# Catholic Education Office - Diocese of Wollongong

130, 132, 150, 160 and 170 Jardine Drive, Edmondson Park, NSW

Remedial Action Plan

September 2016

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# Appendices

# 1. Introduction

## 1.1 Background

GHD Pty Ltd (GHD) was commissioned by the Catholic Education Office – Diocese of Wollongong to prepare a Remedial Action Plan (RAP) for the management of contaminated soil located at site encompassing 130, 132, 150, 160 and 170 Jardine Drive, Edmondson Park, NSW. The site is identified as Lots 19 to 23 within Deposited Plan 29317. The site area is approximately 10.19 ha. The site location and site layout are shown on **Figure 1** and **Figure 2 of Appendix A,** respectively.

The identified contaminants requiring management within the soil include asbestos containing materials (ACM), and a small area impacted by an oil spill from a piece of plant.

The contamination status of the five lots covered by this RAP have been assessed within two Preliminary Site Investigation (PSI) reports (refer to section 3.1). According to information provided within the two PSI documents, there are several areas throughout the five lots that require remediation, as illustrated on **Figure 2**, **Appendix A**. These are as follows:

- Area of TP26 in the north eastern portion of 150 Jardine Drive (Lot 21 DP29317), Total Recoverable Hydrocarbon impact in shallow soils (0.0 – 0.2m);
- Area of BH112 in the northern portion of 132 Jardine Drive (Lot 22 DP29317) adjacent to the residential building, ACM fragments in soil;
- Area of BH202 in the northern portion of 160 Jardine Drive (Lot 20 DP29317) near the former residential building, ACM fragments in soil; and
- Area of BH208 in the southern portion of 160 Jardine Drive (Lot 20 DP29317) near the former storage shed, ACM fragments in soil.

No part of this RAP is to be read in isolation. It should be read in its entirety, including appendices, attachments, associated reports and it is subject to the stated limitations.

## 1.2 Purpose of this report

This RAP has been prepared to:

- Identify the contaminants that require remediation;
- Detail the remedial strategy that will be implemented to manage the identified contamination;
- Detail the validation that will be undertaken to measure the effectiveness of the remediation; and
- Detail the standards and guidelines that the remediation and validation sampling will follow.

## 1.3 Scope

The scope of works undertaken to prepare this RAP comprised the following:

- Collation and review of existing data;
- Documenting relevant guidelines;

- Setting remedial goals;
- Defining the remediation strategy and validation plan;
- Identifying information to be included in the Workplace Health & Safety Plan; and
- Outline contingency measures.

## 1.4 Key environmental guidelines

The remediation and validation activities undertaken at the site will be performed with reference to the following key guidance documents:

- The *Contaminated Land Management Act 1997* (CLM Act).
- NEPM (1999). *National Environment Protection (Assessment of Site Contamination) Measure (NEPM 2013 revision)*
- NSW DEC (2006). *Contaminated Sites: Guidelines for NSW Site Auditor Scheme.*
- NSW EPA (2014). *Waste Classification Guidelines Part 1: Classifying Waste.*
- NSW EPA (2011). *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites.*

Asbestos management in NSW is controlled through the *Work Health and Safety Act 2011 (NSW)* and associated legislation including *Work Health and Safety Regulations 2011 (NSW).* The most relevant section of the regulation is Chapter 8 Asbestos.

The following asbestos Codes of Practise (COP) are approved under Section 274 of the *Work Health and Safety Act 2011* (NSW):

- Safe Work Australia (2011). *How to Manage and Control Asbestos in the Workplace*.
- WorkCover (2014). *NSW Managing asbestos on or in soil*
- Safe Work Australia (2011). *How to Safely Remove Asbestos*.

## 1.5 Asbestos definitions

The following definitions are of relevance to this RAP. These definitions are adapted from NEPM (2013) Schedule B1.

**ACM** – an *asbestos containing material* which is in sound condition, although possible broken or fragmented, and the asbestos is bound in a matrix; for instance, asbestos fencing or vinyl tiles. This is also restricted to material that cannot pass through a 7 mm x 7 mm sieve. This sieve size is selected because it approximates the thickness of common asbestos cement sheeting and for fragments to be smaller than this would involve extreme mechanical action probably also associated with asbestos fibre release. The smaller fragments are covered by the third category described below. ACM usually represents a low human health risk.

**FA** –*fibrous asbestos* and encompasses friable asbestos material such as severely weathered ACM, and asbestos in the form of loose fibrous material such as insulation products. Friable asbestos is defined here as asbestos material that is in a degraded condition such that it can be broken or crumbled by hand pressure. Both ACM and FA can often be detected visually.

**AF** – *asbestos fines* include free fibres of asbestos, small fibre bundles and also ACM fragments that pass through a 7 mm x 7 mm sieve. Both FA and AF have the potential to generate or be associated with free asbestos fibres, which can pose an unacceptable inhalation risk if made airborne.

# 2. Site identification and environmental setting

## 2.1 Site setting

**Table 1** provides a summary of the site setting.

**Table 1 – Site setting summary**

| Information | Details |
|---|---|
| Site address | 130 – 170 Jardine Drive, Edmondson Park, NSW |
| Lot and DP | Lots 19 – 23 in Deposited Plan 29317 |
| Local Government area | Liverpool City Council |
| Zoning | R1 General Residential and SP2 Infrastructure (Educational establishment) |
| Area | Approximately 10.19 Ha |
| Approximate grid co-ordinates | Easting 301630 and Northing 6293899 (GDA94 – MGA56) |
| Current land use | Low density residential/ rural |
| Surrounding land uses | • North: Rural with residential development underway<br>• South: Rural with residential development underway<br>• East: Rural with residential development underway<br>• West: Rural with residential development underway |

## 2.2 Environmental setting

### 2.2.1 Soil landscape

The *Soil Conservation Service of NSW 1:100,000 Soil Landscape Series Sheet 9130, Sydney*, classifies the soil landscape at the site as comprising disturbed terrain and describes the soil and landscape as follows:

Disturbed terrain

- Landscape – gently undulating rises on Wianamatta Group shales. Local relief to 30 m, slopes usually <5%. Broad rounded crests and ridges with gently inclined slopes. Cleared eucalypt woodland and tall open-forest (dry sclerophyll forest)
- Soil – shallow to moderately deep (<100 cm) hard setting mottled texture contrast soils, red and brown podzolic soils on crests grading to yellow podzolic soils on lower slopes and in drainage lines
- Limitations – dependent on nature of fill material. Moderately reactive highly plastic subsoil, low soil fertility, poor soil drainage.

### 2.2.2 Acid sulfate soils

Land and Water Conservation (1997) *Acid Sulfate Soil Risk Map – Liverpool*, Ed. 2 describes the site as:

- No known occurrence of acid sulfate soils.
- Land management activities not likely to be affected be acid sulfate soil materials.

### 2.2.3 Hydrology

Cabramatta Creek flows adjacent to the site and to the west. Stormwater runoff from the site is likely to both infiltrate the site and or runoff into Jardine Drive curb side drainage system directly to the west or into Cabramatta Creek adjacent to the northern site boundary.

### 2.2.4 Geology.

According to the *Geological Series Sheet Sydney 1:250,000 scale* the site appears to be underlain by the following geological units:

- Bringelly shale
- Minchinbury Sandstone
- Ashfield shale

# 3. Previous investigations

GHD and GeoEnviro Consultancy Pty Ltd conducted Preliminary Site Investigations at the site in 2014 and 2015. **Section 3.1** provides a summary of these previous investigations.

## 3.1 Summary of previous reports

### 3.1.1 GHD Preliminary Rite Assessment – 130, 132, 160 and 170 Jardine Drive, Edmondson Park, NSW (2016)

GHD Pty Ltd (GHD) was commissioned by the Catholic Education Office – Diocese of Wollongong to undertake a PSI and targeted soil sampling in relation to the purchase and future lodgement of a development application (DA) for the construction of educational facilities at the following residential sites:

- **Site 1**: comprises Lot 22 and 23 within DP 29317; also known as 130 and 132 Jardine Drive, Edmondson Park, NSW.
- **Site 2**: comprises Lot 19 and Lot 20 within DP 29317; also known as 160 and 170 Jardine Drive, Edmondson Park, NSW.

The objective of the works was to undertake a PSI with targeted soil sampling at the sites to determine if past or present land uses have the potential to cause contamination that presents a risk to human health or the environment, and to determine whether the sites are suitable for the proposed school development.

The scope of works completed by GHD comprised a desktop study and a limited intrusive field based investigation.

GHD undertook intrusive investigations at the sites on 1 and 2 September 2014. The investigation included hand augering of 40 shallow boreholes to a maximum depth of 0.5 m below ground level (bgl), and collection and chemical analysis of soil samples.

The analytical results were used as part of a Tier 1 risk screening process and to identify whether the site is contaminated and whether contaminants of potential concern present a risk to human health and the ecological environment.

The following conclusions were realised based on the findings of the assessment:

- No evidence of gross contamination was identified at the site.
- Non-friable asbestos fragments were found on the surface of the site near the former residential building and storage shed on site 2 at 160 Jardine Drive, and near the residential property on site 1 at 132 Jardine Drive.
- The presence of non-friable asbestos fragments found on the surface of the sites present a potential risk to current and future users of the site if not properly managed and elevated levels of asbestos fibres become airborne and are breathed in.

Based on the conclusions above, GHD made the following recommendations:

- The asbestos must be managed in accordance with *NSW WorkCover guidance for Managing Asbestos in or on Soil (*2014), NSW WorkCover *How to manage and control asbestos in the workplace: Code of practice* (January 2012) and NSW WorkCover *How to safely remove asbestos: Code of practice* (January 2012).

- A suitably qualified asbestos consultant should be engaged to inspect buildings on the site and develop an asbestos management plan to be implemented during demolition and redevelopment of the site.
- Fragments of non-friable asbestos on the surface of the site should be removed (in accordance with the NSW WorkCover Guidance) by hand-picking, tilling or screening.
- The top 10 cm of soil in the footprint of the former buildings following demolition and garden and landscaped areas of the proposed educational facility should be wet and raked to remove any asbestos fragments that are encountered.
- Ensure suitable work health and safety practices are used when handling, transporting, and disposing of asbestos.
- Engage a suitably qualified asbestos consultant to oversee the raking and removal of asbestos and to provide a validation report/clearance certificate confirming the asbestos has been removed and the land is suitable for use.

### 3.1.2 GeoEnviro Consultancy Pty Ltd, Contamination Assessment, Lot 21 DP29317, 150 Jardine Drive, Edmondson Park, NSW (2015)

GeoEnviro Consultancy Pty Ltd (GeoEnviro) was commissioned by Jenga Star Investments Pty Ltd and Trustee for the Wollongong Diocese to conduct a contamination assessment at Lot 21 DP 29317, 150 Jardine Drive, Edmondson Park.

The objective of this assessment was to determine if significant subsurface soil contamination is likely to exist on site that may present a risk to human health and/or the environment as a result of previous and current land use. The report was designed to feed into a development application to council.

The scope of work consisted of:

- A review of historical site information including aerial photographs, historical title search and a NSW EPA records search.
- A search of groundwater bores in the area of the site.
- A review of the Liverpool Council Section 149 certificate
- A site inspection and test pit investigation to identify apparent or suspected areas of contamination.
- Collection of soil samples.
- Collection of dam silt samples and water samples.
- Laboratory analysis of all samples.

The desktop review of historical information and the site inspection identified several potential sources of contamination. These included former poultry farming and market gardening activities that were undertaken at the site. The potential for contaminated fill material to have been used at the site and an area of oil staining beneath a piece of mobile plant were also identified.

A total of 31 test pits were excavated across the site to depths between 0.35 m and 3.0 m bgl. The investigation revealed fill material up to 1.8 m deep with inclusions of building rubble (concrete and bricks) at the front of the site. Fill material including rubbish and bricks was also encountered at the rear of the site at depths of up to 0.5 m. Whilst ACM was not identified at the site, GeoEnviro did note that it may still exist on site and should be managed appropriately

should be discovered. Laboratory analysis revealed concentrations of contaminants of concern were all below the adopted site criteria, with the exception of TRH at location TP26 (the site of an oil leak from a piece of mobile plant). This impact appeared to be confined to an area less than 1.5 $m^2$.

GeoEnviro made the following recommendations:

- Hydrocarbon impacted soil in the area of TP26 should be excavated and disposed of to a licensed landfill facility with validation sampling undertaken following excavation to confirm adequate remediation;
- All excavated material to be classified in accordance with the NSW EPA Waste Classification Guidelines; and
- Areas where fill material has been identified should be remediated by excavation of all fill containing building material or rubbish and disposal of this material to a licensed landfill facility following waste classification.
- An unexpected finds protocol should be developed for the construction works and implemented should any buried waste, fill or ACM be discovered during site works.
- Further investigation to be undertaken following building demolition to assess for the presence of asbestos pipes. Any asbestos pipes discovered should be removed from the site.
- Validation sampling to be undertaken beneath the former site buildings to ensure contamination is not present beneath the existing structures.
- Dam de-watering may be undertaken via pumping and discharge to downstream receiving waters or on-site irrigation.

# 4. Conceptual site model

## 4.1 Contaminants of concern

Based on the outcomes of the environmental assessments conducted to date, the contaminants of potential concern (CoPC) in soil beneath the site are:

- Asbestos Containing Materials (bonded and friable)
- TRH
- Fill material containing building rubble and rubbish

## 4.2 Conceptual site model

The following conceptual site model (CSM) has been developed based on GHD's understanding of the site setting, including geology, hydrogeology and surrounding land use in order to identify potentially significant source-pathway-receptor (SPR) linkages in respect of risks to human health and the environment.

### 4.2.1 Sources

The primary sources of the CoPC were identified by GHD as asbestos (bonded) from broken building materials, and TRH from an oil leak from a piece of mobile plant. Whilst fill material containing building rubble was highlighted by GeoEnviro as requiring remediation, it is considered that fill material containing building rubble does not pose a risk to human health or the environment and as such this material can be managed on site as opposed to being remediated or disposed of off-site. Further, GeoEnviro recommended investigation for the presence of asbestos pipes at the site, GHD consider that any asbestos pipes can be managed under the unexpected finds protocol provided in Section 8.10 of this document.

### 4.2.2 Pathways

The primary pathways through which humans and/or ecological receptors could be exposed to the sources of contamination are considered to be:

- Direct contact with contaminated soil
- Inhalation of asbestos fibres and/or contaminated dust
- Ingestion of contaminated soils and/or dust
- Leaching into underlying groundwater or migration via surface water runoff.

### 4.2.3 Receptors

When evaluating potential adverse health effects to people from exposure to a contaminated site all potentially exposed populations should be considered.

For the site, the key populations or receptors of interest are considered to include:

- Construction / maintenance workers
- General public

- Nearby residential properties
- Future site users (proposed use as an educational facility)
- Environmental receptors including Cabramatta Creek and groundwater.

The potential SPR linkages are summarised in **Table 2** along with comment on whether the linkages are considered to be complete based on the most recent assessments.

**Table 2 – Potential source receptor pathway linkages**

| Source | Receptors | Pathways | Potential linkage |
|---|---|---|---|
| Soil which contains the following CoPC:<br>• Asbestos containing materials (bonded) on surface | Human:<br>• Construction / maintenance workers<br>• General public<br>• Nearby commercial properties | • inhalation of asbestos fibres | Potentially complete |
| • TRH | Human:<br>• Construction / maintenance workers<br>• General public<br>• Nearby commercial properties<br>Environmental:<br>• Cabramatta Creek<br>• Groundwater | • Direct contact | • Potentially complete |
| | | • Inhalation of contaminated dust | • Potentially complete |
| | | • Ingestion of contaminated soils and/or dust | • Potentially complete |
| | | • Leaching into underlying groundwater or migration via surface water runoff. | • Potentially complete |

# 5. Basis for assessment

## 5.1 Relevant guidelines

The framework for this remediation action plan was developed with reference to guidelines "made or approved", by the Department of Environment, Climate Change and Water (DECCW), under Section 105 of the *Contaminated Land Management Act, 1997*. These guidelines include, but are not limited to the following:

- NEPM (2013). *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)", National Environment Protection Council (NEPC).*
- NSW EPA (2014). *Waste Classification Guidelines Part 1: Classifying Waste*.
- NSW EPA (2011). *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites.*

## 5.2 Remediation criteria (soil)

The remediation criteria against which the project analytical data will be compared (if required) have been taken from those guidelines made or approved by the NSW EPA.

Based on the site setting and accessibility, GHD considers the Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) (2011) Health Screening Levels for low density residential land use (HSL A) to be most appropriate. HSL A is the most conservative setting, but is deemed suitable given the potential use of the site as a primary/pre-school. The criteria for vapour intrusion and direct contact have been adopted.

**Table 3 – Adopted soil criteria**

| Compound | Health Screening Level (mg/kg)<br>Low density residential (A) |
|---|---|
| **Total recoverable hydrocarbons** | |
| TRH $C_6$ – $C_{10}$ | 50[(a)] |
| TRH $C_{10}$-$C_{16}$ | 280[(a)] |
| TRH $C_{16}$ – $C_{34}$ | 4,500[(b)] |
| TRH $C_{34}$ – $C_{40}$ | 6,300[(b)] |
| **Asbestos** | |
| Bonded ACM | 0.01% w/w |
| All forms of asbestos | No visible asbestos in surface soil (0.0-0.1m) |

a) CRC Care, Technical Report No. 10: Health screening levels for petroleum hydrocarbons in soil, 2011 – Vapour intrusion for low density residential 0 to <1 m, Clay (most conservative)
b) CRC Care, Technical Report No. 10: Health screening levels for petroleum hydrocarbons in soil and groundwater, 2011 - Direct Contact

## 5.3 Waste classification guidelines

A summary of the waste classification levels which may be used to evaluate measured chemical concentrations in soil if offsite disposal is required are provided in **Table 4.**

### Table 4 – Waste criteria

| Analyte | General Solid Waste | | | Restricted Solid Waste | | |
|---|---|---|---|---|---|---|
| | CT1 [(a)] (mg/kg) | SCC [(b)] (mg/kg) | TCLP [(c)] (mg/L) | CT2 [(a)] (mg/kg) | SCC [(b)] (mg/kg) | TCLP [(c)] (mg/L) |
| Arsenic | 100 | 500 | 5 | 400 | 2000 | 20 |
| Cadmium | 20 | 100 | 1 | 80 | 400 | 4 |
| Chromium (VI) | 100 | 1900 | 5 | 400 | 7600 | 20 |
| Lead | 100 | 1500 | 5 | 400 | 6000 | 20 |
| Mercury (inorganic) | 4 | 50 | 0.2 | 16 | 200 | 0.8 |
| Nickel | 40 | 1050 | 2 | 160 | 4200 | 8 |
| Total PAH | 200 | N/A | N/A | 800 | N/A | N/A |
| Benzo(a)pyrene | 0.8 | 10 | 0.04 | 3.2 | 23 | 0.16 |
| TPH $C_6$-$C_9$ | 650 | N/A | N/A | 2600 | N/A | N/A |
| TPH $C_{10}$-$C_{36}$ | 10000 | N/A | N/A- | 40000 | N/A | N/A- |
| Benzene | 10 | 18 | 0.5 | 40 | 72 | 2 |
| Toluene | 288 | 518 | 14.4 | 1152 | 2073 | 57.6 |
| Ethylbenzene | 600 | 1080 | 30 | 2400 | 4320 | 120 |
| Xylenes | 1000 | 1800 | 50 | 4000 | 7200 | 200 |
| Endodulfan (OCP) | 60 | 108 | 3 | 240 | 432 | 12 |
| PCB | NA | <50 | NA | NA | <50 | NA |

c) Maximum values of specific contaminant concentrations (SCC) for classification without TCLP. Contaminant Threshold (CT) values presented in Table 1 of *NSW EPA (2014) Waste Classification Guidelines*.
d) Maximum values of leachable concentrations and SCC for classification when used together. Specific contaminant concentration as presented in Table 2 of the *NSW EPA (2014) Waste Classification Guidelines*.
e) Maximum values of leachable concentrations and SCC for classification when used together. Leachable concentration (TCLP) as presented in Table 2 of the *NSW EPA (2014) Waste Classification Guidelines*.

It is noted that the TRH concentrations detected within surface soils at TP26 by GeoEnviro exceed the CT2 criteria. This material to be excavated from this area will therefore be classified as Hazardous Waste.

# 6. Remedial methodology

## 6.1 Objectives of remediation

The overall goal of the project is to remediate the contaminated soil to make the site suitable for land use as an educational facility. The objective of the RAP is to document the processes required to address the identified soil contamination so that the site is made suitable (from a contamination perspective) for use as an educational facility.

## 6.2 Remedial options

With regard to site remediation, the NSW EPA (2006) *Guidelines for the NSW Site Auditor Scheme* endorses the policy of the Australian and New Zealand Environment and Conservation Council (ANZECC) and National Health and Medical Research Council (NHMRC) – as published in the *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites,* (ANZECC, 1992).

Under this policy, the preferred options for site remediation and management are (in descending order):

1) On-site treatment of contamination – so that the contaminant(s) are either destroyed or the associated hazard is reduced to an acceptable level; then

2) Off-site treatment of contamination – so that the contaminant(s) are either destroyed or the associated hazard is reduced to an acceptable level, after which the formerly contaminated material is returned to the site.

If these options cannot be implemented, then the other options that should be considered include:

3) Removal of contaminated material to an approved site or facility (such as a landfill), followed, where necessary, by the reinstatement of formed excavations using clean fill; then

4) Consolidation and isolation of the contaminated material on-site by containing the contaminated material within a properly designed barrier.

If remediation is likely to cause a greater adverse effect than would occur if the site were left undisturbed, then remediation should not proceed.

### 6.2.1 Options evaluation

As detailed in previous sections, asbestos (bonded) is the primary contaminant of concern with a small specific hotspot of TRH, the secondary contaminant of concern.

In order to establish the most appropriate (from a technical, environmental and legislative standpoint) remedial strategy for the ACM contaminated soils, GHD has completed an assessment of the potential remediation options, taking into consideration the hierarchy endorsed by NSW EPA, the proposed site use and the principles of ecologically sustainable development.

Appropriate remediation methodologies for the contaminants of concern include:

- **Option 1**: On-site treatment
- **Option 2**: Excavation and off-site disposal (to landfill) of impacted soils, or

- **Option 3**: Capping the site with future management of capped contamination in accordance with a long term post remediation site management plan (PRSMP).

In order to evaluate the appropriateness of these options, technical, economic and policy related issues need to be assessed. A summary of this evaluation is presented in **Table 5**.

### Table 5 – Remedial options assessment

| Issues | | Option 1 On-Site treatment | Option 2 Excavation & Off-Site Disposal | Option 3, Capping, site management |
|---|---|---|---|---|
| Policy | The NSW EPA endorsed policy dictates that a remediation system, which results in the destruction of contamination, is generally preferable to off-site disposal of contaminated material, or on-site containment | Not possible | First preference based on the hierarchy outlined in Section 6.2 | Second preference based on the hierarchy outlined in Section 6.2 |
| Reliability | Reliability is a measure of the degree of certainty that the remedial system will succeed in meeting the site remediation goals in both the short and long term. | Unreliable given asbestos is not treatable. | Reliable option to ensure removal of the contaminated material | Relatively reliable option as exposure to contamination is managed if PRSMP is appropriately implemented |
| On-going Liability | Any system that does not involve the full remediation of all contamination may necessitate some form of ongoing maintenance and/or monitoring to ensure the longer-term integrity of the remediation system adopted. | Liability ongoing as asbestos cannot be treated | Contaminated materials removed off site, ongoing liability removed | On-going liability associated with presence of capped contamination requiring ongoing management |
| Capital Cost | The actual capital cost of implementing the chosen remediation strategy(ies) is an important consideration in the evaluation of the various remediation options. | Cannot be calculated as asbestos cannot be treated | Cost associated with excavation and off-site disposal considered to be high. | Cost is associated with capping considered to be moderate. |
| Human Health Risk | Works that involve the disturbance of contaminated soils can potentially | High as asbestos contamination cannot be | Low given the minimal mechanical disturbance of | Low to moderate given the disturbance of asbestos |

| Issues | | Option 1 On-Site treatment | Option 2 Excavation & Off-Site Disposal | Option 3, Capping, site management |
|---|---|---|---|---|
| | create health risk concerns to site workers. | treated | asbestos containing material during remedial works | containing material during encapsulation works |
| Regulatory Approvals | Any remediation system needs to be endorsed by the relevant regulatory authorities. The difficulty in obtaining regulatory approvals will be largely dependent upon the nature of the remediation system proposed. | N/A as asbestos contamination cannot be treated | Generally satisfactory. | Generally satisfactory. |
| Site Disruption | Remediation of the site will invariably involve some disturbance to site occupiers/ users | N/A as asbestos contamination cannot be treated | Some minor disruption during remediation phase. Minimal disruption to surrounding land users | May be substantial during encapsulation phase. Moderate disruption to surrounding land users with increased traffic movement. |
| Contractor Experience | The success and cost effectiveness of any remediation system will be at least partially dependent upon the experience local contractors have in undertaking the type of remediation works proposed. | N/A as asbestos contamination cannot be treated | Relatively simple strategy involving basic technologies, supervision and monitoring by environmental consultant. | Relatively simple strategy involving basic technologies, supervision and monitoring by environmental consultant. |
| Disposal Site Availability | Any works involving landfill disposal of contaminated soil will only be feasible if a landfill site is available which is licensed to accept the contaminated soils excavated from the site. | N/A as asbestos contamination cannot be treated | Suitable off-site disposal facilities are present within Sydney | No material requires off-site disposal |
| Timeframe | Timeframe within which the client requires the work to be completed should be considered. | N/A as asbestos contamination cannot be treated | Can be completed within reasonable time frame dependent mainly on subcontractor availability (Approximately. 1 month) | Can be completed within reasonable time frame dependent on encapsulation design requirements (Approximately 2 months) |

### 6.2.2 Nominated remedial strategy

In addition to the consideration of the information presented in **Table 5,** cost benefit analysis, subsequent environmental impact and sustainability were considered by GHD and Catholic Education Office, Diocese of Wollongong during the evaluation of remedial options for the site remediation. Considerations were also based on the evaluation of available data and site constraints including the site area, multiple construction projects underway on adjacent roadways and the anticipated low volumes of contaminated material present on site.

Overall, the assessment of the three remedial options identified that **Option 2 (Excavation and off-site disposal)** was the most appropriate in that it could address the presence of all identified COPCs and would not necessitate the costly design and construction of a containment cell or potentially ongoing environmental monitoring.

Based on these considerations, the preferred remedial strategy includes the following:

- Remediation of site soils as follows:
  - Area of TP26 in the north eastern portion of 150 Jardine Drive (Lot 21 DP29317), TRH impact in shallow soils (0.0 – 0.1 m) - (Area 1);

    Excavate stained TRH impacted soils, (likely to be top 200 mm) and place into drums for off-site disposal. Undertake validation sampling to ensure effective remediation.
  - Area of BH112 in the northern portion of 132 Jardine Drive (Lot 22 DP29317) adjacent to the residential building, ACM fragments in soil - (Area 2);

    Conduct an 'Emu Pick' of ACM fragments of the building footprint plus 5m in each direction. Rake top 100 mm of soil to reveal any ACM fragments and remove any ACM fragments revealed. All fragments to be double bagged for off-site disposal. A clearance certificate should be provided by a licensed asbestos assessor following completion of the remedial works.
  - Area of BH202 in the northern portion of 160 Jardine Drive (Lot 20 DP29317) near the former residential building, ACM fragments in soil - (Area 3);

    Conduct an 'Emu Pick' of ACM fragments of the building footprint plus 5m in each direction. Rake top 100 mm of soil to reveal any ACM fragments and remove any ACM fragments revealed. All fragments to be double bagged for off-site disposal. A clearance certificate should be provided by a licensed asbestos assessor following completion of the remedial works.
  - Area of BH208 in the southern portion of 160 Jardine Drive (Lot 20 DP29317) near the former storage shed, ACM fragments in soil – (Area 4);

    Conduct an 'Emu Pick' of ACM fragments of the building footprint plus 5 m in each direction. Rake top 100 mm of soil to reveal any ACM fragments and remove any ACM fragments revealed. All fragments to be double bagged for off-site disposal. A clearance certificate should be provided by a licensed asbestos assessor following completion of the remedial works.

# 7. Remedial works plan

## 7.1 Overview and scope

The scope of remediation to be carried out, based on the selected approach, is envisaged to comprise an 'Emu Pick' to remove ACM fragments from soil surface and subsequent raking to ensure top 100 mm of soil is free of asbestos fragments. TRH impacted soil will be excavated for offsite disposal.

## 7.2 Roles and responsibilities

The Remediation Contractor will be responsible for undertaking the remedial works.

The Environmental Consultant will be required to provide an independent review and validation of the remedial works. This will include validation of soils in the area impacted with TRH and provision of an Asbestos Clearance Certificate.

## 7.3 Preliminaries and approvals

Prior to commencing remedial works, all relevant licences and approvals must be obtained by the site owner, Environmental Consultant and/or Remediation Contractor from the relevant authorities. It has previously been established that the remedial works at this site are deemed 'Category 2' remediation and therefore do not require development consent. There is however a requirement to give notice of intended remedial works to the local council.

Prior to establishment at the site, the Remediation Contractor must possess plans, programmes, licences, certificates and other documents necessary for the commencement of the work. All such plans must be completed and approved by the relevant consent authority (where required). These documents are anticipated to include, but not limited by, the following:

- A detailed work programme
- Insurance Certificates
- WorkCover Authority notifications
- A management plan and procedures covering all aspects of the work, including:
  - Occupational Health and Safety
  - Environmental Management
  - Project Management
  - Emergency Response Procedures

It is the responsibility of the Remediation Contractor to prepare and obtain all appropriate documentation prior to the commencement of the works.

Following provision and approval of these documents, the Remediation Contractor will mobilise all necessary plant, equipment and amenities as required to complete the project in accordance with these requirements.

Given that there are areas of identified bonded ACM contamination, a supervisor licensed for the management and monitoring of bonded asbestos (Class B) is required on site at all times during remediation.

## 7.4 Site establishment

Prior to site establishment, all staff involved in the remedial works must be aware of, and provided with all relevant documents necessary for the commencement of work.

Prior to any work commencing, the Remediation Contractor shall delineate, barricade and manage the nominated remediation work area in accordance with WorkCover requirements. The extent of the remediation required will be verified with the Environmental Consultant on site.

Accesses to the work area will be determined by the Remediation Contractor. The site shall be accessible only to personnel inducted for work within the work area.

## 7.5 Management of TRH impacted material

Excavation work must be undertaken as follows:

- Sequencing of the work is to be agreed with the Client and the Environmental Consultant prior to commencement of the works.
- All necessary environmental control and Workplace Health and Safety measures must be implemented prior to the commencement of any excavation work and it must be ensured that such measures are properly implemented and maintained throughout the work period. This includes taking the appropriate measures to avoid dust generation and any migration of potential contaminants.
- All excavation work and transportation of excavated soil must be carried out so to prevent dust generation and/or cross-contamination of unexcavated and/or uncontaminated areas of the site.
- Excavated area should be validated by an Environmental Consultant as described in Section 7.7.

## 7.6 Validation

Following remediation, the TRH impacted area at 150 Jardine Drive (area of TP26) is required to be validated. This validation will require soil sampling of the walls and base of the excavation on a '1 soil sample per 5 linear metres of wall basis' with 1 sample from the base collected. It is likely that 3 samples in total will be sufficient to validate this area (depending on the extent of the soil contamination).

Following the emu pick of ACM fragments at the three defined areas described in section 1.1 and raking of these areas, and an additional emu pick, a clearance certificate is required to be prepared by a licensed asbestos assessor. One clearance certificate can be provided to cover all of the areas identified for remediation providing each of these areas is clearly described within the clearance certificate.

## 7.7 Demobilisation

Following completion of remediation works, the Remediation Contractor shall be responsible for removing all plant, equipment and general rubbish generated through the remediation process.

## 7.8 Reporting

An appropriately qualified Environmental Consultant should produce a validation report detailing the completion of the remediation works. The report should be completed in

accordance with the NSW EPA (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*.

# 8. Remediation site management

The following provides a guide to the minimum site management controls that should be implemented for the remedial works. The selected Remediation Contractor should however prepare its own site management and occupational health and safety protocols that are based on these controls and any other regulatory requirements.

## 8.1 Site access and security

Temporary boundary fencing should be set up to prevent public access to the site.

## 8.2 Hours of operation

All remediation work shall be conducted in compliance with Principal Contractor's standard hours of construction and work and any council requirements.

## 8.3 Dust control

Dust emissions shall be confined within the site boundary. The following dust control procedures must be employed to comply with this requirement:

- Vehicles transporting waste or other materials that may produce odours or dust will be covered;
- Water sprays will be used to suppress any potential asbestos fibres and dust in the areas where ACM remediation is being undertaken. Water spray equipment is to be readily accessible to ensure it can be applied on site at the onset of windy conditions;
- Covering of all temporary stockpiles of contaminated soil remaining more than 24 hours;

Dust emissions shall also be controlled by ensuring vehicles leave via stabilised site access.

## 8.4 Noise

The remedial works will also comply with *NSW Interim Construction Noise Guidelines* (DECC 2009).

No "offensive noise" as defined under the *Protection of the Environment Operations Act*, 1997 shall be created during remediation works/activities.

All associated mechanical plant, equipment and the like used during remediation works/activities shall use all practical and reasonable noise attenuating devices and measures to minimise noise being transmitted from the site.

## 8.5 Odours

Offensive odours are not expected to be encountered during site remediation. If encountered, odour shall be controlled so that no odours are detected at any boundary of the site during remediation works. The following procedures may be employed to comply with this requirement:

- use of appropriate soil covering techniques e.g. use of plastic sheeting to cover excavation faces or stockpiles; and
- adequate maintenance of equipment and machinery to minimise exhaust emissions.

## 8.6 Materials management

All waste generated by the remediation contractor as part of remedial works must be stored in appropriate containers or piles, which will be appropriately sealed or lined (to prevent leaching or creation of dust) in a designated area, prior to offsite disposal. Waste will be disposed of by approved waste handlers, in accordance with NSW EPA guidelines and/or best industry practice.

## 8.7 Workplace health and safety and asbestos management plan

### 8.7.1 Health and safety plan

A workplace health and safety (WHS) plan is an essential part of all remediation projects to manage the health and safety of all personnel working on or visiting the site.

A detailed Workplace Health and Safety (WHS) plan must be prepared by the Remediation Contractor prior to the commencement for remedial works. The WHS plan is to be developed in accordance with the relevant regulatory guidelines.

The purpose of the plan is to provide all relevant health and safety information for all personnel undertaking work at the site and to provide and maintain safety standards and practices which offer the highest practical degree of personal protection to the on-site workers, based on current knowledge.

The works should comply (at a minimum) with all legislation, regulations and standards. At a minimum the legislation related to activities that may take place during the remedial works will include:

- NSW (2003), *OH&S Amended (Dangerous Goods) Act*.
- AS 2436 (1981). *Guide to Noise Control on Construction, Maintenance and Demolition Sites.*
- AS 1470 (1986). *Health and Safety at Work – Principles and Practices.*
- AS 1319 (1994). *Safety Signs for the Occupational Environment.*
- NSW WorkCover (2014). *Managing asbestos in or on soil*.
- NSW WorkCover (2011). *Code of Practice - How to Manage and control asbestos in the workplace.*
- Safe Work Australia (2011). *Code of Practice – How to Safely Remove Asbestos.*
- Safe Work Australia (2011). *Code of Practice - Excavation Work.*
- *Workplace Health and Safety Act (2011)*.
- *Workplace Health and Safety Regulation (2011)*.

### 8.7.2 Asbestos management

Under the *Work Health and Safety Regulation 2011* laws asbestos removal work is licensed. A licence for friable asbestos removal work is a 'Class A' asbestos removal licence and a licence for bonded asbestos removal work is a 'Class B' asbestos removal work licence under the *Work Health and Safety Regulation 2011*. Based on the known presence of bonded ACM and friable

asbestos not having been detected at the site, the works will require a Class B licenced contractor.

Asbestos air monitoring is not a statutory requirement during removal of bonded ACM as detailed in the SafeWork NSW/WorkSafe Australia guidelines regarding working with and removal of asbestos. It is however considered industry best practice to undertake boundary air monitoring during all asbestos remediation work.

## 8.8 Safe work practices

The Contractor will be required to assess the level of personal protective equipment (PPE) for personnel working at the site. This may include:

- P2 mask or equivalent respirator
- Tyvek suit
- Steel capped boots
- Hard hat
- Safety vest
- Safety glasses (when in an active work zone).

Personnel working at the site will be required to prevent the transport of contaminants out of the site.

Appropriate amenities and decontamination facilities should be provided by the remediation Contractor.

## 8.9 Emergency response plan

An Emergency Response Plan should be prepared by the remediation contractor prior to the commencement of the remediation works.

The purpose of the plan is to identify possible emergency situations and to define procedures that would be used to ensure the safety of both on- and off-site personnel in the event of an emergency.

The information to be provided (but not limited to) in the plan will include:

- Assignment of responsibilities to nominated key personnel
- Hazard assessment of potential off-site impacts;
- Emergency responses
- Reporting to regulatory authorities

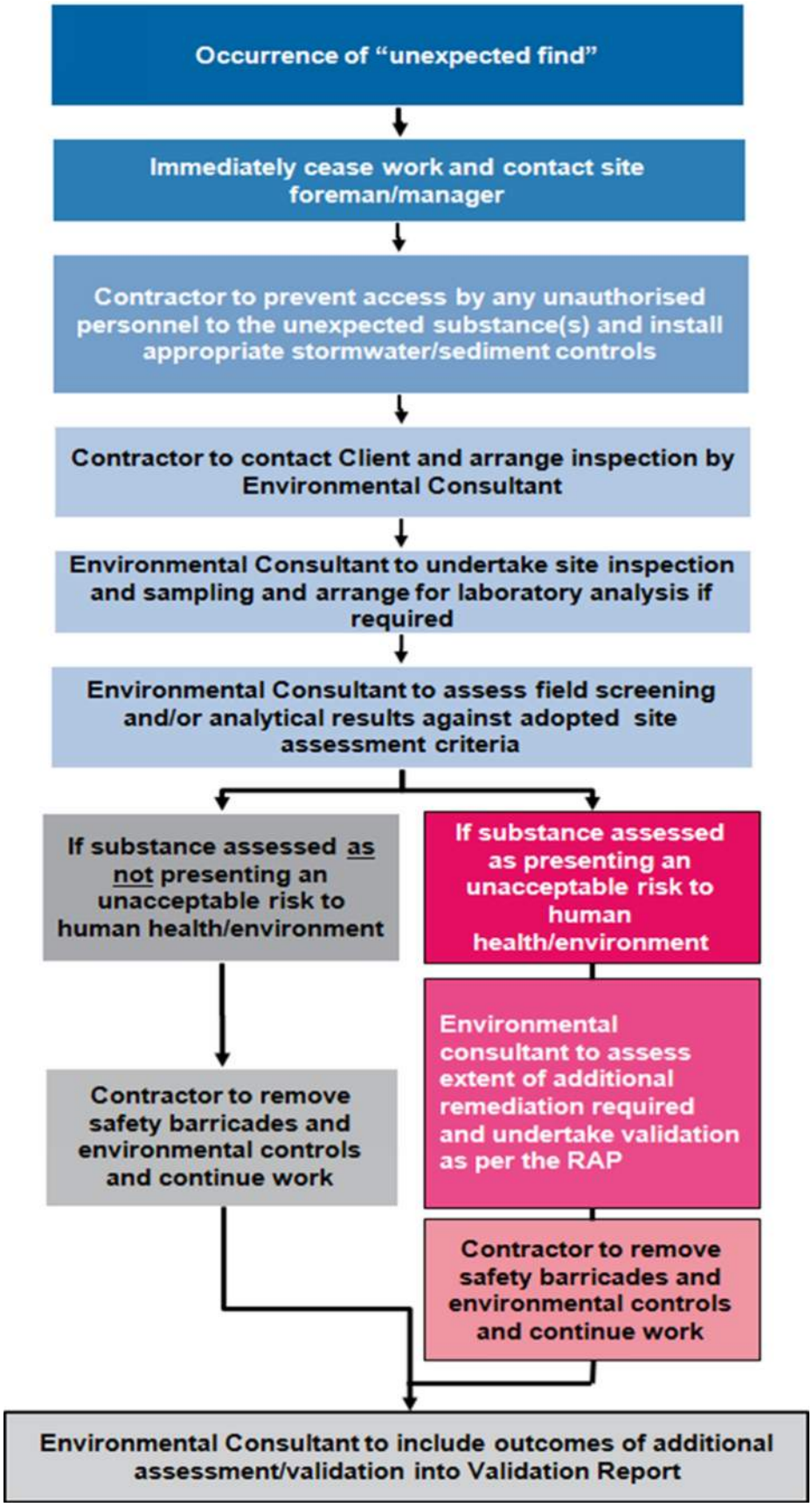
Features that should be included in the plan are procedures for:

- Dealing with on-site fires / explosions
- Dealing with chemical spills
- Dealing with rupturing of buried services
- Dealing with unknown / uncertain situations
- Dealing with gas releases
- First aid for injured personnel

- Evacuation for on-site personnel
- Notification for emergency response services (e.g. fire brigade, ambulance, police and hospitals)

## 8.10 Unexpected finds protocol

The presence of unknown materials could be highlighted during remedial works by the observation of unusual physical/sensory characteristics of the contaminated fill material. All site personnel should be instructed on the circumstances which may trigger the identification of unexpected contaminated material. In the event that unexpected contaminated material is identified at the site, an assessment of the impact of the material must be undertaken and management requirements provided by a suitably qualified environmental consultant. The procedures to be followed in the event of an unexpected find are shown in **Chart 1**.


Occurrence of "unexpected find"
Immediately cease work and contact site foreman/manager
Contractor to prevent access by any unauthorised personnel to the unexpected substance(s) and install appropriate stormwater/sediment controls
Contractor to contact Client and arrange inspection by Environmental Consultant
Environmental Consultant to undertake site inspection and sampling and arrange for laboratory analysis if required
Environmental Consultant to assess field screening and/or analytical results against adopted site assessment criteria
If substance assessed as not presenting an unacceptable risk to human health/environment
If substance assessed as presenting an unacceptable risk to human health/environment
Contractor to remove safety barricades and environmental controls and continue work
Environmental consultant to assess extent of additional remediation required and undertake validation as per the RAP
Contractor to remove safety barricades and environmental controls and continue work
Environmental Consultant to include outcomes of additional assessment/validation into Validation Report

# 9. References


- *Contaminated Land Management Act 1997*
- GeoEnviro Consultancy Pty Ltd (2015). *Contamination Assessment – Proposed Residential Subdivision Development Lot 21 in DP 29317, No 150 Jardine Drive, Edmondson Park, NSW* (JC15236A).
- GHD (2015). 130, 132, 160 and 170 Jardine Drive, Edmondson Park, NSW, *Preliminary Site Investigation*, (21/23862 25776).
- NEPM (2013). National Environment Protection (Assessment of Site Contamination) Measure, National Environment Protection Council (NEPC).
- NSW DEC (2006). *Contaminated Sites: Guidelines for NSW Site Auditor Scheme*.
- NSW DECC (2009). *Waste Classification Guidelines Part 1: Classifying Waste*.
- NSW EPA (2011). *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*.
- NSW WorkCover (2014). *Managing asbestos in or on soil*.
- NSW WorkCover (2011). *Code of Practice - How to Manage and control asbestos in the workplace*.
- Safe Work Australia (2011). *How to Manage and Control Asbestos in the Workplace*.
- Safe Work Australia (2011). *How to Safely Remove Asbestos*.

# 10. Limitations

*This Remedial Action Plan ("RAP"):*

1. *has been prepared by GHD Pty Ltd ("GHD") for Catholic Education Office, Diocese of Wollongong;*
2. *may only be used and relied on by Catholic Education Office, Diocese of Wollongong;*
3. *must not be copied to, used by, or relied on by any person other than Catholic Education Office, Diocese of Wollongong without the prior written consent of GHD and subject always to the next paragraph;*
4. *may only be used for the purpose as stated in this RAP (and must not be used for any other purpose).*

*GHD and its servants, employees and officers otherwise expressly disclaim responsibility to any person other than Catholic Education Office, Diocese of Wollongong arising from or in connection with this RAP.*

*To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the RAP are excluded unless they are expressly stated to apply in this RAP.*

*The services undertaken by GHD in connection with preparing this RAP:*

- were limited to those specifically detailed in Section 1 of this RAP and GHD proposal email dated 26th August 2016, from John Ewing to Chris Whelen;
- were undertaken in accordance with current profession practice and by reference to relevant environmental regulatory authority and industry standards, guidelines and assessment criteria in existence as at the date of this RAP and any previous site investigation and assessment RAPs referred to in the RAP.

*The opinions, conclusions and any recommendations in this RAP are based on assumptions made by GHD when undertaking services and preparing the RAP ("Assumptions"), as specified throughout this RAP.*

*GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the Assumptions being incorrect.*

*Subject to the paragraphs in this section of the RAP, the opinions, conclusions and any recommendations in this RAP are based on conditions encountered and information reviewed at the time of preparation of this RAP and are relevant until such times as the site conditions or relevant legislations changes, at which time, GHD expressly disclaims responsibility for any error in, or omission from, this RAP arising from or in connection with those opinions, conclusions and any recommendations."*

*This RAP is based solely on the investigations and findings contained in the reports referenced in the RAP and on the conditions encountered and information reviewed at the time of each Attached Report. This RAP should be read in conjunction with the Attached Reports. It is also subject to all the limitations and recommendations in the Attached Reports.*

*GHD has prepared this RAP on the basis of information provided by Catholic Education Office, Diocese of Wollongong and others who provided information to GHD (including Government*

*authorities), which GHD has not independently verified or checked ("Unverified Information") beyond the agreed scope of work.*

*GHD expressly disclaims responsibility in connection with the Unverified Information, including (but not limited to) errors in, or omissions from, the RAP, which were caused or contributed to by errors in, or omissions from, the Unverified Information.*

*The opinions, conclusions and any recommendations in this RAP are based on information obtained from, and testing undertaken at or in connection with, specific sampling points and may not fully represent the conditions that may be encountered across the site at other than these locations. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.*

*Investigations undertaken in respect of this RAP are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this RAP.*

*GHD has considered and/or tested for only those chemicals specifically referred to in this RAP and makes no statement or representation as to the existence (or otherwise) of any other chemicals.*

*Site conditions (including any the presence of hazardous substances and/or site contamination) may change after the date of this RAP. GHD expressly disclaims responsibility:*

- arising from, or in connection with, any change to the site conditions; and
- to update this RAP if the site conditions change.

*Except as otherwise expressly stated in this RAP GHD makes no warranty or representation as to the presence or otherwise of unidentified asbestos and/or asbestos containing materials ("ACM") on the site. If fill material has been imported on to the site at any time, or if any buildings constructed prior to 1970 have been demolished on the site or material from such buildings disposed of on the site, the site may contain additional asbestos or ACM.*

*Subsurface conditions can vary across a particular site and cannot be exhaustively defined by the investigations carried out prior to this RAP. As a result, it is unlikely that the results and estimations expressed or used to compile this RAP will represent conditions at any location other than the specific points of sampling. A site that appears to be unaffected by contamination at the time of the reports attached to this RAP may later, due to natural causes or human intervention, become contaminated.*

*Except as otherwise expressly stated in this RAP, GHD makes no warranty, statement or representation of any kind concerning the suitability of the site for any purpose or the permissibility of any use, development or re-development of the site.*

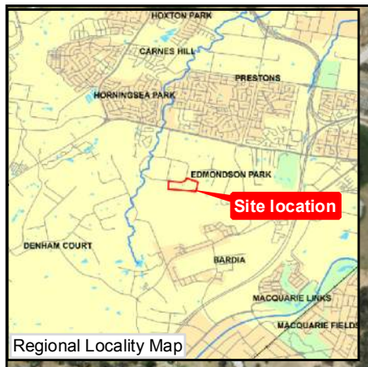
*These Disclaimers should be read in conjunction with the entire RAP. This RAP must be read in full and no excerpts are taken to be representative of the findings of this RAP.*

# Appendices

# **Appendix A** - Figures

Figure 1- Site Location Map

Figure 2 – Remediation Areas



Regional Locality Map



Paper Size A3

0 50 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Site Boundary (Approximate)
- Major Waterways
- Streets

Catholic Education Office - Diocese of Wollongong
Remedial Action Plan
Jardine Drive, Edmondson Park, NSW

| | |
|---|---|
| Job Number | 21-25776 |
| Revision | A |
| Date | 14 Sep 2016 |

Site Location

Figure 1

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Data source: Imagery - ©Land and Property Information (Extracted: 14/09/16); Streets, Waterways - NSW LPI 2012 DTDB. Created by:mweber

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au


Paper Size A3

0 5 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Site Boundary (Approximate)
- Streets
- Borehole Location
- Testpit Location
- ACM Observed
- TRH Contamination

Catholic Education Office - Diocese of Wollongong
Remedial Action Plan
Jardine Drive, Edmondson Park, NSW

| | |
|---|---|
| Job Number | 21-25776 |
| Revision | A |
| Date | 14 Sep 2016 |

# Remediation Areas

Figure 2

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Data source: Imagery - ©Land and Property Information (Extracted: 14/09/16); Streets - NSW LPI 2012 DTDB. Created by:mweber

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

GHD

133 Castlereagh St Sydney NSW 2000

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T: +61 2 9239 7100  F: +61 2 9239 7199  E: sydmail@ghd.com.au



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