf of the NSW Department of Education to prepare a Remediation Action Plan (RAP – this report) for identified contamination at a proposed school development located on Londonderry Road, Richmond, NSW ('the site'). The site locality is presented on Drawing 1, Appendix A.

The RAP has been prepared with reference to NSW Environment Protection Authority (EPA) guidelines under the Contaminated Land Management (CLM) Act 1997, and the findings of DP report titled *Report on Detailed Site Investigation (Contamination), Hurlstone Agricultural High School (Hawkesbury), Londonderry Road, Richmond, Project 85644.04, Rev 0 dated March 2018* (DP, 2018 – 'the DSI').

Filling containing anthropogenic material including bonded asbestos containing materials (ACM) has been identified in the central-southern portion of the site; isolated metals (lead and zinc) and benzo(a)pyrene exceedances above human health and ecological criteria have also been identified in the filling material. The DSI recommended remediation of identified metals, benzo(a)pyrene and ACM exceedances be carried out to render the site suitable for the proposed development, from a contamination perspective. This RAP documents the remediation and validation procedures required to resolve the identified remediation works.

DP understands the top 300 – 400 mm of the soil profile (topsoil) at the site is currently unsuitable for crop growing and landscaping, therefore the topsoil will be regenerated for agronomical purposes with the addition of nutrients ('topsoil regeneration works'). It will be necessary to complete the remediation works documented in this RAP prior to any topsoil regeneration works within the central southern portion of the site. This is further documented in Section 8.1 of this RAP.

2. Site Information

2.1 Site Identification

The site is located to the south-west of the main Western Sydney University buildings on part of Lot 2 DP 1051798. The site is approximately 12.2 ha in area. It is bound by Western Sydney University and an aged-care facility to the north, land used largely for agricultural purposes to the east and south, and Londonderry Road to the west. The ground surface on the site slopes very gently downwards to south-east; surface levels vary between about RL 23.5 m and RL 22.5 m AHD.

At the time of the DSI the site was divided into paddocks with very few improvements. A number of drainage swales were located between the paddocks. The surface was generally well-grassed and some trees were present along the southern boundary as well as scattered sparingly elsewhere on the site.

The location of the site is shown on Drawing 1 in Appendix A.

2.2 Regional and Site Geology and Hydrogeology

As presented in the DSI, reference to the Penrith 1:100,000 Soils Landscape Sheet (Soil Conservation Service of NSW, 1990) indicates that the site is underlain by the Tertiary-aged Londonderry Clay which comprises clay with patches of cemented, consolidated sand. The area to the north is shown as being underlain by the Quaternary-aged Clarendon Formation which comprises clay, clayey sand and silt. An extract from the soil landscape map is shown in Figure 1 below.

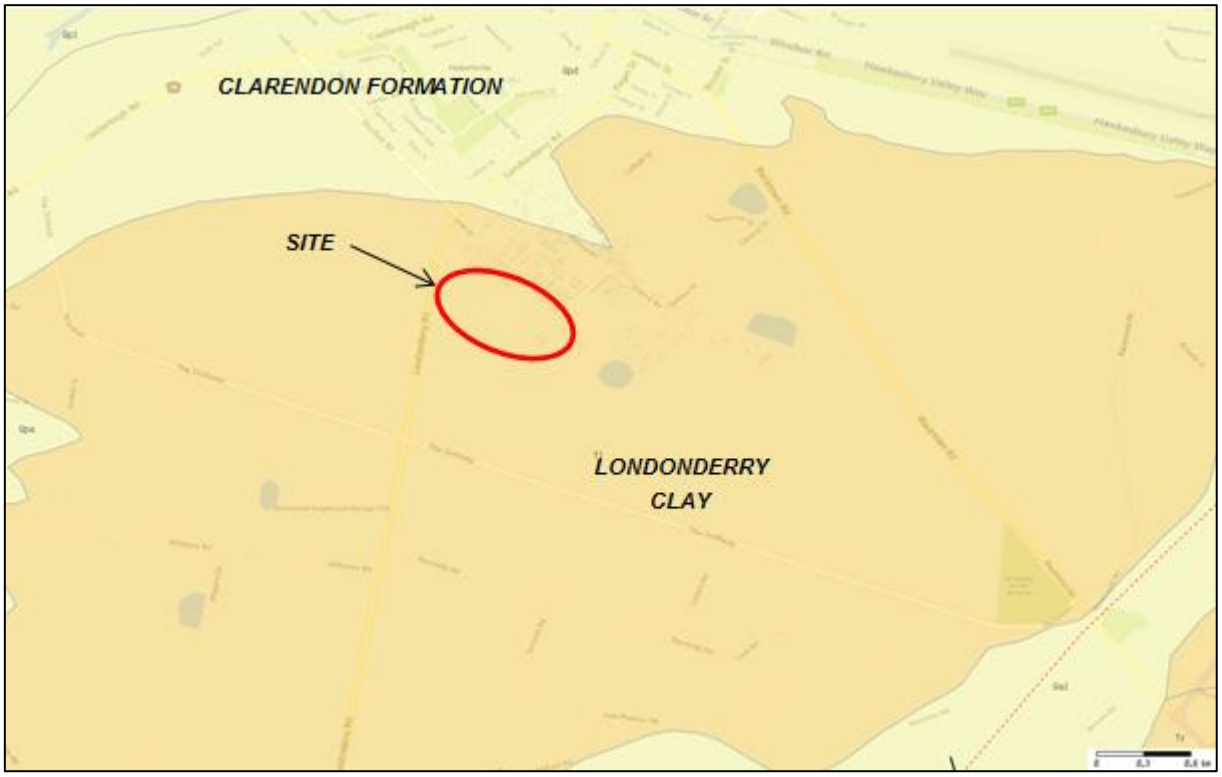

Figure 1: Extract from Penrith 1:100,000 Soils Landscape Sheet (Soil Conservation Service of NSW, 1990)

The topography of the site suggests that groundwater may be shallow and possibly a beneficial resource in sandy zones of the aquifer.

The field work undertaken for the DSI confirmed the mapping.

3. Previous Investigations

Prior to carrying out the DSI (DP, 2018), DP completed a Preliminary Site Investigation (PSI) for the site in November 2016 (Ref. 85644.00.R.003.Rev0). The scope and key findings of the DSI are summarised below:

- A total of 130 test pits (C1 to C130) were excavated across the site at accessible locations to complement four boreholes (BH3, BH5, BH6 and BH9) carried out at the site as part of the PSI;
- Six groundwater monitoring bores were drilled and installed at the site;
- Select soil samples collected from the test pits were analysed for a range of potential contaminants including total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene and total xylenes (BTEX, polycyclic aromatic hydrocarbons (PAH), organochlorine and organophosphorus pesticides (OC / OP), polychlorinated biphenyls (PCBs), total phenols, heavy metals, asbestos and volatile organic compounds (VOCs). It is noted that select samples from the four boreholes completed at the site as part of the PSI was also carried out to inform the PSI. Groundwater samples were analysed for a similar suite of compounds as well as per- and poly-fluoroalkyl substances (PFAS);
- The site was originally dedicated for use as an agricultural high school in 1892 and has been consistently used for such purposes since. A review of aerial photographs identified a small dam in the central-southern area of the site in 1947. Buildings associated with the college were visible to the north of the site in aerial photographs from 1947 to current;
- Numerous licensed groundwater bores located on adjacent sites are recorded as being used for domestic, irrigation, industrial and monitoring purposes with recorded standing water levels between 10 and 15 m below ground level (bgl). There are no licensed bores on the site;
- Two small stockpiles were observed in the central-northern portion of the site which was included in the sampling regime adopted for the DSI. No exceedances above site assessment criteria (SAC) were observed;
- As the proposed development (an agricultural high school) is likely to require a greater frequency of access to soils (compared to a typical high school), the adopted SAC comprises health investigations levels/health screening levels (HIL/HSL) for category 'A' sites including primary schools and in turn more sensitive direct contact/ingestion/inhalation soil contact exposure scenarios which is considered by DP to be suitably representative for the site (as opposed to typical high schools which would be HIL/HSL C) . Ecological investigation levels/ecological screening levels (EIL/ESL) were selected for a residential scenario for coarse-grained sites due to the sandy nature of the upper soil profile;
- Filling with anthropogenic material including porcelain, bricks, glass, terracotta, sheet metal, concrete, plastic, scrap metal and bonded asbestos containing materials (ACM) in places was observed in the central-southern portion of the site (refer Drawing 1, Appendix A); and
- Within this area bonded asbestos containing materials (ACM) has been identified in filling in five test pits (C27, C34, C41, C47 and C60 [notated incorrectly in the DSI as D80]). The location of identified filling is presented on Drawing 1, Appendix A. Exceedances above human health and ecological criteria were also identified in the filling material at the following locations:

- C27:
  - 0.9 – 1.0 m bgl:
    - Lead (1,700 mg/kg) exceeds both human health and ecological criteria;
    - Zinc (2,400 mg/kg) exceeds both human health and ecological criteria;
  - 1.4 – 1.5 m bgl:
    - Lead (1,000 mg/kg) exceeds human health criteria;
    - Zinc (3,700 mg/kg) exceeds both human health and ecological criteria;
- C47:
  - Zinc in filling from 0.4 – 0.5 m bgl (730 mg/kg) exceeds both human health and ecological criteria;
- C60:
  - Zinc in filling from 0 – 0.1 m bgl (880 mg/kg) exceeds both human health and ecological criteria;
- BH6:
  - Benzo(a)pyrene toxic equivalence quotient (TEQ) in filling from 0.5 m bgl (8.2 mg/kg) and 1.0 m (7.3 mg/kg) exceeds human health criteria.

4. Conceptual Site Model

The site history information indicates that the site has been used for agricultural teaching purposes since the late 19th Century. Activities of a rural nature have therefore been undertaken on the site for at least the last 120 years.

Potentially contaminating activities that may have occurred on the site include:

- The placement of filling on the site (including the identified stockpiles);
- Contaminants associated with farming/grazing (eg: pesticides);
- The placement of waste and/or incinerator ash which was prevalent in rural areas throughout the 20th Century; and
- Naturally occurring elements in the soils and rock underlying the site (eg: heavy metals).

The regional groundwater table is likely to relatively shallow. Significant excavation is not proposed and the use of groundwater within the development will only be undertaken (if at all) following approvals for groundwater extraction. The quality of the groundwater from a land-use perspective would therefore only be of significance if volatile contaminants had been present.

No exceedances of volatile/ contaminants were observed during the DSI, therefore soil vapour intrusion and/or ground gas exposure pathways are not considered to be present at the site.

The human receptors to soil contamination are likely to be the teachers, students, support staff and visitors to the redeveloped site; given the type of education facility proposed (agricultural high school), exposure scenarios including direct contact with soil and accidental ingestion / inhalation of dust including fibres apply. Construction personnel, nearby workers/students/residents and the general public require consideration during the construction phase of the redevelopment project.

The ecological receptors are likely to include flora and fauna that grow/live on the site, and on adjacent sites as well as farmed animals. The area is not known to be ecologically significant. Any contamination present in the upper 2 m of the soil profile (root zone) is potentially in contact with fauna at the site.

5. Summary of Remediation Required

Based on the findings of the DSI, the extent of remediation required is defined as follows:

- Asbestos impact in filling in the central southern portion of the site; and
- Metals (lead and zinc) and benzo(a)pyrene exceedances in filling in four test pits (C27, C47, C60 and BH6) in the same central southern portion of the site.

6. Remediation Acceptance Criteria

The remediation works will be validated as meeting an acceptable standard for the proposed land use. The validation will be undertaken based on visual inspection, field screening, sample analysis and review of disposal dockets as discussed in Section 10.

The remediation acceptance criteria (RAC) for the identified COPC are based on the health investigation levels (HIL), health screening levels (HSL), ecological investigation levels (EIL) and ecological screening levels (ESL) provided in DP (2018) for a residential site with plant uptake, which includes primary schools on the basis that soil contact is likely to be more prevalent at an agricultural school when compared to less conservative criteria as presented in Schedule B1, of the National Environment Protection Council, *National Environment Protection (Assessment of Site Contamination) Measure* 1999, as amended 2013 (NEPC 2013).

6.1 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 potential contaminants of concern are presented in Table 2, with inputs into their derivation shown in Table 1.

Table 1: Inputs to the Derivation of HILs and HSLs

Variable	Input	Rationale
Potential exposure pathway	Ingestion and dermal contact, Inhalation of dust / fibres	The National Environment Protection Council, *National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1 – Guideline on Investigation Levels for Soil and Groundwater* (NEPC, 2013) provides assessment levels for various soil, groundwater and vapour contaminants. Taking into account the nature of the proposed development (agricultural high school) which is likely to require a greater frequency of access to soils (compared to a typical high school), the adopted SAC comprises health investigations levels / health screening levels (HIL / HSL) for category 'A' sites including primary schools and in turn more sensitive direct contact / ingestion / inhalation soil contact exposure scenarios which is considered by DP to be suitably representative for the site.
Soil Type	sand	The dominant soil type observed in surface soils during the DSI (DP, 2018) is silty sand
Depth to contamination	0 m to <1 m	Considers the most sensitive exposure pathways (direct contact / ingestion / inhalation) accordingly.

Table 2: HIL and HSL in mg/kg Unless Otherwise Indicated

Contaminants		HIL- A	HSL- A & B
Metals	Lead	300	-
	Zinc	7400	-
PAH	Benzo(a)pyrene TEQ [1]	3	-

Note: 1. Sum of carcinogenic PAH

6.2 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 4, with inputs into their derivation shown on Table 3.

Table 3: 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	6.0	Based on approximate average from DSI (DP, 2018)
CEC	5 cmolc/kg	Based on approximate average from DSI (DP, 2018)
Clay content	10 %	Conservative value for initial screen
Traffic volumes	low	The site is considered to be located within a low traffic area
State / Territory	New South Wales	-

Table 4: EIL in mg/kg

Analyte		EIL
Metals	Lead	1100
	Zinc	230
PAH	Naphthalene	170

6.3 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 5.

Table 5: ESL in mg/kg

Analyte		ESL	Comments
PAH	Benzo(a)pyrene	0.7	All ESLs are low reliability apart from those marked with * which are moderate reliability

6.4 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 eg: penetration of, or damage to, in-ground services.

The adopted management limits, based on a fine soil type, are shown in the following Table 6.

Table 6: Management Limits in mg/kg

Analyte		Management Limit
TRH	$C_6 – C_{10}$ (F1) #	800
	$>C_{10}$-C_{16} (F2) #	1000
	$>C_{16}$-C_{34} (F3)	3500
	$>C_{34}$-C_{40} (F4)	10,000

Note: # 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.

6.5 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 (agricultural school), and in accordance with Table 7, Schedule B1, NEPC (2013) the following asbestos HSLs have been adopted:

Table 7: Health Screening Levels for Asbestos Contamination in Soil (% w/w)

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

7. Assessment of Remediation Options

7.1 Remediation Goal

The ultimate goal/objective of the remediation will be to render the site compatible with the proposed land use (school).

7.2 Extent of Remediation

The extent of remediation is summarised below:

- Asbestos in filling in the central southern portion of the site; and
- Metals (lead and zinc) and benzo(a)pyrene exceedances in filling in four test pits (C27, C47, C60 and BH6) in filling in the same portion of the site.

7.3 Remediation Options Assessment

The preferred hierarchy for remediation of soil at contaminated sites in a decreasing order of preference, as set out in NEPC (2013) and outlined in NSW EPA *Contaminated Land Management Guidelines for the NSW Site Auditor Scheme* 3rd Edition, 2018 (NSW DEC, 2006) is:

1) Onsite treatment of excavated soil (so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level); and
2) Offsite treatment of excavated soil (so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site).

If the above is not practicable:

3) Consolidation and isolation of the contaminant by containment within a properly designed barrier; and
4) Removal of contaminated material to an approved site or facility, followed, where necessary, by replacement with appropriate material.

DP assessed selected remediation alternatives, taking into considerations their applicability for the Site, time constraints, economic feasibility, and potential environmental and health impacts. Off-site treatment is generally not viable for the contaminants observed at the site, therefore this option is not further considered at this time. The remediation options evaluation is summarised in Table 9 below.

Table 9: Remediation Options Evaluation

Remediation Option	Assessment – Asbestos	Assessment – Metals and B(a)p
On-site treatment	ACM impact in fill soil can be remediated to reduce the quantity of ACM fragments to levels below remediation criteria. Treatment cannot however completely eliminate the presence of ACM in such soils. As such, the reuse of treated and validated material does require some restrictions, i.e. treated and validated material must be placed either below a slab / building or at least 0.4 m below an unconsolidated surface (eg: in a field). This is further discussed below (on-site burial of material at depth). It is noted that if AF / FA is identified during the delineation, this material cannot be treated and will require disposal.	Not technically viable for metals and benzo(a)pyrene exceedances.
	Potentially suitable pending findings of delineation (refer to Section 8.2)	**Unsuitable**
On-site burial of material at depth	All filling material identified in the delineation works as passing RAC as well as material treated and validated to remove ACM can be placed at depth at the site, either below a slab / building or at least 0.4 m below an unconsolidated surface (eg: in a field). On-site reuse through burial involves excavation and appropriate placement at depth within suitable land use areas within the site. Geotechnical suitability is based on the proportion of oversized (>150 mm) and organic material being below required guidelines. Over excavation of the proposed placement area may be required to achieve the proposed site level. DP also notes that this option will result in asbestos fragments remaining buried on the site (albeit below guideline values). This may have an implication during construction as subcontractors working on the site may encounter asbestos. SafeWork NSW may require that all contractors working below the site surface (i.e. excavating) be asbestos licenced contractors. It is considered that the implementation	The leachability of the metals and benzo(a)pyrene exceedances are to be confirmed during the delineation works. If results demonstrate the material is not significantly leachable, the metals and benzo(a)pyrene exceedances can be buried at a depth of 2 m or greater. Over excavation of the proposed placement area may be required to achieve the proposed site level.

Remediation Option	Assessment – Asbestos	Assessment – Metals and B(a)p
	of a post construction Environmental Management Plan (EMP) is prudent for the areas of the site where asbestos and construction demolition waste will remain.	
	Potentially suitable pending findings of the delineation	**Potentially suitable pending findings of delineation works**
Consolidation and isolation within a properly designed containment cell	Impacted material may be placed in a constructed containment cell on site, however it will be necessary to: • Seek Council approval prior to burial; • Prepare an Ongoing Environmental Management Plan (EMP) to document required management procedures to retain the integrity of the burial area, such as management measures during construction works, during utility works and so on; and • The burial area will require survey and recording on the site Section 149 certificate. On-site reuse through burial involves excavation and appropriate placement at depth within a cell constructed at depth at the site. The cell will require a low permeability membrane (eg: clay) and a cover comprising a coloured geotextile cover layer to both act as an impermeable cover and a physical marker for any future excavation works. A minimum soil capping thickness of 2 m is required above the geotextile cover. Some geotechnical advice may be required regarding the acceptable amount of organics and oversize material that can be placed within the cell.	The leachability of the metals and benzo(a)pyrene exceedances are to be confirmed during the delineation works. If results demonstrate the material is not significantly leachable, the metals and benzo(a)pyrene exceedances can be buried within the cell.
	Suitable	**Potentially suitable pending findings of further leachability assessment**

Remediation Option	Assessment – Asbestos	Assessment – Metals and B(a)p
Removal to an approved facility	Off-site disposal is technically a straight forward option and could be completed in a relatively short time scale prior to development of the site. The option would remove from the site any maintenance and risk legacy associated with impacted soils. It is noted that it will be necessary to validate the resultant excavation after removal of impacted soils; if further impact is identified additional soil will need to be removed and disposed of until validation sample results pass the RAC.	Off-site disposal is technically a straight forward option and could be completed in a relatively short time scale prior to development of the site. The option would remove from the site any maintenance and risk legacy associated with impacted soils. It is noted that it will be necessary to validate the resultant excavation after removal of impacted soils; if further impact is identified additional soil will need to be removed and disposed of until validation sample results pass the RAC.
	Suitable	**Suitable**

8. Remediation Methodology

8.1 Overview

The extent of remediation works is summarised in Section 7.2. Taking into account the nature and potential extent of remediation required and the proposed development, the recommended remediation approach is summarised below (in order):

1. Carry out a detailed asbestos delineation of the filling in the central southern portion of the site. The purpose of the delineation is to determine the extent of asbestos impact and further characterise identified metal and benzo(a)pyrene exceedances. The findings of the delineation will also inform a waste classification for any material identified as requiring disposal. This is further discussed in Section 8.2 below;
2. Excavate and dispose of metal and benzo(a)pyrene exceedances where additional testing confirms impact can potentially leach into groundwater. This is further discussed in Section 8.3 below;
3. For all remaining filling material;
    - o For material that passes RAC: place at depth at the site (burial), either below a slab / building or at a depth of 0.4 m or greater in areas of unconsolidated cover (eg: fields). This is further discussed in Section 8.4 below;
    - o For material that fails the RAC: Construct a containment cell at the site below ground for asbestos and immobile metal and benzo(a)pyrene exceedances. The requirements for the cell are further discussed in Section 8.5; and
4. Validate the extent of the filling area after removal of all filling material. Refer to Section 8.6 for further details.

DP understands the top 300 – 400 mm of the soil profile (topsoil) at the site is currently unsuitable for crop growing and landscaping, therefore the topsoil will be regenerated for agronomical purposes with the addition of nutrients ('topsoil regeneration works'). It will be necessary to complete the above remediation works prior to any topsoil regeneration works within the central southern portion of the site. Topsoil identified to be impacted with asbestos will not be able to be reused.

8.2 Detailed Asbestos Delineation

A delineation of the filling area in the central southern portion of the site is required to determine the extent of asbestos impact in filling. Targeted testing of metal and benzo(a)pyrene leachability will also be undertaken to inform the remediation design (this is further discussed in Section 8.3).

The delineation is a high density asbestos investigation which will inform the remediation design as follows:

- What portion (if any) of the material passes criteria and can be buried as part of the development. Conditions may apply, eg: the material shall be placed below a specific depth (eg: 0.4 m below unconsolidated ground, or immediately below a slab / building);
- What portion (if any) of the material does not pass criteria. Conditions may apply, eg: the material shall be placed below a specific depth (eg: 0.4 m); and

- What portion (if any) of the material contains AF / FA and therefore requires disposal.

The findings of the delineation will be assessed against the RAC (Section 6). The targeted testing for metals and benzo(a)pyrene will include leachate testing to confirm if the observed exceedances could potentially leach into groundwater. If results confirms metals / benzo(a)pyrene is not significantly leachable, the material can potentially be placed at depth below the site as part of the development. However, if results confirm the exceedances could potentially leach into groundwater, disposal to landfill will be required.

After completion of the delineation, the Environmental Consultant (EC) will confirm the extent of remediation required, including which areas require disposal (Section 8.3), which areas can be placed at the site at depth (Section 8.4) and which areas require placement in a containment cell at the site (Section 8.5).

8.3 Excavate and Dispose Metal and Benzo(a)pyrene Exceedances

The DSI identified metals (lead and zinc) and benzo(a)pyrene exceedances in filling in four test pits in the central southern part of the site (C27, C47, C60 and BH6). The delineation will include limited leachate testing of these compounds in this portion of the site and will confirm if the contamination:

- Is potentially leachable into groundwater and therefore requires disposal; or
- Is not significantly leachable into groundwater and therefore the impacted material can be placed in the containment cell at the site (Section 8.5).

The approximate remediation dimensions for each location is 5 m x 5 m x 0.5 m below the depth of impact. It will be necessary to validate the remediation excavation for all four locations after removal of impacted material (see Section 10.1) and “chase out” any remaining contamination.

8.4 Place Filling at Depth

The DSI confirmed the presence of asbestos in some test pits; the delineation (Section 10.2) will serve to determine the extent of asbestos impact to inform the remediation design. It is possible that asbestos will be present in filling where material passes the RAC. Therefore, it is recommended that all filling material that passes the RAC is placed at depth at the site as follows:

- Below hard stand, eg: a slab or building; or
- At a minimum 0.4 m depth below unconsolidated ground cover.

The greater depth for unconsolidated areas of the site is to prevent exposure of the material during minor excavation works such as utility installation and maintenance and landscaping.

8.5 Containment Cell

The following material shall be placed in a containment cell at the site:

- Asbestos impacted filling that exceeds the RAC; and

- Metal and benzo(a)pyrene exceedances confirmed by the delineation works (Section 8.2) as being relatively immobile (i.e. unlikely to leach into groundwater).

The containment cell requires the following:

- A suitable size to house all impacted material and taking into account soil bulking factor;
- Survey of the excavated cell
- The Remediation Contractor shall place the impacted material into the cell; after placement of the material, the surface of the impacted material shall be covered using a coloured geotextile cover layer to act as a physical marker for any future excavation works;
- Suitable soil cover shall be placed above the geotextile cover; and
- the top of the containment cell (i.e. the geotextile cover) shall be a minimum 0.5 m below the final site level.

The Remediation Contractor shall survey the base and top of the containment cell and confirm the construction of the cell in as-built. It will be necessary to include the survey as part of the Validation Report and the EMP. If a containment cell is required and after the area for the cell has been determined a work method statement should be prepared by DP to provide clear instruction to the remediation contractor on the requirements for construction.

8.6 Validate the Excavation after Removal of Filling

After removal of all filling in the central southern portion of the site it will be necessary for the Environmental Consultant to validate the extent of the excavation in accordance with the validation plan (refer to Section 10.1.2).

9. Remediation Strategy

The detailed procedures and sequence for the remediation work will rest with the contractor and will depend upon the equipment to be used and the overall sequence of the remediation or development. It is the contractor's responsibility to devise a safe work method statement and to implement proper controls that enable the personnel undertaking the remediation to work in a safe environment. This RAP does not relieve the contractor(s) of their ultimate responsibility for occupational health and safety of their workforce and to prevent contamination of areas outside the immediate workspace. This RAP sets out the minimum standards and guidelines for remediation that will need to be used in preparing a method statement.

Any asbestos remediation works must be undertaken by an appropriately licensed asbestos Remediation Contractor and in accordance with *Work Health and Safety Regulation NSW 2011* and any other applicable SafeWork NSW or Safe Work Australia regulations or guidelines.

DP recommends that the asbestos Remediation Contractor must be licensed for Class B asbestos removal. A Class B licence is suitable for the remediation related to areas impacted with asbestos given that asbestos at the site has been identified in the bonded (non-friable) form (i.e. ACM in good condition). Considering the nature of the site it is recommended that air quality monitoring is undertaken during bonded ACM removal work by DP.

In the event that significant quantities of AF or FA are observed during the remediation, works shall cease until a Class A asbestos removal license is obtained by the Remediation Contractor. A licenced asbestos assessor must undertake air quality monitoring for all removal work requiring a Class A asbestos removal licence.

The licensed asbestos Remediation Contractor must give written notice to SafeWork NSW at least five days before remediation work commences.

9.1 Site Establishment

Prior to the implementation of remediation, the site is to be established in accordance with all NSW legislative requirements.

Air quality monitoring for airborne asbestos fibres using the Membrane Filter Method in accordance with the *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres* (NOHSC: 3003, April 2005) is to be conducted prior to commencement of works (baseline) and on a daily basis when works involving the excavation, transport or placement of asbestos impacted and potentially impacted soils / materials are being conducted within the site. The Environmental Consultant is to conduct the air quality monitoring or manage the works through an experienced contractor. If friable asbestos is recorded at any stage of the remediation works, air quality monitoring will be required to be carried out by a suitably licensed asbestos assessor.

The client will be notified by the Environmental Consultant of any laboratory detections of airborne asbestos fibres during the course of the works. In the event of detections the Remediation Contractor should make appropriate modifications to works methods, as required.

9.2 Contingency for Unexpected Finds

If unexpected conditions are encountered during the remediation (such as buried tanks, unexpected contaminated soil or contaminants including additional ACM or FA / AF asbestos), the following general approach will be adopted:

- Stop work in the area of impact and barricade area to prevent access;
- The Remediation Contractor is to contact the principal's representative (PR) and the Environmental Consultant;
- The Environmental Consultant will make an assessment of the severity of the unexpected find in terms of the potential impact to human health and the environment;
- The Environmental Consultant will liaise with the PR as required;

- The Environmental Consultant will provide advice to the PR regarding the recommended course of action;
- The client will obtain necessary approvals from Council; and
- The Remediation Contractor is to implement the agreed management / remedial strategy.

9.3 Minimisation of Cross-Contamination

Appropriate measures should be adopted, as required, to eliminate or at least minimise the potential for cross contamination. In addition to the recommendations provided in the following sections for management of the remediation works, plant movement within areas of active remediation should be restricted and monitored to ensure vehicles do not unnecessarily pass over validated surfaces or through contaminated areas.

9.4 Waste Disposal

A waste classification assessment should be carried out in accordance with NSW EPA (2014) *Waste Classification Guidelines, Part 1: Classifying Waste* (EPA, 2014) for any material requiring offsite disposal. The scope of the assessment will depend on the volume and type of material requiring disposal.

9.5 Contingency for Stockpiling of Contaminated Materials

Potentially contaminated material shall be stockpiled at a suitable designated location. Dust control is required for all stockpiled materials and should include light conditioning with water (spray) for exposed materials or covering with anchored geotextile or similar.

All stockpiles of contaminated material which may be required to remain on the site overnight shall be demarcated to clearly delineate their boundaries and be adequately secured in order to reduce the risk of sediment runoff and dust blow. Should the stockpiles remain for over 48 hours they should be appropriately managed to prevent fugitive dust leaving the site (eg: light wetting or covering with anchored geotextile depending on weather conditions). The defined stockpile footprint area will be subject to validation upon completion of the remediation works (refer to Section 10).

9.6 Loading and Transporting of Spoil

All transport of waste and disposal of materials must be conducted in accordance with the requirements of the *POEO* Act (1997). All required licences and approvals required for disposal of the material will be obtained prior to removal of the materials from the site.

Transport of spoil shall be via a clearly delineated, pre-defined haul route.

Removal of waste materials from the site shall only be carried out by a licensed contractor holding the appropriate licence, consent or approvals to dispose of the waste materials according to the classification outlined in the NSW EPA *Waste Classification Guidelines* (2014) and with the appropriate approvals obtained from the NSW EPA, if required.

The proposed waste transport route will be notified to the local Council and truck dispatch shall be logged and recorded by the Contractor for each load leaving the site. A record of the truck dispatch will be provided to the PR. Asbestos transporters and facilities receiving asbestos waste in NSW weighing more than 100 kilograms, or consisting or more than 10 square metres of asbestos sheeting in one load must track and report this waste to the EPA using WasteLocate[1].

9.7 Disposal of Material

All materials excavated and removed from the site shall be disposed in accordance with the *POEO* Act 1997 and to a facility / site legally able to accept the material. Confirmation on the landfill current licensing should be provided to the Environmental Consultant prior to commencement of disposal.

Copies of all necessary approvals from the receiving site shall be given to the Environmental Consultant prior to any contaminated material being removed from the site. A record of the disposal of materials will be maintained and provided to the Environmental Consultant for waste reconciliation purposes.

All relevant analysis results shall be made available to the Contractor and proposed receiving site/waste facility to enable selection of a suitable disposal location.

Details of all contaminated and spoil materials removed from the site shall be documented by the Contractor with copies of weighbridge slips, trip tickets and consignment disposal confirmation where appropriate) provided to the Environmental Consultant and the Principal's Representative. A site log will be maintained by the PR to track disposed loads against on-site origin.

9.8 Materials for Use in Backfilling and Imported Fill

Any additional material required for redevelopment works, including backfilling of remedial excavations shall be either:

- uncontaminated material from the site (i.e.: materials meeting the RAC); or
- imported material, which is to be analysed and certified as VENM, as well as meeting the RAC via a validation certificate by the Contractor. The material and material management should also comply with relevant legislation (eg: POEO Act 1997).

Materials used on site should also meet other requirements (eg: geotechnical and salinity requirements or any specific fill management plan which is devised for the site).

[1] http://www.epa.nsw.gov.au/your-environment/waste/transporting-asbestos-waste-tyres/tracking-asbestos-waste-locate

10. Validation Plan

10.1 Validation Scope

10.1.1 Validation Data Quality Objectives (DQO)

The objective of the validation plan is to assess the results of post remediation testing against the RAC stated within this RAP (Section 6) and to provide information on environmental impacts which may have resulted from the works.

The validation assessment will be conducted in accordance with Data Quality Objectives (DQOs) and Quality Assurance / Quality Control (QA / QC) procedures to demonstrate the repeatability and reliability of the results.

The following DQOs will be adopted based on those provided in Appendix B, Schedule B2 of NEPC (2013). The DQO process is outlined as follows:

- State the Problem;
- Identify the Decision;
- Identify Inputs to the Decision;
- Define the Boundary of the Assessment;
- Develop a Decision Rule;
- Specify Acceptable Limits on Decision Errors; and
- Optimise the Design for Obtaining Data.

A checklist of Data Quality Indicators (DQI) will be completed as part of the validation assessment.

10.1.2 Validation of Excavations

The following validation works will be carried out by the Environmental Consultant:

- Removal of identified impact:
  - Visual inspection of the excavation extent;
  - If any ACM is observed during the visual inspection, an additional 0.3 m of material will be removed below the observed ACM;
  - The excavation surface will be validated as follows:
    - If the excavation surface is at least 0.3 m into underlying natural soils, visual inspection is sufficient to validate the excavation;
    - If the excavation comprises shallower (eg: fill) material and / or the excavation is the result of the removal of AF / FA impacted material, sampling of the excavation will be undertaken on a 10 m x 10 m grid basis. Sampling of the side walls of excavations will be undertaken at 10 m lateral and 1 m depth intervals. Sampling shall be conducted with reference to NEPC (2013) and DoH (2009) guidelines and shall include collection of ~10 L bulk samples and a 500 mL sample for each ~10 L bulk sample for laboratory analysis of AF and FA. Field screening and laboratory assessment results shall be used to calculate the asbestos %w/w and compare against the RAC;

- Removal of filling below the RAC;
  - o Visual inspection of the excavation extent to confirm no residual filling remains.

10.2 Quality Assurance Plan

10.2.1 Sample Collection and Handling

The general sampling procedures comprise:

- The use of stainless steel or disposable sampling equipment;
- Decontamination of sampling equipment prior to the collection each sample;
- Labelling of the sample containers with individual and unique identification including Project No. and Sample No.; and
- The use of chain-of-custody documentation so that sample tracking and custody can be cross-checked at any point in the transfer of samples from the field to hand-over to the laboratory.

10.2.2 Field QA/QC

Appropriate sampling procedures will be undertaken to prevent cross contamination. These include:

- Standard DP operating procedures are followed;
- Replicate field samples are collected and analysed;
- Samples are stored under secure, temperature controlled conditions;
- Chain-of-custody documentation is employed for the handling, transport and delivery of samples to the selected laboratory; and
- Proper disposal of contaminated soil, fill or surface water originating from the site.

10.2.3 Laboratory QA/QC

A NATA accredited laboratory will be used to conduct analysis.

10.2.4 Achievement of Data Quality Objectives

Based on fulfilment of the data quality objectives, an assessment of the overall data quality will be presented in the final validation report.

10.3 Validation Reporting

A validation assessment report will be prepared by the environmental consultant in accordance with EPA NSW *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (2011). The objective of the validation report will be to confirm that the site has been remediated to a suitable standard for the proposed redevelopment and that no related adverse human health and environmental effects have occurred as a result of the works. The validation report will also include a summary of the information from previous investigations.

The validation report will include:

- Documentation of the implementation of the Remedial Strategy;
- Details of the location and total estimated volume of materials excavated and replaced within the site and volume of material removed from the site for disposal as well as the tonnages reported by the licensed landfill;
- Photographic record during the works and of final excavations;
- Survey records of excavations and final levels after fill placement;
- Drawings showing contamination assessment sample locations and validation sample locations;
- Detailed analytical results;
- Details of materials imported to the site, as required; and
- Details, including survey records, of the final cover.

11. Site Management Plan

It is the responsibility of the Contractor to develop a Site Management Plan (SMP) detailing overall site management, environmental management (including soil, air and water) and occupational health and safety (OH&S) plans. This section provides a brief summary of some of the items which need to be included in the Contractor's plans.

Works shall comply with all legislative requirements including, but not limited, to those set out under the following Acts (and subsequent amendments and regulations):

- Environmentally Hazardous Chemicals Act (1985);
- *Hazardous Chemicals* Act (1985) (under review);
- Environmental Offences and Penalties Act (1989);
- Agricultural and Veterinary Chemicals Act (1994);
- *Protection of the Environment Operations* Act (POEO) (1997) and associated exclusions;
- *Pesticide* Act (1999);
- Work Health and Safety Act 2011;
- *OHS Amendment (Dangerous Goods)* Act 2003 (including OHS Amendment (Dangerous Goods) Regulation 2005); and

- *POEO Amendment* Act 2005 (including POEO Amendment (Scheduled Activities and Waste) Regulation 2008).

11.1 Site Operations

The schedule of remedial works, including timing and staging is to be prepared by the Contractor to meet the requirements of this RAP.

Remediation works will be restricted to the hours set out by Council.

It is the site owner / developers responsibility to ensure that appropriate personnel are appointed to manage and conduct the remediation and validation works. This will include:

- The Principal's Representative (PR – Tribeca), who is responsible for overseeing the implementation of this RAP;
- The Contractor, who is responsible for overseeing the implementation of this RAP, conducting the remedial works (may be subcontracted) and managing the site; and
- An Environmental Consultant, who will be responsible for providing advice as required for the remedial works and undertaking the validation works in accordance with this RAP.

Other parties who may be employed to assist in the implementation of this RAP include, but are not limited to, occupational hygienist(s) and licensed asbestos contractor(s).

The Contractor will be responsible for preparing a list of contacts for the works, including emergency contacts for the site operations and provision of signage at the site to allow the public to contact nominated site personnel out of hours.

11.2 Environmental Management

The work shall be undertaken with all due regard to the minimisation of environmental effects and to meet all statutory requirements. The Contractor shall have in place an Environmental Management Plan (EMP) which addresses the following items:

- Site stormwater management plan;
- Soil management plan;
- Noise control plan;
- Dust control plan;
- Odour control plan; and
- Contingency measures for environmental incidents.

The Contractor shall also be responsible to ensure that the site works comply with the following conditions:

- fugitive dust leaving the confines of the site is minimised;

- no water containing suspended matter or contaminants leaves the site in a manner which could pollute the environment;
- vehicles shall be cleaned and secured so that no mud, soil or water are deposited on any public roadways or adjacent areas;
- spoil is managed in accordance with this RAP; and
- noise and vibration levels at the site boundaries comply with the legislative requirements.

11.3 Occupational Health and Safety

The Contractor should develop a site emergency response plan (ERP) and work health and safety management plan (WHS). This will ensure the safety of the personnel working on site, given any likely emergency situation which may occur. The WHS and ERP should include emergency phone numbers and details of local emergency facilities.

Appropriate fencing and signage should be installed around and within the site to prevent unauthorised access to the site, restricted access remedial areas (eg: asbestos remediation areas) and deep excavations. Signage should be appropriate to inform of the occurrence of asbestos remediation works.

All asbestos works will be conducted by an appropriately licensed asbestos contractor and in accordance with SafeWork requirements.

All personnel on site should be required to wear the following personnel protective equipment (PPE) at all times (as a minimum):

- Steel-capped boots;
- High visibility clothing; and
- Hard hat meeting AS1801-1981 requirements.

The following additional PPE will be worn as required:

- All PPE required by the Licenced asbestos contractor (eg: P2 disposable dust mask or a particulate half-face mask with a P3 filter, disposal coveralls);
- Hearing protection meeting AS1270-1988 requirements when working around machinery or plant equipment if noise levels exceed exposure standards;
- Safety glasses or safety goggles with side shields meeting AS1337-1992 requirements (as necessary, particularly during demolition);
- Disposable coveralls (if necessary) to prevent contact with splashed contaminated soil, materials or water;
- Nitrile work gloves meeting AS2161-1978 requirements or heavy duty gauntlet gloves; and
- Any additional protection identified by the Environmental Consultant.

All contractors are required to show compliance with the Work Health and Safety Regulation 2011, including the preparation of a Site Safety Management Plan and Safe Work Method Statements.

12. Conclusions

It is considered that delineation followed by remediation of the site in accordance with this RAP will render the site suitable for the proposed agricultural high school development and will facilitate the appropriate management of potential temporary impacts on the environment. If a containment cell is constructed an Environmental Management Plan will need to be prepared and a notification on title will be required (149 Certificate).

13. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report (or services) for this project at Londonderry Road, Richmond in accordance with DP's proposal SYD171265 dated 5 April 2018 and acceptance received from Phil Baigent of Conrad Gargett Pty Ltd dated 18 April 2018. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of NSW Department of Education 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 subsurface 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. Subsurface 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

Drawing 1

0 10 20 30 40 60 80 100 150 200 250m

1:2500 @ A30

APPROXIMATE_SITE_BOUNDARY

Zinc 880 mg/kg
ACM fragments

ACM fragments

Benzo(a)pyrene 8.2 mg/kg

Zinc 730 mg/kg, ACM fragments

ACM fragments

Lead 1700 mg/kg, Zinc 3700 mg/kg
ACM fragments

Existing brick wall

LEGEND

- Test Pit
- Groundwater Well
- Borehole
- Anthropogenic inclusions encountered in these areas (approximate only)

Douglas Partners
Geotechnics | Environment | Groundwater

CLIENT: Conrad Gargett Pty Ltd		TITLE: **Site Layout and Remediation Area** **Hurlstone Agricultural High School (Hawkesbury)** **Londonderry Road, RICHMOND**
OFFICE: Sydney	DRAWN BY: PSCH	
SCALE: 1:2500 @ A3	DATE: 22.05.2018	

N

PROJECT No:	85644.05
DRAWING No:	1
REVISION:	0