



REMEDIATION ACTION PLAN

**TWEED VALLEY HOSPITAL SITE
771 CUDGEN ROAD, CUDGEN,
NSW**

Prepared For: NSW Health Infrastructure c/o – TSA Management

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This report describes an assessment undertaken for the Site, on the basis of the proposed future land use. Should the future use of the Site change substantially, either through a change in site activities or through substantial redevelopment of the Site, then the findings of this assessment may not be applicable and reliance on them in that instance should not occur. In that instance, advice should be sought from OCTIEF on whether any further assessment or interpretation of existing data is required.

The nature of the assessment means that the findings are limited in their application and should not be considered as comprehensively addressing all potential environmental issues and risks.

Whilst we infer that the data was representative of soil conditions at the time of sampling, actual site conditions at and between the sampling locations may vary.

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1. THE PROJECT

1.1 INTRODUCTION

OCTIEF Pty. Ltd. (OCTIEF) were engaged by TSA Management. on behalf of NSW Health Infrastructure (HI) to compile a Remediation Action Plan (RAP) for Lot 11 DP1246853 (the site), located at 771 Cudgen Road, Cudgen. The proposed Stage 1 Development Area for the Tweed Valley Hospital is located on the southern portion of the lot.

This RAP provides a summary of identified site contamination issues, and description of the proposed remediation and soil management programs, procedures and standards which are to be followed during the course of the preliminary works and redevelopment, to ensure the successful remediation of the site to a level suitable for the proposed land use (Hospital). This RAP has been developed in accordance with, and to meet the requirements of SEPP55 and the accompanying Department of Planning and Urban Development (DUAP) 1998 Guidelines.

1.2 BACKGROUND

A combined Stage1 and Stage 2 Environmental Site Assessment (Preliminary and Detailed Site Investigation) of the site was undertaken by OCTIEF in July 2018, in order to provide HI with confidence that the site contamination characteristics are sufficiently understood to determine the remediation required to make the site suitable for the final land use. The PSI/DSI concluded that the investigation works undertaken have sufficiently characterised the site to enable an assessment of its suitability for the proposed purpose (hospital with open space grounds), subject to implementation of a remediation action plan for the identified asbestos impacted soil.

This RAP should be read in conjunction with the PSI/DSI report.

1.3 PROPOSED DEVELOPMENT

An EIS has been prepared to accompany a State Significant Development Application for the Tweed Valley Hospital which will be assessed under Part 4 of the Environmental Planning and Assessment Act. The project has been established based on the following supporting documentation:

- Tweed Valley Hospital Business Case
- Tweed Valley Hospital Master Plan
- Tweed Valley Hospital Concept Proposal and design.

The Tweed Valley Hospital Project for which a staged approval is sought consists of:

- Delivery of a new Level 5 major referral hospital to provide the health services required to meet the needs of the growing population of the Tweed-Byron region, in conjunction with the other hospitals and community health centres across the region;
- Master planning for additional health, education, training and research facilities to support these health services, which will be developed with service partners over time. These areas will be used initially for construction site/ compound and at-grade car parking;
- Delivery of the supporting infrastructure required for the new hospital, including green space and

other amenities, campus roads and car parking, external road upgrades and connections, utilities connections, and other supporting infrastructure.

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) which will consist of:

- Preliminary works comprising two components:
 - CDC approval – Demolition of existing site infrastructure; and
 - REF approval – Construction of Sedimentation Basins and road way entries
- A concept development application and detailed proposal for Stage 1 (early and enabling works); and
- A second development application for Stage 2 works which will include detailed design, construction and operation of the Tweed Valley Hospital.

A detailed description of the proposed staging of the development is provided in the following sections.

1.3.1 Concept Proposal and Stage 1 Early Works

The Concept Proposal is informed by service planning to 2031/32 and has an expected gross floor area in the range 55,000m² to 65,000m². The hospital is expected to include (with more detail to be confirmed/provided at Stage 2) the following components/ services:

- A main entry and retail area
- Administration Services
- Ambulatory Services
- Acute and Sub-Acute in-patient units
- Paediatrics
- Intensive Care Unit
- Close Observation Unit
- Mental Health Services
- Maternity Unit
- Renal Dialysis
- Pathology
- Pharmacy
- Cancer Services including Day Oncology and Radiation Oncology
- Emergency Department
- Integrated Interventional Services
- Interventional Cardiology
- Medical Imaging
- Mortuary
- Back of house Services
- Car parking
- Future expansion areas;

Preliminary Works prior to commencement of Stage 1, consisting of :

- CDC approval – demolition of existing site infrastructure; and
- REF approval – Construction of sedimentation Basins and road way entries.

Stage 1 includes:

- Early and enabling works (for site clearance and preparation), generally comprising:
 - Construction Compound for Stage 1 Works;
 - Augmentation and connection of permanent services for the new facility (water, sewer, electricity, telecommunications);
 - General clearance of site vegetation within the footprint of construction works, including tree stumps;
 - Chipping of cleared vegetation (excluding weed species) to use on site for ground stabilisation/ erosion control, or off-site disposal (as required);
 - Bulk earthworks to establish the required site levels and create a stable landform in preparation for hospital construction;
 - Piling and associated works;
 - Rehabilitation and revegetation of part of the wetland area;
 - Construction of internal road ways for use during construction and in preparation for final road formations in Stage 2;
 - Retaining walls.

Plans for the preliminary works, and Concept design are attached at **Appendix C**. Further explanation of the Concept Proposal and an outline construction methodology for Stage 1 is provided at **Sections 3.7** and **3.8** respectively.

1.3.2 Stage 2: Hospital Delivery - Main Works and Operation

Stage 2 would include the detailed design, construction and operation of the Tweed Valley Hospital. Stage 2 will be subject to a separate application following Stage 1.

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1.3.3 Subsequent Stages: Potential Future Expansion

Any subsequent stages would be subject to a separate application(s) as required and would be related to works for potential future expansion of the facility. Details of this are unknown at this stage and would be developed as required

1.4 PURPOSE

The purpose of this RAP is to provide a description of the proposed contamination remediation program, procedures and standards, which will be followed for remediation works to ensure the successful remediation of contamination at the site to render the site suitable for the proposed hospital land use and consequently the protection of the environment and human health. This RAP has been developed in accordance with, and to meet the requirements of SEPP55 and the accompanying DUAP 1998 Guidelines.

1.5 OBJECTIVES

The objectives of the RAP are to:

- Provide a framework for the remediation of soil impacts within the identified remedial areas;
- Provide validation requirements for the remediated areas;
- Provide a framework for the investigation of identified data gaps;
- Provide an outline for additional remediation/validation requirements in the event that the data gap investigation identifies contamination ;
- Establish the various safeguards required to complete remediation work in a safe and environmentally acceptable manner;
- Identify the necessary approvals and licences required by regulatory authorities in order to enable the remediation works to proceed; and
- Assist with asbestos regulatory compliance during soil disturbance activities.

1.6 SCOPE OF WORKS

The scope of works undertaken for this RAP consisted of:

- Review of existing data;
- Identification of areas of concern within the site requiring remediation;
- Outline the remediation strategy and remedial goals;
- Review and address (where relevant) comments received by DPI, EPA and the site auditor;
- Development of remediation procedures for remediation contractors to utilise in development of detailed work methods;
- Establishment of validation process;
- Identification of appropriate licence and approvals required to undertake remediation works;

2. SITE DESCRIPTION

2.1 SITE IDENTIFICATION

The investigation area is located at 771 Cudgen Road, Cudgen, NSW 2487 and is described as Lot 11 / DP1246853 (28°15'48"S, 153°34'02"E) as shown in **Figure 1, Appendix A**. The subject property lot covers an area of 19.38Ha, with approximately 16 Ha being used for agricultural production. The proposed hospital development covering 65,000m² (6.5 Ha) within the southern portion of the property (as shown in the design plan in Appendix C)

2.2 EPA CONTAMINATED SEARCH RESULTS

A search of the NSW Environmental Protection Agency (EPA) Contaminated land record was undertaken by OCTIEF. The search results (www.epa.nsw.gov.au/your-environment/contaminated-land/notification-policy/contaminated-sites-list) show that the property lot is not listed on the contaminated land record.

A search of the NSW Environmental Protection Agency (EPA) POEO Registry for Environmental Protection Licences, Notices and audits showed that there are no Environmental protection licences, notices or audits for the site.

2.3 ZONING

The current primary use of the Site is for agricultural production (approximately 16ha) and is zoned accordingly as RU1 Primary Production under the Tweed Local Environmental Plan (LEP) 2014.

0.446ha of the site is zoned R1 General Residential, while 0.267ha is zoned urban expansion (2c) and 0.04ha is listed as Agricultural Protection zone. The remaining 2.944Ha is zoned as an Environmental Protection (habitat) zone.

2.4 CURRENT AND PROPOSED FUTURE LAND USE

The current primary use of the Site is for agricultural production. The site was selected, and the proposed land use (Hospital) designed/assessed in response to a range of hospital related planning criteria. This included avoiding flood prone land, providing adequate bushfire protection, lower risk acid sulfate soils, and buildability without impacts to severe slopes or highly erodible land.

2.5 SITE LAYOUT AND SIGNIFICANT FEATURES

The subject property lot is irregular in shape and includes the following significant features:

- Former residential house on the southern site boundary with access from Cudgen Road (demolished December 2018);
- Former chemical storage / equipment shed on the southern property boundary to the east of the residential house, (demolished December 2018);
- Cultivated paddocks covering approximately 16Ha;
- Undeveloped wetland in the northern/northwestern portion of the site;

2.6 SURROUNDING LAND USE

The land use adjacent to the site is summarised as follows:

- North – Agricultural farm land to north west, undeveloped land;
- South – Open farmland and TAFE buildings (Education);
- East – Low/Medium density residential;
- West – Farmland and dense forest.

2.7 TOPOGRAPHY AND DRAINAGE

The site has a gradual slope leading towards the north side of the site. The NSW Six Maps indicates the investigation area has an elevation between 25mAH to the south east and 8mAH to the north.

2.8 FLOOD INFORMATION

Based on the Tweed maps – Flood information Overlay Map, the investigation area is within a designated flood affected area only on the northern (currently undeveloped) side of the site.

2.9 GEOLOGY

The Tweed Heads 1:250,000 Geological map indicates that the underlying geology at the site is the Lamington Volcanics from the Tweed Range-Lamington Area. This is made up of basalt with members of rhyolite, trachyte, tuff, agglomerate, and conglomerate.

During the Stage 2 Detailed Site Investigation, the following subsurface conditions were encountered (Borehole locations provided on Figure 2, Appendix A):

Table 2-1 General Soil Description

Depth (m)	General Soil Description
0.0 - 0.15 m	Silty CLAY: red brown, traces to some fine gravel, medium plasticity, dry to damp.
0.15 – 1.0m (up to 3.6m) (1.0m - maximum depth of environmental sampling program)	Silty CLAY: red brown medium plasticity, damp to moist, firm, some fine to coarse gravel/ extremely weathered basalt fragments.
3.6 – 20.5	BASALT – zones ranging from fresh, vesicular dark grey very high strength basalt through to low strength , extremely weathered, clayey material.

2.10 HYDROGEOLOGY

A search of groundwater bores registered with the NSW Department of Primary Industries, Office of Water identified eight bores within a 500 m radius of the site's boundaries. Bore reports for bores provided by NSW Office of Water are provided and summarised in Table 2-2 below.

Table 2-2 Summary of Groundwater Database Bore Reports

Registered No.	Date Registered	Standing Water Level (m BGL)	Aquifer geology	Distance from site	Use
GW307808	No data available			450m NE	
GW304908	3/11/2004	3.00	0-5m – Sand grains (lithic)	475m NE	Domestic
GW065030	16/10/1989	12.00	0-15m – Clay 15-17m – Weathered rock 17-20m – Basalt 20-24m – Weathered Basalt 24-30m – Clay & Sandstone	100m South	Irrigation
GW047693	1/3/1980	N/A	0-4.57m – Soil 4.57-14.00m - Shale	100m South	Irrigation
GW047692	1/10/1980	N/A	0-1.2m – Soil 1.2-7.6m – Clay decomposed basalt 7.6-11.3m – Clay 11.3-21.3m – Basalt Layers	100m South	Irrigation
GW044188	1/1/1945	6.0m	0-4.57m – Soil 4.57-12.19m – Shale	100m South	Domestic
GW069108	7/3/1991	NA	0-10m – Clay 10-13m – Basalt 13-16m – Clay 16-21m – Basalt 21-33m – Clay 33-40m – Basalt 40-47m – Clay 47-54m - Granite	150m south west	Farming

Groundwater field parameters collected from during the Detailed Site Investigation recorded the following:

- Dissolved Oxygen – 5.27mg/L
- Electrical Conductivity - 178µs/cm indicating the groundwater is freshwater;
- pH – 6.03;
- Redox (Eh) - -66.3mV, within the range indicating oxidizing conditions.

2.11 VEGETATION AND ENVIRONMENTAL VALUES

The following EHP Environmental Reports were reviewed to assess the quality of existing environmental values and designated environmentally sensitive areas:

- The site has a stretch of tree preservation order (2004) - Koala Habitat Study Area for the northern side of the site;
- This same region and including the northernmost point is under the State Environmental Planning Policy (SEPP) coastal management – Coast wetland;
- The northern part of the site is classified as Bushfire prone land with the middle of the site classed as a vegetation buffer;

2.12 SENSITIVE ENVIRONMENTAL RECEPTORS

The following sensitive receptors were identified within a 200 m radius of the site:

- Education facility (TAFE) to the south of the site;
- The area is listed as having high ground water vulnerability (Tweed shire council, planning and flooding maps, 2018)

3. Contamination Summary

3.1 Previous Investigations

Desktop investigations have been undertaken for the site as part of the initial site selection process for the Tweed Valley Hospital. A review of the desktop investigation reports (HMC, 2017) and (Charter. 2018) identified the following:

- Broadacre intensive cropping across the elevated part of site may have been subject to agrichemical applications. Generally broadacre application meets investigation criteria for residential land use.
- 2-3 structures near Cudgen Road may have been used for storage/mixing of chemicals and storage of fuel. Small areas, may be hotspots requiring remediation.
- Further investigation in the form of detailed site inspection, additional site history and soil investigation is required prior to confirming site suitability, subject to final location of proposed development.

3.1.1 Preliminary and Detailed Site Investigation – (OCTIEF 2018)

An initial site inspection was undertaken on 14 June 2018 by a Suitably Qualified Person (SQP) to validate results of the site history review and identify additional sources or evidence of potential contamination. At the time of the site inspection, cultivation of sweet potatoes was being undertaken at the site, with some fields yet to be harvested. Based on the initial site inspection, the potentially contaminating activities were:

- Potential for the release of chemicals to the subsurface into the environment resulting from poor chemical storage or waste disposal practices;
- Potential for the release of chemicals to the subsurface into the environment resulting from poor agricultural practices;
- Asbestos building materials in onsite structures;
- Above ground diesel tank (AST);
- Onsite Farm dump; and
- Onsite surface water storage dam.

Chemicals of potential concern include:

- inorganic pesticides, e.g., arsenical and mercurial compounds
- organic pesticides, e.g., organochlorines (OCPs), organophosphates or (OPPs);
- volatile organic compounds;
- Hydrocarbon compounds (TRH. BTEX and PAH) associated with fuels and motor oils for machinery; and
- Asbestos (associated with degradation of building materials in onsite structures).

Other chemicals typically used in the agricultural environment (carbamates, synthetic pyrethroids, and growth regulators) have little or no residual activity i.e., they are highly biodegradable; and therefore are considered unlikely to cause soil contamination.

The Detailed Site Investigation (DSI) was completed in August 2018 by OCTIEF, the DSI focused on further assessment of potential sources identified. The main objectives of the DSI were to:

- To investigate potential contamination sources and chemicals of potential concern (CoPC) identified, and assess the risks posed by identified contamination (if present) to human health and the environment.
- Assess if further assessment or remediation measures are required.

The scope of works for the DSI included;

- Handaugering of 50 locations across the site. Locations in cultivated areas were undertaken to enable composite sampling to be completed, with four hand augers per location. The composite sample locations were evenly spaced across the cultivated areas of the site with 4 locations per hectare within the hospital development area and two locations per hectare for the remaining cultivated areas of the site. Targetted handaugers were also completed in the vicinity of the identified potential sources onsite (main shed, AST, farm dump, storage dam).
- Collection of a groundwater sample from the groundwater monitoring well installed as part of the Geotechnical site investigation works, and collection of surface water samples from the onsite storage dam.
- Submitting soil and groundwater samples for laboratory analysis for the CoPC including heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), BTEX (benzene, toluene, ethylbenzene and xylene), TRH (total recoverable hydrocarbons), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), organophosphorous (OP) and organochlorine (OC) pesticides and asbestos.
- Preparation of a combined Preliminary and Detailed Site investigation report.

Based on the completed scope of works of the DSI, OCTIEF concluded the following;

- Sediment sample SED01 reported copper and nickel concentrations exceeding the low sediment quality guidelines (SQG) but below the high-SQG. The copper and nickel concentrations detected were comparable to the surface soil concentrations across the cultivated area of the site and are not considered indicative of any significant contamination in the dam sediments.
- Asbestos Fibres (AF) and Fibrous Asbestos (AF) was detected at concentrations exceeding the residential guideline levels in sample HA1-0.1 collected from adjacent to the western side of the main shed onsite.
- Zinc detected in the groundwater sample above the nominated investigation level is considered likely to be indicative of naturally occurring background concentrations in the groundwater.
- The surface soil sample collected adjacent to the main shed during the initial site inspection and sample HA4-0.15 collected during DSI reported zinc concentrations exceeding the ecological investigation levels for residential land use. These exceedances of the ecological assessment criteria are relatively minor and isolated, and not considered to affect suitability of the site for the proposed development.

3.1.2 Hazmat Assessment (Cavvanba Consulting Pty Ltd)

A hazardous material audit by Cavvanba Consulting Pty Ltd on 19th November of the residential premises and attached garage reported lead paint on internal walls and the ceiling within the premises. Sampling of external building panelling indicated that the external paint was not lead paint.

3.2 Refined Conceptual Site Model

A conceptual site model (CSM) has been refined for the site to identify the contamination sources at the site and provide an understanding of the pathways by which receptors at the site and surrounding areas may be exposed to contaminants.

The potential Source-Pathway-Receptor (SPR) linkages identified for the site, based on site information gathered during this investigation are presented in Table 3-1.

Table 3-1 Potential Complete Exposure Pathways

Potential Source	Pathway	Receptor	Pathway complete
Contaminated Soil	Surface water runoff	Ecological receptors	Unlikely – elevated zinc concentrations of limited lateral extent ,
	Atmospheric dispersion	Ecological receptors	Unlikely – elevated elevated zinc concentrations of limited lateral extent
	Leaching to groundwater	Ecological receptors	Unlikely – elevated zinc concentrations of limited lateral extent , and depth to groundwater is >10m with fresh to slightly weathered basalt overlying aquifer
Contaminated Groundwater	Lateral migration of groundwater	Ecological receptors of wetland	Unlikely – Groundwater concentrations likely to be indicative of natural background conditions and unlikely to be ecological risk
Asbestos Containing Materials	Inhalation of fibres	Maintenance/ construction workers; future site users	Friable asbestos and/or asbestos fines were detected in surface soil sample HA1. Some bonded ACM was also observed which could release fibres if inappropriately managed. Area is limited in extent.

3.3 Site Suitability

3.3.1 Chemical Contaminants

The site has been compared to “Tier 1” investigation or screening levels for land use settings equivalent to residential development, which is considered a conservative basis to assess the suitability of site materials for a hospital and associated grounds. No exceedances of health based criteria were identified during the PSI/DSI.

Environmental Investigation Level exceedances (zinc), are considered to be associated with the weathering and degradation of farm equipment stored between the main storage and vehicle sheds onsite. Exceedances were relatively minor and considered sufficiently isolated as to not present an unacceptable risk to human health or the environment. It should be noted that the elevated zinc concentration was detected within the area of identified ACM impacted soil.

3.3.2 Asbestos

Asbestos has been detected in soil samples from the site, the ACM identified in its present state (bonded condition with some degradation and fibres in soil) presents risk to human health if disturbed, and remediation works are required in the area on the western side of the main site shed. No visible asbestos in surface soils should be present for residential and open space land use, and both the NEPM and WHS regulations require removal of visible asbestos prior to any work activities that may disturb it. Any ACM to be disposed off-site would require appropriate classification in accordance with the *Waste Classification Guidelines: Part 1 – Classifying waste* (EPA, 2014) prior to disposal to an appropriately licenced facility.

3.3.3 Unexpected Finds and Soil Management

The findings of the investigations to date are based on lines of evidence including historical site use, site observations and sampling and analysis from discrete locations. The site history indicates historical site use has been broadacre agricultural activities, and investigations do not indicate any significant disposal of waste has occurred. The small farm dump of inert waste identified is outside the proposed hospital development area, and it is unlikely that other such areas will be encountered during redevelopment of the site.

It is considered unlikely that unexpected contamination could be encountered during earthworks for redevelopment of the site, however the management requirements for unexpected finds are discussed further in Section 10.

3.3.4 Potential Data Gaps

Anecdotal information from Mr Brent Gibson has indicated the potential for a cattle dip being present onsite in the vicinity of the recently demolished main shed. Inspection of the area following demolition of the main shed and vehicle shed and clearance of surface debris in the area by Cavvanba Consulting on 29 January 2019 has identified a concrete slab of unknown origin immediately to the west of the former vehicle shed (shown on Figure 4). During the inspection, Cavvanba noted small quantities of liquids and wastes were present associated with the concrete slab, including brake pads, spark plugs, a blue powder (like copper), red/purple sand (appears like sand blasting grit), oil staining, and mechanical parts.

A data gap investigation has been included in this RAP to address the presence of the potential cattle dip, the details of which are outlined in sections 3.4.1, Section 7 and Section 10 below.

3.4 Extent of Remediation Required

ACM surface debris was noted along the western side of the main shed, and asbestos fines (AF) were detected at a concentration exceeding the health screening level of 0.001% w/w in sample HA1-0.1m. Based on the results of the detailed site investigation conducted by OCTIEF, remediation is required in the area adjacent to the western wall of the former main shed.

The WA DoH (2009) guidelines recommend the removal of an additional 1m laterally in all directions beyond the contaminated area. Based on site observations and sample locations the remediation area is shown in Figure 3 covering an area of approximately 230m², which extends from 1m to the east of the western wall of the shed to 6m west of the north west corner and 2m west of the southwest corner.

In accordance with the WA DoH (2009) guidelines for assessment and remediation of asbestos contaminated soil the proposed excavation should be to a depth 30cm below the contaminated zone and consequently the remediation works will be to a depth of 0.4m.

3.4.1 Data Gap Investigation

As part of the remediation works of the identified asbestos impacted area, a data gap investigation in accordance with the relevant guidelines and with oversight of the site auditor must be undertaken in the indicative area anecdotally identified as containing a potential cattle dip (shown in Figure 4).

The data gap investigation must include the excavation and removal of the concrete slab described in section 3.3.4, with validation sampling immediately around the slab, and a series of testpits across the remaining indicative area shown in Figure 4 to enable identification of any former cattle dip structure. Due to the absence of any documentation regarding the location of the potential dip, testpitting across the identified area following the removal of surface infrastructure and concrete slabs is required to enable characterisation of the area.

4. Relevant Guidelines and Legislation

4.1 Preparation of the RAP

This RAP has been prepared with consideration of relevant guidelines and policy, as listed below. A summary of relevant aspects of these guidelines, Acts and regulations are provided in the following sections.

The remediation contractor shall be responsible for ensuring the remediation works are carried out in accordance with regulatory requirements.

4.2 National Environmental Protection (Assessment of Site Contamination) amendment Measure 2013

The National Environment Protection (Assessment of Site Contamination) Measure (referred to here as the NEPM) was produced by the federal National Environmental Protection Council (NEPC) in 1999 was revised and updated in 2013 by way of the National Environmental Protection (Assessment of site Contamination) Amendment Measure 2013. The amended NEPM is still referred to as the NEPM 1999. The NEPM provides a national framework for conducting assessments of contaminated sites in Australia.

The purpose of the NEPM is to *“establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, environmental auditors, landowners, developers and industry.”*

The desired environmental outcome for the NEPM is to *“provide adequate protection of human health and the environment, where site contamination has occurred, through the development of an efficient and effective national approach to the assessment of site contamination”.*

The NEPM addresses assessment of contamination, and does not provide specific guidance for remediation or management of risk.

The NEPM (2013) provides guidance relating to the assessment of known and suspected asbestos contamination in soil and addresses both friable and non-friable forms of asbestos. The health screening levels for asbestos in soil have been adopted from the Western Australian Department of Health (WA DoH) Guidelines for Remediation and Management of Asbestos Contaminated Sites in Western Australia (WA DoH 2009). The NEPM also refers to the WA DoH Guidelines for further information on risk assessment, remediation and management procedures.

4.3 State legislation and guidelines

The framework for this report has been developed in accordance with guidelines “made or approved” by the NSW EPA under Section 105 of the Contaminated Land Management Act, 1997.

These guidelines include the following:

- NSW Department of Environment & Climate Change (DECC) 2015, Contaminated Sites: Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997.
- NSW Office of Environment & Heritage (OEH) 2011, Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites.

- NSW DEC (2007) Guidelines for the Assessment and Management of Groundwater Contamination (the Groundwater Guidelines)
- NSW EPA 2017, Contaminated Land Management: Guidelines for NSW Site Auditor Scheme (3rd Edition).
- NSW EPA 1995, Contaminated Sites: Sampling Design Guidelines.

4.4 State Environment Planning Policy 55

SEPP55 introduces state wide planning controls for the remediation of contaminated land. Under the provisions of SEPP55, *“land must not be developed if it is unsuitable for a proposed use owing to contamination and must be remediated prior to development”*. This Remediation Action Plan has been developed in accordance with, and to meet the requirements of SEPP55 and the accompanying DUAP 1998 Guidelines.

Under the requirements of the SEPP55, remediation is to be classified as either:

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

Category 1 remediation work, for which development consent is required includes:

- Work which is designated development under Schedule 3 of the Environmental Planning and Assessment (EP & A) Regulation or under a planning instrument.
- Work proposed on land identified as critical habitat under the Threatened Species Conservation Act 1995.
- Works where consideration of section 5A of the EP&A Act indicates that remediation work is likely to have a significant effect on threatened species, populations, ecological communities or their habitats.
- Works proposed in an area or zone identified in a planning instrument as being an area of environmental significance.
- Works proposed on any land in a manner that does not comply with a policy made under the contaminated land planning guidelines by the Council.

OCTIEF has not carried out a detailed planning assessment, however as far as the proposed remediation work outlined in this RAP is concerned, to the best of our knowledge none of the above apply to the proposed remediation works. On this basis the remediation work is considered to be Category 2.

If the remediation work is treated as category 2 remediation work, notice must be given to Council at least 30 days prior to the commencement of the work, in accordance with clause 16 of SEPP 55. Regardless of category, a notice of completion of the remediation work must be given to Council within 30 days after completion of the work, in accordance with clauses 17 and 18 of SEPP 55.

4.5 Work Health and Safety Act

All proposed remediation works for the Site (including asbestos work) should be completed in accordance with the *Work Health and Safety Act and Regulation 2011*. Asbestos works must also follow the guidelines of the *Safe Work Australia Code of Practice - How to Manage and Control Asbestos in*

the Workplace (December 2011), and the *Code of Practice – How to Safely Remove Asbestos* (December 2011).

HI has a legal obligation under the Work Health and Safety (National Uniform Legislation) Act 2011, (the WHS Act) and prescribed in the Work Health and Safety (National Uniform Legislation) Regulations 2012, to ensure the work health and safety of its workers, subcontractors and visitors.

Primary legislative requirements detailing obligations regarding the presence of asbestos on the Site are listed as follows:

- Work Health and Safety Act 2011(NSW)
- Work Health and Safety Regulations 2011 (NSW)
- How to Manage and Control Asbestos in the Workplace, 2011. Safe Work Australia (approved under Section 274 of the Work Health and Safety Act 2011 NSW)
- How to Safely Remove Asbestos, 2011. Safe Work Australia (approved under Section 274 of the Work Health and Safety Act 2011)

It is recommended that the remediation of the asbestos impacted materials on site be undertaken by an asbestos removalist contractor with a current friable asbestos removal licence (Class A).

WorkCover NSW must be notified five days before licensed asbestos removal work is commenced.

4.6 Protection of the Environment Operations Act 1997

The proposed remediation/management activities are not required to be licensed under the Protection of the Environment Operation Act 1997 since the works do not involve: treatment otherwise than by incineration and store more than 30,000 cubic metres of contaminated soil originating exclusively from the site, or disturb more than an aggregate area of 3 hectares of contaminated soil originating exclusively from the site.

The provisions of the POEO Act and Regulations will apply to offsite transport and disposal of soils. The regulatory provisions governing the management of waste generally apply to transport, treatment, disposal or receipt of waste, and hence only come into effect if the waste is removed from the site and/or received from another site.

5. Remediation Criteria

Remediation criteria are required to assess soil validation results against to ensure the impacted area has been successfully remediated to a level where the remedial goal has been met. The adopted remediation criteria are discussed below:

5.1 Asbestos

The NEPM (2013) provides guidance relating to the assessment of known and suspected asbestos contamination in soil and addresses both friable and non-friable forms of asbestos. The health screening levels for asbestos in soil have been adopted from the Western Australian Department of Health (WA DoH) Guidelines for Remediation and Management of Asbestos Contaminated Sites in Western Australia (WA DoH 2009). The NEPM also refers to the WA DoH Guidelines for further information on risk assessment, remediation and management procedures.

The NEPM guidance emphasises that the assessment and management of asbestos contamination should take into account the condition of the asbestos materials and the potential for damage and resulting release of asbestos fibres. Therefore, for the purposes of assessing the significance of asbestos in soil contamination, three terms are used as summarised below:

- Bonded asbestos containing material (Bonded ACM) – sound condition although possibly broken or fragmented and the asbestos is bound in a matrix such as cement or resin.
- Fibrous asbestos (FA) – friable asbestos materials such as severely weathered ACM and asbestos in the form of loose fibrous materials such as insulation.
- Asbestos fines (AF) – including free fibres of asbestos, small fibre bundles and also fragmented ACM that passes through a 7 mm x 7 mm sieve.

From a risk to human health perspective, FA and AF are considered to be equivalent to “friable” asbestos in Safe Work Australia (2011), which is defined therein as ‘material that is in a powder form or that can be crumbled, pulverised or reduced to a powder by hand pressure when dry, and contains asbestos’.

Bonded asbestos ACM in sound condition represents a low human health risk. However, both FA and AF materials have a significantly higher potential to generate, or be associated with, free asbestos fibres and may represent a significant human health risk if disturbed and fibres are made airborne. Table 5-1 summarises the land use setting and health screening levels for asbestos in soil that are considered the most appropriate for the site.

Table 5-1 Health Screening Levels for Asbestos contamination in soil

Form of asbestos	Health Screening Level (w/w)			
	Residential A ¹	Residential B ²	Recreational C ³	Commercial/ Industrial D ⁴
Bonded ACM	0.01%	0.04%	0.02%	0.05%
FA and AF ⁵ (friable asbestos)	0.001%			
All forms of asbestos	No visible asbestos for surface soil			

6. REMEDIAL OPTIONS ASSESSMENT

The objective of the RAP is to document the processes required to address soil contamination to achieve the remediation goals. The remediation goals are to.

- Remediate the site to a level suitable for the for the proposed future land use (Hospital).;
- 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.

This Remediation Action Plan has been developed in accordance with, and to meet the requirements of SEPP55 and the accompanying DUAP 1998 Guidelines. The extent of remediation works required are outlined in Section 3.4.

6.1 Remedial Options

With regard to site remediation, the NSW EPA guidelines indicate that the preferred options for site remediation and management are (in descending order):

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

- 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
- 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 should the site be left undisturbed, then remediation should not proceed.

In relation to asbestos, the NEPM (Schedule B1 section 4.11) notes that remediation options which minimise soil disturbance and therefore public risk are preferred; and management of asbestos in situ is encouraged, which may include covering the contamination with uncontaminated fill or other protective or warning layers. However, Section 4.1 of Schedule B1 notes that this guidance is not applicable to asbestos materials which are wastes such as demolition materials present on the surface of the land. Section 4.3 also notes that if visible asbestos is present and it may be disturbed during work activities, it must be removed.

The WA DoH (2009) guidelines for the assessment, remediation and management of asbestos contaminated soil outline that main remediation options for asbestos contaminated soil can be broadly divided into management *in situ*, treatment on-site, and removal of the contaminated soil from the site.

6.2 Evaluation of remediation Options

Presented below is a brief overview of commonly used soil remediation technologies associated with the types of contamination identified onsite and/or the nature of the site. This is a preliminary evaluation only, from which appropriate options have been further assessed in Section 6.4 and 6.5

Table 6-1 Overview of Remediation Options

Remediation Method	Description	Applicability
Management of Exposure	Management of exposure risks can involve: - Precluding access to the Site (secure fencing and signage) to prevent or minimise access to affected areas and reduce the potential for exposure. This method requires a Site Management Plan to ensure the site remains secure and no migration of contamination has occurred. - Preventing exposure to contaminants by placing them in an area where they would not be expected to be subject to disturbance under reasonably foreseeable future land use.	Given the objectives of the remediation work is to allow the Site to be redeveloped, the option of precluding access to the site is not considered to be applicable, although it may be appropriate as an interim management measure. The option of selective placement of contaminated materials may be applicable to areas of the site where future disturbance would not be expected to occur. This management option is discussed further under onsite capping and containment, below.
Physical Separation	Physical separation (such as mechanical screening) to separate types or sizes of material enabling removal or concentration of contaminants.	While generally applicable to ACM contamination, Not considered applicable in cases where ACM has been identified to be highly weathered, or FA / AF asbestos contamination has been identified.

Excavation and Disposal	Excavation and offsite disposal to a NSW EPA approved landfill disposal site with appropriate environmental safeguards. The resulting excavation is generally backfilled (if required) using clean, validated fill materials. Disposal of contaminated material is permitted by the NSW EPA subject to the provisions of the POEO Act 1997. NSW EPA 2014 sets out the methodology for assessing and classifying solid wastes to be disposed to landfill.	This method is suitable for some contamination at the site where low volumes are expected or where policy prefers off- site disposal (such as ACM contamination).
On-site capping and containment	Capping involves the installation of a physical barrier to separate contaminated soil from infiltration and to provide a barrier to minimise human exposure. Containment involves the installation of a physical barrier around the contaminated area to prevent contaminants migrating away for the area. Thus, when used in combination, capping and containment essentially isolates the contaminated soil from the surrounding area. The inclusion of an effective low permeability capping system and appropriate surface water controls/management can be used to result in minimisation of groundwater generated within the cell. Capping and containment generally require long term management to prevent future exposure, in the form of a Site Management Plan.	Capping is a commonly used remedial strategy due to its effectiveness, simplicity and low overall cost. As noted in Section 6.1, the NEPM advocates in-situ management of asbestos contaminated soils (with the exception of asbestos materials which are wastes such as demolition materials present on the surface of the land), and hence this method is not recommended for the identified contamination

6.2.1 PREFERRED REMEDIAL OPTION

To meet the remedial goal, of remediating the site to a level suitable for the proposed land use (hospital) the adopted remedial method is excavation and offsite disposal. Physical removal and disposal of asbestos-containing materials that may be disturbed by the site works is the preferred strategy and consistent with regulatory requirements

The preferred remedial option would include the removal of hazardous building materials by an appropriately licenced asbestos removalist in accordance with the requirements of the *Work Health and Safety Act and Regulation 2011* and the *Code of Practice – How to Safely Remove Asbestos* (December 2011).

7. Remedial Strategy

The information presented in this section presents the remediation strategy and the procedures to address the presence of any soil contamination so the site can be made suitable from a contamination perspective. The section provides a description of the steps and procedures required to protect health, safety and the environment. It is expected that these will be supplemented by technical specifications for the remediation contractor who will prepare an appropriate detailed work plan based on the requirements of this RAP and the technical specifications.

7.1 Preliminaries

SEPP 55 provides state wide planning controls for the remediation of contaminated land. Under the provisions of SEPP 55, *“land must not be developed if it is suitable for a proposed use owing to contamination and must be remediated prior to development”*.

Under the requirements of SEPP 55, remediation work is classified as either:

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

Based on the information regarding site contamination, OCTIEF considers that the proposed remedial works are likely to be classified as Category 2 works and specific development consent is not required.

Prior to the establishment at the site, the Contractor is required to prepare a Detailed Work Plan incorporating the following documentation:

- Work Health and Safety Plan (WHSP)
- Asbestos Management Plan (AMP) – to be prepared in conjunction with the environmental consultant and reviewed by the site auditor.
- Emergency Response Procedures

It is the responsibility of the Contractor to prepare and/or obtain all appropriate documentation prior to the commencement of the works including plans, programmes, licences and certificates as appropriate. Following provision and approval of these documents, the Contractor will mobilise all necessary plant, equipment and amenities as required to complete the project in accordance with these requirements.

7.2 Site Establishment

Prior to site establishment, all staff involved in the proposed 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 the work area. A temporary fence should be erected around any work areas where appropriate. Survey markers can be used to identify the extent of any remediation areas and should be verified with the Environmental Consultant.

Access 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

7.3 Vegetation Clearance

Vegetation clearance will be subject to any requirements of the project approvals and design. In relation to site contamination, particular care shall be taken when clearing any vegetated areas to avoid disturbance and spreading of ACM. An appropriately trained “spotter” shall supervise all vegetation clearance to ensure these requirements are met.

7.4 Removal of ACM and validation of excavation

In relation to asbestos, the NEPM (Schedule B1 section 4.11) notes that asbestos materials which are present on the land surface and are included in wastes such as demolition materials, must be removed prior to disturbance during proposed site work activities. Based on the findings of the PSI/DSI, removal of remaining ACM building materials from the main shed should also be undertaken in accordance with the requirements of the *Work Health and Safety Act and Regulation 2011*.

As outlined in Section 3.4, the asbestos impacted area extends along the former western wall of the main shed with surface ACM visually identified and AF identified in soil sample HA1-0.1 at levels exceeding the nominated health screening levels.

The WA DoH (2009) guidelines recommend the removal of an additional 1m laterally in all directions beyond the contaminated area. Based on site observations and sample locations the remediation area is shown in Figure 3 covering an area of approximately 230m² extending from 1m east of the former western wall of the shed to 6m west of the north west corner of the former shed and 2m west of the southwest corner.

The WA DoH (2009) guidelines recommend the boundaries of excavation works include an additional 30cm depth to account for uncertainty in the contamination delineation and removal process and therefore the below process should be undertaken for excavation and validation of ACM and asbestos impacted soils.

- Excavation of asbestos impacted area to minimum depth of 0.4m to ensure and allow visual clearance of base of excavation and validation sampling by suitably qualified persons i.e. environmental consultants supervised by a lead consultant with appropriate asbestos credentials and a minimum of 3 years continuous experience with asbestos contamination and relevant tertiary qualifications.

Validation samples will be collected by a SQP in accordance with **Section 10** of this RAP over the area of remedial excavation. A breakdown of tasks associated with the validation is presented in **Table 7-1** below. In the event that validation is required to be undertaken in sections to facilitate access for other site works, then the remediation contractor must ensure that no vehicle movement subsequently occurs between validated and unvalidated areas.

Table 7-1 – Validation Tasks

Step	Details
Conduct visual assessment of excavation during the remedial works .	Visual assessment should include observations to inform additional excavation required. Further details are provided in Section 10 ..

Validation of the excavation	Validation samples should be collected from the walls and base of the excavation by the Environmental Consultant. Validation sampling should be completed in accordance with the procedures outlined in the validation plan in Section 10
Survey of the excavation area	The horizontal and vertical extent of the excavation should be surveyed upon completion.
Stockpiling of excavated material	Excavated soils should be temporarily stockpiled on site in a designated stockpile area prior to off-site disposal. Stockpiles should be placed on hardstand where available. If stockpiled material is placed on unsealed areas, the footprints of stockpile are required to be validated once removed. Waste classification samples for off site disposal should be collected in accordance with the sampling procedure outlined in Section 10.
Off-site disposal of excavated material	Following the successful validation of the excavation and receipt of waste classification analytical data - excavated material should be disposed off-site to an appropriately licenced facility. Waste disposal documentation should be retained and presented in the validation report.

Asbestos fibre air monitoring will be undertaken during the excavation of asbestos impacted soils and any disturbance of the potentially asbestos impacted material.

7.5 Data Gap Investigation

As part of the remediation works of the identified asbestos impacted area, a data gap investigation in accordance with the relevant guidelines and with oversight of the site auditor must be undertaken in the indicative area anecdotally identified as containing a potential cattle dip (shown in Figure 4).

The data gap investigation must include the excavation and removal of the concrete slab described in section 3.3.4, with validation sampling immediately around the slab, and a series of testpits across the indicative area shown in Figure 4 to enable identification of any former cattle dip structure. Due to the absence of any documentation regarding the location of the potential dip, testpitting across the identified area following the removal of surface infrastructure and concrete slabs is required to enable characterisation of the area.

Samples from around the excavated concrete slab and from the testpits will be collected by a SQP in accordance with **Section 10**.

7.6 Transport of Material

Transportation of material shall be undertaken in accordance with the Detailed Work Plan.

- All material movements, including on-site movements, shall be recorded on a material tracking plan documenting material source, type, description, volume, destination, reference to testing results, approval for movement and date(s) of movement. A register setting out this information shall be established as part of the CQA plan.

- Wastes shall only be removed off-site after the material has been classified and written approval has been received for the disposal of the contaminated soil at the nominated treatment or disposal site, or evidence of appropriate recycling (in accordance with regulatory requirements and relevant codes of practice) has been provided.
- All asbestos debris and contaminated PPE should be doubled bagged prior to transportation to an appropriately licensed landfill that can accept asbestos waste. Management of asbestos waste is to be undertaken in accordance with CI 42 of the POEO (Waste) Regulation 2005.
- Waste tracking shall be undertaken in accordance with EPA requirements (specifically CI 49 of the POEO (Waste) Regulation 2005) and include evidence of instructions, load registers/records (source, classification, volume, date and time, vehicle details etc), weigh bridge dockets.

8. KEY CONTACTS AND RESONSIBILITIES

8.1 ROLES and RESPONSIBILITIES

8.1.1 Principal

The Principal has responsibilities that include:

1. Ensuring guidelines and recommendations set out in this RAP are adhered to;
2. Management of company systems to ensure suitably qualified contractors and consultants are engaged to carry out the proposed works and to ensure the necessary safety standards are being maintained;
3. Completing sufficient stakeholder and community consultation where required; and
4. Maintaining a register of all relevant documentation pertaining to the remedial works.

8.1.2 Remediation Contractor

The remediation contractor has responsibilities that include:

1. Ensuring guidelines and recommendations set out in this RAP are adhered to;
2. Required civil works (i.e., remediation or associated works), including all measures required to protect worker and public health and the environment during the works.
3. Preparing a detailed work plan for implementing the works.
4. Undertaking material inspections and clearances in accordance with this RAP,
5. Preparing / obtaining and providing all relevant supporting documentation to the environmental consultant in relation to any remediation works carried out.

8.1.3 SQP/Licensed Asbestos Assessor

The Suitably Qualified Person (SQP)/ Licensed Asbestos Assessor will:

1. Provide direction and advice for the safe handling and removal of ACM and contaminated soil;
2. Inspect and approve control measures prior to soil disturbance activities;
3. Be responsible for the supervision of asbestos related site works (as required);
4. Conduct fibre air monitoring during soil disturbance;
5. Ensure remedial works are performed in accordance with this RAP, and other Government Legislative requirements relevant to asbestos and contaminated land including Codes of Practices and Guidance Notes;
6. Complete soil validation sampling and waste characterisation sampling as required;
7. Provide a remediation and validation report on completion of works.

8.1.4 All Site Personnel

Each employee (and/or sub-contractor where applicable) engaged to undertake site works shall be responsible for:

1. Operating within the requirements of this RAP;
2. Ensuring their PPE is effective and in sound working order;
3. Promoting safe work practices;
4. Adopting work practices that minimise disturbance of ACM and the creation of hazardous atmospheres;
5. Ensuring that all work is conducted in a safe and competent manner; and
6. Reporting incidences or potential hazards to the applicable responsible officer(s) before further works are carried out.

8.2 PUBLIC COMMUNICATION AND COMPLAINTS

Involvement and communication with site stakeholders is necessary to prevent undue concerns regarding management of site works and the associated risks. Consultation will address potential concerns that may be raised prior to or during site works that may include the following:

- Potential airborne asbestos fibre exposure;
- Potential odour, noise, vibration and dust generation;
- Traffic movement;
- Working hours;
- Treatment and management of asbestos containing materials and contaminated material; and
- Safety and security concerns.

It is anticipated that community consultation will be carried out by the Principal at their discretion (or a nominated representative during site works).

Any public concerns or complaints received by site personnel should be directed to the remediation contractor. A complaints register will be established by the contractor for site works. The register will comprise a system or protocol for the receipt, recording and response to community complaints, and methods for dealing with complaints. Complaints will be investigated and documented as a non-conformance (if justified) and appropriate corrective actions implemented in a timely manner.

9. DATA QUALITY OBJECTIVES

The Data Quality Objective (DQO) process will be applied to the remediation earth works and validation sampling as described below, to ensure that data collection activities are appropriate and achieve the stated objectives.

A process for establishing data quality objectives for an investigation site has been defined by Australian Standard AS4482.1 (1997) Guide to the Sampling and Investigation of Potentially Contaminated Soil - Parts 1 and 2 and DEC 2006. The DQO process involves seven steps as follows:

1. State the problem;
2. Identify the decision;
3. Identify the inputs into the decision;
4. Define the boundaries on the investigation;
5. Develop a decision rule;
6. Specify limits on decision errors; and
7. Optimise the design for obtaining data.

9.1 STEP 1 – STATE THE PROBLEM

Contamination has been identified at the site that may adversely impact the site's suitability for various uses and/or may have adverse impacts upon environmental receptors. Sources of contamination at the site have been identified to include:

- Poor storage / maintenance of ACM building materials; and
- Heavy metal (zinc) contamination of soil above ecological investigation levels associated with degradation of galvanised steel sheeting;

In its current state the area adjacent to the western side of the main shed is not suitable for the proposed development without remediation of ACM and asbestos contaminated soils. The demolition of the shed itself has the potential to cause the site to be impacted by hazardous building materials (ACM guttering and loose ACM Sheeting), and remediation work should include removal of ACM materials from the main shed.

9.2 STEP 2 – IDENTIFY THE DECISIONS

The required remediation area has been defined as an area of approximately 230m² extending from 1m east of the former western wall of the shed to 6m west of the north west corner of the former shed and 2m west of the southwest corner (refer figure 3). The excavation works of asbestos impacted area will extend to minimum depth of 0.4m to ensure and allow visual clearance of base of excavation and validation sampling by suitably qualified persons.

The aim of the validation program is to collect sufficient data to verify that the remediation has been carried out satisfactorily to achieve the remediation goal of rendering the site suitable for the proposed use (hospital).

The data gap investigation area shown in Figure 4, is an indicative area around the recently demolished site sheds and the identified concrete slab of unknown origin and is based on the available anecdotal information. The investigation will include excavation of the concrete slab and

associated sampling and the completion of testpits across the potential area of the cattle dip to enable adequate characterization of the area.

The aim of the data gap investigation is to collect sufficient data to verify if there is any contamination associated with a potential cattle dip in the area, and if contamination is identified, to enable the development of a suitable remediation plan.

These questions to be answered are the following:

- Has the extent of the identified impacts been adequately removed?
- In the event that un-forseen impacts are identified (i.e. unidentified contamination), is the proposed remedial plan adequate to manage this contamination?

9.3 STEP 3 – IDENTIFY INPUTS INTO THE DECISION

The validation program and data gap investigation has been designed to provide sufficient information to allow a sound scientific evaluation of the questions set out above. This will be achieved by comparing the soil results data to applicable guidelines to evaluate the potential for contamination to adversely impact upon human health and/or ecological receptors, and determine if remediation works have been completed to the extent necessary to achieve the remediation goal, or if the development of an additional remediation plan is required to remediate contamination associated with the potential cattle dip.

9.4 STEP 4 – DEFINE THE BOUNDARIES OF THE INVESTIGATION

The lateral boundaries of the site investigation included the subject property lot, the cleared areas of the property, and the extent of the Stage 1 Development Area.

The required remediation area has been defined as an area of approximately 230m² extending from 1m east of the former western wall of the main shed to 6m west of the north west corner of the former shed and 2m west of the southwest corner (refer figure 3). Excavation works in the remediation area will be 0.4m deep.

9.5 STEP 5 – DEVELOP A DECISION RULE

The decisions associated with accepting data in relation to soil sampling will be assessed with reference to the chosen guidelines (**Section 5**), which were established within the framework of guidelines made or approved by the NSW EPA.

- If the validation data are above the nominated guidelines, then additional remediation or risk assessment may be required.
- If the validation data indicates that the analysis is less than the nominated guidelines, then no further remediation or risk assessment is required

9.6 STEP 6 – SPECIFY LIMITS ON DECISION ERRORS

With respect to the decision rules, decision errors would occur as a result of presenting concentrations of the COC or other data which are not representative of site conditions. This may lead to non-contaminated land being remediated/managed as contaminated, contaminated land being considered suitable for use without remediation/management or incorrect management/remediation methods applied. Decision errors may be a result of the following:

- Execution of an incorrect sampling plan;
- Field sampling errors;
- Failure to identify preferential pathways;
- Not following QA/QC procedures;
- Use of non NATA accredited analytical techniques;
- Errors made by the analytical laboratories;
- Transcriptions errors in laboratory result summary tables;
- Applying incorrect methods for statistical analysis of results; and
- Adoption of assessment criteria which does not best represent the site's land use.

The limits on decision errors are best defined by establishing a framework for the assessment of data quality, including data quality indicators. The data quality assessment process will be used to assess the representativeness of analytical results and the effects of the sampling program on data quality.

9.7 STEP 7 – OPTIMISE THE DESIGN FOR OBTAINING DATA

The following will be undertaken to optimise the data collection process:

- Where sampling is to be undertaken for asbestos analysis, field works will be undertaken by a an appropriately experienced and qualified environmental scientist i.e. environmental consultants supervised by a lead consultant with appropriate asbestos credentials and a minimum of 3 years continuous experience with asbestos contamination and relevant tertiary qualifications; and

Laboratory analysis is to be undertaken by a NATA accredited laboratory.

10. VALIDATION AND REPORTING

10.1 Validation Criteria

Section 4 details the relevant guidelines utilised in the development and selection of the validation criteria. All validation sampling and assessment should comply with the data quality objectives detailed in **Section 7.1**.

10.2 Soil Validation Plan

10.2.1 Remediation Area

The validation sampling frequency for the remediation area specified in Section 7.4 and analytical schedule is outlined in Table 10-1, **below** . Samples should be submitted to a NATA accredited laboratory for analysis for the CoPC. The results of the validation sampling should be compared against the remedial criteria specified in **Section 4**.

Table 10-1 **Validation Sampling**

Sample type	Required frequency	Anticipated number of samples ^(a)	Analytical schedule
Wall samples	Every 5 metres along each wall of the excavation.	fifteen wall samples (six from each of the eastern and western walls, one from the southern wall and two from the northern wall)	Asbestos
Base samples	A minimum of two samples per 100m ² on base of the excavation.	Six base sample	Asbestos
Quality control samples	Duplicate samples (blind and split) should be collected at a combined rate of not less than 1 per 20 samples .	Two blind duplicate samples Two split duplicate sample	Asbestos

10.2.2 Sampling protocols and quality control procedures

Validation sampling for asbestos analysis should be undertaken in accordance with WA DoH (2009) and NEPM (2013) guidelines in particular:

- At least one 10 L sample from each sampling location;
- Sample screened manually on-site through a < 7 mm sieve or spread out for inspection on a contrasting colour material (recommended for FA);
- Identified ACM and FA collected and submitted to laboratory along with the soil sample (outlined below) to be weighed to calculate asbestos soil concentration.
- A wetted 500 ml soil sample from each location submitted for laboratory analysis.

All sampling should be conducted in strict accordance with accepted industry standards for quality control. This ensures that all samples are collected via a set of uniform, systematic methods. In particular:

- All sampling equipment shall be thoroughly decontaminated, using phosphate free detergent and deionised water rinse between sampling events.
- All field equipment should be calibrated in accordance with documented requirements.
- Samples should be collected in suitable containers, as provided by the project analytical laboratories.
- All soil samples collected should be transported to the testing laboratory under strict chain of custody documentation.
- Photographs of the excavation should be taken as part of the validation works.

The Environmental Consultant will undertake an independent visual assessment of the remedial excavations and stockpiles to provide an accurate log/description of their condition and provide a photographic record of the materials, and prepare / review the records of soil classification.

Copies of documentation (including details of source, quality and records of material movement) for the excavated material will be required to support the Environmental Consultant's assessment.

10.3 Data Gap Investigation

The sampling frequency for the data gap investigation specified in Section 3.4 and analysis frequency outlined below. Samples from the testpits should be submitted to a NATA accredited laboratory for analysis for heavy metals, while samples from the walls and floor of the slab excavation should be analysed for TPH/BTEX compounds, PAHs, heavy metals and asbestos based on the observations reported by Cavvanba Consulting during the inspection of the slab on 29 January. As a conservative measure the results of the sampling should be compared against the NEPM (2013) investigation criteria for human health and environmental receptors for residential land use.

Validation of Concrete slab excavation:

- 1 sample per 5 linear metres along each wall of excavation.
- 1 sample per 5 linear metres along base of excavation.

Characterisation testpits:

- Testpits are to be completed across the indicative area of the potential cattle dip (shown in Figure 4) at an equivalent density of 1 per 100m² to provide suitable characterisation to detect

any hotspots associated with a potential cattle dip. 3 samples per testpit should be collected for analysis in accordance with Australian Standards AS4482.2-1999 and NEPM Guidelines (2013).

10.4 Waste Classification

Waste classification is required prior to offsite disposal of material excavated. The recommended sampling density is a minimum rate of one sample per 25 m² (based on the sampling density for in-situ classification detailed in the *NSW EPA excavated natural material guidelines*). All waste classification is to be undertaken in accordance with NSW EPA (2014) *Waste Classification Guidelines Part 1: Classifying Waste*. Waste disposal is to be undertaken in accordance with applicable legislation and any specific council requirements.

Samples should be analysed for the following suite (as a minimum):

- Heavy metals (As, Cd, Cr, Cu, Ni, Hg, Pb, Zn).
- Asbestos.

Toxicity characterisation leaching procedure and analysis for selected analytes may be required for waste classification purposes.

10.5 Validation of imported fill

Based on the nature of proposed remediation works, there is not expected to be any requirement for importation of fill material for the remediation works. However in the event that material is imported to site, all material imported to the site as part of the remediation should be either virgin excavated natural material (VENM) or material for which a valid exemption exists (such as Excavated Natural Material (ENM)). Material which does not comply with this requirement will not be brought on to site. The Environmental Consultant will carry out an inspection and a review of site history for each identified source of VENM. The nature of the imported material will be recorded (including photographs) at the source so it can be verified on site. The Contractor will need to provide tracking details of imported material.

In the event that the proposed backfill material is not pre-classified or certified as VENM or ENM, validation samples should be collected to confirm the suitability of the material for use on the site. In this instance, the Environmental Consultant will collect validation samples from imported materials at a minimum frequency of five validation samples per source or one per 100 m³, whichever is the higher. In addition, the imported soil must be inspected and verified as being free from deleterious materials, for example, rubbish and other man made materials. Samples will be tested for the following suite of contaminants at a NATA accredited laboratory:

- Heavy metals (As, Cd, Cr, Cu, Hg, Pb, Ni, Zn).
- Asbestos.
- TRH.
- BTEX.
- PAHs.
- Organochlorine pesticides (OCP).
- Polychlorinated biphenyls (PCBs).

10.6 Validation Reporting

The report will document the remediation and validation program activities including the final methodologies adopted and an evaluation of the results against the remedial goals demonstrating compliance with the conditions of this RAP.

This report shall contain all relevant information and shall conform to:

- NSW EPA (2011) *Contaminated sites: guidelines for consultants reporting on contaminated sites*; and
- Department of Environment and Conservation NSW (2006) – *Contaminated sites: Guidelines for the NSW site auditor scheme (2nd edition)*.

Following appropriate implementation of the remedial measures and associated activities documented in this RAP, and subject to validation by the Environmental Consultant, the site will be considered suitable for proposed hospital land use.

10.7 Contingency Plan

A contingency plan incorporating an “Unexpected Finds Protocol” (UFP) to be followed in the event of unexpected situations shall be prepared by the Contractor and form part of the Detailed Work Plan. The Contractor will be required to follow the contingency plan if unexpected situations are encountered during the remediation works.

The contingency plan should outline procedures that can be implemented to manage such situations and prevent adverse impacts to the environment and human health, and manage unexpected situations.

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

For the data gap investigation, if elevated arsenic concentrations are detected from validation sampling around the slab or the testpits, then installation of groundwater wells will be required, and an addendum to the RAP will be prepared outlining the requirements for excavation, and offsite disposal of the impacted material,

10.7.1 Unexpected Finds Protocol

For all sites, a potential exists that wastes or contaminated soils exist through undetected hotspots or uncontrolled dumping. During the proposed site development works, all materials should be assessed for potential contamination. Indications of potential contamination can include soil, fill material or wastes which exhibit one or more of the following:

- staining or discolouration;
- odours;
- waste materials such as ash or slag;
- construction or demolition wastes (brick, concrete, tile, timber, steel, carpet, etc.);
- asbestos cement sheeting or pipe pieces or fragments;
- bottles, chemical containers, broken glass, plastic, etc.; and/or
- white goods, garbage, etc.

The unexpected finding protocol (UFP) to be developed for the site works should include (but not be limited to) 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.

11. Site Management Plan

11.1 Hazard Identification and Exposure Pathway

Based on the site assessment, the hazards which require management are:

- soil potentially contaminated with asbestos; and
- standard construction site hazards.

11.1.1 Exposure Pathway

Exposure pathways are limited to inhalation of asbestos fibres.

11.2 Interim Site Management

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.

The remediation schedule is yet to be finalised, and until commencement of remediation works the surrounding fence and geofabric material should be maintained in order to sustain the appropriate control measures for asbestos.

11.3 Site Management (Remediation Works)

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.

11.3.1 Dust Control

Generation of dust must be kept to a minimum by the addition of adequate volumes of water or dust suppression product during all phases of soil disturbance. If the soil is dry, water must be added at the following stages to effectively minimise generation of airborne dust:

- Exposed areas of asbestos impacted soil;

- During soil excavation;
- During placement of soil/ACM into trucks; and
- If soil is placed in temporary stockpiles prior to loading on trucks.

Water applied to stockpiles must be completed in a manner that does not generate runoff.

In addition, wind direction and wind strength should be considered during soil disturbance works. It may be necessary to suspend works during times of strong winds. Staff and plant should be situated upwind from excavation areas as much as practical.

11.3.2 Stormwater Management

Remediation works must comply with appropriate requirements for stormwater management on construction sites. This includes stockpiling excavated soil in a manner that shall prevent contamination from being transported off-site by stormwater. The Contractor must control surface water on site as follows:

- Diversion of clean stormwater runoff outside of any exposed contaminated areas so the water does not flow through the areas of impact;
- Control drainage at site by interception and redirecting clean runoff in a controlled manner.

Local Government approval must be sought prior to off-site discharge of any water suspected to be contaminated. Water collected in excavations in contact with contaminated soil must be sampled and analysed to determine a suitable disposal option.

11.3.3 Sediment Control

Sediment released to surface waters must be avoided by the use of sediment controls such as detention basins, diversion drains or silt fencing. Any silt or soil must not be released to stormwater outlets. Measures to limit the generation of sediment runoff from onsite soil stockpiles include:

- Covering of stockpiles to limit erosion; and
- Surround stockpiles by an appropriate sediment fence to limit the ability of soil to become mobile.

All trucks and machinery entering the work zones are to be inspected and cleaned as necessary prior to leaving the work zone to ensure soil is not leaving the site in an uncontrolled manner.

11.3.4 Remediation Schedule

The remediation schedule is yet to be finalised

11.3.5 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.

11.3.6 Long Term Management

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

12. REFERENCES

NEPC 2013. National Environment Protection (Assessment of *Site Contamination*) Measure 1999, as amended by the National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1), National Environment Protection Council, May 2013.

NHMRC. 2011. Australian Drinking Water Guidelines (updated March 2015).

NSW DEC 2006. Contaminated sites: Guidelines for NSW site Auditor Scheme, (2nd Edition). New South Wales Department of Environment and Conservation, 2006.

NSW DEC 2007. Contaminated sites: Guidelines for the Assessment and Management of Groundwater Contamination. New South Wales Department of Environment and Conservation, 2007.

NSW EPA 2015. Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997. New South Wales Environment Protection Authority, 2015.

NSW EPA 1995. Contaminated sites: Sampling Design Guidelines. New South Wales Environment Protection Authority, 1995.

NSW DUAP & NSW EPA 1998, Managing land contamination: Planning guidelines, SEPP 55 – remediation of land, NSW Department of Urban Affairs and Planning and NSW Environment Protection Authority

NSW OEH 2011. Contaminated sites: Guidelines for Consultants Reporting on Contaminated sites. New South Wales Office of Environment and Heritage, 2011.

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

APPENDIX A FIGURES



LEGEND				
1		04/4/2016	MO	RJ
REV	DESCRIPTION	DATE	INT	APP



CLIENT:	Health Infrastructure NSW	DESIGNED:	DRAWN:
PROJECT TITLE:	Tweed Hospital - RAP	CHECKED:	No. SHEETS:
SITE ADDRESS:	771 Cudgen Road, Cudgen	SCALE:	DATE STARTED:
DRAWING TITLE:	Site Location	JOB No:	J8961
		DRAWING No:	1



LEGEND

HA37

Hand Auger
location



0 75 150m

1		04/4/2016	MO	RJ
REV	DESCRIPTION	DATE	INT	APP



CLIENT:	Health Infrastructure NSW	DESIGNED:	DRAWN:
PROJECT TITLE:	Tweed Hospital RAP	CHECKED:	No. SHEETS:
SITE ADDRESS:	771 Cudgen Road, Cudgen	SCALE:	DATE STARTED:
DRAWING TITLE:	DSI Sampling Locations	JOB No:	J8961
		DRAWING No:	2



1		04/4/2016	MO	RJ
REV	DESCRIPTION	DATE	INT	APP



CLIENT:	Health Infrastructure NSW	DESIGNED:	DRAWN:
PROJECT TITLE:	Tweed Hospital RAP	CHECKED:	No. SHEETS:
SITE ADDRESS:	771 Cudgen Road, Cudgen	SCALE:	DATE STARTED:
DRAWING TITLE:	Remediation Area	JOB No:	J8961
		DRAWING No:	3



Indicative Data
Gap Investigation
Area

Concrete Slab

1		04/4/2016	MO	RJ
REV	DESCRIPTION	DATE	INT	APP



CLIENT:	Health Infrastructure NSW	DESIGNED:	DRAWN:
PROJECT TITLE:	Tweed Hospital RAP	CHECKED:	No. SHEETS:
SITE ADDRESS:	771 Cudgen Road, Cudgen	SCALE:	DATE STARTED:
DRAWING TITLE:	Indicative Data Gap Investigation Area	JOB No:	J8961
		DRAWING No:	4

APPENDIX B Analytical Results Tables

Notes		
	X	Results in yellow highlight and bold indicate an exceedance of the adopted health based assessment criteria
		Results in green highlight and bold indicate an exceedance of the adopted ecological based assessment criteria
1		NPWT (1999) Cohort study

Table 3 - Results of sample examination using polarised light microscopy (PLM) including Dispersion Staining

Qualitative Results (NATA)							Quantitative Results (non NATA)					
AS 4964 – 2004 Identification of Asbestos in Bulk Samples							National Environment Protection (Assessment of Site Contamination) Measure (2013)					
Sample ID	Sample Location	Sample Description	Approx. Sample Weight (dry) (g)	Asbestos Detected	Fibre Type Detected	Trace Asbestos Detected	Approx. Sample Weight (dry) (kg)	AF / FA (2 - 7mm)		AF / FA (<2mm)		
								Weight of AF/FA (g)	AF/FA (as 100% Asbestos in AF/FA) (%)	Sub-sample Weight (g)	Weight of AF/FA (g)	AF / FA (as 100% asbestos in AF/FA)
HA 1 - 0 - 0.1	-	Soil	530	Yes	CHR-ORG	No	0.53	0.111	0.021	102.00	0.0100	0.010
HA 2 - 0 - 0.1	-	Soil	402	No	NAD-ORG	No	0.402	0.000	<0.001	105.00	0.0000	<0.001
HA 7 - 0 - 0.1	-	Soil	254	No	NAD-ORG	No	0.254	0.000	<0.001	102.00	0.0000	<0.001
HA 4 - 0 - 0.1	-	Soil	322	No	NAD-ORG	No	0.322	0.000	<0.001	100.00	0.0000	<0.001

(results in mg/kg unless otherwise stated)

[illegible]

X	Results in yellow highlight and bold indicate an exceedance of the adopted health based assessment criteria -
	Results in green highlight and bold indicate an exceedance of the adopted ecological based assessment criteria for residential land use
	Results in green highlight and bold indicate an exceedance of the adopted ecological based assessment criteria for Ecologically significant Area

2 NEPM (1999) Schedule B1 Table 1B - Ecological Investigation levels, urban, residential and public open space

Composite samples - relevant HIL/EIL has been divided by the the number of samples that formed the composite i.e. default HIL / added contaminant limit has been divided by 4

Table 4 - Soil analytical results - composite samples

J8961
(results in mg/kg unless otherwise stated)



ANALYTE	LOR	Units	ASSESSMENT CRITERIA			M18-Au09806	M18-Au09807	M18-Au09808	M18-Au09809	M18-Au09810	M18-Au09811	M18-Au09812	M18-Au09813	M18-Au09772	EB1819257002	M18-Au09814	M18-Au09815	M18-Au09816
			HIL A ⁽¹⁾⁽²⁾	EIL A ⁽¹⁾⁽²⁾	EIL - Ecologically significant ⁽¹⁾⁽²⁾													
Laboratory ID																		
Sample name						HA28	HA29	HA30	HA31	HA32	HA33	HA34	HA35			HA36	HA37	HA38
Sample depth						0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15			0.15	0.15	0.15
Sample date						3/08/18	3/08/18	3/08/18	3/08/18	3/08/18	3/08/18	3/08/18	3/08/18			3/08/18	3/08/2018	3/08/2018
Metals																		
Arsenic	2	mg/kg	25	25	10	5.4	4.2	4.7	5.4	4.3	5.5	4.7	5.7	4.9	15	6	5	4.4
Cadmium	1	mg/kg	5	-	-	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	-	2	-	<0.4
Chromium (Total)	5	mg/kg	25	118	50.5	26	20	23	18	16	20	18	19	17	11	53	17	16
Copper	5	mg/kg	1500	211	118.5	70	63	52	39	34	60	41	34	33	3	29	15	34
Lead	5	mg/kg	75	286	128	24	15	12	12	8.8	14	10	12	12	0	9	28	11
Mercury	0.1	mg/kg	10	-	-	0.1	0.2	0.1	0.2	0.1	0.2	0.2	0.2	0	0	0.2	0.2	0.2
Nickel	5	mg/kg	100	79.5	44.5	15	17	19	20	16	24	18	20	17	16	10	66	21
Zinc	5	mg/kg	1850	270	192.5	130	130	120	120	110	150	130	130	130	0	88	38	140
Organochlorine Pesticides																		
4,4'-DDT ⁽³⁾	0.05	mg/kg				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	<0.05
4,4'-DDT ⁽³⁾	0.05	mg/kg				0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.21	0.19	10	0.13	47	0.06
4,4'-DDT ⁽³⁾	0.05	mg/kg		45	0.75	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	0.06	0	<0.2	-	<0.05
β-BHC ⁽⁴⁾	0.05	mg/kg				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	<0.05
Aldrin ⁽⁴⁾	0.05	mg/kg				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	<0.05
Aldrin and Dieldrin (Total)	0.05	mg/kg	1.5			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	<0.05
β-BHC	0.05	mg/kg				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	<0.05
Chlordanes - Total	0.05	mg/kg	12.5			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.05	-	<0.1
α-BHC	0.05	mg/kg				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	<0.05
DDT + DDE + DDD (Total)*	0.05	mg/kg	60			0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.27	0.25	10	0.13	70	0.06
Dieldrin ⁽⁴⁾	0.05	mg/kg				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	<0.05
Endosulfan I	0.05	mg/kg	67.5			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	<0.05
Endosulfan II	0.05	mg/kg	67.5			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	<0.05
Endosulfan sulphate	0.05	mg/kg				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	<0.05
Endrin	0.05	mg/kg	2.5			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	<0.05
Endrin aldehyde	0.05	mg/kg				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	<0.05
Endrin ketone	0.05	mg/kg				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-	-	<0.05
γ-BHC (Lindane)	0.05	mg/kg				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	<0.05
Heptachlor	0.05	mg/kg	1.5			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	<0.05
Heptachlor epoxide	0.05	mg/kg				<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	<0.05
Hexachlorobenzene	0.05	mg/kg	2.5			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	<0.05
Methoxychlor	0.05	mg/kg	75			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.2	-	<0.05
Toxaphene		mg/kg	5			<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-	-	<1
Vic EPA IWRG 621 OCP (Total)*		mg/kg				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.27	0.25	-	-	-	<0.1
Vic EPA IWRG 621 Other OCP (Total)*		mg/kg				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-	<0.1
Organophosphorus Pesticides																		
Azinphos-methyl		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.05	-	<0.2
Bostar		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2
Chlorfenvinphos		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.05	-	<0.2
Chlorpyrifos		mg/kg	26.5			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.05	-	<0.2
Chlorpyrifos-methyl		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.05	-	<0.2
Coumaphos		mg/kg				<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	<2
Demeton-O		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2
Demeton-S		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.05	-	<0.2
Disatrin		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.05	-	<0.2
Dichlorvos		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.05	-	<0.2
Dimethoate		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.05	-	<0.2
Disulfoton		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2
EPN		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2
Ethion		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.05	-	<0.2
Ethoprop		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2
Ethyl parathion		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2
Fenitrothion		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2
Fensulfotthion		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2
Fenthion		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.05	-	<0.2
Malathion		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.05	-	<0.2
Merphos		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2
Methyl parathion		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	-	<0.2
Mevinphos		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2
Monocrotophos		mg/kg				<2	<2	<2	<2	<2	<2	<2	<2	<2	-	<0.2	-	<2
Naled		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2
Omethoate		mg/kg				<2	<2	<2	<2	<2	<2	<2	<2	<2	-	-	-	<2
Phorate		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2
Priniphos-methyl		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.05	-	<0.2
Pyrazophos		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2
Ronnel		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2
Terbufos		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2
Tetrachlorvinphos		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2
Toluthion		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2
Trichloronate		mg/kg				<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	-	-	<0.2

Notes

x	Results in yellow highlight and bold indicate an exceedance of the adopted health based assessment criteria -
	Results in green highlight and bold indicate an exceedance of the adopted ecological based assessment criteria for residential land use
	Results in green highlight and bold indicate an exceedance of the adopted ecological based assessment criteria for Ecologically significant Area

Table 4 - Soil analytical results - composite samples

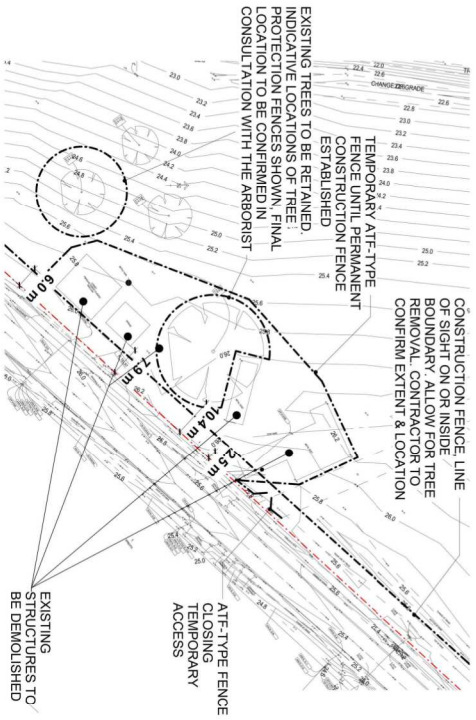
J8961
(results in mg/kg unless otherwise stated)

[illegible]

Notes

X	Results in yellow highlight and bold indicate an exceedance of the adopted health based assessment criteria -
	Results in green highlight and bold indicate an exceedance of the adopted ecological based assessment criteria for residential land use
	Results in green highlight and bold indicate an exceedance of the adopted ecological based assessment criteria for Ecologically significant Area
1	NEPM (1999) Schedule B1 Table 1A(1) - Health Investigation Level A - low to high density residential
2	NEPM (1999) Schedule B1 Table 1B - Ecological Investigation levels, urban, residential and public open space
3	NEPM (1999) Schedule B1 Table 1B - Ecological Investigation levels, Areas of Ecological Significance
#	Composite samples - relevant HIL/EIL has been divided by the number of samples that formed the composite i.e. default HIL / added contaminant limit has been divided by 4

APPENDIX C Design Plan



REVISIONS	DATE	BY	DESCRIPTION
1	2023/03/01	AB	ISSUED FOR INFORMATION
2	2023/03/01	AB	ISSUED FOR INFORMATION

N

LEGEND

— SITE BOUNDARY

- - - CONSTRUCTION FENCE

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DIMENSIONS

ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED. DIMENSIONS ARE TO BE CONFIRMED BY THE CONTRACTOR.

PROVIDE FITTINGS & EQUIPMENT SPECIFICATIONS

ALL FITTINGS & EQUIPMENT TO BE PROVIDED BY THE CONTRACTOR. SPECIFICATIONS TO BE PROVIDED BY THE CONTRACTOR.

SERVICE POINTS SPECIFICATIONS

ALL SERVICE POINTS TO BE PROVIDED BY THE CONTRACTOR. SPECIFICATIONS TO BE PROVIDED BY THE CONTRACTOR.

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STH BATESMARTL

TSA

NSW Health

TWEED VALLEY HOSPITAL

PRELIMINARY WORKS

10363.00 AR-DWG-10-101 2

ESSENTIAL ENERGY
SWITCHING STATION



NOTES

LANDSCAPE INDICATIVE ONLY - REFER LANDSCAPE ZONAL PLAN L-MP-12

LEGEND

- SITE BOUNDARY
- MAXIMUM PLANNING ENVELOPE
- TREE TRUNK LINE
- APZ OFFSETS
- PROBABLE MAXIMUM FLOOD LEVEL
- ➡ INDICATIVE BUILDING ENTRIES



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PROJECT MANAGER



CLIENT



PROJECT

TWEED VALLEY HOSPITAL
771 Cudgen Road, Cudgen

DRAWING TITLE

MASTERPLAN
CONCEPT PLAN

SCALE	DATE	DRAWN BY	CHECKED
1:2500 @ A3	19/09/2018	CE	MH
PROJECT No	DRAWING No	REVISION	
10363	AR-SKE-10-006	04	