Remedial Action Plan Addendum – Farm Shed

771 Cudgen Road, Cudgen, NSW

January 2019, Ref. 18084 R04 V2

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771 Cudgen Road,
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Ref: 18084 R04 V2

for

Woollam Constructions Pty Ltd

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1.0 Introduction

Cavvanba Consulting (Cavvanba) was engaged by Woollam Constructions Pty Ltd (Woollam) to prepare a remedial action plan (RAP) for asbestos contamination in soil at a site located at 771 Cudgen Road, Cudgen NSW 2487.

This RAP should be read in full, including Section 1.5, *General limitations to environmental information.*

1.1 Professional experience

Cavvanba is a specialist contaminated land consultancy and is suitably qualified to conduct the works. Cavvanba employees hold certified environmental practitioner (CEnvP) qualifications, which are nationally recognised competencies.

Cavvanba is a full member of the Australian Contaminated Land Consultants Association (ACLCA) in NSW and Queensland. ACLCA is an association that "represents the major environmental consulting firms involved in the assessment and management of contaminated sites in Australia".

Ben Wackett is a WorkCover NSW licensed asbestos assessor (LAA 000132), and an associate member of the Australian Institute of Occupational Hygienists (AIOH). Ben is also a NSW EPA accredited Site Auditor, under the *Contaminated Land Management Act 1997.*

Ben is a member of the Environmental Institute of Australia and New Zealand (EIANZ).

1.2 Background

The site consists of a farm shed, residential house and garage with farmland extending out into the western portion. Refer to Figure 1 for an overview of the investigation boundary and features. It is understood that the previous owner had occupied the site for approximately 30 years, and used it for agriculture.

As part of the new Tweed Valley Hospital development the residential house and garage are proposed to be demolished in order for preliminary works to continue at the site. OCTIEF conducted a preliminary and detailed investigation at the site in September 2018:

- OCTIEF (2018), *Preliminary and Detailed Site Investigation – 771 Cudgen Road, Cudgen, NSW 2487* (Ref. J8961).

The scope comprised of a soil and groundwater investigation which extended broadly over 771 Cudgen Road (Lot Lot 11, Deposited Plan 1246853). A total of 44 boreholes were advanced over the site, however it is noted that only two of these boreholes are relevant to the investigation area of this report (HA1 and HA2).

OCTIEF (2018) prepared a remediation action plan for asbestos contaminated soil associated with the farm shed, adjacent to the house:

- OCTIEF (2018) *Remediation action plan – Tweed Valley Hospital Site, 771 Cudgen Road, Cudgen NSW* (Ref: J8961).

Cavvanba conducted a contamination investigation at the site during November and December 2018, focussing on contaminants of asbestos, lead and organochlorine pesticides (OCPs) associated with the farm shed:

- Cavvanba Consulting (2019), *Soil investigation report – Farm shed, 771 Cudgen Road, Cudgen, NSW* (Ref.: 18084 R03).

The investigation included the advancement of 21 test pits to maximum explored depths of 0.3 m. Delineation of ACM in soil has not been completely achieved for the farm shed.

Investigation beyond the immediate perimeter hasn't been undertaken at TP32 due to presence of an access road. The results are further discussed in Section 2.5.

1.3 Objectives

The objectives of the RAP are to:
- summarise background information and current conditions at the site;
- summarise the nature and extent of contamination at the site;
- summarise the results with respect to the proposed land use;
- describe the regulatory issues associated with the proposed remediation;
- describe the overall remedial strategy necessary to remove unacceptable risks to human health and the environment associated with the identified contaminants, as well as potential contingencies; and
- describe the remedial works to be conducted, including environmental management, occupational health and safety (OH&S), and site validation.

1.4 RAP Requirements

Office of Environment and Heritage (OEH) (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*, describes that RAPs should:

- Set remediation goals that ensure the remediated site will be suitable for the proposed use and will pose no unacceptable risk to human health or to the environment.
- Document in detail all procedures and plans to be implemented to reduce risks to acceptable levels for the proposed site use.
- Establish the environmental safeguards required to complete the remediation in an environmentally acceptable manner.
- Identify and include proof of the necessary approvals and licenses required by regulatory authorities.

The information required by OEH (2011) in regard to RAPs, and where this information is addressed in this RAP, is shown in Table 1.1. Section 2 of the RAP summarises the site condition and previous investigation findings, and is based on the previous Cavvanba investigation.

Table 1.1: RAP requirements

Report requirement	Section
Discussion of the extent of remediation required.	4.0
Identification of regulatory compliance requirements such as licences and approvals.	5.0
Remediation goal.	6.1
Discussion of possible remedial options and how risk can be reduced.	6.2
Rationale for the selection of recommended remedial option.	6.3.1
Contingency plan if the selected remediation strategy fails.	6.4
Proposed testing to validate the site after remediation.	7.1

Report requirement	Section
Interim site management plan (before remediation), including e.g. fencing, erection of warning signs, stormwater diversion.	8.2
Site management plan (operation phase): - site stormwater management plan; - soil management plan; - noise control plan; - dust control plan, including wheel wash (where applicable); - odour control plan; and - occupational health and safety plan.	8.0
Remediation schedule.	8.4
Hours of operation.	8.5
Contingency plans to respond to site incidents, to obviate potential effects on surrounding environment and community.	8.7
Names and phone numbers of appropriate personnel to contact during remediation.	8.8
Community relations plans, where applicable.	n/a
Staged progress reporting, where appropriate.	n/a
Long-term site management plan.	8.9

1.5 Limitations

The findings of this report are based on the objectives and scope of work outlined above. Cavvanba performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental assessment profession. No warranties or guarantees, express or implied, are made. Subject to the scope of work, Cavvanba's assessment is limited strictly to identifying typical environmental conditions associated with the subject property, and does not include evaluation of any other issues. This report does not comment on any regulatory obligations based on the findings, for which a legal opinion should be sought. This report relates only to the objectives and scope of work stated, and does not relate to any other works undertaken for the Client.

The report and conclusions are based on the information obtained at the time of the assessment. Changes to the subsurface conditions may occur subsequent to the investigation described herein, through natural processes or through the intentional or accidental addition of contaminants, and these conditions may change with space and time.

The site history, and associated uses, areas of use, and potential contaminants, were determined based on the activities described in the scope of work. Additional site history information held by the Client, regulatory authorities, or in the public domain, which was not provided to Cavvanba or was not sourced by Cavvanba under the scope of work, may identify additional uses, areas of use and/or potential contaminants. The information sources referenced have been used to determine site history and desktop information regarding local subsurface conditions. While Cavvanba has used reasonable care to avoid reliance on data and information that is inaccurate or unsuitable, Cavvanba is not able to verify the accuracy or completeness of all information and data made available.

Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history, and which may not be expected at the site. The absence of any identified hazardous or toxic materials on the subject property, should not be interpreted as a

warranty or guarantee that such materials do not exist on the site. If additional certainty is required, additional site history or desktop studies, or environmental sampling and analysis, should be commissioned.

The results of this assessment are based upon site inspection and fieldwork conducted by Cavvanba personnel and information provided by the Client. All conclusions regarding the property area are the professional opinions of the Cavvanba personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, Cavvanba assumes no responsibility or liability for errors in any data obtained from regulatory agencies, information from sources outside of Cavvanba, or developments resulting from situations outside the scope of this project.

2.0 Site Setting

2.1 Site identification

The site location and investigation boundary are shown on Figure 1.

Owner:	Health Infrastructure NSW.
Street address:	771 Cudgen Road, Cudgen NSW 2487.
Property description:	Lot 11 Deposited Plan (DP) 1246853.
Investigation area (part of Lot 11 DP1246853):	Approximately 750 m^2 (consisting of the area surrounding the residential house and garage).
Co-ordinates:	Latitude: -28.265041651 Longitude: 153.566689951.
Local government area:	Tweed Shire Council.
Elevation:	Approximately 27 m above AHD.
Landuse – existing:	Rural Residential/Agricultural.
Landuse – proposed:	Hospital.
Zoning – existing:	RU1 Primary Production.
Zoning – proposed:	SP2 Infrastructure (Hospital).

2.2 Surrounding Land Uses

The site is located in an area of mainly rural and recreational landuse, with the surrounding landuses identified as:

North:	Agricultural land use, followed by bushland.
East:	Cudgen Road followed by TAFE NSW Kingscliff.
West:	Agricultural land use.
South:	Cudgen Road followed by agricultural land use.

2.3 Surrounding environment

The site is situated at approximately 27 m AHD. Cudgen Creek is located approximately 500 m to the south-east of the site.

These environments are considered to be sensitive receptors, the aquatic ecosystem and dependent species would be potential environmental receptors. Recreational users of the creek would be potential human receptors, including both primary (e.g. swimming) and secondary (e.g. boating) contact.

2.4 Topography

The site is relatively flat with a slight slope falling toward the south-west.

2.5 Geology and soils

2.5.1 Geology

Based on NSW Environment & Heritage Soil and Land Information (eSPADE, accessed 13 December 2018), the site lies on Lamington Volcanics—Tertiary basalt, consisting of rhyolite, trachyte, tuff, agglomerate, conglomerate.

The landscape consists of very low to low undulating hills and rises on the Cudgen Plateau and nearby basalt caps. Elevation is 30–40 m on the Cudgen Plateau.

The vegetation in the area is cleared closed-forest (rainforest). Most of this landscape is cultivated, but the original vegetation would have been be similar to that of the Limpinwood (li) or Green Pigeon (gp) soil landscapes.

2.5.2 Soils

Based on NSW Environment & Heritage Soil and Land Information (eSPADE, accessed 10 January 2019) the soil profile in the area consists of deep (>100 cm), well-drained red silty clay (Krasnozems). This soil profile is consistent with the observations made during the investigation of the house and garage.

2.6 Previous environmental investigation

Cavvanba conducted a soil investigation at the site during November and December 2018:

- Cavvanba Consulting (2018), *Soil investigation report – Farm shed, 771 Cudgen Road, Cudgen, NSW* (Ref.: 18084 R03).

The potential sources of contamination were identified to be associated with lead paint, underneath the farm shed slab and areas where ACM fragments had been previously identified. These areas were targeted for potential contamination of asbestos, lead and/or OCPs.

2.6.1 Scope

The scope of work included:

- Review of a previous environmental investigation (OCTIEF, 2018).
- Completion of a comprehensive site walkover and visual inspection for key features to identify potential areas of environmental concern on- and off-site.
- Advancement of 21 soil test pits using a hand auger in a staged investigation.
- Collect and analyse samples for potential contaminants of concern, which will assist in the classification of any material required for offsite disposal.
- Inclusion of the results and findings into a report.

The analytical results were compared to residential land use with minimal opportunities for soil access land use for human health screening (HIL A), urban residential and public open space environmental screening (EIL), and site-specific asbestos criteria and have been provided in Section 2.5.3.

2.6.2 Sampling conducted

The assessment of asbestos impact was undertaken by targeted test pit locations positioned around the farm shed perimeter. A total of 21 test pits were advanced around

the perimeter and beneath the concrete slab which may represent potential sources of contamination. Cavvanba's expectation of contamination based on similar sites, is that asbestos fibres in soil are usually associated with nearby fragments of ACM from buildings.

Therefore, the sampling strategy included collection of samples at the following locations:
- within 1 m of the existing perimeter on each side of the farm shed;
- eight samples beneath the farm shed concrete slab; and
- samples at 0.1 m and 0.3 m at each location.

Initial sample analysis selection was based on a minimum:
- beneath farm shed concrete slab;
- within 1 m of building perimeter i.e. on each side of the farm shed; and
- samples at shallow depth (0.1 m).

Additional analysis was undertaken at greater depths (0.3 m) to delineate any criteria exceedances in the shallow samples. The sampling strategy completed was considered to meet the definition of a systematic approach and meets the minimum sampling requirements in accordance with *Sampling Design Guidelines* (NSW EPA, 1995). Additionally, consideration was given to the Tweed Shire Council for Pre-Demolition Testing of organochlorine pesticides beneath structures and dwellings.

Table 2.1 below describes the rationale for the chosen sampling design and additional delineation sampling/analysis.

Table 2.1: Overall sampling design and rationale

Location/sample ID	Rationale
First stage of analysis	
TP20_0.1 to TP27_0.1	Targeting sub slab of farm shed.
TP31_0.1 to TP43_0.1	Targeting any potential sources of lead paint and or asbestos fibres in soil located around the farm shed.
Delineation sampling/analysis	
TP32_0.3	Further sampling/analysis conducted at 0.3 below the ground surface; aiming to delineate the vertical extent of asbestos fibres.

2.6.3 Analytical results

The results are summarised in Table 2.2 on the following page. The analytical results have been compared to the screening criteria adopted for the site. The NEPM health investigation and screening levels for residential land use (HIL A) have been used along with the ecological investigation levels (EILs) for urban residential and public open space to ascertain the magnitude of impacts.

Table 2.2: Soil analytical summary

Analyte	Health criteria	Ecological criteria	Site data			
	HIL / HSL (mg/kg)	EIL/ESL (mg/kg)	No. samples analysed	Number of detects	Max' (mg/kg) Detected (Yes/No)	Meets screening criteria?
Metals						
Lead	300	1,100	13	13	44	Yes
Organochlorine pesticides						
DDT+DDE+DDD	240	180[1]	21	1	0.27	Yes
Aldrin and dieldrin	6	-[2]		7	1.18	Yes
Chlordane	50	-		0	<0.05	Yes
Endosulfan	270	-		1	0.89	Yes
Endrin	10	-		0	<0.05	Yes
Heptachlor	6	-		0	<0.05	Yes
HCB	10	-	21	0	<0.05	Yes
Methoxychlor	300	-		0	<0.2	Yes
Asbestos in soil						
Asbestos	**Detect**	-	14	2	**Detect**	**No**

Table notes:
1 * Criteria for DDT only.
2 – No criteria available.
3 – **BOLD** indicates exceedance of HILs/site-specific asbestos criteria.
4 – Underscore indicates exceedances of EILs criteria.

The results are summarised below:
- two samples (TP32_0.1 and TP33_0.1) had detections of asbestos fibres in soil which exceeds the site-specific asbestos criteria. No asbestos was detected in soil at TP32 at 0.3 m depth, suggesting the impact was limited to shallow depths;
- all sample concentrations of lead were below residential criteria; and
- while OCPs were detected at three sample locations, concentrations were below the adopted criteria. The maximum sum of OCPs is 1.25 mg/kg.

2.6.4 Discussion and recommendations

Following this soil investigation and the previous investigation (OCTIEF, 2018), asbestos contamination is believed to be limited to:
- approximately 1 m from the north-eastern wall of the farm shed;
- approximately 3 m from the south-western wall of the farm shed; and
- no deeper than 0.3 m below the ground surface.

The nature of asbestos contamination is considered to be ACM in soil. Whilst is it recognised that asbestos fibres have been detected in laboratory analysed soil samples, the presence of fibres is expected to be the ACM, rather than a friable asbestos source such as pipe lagging or loose insulation. The condition of the ACM as observed by Cavvanba, did not appear to be highly weathered or pulverised. The detection of fibres in soil associated with ACM therefore does not represent an elevated risk of generating airborne fibres, and the material should otherwise be treated as bonded asbestos.

Investigation beyond the immediate perimeter hasn't been undertaken at TP32 due to presence of an access road. Determination of the extent in this area will be undertaken during the proposed remediation.

2.7 Recommendations

Based on the detection of asbestos fibres and observation of ACM in the soil around the former farm shed, remediation and/or management is required.

A remedial action plan for asbestos in soil should be prepared for the farm shed investigation area which should consider:
- off-site disposal; and/or
- on-site management/capping including long term management.

Based on the uneven distribution of visual observations of ACM fragments around the apron of the shed, a conservative approach should be adopted, and the ultimate extent of remediation should be based on field observations.

Validation samples will be collected following the completion of remediation.

2.8 Overarching RAP

OCTIEF was engaged by TSA management on behalf of NSW Health Infrastructure to compile a remediation action plan for Lot 11 DP 1246853 (the site) located at 771 Cudgen Road, Cudgen NSW:

– OCTIEF (2018) *Remediation action plan – Tweed Valley Hospital Site, 771 Cudgen Road, Cudgen NSW*. (Ref: J8961)

The OCTIEF RAP outlined remediation works which are considered Category 2. The scope included excavation and disposal of asbestos contaminated soil to the west of the farm shed. Given the remediation strategy is similar, this RAP supports the OCTIEF RAP.

3.0 Remediation criteria

The remediation area is to be made suitable for residential soil land use.

3.1 Asbestos in soil

It should be noted that the proposed use of the site is a public hospital. Cavvanba has therefore adopted site-specific investigation screening criteria. The screening criteria is a combination of no visual observations of ACM as well as non-detects of asbestos fibres in soil.

ASC NEPM 2013 states that the NEPM HILs are not protective of construction workers, and site specific risk should be taken into consideration: (Schedule B7: Guideline on health-based investigation levels – Section 3.1) *The HILs are therefore considered to be protective of exposures to other receptor populations; however, the HILs do not specifically address short-duration exposures that may occur during construction and maintenance of a site (including intrusive works). These exposures should be addressed on a site-specific basis.* Based on this, elimination of asbestos was seen as a more appropriate criteria for handing the site over from the demolition stage to the construction stage. This also takes into consideration the following points:

- the small area of asbestos present is likely to be limited and can be feasibly removed from the site;
- there are inherent and unavoidable uncertainties associated with the uneven distribution of ACM found on these types of sites, therefore a conservative approach has been adopted;
- there is a high level of public interest in this site, and eliminating asbestos issues for construction workers is considered appropriate, rather than to conveying risk to future workers by relying on criteria thresholds of asbestos concentrations in soil; and
- there are proposed construction works and the HILs for commercial/industrial landuse were not developed to be specifically protective of construction workers.

3.2 Waste

All soil material must be classified for disposal in accordance with the current NSW Environment Protection Authority (EPA) *Waste Classification Guidelines* (2014).

Off-site disposal may also consider interstate disposal to Queensland, with the appropriate approvals for contaminated soil and/or regulated wastes.

The soil data provided in the following report can be used for waste classification purposes in conjunction with additional sampling of soil to be disposed of off-site:

- Cavvanba Consulting (2018), *Soil Investigation Report – Farm shed, 771 Cudgen Road, NSW* (Ref.: 18084 R03).

The waste must be taken to a facility licenced to receive that waste.

3.3 Imported fill

Any soil imported to the site must be obtained from reputable suppliers and must comprise virgin excavated natural material (VENM).

Any material to be transported to another site is subject to the waste requirements of the POEO Act, i.e. the waste guidelines are relevant.

4.0 Extent of remediation required

4.1 Media

This remedial action plan is limited to soil only.

4.2 Potential contaminants of concern

Potential contaminants of concern associated with the site are limited to asbestos only.

The nature of asbestos contamination is considered to be ACM in soil. Whilst is it recognised that asbestos fibres have been detected in laboratory analysed soil samples, the presence of fibres is expected to be the ACM, rather than a friable asbestos source such as pipe lagging or loose insulation. The condition of the ACM as observed by Cavvanba, did not appear to be highly weathered or pulverised. The detection of fibres in soil associated with ACM therefore does not represent an elevated risk of generating airborne fibres, and the material should otherwise be treated as bonded asbestos.

4.3 Lateral and vertical extent

Delineation of ACM in soil has not been completely achieved for the farm shed and has been based on observations made in the field, soil analytical results, and conservative assumptions based on proximity to the building and a typical uneven distribution of ACM. Investigation beyond the immediate perimeter was not undertaken beyond TP32 due to presence of an access road.

Determination of the extent in this area will be undertaken during the proposed remediation. The ultimate extent of remediation will be established based on field observations of the presence of ACM fragments during the proposed remediation. Where undisturbed natural soil is encountered, this will be considered unlikely to be impacted with ACM, and represent the preliminary extent of excavations prior to validation.

5.0 Regulatory requirements

Regulatory aspects relating to the remediation of this site are summarised below.

5.1 SEPP 55

The planning approach to the remediation of contaminated land is legislated in *State Environmental Planning Policy No 55—Remediation of Land* which requires certain considerations of when consent is required to undertake remediation works. The SEPP classifies remediation as either:

- Category 1 – remediation work for which development consent is required; or
- Category 2 – remediation work not requiring development consent.

Whilst Category 2 remediation may not require consent, all relevant conditions described in the SEPP must be considered, and notice must be given to the consent authority and local council 30 days prior to the commencement of the work. It is understood that Tweed Shire Council was notified of remedial works on 5 December 2018.

The development application pathway for the Project consists of a staged Significant Development Application under section 4.22 of the Environmental Planning and Assessment Act 1979 (EP&A) Act. This report is provided to meet the requirements of SEPP 55 and Department of Planning and Urban Affairs (1998) *Planning Guidelines SEPP 55 – Remediation of Land*.

5.2 Environmentally Hazardous Chemicals act 1985

The Environmentally Hazardous Chemicals Act (1985) has been taken into consideration and is relevant to the remedial phase of the project. Section 4.14 in the order describes scheduled chemical wastes:

> *scheduled chemical wastes means any liquid or solid waste that contains one or more of the chemicals listed in Schedule A to this chemical control order where the total concentration of those chemicals is more than two milligrams per kilogram.*

The impacted soil is not considered to be a scheduled chemical waste as maximum reported concentrations of OCPs were 1.25 mg/kg, which is less than 2 mg/kg.

5.3 POEO Act 1997

The requirements of the *Protection of the Environment Operations (POEO) Act* 1997, and associated schedules and regulations, are relevant to the remedial phase of the project. The objectives of the Act include to protect, restore and enhance the quality of the environment in New South Wales, having regard to the need to maintain ecologically sustainable development.

The Act includes requirements not to pollute waters, to prevent or minimise air pollution, to maintain and operate plant in a proper and efficient condition/manner and to deal with materials in a proper and efficient manner to minimise noise impacts, and to minimise and manage wastes. The Act also requires notification to the EPA when a pollution incident occurs that causes or threatens material harm to the environment.

The POEO Act is relevant for disposal of wastes, importation of backfill materials, and excavation validation and reporting.

5.4 CLM Act

The Contaminated Land Management (CLM) Act 1997 enables the EPA to respond to contamination that is significant enough to warrant regulation to protect humans or the environment. The *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (June 2009) outline a decision-making process for reporting contamination to the EPA.

5.5 Environmental Planning & Assessment (EP&A) Act 1979

The Environmental Planning & Assessment (EP&A) Act enables the consent authority to consider the suitability of the site for the development, which includes whether the site is contaminated.

The site is mapped as having no known occurrence of acid sulphate soils (ASS). Based on this, a preliminary acid sulphate investigation is not considered necessary.

6.0 Remedial actions

6.1 Remediation goal

The remediation goal for the site is to:
- render the site suitable for the intended land use (for conservative purposes, residential with garden/accessible soils;
- remove any unacceptable risk to human health and environment associated with contaminated material; and
- ensure protection of the remediation team, surrounding community and the environment throughout the remediation works.

6.2 Remedial options

NEPM, 2013 outlines a remediation hierarchy in the Assessment of Site Contamination Policy Framework (Attachment A, page 8 and 9).

> *(16) Attainment of environmental outcome*
>
> *In general, to achieve the desired environmental outcome, the process of the assessment of site contamination should be placed within the context of the broader site assessment and management process. In particular, in assessing the contamination, the site assessor and others should take into account the preferred hierarchy of options for site clean-up and/or management which is outlined as follows:*
>
> - *on-site treatment of the contamination so that it is destroyed, or the associated risk is reduced to an acceptable level; and*
> - *off-site treatment of excavated soil, so that the contamination is destroyed or the associated risk is reduced to an acceptable level, after which soil is returned to the site; or*
>
> *If the above are not practicable,*
> - *consolidation and isolation of the soil on site by containment with a properly designed barrier; and*
> - *removal of contaminated material to an approved site or facility, followed, where necessary, by replacement with appropriate material;*
>
> *or,*
> - *Where the assessment indicates remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy.*

In assessing the remedial options available for the site, the following have been considered:
- the types and form of the contaminants present;
- the land use proposed for the remediation area;
- available proven remediation methods/technologies; and
- regulatory requirements.

Based on this, a range of remedial options has been considered, comprising:
1. no action;
2. treatment of the impacted material;
3. removal and offsite disposal of the impacted material.

A brief review of the remedial options is summarised on the following page.

6.2.1 No action

Contamination has been detected at the site which requires remediation and/or management and as the site is to be redeveloped, the 'no action' option is not considered to be appropriate.

6.2.2 Stabilisation/treatment

Stabilisation generally requires the excavation and either on-site or off-site treatment and/or disposal, and is essentially a remediation technology that reduces the mobility of contaminants, either by chemically altering or binding it (USEPA 1994). It is most applicable to inorganic (metal) contamination.

Immobilisation requires additional investigation, testing and verification, and at this stage is not considered appropriate.

6.2.3 Removal

Removal of contaminants involves physically digging up the contaminated material and off-site disposal of these materials. Contaminants can be effectively 'chased-out' based on the investigation results and current understanding. It is relatively time efficient and low-tech, however the removal requires some form of reinstatement and disruption, and can be costly for large volumes requiring off-site disposal.

Removal of ACM fragments by handpicking is not considered to be appropriate due to the detection of associated asbestos fibres in soil.

Delineation of ACM in soil has not been achieved for the farm shed. Investigation beyond the immediate perimeter hasn't been undertaken at TP32 due to presence of an access road. The lateral and vertical extent has however been estimated based on the laboratory results, field observations of ACM and typically irregular distribution of ACM. Approximately 100 m^3 of soil required disposal off-site, depending on the level of certainty required. Considering the detections of asbestos and the volume of waste present, removal is considered appropriate.

A remedial plan for removal has been provided as Figure 2. As a conservative measure, the strategy is to excavate and remove 0.3 m of soil across the entire remediation area.

6.2.4 Capping and containment

Capping

This primarily involves isolating the contaminated area with barriers and covering it so that it cannot be disturbed during normal site activities associated with the proposed landuse. The contamination therefore cannot generate dust, or come into contact with site occupiers. This option is generally applicable where the contamination is buried at depth, or will be buried at depth, where a layer of clean fill covers the impacted area. Capping also minimises disturbance, and infiltration of surface waters, therefore minimising the potential for migration of contaminants.

This option requires the placement of a geo-textile marker layer or similar to avoid disturbance, and requires ongoing management and notification on the Section 10.7 certificate.

The long term management also requires that its implementation is legally enforceable, and requires all stakeholders to agree. Given the relatively small volume of waste, and available resources for removal, this option is not considered to be appropriate.

In-situ

Containment technologies include both surface capping to impede direct contact (USEPA 1994), and construction of purpose built cells. ANZECC (1999) outlines design requirements for onsite containment of contaminated soils, and includes contingencies for accumulation of vapours, potential for groundwater contamination, infiltration etc. The option of designing and constructing a cell onsite is not considered a feasible option, and would require ongoing management and notification on the Council 10.7 certificate.

Ex-situ

Ex-situ containment involves excavation and re-placement of the soil in a suitable place, which may include a specially designed cell offsite. This option, when compared to disposal to landfill is not economical.

6.3 Remedial strategy

The remedial strategy of off-site disposal is considered to meet the remedial requirements and be acceptable for the proposed development. The asbestos remediation area is outlined in Figure 2.

Table 6.1: Summary remedial and management strategy

Aspect	Specific remedial or management strategy
Asbestos in soil	An asbestos in soil management area has been outlined in Figure 2 and is to be excavated and disposed of off-site.
Off-site disposal	Off-site disposal of soil is proposed. Asbestos has been detected in soil. A waste classification letter will need to be provided to the receiving landfill facility prior to disposal. Off-site disposal may include inter-juristictional transport and consignments. All necessary approvals and documented evidence of appropriate licences regarding disposal should be obtained prior to movement of asbestos contaminated soil.
Validation	Validation sampling for asbestos will be required, following the removal of impacted soil. This needs to be completed by a suitably qualified contaminated land environmental consultant. Further information is provided in Section 7.0.
Imported fill	If back filling is required, imported VENM may be required to bring the site back to grade, which will need to be evaluated in line with the guidance provided in Section 3.3.
Interim measures	Refer to Section 8.2.
Long term management	No long term management will be required, following the excavation and off-site disposal works.

6.3.1 Appropriateness of remedial strategy

For this site and scenario, the remedial strategy to excavate and remove up to 100 m^3 of asbestos contaminated soil is the most appropriate based on the following:

- the duration of remedial works;
- the volume of soil required for off-site disposal;
- minimal disturbance of the property; and
- long-term management or notification is considered unnecessary.

6.4 Remediation contingency

Remediation contingencies are limited to further excavation and disposal being required if the initial validation results have detections of asbestos.

7.0 Remediation validation and monitoring

7.1 Validation works

A validation report must be prepared following the works which is in accordance with:
- EPA (1995) *Contaminated Sites - Sampling Design Guidelines*;
- NSW OEH (2011) *Guidelines for consultants reporting on contaminated sites;*
- Western Australia Department of Health (WA DOH) (2009) *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*.

Validation sampling will be undertaken in accordance with WA DOH, and a quantitative assessment of asbestos in soil conducted. Based on an excavation area of approximately 200 m^2 the following will be required:
- At least 1 sample from each wall per 5 m length of strata of interest (or per 1 m depth), additional discretionary samples if necessary;
- Floor should be visually inspected and if suspect may need to be sampled at twice the minimum density outlined in NSW EPA Sampling Design Guidelines (1995). I.e. a minimum of ten locations will be required (ten locations for less than 0.05 hectares).

The report will provide a clear conclusion stating whether or not the RAP has been satisfied and a conclusion regarding the site suitability for its existing or proposed future use.

7.2 Imported fill

VENM is described in the waste guidelines as natural material (e.g. clay, gravel, sand, soil or rock fines):

- *that has been excavated or quarried from areas that are not contaminated with manufactured chemicals or process residues, as a result of industrial, commercial, mining or agricultural activities; and*
- *that does not contain sulphidic ores or soils, and includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved for the time by a notice published in the NSW Government Gazette.*

Any material to be transported to another site is subject to the waste requirements of the POEO Act, i.e. the waste guidelines are relevant.

To validate imported fill, one sample per 25 m^3 will be collected and analysed for potential contaminants of concern (PCOCs) as per NSW EPA *Technical Note: Investigation of Service Station Sites* (2014), namely metals (arsenic, cadmium, chromium, copper, lead, mercury and zinc), TRH, BTEXN, organochloride pesticides (OCPs) and polychlorinated biphenyls (PCBs). Visual observation for asbestos must also be conducted.

8.0 Site Management Plan

Specific controls and strategies for environmental protection during remediation forms part of the requirements of the RAP.

8.1 Hazard identification and exposure pathways

8.1.1 Hazards

Based on the site assessment, the hazards which require management are:
- soil potentially contaminated with asbestos; and
- standard construction site hazards.

8.1.2 Exposure

Exposure pathways are limited to inhalation of asbestos fibres.

8.2 Interim (before remediation)

The site is currently fenced, and Tweed Coast Demolition & Excavations Pty Ltd have put the following control measures in place in order to reduce the risk and or exposure to human health:
- geofabric material was placed over the topsoil contaminated with ACM fragments; and
- ~ 200 mm of clean gravel was placed over top of the geofabric material.

It is expected that the remediation works will be undertaken imminently, however in the circumstance that remediation is delayed, the surrounding fence and geofabric material should be maintained in order to sustain the appropriate control measures for asbestos.

8.3 Site management (remediation phase)

The remedial program should be undertaken with due regard to legislative requirements and any relevant environment planning instruments that apply to the site described in the above sections.

In particular, in addition to any statutory compliance required by the above-mentioned Acts and planning instruments, the contractor shall carry out the site works with all due care, to ensure that the following conditions are complied with, as far as practicable:
- wind-borne dust is minimised;
- no water containing any suspended matter or contaminants is to be allowed to leave the confines of the site in such a manner that it could pollute any nearby waterway;
- material from exposed, surfaces is not to be tracked onto other areas of the site by personnel or equipment; and
- noise levels at the site boundary are to comply with the Council requirements.

The contractor will ensure that each employee or sub-contractor employed by the contractor is familiarised with the requirements of the RAP by the site manager/supervisor. Specific environmental requirements relating to the remediation works include:

1. Maintain erosion and sediment controls to prevent offsite migration of impacted soils.

2. Use appropriate methods to control the generation of dust, e.g. limit extent of works at any one time, use water sprays to keep soils moist (but not enough to generate surfacewater), cover work areas if required, or stop work if wind sufficient to generate dust.

3. During excavation works, use methods which minimise manual handling of soils.

4. Minimise the movement of soil via personnel and machinery tracking soil out of the asbestos in soil remediation area.

5. Ensure all personnel whom are coming into contact with potentially contaminated soils are wearing appropriate personal protective equipment (PPE), such as gloves, long sleeves shirt, long pants and the like.

6. Given ingestion is a primary exposure pathway, all workers must wash their hands and faces before eating.

8.4 Remediation schedule

The remediation schedule is yet to be defined.

8.5 Hours of operation

Remediation works must comply with the development application, including:
- Monday to Saturday from 7.00 am to 5.00 pm;
- no work to be carried out on Sundays or Public Holidays; and
- the proponent is responsible to instruction and control subcontractors regarding hours of work.

8.6 Unexpected finds

As for all sites, a potential exists that wastes or contaminated soils exist through undetected hotspots or uncontrolled dumping. During the site works, all materials should be assessed for potential contamination. Indications of contamination include, but are not limited to, soils, fills or wastes which exhibit:
- staining or discolouration; and/or
- odours; and/or
- waste materials such as ash or slag; and/or
- construction or demolition wastes (brick, concrete, tile, timber, steel, carpet, etc.); and/or
- asbestos cement sheeting or pipe pieces or fragments; and/or
- bottles, chemical containers, broken glass, plastic, etc.; and/or
- white goods, garbage, etc.

An unexpected finding protocol (UFP) for the site works includes, the following:
- immediately stop work in the area of concern;
- contact the site manager or their designated authority;
- erect temporary barricading to prevent access, and warning signs as required;
- provide cover or suitable suppressant if odorous;
- provide erosion and sediment control measures as required; and
- contact appropriate organisations to provide specialist advice/support.

The UFP should be integrated with the site-specific emergency response plan. If the unexpected findings present an immediate hazard, then the emergency response plan should take precedence over the UFP

8.7 Contingency plans

The purpose of the contingency plan is to identify unexpected situations that could occur during the remediation works, and specify procedures that can be implemented to manage such situations and prevent adverse impacts to the environment and human health, and manage unexpected situations.

Contingency plans for the remedial works include:

- If initial validation works do not remove all sufficient contamination, further excavation and off-site disposal may be required to meet site criteria.

- Dust emissions are to be confined within the site boundary. The following dust control procedures may be employed to comply with this requirement:
  - minimisation of work areas;
  - erection of dust screens around the perimeter of the site or dust generating activities;
  - use of water sprays across the site to suppress dust (but not to generate runoff);
  - covering of all stockpiles of soil or other materials likely to generate dust or odours; and
  - changing or modifying work practices based on climatic conditions.

8.8 Contact details

The following contact details are to be provided:

Contact	Name	Details
The Tweed Hospital, Powell St & Florence Street, Tweed Heads NSW 2485	Nearest Medical Assistance	(07) 5536 1133
Emergency	-	000
Client	Tony Jackman Woollam Constructions Pty Ltd	0408 464 648
EPA	Pollution Hotline	(02) 9995 5000
Cavvanba Consulting Pty Ltd 1/66 Centennial Circuit, Byron Bay NSW 2481 ABN: 37 929 679 095	Ben Wackett Ross Nicolson Rob McLelland	0428 606 064 0488 225 692 02 6685 7811
Cavvanba Field Scientist	Glen Chisnall	0499 401 092

8.9 Long term management plan

A long-term management plan is not considered likely to be required following remediation works.

9.0 References

Consultant reports

Cavvanba Consulting (2018), *Residential house – soil investigation report, 771 Cudgen Road, Cudgen, NSW* (Ref.: 18084 R01).

Cavvanba Consulting (2018) *Residential house – remedial action plan addendum. 771 Cudgen Road, Cudgen, NSW* (Ref.: 18084 R02).

Cavvanba Consulting (2019) *Soil investigation report – Farm shed, 771 Cudgen Road, Cudgen, NSW* (Ref. 18084 R03).

OCTIEF (2018), *Preliminary and Detailed Site Investigation – 771 Cudgen Road, Cudgen, NSW 2487* (Ref. J8961).

OCTIEF (2018) *Remediation action plan – Tweed Valley Hospital Site, 771 Cudgen Road, Cudgen NSW* (Ref: J8961)

References

State of NSW and Office of Environment & Heritage (2018) eSPADE (accessed January 2019).

Asbestos Guidance

Western Australia Department of Health (WA DOH) (2009) *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*.

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EPA (1985) *Environmentally Hazardous Chemicals act 1985, Chemical control order in relation to scheduled chemical wastes. (Published in Government Gazette No 77 of 30.4.2004, p 2283)*.

DEC (2007) *Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination*. NSW EPA, Sydney.

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

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EPA (1995a) *Contaminated Sites: Guidelines for the Vertical Mixing of Soil on Former Broad-acre Agricultural Land*. NSW EPA, Sydney.

EPA (1995b) *Contaminated Sites: Sampling Design Guidelines*. NSW EPA, Sydney.

EPA (1997) *Contaminated Sites: Guidelines for Assessing Banana Plantation Sites*. NSW EPA, Sydney.

EPA (2005) *Contaminated Sites: Guidelines for Assessing Former Orchards and Market Gardens*. NSW EPA, Sydney.

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EPA (2012) *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases*.NSW EPA, Sydney.

EPA (2015) *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*. NSW DECC, Sydney.

EPA (November 2014) *Waste Classification Guidelines – Part 1: Classifying Waste*. NSW EPA, Sydney, NSW.

Office of Environment & Heritage (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*. NSW OE&H, Sydney.

Guidelines approved by the EPA

Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, August 2018).

ANZECC/NHMRC (1992) *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*. Australian and New Zealand Environment and Conservation Council and the National Health and Medical Research Council, Canberra.

Australian Government Department of Health (2017) *Health Based Guidance Values for PFAS for use in site investigations in Australia*.

Department of Health and Ageing and EnHealth Council (2002) *Environmental Health Risk Assessment: Guidelines for Assessing Human Health Risks from Environmental Hazards*. Commonwealth of Australia, Canberra.
Lock, W. H., (1996) "Composite Sampling", *National Environmental Health Forum Monographs, Soil Series No. 3*. SA Health Commission, Adelaide.

NEPC (1999) *National Environment Protection (Assessment of Site Contamination) Measure, Schedule A and Schedules B(1)-B(10), amended April 2013*. National Environment Protection Council, Adelaide.

NHMRC/ NRMMC (2011) *Australian Drinking Water Guidelines*. National Health and Medical Research Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, and Natural Resource Management Ministerial Council (NRMMC), Australian Government, Canberra.

NSW Agricultural/CMPS&F (1996) *Guidelines for the Assessment and Clean Up of Cattle Tick Dip Sites for Residential Purposes*. NSW Agricultural and CMPS&F Environmental, Canberra.

Figures

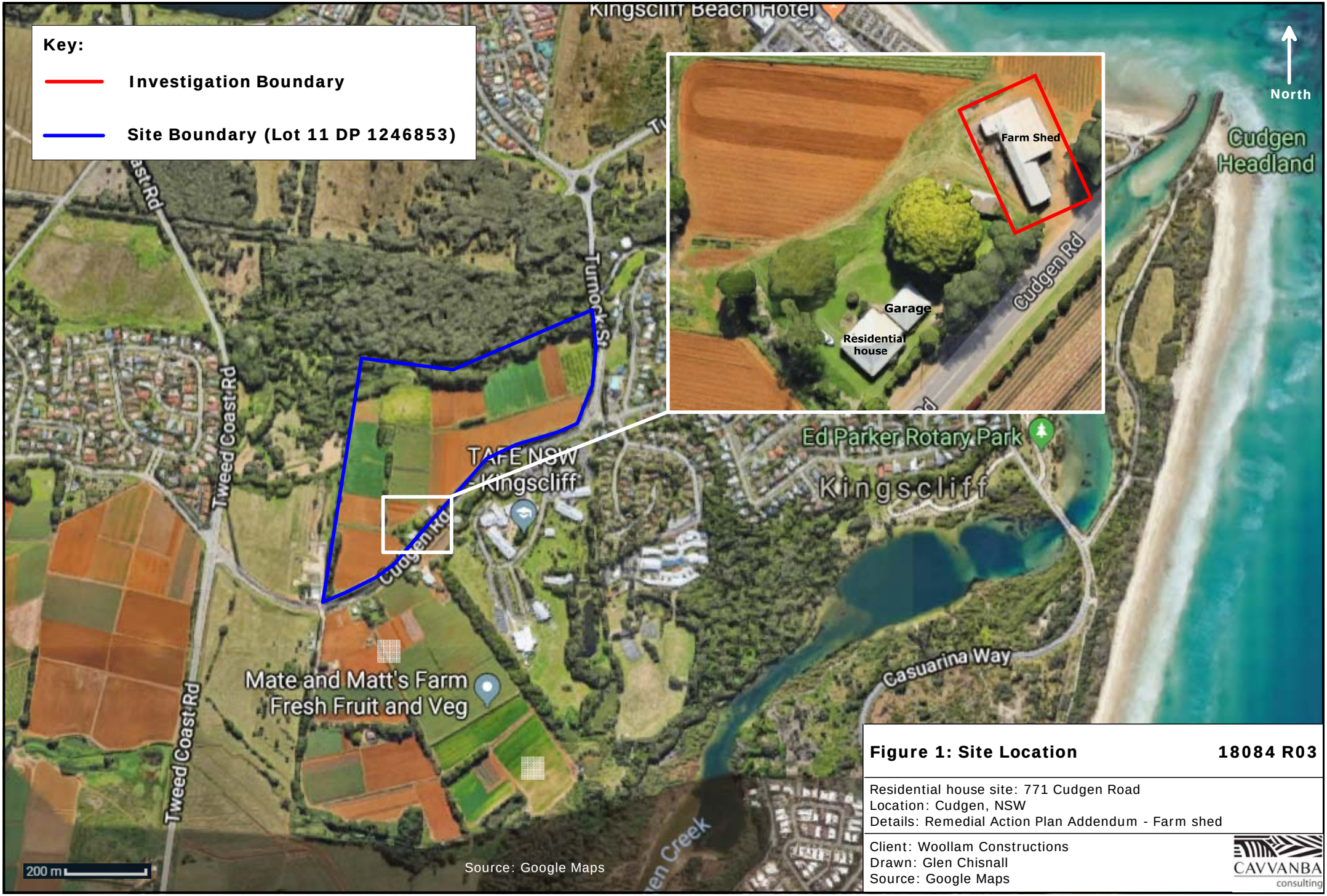

Figure 1: Site Location **18084 R03**

Residential house site: 771 Cudgen Road
Location: Cudgen, NSW
Details: Remedial Action Plan Addendum - Farm shed

Client: Woollam Constructions
Drawn: Glen Chisnall
Source: Google Maps

CAVVANBA consulting

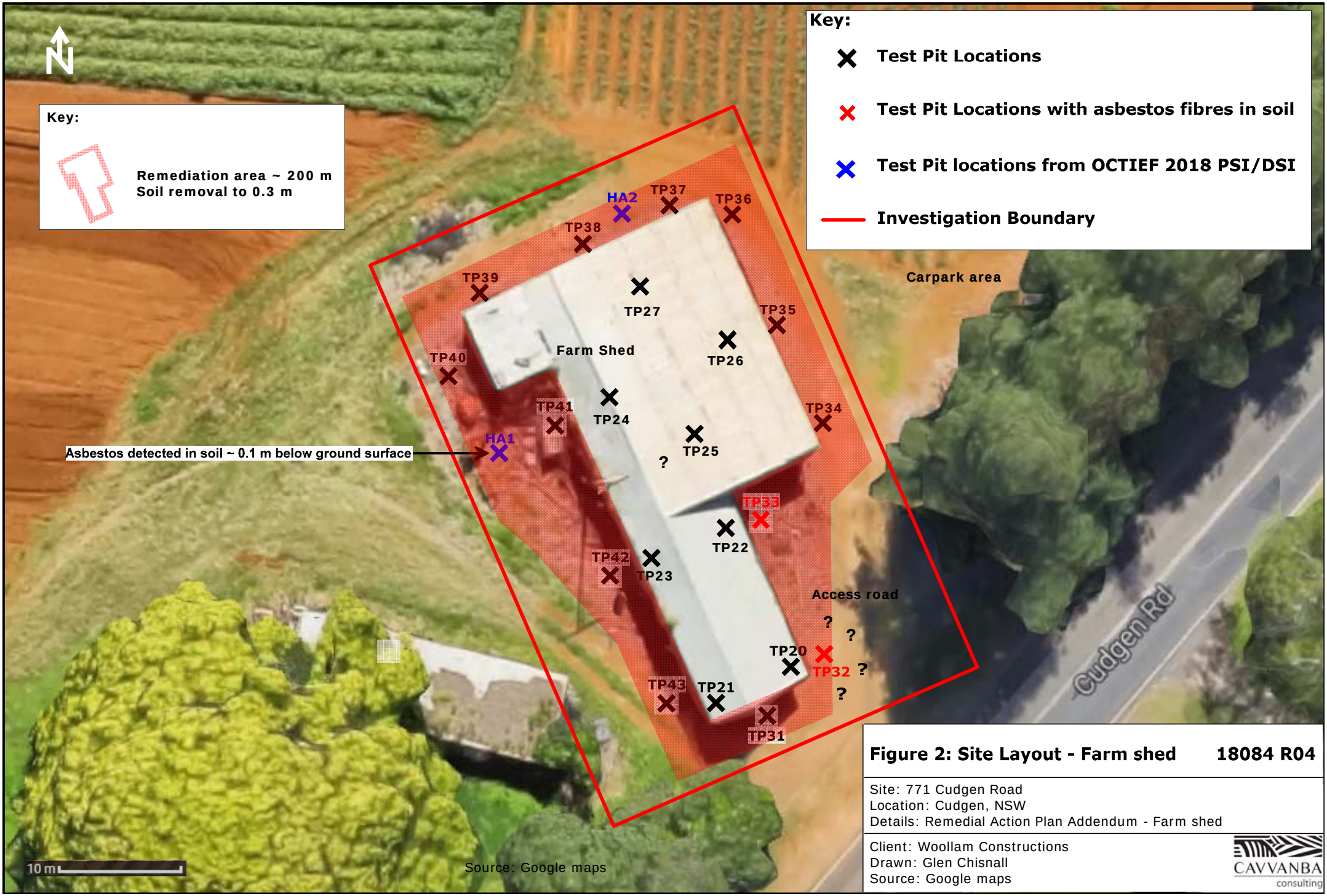

Figure 2: Site Layout - Farm shed **18084 R04**

Site: 771 Cudgen Road
Location: Cudgen, NSW
Details: Remedial Action Plan Addendum - Farm shed

Client: Woollam Constructions
Drawn: Glen Chisnall
Source: Google maps

CAVVANBA consulting

Tables

Table 1: Sample Description and Analytical Summary

Sample	Depth (m)	Date sampled	Description	OCPs	Lead	Asbestos
Soil - Test Pits						
Cavvanba, 2018: Underneath farm shed slab						
TP20	0.1	11/12/18	Dark brown to red silty CLAY. Slightly moist with low plasticity.	•		
TP21	0.1	11/12/18	Dark brown to red silty CLAY. Slightly moist with low plasticity.	•		
TP22	0.1	11/12/18	Dark brown to red silty CLAY. Slightly moist with low plasticity.	•		
TP23	0.1	11/12/18	Dark brown to red silty CLAY. Slightly moist with low plasticity.	•		
TP24	0.1	11/12/18	Dark brown to red silty CLAY. Slightly moist with low plasticity.	•		
TP25	0.1	11/12/18	Dark brown to red silty CLAY. Slightly moist with low plasticity.	•		
TP26	0.1	11/12/18	Dark brown to red silty CLAY. Slightly moist with low plasticity.	•		
TP27	0.1	11/12/18	Dark brown to red silty CLAY. Slightly moist with low plasticity.	•		
OCTIEF, 2018: Around farm shed						
HA1	0.15	01/08/18	Silty CLAY: red brown, traces to some fine gravel, medium plasticity, dry to damp. Inclusion of ACM fragments.	•	•	•
HA2	0.15	01/08/18	Silty CLAY: red brown, traces to some fine gravel, medium plasticity, dry to damp.	•	•	•
HA2	0.5	01/08/18	Silty CLAY: red brown, traces to some fine gravel, medium plasticity, dry to damp.	•	•	•

Table 1: Sample Description and Analytical Summary

Sample	Depth (m)	Date sampled	Description	OCPs	Lead	Asbestos
Cavvanba, 2018: Around farm shed						
TP31	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP32	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity. Inclusions of ACM fragments.	•	•	•
TP32	0.3	14/12/18	Natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.			•
TP33	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP34	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP35	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP36	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP37	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP38	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP39	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP40	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP41	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP42	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity.	•	•	•
TP43	0.1	14/12/18	Disturbed natural: Dark brown to red silty CLAY. Slightly moist with low plasticity. Inclusions of plastic and nails.	•	•	•

Table 2: Soil Analytical Summary, OCPs and Lead

Sample	Depth (m)	OCPs									Metals
		Heptachlor	Total Chlordane (sum)	Endrin	Endosulfan (sum)	Methoxychlor	Sum of Aldrin + Dieldrin	Sum of DDD + DDE + DDT	Hexachlorobenzene (HCB)	Sum of OCPs	Lead
LORs		*0.05*	*0.05*	*0.05*	*0.05*	*0.2*	*0.05*	*0.05*	*0.05*	-	*0.1*
Analytical - Test pits											
Cavvanba, 2018: Underneath farm shed slab											
TP20	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	-
TP21	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	-
TP22	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	-
TP23	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	-
TP24	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	-
TP25	0.1	nd	nd	nd	nd	nd	0.56	nd	nd	nd	-
TP26	0.1	nd	nd	nd	nd	nd	0.19	nd	nd	0.19	-
TP27	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	-
OCTIEF, 2018: Around farm shed											
HA1	0.15	nd	nd	nd	nd	nd	nd	0.08	nd	0.08	23
HA2	0.15	nd	nd	nd	nd	nd	nd	0.08	nd	0.08	63
HA2	0.5	nd	nd	nd	nd	nd	nd	0.07	nd	0.07	23
Cavvanba 2018: Around farm shed											
TP31	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	33.8
TP32	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	39.1
TP33	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	34.7
TP34	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	38.2
TP35	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	26.4
TP36	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	20
TP37	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	7.3
TP38	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	9.8
TP39	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	20.6
TP40	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	32
TP41	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	13.8

Table 2: Soil Analytical Summary, OCPs and Lead

Sample	Depth (m)	OCPs									Metals
		Heptachlor	Total Chlordane (sum)	Endrin	Endosulfan (sum)	Methoxychlor	Sum of Aldrin + Dieldrin	Sum of DDD + DDE + DDT	Hexachlorobenzene (HCB)	Sum of OCPs	Lead
LORs		*0.05*	*0.05*	*0.05*	*0.05*	*0.2*	*0.05*	*0.05*	*0.05*	-	*0.1*
TP42	0.1	nd	nd	nd	nd	nd	nd	nd	nd	nd	23
TP43	0.1	nd	nd	nd	0.89	nd	0.09	0.27	nd	1.25	43.8
Statistics											
Samples analysed		21	21	21	21	21	21	21	21	21	13
Detects		0	0	0	1	0	3	4	0	5	16
% detect		0%	0%	0%	5%	0%	14%	19%	0%	24%	123%
Maximum		<0.05	<0.05	<0.05	0.89	<0.05	0.56	0.27	<0.05	1	63
Mean		<0.05	<0.05	<0.05	0.04	<0.05	0.04	0.02	<0.05	0.08	34.73
Median		<0.05	<0.05	<0.05	0.89	<0.05	0.19	0.08	<0.05	0.08	24.70
Minimum		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	7
Criteria											
HILs- Residential A		6	50	10	270	300	6	240	10	-	300
EILs - Urban residential and public open space		-	-	-	-	-	-	180 (DDT only)	-	-	1,100

Table 3: Soil Analytical Summary, Asbestos in soil

Sample	Depth (m)	Date	Asbestos detected in soil
LORs			-
Analytical - Asbestos			
OCTIEF, 2018: Around Farm Shed			
HA1	0.0 - 0.1	1/08/2018	**Yes**
HA2	0.0 - 0.1	1/08/2018	No
Cavvanba, 2018: Around Farm Shed			
TP31	0.1	14/12/2018	No
TP32	0.1	14/12/2018	**Yes**
TP32	0.3	14/12/2018	No
TP33	0.1	14/12/2018	**Yes***
TP34	0.1	14/12/2018	No
TP35	0.1	14/12/2018	No
TP36	0.1	14/12/2018	No
TP37	0.1	14/12/2018	No
TP38	0.1	14/12/2018	No
TP39	0.1	14/12/2018	No
TP40	0.1	14/12/2018	No
TP41	0.1	14/12/2018	No
TP42	0.1	14/12/2018	No
TP43	0.1	14/12/2018	No
Criteria			
Site specific criteria**			**Yes**

*** -** Asbestos material was detected and positively identified at concentrations estimated to be below 0.1g/kg. No asbestos found at the reporting limit of 0.1g/kg, by polarised light microscopy including dispersion staining.

** - Site specific investigation screening criteria.

See table notes at end of section

Table 4: Soil Analytical Summary, Quality Control (mg/kg)

Analyte	LOR mg/kg	TP39_0.1	QS07	**RPD**	TP39_0.1	QS08	**RPD**
Type	-	*Primary*	*Duplicate*	*%*	*Primary*	*Inter-laboratory Duplicate*	*%*
Date	-	14/12/18	14/12/18	-	14/12/18	14/12/18	-
Media	*Soil*	*Soil*	*Soil*	-	*Soil*	*Soil*	-
Heavy metals							
Lead	5	11.1	13	12	11.1	16	36
Organochlorine Pesticides (OCPs)							
Heptachlor	0.05	nd	nd	-	nd	nd	-
Total Chlordane (sum)	0.05	nd	nd	-	nd	nd	-
Endrin	0.05	nd	nd	-	nd	nd	-
Endosulfan (sum)	0.05	nd	nd	-	nd	nd	-
Methoxychlor	0.2	nd	nd	-	nd	nd	-
Sum of Aldrin + Dieldrin	0.05	nd	nd	-	nd	nd	-
Sum of DDD + DDE + DDT	0.05	nd	nd	-	nd	nd	-
Hexachlorobenzene (HCB)	0.05	nd	nd	-	nd	nd	-
Sum of OCPs	-	nd	nd	-	nd	nd	-
Data Quality Indicator		-	-	*<50%*	-	-	*<50%*

See tables notes at end of section

Soil Analytical Summary Table Notes

LOR denotes limit of reporting (standard LOR unless otherwise shown)

PBILs denotes phytotoxicity based investigation levels

nd denotes not detected above the LOR

NL denotes non-limiting

- denotes not analysed/not available

Bold - Exceeds landuse criteria

^ denotes raised LOR

TRH C6-C10 F1 = TRH C6-C10 minus BTEX compounds

*analyte list shown on laboratory report

1. Methyl mercury / inorganic mercury
2. Netherlands protection of terrestrial organisms/ Netherlands human health based and human health and ecologically based protection level.
3. Criteria for phenol