



Remedial Action Plan

Abel Tasman Village

138 & 140 Campbell Hill Road, Chester Hill NSW

Prepared for Abel Tasman Village Association Limited

Project No. 22065

18 May 2023

Version 2

Remedial Action Plan

Abel Tasman Village, Chester Hill NSW

Prepared for Abel Tasman Village Association Limited



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Table of Contents

1. Introduction & Background.....	5
1.1. Objectives.....	6
1.2. Scope of Works	6
2. Site Identification	8
2.1. Site Condition	8
2.2. Surrounding Environment	9
2.3. Previous Site Investigations	11
3. Site History Review	14
4. Conceptual Site Model	15
4.1. Contamination Sources	15
4.2. Review of Potential and Complete Exposure Pathways	15
4.3. Source, Pathway and Receptor Linkages	16
4.4. Duty to Report Contamination.....	17
5. Data Quality Objectives	18
6. UPSS Validation Assessment Criteria.....	21
7. Remediation Works	23
7.1. Remediation Objectives	23
7.2. Extent of Remediation Required	23
7.3. Remediation Options Hierarchy.....	23
7.4. Remediation Options Evaluation	24
7.5. Remedial Plan	25
7.6. Materials Not Suitable for Offsite Disposal	26
7.7. Stockpile Management	26
7.8. Visual Validation	26
7.9. Backfilling Excavations	27
7.10. Future Exposure Scenarios	27
8. Remedial Works Plan	28
8.1. Underground Storage Tank Validation	28



9. Validation Sampling Plan	30
9.1. Visual Inspection	30
9.2. Validation Sampling and Analysis.....	30
9.3. Soil Sampling Methodology	30
9.4. Soil Laboratory Analyses	31
9.5. Quality Assurance/Quality Control	32
9.6. Validation of Imported Backfill Materials	32
9.7. Validation Reporting	32
10. Contingency Plan	34
10.1. Unexpected Finds	34
10.2. Remediation Strategy Unsuccessful	35
10.3. Groundwater Ingress and/or Rainwater Entering Any Excavations	35
10.4. Groundwater and/or Soil Vapour Contamination is Identified.....	35
11. Site Management Plan	36
11.1. Hours of Operation	36
11.2. Community Consultation and Engagement.....	36
11.3. Site Establishment.....	37
11.4. Preparation Works.....	37
11.5. Site Access and Fencing Requirements.....	37
11.6. Material Tracking	37
11.7. Material Transport	38
11.8. Imported Fill for Design Levels	38
11.9. Soil and Water Management.....	38
11.10. Stockpiles	38
11.11. Noise	39
11.12. Vibration.....	39
11.13. Air Quality.....	39
11.14. Dust Control.....	39
11.15. Odour	39
11.16. Hazardous Materials	40
11.17. Removal and Disposal of Contaminated Soil and Asbestos.....	40
11.18. Complaint Reporting and Resolution	41
11.19. Validation.....	41
11.20. Site Dis-establishment	41
12. Health and Safety	42



12.1. Responsibilities	42
12.2. Other Members of the Site Workforce.....	44
12.3. Hazards.....	44
12.4. Contamination Hazards	45
12.5. Physical Hazards.....	45
12.6. Personal Protective Equipment	46
12.7. Decontamination Procedures.....	47
12.8. Contamination Control Zone	48
13. Regulatory Approvals/Licensing	49
13.1. State Environment Planning Policy (Resilience and Hazards) 2021	49
13.2. Canterbury Bankstown Consolidated LEP 2020	49
13.3. Protection of the Environment Operations Act 1997.....	49
13.4. Protection of The Environment Operations (Waste) Regulation 2014.....	49
13.5. Protection of The Environment Operations (Clean Air) Regulation 2010.....	50
13.6. Protection of The Environment Operations (Underground Petroleum Storage System) Regulation 2019	50
13.7. Waste Classification Guidelines, Part 1: Classifying Waste	50
13.8. Work Health and Safety Act 2011	50
13.9. Roads and Rail Transport (Dangerous Goods) Act 1997	50
13.10. NSW EPA Asbestos and Waste Tyres Guidelines (2015)	50
14. Construction and Environmental Management Plan	51
15. Approvals, Conditions, Licensing, Legislation & Guidelines	52
16. Conclusions	54
17. Limitations.....	55
18. References	57

Appendix A – Figures

Appendix B – Summary Results Tables



1. Introduction & Background

Reditus Consulting Pty Ltd (Reditus) was engaged by Abel Tasman Village Association Limited (ATV) (the client) to prepare a revised Remedial Action Plan (RAP) to inform a development application (DA) for the proposed redevelopment at Abel Tasman Village (ATV). The ATV development will include the sites at 138 & 140 Campbell Hill Road, Chester Hill NSW, inclusive of a decommissioned service station, of which this RAP applies.

The location and layout of the ATV site redevelopment area is presented on **Figure 1, Appendix A**, with the service station configuration, inclusive of inferred UPSS infrastructure to which this RAP relates, illustrated in **Figure 2, Appendix A**. The service station portion of the redevelopment, that forms the basis for the RAP, is located in the eastern portion of the redevelopment area and identified as NSW Cadastral Property Lots 6 and 7 DP30305.

Based on the findings of a historical Environmental Site Assessment (ESA) by Environmental Strategies (*Environmental Strategies, March 2014, Environmental Site Assessment, 138-140 Campbell Hill Rd Chester Hill, prepared for Estate of the Late G J McHale, ES Reference 13126RP01_Rev1*), it was concluded that whilst no gross impacts were detected in soil on the site and no reported impact to groundwater from historical site activities, localised site contamination and soil vapour impacts were identified at unacceptable concentrations around the pump islands of the former forecourt. It was also considered likely that backfill sands of the underground storage tank pits had the potential to be contaminated.

The historical investigation (ES 2014), indicated that a 75KL UST was installed on the site in or around 2001, confirming that the SafeWork NSW Dangerous Goods (DG) License records obtained at the time of the report (dated April 2000) were obsolete. Based on site observations and the DG search, it was ascertained that petroleum related infrastructure remaining on site comprised of three disconnected fuel pump islands (with three dispensers per island) and four identified underground storage tanks (USTs) consisting of:

- 1 x 70KL UST (unleaded petrol – ULP).
- 2 x 20KL UST (Premium Unleaded Petrol – PULP and Super).
- 1 x 30KL UST (automotive diesel oil – ADO).

Observations made by Reditus during fieldwork undertaken in May 2022 (Reditus 2022), confirmed that the configuration of the site remains unchanged since the historical investigation (ES 2014), and comprises underground petroleum infrastructure and site building comprising of sales building and adjacent workshop.

A groundwater assessment completed as part of the DSI undertaken by Reditus (Reditus 2022a) did not identify hydrocarbon contamination in groundwater that would preclude the proposed land use, the UPSS infrastructure will require safe removal with validation of resultant tank pit excavations in order to satisfy NSW EPA regulations as well as prepare the former service station site for future redevelopment.

As per the NSW EPA (2020) Guidelines for implementing the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2019:

“Where a tank or UPSS has not been used to store fuel for two or more years or where it is not intended to be used to store fuel again, it is deemed to be abandoned. Abandoned UPSSs or tanks must be decommissioned appropriately. This means to remove the system or render it permanently unusable.”

Following completion of the ESA (ES 2014), a Remedial Action Plan (RAP) was prepared by Environmental Strategies (*Environmental Strategies, August 2016, Remedial Action Plan, 138-*



140 Campbell Hill Rd Chester Hill, prepared for Estate of the Late G J McHale, ES Reference 16166 RAP(Rev1) to facilitate the removal of UPSS infrastructure and validation of resultant tank pit excavations, footprints of dispenser pads and ancillary infrastructure trenches.

Reditus, following completion of the DSI, recommended that the preparation of revised RAP, incorporating the measures outlined by the existing RAP prepared by Environmental Strategies (2016). The updated RAP will address statutory requirements taken effect since 2016.

This Updated RAP addresses the removal of UPSS infrastructure pursuant with the following NSW EPA endorsed guidelines, Standards, and technical documentation, specifically:

- NSW EPA (2020) Guidelines for implementing the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2019.
- Australian Standard AS 4976 – 2008 The Removal and Disposal of Underground Petroleum Storage Tanks.
- Workcover NSW (2005) Storage and Handling of Dangerous Goods Code of Practice.
- NSW DECCW (2010) UPSS Technical Note: Site Validation Reporting.
- Waste Classification Guidelines (EPA 2014).
- NEPC (2013) National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM).
- NSW EPA (2020) Consultants Reporting on Contaminated Land.
- Work Health and Safety Act 2011 and Work Health and Safety Regulation 2017.

1.1. Objectives

The objective of this RAP was to document activities, procedures, control measures, contingencies, and validation requirements to facilitate effective remediation of the site for the proposed aged care facility development in accordance with State Environment Protection Policy (Resilience and Hazards) 2021.

The RAP informs a proposed development application to Council and the site management plan to be prepared prior to commencement of construction works.

1.2. Scope of Works

The following scope of works was completed by Reditus:

- Review of previous contamination reports.
- Summarise the site investigation history and conceptual site model (CSM) to identify viable remediation options.
- Document the identified contamination risks to human health and/or the environment.
- Define the site remediation objectives that will be achieved by the RAP to ensure that the site will be made suitable for its proposed land use, and which will result in no unacceptable risk to human health or to the environment.
- Define the extent of remediation required at the site.



- Assess options and Remediation technologies to achieve the remediation objectives and justify a preferred approach, which includes the consideration of the principles of ecologically sustainable development.
- Document all procedures and plans to reduce risks posed by contamination to acceptable levels for the proposed site use.
- Establish the environmental safeguards required to complete the remediation in an acceptable manner, including consideration of the potential for off-site impacts (such as air quality, odour, and aesthetics).
- Address contingencies and unexpected finds protocols.
- Identify the necessary approvals and licences required by regulatory authorities including any items contained in development consent conditions.
- Outline waste classification, handling and tracking requirements in accordance with the Guidelines for the NSW Site Auditor Scheme and Waste Classification Guidelines (EPA 2014).
- Document Site Validation requirements with clearly defined acceptance validation criteria, including a Validation Sampling and Analysis Quality Plan.
- Preparation of a RAP (this document) in general accordance with the NSW EPA (2020) Consultants Reporting on Contaminated Land and NEPC (2013) National Environmental Protection (Assessment of Site Contamination) Measure (NEPM) and other relevant NSW EPA Guidelines.



2. Site Identification

The site identification details have been prepared in general accordance with the NSW EPA (2020) Consultants Reporting on Contaminated Land and the ASC NEPM (2013) Field Checklist 'site Information' and are summarised in **Table 2-1** below. It must be noted that this RAP relates only to the service station portion of the redevelopment which required removal of UPSS to facilitate redevelopment.

Table 2-1: Site Identification Summary

Item	Detail
Address	138-140 Campbell Hill Road, Chester Hill NSW 2162
Title and Land Information	Lots 5,6 & 7 DP30305
Site Area	Approximately 2,000 m ²
Local Government Area	Canterbury-Bankstown Council
Zoning	B2 Local Centre (138 & 140 Campbell Hill Road)
Current Land Use	Disused Service Station (140 Campbell Hill Road) Vacant lot (138 Campbell Hill Road)
Future Land Use	Proposed Retirement Village Development
Trigger for Assessment	To inform a development application to be submitted to Canterbury-Bankstown Council.
Surrounding Land Uses	The land uses currently surrounding the site include: ▪ North: Low density residential buildings. ▪ South: Waldron Road followed by residential apartments ▪ West: ATV Property. ▪ East: Town centre / commercial premises and low density residential.
Remediation Area Site Layout	Figure 3, Appendix A.

2.1. Site Condition

An initial site visit was conducted by Reditus' Senior Environmental Scientists Robert Cameron and Environmental Scientist Kyle Sier on 28 April 2022, noting site conditions consistent with those identified by ES in 2016. The following was noted for the entire redevelopment area for completeness:

- The former service station and adjoining grassed lot has a rectangular boundary and consists of one main structure used for the former service station and associated workshop area.
- The service station consists of a hardstand and a metal canopy.
- Fuel staining was noted on the ground surface surrounding the former bowser locations.
- A filling sand stockpile was noted below the canopy of the former petrol station.



- Potential asbestos containing material was noted in the service station eaves during site inspection.

2.2. Surrounding Environment

A summary of the surrounding environment obtained from the most recent previous investigation (GHD 2018) is provided in **Table 2-2** below.

Table 2-2: Site Setting and Surrounding Environment

Item	Detail
Topography	Approximately 31 m (southwest corner) to 38 m (northeast corner) above Australian Height Datum. The site slope falls approximately 10m from north-east top south-west corner.
Hydrology	The nearest surface water body is a small creek approximately 500 m southwest of the site which acts as a tributary of Prospect Creek which drains to the Georges River. The drainage channel exists in a manmade culvert and appears to be used for regional stormwater collections and drainage.
Regional geology and soils	The Soil Landscapes of the Penrith 1:100,000 Sheet 9030 indicates that the site is underlain by the Blacktown soil landscape comprising gently undulating rises on Wianamatta Group Shales (Bringelly Shale). Local relief to 30 m with slopes usually >5 %. Soils are shallow to moderately deep (>100 cm) hardsetting mottled texture contrast soils with red and brown podzolic soils on crests grading to yellow podzolic soils on lower slopes and in drainage lines. The Penrith 1:100,000 Sheet 9030 indicates that the site is generally underlain by the Bringelly Shale of the Wianamatta Group including shale, carbonaceous claystone, claystone, laminate, fine to medium-grained lithic sandstone, rare coal, and tuff. The previous investigation by ES (2016) identified sand and sandy clay fill to 0.4m underlain by natural and reworked natural clays overlying weathered silty claystone and clayey siltstone.
Acid Sulfate Soils (ASS)	The Liverpool Acid Sulfate Soil Risk Map – Edition Two indicates the site is situated within an area of “No known occurrence of acid sulfate soil materials”.
Registered Groundwater Bore Search	A search of registered groundwater bores undertaken by GHD (2018) identified three registered bores (monitoring purposes to Energy Australia Ausgrid) within 500 m of the site, situated between 470 m and 500 m west of the site. The maximum drilling depth of the registered bores was 8.46 m bgl.
Regional Hydrogeology	A review of Hydrogeology map of Australia (Geoscience Australia) indicates that site aquifers are porous aquifers of low to moderate yield.



Item	Detail
Inferred Groundwater Flow Direction	Based upon regional topography it is anticipated that groundwater would flow to the southwest of the site, conforming with site topography.
Depth to Water Table	A gauging round undertaken by Reditus on 17 May 2022 recorded groundwater standing levels between 1.145 (MW1) and 1.345 (MW3) metres below top of casing (m bTOC). It is noted that all four wells on the former service station site are screened between 3.8 and 7.5 m bgl.
Yield and Inferred Groundwater Quality	All registered bores within 2 km radius of the site did not report any yield or groundwater quality data, however the Hydrogeology map of Australia (Geoscience Australia) indicates of low to moderate yield.
Groundwater Dependant Ecosystems (GDEs)	Registered bores used for irrigation purposes were not reported within a 2 km radius of the site. No groundwater dependent ecosystems have been identified at or within proximity to the site.
Groundwater Embargoes	No groundwater embargoes apply to the site.
Sensitive Environments	The nearest sensitive environments are summarised as follows: The Abel Tasman Retirement Village itself (onsite). Local stormwater network. Low-density residential dwellings in the immediate surrounding area. Child Care Centre located 130m to the south-west. Sports fields and oval immediately west of the site.



2.3. Previous Site Investigations

Reditus are aware of the following historical contamination investigations pertaining to the 138-140 Campbell Road site:

- Environmental Strategies (ES) (March 2014) Due Diligence Phase 1 and 2 Environmental Site Assessment. 138-140 Campbell Hill Road, Chester Hill, NSW.
- Environmental Strategies (August 2016) Remedial Action Plan (RAP), 138-140 Campbell Hill Road, Chester Hill, NSW.
- Reditus Consulting Pty Ltd (Reditus) (2022) Detailed Site Investigation. Abel Tasman Village, 222 Waldron Road, 138 & 140 Campbell Hill Road, Chester Hill NSW.

The reports are summarised below.

2.3.1. ES (2014) Due Diligence Phase 1 & 2 Environmental Site Assessment:

- The investigation included the advancement of ten (10) boreholes to 0.5 m below natural material with three being converted to groundwater monitoring wells which were advanced to a maximum depth of 10 metres.
- These wells were positioned downgradient to the in-situ underground storage tanks (USTs) so a baseline of groundwater conditions could be obtained.
- The subsurface geology observed across the site was as follows:
 - Hardstand was present across the site to a depth of 0.15 m, except in the area of the vacant lot (Lot 7 DP 30305), and the area west of the building in Lot 6 DP 30305.
 - Fill was observed to be present below the hardstand to a depth of between 0.2 to 0.4m across the site.
 - Reworked natural material below the fill layer was generally a blueish grey to orange silty clay, above brown to greyish-brown silty clays. Weathered silty claystone to clayey siltstone was present at depths below approximately 6.0-7.0m with solid flight auger refusal occurring at 6.8-7.5m.
- The highest PID measurement (maximum 953.3ppm) was inferred be due to a leaky fuel line that was removed 15 years prior to the assessment.
- The standing water level (SWL) measured in monitoring wells MW1, MW2 and MW3 ranged between 1.195-1.45 m bgl after purging.
- The concentrations of contaminants of concern in soil were reported to be below the adopted Soil Assessment Criteria (SAC) in all samples.
- The concentrations of contaminants of concern in groundwater were reported to be below the adopted Groundwater Assessment Criteria (GAC) in all samples, except for lead, which was above the adopted criteria (3.4 mg/L) in MW1 (16 µg/L) and MW3 (6 mg/L). However, ES considered that these levels are reflective of background conditions and were not likely to pose a risk to site users or ecological receptors.
- No asbestos was detected at the reporting limit of 0.1g/kg and no respirable fibres were detected in the soil samples submitted for analysis.

2.3.2. ES (2016) Remedial Action Plan:

Based on the findings of the Phase 1 and 2 reports a remedial action plan (RAP) for 138 & 140



Campbell Hill Road was produced by ES, which detailed the following:

- Excavation and off-site disposal of fuel infrastructure to a licensed destruction facility including:
 - 4 x USTs, 1 x above ground storage tank (AST) and associated infrastructure (i.e., fuel bowers (6), lines, fill points, vent lines).
- Identification and excavation of contaminated backfill sands/surrounding soils.
- Validation of the walls and base of the excavated areas with prescribed sampling frequencies for each UST, AST, and workshop area.
- Soils identified as contaminated are to be classed under the NSW EPA (2014) Waste Classification Guidelines.
- Validation of groundwater from the installed downgradient wells.

2.3.3. Reditus (2022) Detailed Site Investigation:

Reditus completed a detailed site investigation (DSI) for the site located at 222 Waldron Road and 138 & 140 Campbell Hill Road, Chester Hill NSW) to inform a development application (DA) for the proposed redevelopment the Abel Tasman Village (ATV). The DSI included a combined systematic and judgement sampling, in accessible areas of the site, including:

- An assessment of soils via hand auger at a total of 21 locations; and
- An assessment groundwater, including one newly installed well and three existing wells within the adjacent former service station property.
- Based on a review of the site history and previous contamination investigations, observations made during fieldwork, results of laboratory analysis and in the context of the proposed development, Reditus concludes the following:
 - All concentrations of contaminants of potential concern (COPCs) in soil samples were reported below the adopted soil assessment criteria.
 - All concentrations of contaminants in groundwater samples were reported below the adopted groundwater assessment criteria except for copper, reported marginally above the ANZG 2018 ecological criteria. However, due to the marginality of the exceedance and the reported concentration being within an order of magnitude of concentrations typically found within the urban environment (ambient urban conditions), the reported exceedance not considered to warrant further assessment of groundwater at the site. The reported concentration is not considered to pose a risk to the proposed redevelopment at the site.
 - The results of the groundwater investigation indicated that the potential source of hydrocarbon contamination in groundwater did not impact groundwater quality to an extent that would preclude the proposed land use, as a result of the former service station and UPSS infrastructure at 140 Campbell Hill Road.
- Reditus considered the site can be made suitable for its proposed land use. The site however does require remedial works prior to redevelopment. Such works primarily relate to removal of UPSS infrastructure at the former service station, therefore it was recommended that:
 - An updated an updated Remedial Action Plan (RAP) be prepared, incorporating the measures outlined by the existing RAP prepared by



Environmental Strategies (2016) statutory requirements taken effect since 2016. The Updated RAP will address the removal of UPSS infrastructure in accordance with NSW EPA and SafeWork NSW requirements and include an unexpected finds protocol detailing the methods and procedures to be followed during construction if suspected contamination is encountered.

- A pre-demolition Hazardous Materials Survey should be completed by a suitably qualified and experienced consultant prior to any demolition works, to identify hazardous materials that may be present within existing structures onsite.
- Completion of a waste classification assessment in accordance with NSW EPA (2014) Waste Classification Guidelines for any soils to be disposed offsite is to be obtained from a suitably qualified environmental consultant prior to the disposal of the soil materials.



3. Site History Review

A site history review can be found within the ES (2014) ESA for 138 & 140 Campbell Hill Road. Detailed findings of historical photographs, title deed searches, business directories, council record and regulatory searches are included within those documents.

Key findings from the previous site history reviews are as follows:

- Land was vacant bushland with service roads until the development of a service station around 1965.
- At which point the land remains a service station to the present day (2014), notably the extension of the service station to include a workshop is seen first in the 1982 photograph.
- The Shell Company of Australia Limited leased part of the land between 1958 and 1968.
- Throughout the aerial photographs Lot 5 DP30305 remains vacant as a grassed area adjacent to the service station usage.
- There are two NSW EPA listed contaminated sites within 500 m of the site:
 - 127 Orchard Road, Chester Hill, 383m south of the site (chemical industry).
 - 2 Christina Road, Villawood, 383m west of the site (chemical industry).
- POEO Act 1997 licensed activities within 500 m of the site:
 - Railway systems activities – 72m west
 - Waste storage – 100m southwest
 - Printing, packaging, and visual communications waste generation – 270m south
 - Chemical production waste generation – 383m west
- Filling activities may have taken place on the site, fill may have been imported to create current site level.



4. Conceptual Site Model

Schedule B(2) of the NEPM (NEPC, 2013) describes a conceptual site model as:

“A conceptual site model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The development of a CSM is an essential part of all site assessments and provides the framework for identifying how the site became contaminated and how potential receptors may be exposed to contamination either in the present or the future”.

Based on the site history, site setting, and contamination identified above, the following CSM has been developed.

4.1. Contamination Sources

Known and potential sources of contamination at the site, the associated contaminants of potential concern (CoPC) and potentially affected media refined from the results of the historical investigations of the site are listed in Table 4-1, which follows.

Table 4-1: Known and Potential Contaminant Sources

Source	Location	CoPC	Affected Media
Bulk underground fuel storage	Former Service Station	Total Recoverable Hydrocarbons (TRH), Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), Polycyclic Aromatic Hydrocarbons (PAH) and heavy metals.	Soil

4.2. Review of Potential and Complete Exposure Pathways

4.2.1. Human Health – Direct Contact Pathway

High PID measurements recorded by ES (2014) at the former service station site (140 Campbell Hill Road) indicated hydrocarbon impacted soil is present within the vicinity of the UPSS infrastructure. Whilst the RAP outlines the remediation of the UST infrastructure and validation works which would inherently render the site suitable for the proposed future residential use, it is likely that previously identified petroleum hydrocarbon impacts in soils have naturally attenuated.

4.2.2. Human Health – Inhalation / Vapour Intrusion Pathway

The results of the ES (2014) investigation suggested there could be an unacceptable risk to current or future site receptors. The results of the laboratory analysis indicate that the concentrations of the contaminants of potential concern in soil and groundwater at each respective sample location was below adopted NEPC (2013) HSL-A&B assessment criteria for vapour intrusion.

It was also noted that:

- headspace screening during fieldwork did not return results indicative of the presence of VOCs. there was unlikely to be any gross contamination associated with VOCs; and



- no olfactory evidence of hydrocarbon or organic odours were detected in the soil samples.

It is noted, however, that historically, high PID measurements were recorded by ES (2014) during their investigation at the former service station site (140 Campbell Hill Road) indicating the presence of hydrocarbon impacted soil within the vicinity of the UPSS infrastructure, which could pose a vapour intrusion risk pathway.

A groundwater assessment completed as part of the DSI undertaken by Reditus (Reditus 2022) did not identify hydrocarbon contamination in groundwater that would preclude the proposed land use, and it is likely that previously identified petroleum hydrocarbon contamination has naturally attenuated.

In addition, adherence to the RAP will ensure remediation of the UST infrastructure and validation works that will inherently render the site suitable for the proposed future residential use.

4.2.3. Ecological – Terrestrial Ecosystems

The results of the historical investigations did not identify an unacceptable level of risk to potential current or future terrestrial ecological receptors on site.

4.2.4. Ecological – Aquatic Ecosystems

The results of previous investigations did not identify an unacceptable level of risk to potential current or future aquatic ecological receptors on site, apart from one concentration of copper in groundwater reported marginally above the adopted ecological GAC which is considered to be representative of background conditions within the locality.

4.2.5. Management Limits

Adherence to this RAP for the Service Station (138-140 Campbell Hill Road) portion of the redevelopment including detailed plan of activities, procedures and objectives will ensure the effective and controlled remediation of Underground Petroleum Storage Systems (UPSS) infrastructure and subsequent validation works required to enable the sites to be deemed suitable for residential use.

4.3. Source, Pathway and Receptor Linkages

The CSM was refined and prepared for the site based on the outcomes of the DSI (Reditus 2022) with consideration of the previous investigations (ES 2016; GHD 2018) and presented below in Table 4-3. The tabular CSM describes potential source, pathway, and receptor (SPR) linkages and assesses each of the linkages as probably, possible, or unlikely based on the likelihood of occurrence and data obtained from the DSI undertaken.



Table 4-3: Potential Exposure Pathway Assessment

Source	Exposure Pathway	Receptor	Exposure Assessment
Bulk underground fuel storage <i>Potential spills and leaking USTs / ancillary infrastructure and storage and dispensing of petroleum-based fuel products upgradient and on the site.</i>	▪ Direct contact with contaminated soils during sub-surface works at the site (i.e., trenching and/or excavation works) or by future users of the area. ▪ Inhalation of dust and vapours. ▪ Surface water run-off. ▪ Pumping / extraction of potentially contaminated groundwater underlying the site.	▪ Construction Workers. ▪ Site occupants. ▪ Maintenance workers attending the site, particularly if works require excavation, trenching or any activities applicable to the sub-surface of the site.	Possible High PID measurements recorded by ES (2014) at the former service station site (140 Campbell Hill Road) indicate hydrocarbon impacted soil is present within the vicinity of the UPSS infrastructure. The RAP outlines the remediation of the UST infrastructure and validation works required to enable the site to be deemed suitable for residential use and future site receptors. The groundwater samples collected as part of this DSI demonstrate that groundwater quality has not been impacted to an extent that would inhibit the proposed land use and previously identified petroleum hydrocarbons in soil are likely to have attenuated. The UPSS infrastructure will require removal to comply with the UPSS regulation and NSW EPA requirements.

4.4. Duty to Report Contamination

The results of the historical investigations of the site suggest that there is no requirement to notify the reported contamination to the NSW EPA under Section 60 of the Contaminated Land Management Act (1997) subject to development of a RAP and successful remediation and validation of identified contamination.



5. Data Quality Objectives

The Data Quality Objective (DQO) process is a systematic planning tool based on the scientific method for establishing criteria for data quality and for developing data collection designs. The DQO defines the experimental process required to test a hypothesis. The DQO process has been developed to ensure that efforts relating to data collection are cost effective, by eliminating unnecessary, duplicative, or overly precise data whilst at the same time, ensuring the data collected is of sufficient quality and quantity to support defensible decision making.

It is recognised that the most efficient way to accomplish these goals is to establish criteria for defensible decision making before data collection begins and develop a data collection design based on these criteria. By using the DQO process to plan the investigation effort, the relevant parties can improve the effectiveness, efficiency, and defensibility of a decision in a resource and cost-effective manner.

The DQO process consists of seven steps, which are designed to clarify the study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors. The seven-step DQO process adopted for this RAP can be summarised as:

- **Step 1: State the Problem** – concisely describe the problem to be studied. Review prior studies and existing information to gain a sufficient understanding to define the problem.
- **Step 2: Identify the Decision** – identify what questions the study will attempt to resolve, and what actions may result.
- **Step 3: Identify the Inputs to the Decision** – identify the information that needs to be obtained and the measurements that need to be taken to resolve the decision statement.
- **Step 4: Define the Study Boundaries** – specify the time periods and spatial area to which decisions will apply. Determine when and where data should be collected.
- **Step 5: Develop a Decision Rule** – define the statistical parameter of interest, specify the action level, and integrate the previous DQO outputs into a single statement that describes the logical basis for choosing among alternative actions.
- **Step 6: Specify Tolerable Limits on Decision Errors** – define the decision maker's tolerable decision error rates based on a consideration of the consequences of making an incorrect decision; and
- **Step 7: Optimise the Design** – evaluate information from the previous steps and generate alternative data collection designs. Choose the most resource-effective design that meets all DQOs.

The DQOs are provided in Table 5-1 below and were derived in accordance with Australian Standard 4482.1-2005 'Guide to the investigation and sampling of sites with potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds' (AS 4482.1-1997).

Table 5-1: Data Quality Objectives

Step	Discussion
1. State the Problem	The site proposed for redevelopment has historically been used as a service station and workshop. PID screening and groundwater suggests that there may be residual contamination present within tank pit back fill sand or product/ vent line trenches. Adherence to the RAP will inherently facilitate the safe removal of redundant UPSS development application (DA) as well as satisfy Chapter 4 of SEPP (Resilience &



Step	Discussion
	Hazards) 2021 and remove any potential risk to construction workers during the site redevelopment and basement installation.
2: Identify the decision/goal of the study	The goal of the study was to determine if elevated concentrations of CoPCs are present at the site and if so, determine: ▪ What is the extent of the impact? ▪ Does any CoPC at the site occur at concentrations that pose or may pose an unacceptable liability or risk to the environment and/or human health to persons who will utilise the future development? ▪ If so, what is the order of priority to minimise the risk and what additional measures are required to mitigate, remediate, or manage the risk? ▪ Is the site suitable (from a site contamination perspective) for its proposed usage?
Step 3: Identify the information inputs	Key data is required to resolve the project problem included concentrations of CoPC in the soil collected in the study area, the structure and depth of the underlying site geology and nature of the on-site aquifer. The CoPC selected were based on the review of the historical assessments and the current site condition observed during fieldworks. Coarse grained soils (sands) have been adopted for conservativeness. Soil Assessment Criteria: ▪ NEPM ASC (2013) Health Screening Levels (HSLs) for Vapour Intrusion Residential A/B – (sand). ▪ NEPM ASC (2013) Health Investigation Levels (HIL) A – Residential A. ▪ NEPM ASC (2013) Environmental Investigation Levels (EIL) – Urban Residential and Public Open Space – generic trigger values. ▪ NEPM ASC (2013) Ecological Screening Levels (ESLs) – Urban Residential – coarse soils. ▪ Management Limits (ML) Residential, parkland and public open space – Coarse soil. ▪ Assessment for signs of asbestos within soil samples (present/not present). Further explanation for the selection of these criteria is provided below in Section 6 below. In the case that CoPC are detected that do not currently have a state or nationally endorsed assessment criteria, an appraisal of international guidelines will be conducted to determine an appropriate screening value.
Step 4: Define the boundaries of the study	This investigation was restricted to the physical site boundaries, as shown in Figure 2, Appendix A .
Step 5: Develop a decision rule	If the concentrations of CoPCs in the soil reported to be below the relevant adopted guidelines, then the site will be deemed suitable, and no additional management/remediation options will be proposed for the proposed future use at the site.



Step	Discussion
	If, however, the concentration of one or more CoPCs are greater than the guidelines, then further investigation may be required to laterally and vertically delineate the extent of the impact and/or recommendations made for the remediation/management of contamination to render the site suitable for the proposed use.
Step 6: Specify Tolerable Limits on Decision Errors	The acceptable limits for samples are as follows: ▪ % RPD for laboratory duplicates for TRH and BTEX analysis is less than 60%; and ▪ Recovery of matrix spikes and surrogate spikes is as per the laboratory's Quality Assurance targets accepted under their National Association of Testing Authorities (NATA) accreditation. Precision is measured using the standard deviation 'SD' or Relative Percent Difference '%RPD'. Replicate data for field duplicates of organics is expected to be as follows: ▪ RPD criteria of 50% or less, for concentrations > or = 10 times practical quantitation limits (PQL). ▪ RPD criteria of 75% or less, for concentrations between 5 and 10 times the EQL. ▪ RPD criteria of 100% or less, for concentrations < 5 times PQL. Replicate data for field duplicates for inorganics, including metals is expected to be as follows: ▪ RPD criteria of 30% or less, for concentrations > or = 10 times PQL. ▪ RPD criteria of 75% or less, for concentrations between 5 and 10 times the EQL. ▪ RPD criteria of 100% or less, for concentrations < 5 times PQL. Where acceptable limits for field duplicates were not met, a discussion on low biased error will be provided. For this investigation, a decision error of 5% will be considered acceptable. This error rate is in accordance with Appendix B of Schedule B(2) of the ASC NEPM. To achieve this level of confidence, the investigation has been designed as described below.
Step 7: Optimise the Design	Soil samples will be collected at relevant densities as specified in this RAP, changes in geology or in zones of gross contamination and locations selected for efficient and representative sampling. All media sampled will be conducted in accordance with Reditus standard operating procedures (SOPs) and relevant industry guidelines.



6. UPSS Validation Assessment Criteria

The remediation acceptance criteria adopted for soil validation works were based on the sensitive proposed aged care facility use designated for the proposed aged care facility development, including one basement level:

- The site is to be redeveloped and will include some concrete/paved/asphalt hard stand cover and areas with accessible soils and landscaped gardens therefore the EILs and ESLs will be considered applicable for the future use. Coarse grained soils have been adopted for conservativeness.
- Detected soil concentrations will be assessed against the NEPC (2013) NEPM HIL-A as the proposed future use of the site includes residential land use with accessible soil. Coarse grained soils have been adopted for conservativeness.
- NEPC (2013) NEPM HSL-A&B for sand have been adopted to evaluate the risk posed from vapour intrusion. The soil HSLs are based on depth of impacts, overlying soil type and land use. The selection of HSL-A & B was based the applicable ground floor land use (aged care facility), the potential receptor/s onsite and the exposure that may be experienced. Coarse grained soils have been adopted for conservativeness.
- Management Limits (MLs – Residential, parkland and public open space) have been adopted and are used to consider the potential formation of light non-aqueous phase liquids, fire and explosion risks and damage to buried infrastructure. Coarse grained soils have been adopted for conservativeness.

Validation acceptance criteria for soil analytical results are presented in Table 6-1 below.



Table 6-1: Soil Validation Criteria (mg/kg)

Analyte	HIL A	HSL-A (SAND)				ESL	ML**	EIL
		0 - <1m	1 - 2m	2 - 4m	>4 m			
Arsenic	100	-	-	-	-	-	-	100
Cadmium	20	-	-	-	-	-	-	-
Chromium (VI)	100*	-	-	-	-	-	-	-
Copper	6,000	-	-	-	-	-	-	-
Lead	300	-	-	-	-	-	-	1100
Mercury	40	-	-	-	-	-	-	-
Nickel	400	-	-	-	-	-	-	-
Zinc	7,400	-	-	-	-	-	-	-
Naphthalene	-	3	NL	NL	NL	-	-	170
Benzene	-	0.5	0.5	0.5	0.5	50	-	-
Toluene	-	120	220	310	540	85	-	-
Ethylbenzene	-	55	NL	NL	NL	70	-	-
Xylenes	-	40	60	95	170	105	-	-
F1 (C ₆ -C ₁₀)	-	45	70	110	200	180	700	-
F2 (C ₁₀ -C ₁₆)	-	110	240	440	NL	120	1,000	-
F3 (C ₁₆ -C ₃₄)	-	-	-	-	-	300	2,500	-
F4 (C ₃₄ -C ₄₀)	-	-	-	-	-	2,800	10,000	-
B(a)P	-	-	-	-	-	0.7	-	-
B(a)P TEQ	3	-	-	-	-	-	-	-
Total PAHs	300	-	-	-	-	-	-	-
Asbestos (bonded) >7mm	0.01 %w/w							
Asbestos (AF/FA)	0.001 %w/w							
Visible Asbestos	No visible asbestos in top 10cm							

* Guideline for Chromium (III)

** Separate management limits for BTEX and naphthalene are not available hence these should not be subtracted from the relevant fractions to obtain F1 and F2.

NL – Non-Limiting. No limit value specified, exceeds saturation limit.



7. Remediation Works

7.1. Remediation Objectives

The objective of the RAP is to provide a detailed plan of activities, procedures, contingency measures, and objectives to ensure the effective and controlled remediation of the site for the future redevelopment of the property, for use as an aged care facility development, inclusive of one level of basement parking. It describes the procedures and standards to be followed throughout the project to facilitate successful remediation / management of the site and ensure protection of human health and the environment.

The remediation objectives are outlined as follows:

- Remediate the site to a level enabling future redevelopment as an aged care facility (residential land use) with basement parking.
- Prevent or minimise to the extent practicable further migration of contaminants from source areas that pose an unacceptable risk to either future site occupants (high-density residential) or environmental receptors.
- Validate the soil, groundwater and soil vapour remedial/assessment works by demonstrating the impacted fill material and UPSS has been adequately removed.
- Validate and provide relevant documentation in regard to the remedial works in accordance with NSW EPA endorsed guidelines.

7.2. Extent of Remediation Required

The areas have been identified as requiring remediation/management are restricted to the UPSS infrastructure still present at the site. Refer to **Appendix A, Figure 2** for a drawing depicting the inferred extent of remediation and further investigation which include:

- 1 x 70KL UST (unleaded petrol – ULP).
- 2 x 20KL UST (Premium Unleaded Petrol – PULP and Super).
- 1 x 30KL UST (automotive diesel oil – ADO).
- Dispenser pads, vent, and product lines.

7.3. Remediation Options Hierarchy

The NSW Waste Avoidance and Resource Recovery Strategy 2014 – 2021 endorses the principles of ecologically sustainable development as informed by the objectives of the Waste Avoidance and Resource Recovery (WARR) Act 2001. In order to adopt a proactive approach to efficient resource use the waste hierarchy provides the basis for avoiding the unnecessary costs in waste disposal and maximising the efficiency in managing wastes by means of re-use or recycling.

The preferred hierarchy of options for site remediation and/or management is set out in s.6(16) Assessment of Site Contamination Policy Framework of Schedules A and B of the NEPM. This hierarchy is followed in New South Wales. Sustainability (environmental, economic, and social) aspects should be considered when deciding which remediation option to choose, in terms of achieving an appropriate balance between the benefits and effects of undertaking the option. This means that soil remediation and management is implemented in the following preferred hierarchy:



- On-site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level; and
- Off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site; or

If the above are not practicable,

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

7.4. Remediation Options Evaluation

A summary of the remedial options is provided in Table 7-1.

Table 7-1: Soil Remedial Options Screening Matrix

Option	Discussion	Conclusion
Option 1 Do Nothing	Remediation of the site is required to facilitate the proposed re-development. In addition, potential exists for concentrations of hydrocarbons, in soils within tank pit backfill sands and surrounding soils that are likely to cause a risk to human health. Additionally, the site is to be excavated to facilitate basement installation.	The UPSS require removal to facilitate site redevelopment and basement installation. Option 1 is not currently a suitable option.
Option 2 Targeted excavation and removal of the impacted soils	There are currently suitably licensed waste facilities in the Sydney Metropolitan region capable of receiving TRH, BTEX, PAH and heavy metal impacted soils (following waste classification). Offsite disposal of impacted material, if any, is likely the fastest method of remediating soil impacts at the site. This option generates the highest quantity of waste since the materials are disposed to landfill rather than retained on site. This option also generates additional truck movements, associated fuel/emissions, and additional road safety concerns. In addition, the NSW EPA waste hierarchy places disposal of waste as the least preferable option. Given the volume of the soils is likely to be relatively small, the number of truck movements and total magnitude of soils to be removed offsite are relatively minor. The	Provided the volumes of impacted soils remain relatively small. Option 2 is the preferred option.



Option	Discussion	Conclusion
	benefits of removing a buried source material from within a residential area are considered to outweigh the temporary disadvantages.	
Option 3 In-situ stabilisation/immobilisation of the impacted fill soil.	In-situ stabilisation/immobilisation entails the treatment of impacted fill with a material or chemical that removes the exposure pathway. This may include in-situ soil mixing of Portland cement additives which bind the fill into a consolidated matrix preventing both direct exposure (dust ingestion) and leaching to groundwater. Other variants may also include chemical stabilisation through soil mixing of reductants (such as calcium polysulfide, zero valent iron) which have the potential to form irreversible mineral complexes from any leachate, minimising/preventing impact to groundwater. It is noted however that this would only reduce the leaching potential of the material and not destroy any of the heavy metal contaminant mass.	former UPSS will require excavation to confirm the removal of the former UST. The quantity of soils requiring remediation are relatively small. Option 3 is not currently a suitable option.
Option 4 'Cap and Contain' the impacted fill soils	The area in which the UPSS are situated is to be excavated to facilitate basement installation.	Option 4 is not currently a suitable option.

7.5. Remedial Plan

With consideration to NSW EPA's endorsed guideline hierarchies for soil remediation options and clean-up objectives (DEC 2007), and to the site-specific contaminants and environmental setting a summary of the preferred remediation strategy is provided as follows:

- Demolition and hazardous materials clearance of onsite structures.
- UPSS exhumation and excavation of all suspected contaminated material (tank pit backfill sands) to the extent practicable from areas where contaminants have been identified to potentially pose an unacceptable risk to human health.
- Validation of the resulting excavations through the collection of soil validation samples, visual olfactory and PID observations (refer Section 9).
- Stockpiling of the excavated soils, creating a separate stockpile for each different source zone, classification of the waste in accordance with the NSW EPA 2014 Waste Classification Guidelines and lawful disposal to an offsite waste facility licenced to accept the waste.
- Validation of any imported soil materials used for backfilling and general site filling works.



A suitably experienced environmental professional will supervise all remediation and validation works and compile report/s required to document the site remediation.

7.6. Materials Not Suitable for Offsite Disposal

Hazardous waste is subject to strict controls regarding its movement and methods for management of hazardous waste will be developed should the need arise, based on the contaminants and concentrations involved.

Adoption of any strategy for the management of hazardous waste will require close management by a suitably qualified environmental consultant and will increase the time allowed for completion of the remedial work to allow for liaison with relevant authorities, contractors and landfill disposal or storage sites.

At the time of remedial works the civil contractor will need to identify a suitably licence NSW EPA haulage contractor and waste receiver who can lawfully accept the waste.

7.7. Stockpile Management

Prior to the excavation, importation, and stockpiling of material the following controls and establishment will have been developed:

- If stockpiling of impacted soils is required, sampling of the stockpile footprint once the stockpile has been removed, to ascertain that no residual impacted soils remain will be required. Soils may also be placed on a dedicated hardstand sealed or plastic lined surface to negate this requirement.
- Covering or continual wetting of all impacted excavated/stockpiled material to prevent dust generation. Note if continual wetting is used for dust suppression the quantity of water used should not create run-off.
- As the neighbouring properties are residential in nature, the use of a hydrocarbon odour suppression spray (such as Biosolve ®) diluted and applied to the surface of the stockpile to manufacturers specification can be regularly applied to the stockpile to prevent the formation of nuisance odours. The stockpile should not remain onsite for any longer than is necessary to facilitate lawful offsite transport and disposal.
- Construction of sediment retention features around stockpiled materials.

7.8. Visual Validation

Validation of the remedial works is an integral part of the remediation process. Validation sampling is used to demonstrate that the remediation objectives have been achieved. Details of the validation program are provided in Section 8.

Delineation and excavation of impacted soils, where they are identified either visually, from olfactory detection or through the use of a Photo-ionisation Detector (PID for volatiles only), shall be 'chased' out. This will be conducted under the direction and supervision of a suitably qualified and experienced environmental (contaminated sites) professional. The procedure for undertaking this excavation activity will be by:

- Observation of the site where contaminated soils are suspected of being present, and identification of the impacted soils.
- Excavation of impacted soils to lateral and vertical extent of physically identifiable impact, with additional break up and removal of concrete to remove soils where impact extends laterally.



- Soils to be appropriately disposed of offsite in accordance with this RAP.

7.9. Backfilling Excavations

In the event that material is required to be imported to site for backfilling of excavations, it is required to be accompanied by a VENM Certificate or be sampled in accordance with the ENM Order (NSW EPA 2014) and include analysis for asbestos. Although not a requirement, the use of VENM is the preferred option.

If backfill material is won from site, i.e., to backfill depressions or tank pits prior to the importation of VENM then the environmental consultant should first confirm the suitability of the proposed material prior to re-use in backfilling.

7.10. Future Exposure Scenarios

The likely exposure risk scenario will be minimal due to the complete removal and or isolation and long-term management of the contaminant source.



8. Remedial Works Plan

8.1. Underground Storage Tank Validation

The removal of USTs and associated infrastructure (UPSS) will be undertaken by an appropriately experienced and qualified contractor in accordance with the NSW environmental and safety requirements, industry best practice and the following guidance documents:

- Australian Standard AS 4976 (2008): The removal and disposal of underground petroleum storage tanks.
- AS 1940–2004: Storage and handling of flammable and combustible liquids (AS 2004b).
- AS 4976–2008: The removal and disposal of underground petroleum storage tanks (AS 2008b).
- Code of Practice: Storage and handling of dangerous goods (NSW WorkCover Authority 2005).
- NSW EPA Technical Note: Investigation of Service Station Sites, April 2014 (NSW EPA 2014).
- Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2019.

The following methodology will be applied to fuel related infrastructure:

- Daylighting the top of each respective UST. All concrete and tank pit sands will be stockpiled with appropriate sedimentation mitigation measures in place to prevent egress of sediment or contaminated soils from the site. Overburden material will be stockpiled on waterproof lining (or impermeable surface) in an agreed location with environmental controls installed. This material may be sampled and placed back in situ following completion of UST infrastructure removal works if it meets the adopted land-use criteria, noting stained, odorous or soils with elevated PID measurements will not be re-used. If the material does not meet the adopted site re-use criteria the excavated material will remain stockpiled. Waste classification samples will then be collected, and soil appropriately classified prior to lawful disposal offsite.
- Completion of cold-cutting (safest method for cutting in hazardous/explosive environments) to create an access point in each of the USTs for cleaning and removal of residual liquids and wash waters.
- Pump-out of residual liquids from the combined USTs by a liquid waste contractor. Waste liquid is assumed to be disposed at Cleanaway Waste Services in Homebush (a NSW EPA licenced Liquid Waste Facility) as J120 classification (oily water) and G110 (flammable liquid – subject to flash testing), where applicable.
- Completion of high-pressure jet washing of UST, required for offsite disposal of UST, destruction, and issue of tank destruction certificate.
- Pump-out of wastewater liquids from the UST by a liquid waste contractor. Waste liquid is assumed to be disposed at Cleanaway Waste Services in Homebush (a NSW EPA licenced Liquid Waste Facility) as J120 classification (oily water).
- Conduct gas monitoring of the UST and issuance of a gas free certificate following tank cleaning activities to facilitate safe exhumation and tank processing.



- Pipework, if any, will be drained and disconnected, and all fittings and internal tubes that are not specifically required for the selected purging method are removed and plugged; and
- Gaskets (if present) will be assumed to comprise asbestos containing materials and will be disposed at an appropriate off-site facility.
- Once the UST is visible (following removal of overburden) and empty they will be inspected for defects and photographed. The UST will again be monitored to confirm they are gas free prior to being mechanically cut-up on Site by an excavator using hydraulic shears.
- Cut-up UST metals will be transported off Site for disposal at a metal recycler and a Tank Destruction Certification will be obtained.
- Remove all other associated fuel related infrastructure, including lines, bowser points and vent pipes.

Following removal of the UST, related subsurface infrastructure (if present) and odorous and stained soils the material from the walls and floor of the UST and pipework excavations will be sampled and analysed for COPC listed in **Table 9.1, Section 9.4**. If the results meet the validation criteria the material will be considered validated. If they do not meet validation criteria additional excavation of the impacted soil and fill material will be undertaken until sample results met the adopted site criteria or the geotechnical stability limit of the site has been reached. The geotechnical stability of the excavation will be determined by a suitably qualified Geotechnical Engineer, any advice provided by this engineer will be included within the site validation report.

UST validation samples will be collected as outlined in **Table 9.1, Section 9.4**.



9. Validation Sampling Plan

9.1. Visual Inspection

Potential exists for the presence of asbestos containing building materials following demolition of site structures, not previously identified during historical investigations. Therefore, a visual inspection is to be completed by SafeWork NSW Licensed Asbestos Assessor (LAA) to confirm no visible ACM is present within the top 100 mm of the residual soil surface:

- Following demolition and removal of hazardous building materials; and
- The walls and base of the remediation excavation extents.

Following the visual inspection, soil validation sampling is to be completed

Following excavation and removal of impacted fill material (i.e containing ACM) from accessible areas of the site, the nominated project environmental consultant is to visually confirm the excavation has been completed to a depth in which the natural soil profile, or differing fill profile (not containing ACM) is encountered prior to soil validation sampling.

9.2. Validation Sampling and Analysis

Validation of the excavation extent will be based on visual observations and sample and analysis outlined in **Table 9-1**.

If the samples collected from the base and walls of the excavation meet validation criteria the material will be considered validated. If they do not meet validation criteria additional excavation of the impacted soil and fill material will be undertaken until sample results meet the adopted site criteria.

Validation of asbestos in soil is required only in areas in which fill materials are encountered and to be retained in accessible areas, i.e., walls of the excavation along the periphery of the site boundary (lateral extent of the excavation).

9.3. Soil Sampling Methodology

All validation samples will be collected by an appropriately trained and experienced environmental professional. Samples will be collected in a method which prevents cross contamination and enhances the integrity of the process. These processes are discussed briefly below.

All soil samples will be collected directly from the residual soil surface, the excavator bucket or stockpile by hand whilst using nitrile gloves which were replaced between each sample. Part of each soil sample will be placed into snap lock plastic bags for screening with a PID and the other part of the sample was placed directly into a laboratory prepared 250 millilitre (mL) glass jar with the details of the sample, including the sample name, the job number, and the date of sampling.

Samples will be placed directly into appropriately preserved, laboratory supplied and preserved sampling containers.

If asbestos in soil validation sampling is required, a 10L field screening sample and 500 mL quantification sample from each wall, and 1 per 25 m² from the base will be collected. All samples will be individually screened manually through a 7 x 7 mm sieve. Any ACM or FA identified will be collected, bagged, and weighed by the laboratory using a calibrated scale.



Each 500mL soil sample will be placed into snap lock plastic bag (double bagged), with the details of the sample, including the sample name, the job number, the date of sample and the sample depth, for laboratory analysis of AF and FA asbestos in accordance with the NEPC (2013) NEPM, where possible.

9.4. Soil Laboratory Analyses

NATA accredited labs are to be used for all laboratory analyses for soil. Any method not NATA accredited will require justification.

Laboratory analysis of samples will be conducted with reference to known or anticipated CoPCs. The proposed soil validation sampling and analytical program is outlined in **Table 9-1** below.

Table 9-1: Soil Validation Sampling and Analytical Program

Item	Sample Frequency	Analytes	Number of Proposed Sample Locations
UST Tank Pit (Assuming individual tank pits)	Base samples to be collected at a rate of ~2 per UST. Wall samples to be collected in fill and natural soils at a frequency of one (1) sample per 5 lineal metres.	TRH, BTEX, heavy metals and PAHs	Eight (8) – base. Final number of wall samples will depend on the final extent of the excavation area.
Fuel and vent lines	Samples will be collected at a rate of one sample per 5 linear metres	TRH, BTEX, heavy metals and PAHs	Approximately ten (10).
Dispenser Pads	Samples to be collected at a frequency of one sample at the base of each former dispenser	TRH, BTEX, heavy metals and PAHs	Approximately nine (9).
Waste Soils	One sample per 25m ³ or minimum three samples per stockpile.	TRH, BTEX, heavy metals and PAHs	Final number of samples will depend on the amount of material requiring offsite disposal during remedial works, if any.
Imported VENM material	One sample per 250m ³ minimum of three sample per source site.	TRH, BTEX, heavy metals, OCPs, OPPs, PCBs, PAHs, and asbestos	It is unlikely that any fill material will be imported to site. Scope provided for contingency.
Unexpected Finds	To be confirmed by a suitably qualified environmental consultant following the inspection and appropriate characterisation of the contamination.		



9.5. Quality Assurance/Quality Control

The QA/QC program for the site should comprised the following elements:

- Field Duplicate Samples (chemical analytes only): one field duplicate sample to be collected for every 20 primary samples collected (or part thereof). Duplicate samples are to be sent to the primary analytical laboratory to check the accuracy of the analytical results.
- Field Triplicate Samples (chemical analytes only): one field triplicate sample to be collected for every 20 primary samples collected (or part thereof). Triplicate samples are sent to be sent to a secondary analytical laboratory to check the accuracy of the analytical results.
- Rinsate Blank: A rinsate blank to be collected during each sampling event. Rinsate blanks are to be collected from rinsing field sampling equipment to assess the effectiveness of the decontamination procedures between sampling locations.
- Trip spike: A triplicate spike to be prepared by the NATA accredited laboratory during each soil sampling event for volatile contaminants.
- A Trip Blank: A triplicate blank to be prepare by the NATA accredited laboratory with deionised to determine the potential for cross contamination.

9.6. Validation of Imported Backfill Materials

It is not anticipated that soils will require importation as the area will be excavated to facilitate basement installation following UPSS removal. Should imported backfill materials be required the material is to be classified as Virgin Excavated Natural Material (VENM).

The Protection of the Environment Operations Act 1997 (POEO Act) defines VENM as:

'natural material (such as clay, gravel, sand, soil, or rock fines):

- a. *That has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial, mining or agricultural activities; and*
- b. *That does not contain any sulfidic ores or soils or any other waste.*

and includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved for the time being pursuant to an EPA Gazettal notice.'

Prior to importation of any VENM to site, the nominated project environmental consultant/professional is to (where reasonably practicable to do so) conduct an inspection of the source site to confirm the material meets the POEO Act definition as VENM.

Furthermore, validation of imported VENM is to include collection of soil/material samples at a minimum rate of three (3) samples source site by a suitably qualified environmental consultant. Sample analysis and acceptance criteria is to include, as a minimum, the analytes listed in Table 4 of the NSW EPA (2014) Excavated Natural Material (ENM) Order and completed by a NATA accredited laboratory.

9.7. Validation Reporting

A Site Validation Report must be prepared verifying that the site is suitable for the proposed development in general accordance with the NSW EPA (2020) Consultants Reporting on



Contaminated Land, documenting the works as completed. This report will contain information including:

- Details of the remediation works conducted.
- Information demonstrating that the objectives of the RAP have been achieved, the sample results of any waste classification, imported material, any waste dockets along with assessment of the data against both the pre-defined data quality objectives and the remediation acceptance criteria.
- Information demonstrating compliance with appropriate regulations and guidelines.
- Any variations to the strategy undertaken during the implementation of the Remediation work.
- Details of any environmental incidents occurring during the Remediation works and the actions undertaken in response to these incidents.
- Details of any unexpected finds including the additional and Remediation works required to appropriately manage the finds.
- Other information as appropriate, including requirements (if any) for ongoing monitoring / management.

The report will serve to document the remediation works for future reference.

The following records will be maintained by the civil contractor during remediation work and will be made available for inclusion into the Validation Report:

- Any complaints made towards the Remediation works, the date and time that the complaint was made, and corrective actions taken.
- Records of approvals to remove or dispose soil from the site.
- Suspicious soil material encountered in the materials brought onto site.
- Source of material being brought onto site for the sub-grade layer or for backfilling.
- Dockets for the quantities of material being brought onto site as well as the EPA approvals.
- Any amendments to works which deviate from this RAP, EPA comments to these amendments, as well as any comments and/or endorsements.
- Photographic records of the stockpiled materials as well as stockpile management, and site establishment.

All works will be reported within the site validation plan, however if further investigation uncovers additional contamination the RAP will need to be revised.

Materials imported and exported from the site will be tracked and documented as follows:

- **Material leaving the site:** Include records of disposal dockets, disposal dates and quantity/volume for each material type and provide a tally of total volume/quantity (by waste classification type) against the disposal dockets.
- **Material imported to the site (prior to validation):** Include records of quantity/volume of material imported to the site by type, analytical test results of imported material and the associated material certification (a simple material certification will not be adequate).



10. Contingency Plan

A review of remediation works has been undertaken to identify potential risks to meeting the specified site validation criteria. Several potential risks have been identified. These potential scenarios and associated contingencies will be implemented to ensure that validation criteria are met.

10.1. Unexpected Finds

The possibility exists for undiscovered hazards to be present at the site.

Environmental sampling is based on identification of potential chemical analytes that have been identified during a documented process of reviewing historical site activities and previous investigation results. Ground conditions however between sampling points may vary, and further hazards may arise from unexpected sources and/or in unexpected locations. The nature of any undiscovered hazards which may be present at the site are generally detectable through visual or olfactory means, for example:

- Petroleum contaminated soils (staining / discoloration visible).
- Hydrocarbon Organic Compound contaminated soils (odorous).
- Fragments of asbestos-containing materials (visible).
- Significant ash and/or slag contaminated soils / fill materials (visible).
- USTs that have not been previously identified.

As a precautionary measure to ensure the protection of the workforce and surrounding community, should any unexpected potentially hazardous substance be encountered the works should cease immediately before being assessed by a suitably qualified and experienced environmental professional.

Should material be encountered that is suspected of containing ACM, the following actions are to be undertaken:

- Material that is suspected of containing asbestos must be isolated and the area barricaded to prevent the possible exposure of workers to asbestos. Signs notifying site workers of the presence of asbestos must be placed on the barricades.
- All suspicious material must be assumed to contain asbestos until it has been proven otherwise by laboratory analysis.
- All suspicious material and other unexpected finds are to be logged on the Unexpected Finds Register.

The sampling strategy for each “unexpected find” shall be designed by a suitably qualified and experienced environmental professional. The strategy will, however, be aimed at determining the nature of the substance - that is, is it hazardous and, if so, at concentrations which pose an unacceptable risk to human health or the environment.

A risk-based and staged approach to the assessment of on-site groundwater has been adopted for historical investigations and validation works associated with this RAP, whereby preliminary review of field observations and soil analytical data compared against adopted Tier 1 screening criteria would inform whether assessment of groundwater was required.

Remediation of any unexpected finds will be conducted in accordance with the applicable requirements.



10.2. Remediation Strategy Unsuccessful

Should validation be deemed not suitable for the sites intended land use, then a site-specific risk assessment will be conducted. If the site-specific risk assessment indicates the site is unsuitable that further Remediation works will need to occur, and a revised Remediation strategy developed.

10.3. Groundwater Ingress and/or Rainwater Entering Any Excavations

It is unlikely that excessive quantities of groundwater will enter any excavations that may be dug in the site. Rainwater that may pool in the site excavations excessively will be managed in accordance with the following protocol:

- Water will be tested at a frequency of one sample per body of water.
- Samples will be submitted to a NATA accredited laboratory for analysis of the following COPC - BTEXN, PAHs, TRH, 8 Heavy Metals, and VOCs, turbidity, total dissolved solids, and pH.
- Following receipt of the sample results the water will be compared to discharge criteria to be approved by Canterbury Bankstown City Council.
- If the results are below the approved discharge criteria the water will be appropriately release to the stormwater. If the criteria are not exceeded, then the liquid will be transferred to an EPA licenced liquid waste facility by an appropriately licensed liquid waste contractor.

10.4. Groundwater and/or Soil Vapour Contamination is Identified

Should additional investigation uncover groundwater or soil/vapour contamination at the site, then a site-specific risk assessment will be conducted and if the contamination is deemed suitable to remain onsite then an EMP will be needed to manage exposure pathway and risks to site users. If the site-specific risk assessment indicates the site is unsuitable that further remedial works will need to occur, and a revised remedial strategy developed. The revised strategy will need to be determined at the time based on the concentrations and types of contaminants identified in groundwater and soil vapour.

Based on the data collected to date, and the proposed remedial strategy, we consider a EMP will not be required unless additional contamination or unexpected finds are identified.



11. Site Management Plan

The following section contains appropriate details to eliminate / manage potential environmental emissions which may be generated by or during the site remediation works.

11.1. Hours of Operation

Remediation works shall only be permitted during the hours indicated in the site works approval (DA Consent Conditions).

11.2. Community Consultation and Engagement

Given the nature of the densely population residential following community consultation process should be considered, unless otherwise recommended within a dedicated community consultation plan prepared by a professional community consultation consultant.

The purpose of the engagement is so to allow nearby residents to understand the purpose of the works, the likely extent of the disruption, potential temporary changes to amenity and temporary nuisances that may be experienced.

The site owner or relevant site owner's representative (this may be either, but not limited to the Environmental Consultant, Planning Consulting, specialist community engagement consultant or Construction contractor) should complete the following tasks:

- Preparation of a community engagement letter providing details of the following:
 - Brief background to the project.
 - Brief site history and the type and results of investigations completed to date.
 - The name of the accredited site Auditor engaged to review the remedial and validation works.
 - Brief description of the works to be completed including potential concerns the community may have.
 - Who to contact (phone number and email address) regarding queries and concerns.
 - A phone number and email address to contact if a translation for language or other special requirements is needed.
- The letter should be dropped into all non ATV surrounding residential letter boxes in 105 to 119 and 124 to 136 Campbell Hill Road 30 days prior to the commencement of works.
- A copy of the engagement letter should also be provided to all stakeholders, these include, the residents noted above, Council and NSW EPA for their information in the event of any queries by other residents.
- All queries and communication will be kept on record and any actions as a result of the queries recorded. The data will be evaluated on a case-by-case basis and may require a simple explanation, further information to be provided or a direct action to be implemented to alleviate the concern. These records should be kept for at least 12 months following the completion of the site redevelopment works.
- The validation report will include a section on the actions completed in relation to community engagement as executed. This will include details of justification of extent of engagement; details of participants (as deemed relevant by the consultant also



noting privacy concerns); information provided to the community; input and comments received from the community; and, how community data was used in the decision-making process.

If a potential risk to offsite receptors is identified following the additional offsite soils gas sampling the current community engagement process noted above will be reviewed. This will include consideration of engagement of a professional community consultation consultant/company to revise the current strategy and implement a new plan.

11.3. Site Establishment

All safety and environmental controls are to be implemented as the first stage of remediation works. These controls will include:

- Ensure appropriate community consultation has occurred.
- Locate and isolate all required utilities in proximity of the works.
- Work area security fencing.
- Site signage and contact numbers.
- Assess the requirements of dust and odour control measures.
- Sediment fencing.
- Stormwater runoff sediment controls.

11.4. Preparation Works

Prior to the importation of VENM or ENM the emplacement areas will be confirmed to have been validated by a suitability qualified environmental consultant.

11.5. Site Access and Fencing Requirements

During remediation works, high visibility perimeter fencing will be maintained to restrict access to the works area. Only authorised persons will be able to enter the works area.

Vehicle access to the site shall be stabilised to prevent the tracking of soil around the site and the adjoining driveway/access point to the road will be swept or cleaned on an as-needed basis. Any collected materials shall be treated as potentially contaminated and will be suitably managed.

Notwithstanding more stringent site controls, whilst the remediation works are carried out, the site is unattended, and works are not active, high visibility fencing will be placed around the boundary of any excavation to alert any people on site to the presence of the excavation.

11.6. Material Tracking

The quantities of material (disposed offsite) and any other materials brought onto site as part of the remediation works should be recorded in a tracking register.

Prior to the removal of the fill material an accredited surveyor should be commissioned to survey the condition of works. This will allow for the validation of each phase of the remediation works.



11.7. Material Transport

A designated loading area will be established for transport trucks. The transporting contractor shall ensure that there is no material tracked out onto the street and that the load is securely covered. In addition, all site vehicles must leave the site in a forward direction.

All appropriate road rules shall be observed, and state roads will be selected as far as practicable over local roads when deciding on the transport route to the off-site material disposal location.

All carrier of materials and waste must be appropriately licenced to transport the designated material.

11.8. Imported Fill for Design Levels

All imported material will meet the requirements of either the NSW EPA Excavated Natural Material Order (2014) or the comply with the definition of the Virgin Excavated Natural Material (VENM) as defined in the Protection of the Environment Operation Act 1997 (POEO Act). All imported material will be tested in accordance with the validation schedule provided in **Error! Reference source not found..**

11.9. Soil and Water Management

All works shall be conducted in strict accordance with the soil and water management measures outlined in this section.

To prevent the migration of impacted soil/sediment off site, silt fences shall be constructed at the down-gradient works area boundaries, as per the specifications contained in Managing Urban Stormwater – Soil and Construction Volume 1, 4th Edition, NSW Government, March 2004. Any material which is collected behind the sediment controls shall be treated as potentially contaminated and will be suitably managed.

In a storm event, the sediment controls located on-site will need to be monitored and replaced or altered if necessary. Collected material will need to be suitably managed in accordance with remediation works.

11.10. Stockpiles

The following procedures will be implemented:

- No stockpiles or other materials shall be placed on footpaths or roadways and will be away from all stormwater infrastructure (including drainage lines, stormwater pits, gutters, etc) where possible. Where this is not possible, sediment controls will be placed over stormwater grates to prevent ingress of sediment to stormwater drainage lines.
- Stockpiles shall be formed with sediment control structures placed immediately down slope to protect other lands and waters from sediment pollution.
- Placement of material on a sealed or plastic lined surface.
- Covering of all excavated/stockpiled material.
- Stockpiling of impacted soils (excavated fill material, if any) will require additional sampling of the stockpile footprint once the stockpile has been disposed, to ascertain that no residual impacted soils are present onsite or placement of material on a sealed or plastic lined surface can be undertaken. Footprint sampling should be



conducted in accordance with the densities outlined in **Error! Reference source not found..**

11.11. Noise

The remediation works shall comply with the NSW EPA's Environmental Noise Control Manual for the control of noise from construction sites.

All machinery and equipment used on site will be in good working order and with the fitted with appropriate silencers when necessary.

11.12. Vibration

The use of plant and machinery shall not cause vibrations to be felt or capable to be measured at the neighbouring premises.

11.13. Air Quality

Health and air monitoring must be undertaken when a worker is at risk of exposure . The need for health and air monitoring of these workers should be determined based on the potential for exposure, frequency of potential exposure and duration of the work being undertaken.

Consideration must be given to the worker's demographic, medical and occupational history, and records of the worker's personal exposure. The health and air monitoring must include a physical examination of the worker with emphasis on the respiratory system, including standardised respiratory function tests, unless another form of health and air monitoring is recommended by a registered medical practitioner.

11.14. Dust Control

During the remediation, if necessary, dust levels will be monitored and minimised by using mist sprays as necessary on all excavation, stockpiles, and loadout.

Dust shall also be controlled by ensuring vehicles leave via the designated (stabilised) site access points.

Any situations or areas which exceed the asbestos exposure standard are to be controlled to eliminate or minimise risk of exposure.

Any vehicle used to transport asbestos waste should be cleaned before leaving the site and the vehicles load should be covered prior to dispatch.

11.15. Odour

Where complaints occur regarding odour, the contingency measures associated with odour control outlined in Section 8.7 and 11.2 will be implemented. Additional odour suppression actions will be taken to reduce the odours as necessary, which may include increasing the amount of covering of excavations / stockpiles; mist sprays; odour suppressants; or maintenance of equipment.



11.16. Hazardous Materials

Hazardous waste is subject to strict controls regarding its movement and methods for management. If hazardous waste is present onsite storage, haulage and disposal methods will be developed and will be based on the contaminants and concentrations identified.

Any excess excavation soils from the fill material at the site will be stockpiled and classified separately for waste disposal as they may result in a higher level of waste classification (special, hazardous, or restricted waste) due to chemical or other anthropogenic impacts.

Adoption of any strategy for the management of hazardous waste will require close management by a suitably qualified environmental consultant and will increase the time required to complete the remedial works. Liaison with relevant authorities, contractors and landfill disposal or storage sites will be required.

11.17. Removal and Disposal of Contaminated Soil and Asbestos

It is noted that asbestos wastes have not been identified within soils at the site. Some building materials however may be present and contain asbestos. If asbestos containing materials are identified they will need to be handled, transported, and disposed by either a class A for friable or class B for bonded licensed removalist.

Appropriate warning notices and all NSW EPA, Workcover and other relevant authorities will need to be notified as appropriate throughout the removal and disposal process.

The licensed removalist will determine the requirement for air monitoring in accordance with the Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Dust [NOHSC:3003(1988)]. The contractor shall organise for an appropriately licenced or suitably experienced person to complete a clearance inspection at the end of the works.

The current remedial strategy is to remove all contaminated soil offsite Prior to it being removed offsite it will be classified, managed, and disposed in accordance with the Waste Classification Guidelines Part 1: Classifying Waste (NSW EPA 2014).

Asbestos waste must also be disposed in accordance with the regulatory requirements under clause 42 of the Protection of the Operations (Waste) Regulation 2014 which apply to asbestos waste and includes:

- Waste stored onsite prior to disposal must be done so in an environmentally safe manner.
- Non-friable asbestos must be securely packaged at all times.
- Friable asbestos (if encountered) must be kept in a sealed container.
- Asbestos contaminated soil must be wetted down.
- All asbestos waste must be transported in a covered, leak-proof vehicle (applicable to asbestos impacted soil).
- Asbestos waste can be disposed at a landfill site that can lawfully receive this waste. It is recommended that the landfill is contacted beforehand to find out if the facility can receive the waste and whether there may be any special requirements.
- It is illegal to dispose of asbestos waste in domestic garbage bags.
- It is illegal to re-use, recycle or dump asbestos waste.



If friable waste requires disposal, then only a company with a Class A removal license is permitted to remove the waste material and air monitoring will be required to be undertaken by a licensed asbestos assessor in accordance with the Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Dust [NOHSC:3003(1988)].

If more than 100kg of asbestos waste or 10m² (in total) of asbestos sheeting is proposed to be removed from the Site, then information is to be provided to NSW SafeWork and EPA.

11.18. Complaint Reporting and Resolution

Complaints from adjoining site occupants or workers on site will be directed initially to the civil contractor on site. Following that, discussion with the environmental consultant and the complainant will investigate the issue and remedy it as required or applicable.

11.19. Validation

Validation of the remedial works is an integral part of the remediation process.

Validation sampling is used to demonstrate that the remediation objectives have been achieved. Details of the validation program are provided in Section 9.

11.20. Site Dis-establishment

On completion of the remediation works all plant, equipment, safety, and environmental controls shall be removed from the site unless contracted for ongoing redevelopment or construction works.



12. Health and Safety

The principal remedial contractor should prepare a separate work health and safety plan (WHS) prior to the remediation works beginning. The information presented below is not exhaustive and is to be included along with additional relevant information in the WHS plan. The WHS will need to be compliant with relevant guidelines and legislation and consider the information presented within the RAP. As asbestos is likely to occur at the site, the contractor should be suitably licensed, and the WHS plan should outline air monitoring requirements to meet SafeWork Codes of Practice.

The objectives of the health and safety plan are:

- To apply standard procedures that reduce risks resulting from the above works.
- To ensure all employees are provided with appropriate training, equipment, and support to consistently perform their duties in a safe manner; and
- To have procedures to protect other site workers and the general public. These objectives will be achieved by:
 - Assignment of responsibilities.
 - An evaluation of hazards.
 - Establishment of personal protection standards and mandatory safety practices and procedures; and
 - Provision for contingencies that may arise while operations are being conducted at the site.

This health and safety section does not provide safety information specific to construction and other demolition or excavation activities carried out by contractors, such as the safe operation, maintenance, and inspection of plant, etc. Contractors will be required to prepare their own Safe Work Method Statements and incident contingency plans for their work activities. All parties working on the site shall comply with all applicable Health and Safety legislation, regulations, codes, and guidelines.

12.1. Responsibilities

Client Supervisor/Manager/Superintendent

The client supervisor/manager is responsible for:

- Advice on obtaining development approval.
- Helping to ensure all works are compliant with the development approval.
- Providing technical and financial progress updates to the client.
- Assisting with community consultation; and
- The client supervisor/manager contact details will be provided prior to the works.

Remediation Contractor

The remediation contractor is responsible for:

- Ensuring all works are undertaken as per the RAP.
- Ensure all works involving the disturbance of the ACM contaminated soils are conducted under the supervision of a suitably qualified Class A or Class B asbestos licensed contractor.



- Ensure all ACM impacted soils are wetted to reduce the potential generation of dust.
- Minimise erosion at the site, including erosion of soils exposed during excavation and demolition works.
- Protect nearby receiving environments from potential contamination.
- Ensure contaminated site plant are decontaminated prior to commencing work in clean soil.
- Signs and record keeping should indicate the origin and location of contaminated materials.
- No stockpiling of impacted soils (where possible) to prevent cross contamination of clean soils.
- Direct transport from contaminated area to burial site.
- Validated areas should be isolated to prevent cross contamination; and
- Routine site inspections.
- Ensuring all works are undertaken in accordance appropriate regulations and standards.
- Ensuring all works are undertaken as per the health and safety plan.
- Ensuring a copy of the health and safety plan is available at the site during the remediation/validation activities.
- Confirming individuals are competent in performing allotted tasks.
- Liaison with the client supervisor/manager and sub-contractor representatives, as appropriate, regarding safety matters.
- Investigation and reporting of incidents and accidents.

The remediation contractor contact details will be provided prior to commencement of works.

Environmental Consultant

The environmental consultant is responsible for:

- Undertake remediation and validation sampling as per the RAP.
- Ensuring consultant works are undertaken as per the health and safety plan.
- Liaison with the contractor representatives, as appropriate, regarding safety matters.
- Alongside the remediation contractor stockpile and waste tracking.
- Undertake validation and reporting as per the RAP.

The contact details of the responsible parties are provided in **Error! Reference source not found.**, which follows.



Table 12-1 Contact Details

Clients Supervisor/Manager	Details
Name	Nick Winberg
Company	Centurion Project Management
Address	Lvl 36, 1 Farrer Place, Sydney, NSW, 2000
Contact Phone	0403 000 968
Remediation Contractor	
Name	Greg Bartlett
Company	Reditus Consulting
Address	Unit 1A, 29-33 Waratah Street, Kirrawee, NSW, 2232
Contact Phone	0401 278 820
Environmental Consultant	
Name	Greg Bartlett
Company	Reditus Consulting
Address	Unit 1A, 29-33 Waratah Street, Kirrawee, NSW, 2232
Contact Phone	0401 278 820

12.2. Other Members of the Site Workforce

Every individual worker is responsible for conducting their allocated tasks in a safe manner and in accordance with their training and experience. They must give due consideration to the safety of all others in their proximity and cooperate in matters of health and safety. All workers must leave their work areas in such a condition that the location will not be hazardous to others at any time.

12.3. Hazards

The known or potential hazards associated with the work activities are listed below:

- Chemical hazards associated with the presence of contaminated soil.
- Physical hazards, including:
 - Work in or near excavations.
 - Operating machinery.
 - Heat stress and UV exposure.
 - Underground or overhead services.
 - Manual handling.
 - Noise.



In the event of the discovery of any condition that would suggest the existence of a situation more hazardous than anticipated, or of any new hazard that could potentially cause serious harm to personnel or the environment, work will be suspended until the Project Manager has been notified and appropriate instructions have been provided to field personnel.

12.4. Contamination Hazards

The main chemical hazards associated with the remediation/validation works are TRH, BTEX, PAH, 8 priority heavy metals.

When working with contaminated materials in general, care must be taken to ensure that the contamination is not introduced to the worker via ingestion, inhalation, or absorption. Personal Protective Equipment (PPE) and decontamination requirements related to the remedial works are summarised in Sections 12.6 and 12.7.

12.5. Physical Hazards

Operating Machinery

Heavy plant and equipment operating in the vicinity of field personnel presents a risk of physical injury. Personnel should always be cognisant of their position in relation to operating machinery. Personnel must wear high visibility clothing when onsite.

Never walk behind or to the side of any operating equipment without the operator's knowledge. Do not assume that the operator knows your position. Personnel should stay at least 1 m from the operational area of heavy equipment, a minimum of 3m outside of the swing radius of an excavator and should not stand directly below any load or piece of equipment (e.g., backhoes, excavators, vehicles).

Work in or Near Excavations

No site personnel are to stand closer than 0.5m to the edge of an excavation. No site personnel are to enter excavation greater than 1 m deep. Additionally, at the end of each day excavations are to be barricaded to prevent access.

Cuts and Abrasions

The manual work associated with the remediation works gives rise to the risk of cuts and abrasions to personnel working in the area. As well as the direct consequences of any cut or abrasion, such injuries can lead to the possibility of exposure to contaminants through the wound as well as diseases such as tetanus. To minimise the risk of direct or indirect injury, personnel will wear the personal protective equipment described.

Heat Stress and UV Exposure

Site personnel may experience heat stress due to a combination of elevated ambient temperatures and the concurrent use of personal protection equipment; this depends in part on the type of work and the time of year.

In addition to heat stress, overexposure to UV radiation in sunlight can result in sunburn to exposed skin. The use of a high protection sunscreen (SPF15 or greater) on all exposed skin is recommended. Hats (including hard hats in specified areas) will also provide additional sun protection during the peak (i.e., 10:00 am to 3:00 pm) sun period. Sunglasses should be worn (where appropriate) to protect eyes from effects of UV exposure.

Underground Services

There is the potential for underground services (electricity, natural gas lines, water, telephone, sewer, and stormwater) to be present beneath the work area. The remediation



contractor shall ensure that appropriate procedures will be taken to minimise the risk associated with excavation near services.

Aboveground Electrical Hazards

All electrical plant and equipment must comply with the requirements of Australian Standard AS 3000. Handheld Portable tools shall comply with AS/NZS 3160 "handheld Portable electric tools" and shall be double insulated.

Cord connected Portable hand lamps shall comply with AS/NZS 3118. A Residual Current Device (RCD) shall protect plug-in Portable equipment, which is connected to a supply above Extra Low Voltage - 12-24volts (including equipment supplied from a generator or welding set). RCD protection shall always be provided during maintenance of Portable electrical equipment while the equipment is connected to a power supply above Extra Low Voltage, irrespective of whether power is switched ON or OFF. RCD's shall comply with AS 3190 and shall be type II units, rated to trip at or below 30 milliamps within 40 milliseconds.

Manual Handling

When lifting or handling heavy objects, use correct lifting techniques, bending the knees not the back. If the item to be lifted is too heavy or awkward for one person to lift, seek assistance from other company employees or use mechanical help.

Noise

Long-term exposure to high levels of noise is unlikely. However, operating machinery may cause significant noise exposures for short periods. Earplugs or earmuffs should be worn in any situation where noise levels make normal conversation difficult.

12.6. Personal Protective Equipment

All workers who may come into direct contact with contaminated soil will wear the following personal protective equipment for areas with no ACM exposure risks:

- overalls or long-sleeved collared shirt.
- heavy duty outer gloves (e.g., leather) where there is a risk of cuts or abrasions, otherwise PVC outer gloves if in direct contact with contaminated soil.
- steel capped boots.
- safety glasses.
- high visibility vest or jacket.
- hard hat.

It is further noted that additional PPE may be required as part of the SafeWork NSW permitting process. If this occurs, then the above PPE requirements will be upgraded to reflect SafeWork NSW requirements.

If workers will be exposed to highly odorous soil conditions during remediation works, the following additional PPE should be adopted:

- Impermeable disposable overalls; and
- Half or full-face respirator with organic vapour cartridge.

A PID shall be used to monitor the concentrations of VOCs within the workspace, with the following action levels at which the additional PPE mentioned above is required (refer Table 12-2).



Table 12-2: PID Breathing Space Screening Criteria

Instrument	Airborne Levels	Level of Protection
PID	<1 ppm	No additional protection
PID and/or Drager or Kitagawa tubes	>1 ppm	Half or full faced respirator*
PID and/or Drager or Kitagawa tubes	>10 ppm** or >1 ppm on the site boundary	Stop work, cover excavation to minimise production of hydrocarbons

* If action levels exceed the action level following 5 minutes, the use of a respirator is required. Organic respirator cartridge is to be changed daily.

** 10 times the benzene exposure limit as recommended by 3M Respirator Selection Guide.

For areas where a risk of exposure to ACM is present, personal protective clothing should be made from materials that provide protection against fibre penetration and not from wool or other materials that attract fibrous dusts.

All equipment used for the removal of asbestos should be inspected before the commencement of the asbestos removal work, after any repairs and at least once every seven days when it is continually being used. A register with the details of these inspections, the state of the equipment and any repair details should be maintained.

The level of PPE would also need to address / include any other requirements relating to the nature of the activities to be undertaken. Additional PPE may be required at the request of the appropriately asbestos licensed (Class A or Class B) contractor if supervising the works.

All persons engaged in intrusive works within the vicinity of the affected area should wear respiratory protective equipment conforming to the requirements of AS/NZS 1716-2003 Respiratory Protective Devices.

12.7. Decontamination Procedures

At the end of the asbestos removal work (if any) and upon leaving the asbestos removal work area, all PPE must be disposed of as asbestos waste or decontaminated and stored in sealed double bags before being removed from the asbestos removal site to be laundered by a laundry with facilities for laundering asbestos-contaminated materials. PPE should be thoroughly wet before being placed in bags.

The additional decontamination procedures specified below will be followed whenever personnel, plant or equipment leave the site.

Personnel

The following steps should be taken to ensure personnel do not leave the site with potentially contaminated clothing:

- wash boots in clean water.
- remove outer gloves and store for reuse.
- remove overalls (if used) and store for reuse.
- remove respirator and goggles (if used) and store clean for reuse or decontamination, as appropriate.



- thoroughly wash hands and face.

If any part of a worker's body comes into direct contact with any potentially contaminated material, the affected part(s) should be immediately washed with clean water.

Vehicle, Plant and Equipment

All equipment, including personal protective equipment, will be washed, or otherwise cleaned to ensure that contaminated soil, water, or dust is removed before it leaves the Site. All plant and equipment will have their outer bodies thoroughly cleaned of soil and sediment before moving off the site or moving from contaminated zones into clean zones.

Plant equipment used to handle contaminated soils, Waste or ACM must not be used until it has been thoroughly decontaminated and a clearance certificate from suitably experience professional issued.

12.8. Contamination Control Zone

The lunch shed/crib hut and office will be located outside of any contamination control zone and will be designated clean zones. Any personal and plant leaving the contamination zone must undergo appropriate decontamination procedures, in a designated area (decontamination zone) as discussed above, prior to entering the site clean zones.



13. Regulatory Approvals/Licensing

13.1. State Environment Planning Policy (Resilience and Hazards) 2021

Pursuant with Section 4.11, the proposed remediation works are considered to be classified as "Category 2" remediation works.

13.2. Canterbury Bankstown Consolidated LEP 2020

Review of the LEP (2020) indicates there are no provisions in relation to the works proposed to be executed at the site to manage the requirement of State Environment Planning Policy (Resilience and Hazards) 2021.

13.3. Protection of the Environment Operations Act 1997

In relation to the licensing requirements under the Protection of the Environment Operation Act 1997 (POEO Act):

- The works do not fall within the licensing requirements for Contaminated Soil Treatment Works (i.e., works will not incinerate more than 1,000 m³ of contaminated soil per year, treat and store more than 30,000 m³ of contaminated soil or disturb more than 3 hectares of contaminated soil); and
- The works do not fall within the licensing requirements for Crushing, Grinding or Separating Works (i.e., works will not process more than 150 tonnes of material per day or 30,000 tonnes of material per year).

All material to be excavated and removed from the site (including associated activities such as classification) will be undertaken in strict accordance with the requirements of the POEO Act 1997. Such requirements include:

- Ensuring waste is classified appropriately and in accordance with relevant guidelines.
- Waste materials are disposed offsite to appropriately licensed facilities.
- Other materials are removed to facilities lawfully able to accept such materials.

In-line with the opinion in relation to designated development, proposed works do not trigger the requirement for a POEO Licence.

13.4. Protection of The Environment Operations (Waste) Regulation 2014

The regulations make requirements relating to non-licensed waste activities and waste transporting. The proposed works on the site will not require to be licensed. Section 48 of the Regulation requires that wastes are stored in an environmentally safe manner and that vehicles used to transport waste must be covered when loaded.

The Regulation exempts certain waste streams from the full waste tracking and record keeping requirements. Waste tracking is required only for wastes prescribed on the NSW EPA waste locate website the website should be consulted prior to removing wastes from site. [<https://wastelocate.epa.nsw.gov.au>].



13.5. Protection of The Environment Operations (Clean Air) Regulation 2010

Requirements in relation to emission from vehicles and general obligations that the occupiers of non-residential premises do not cause air pollution by failing to operate or maintain plant, carry out work or deal with materials in a proper and efficient manner.

13.6. Protection of The Environment Operations (Underground Petroleum Storage System) Regulation 2019

The POEO (UPSS Regulation) aims to minimise the risk to human health and the environment by requiring best practice design, installation, maintenance, and monitoring of UPSS in NSW. All UPSS removal works will need to comply with the UPSS (2019) regulation. Relevant resources are available at

<https://www.epa.nsw.gov.au/your-environment/contaminated-land/upss>

13.7. Waste Classification Guidelines, Part 1: Classifying Waste

All wastes generated shall be classified and managed in accordance with the NSW EPA Waste Classification Guidelines (2014) and addendum to part 1 (2016).

13.8. Work Health and Safety Act 2011

Requirements in relation to ensure work safety that are enforceable by law, including any asbestos removal works.

13.9. Roads and Rail Transport (Dangerous Goods) Act 1997

Transport of waste classified as Dangerous Goods in accordance with Regulations.

13.10. NSW EPA Asbestos and Waste Tyres Guidelines (2015)

Outlines the legal requirements that consignors, transporters, and occupiers of premises must meet in addition to their obligations under the Waste Regulation.



14. Construction and Environmental Management Plan

The development consent may require a Construction and Environmental Management Plan (CEMP) to be prepared and submitted to Council for approval prior to commencement.

Reditus recommend the appointed contractor refers to the NSW Department of Infrastructure, Planning and Natural Resources (DIPNR) Guideline for the Preparation of Environmental Management Plans 2004.

The CEMP will be the overarching document that for the implementation of environmental control measures during construction. The controls prescribed within this RAP are to be adopted within the CEMP and administered by the appointed Principal Contractor.

As a minimum, the CEMP must detail the following:

- Identify the environmental objectives and outcomes relevant to the proposed development.
- Identify the potential environmental risks that apply to the proposed development.
- Outline the measures that should be implemented to protect the environment during the proposed development.
- Define the responsibilities and reporting requirements relevant to environmental matters and unexpected finds.
- Outline the procedures that should be followed if unidentified finds are encountered during the proposed development.

To ensure compliance with the RAP, the CEMP should also detail the following with regards to the remediation works schedule:

- Communication and sign-off procedure to ensure HOLD POINTs listed in Section 11 are adhered to during the remediation works schedule.
- Procedures for removal of hazardous materials, including.
 - The appointed removal contractor, SafeWork NSW LAA and project Environmental Consultant.
 - HAZMAT removal methodology. Lead paint removal procedure is to be detailed and project specific, ensuring the removal procedure limits the potential for recontamination of the site.
 - Preventative measures to ensure removal works are managed appropriately to prevent recontamination of remediated areas, i.e., by tracking of plant from contaminated areas and/or stockpiling of waste materials.
- Procedures for remediation excavation and validation works, including.
 - HOLD POINTs.
 - Requirement for direction of remediation excavation depth and extent by the appointed project Environmental Consultant in accordance with this RAP.
 - Location of, and methods for storage/stockpiling of contaminated soils prior to off-site disposal.
 - Procedure for granting approval/validation of proposed imported VENM backfill (where required).



15. Approvals, Conditions, Licensing, Legislation & Guidelines

The following approvals/conditions and licences required for the remediation works are detailed below:

- The appointed project Environmental Consultant/Scientist must be suitably and qualified and experienced in the remediation of land. Site Validation Reports should be reviewed and approved by a EIANZ Certified Environmental Practitioner (CEnvP) – Site Contamination Specialist prior to issue to the appointed Site Auditor.
- Visual inspection and clearances of the residual surfaces following removal of asbestos containing materials are to be completed by a SafeWork NSW LAA.
- Any hazardous removal works are to be completed by suitably qualified, experienced, and licenced contractors.
 - Any non-friable asbestos removal shall be by an Asbestos Removalist who holds a SafeWork NSW Bonded (Class B) Asbestos Removal Licence. Note: A licence is required where the surface area of bonded asbestos removed, is greater than 10 m² (as of January 2008). If there is uncertainty about the quantity of asbestos material, a SafeWork NSW licenced removalist (Class A) must be engaged. All works involving friable asbestos removal shall be completed by a Class A licenced removalist.
- Any material leaving site (whether hazardous or not) must be classified in accordance with the NSW EPA (2014) Waste Classification Guidelines.
- If more than 100kg of asbestos waste or 10m² of asbestos sheeting is proposed to be removed from the site, then information is to be provided to the EPA, under the NSW EPA Asbestos and Waste Tyre Guidelines 2015. This guideline contains the legal requirements that consignors, transporters and occupiers of premises must meet in addition to the Waste Regulations.
 - The following requirements are noted:
 - A transporter of Asbestos Waste must be registered as a transporter of Asbestos Waste on WasteLocate before any transport of Asbestos Waste is to occur.
 - The transporter of Asbestos Waste must provide the following information to the NSW EPA upon registration on Waste Locate (<https://wastelocate.epa.nsw.gov.au>) no later than on delivery of its first load of Asbestos Waste to the receiving facility.
 - Name and address of the transporter.
 - Mobile telephone number of the transporter's registered driver.
 - Email address of the transporter.
 - Trading name or agency name of the transporter.
 - Drivers licence number of the transporter's registered driver.
 - Postal address of the transporter, if different from address.
 - Primary telephone number of transporter.
 - The Australian Business Number (ABN) for the transporting company (if the entity has an ABN).
 - WorkCover licence number of the transporter, if held.



- The transporter of a load of Asbestos Waste must provide the following information to the NSW EPA by using WasteLocate before the transportation of any load of Asbestos Waste:
- The type of Asbestos Waste in the load; vehicle registration; number of the vehicle driven by the transporter's registered driver for the specific consignment.
- A transporter of a load of Asbestos Waste to any premises must scan the EPA Fixed Plate at the premises through their mobile device for each load. Scanning of the EPA Fixed Plate by the transporter for a load enables the occupier to meet its obligations under clause 76(7) or 79(6) (as applicable) of the Waste Regulation for that load.
- If the EPA Fixed Plate at an occupier's premises is not scanned by the transporter, the occupier must provide the EPA in writing the date and time of delivery of the load of Asbestos Waste, the vehicle registration number of the vehicle driven by or on behalf of the transporter for the specific consignment.

All remediation works on the site must be undertaken with all due regard to the environment and to statutory requirements. Work on site is to comply with the requirements of the following National and NSW legislation and guidelines:

- Work Health and Safety Act 2011.
- Work Health and Safety Regulation 2017.
- Protection of the Environment (Operations) Act 1997.
- Protection of the Environment Operations (Waste) Regulation 2014.
- NSW Environment Protection Authority (2014) 'Waste Classification Guidelines'.
- NSW SafeWork (2014) 'Managing Asbestos In or On Soil'.
- NSW Government (2019) Code of Practice. How to Manage and control Asbestos in the Workplace.
- NSW Government (2019) Code of Practice. How to Safely Remove Asbestos.
- Australian Standard: Guide to lead paint management, Part 2: Residential and commercial buildings (AS 4361.2 - 2017).
- Control of Workplace Hazardous Substances, Code of Practice, WorkCover Authority of NSW, 2006.
- National Code of Practice for the Control of Workplace Hazardous Substances, National Occupational Health and Safety Commission: 2007, 1994.
- The Demolition of Structures, Australian Standard AS2601, 2001.
- AS/NZS 4361.2:2017 Guide to hazardous paint management, Part 2: Lead paint in residential, public and commercial buildings.
- National Environment Protection (Assessment of Site Contamination) Measure 1999 amended May 2013 (ASC NEPM 2013).

The requirements of the RAP must be explained to all site workers and visitors (as required) as a part of an induction process to the site CEMP and a copy is to be maintained on site during site works. Furthermore, the CEMP development is to incorporate the approvals, conditions, licensing, legislation, and guidelines listed above to ensure adherence to this RAP.



16. Conclusions

It is considered that the objectives of the site remediation will be achieved subject to the successful implementation of the actions contained in this RAP.

This RAP has been prepared with consideration to available information, existing reports, development consent conditions and applicable regulatory provisions. The remediation strategy has been based on the documented site condition, which has been adequately characterised by previous investigations and considers TRH, BTEX, PAH and heavy metals in soil as the primary contaminants of concern warranting remediation.

Appropriate contingencies and controls have been made to accommodate data gaps and unexpected finds during the remediation phase. Validation will be subject to successful implementation of the remediation strategy and requirements prescribed within **Section 8** to **Section 10**.

The RAP includes suitable design and strategy for off-site disposal of contamination to reduce the risk of exposure to future site users. The proposed remediation is considered appropriate to render the site suitable for the proposed development as an aged care facility, inclusive of basement level parking.

These conclusions are made with the limitations attached to this report (Section 17).



17. Limitations

This report has been prepared in accordance with the scope of services described in the Section 1.3. The report has been prepared for the sole use of the client and has been prepared in accordance with a scope of work agreed by the client.

The report or document does not purport to provide legal advice and any conclusions or recommendations made should not be relied upon as a substitute for such advice.

The report does not constitute a recommendation by Reditus for the client or any other party to engage in any commercial or financial transaction and any decision by the client or other party to engage in such activities is strictly a matter for the client.

The report relies upon data, surveys, measurements, and results taken at or under the site at particular times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the client. Furthermore, the report has been prepared solely for use by the client and Reditus accepts no responsibility for its use by other parties. The client agrees that Reditus' report or associated correspondence will not be used or reproduced in full or in part for promotional purposes and cannot be used or relied upon by any other individual, party, group or company in any prospectus or offering. Any individual, party, group, or company seeking to rely on this report cannot do so and should seek their own independent advice.

No warranties, express or implied, are made. Subject to the scope of work undertaken, Reditus assessment is limited strictly to identifying typical environmental conditions associated with the subject property based on the scope of work and testing undertaken and does not include and evaluation of the structural conditions of any buildings on the subject property or any other issues that relate to the operation of the site and operational compliance of the site with state or federal laws, guidelines, standards or other industry recommendations or best practice. Scope of work undertaken for assessments are agreed in advance with the client and may not necessarily comply with state or federal laws or industry guidelines for the type of assessment conducted.

Additionally, unless otherwise stated Reditus did not conduct soil, air or wastewater analyses including asbestos or perform contaminated sampling of any kind. Nor did Reditus investigate any waste material from the property that may have been disposed offsite or undertake and assessment or review of related site waste management practices.

The results of this assessment are based upon (if undertaken as part of the scope work) a site inspection conducted by Reditus personnel and/or information from interviews with people who have knowledge of site conditions and/or information provided by regulatory agencies. All conclusions and recommendations regarding the property are the professional opinions of the Reditus personnel involved with the project, subject to the qualifications made above.

While normal assessments of data reliability have been made, Reditus assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside of Reditus, or developments resulting from situations outside the scope of this project/assessment.

Reditus is not engaged in environmental auditing and/or reporting of any kind for the purpose of advertising sales promoting, or endorsement of any client's interests, including raising investment capital, recommending investment decisions, or other publicity purposes. Reditus assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside of Reditus, or developments resulting from situations outside the scope of this project.

In relation the conduct of Asbestos inspections or the preparation of hazardous materials reports Reditus has conducted inspections and the identification of hazardous material within



the constraints presented by the property. Whilst efforts are made to access areas not normally accessed during normal use of the site to identify the presence of asbestos or other hazardous material, unless explicitly tested no guarantee can be provided that such material is or is not present.

Reditus' professional opinions are based upon its professional judgment, experience, and training. These opinions are also based upon data derived from the limited testing and analysis described in this report or reports reviewed. It is possible that additional testing and analysis might produce different results and/or different opinions or other opinions. Reditus has limited its investigation(s) to the scope agreed upon with its client. Reditus believes that its opinions are reasonably supported by the testing and analysis that has been undertaken (if any), and that those opinions have been developed according to the professional standard of care for the environmental consulting profession in this area at this time. Other opinions and interpretations may be possible. That standard of care may change, and new methods and practices of exploration, testing and analysis may develop in the future, which might produce different results.



18. References

- Australian and New Zealand Governments Guidelines for Fresh and Marine Water Quality 2018.
- Australian Standard AS4482.1-2005. Guide to the Investigation and Sampling of sites with Potentially Contaminated Soil. Part 1: Non-volatile and Semi-volatile Compounds, 2005.
- Australian Standard AS4482.2-1999. Guide to the Investigation and Sampling of sites with Potentially Contaminated Soil. Part 2: Volatile Substances, 1999.
- Environmental Strategies (August 2016) Remedial Action Plan (RAP). 138-140 Campbell Hill Road, Chester Hill NSW.
- Environmental Strategies (ES) (March 2014) Due Diligence Phase 1 and 2 Environmental Site Assessment. 138-140 Campbell Hill Road, Chester Hill NSW.
- National Environment Protection Council (1999) 'National Environment Protection (Assessment of Site Contamination Measure 1999' as amended 2013.
- National Environment Protection Council (1999, Revised 2013) National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 – Schedule B1 Guideline on Investigation levels for Soil and Groundwater (NEPC, 2013).
- NSW Contaminated Land Management Act (the CLM Act 1997).
- NSW EPA (2020) Consultants Reporting on Contaminated Land.
- NSW EPA Guidelines for the Assessment and Management of Groundwater Contamination, 2007.
- NSW EPA Guidelines for the NSW Site Auditor Scheme (3rd Edition), 2017.
- NSW EPA Managing Asbestos in or on Soil, 2014 (NSW EPA 2014).
- NSW EPA Sampling Design Guidelines, 1995.
- NSW State Environmental Planning Policy Number (SEPP) Resilience and Hazards 2021. *Replacing SEPP55 – Remediation of Land, 1998.*
- NSW Work Health and Safety Act, 2011 (WHS Act 2011).
- NSW Work Health and Safety Regulations, 2017 (WHS Reg 2017), Chapter 8 Asbestos, 2017 (NSW WHS Reg 2017).
- Reditus Consulting Pty Ltd (Reditus) (2022) Detailed Site Investigation. Abel Tasman Village, 222 Waldron Road, 138 & 140 Campbell Hill Road, Chester Hill NSW.
- The Acid Sulfate Soil Management Advisory Committee (ASSMAC) Acid Sulfate Soils Assessment Guidelines 1998 (Also referred to as the "Acid Sulfate Soils Manual").
- Western Australia Department of Health Guidelines for the Assessment Remediation and Management of Asbestos Contaminated Sites in Western Australia 2021 (WA DoH, 2021) as referred to by NEPM 2013.



Appendix A - Figures



Overview



Site Location

Inset



Map

22065_rp02_f01_siteloc_v01

Date of Export

27/07/2022

Author

RK

Approver

GB

Data Source

Metromap, Google Maps, Open Street Map, NSW Government

Legend

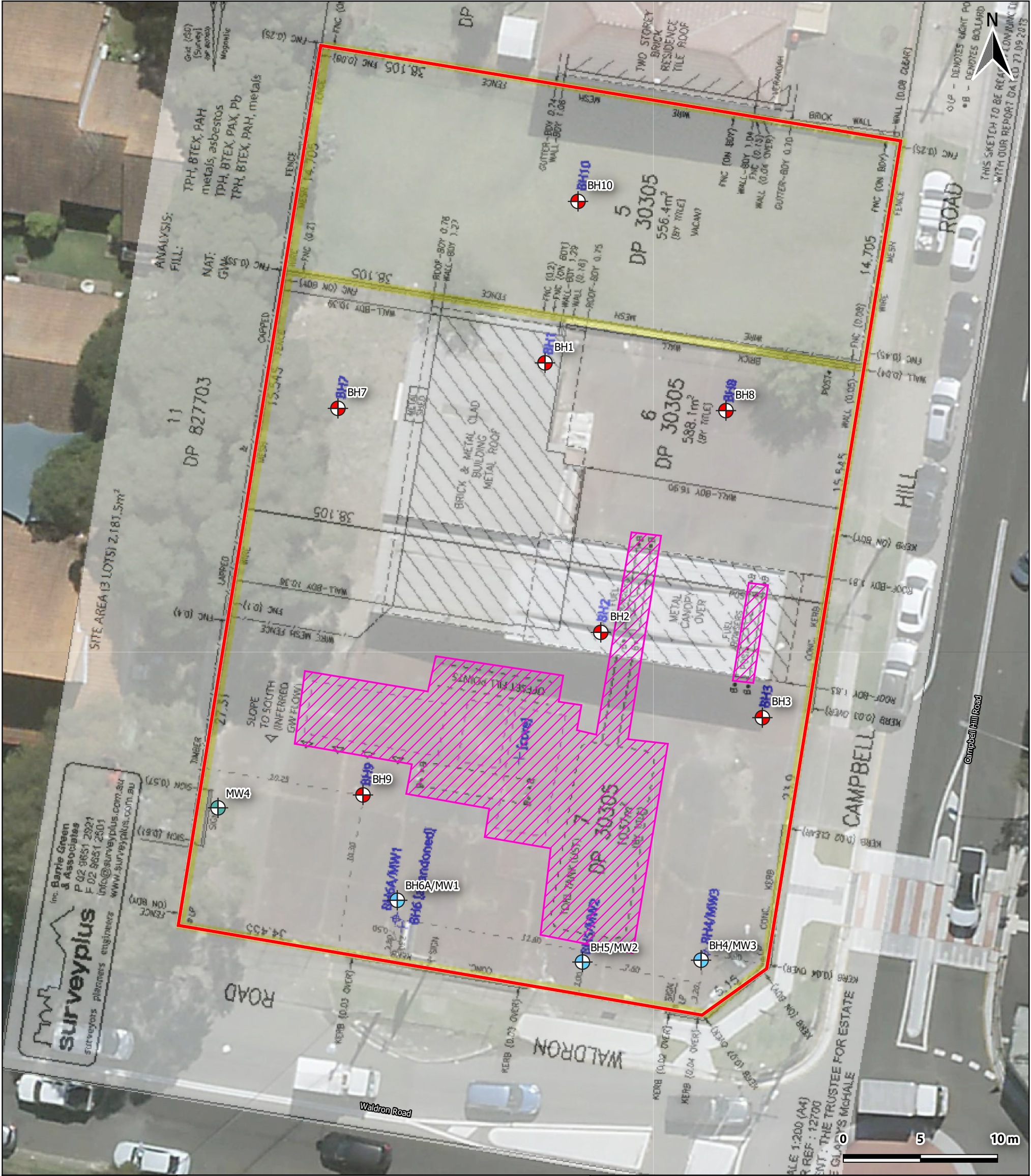
- Site Boundaries
- Surface Water
- Major Roads
- Railways
- Rivers
- Streams

Figure 1 - Site Location

138 & 140 Campbell Hill Rd, Chester Hill, NSW, 2162

22065 - Remediation Action Plan

Asset Geotechnical Engineering Pty Ltd



Map 22065_rp02_f02_UPSSarea_v02		Legend Inferred Remedial Area ES 2014 Soil Bores ES 2014 Monitoring Wells Reditus 2022 Monitoring Well	Figure 2 - Inferred UPSS Remediation Area Lot 6 and 7 DP30305, Chester Hill NSW 22065 - Remediation Action Plan Abel Tasman Village Association Limited
Date of Export 17/05/2023	Map Scale (approx. at A3) 1:300		
Author RC	Approver GB		
Data Source Metromap, Google Maps, Open Street Map, Geoscience Australia			



Appendix B – Summary Results Tables

Location	Depth	NEMP 2013 Lithology	pH	CEC	Logged Lithology
BH1	0.5	CLAY			Silty CLAY
BH2	0.5	CLAY			Silly CLAY
BH10	1.5	CLAY	5.3	15	Silly CLAY
BH1	1	CLAY			Silly CLAY
BH4	1	CLAY			Silly CLAY
BH5	1	CLAY			Silly CLAY/Weathered SHALE
BH9	1	CLAY			Silly CLAY
BH6A	6.8	CLAY			SILY SHALE
BH5	7.5	CLAY			Silly CLAY/Weathered SHALE
BH6A	1	SILT			Silly CLAY/Weathered SILTSTONE
BH7	1	SILT			SILTSTONE
BH8	4	SILT			Weathered Siltstone
BH9	7	SILT			Clayey SILTSTONE/Silly CLAY above refusal
BH7	0.1	SAND	7.0	22	Roadbase
BH5	1.5	SAND			Silly CLAY above 50% lithics
BH4	7	SAND			Silly CLAY above Refusal

[illegible]

[illegible][illegible]

Table 5 - Groundwater Analytical Data
Estate of the Late G J McHale
138-140 Campbell Hill Road
Chester Hill



				Dissolved Metals		PAH																TRH (NEPM 1999)				TRH NEPM 2013				BTEXN									
				Lead (Filtered)	B(a)P Total Potency Equivalent	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Pyrene	C6 - C9	C10 - C14	C15 - C28	C29-C36	C6-C10	C>10-C16	>C16-C34	>C34-C40	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (p)	Xylene (o)	Naphthalene	C6-C10 less BTEX (F1)	>C6-C10 less Naphthalene (F2)	
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
EQL (Grab samples)				30	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100	50	100	100	100	50	100	100	10	10	10	20		10	10	-	-
EQL (Well samples)				1	5	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	10	50	100	100	10	50	100	100	1	1	1	2		1	1	10	50
NEPM 2013 Groundwater HSLs for Vapour Intrusion, 2 to <4m, Sand																														800	NL	NL	NL	NL	NL	NL	1000	1000	
NEPM 2013 Groundwater HSLs for Vapour Intrusion, 4 to <8m, Sand																														800	NL	NL	NL	NL	NL	NL	1000	1000	
ANZECC 95% Level of Protection				3.4 ^{#2}				ID		ID					ID			16		ID									950	ID	ID	ID	200	350	16				
NEPM 2013 GIIL s. Fresh Waters ^A				3.4 ^{#2}														16												950				350	16				
Field ID	Location	Depth	Date																																				
Seepage water																																							
GRAB1 ^B	MW1	1.400	15/01/2014	<30	<5	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1	<1	0	<1	<1	<100	<50	<100	<100	<100	<50	<100	<100	<10	<10	<10	<20		<10	<10	-	-	
Groundwater well samples																																							
MW1	MW1	1.195	24/01/2014	16	<5	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1	<1	0	<1	<1	<10	<50	<100	<100	<10	<50	<100	<100	<1	<1	<1	<2		<1	<1	<10	<50	
MW2	MW2	1.270	24/01/2014	2	<5	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1	<1	0	<1	<1	<10	<50	<100	<100	<10	<50	<100	<100	<1	<1	<1	<2		<1	<1	<10	<50	
MW3	MW3	1.45	24/01/2014	6	<5	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1	<1	0	<1	<1	<10	<50	<100	<100	<10	<50	<100	<100	<1	<1	1	<2		<1	<1	<10	<50	
Statistical Summary (Groundwater well samples only)																																							
Number of Results				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Number of Detects				3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1	0		0	0	0	0
Minimum Concentration				2	<5	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1	<1	<1	0	<1	<1	<10	<50	<100	<100	<10	<50	<100	<100	<1	<1	<1	<2		<1	<1	<10	<50
Minimum Detect				2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<10	<50	<100	<100	<10	<50	<100	<100	<1	<1	1	ND		ND	ND	ND	ND
Maximum Concentration				16	<5	<1	<1	<1	<1	<1	<2	<1	<1	<1	<1	<1	<1	<1	<1	0	<1	<1	<10	<50	<100	<100	<10	<50	<100	<100	<1	<1	1	<2		<1	<1	<10	<50
Maximum Detect				16	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	<10	<50	<100	<100	<10	<50	<100	<100	<1	<1	1	ND		ND	ND	ND	ND
Average Concentration				8	2.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0.5	0.5	5	25	50	50	5	25	50	50	0.5	0.5	0.67	1		0.5	0.5	5	25
Median Concentration				6	2.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0	0.5	0.5	5	25	50	50	5	25	50	50	0.5	0.5	0.5	1		0.5	0.5	5	25	
Standard Deviation				7.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.29	0		0	0	0	0
Number of Guideline Exceedances				2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)				2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Comments
A. Investigation levels apply to typical slightly-moderately disturbed systems.
B. GRAB1 was a screening sample of seepage water at MW1 which did not conform to standard QAQC procedures for water sampling. Different analytical methods were used and the sample should not be directly compared with groundwater well samples
#1 pH>6.5
#2 Criteria based on hardness value of 30mg/L CaCO₃

Table 1
Soil Analytical Results

	Asbestos	BTEX								TRH							TPH					
		Asbestos Identification	Naphthalene (BTEX)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	Total BTEX	C6-C10 Fraction (F1)	C6-C10 (F1 minus BTEX)	>C10-C16 Fraction (F2)	>C10-C16 Fraction (F2 minus Naphthalene)	>C16-C34 Fraction (F3)	>C34-C40 Fraction (F4)	>C40-C60 Fraction (Sum)	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	>29-C36 Fraction	C10-C36 Fraction (Sum)
EQL	Detect	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Comment	1	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.2	10	10	50	50	100	100	50	10	50	100	100	50	
NEPM 2013 Table 1A(1) HILs Res A Soil																						
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand																						
>=0m, <1m		3	0.5	160	55			40			45 ¹⁴		110 ¹³									
>=1m, <2m		NL ¹⁷	0.5	220	NL ¹⁷			60			70		240									
NEPM 2013 Table 1B(5) Generic EIL - Urban Res & Public Open Space		170																				
NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil, 0-2 m			50	85	70			105			180 ¹⁸	120 ¹¹	120 ¹¹	300	2,800							
NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil										700 ¹⁴		1,000 ¹⁴		2,500	10,000							

Field ID	Depth	Date	Matrix Type																					
HA01	0.1	3/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA01	0.5	3/05/2022	Soil		<1	<0.2	<0.5		<2	<1	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA02	0.1	3/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<2	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA02	0.1	3/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<2	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA03	0.5	3/05/2022	Soil		<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA04	0.1	3/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<2	<1	<25	<25	<50	<50	200	<100	200	<25	<50	140	<100	140	
HA05	0.1	3/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<2	<1	<25	<25	<50	<50	250	<100	250	<25	<50	170	110	280	
HA05	0.7	3/05/2022	Soil		<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA06	0.1	3/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	120	<100	120	<25	<50	<100	<100	<50	
HA07	0.1	3/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
DUP1	0.1	3/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
TRIP1	0.1	3/05/2022	Soil		<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	
HA07	0.6	3/05/2022	Soil		<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA08	0.1	3/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<2	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA08	0.6	3/05/2022	Soil		<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA09	0.1	3/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA10	0.1	3/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA10	0.6	3/05/2022	Soil		<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA11	0.1	3/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<2	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA12	0.1	3/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<2	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA12	0.6	3/05/2022	Soil		<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA13	0.1	4/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<2	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA13	0.7	4/05/2022	Soil		<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA13	1.0	4/05/2022	Soil		<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA14	0.1	3/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<2	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
DUP2	0.1	3/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
TRIP2	0.1	3/05/2022	Soil		<1	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100	<50	
HA15	0.1	4/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<2	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA16	0.1	4/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<2	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA17	0.1	4/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<2	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA17	0.4	4/05/2022	Soil		<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA18	0.1	4/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<2	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA19	0.1	4/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<2	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA19	0.4	4/05/2022	Soil		<1	<0.2	<0.5	<1	<2	<2	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA20	0.1	4/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<2	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
HA21	0.1	4/05/2022	Soil	ND	<1	<0.2	<0.5	<1	<2	<2	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	100	100	
HA21	0.5	4/05/2022	Soil		<1	<0.2	<0.5	<1	<2	<1	<1	<25	<25	<50	<50	<100	<100	<50	<25	<50	<100	<100	<50	
SPACM1	Surface	3/05/2022	Material	Detect																				
SPACM2	Surface	4/05/2022	Material	ND																				

Comments
ND = Non Detect
#1 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (ref to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its BaP TEF (ref Table 1A(1)) & summing
#2 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) & naphthalene (should meet relevant HSL)
#3 Arsenic HIL: assumes 70% oral bioavailability. Site-specific bioavailability may be considered where appropriate (refer Schedule B7).
#4 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be considered where appropriate.
#5 Elemental mercury: HIL does not address elemental mercury, a site specific assessment should be considered if elemental mercury is present, or suspected to be present.
#6 PCBs: HIL refers to non-dioxin like PCBs only. Where PCB source is known, or suspected at a site, a site-specific assessment of exposure to all PCBs (inc dioxin like PCBs) should be undertaken
#7 Derived soil HSL exceeds soil saturation concentration
#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#9 To obtain F2 subtract naphthalene from the <C10 - C16 fraction.
#10 Aged values apply to arsenic contamination present in soil > 2 years. Refer Schedule B5c for < 2 years.
#11 Errata Updated 30 April 2014. Naphthalene should not be subtracted.
#12 Errata 30 April 2014. Naphthalene should not be subtracted from >C
#13 Moderate reliability. To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#14 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2
Environmental Standards
2013, NEPM 2013 Table 1A(1) HILs Res A Soil
2013, NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand
2013, NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil
NEPM, NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil

Table 1
Soil Analytical Results

		PAH																			
		benz(a,h)fluoranthene	benz(a)anthracene	benz(b)fluoranthene	anthracene	benz(a)anthracene	benz(a)pyrene	benz(b)fluoranthene	benz(g,h)perylene	benz(k)fluoranthene	benz(e,h)anthracene	fluoranthene	fluorene	benzo(L,2,3-c-d)pyrene	naphthalene	phenanthrene	pyrene	benz(a)pyrene TEQ calc (afl)	benz(a)pyrene TEQ (LCR)	Abs (Sum of total)	Abs (Sum of positives)
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.2	0.1	0.1	0.1	0.1	0.05	0.5	0.1	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.5	0.5	0.05
NEPM 2013 Table 1A(1) HILs Res A Soil																		3 ^{#1}	3 ^{#1}	300 ^{#2}	
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand																					
>=0m, <1m																					
>=1m, <2m																					
NEPM 2013 Table 1B(5) Generic EIL - Urban Res & Public Open Space																					
NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil, 0-2 m							0.7														
NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil																					

Field ID	Depth	Date	Matrix Type	benz(a,h)fluoranthene	benz(a)anthracene	benz(b)fluoranthene	anthracene	benz(a)anthracene	benz(a)pyrene	benz(b)fluoranthene	benz(g,h)perylene	benz(k)fluoranthene	benz(e,h)anthracene	fluoranthene	fluorene	benzo(L,2,3-c-d)pyrene	naphthalene	phenanthrene	pyrene	benz(a)pyrene TEQ calc (afl)	benz(a)pyrene TEQ (LCR)	Abs (Sum of total)	Abs (Sum of positives)
HA01	0.1	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA01	0.5	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA02	0.1	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA03	0.1	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA03	0.5	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA04	0.1	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA05	0.1	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA05	0.7	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA06	0.1	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA07	0.1	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
DUP1	0.1	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
TRIP1	0.1	3/05/2022	Soil		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.05
HA07	0.6	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA08	0.1	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA08	0.6	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA09	0.1	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA10	0.1	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA10	0.6	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA11	0.1	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA12	0.1	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA12	0.6	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA13	0.1	4/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA13	0.7	4/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA13	1.0	4/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA14	0.1	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
DUP2	0.1	3/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
TRIP2	0.1	3/05/2022	Soil		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.05
HA15	0.1	4/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA16	0.1	4/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA17	0.1	4/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA17	0.4	4/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA18	0.1	4/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA19	0.1	4/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA19	0.4	4/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA20	0.1	4/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
HA21	0.1	4/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	0.06	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		0.06
HA21	0.5	4/05/2022	Soil	<0.2	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.5		<0.05
SPACM1	Surface	3/05/2022	Material																				
SPACM2	Surface	4/05/2022	Material																				

Comments
ND = Non Detect
#1 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by
#2 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider pr
#3 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should
#4 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioav
#5 Elemental mercury: HIL does not address elemental mercury, a site specific assessment should be cor
#6 PCBs: HIL refers to non-dioxin like PCBs only. Where PCB source is known, or suspected at a site, a site
#7 Derived soil HSL exceeds soil saturation concentration
#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
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2013, NEPM 2013 Table 1A(1) HILs Res A Soil
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NEPM, NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil

Table 1
Soil Analytical Results

	Metals								PCBs									
	Arsenic	Antimony	Chromium (VI+V)	Copper	Lead	Mercury	Nickel	Zinc	Aroclor 1016	Aroclor 1221	Aroclor 1232	Aroclor 1242	Aroclor 1248	Aroclor 1254	Aroclor 1260	Chl (Sum of total)		
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	4	0.4	1	1	1	0.1	1	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
NEPM 2013 Table 1A(1) HILs Res A Soil	100 ¹⁵	20		6,000	300 ¹⁴	40 ¹⁵	400	7,400										1 ¹⁶
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand																		
>=0m, <1m																		
>=1m, <2m																		
NEPM 2013 Table 1B(5) Generic EIL - Urban Res & Public Open Space	100 ¹⁸																	
NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil, 0-2 m																		
NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil																		

Field ID	Depth	Date	Matrix Type	6	<0.4	31	27	39	<0.1	33	69	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA01	0.1	3/05/2022	Soil	6	<0.4	31	27	39	<0.1	33	69	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA01	0.5	3/05/2022	Soil	<4	<0.4	17	37	17	<0.1	14	47							
HA02	0.1	3/05/2022	Soil	7	<0.4	22	24	26	<0.1	11	37	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA03	0.1	3/05/2022	Soil	7	<0.4	36	21	22	<0.1	29	46	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA03	0.5	3/05/2022	Soil	9	<0.4	22	26	21	<0.1	26	41							
HA04	0.1	3/05/2022	Soil	5	<0.4	28	45	18	0.2	25	63	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA05	0.1	3/05/2022	Soil	7	<0.4	31	35	29	0.1	26	79	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA05	0.7	3/05/2022	Soil	8	<0.4	20	20	17	<0.1	9	31							
HA06	0.1	3/05/2022	Soil	11	0.4	26	57	29	0.3	28	150	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA07	0.1	3/05/2022	Soil	6	<0.4	26	26	27	<0.1	21	65	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DUP1	0.1	3/05/2022	Soil	<4	<0.4	25	15	13	<0.1	25	31	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRIP1	0.1	3/05/2022	Soil	<5	<1	22	22	31	<0.1	22	68							<0.1
HA07	0.6	3/05/2022	Soil	6	<0.4	14	40	17	<0.1	8	45							
HA08	0.1	3/05/2022	Soil	9	<0.4	27	32	24	<0.1	21	41	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA08	0.6	3/05/2022	Soil	6	<0.4	15	31	16	<0.1	12	37							
HA09	0.1	3/05/2022	Soil	7	<0.4	31	21	25	<0.1	24	47	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA10	0.1	3/05/2022	Soil	5	<0.4	18	19	16	<0.1	19	45	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA10	0.6	3/05/2022	Soil	<4	<0.4	6	19	8	<0.1	7	25							
HA11	0.1	3/05/2022	Soil	<4	<0.4	17	14	14	<0.1	16	43	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA12	0.1	3/05/2022	Soil	6	<0.4	22	23	21	<0.1	20	53	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA12	0.6	3/05/2022	Soil	9	<0.4	13	32	16	<0.1	7	35							
HA13	0.1	4/05/2022	Soil	5	<0.4	26	21	18	<0.1	17	37	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA13	0.7	4/05/2022	Soil	<4	<0.4	8	6	5	<0.1	8	21	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA13	1.0	4/05/2022	Soil	<4	<0.4	8	27	6	<0.1	20	28							
HA14	0.1	3/05/2022	Soil	8	<0.4	19	14	33	<0.1	7	40	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
DUP2	0.1	3/05/2022	Soil	9	<0.4	23	15	20	<0.1	6	23	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TRIP2	0.1	3/05/2022	Soil	<5	<1	14	8	14	<0.1	3	12							<0.1
HA15	0.1	4/05/2022	Soil	7	<0.4	23	38	26	0.1	17	69	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA16	0.1	4/05/2022	Soil	6	<0.4	20	20	20	<0.1	13	39	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA17	0.1	4/05/2022	Soil	6	<0.4	15	18	28	<0.1	11	69	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA17	0.4	4/05/2022	Soil	4	<0.4	13	14	13	<0.1	5	21							
HA18	0.1	4/05/2022	Soil	6	<0.4	17	17	29	<0.1	12	64	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA19	0.1	4/05/2022	Soil	7	<0.4	23	29	27	<0.1	26	49	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA19	0.4	4/05/2022	Soil	5	<0.4	14	13	12	<0.1	4	20							
HA20	0.1	4/05/2022	Soil	6	<0.4	18	32	60	<0.1	10	64	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA21	0.1	4/05/2022	Soil	<4	<0.4	15	14	21	<0.1	11	54	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
HA21	0.5	4/05/2022	Soil	5	<0.4	15	27	13	<0.1	5	24							
SPACM1	Surface	3/05/2022	Material															
SPACM2	Surface	4/05/2022	Material															

Comments

ND = Non Detected
#1 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by
#2 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider pr
#3 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability may be important and should
#4 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% below
#5 Elemental mercury: HIL does not address elemental mercury, a site specific assessment should be cor
#6 PCBs: HIL refers to non-dioxin like PCBs only. Where PCB source is known, or suspected at a site, a site
#7 Derived soil HSL exceeds soil saturation concentration
#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#9 To obtain F2 subtract naphthalene from the <C10 - C16 fraction.
#10 Aged values apply to arsenic contamination present in soil > 2 years. Refer Schedule BSc for < 2 years
#11 Errata Updated 30 April 2014 . Naphthalene should not be subtracted.
#12 Errata 30 April 2014. Naphthalene should not be subtracted from >C
#13 Moderate reliability. To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fractio
#14 Separate management limits for BTEX & naphthalene are not available hence should not be subtract
Environmental Standards
2013, NEPM 2013 Table 1A(1) HILs Res A Soil
2013, NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand
2013, NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil
NEPM, NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil

Table 1
Soil Analytical Results



	SVOCs	Organophosphorus Pesticides																Pesticides	
		Permethrin	Chlorpyrifos methyl	Chlorpyrifos ethyl	Carbophenothion	Chlorfenvinphos	Chlorpyrifos	Chlorpyrifos methyl	Diazinon	Dichlorvos	Disulfoton	Endosulfan	Endosulfan	Malathion	Methyl parathion	Monocrotophos	Parathion	Permethrin	Permethrin
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQ		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.05	0.05	0.2	0.2	0.1	0.05	0.1
NEPM 2013 Table 1A(1) HILs Res A Soil							160												
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand																			
>=0m, <1m																			
>=1m, <2m																			
NEPM 2013 Table 1B(5) Generic EIL - Urban Res & Public Open Space																			
NEPM 2013 Table 1B(6) EILs for Urban Res, Coarse Soil, 0-2 m																			
NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil																			

Field ID	Depth	Date	Matrix Type																
HA01	0.1	3/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA01	0.5	3/05/2022	Soil																
HA02	0.1	3/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA03	0.1	3/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA03	0.5	3/05/2022	Soil																
HA04	0.1	3/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA05	0.1	3/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA05	0.7	3/05/2022	Soil																
HA06	0.1	3/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA07	0.1	3/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
DUP1	0.1	3/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
TRIP1	0.1	3/05/2022	Soil		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
HA07	0.6	3/05/2022	Soil																
HA08	0.1	3/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA08	0.6	3/05/2022	Soil																
HA09	0.1	3/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA10	0.1	3/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA10	0.6	3/05/2022	Soil																
HA11	0.1	3/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA12	0.1	3/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA12	0.6	3/05/2022	Soil																
HA13	0.1	4/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA13	0.7	4/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA13	1.0	4/05/2022	Soil																
HA14	0.1	3/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
DUP2	0.1	3/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
TRIP2	0.1	3/05/2022	Soil		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
HA15	0.1	4/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA16	0.1	4/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA17	0.1	4/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA17	0.4	4/05/2022	Soil																
HA18	0.1	4/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA19	0.1	4/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA19	0.4	4/05/2022	Soil																
HA20	0.1	4/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA21	0.1	4/05/2022	Soil		<0.1	<0.1			<0.1	<0.1	<0.1	<0.1	<0.1		<0.1		<0.1		
HA21	0.5	4/05/2022	Soil																
SPACM1	Surface	3/05/2022	Material																
SPACM2	Surface	4/05/2022	Material																

Comments
ND = Non Detect
#1 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by
#2 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider pr
#3 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should
#4 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioav
#5 Elemental mercury: HIL does not address elemental mercury, a site specific assessment should be cor
#6 PCBs: HIL refers to non-dioxin like PCBs only. Where PCB source is known, or suspected at a site, a sit
#7 Derived soil HSL exceeds soil saturation concentration
#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#9 To obtain F2 subtract naphthalene from the >C10 - C16 fraction.
#10 Aged values apply to arsenic contamination present in soil > 2 years. Refer Schedule B5c for < 2 years
#11 Errata Updated 30 April 2014. Naphthalene should not be subtracted.
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#13 Moderate reliability. To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fractio
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Environmental Standards
2013, NEPM 2013 Table 1A(1) HILs Res A Soil
2013, NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand
2013, NEPM 2013 Table 1B(6) EILs for Urban Res, Coarse Soil
NEPM, NEPM 2013 Table 1B(7) Management Limits in Res / Parkland, Coarse Soil

Table 2
Groundwater Analytical Results

	BTEX						TRH							TPH				
	Naphthalene (BTEX)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	C6-C10 Fraction (F1)	C6-C10 (F1 minus BTEX)	>C10-C16 Fraction (F2)	>C10-C16 Fraction (F2 minus Naphthalene)	>C16-C24 Fraction (F3)	>C24-C40 Fraction (F4)	>C40-C60 Fraction (Sum)	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Sum)
	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
EQL	1	1	1	1	2	1	10	10	50	50	100	100	50	10	50	100	100	50
ANZG (2018) Freshwater 95% LOSP Toxicant DGVs	16 ^{#1}	950 ^{#2}	180 ^{#3}	80 ^{#3}		350 ^{#1}												
NEPM 2013 Table 1A(4) Res HSL A & B GW for Vapour Intrusion, Sand																		
>=2m, <4m	NL	800	NL	NL				1,000 ^{#9}		1,000 ^{#10}								
>=4m, <8m	NL	800	NL	NL				1,000		1,000								
>=8m	NL	900	NL	NL				1,000		1,000								

Field ID	Date	Matrix Type																	
MW1_170522	17/05/2022	Water	<1	<1	<1	<1	<2	<1	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100
MW2_170522	17/05/2022	Water	<1	<1	<1	<1	<2	<1	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100
MW3_170522	17/05/2022	Water	<1	<1	<1	<1	<2	<1	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100
MW4_170522	17/05/2022	Water	<1	<1	<1	<1	<2	<1	<10	<10	<50	<50	<100	<100	<50	<10	<50	<100	<100

Comments

- #1 Low reliability
- #2 Moderate reliability
- #3 Unknown reliability. Recommended for application for slightly to moderately disturbed ecosystems.
- #4 Unknown reliability
- #5 Very high reliability
- #6 High reliability
- #7 Low reliability. DGV may not protect key test species from chronic toxicity (this refers to experimental chronic values or geometric mean for species). Check toxicant DGV technical brief for spread of data and its significance.
- #8 Very Low reliability
- #9 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
- #10 To obtain F2 subtract naphthalene from the >C10 - C16 fraction.

Environmental Standards

ANZG, March 2021, ANZG (2018) Freshwater 95% LOSP Toxicant DGVs
2013, NEPM 2013 Table 1A(4) Res HSL A & B GW for Vapour Intrusion, Sand

Table 2
Groundwater Analytical Results



PAH																		
	Benzo(b+h)fluoranthene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	Benzo(a)pyrene TEQ	PAHs (Sum of positives)	
	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
EQL	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.5	0.1	0.1
ANZG (2018) Freshwater 95% LOSP Toxicant DGVs				0.4 ^{#4}		0.2 ^{#4}				1.4 ^{#4}			16 ^{#1}	> ^{#4}				
NEPM 2013 Table 1A(4) Res HSL A & B GW for Vapour Intrusion, Sand													NL					
>=2m, <4m													NL					
>=4m, <8m													NL					
>=8m													NL					

Field ID	Date	Matrix Type																
MW1_170522	17/05/2022	Water	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.5	<0.1
MW2_170522	17/05/2022	Water	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.5	<0.1
MW3_170522	17/05/2022	Water	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.5	<0.1
MW4_170522	17/05/2022	Water	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.5	<0.1

Comments

#1 Low reliability

#2 Moderate reliability

#3 Unknown reliability. Recommended for application for slightly to moderately dist

#4 Unknown reliability

#5 Very high reliability

#6 High reliability

#7 Low reliability. DGV may not protect key test species from chronic toxicity (this re

#8 Very Low reliability

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Environmental Standards

ANZG, March 2021, ANZG (2018) Freshwater 95% LOSP Toxicant DGVs

2013, NEPM 2013 Table 1A(4) Res HSL A & B GW for Vapour Intrusion, Sand

Table 2
Groundwater Analytical Results



			Metals								VOCs										
			Arsenic (filtered)	Cadmium (filtered)	Chromium (III+VI) (filtered)	Copper (filtered)	Lead (filtered)	Mercury (filtered)	Nickel (filtered)	Zinc (filtered)	1,1,1,2-tetrachloroethane	1,1,1-trichloroethane	1,1,2,2-tetrachloroethane	1,1,2-trichloroethane	1,1-dichloroethane	1,1-dichloroethene	1,1-dichloropropene	1,2,3-trichlorobenzene	1,2,3-trichloropropane	1,2,4-trichlorobenzene	1,2,4-trimethylbenzene
EQL			1	0.1	1	1	1	0.05	1	1	1	1	1	1	1	1	1	1	1	1	1
ANZG (2018) Freshwater 95% LOSP Toxicant DGVs			24	0.2 ⁹⁵	1	1.4 ⁹⁵	3.4 ⁹²	0.6 ⁹¹	11 ⁹¹	8 ⁹⁵		270 ⁹³	400 ⁹³	6,500 ⁹²		700 ⁹³		10 ⁹¹		170 ⁹⁷	
NEPM 2013 Table 1A(4) Res HSL A & B GW for Vapour Intrusion, Sand																					
>=2m, <4m																					
>=4m, <8m																					
>=8m																					

Field ID	Date	Matrix Type	<1	0.2	<1	<1	<1	<0.05	2	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW1_170522	17/05/2022	Water	<1	0.1	<1	3	<1	<0.05	<1	4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW2_170522	17/05/2022	Water	<1	<0.1	<1	<1	<1	<0.05	1	3	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW3_170522	17/05/2022	Water	<1	<0.1	<1	<1	<1	<0.05	2	7	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Comments

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ANZG, March 2021, ANZG (2018) Freshwater 95% LOSP Toxicant DGVs

2013, NEPM 2013 Table 1A(4) Res HSL A & B GW for Vapour Intrusion, Sand

Table 2
Groundwater Analytical Results



			VOCs																				
			1,2-dibromo-3-chloropropane	1,2-dibromoethane	1,2-dichlorobenzene	1,2-dichloroethane	1,2-dichloropropane	1,3,5-trimethylbenzene	1,3-dichlorobenzene	1,3-dichloropropane	1,4-dichlorobenzene	2,2-dichloropropane	2-chlorotoluene	4-chlorotoluene	Bromobenzene	Bromochloromethane	Bromodichloromethane	Bromodiform	Bromomethane	Carbon tetrachloride	Chlorobenzene	Chlorodibromomethane	Chloroethane
			ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
EQL			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	10	1	1	1	10
ANZG (2018) Freshwater 95% LOSP Toxicant DGVs					160 ^{#2}	1,900 ^{#3}	900 ^{#3}		260 ^{#2}	1,100 ^{#3}	60 ^{#8}									240 ^{#3}	55 ^{#3}		
NEPM 2013 Table 1A(4) Res HSL A & B GW for Vapour Intrusion, Sand																							
>=2m, <4m																							
>=4m, <8m																							
>=8m																							
Field ID	Date	Matrix Type																					
MW1_170522	17/05/2022	Water	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<1	<1	<1	<10
MW2_170522	17/05/2022	Water	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<1	<1	<1	<10
MW3_170522	17/05/2022	Water	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<1	<1	<1	<10
MW4_170522	17/05/2022	Water	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<1	<1	<1	<10

Comments

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Environmental Standards

ANZG, March 2021, ANZG (2018) Freshwater 95% LOSP Toxicant DGVs

2013, NEPM 2013 Table 1A(4) Res HSL A & B GW for Vapour Intrusion, Sand

Table 2
Groundwater Analytical Results



VOCs																					
	Chloroform	Chloromethane	cis-1,2-dichloroethene	cis-1,3-dichloropropene	Cyclohexane	Dibromomethane	Dichlorodifluoromethane	Heachlorobutadiene	Isopropylbenzene	n-butylbenzene	n-propylbenzene	p-isopropyltoluene	sec-butylbenzene	Styrene	Trichloroethene	tert-butylbenzene	Tetrachloroethene	trans-1,2-dichloroethene	trans-1,3-dichloropropene	Trichlorofluoromethane	Vinyl chloride
	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
EQL	1	10	1	1	1	1	10	1	1	1	1	1	1	1	1	1	1	1	1	10	10
ANZG (2018) Freshwater 95% LOSP Toxicant DGVs	770 ^{RS}								30 ^{RS}						330 ^{RS}		70 ^{RS}				100 ^{RS}
NEPM 2013 Table 1A(4) Res HSL A & B GW for Vapour Intrusion, Sand																					
>=2m, <4m																					
>=4m, <8m																					
>=8m																					

Field ID	Date	Matrix Type																			
MW1_170522	17/05/2022	Water	<1	<10	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10
MW2_170522	17/05/2022	Water	<1	<10	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10
MW3_170522	17/05/2022	Water	<1	<10	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10
MW4_170522	17/05/2022	Water	<1	<10	<1	<1	<1	<1	<10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<10	<10

Comments

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