



Site Audit Report

PFAS Material Emplacement Area (PFAS MEA), Former Schofields Aerodrome, off Mariner Avenue, Schofields, NSW 2762
MP169_01

Prepared for:
Defence Housing Australia
Suite 2, Level 2/287 Elizabeth Street
Sydney NSW 2000

22 June 2021





Distribution

Site Audit Report, PFAS Material Emplacement Area (PFAS MEA), Former Schofields Aerodrome, off Mariner Avenue, Schofields, NSW 2762

22 June 2021

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List of Acronyms

Acronym	Definition
Measures	
%	per cent
µg/L	Micrograms per Litre
ha	Hectare
km	Kilometres
m	Metre
m ³	Cubic Metre
mAHD	Metres Australian Height Datum
mbgl	Metres Below Ground Level
mBTOC	Metres Below Top of Casing
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Litre
mm	Millimetre
General	
AFFF	Aqueous Film Forming Foam
ALS	Australian Laboratory Services
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASLP	Australian Standard Leaching Procedure
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Governments and Australian State and Territory Governments
CCME	Canadian Council of Ministers of the Environment
CEMP	Construction Environmental Management Plan
CLM Act	NSW Contaminated Land Management Act 1997



Acronym	Definition
COC	Chain of Custody
Council	Blacktown City Council
CSM	Conceptual Site Model
DA	Development Application
DHA	Defence Housing Australia
DP	Deposited Plan
DQI	Data Quality Indicator
DQO	Data Quality Objective
EBPC Act	Environment Protection and Biodiversity Conversation Act
EIL	Ecological Investigation Level
EMP	Environmental Management Plan
Envirolab	Envirolab Services Pty Ltd
EPA	Environment Protection Authority (NSW)
ESL	Ecological Screening Level
FFTA	Former Fire Training Area
GME	Groundwater Monitoring Event
HDPE	High-density Polyethylene
HEPA	Heads of EPAs Australia and New Zealand
HIL	Health Investigation Level
IAA	Interim Audit Advice
LC/MS	Liquid Chromatography-Mass Spectrometry
LOR	Limit of Reporting
MEA	Material Emplacement Area
MS	Matrix Spike
NATA	National Association of Testing Authorities
NEMP	National Environmental Management Plan



Acronym	Definition
NEPM ASC	National Environment Protection (Assessment of Site Contamination) Measure
NHMRC	National Health and Medical Research Council
PFAS	Per-and poly-fluoroalkyl substances
PFHxS	Perfluorohexane sulfonate
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonate
PQL	Practical Quantitation Limit
QA/QC	Quality Assurance/Quality Control
RAAF	Royal Australian Air Force
Ramboll	Ramboll Australia Pty Ltd
RAN	Royal Australian Navy
RAP	Remediation Action Plan
RPD	Relative Percent Difference
SAR	Site Audit Report
SAS	Site Audit Statement
SEPP	State Environmental Planning Policy
SWL	Standing Water Level
TBA	To be announced
TCLP	Toxicity Characteristic Leaching Procedure
UPRN	Unique Property Reference Number
USEPA	United States Environmental Protection Agency
VAC	Validation Acceptance Criteria
VENM	Virgin Excavated Natural Material
-	On tables is "not calculated", "no criteria" or "not applicable"



1.0 Introduction

A site contamination audit (the audit) has been conducted in relation to the PFAS Material Emplacement Area (MEA) (the site or audit site) located within a new residential development at the new suburb of Nirimba Fields (the Nirimba Fields), NSW 2763.

As shown in Attachment 1, 9 and 10 (**Appendix A**), the PFAS MEA (approximately 1.81 hectares) is located approximately in the centre of the Nirimba Fields housing estate. The larger Nirimba Fields housing estate has a total area of 141 hectare and forms part of the former Schofields Aerodrome.

1.1 Audit Objective

The audit was conducted to provide an independent review by an EPA-accredited site auditor of whether the nature and extent of per-and poly-fluoroalkyl substances (PFAS) contamination at the PFAS MEA has been appropriately determined and to assess the suitability and appropriateness of the validation report prepared for the PFAS MEA, i.e. a "Site Audit" as defined in Section 4 (1) (b) (i and v) of the NSW *Contaminated Land Management Act* 1997 (the CLM Act).

Blacktown City Council (Council) issued a Development Consent (DA 18-00972) dated 17 January 2019 (also referred to as Stage 3). The consent condition relevant to the audit was as follows:

Site Contamination.

A NSW Environment Protection Authority accredited Site Auditor shall review the validation report and submit to Council a Site Audit Statement. The Site Audit Statement shall verify that the investigation, remediation and validation was carried out in accordance with the aforementioned guidelines and that the site is suitable for proposed use.

Council also issued a Development Consent (DA 15-00999) dated 21 April 2017 (bulk earthworks). The condition was as follows:

Site Contamination.

Prior to the issue of a Subdivision Certificate, an EPA recognised accredited geoscientist is to validate the site as suitable for residential development in accordance with the strict residential use criteria as set out in the National Environment Protection (Assessment of Site Contamination) Measures (NEPM) 1999 as amended 2013.

The auditor considers the above condition (for the bulk earthworks) does not clearly request a "Site Audit" as defined in the NSW *Contaminated Land Management Act* 1997 (the CLM Act).

The SAN (MP169-01) was issued dated 26 February 2025 to the EPA. Note that the Development Consent was provided to the Auditor on 5 February 2025.

Please note that:

- SAR and SAS were re-issued as R1 to reflect minor changes associated with the now statutory nature of the audit.
- The contamination or status of the site since the completion of the audit have not been taken into account in the re-issued audit.

1.2 Scope of the Audit

Details of the site audit are:

Requested by: [REDACTED] on behalf of Defence Housing Australia (DHA)

Request/Commencement Date: 12 February 2021

Auditor: [REDACTED]

Accreditation No.: [REDACTED]



The scope of the site audit included:

- Review of the following documents:
 - *PFAS Validation Report*, Former Schofields Aerodrome, draft, revision D4, prepared by Ramboll Australia Pty Ltd (Ramboll) dated 12 February 2021.
 - *PFAS Validation Report*, Former Schofields Aerodrome, draft, revision D5, prepared by Ramboll dated 5 March 2021.
 - *PFAS Validation Report*, Former Schofields Aerodrome, draft, revision D6, prepared by Ramboll dated 8 April 2021.
 - *PFAS MEA Validation Report*, Former Schofields Aerodrome, draft, revision D8, prepared by Ramboll dated 3 May 2021.
 - *PFAS MEA Validation Report*, Former Schofields Aerodrome Final, revision F1, prepared by Ramboll dated 21 May 2021 (referred to as 'the Validation Report' or 'Ramboll 2021').
 - Former Schofields Aerodrome, Quakers Hill, NSW: Screening Assessment of Potential Risks from the PFAS Impacted Soil Layer, draft, revision D1, prepared by Ramboll dated 29 January 2021.
 - Former Schofields Aerodrome, Quakers Hill, NSW: Screening Assessment of Potential Risks from the PFAS Impacted Soil Layer, draft, revision D2, prepared by Ramboll dated 22 March 2021.
 - Former Schofields Aerodrome, Quakers Hill, NSW: Screening Assessment of Potential Risks from the PFAS Impacted Soil Layer, final, revision F1, prepared by Ramboll dated 13 April 2021.
 - *Former Schofields Aerodrome, Quakers Hill, NSW: Screening Assessment of Potential Risks from the PFAS Impacted Soil Layer*, final, revision F2, prepared by Ramboll dated 16 April 2021. (This is provided as Appendix 8 of the final PFAS Validation Report).
- The following reports were provided to the auditor for information only as it was prepared either prior to the auditor's engagement for the larger Nirimba Fields; or prepared for areas outside of the audit site:
 - *Site Contamination Due Diligence Assessment*, Former Schofields Aerodrome, Schofields NSW, prepared by JBS Environmental Pty Ltd (JBS) dated October 2012 (referred to as 'JBS 2012').
 - *Site Audit Report – Part of Former Schofields Aerodrome, Lot 400 in DP1171596*, audit number GN481, prepared by ENVIRON Australia Pty Ltd (Environ) dated September 2013 (referred to as 'Environ 2013').
 - *Targeted Phase 2 PFAS Site Investigation, Former Schofields Aerodrome Quakers Hill NSW*, prepared by Ramboll Environ Australia Pty Ltd dated November 2017 (referred to as 'Ramboll 2017').
 - *PFAS Leachate Analysis – Former Schofields Aerodrome*, prepared by Ramboll Australia Pty Ltd (Ramboll) dated 31 May 2018 (referred to as 'Ramboll 2018').
 - PFAS Assessment Overview Letter - Former Schofields Aerodrome/Nirimba Fields, Quakers Hill NSW, draft D2, prepared by Ramboll dated 16 March 2021.
 - Former Schofields Aerodrome/Nirimba Fields, Quakers Hill, NSW: Potential Risks Associated with PFAS Impacted Scraped Soil, draft v1, prepared by Ramboll dated 11 March 2021.
 - PFAS Assessment Overview Letter - Former Schofields Aerodrome/Nirimba Fields, Quakers Hill NSW, draft D3, prepared by Ramboll dated 31 March 2021.
 - *PFAS Assessment Overview Letter - Former Schofields Aerodrome/Nirimba Fields, Quakers Hill NSW*, draft D4, prepared by Ramboll dated 6 May 2021. This is hereafter referred to as the Overview Letter.
 - Former Schofields Aerodrome/Nirimba Fields, Quakers Hill, NSW: Potential Risks Associated with PFAS Impacted Scraped Soil, draft v2, prepared by Ramboll dated 12 April 2021. This is provided as Appendix 2 of the Overview Letter.



- *PFAS Validation Report*, Former Schofields Aerodrome, No Scrape Area, North of Swale, draft, revision D1, prepared by Ramboll dated 3 May 2021.
- A site visit by the auditor on 26 April 2021.
- Discussions with DHA and Ramboll with who undertook the investigation and validation works.

During the course of the audit, letters of Interim Audit Advice (IAA) were issued as part of the review of the PFAS MEA validation report (refer to **Appendix C**):

- Interim Site Audit Advice No. 1 dated 2 March 2021.
- Interim Site Audit Advice No. 2 dated 16 March 2021.
- Interim Site Audit Advice No. 6 dated 30 March 2021.
- Interim Site Audit Advice No. 8 dated 13 April 2021.
- Interim Site Audit Advice No. 9 dated 16 April 2021.
- Interim Site Audit Advice No. 13 dated 18 May 2021.

1.3 Audit Exclusions

The following aspects of the environment or items are excluded this Section B1 and B2 site contamination audit:

- Only the nature and extent of PFAS contamination at the PFAS MEA associated with historical site activities and site use, is assessed as part of this audit. All other contaminants are excluded as a Section A Site Audit Report was completed for the entire former Schofields Aerodrome (refer to **Section 2.7**).
- Only the PFAS MEA site is assessed as part of this audit. All other areas within the larger Nirimba Fields housing estate are excluded.
- This audit does not include the suitability of the fill material (being Virgin Excavated Natural Material [VENM]) overlying and underlying the PFAS-impacted soil at the PFAS MEA for the proposed residential development.
- The design and construction of the PFAS MEA.
- The validation and review of the surplus or waste material generated or removed from PFAS MEA due to construction.



2.0 Site Description

2.1 Location

The PFAS MEA site locality is shown on Attachment 1 and 10 (**Appendix A**).

Due to the subdivision of the site into multiple sub-lots as part of the residential development, there are multiple street address and land title identifiers within the audit site. The complete list of current and proposed street addresses and associated land parcel legal description provided by DHA to the auditor on 6 April 2021 are presented in **Appendix D**.

The site details indicated in the Validation Report are as follows:

Street address:	Former Schofields Aerodrome, off Mariner Avenue, Schofields NSW 2762
	For the sub-lots which have been subdivided - 14 and 16 Dolphin Street, and 9, 11, 13, 15 and 17 Swordfish Street, Nirimba Fields NSW 2763 (refer to Appendix D).
Identifier:	Part Lot 4100 DP 1261628; Lot 2314 to 2318 DP 1252016 and Lot 2240 to 2241 DP 1252015 (refer to Appendix D and Attachment 14, Appendix A)
Local Government:	Blacktown City Council
Owner:	Defence Housing Australia (DHA)
Site Area:	Approximately 1.81 ha

2.2 Zoning

The current zoning of the site is:

- R2 – Low density residential as per the Blacktown Local Environmental Plan Amendment (Sydney Region Growth Centres – Schofields Precinct) 2014.
- RE1 – Public recreation
- SP2 – Infrastructure

The auditor notes that the Validation Report also included zone B2 (Local Centre) but a review of the NSW Planning Portal¹ by the auditor on 18 May 2021 identified that zone B2 is located off-site north of the site.

¹ NSW ePlanning Spatial Viewer accessed at: <https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address>



2.3 Adjacent Uses

The PFAS MEA is located approximately in the centre of the Nirimba Fields housing estate (refer to Attachment 1, 12 and 13, **Appendix A**). Based on the plans provided in the Validation Report, the surrounding site use includes:

- North – A newly constructed access road and proposed new primary school and residential properties (currently vacant).
- East – Newly constructed residential properties and access roads.
- South – Newly constructed residential properties and access roads.
- West – Proposed primary school and playing fields (currently vacant).

In a wider context, the Nirimba Fields (former Schofields Aerodrome) is bound by:

- North – New residential development (Altrove development) and vacant land.
- East – Blacktown-Richmond Railway line corridor followed by residential properties and parkland.
- South – Industrial properties, Nirimba Education Precinct (university/TAFE and a high school).
- West – Eastern Creek (approximately 550 m away from the site), Stonecutters Ridge Golf Club and a new residential development.

2.4 Current Site Condition

The Validation Report indicated that the site was a construction site for residential development in December 2020 and provided the following description:

- Construction of residential houses had commenced, and filling of the site (reportedly with VENM) was being undertaken.
- Drains were being constructed along the roads.
- Temporary drainage channels were constructed, and they drained into a temporary sediment basin (adjacent to Eastern Creek) in the western portion of the Nirimba Fields.

Site photographs from December 2020 are provided in Appendix 3 of the Validation Report and they confirmed the site had been cleared. The site surface appeared to be topographically flat and covered by fill soil. There was no surface water body present at the PFAS MEA.

As indicated in **Appendix D**, there are seven low-density residential houses already constructed on the MEA.

The description of the site presented in the Validation Report was generally consistent with the auditor's observation from the site visit conducted on 26 April 2021.

2.5 Proposed Development

As shown in Attachment 1, 12 and 13 (**Appendix A**), the former Schofields Aerodrome is being developed into a new residential estate called Nirimba Fields. The development master plan for the Nirimba Fields comprised residential lots, a primary school, playing fields, netball courts, parks and commercial/retail facilities.

The PFAS MEA is currently being constructed into low density residential properties (in the eastern half), a primary school and playing fields (in the western portion) and a new access road (orientated roughly north-south in the middle) as part of the overall development of the Nirimba Fields housing estate.

For the purposes of this audit, the following land use scenario has been assumed as 'low density residential with accessible soil' land use scenario.



2.6 Site History

The high-level site history of the former aerodrome was summarised in the Validation Report as follows:

- Pre-1851 – Greenfield site.
- 1851 to 1942 – Agricultural land (dairy and orchards).
- 1942 to 1975 – Training base and airfield by Royal Australian Air Force (RAAF) and Royal Australian Navy (RAN). The site included runways, repair stores, sleeping huts, offices, sewerage treatment plant, machine gun test butt and a fire training area. Aqueous film forming foam (AFFF) were used for firefighting purpose at the former fire training area (FFTA). A separate section of the former aerodrome was used as a migrant hostel. A piggery and a sports field and weapons electrical engineering school were present from 1952 to 1975.
- 1975 to 1993 – Former aerodrome was used by Schofields Flying Club where light planes were housed and maintained.
- 1986 – The piggery was demolished and an airship (blimp) hangar was constructed.
- 1993 to 2017 – Vacant and miscellaneous use (such as go-cart track, driver training, film set, training facility for Sydney 2000 Olympics). Demolition of some structures. The northern part of the former aerodrome was used as a staging area for the Blacktown-Richmond rail line duplication.
- 2018 to current – Land clearing to facilitate construction of new residential estate Nirimba Fields which included “significant land raising earthworks” to mitigate flooding risk from Eastern Creek. The PFAS MEA was understood to be constructed between May 2018 and December 2020.

As indicated in Attachment 2 (**Appendix A**), the PFAS MEA was formerly part of a runway and grassed areas adjacent to the runway.

In the auditor’s opinion, the site history review conducted provides an adequate indication of past activities. In relation to PFAS contamination, previous site use does not suggest the presence of PFAS contamination sources within the audit site.



3.0 Summary of Previous Audit and Environmental Investigations

The table below provides a summary of the audit and environmental investigations conducted to date that are relevant to the PFAS MEA.

Table 3.1: Summary of audit and assessment events

Date	Description	Reference
2005	Section A Site Audit Report for the entire former Schofields Aerodrome was completed by [REDACTED] (ref: Site Audit Report, Lot 4 DP853847 Part of Schofields Aerodrome and Site Audit Statement [SAS] GN 6-1 dated 16 May 2005. The SAS stated that the former aerodrome (including PFAS MEA) was suitable for sensitive use including <i>“residential with accessible soil, including garden...excluding poultry”</i> and <i>“day care centre, preschool, primary school”</i>.	Environ 2005 (as referenced in JBS 2012 and Environ 2013)
2012	JBS conducted due diligence assessment to identify risk of unexpected finds and residual contamination as a burial pit containing asbestos, stockpiles, hazardous building material and minor unexploded ordnance were identified. This investigation focused on previous locations of buildings and infrastructure, underground structures, areas covered by bitumen and stockpiles. No sampling and laboratory analysis of soil, sediment or groundwater was conducted. This assessment concluded that generally, the former aerodrome is suitable for the proposed redevelopment for mixed uses however, recommended further remediation works to be conducted where residual contamination was identified. It was also recommended that a construction environmental management plan (CEMP) be developed.	JBS 2012.
2013	Section A Site Audit Report for the entire former Schofields Aerodrome was completed by [REDACTED] (ref: Site Audit Report – Part of Former Schofields Aerodrome, Lot 400 in DP1171596 and Site Audit Statement [SAS] GN481 dated 25 September 2013. This 2013 audit was conducted to incorporate results of investigation and remediation conducted and the changes in guidelines and legislation since 2005. An environmental management plan (EMP) was prepared to identify and manage unexpected finds. No significant contamination was found in groundwater and the audit recommended that if groundwater was abstracted, its suitability for use be assessed. The audit also indicated that the major sources of contamination have been removed from the former aerodrome. The SAS stated that the former aerodrome was suitable for sensitive use including <i>“residential with accessible soil, including garden...excluding poultry”</i> and <i>“day care centre, preschool, primary school”</i>.	Environ 2013
May to October 2017	A targeted PFAS environmental assessment was conducted at the former fire training area (FFTA) because Aqueous Film Forming Foam (AFFF) was used. This included soil, sediment and shallow groundwater testing within and around the FFTA. Groundwater monitoring events (GME) were conducted in May, June and August 2017. Isolated PFAS impacts in top-soil, sediment and shallow groundwater were found in the close vicinity of the FFTA (refer to Section 6.0). The PFAS soil impacts were delineated with two areas highlighted (Refer to Attachment 1 and 2, Appendix A): • Soil within FFTA (approximately 1.14 hectare) that are not suitable for re-used due to contamination. This material was placed in PFAS MEA. • Shallow surface soil within the No Scrape Area (approximately 4.4 hectare) which were placed in PFAS MEA as they are not suitable for reuse as topsoil.	Ramboll 2017; Attachment 3 and 4 (Appendix A)
May 2018	Additional PFAS leachate analysis was conducted on the PFAS-contaminated top-soil within the No Scrape Area for the purpose of assessing whether the material can be excavated, mixed with geotechnically suitable VENM soil (because of its high organic content) and placed at PFAS MEA. Toxicity characteristic leaching procedure (TCLP) was conducted on soil PFAS.	Ramboll 2018



Date	Description	Reference
May 2018 to December 2020	Excavation of material from FFTA and No Scrape Area and placement of material into PFAS MEA. Limited information is provided the Validation Report about the 'construction' of PFAS MEA. Ramboll indicated that they were not aware of a remedial action plan [RAP] prepared to implement the recommendations discussed in their 2018 report.	Ramboll 2021
December 2020	Validation works conducted of PFAS MEA on 9 and 10 December 2020. This included advancement of 14 soil bores (via push tubes drilling method) within PFAS MEA and collection and analysis of soil validation samples for PFAS compounds. The sampling was conducted in the: • VENM layer above the PFAS material placement layer. • the PFAS material placement layer. • VENM layer or natural soil below the PFAS material placement layer. Australian Standard Leaching Procedure (ALSP) was undertaken on 14 soil samples, of which two samples were also submitted for TCLP analysis. No groundwater monitoring was conducted as part of the validation activity. The purpose of the Validation Report is stated to be <i>"to assess whether the PFAS MEA is suitable for future residential land use with respect to the PFAS material placement layer and is adequately protective of the environment following placement of PFAS impacted material at depth"</i>. The Validation Report conducted a screening assessment of potential risks associated with the PFAS MEA (provided as Appendix 8 of the Validation Report) and concluded that <i>"the PFAS MEA is considered suitable for future low-density residential with garden and accessible soil with respect to the PFAS material placement layer"</i>.	Ramboll 2021; Attachment 5 and 6 (Appendix A)



4.0 Evaluation of Quality Assurance and Quality Control

The auditor has assessed the overall quality of the data by review of the information presented in the referenced reports, supplemented by field observations. The data sources are summarised in **Table 4.1**.

Table 4.1: Summary of Investigations

Investigations	Field Investigations	Analytical Data Obtained
Targeted Phase 2 PFAS Site Investigation at the FFTA and No Scrape Area - Ramboll (2017)	Soil and groundwater [#]	PFAS
PFAS Leachate Analysis of samples from the FFTA and No Scrape Area - Ramboll (2018)	Leachate	PFAS
PFAS Validation Report for the PFAS MEA - Ramboll (2021)	Soil and leachate	PFAS

[#] Even though sediment sampling was also including in the field program, the sediment results are not relevant to PFAS MEA and therefore, they are not discussed or assessed.

The auditor's assessment specific to PFAS data from the PFAS MEA, FFTA and No Scrape Area (where relevant) follows in Table 4.2 and Table 4.3.

Table 4.2: QA/QC – Sampling and Analysis Methodology Assessment

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
Data Quality Objectives (DQO) Ramboll (2017) defined specific DQOs in accordance with the seven steps process outlined in NSW EPA (2017) Guidelines for the NSW Site Auditor Scheme. Ramboll (2021) defined DQOs in accordance with US EPA, which was endorsed in Section 5 of Australian Standard guideline AS4482.1-2005.	The DQOs presented in the Ramboll (2017) and Ramboll (2021) reports are considered appropriate for the investigations undertaken at the respective FFTA and PFAS MEA sites.
Sampling pattern, locations, and sampling density <u>PFAS MEA</u> Soil: A reduced sampling density of 14 sample locations (instead of 28 sample locations for an approximate area of 1.81 ha, recommended by EPA 1995) was developed with respect to the objectives of the targeted validation works. Ramboll (2021) indicated that the sampling density was reduced because: • Low potential for soil disturbance at depths greater than 3 m. • The extent and dimension of PFAS MEA (provided in Appendix 5 of Validation Report) was already known. <u>FFTA and No Scrape Area</u> Soil: Approximately 35 soil samples were analysed from 32 locations. Samples were collected from shallow and deeper test pits, grab surface samples from 11 step-out locations around the FFTA. The sample locations were designed to target potential pathways and effectively map the distribution of PFAS associated contamination with on-site historical FFTA activities (Ramboll, 2017). Groundwater: A total of 11 monitoring bores were installed around the vicinity of the FFTA. The majority of the bores were targeted to the west of the site, in the assumed down-gradient positions of the FFTA, with the exception of one bore in the FFTA.	These investigation locations adequately target the various strata of the PFAS mixed material, in line with the objectives of the validation works at PFAS MEA. The auditor notes that the PFAS placement layer was blended (i.e. homogenous) material from the FFTA that had also been characterised.



Sampling and Analysis Plan and Sampling Methodology

Auditor's Opinion

Sample depths

PFAS MEA

Soil: Samples were collected based on the anticipated depth of the PFAS material placement layer and when a change in strata was evident – from the VENM fill material immediately above the PFAS placement layer, from within the PFAS placement layer, from the fill material immediately below the PFAS placement layer and from underlying natural material.

FFTA and No Scrape Area

Soil: Samples were collected from within the shallow fill (0-0.2m) of the 12 test pits, step-out locations (grab surface) around the FFTA, were analysed to assess and delineate contamination (presence of PFAS) related to the FFTA.

Groundwater: Monitoring bores were installed to depths ranging between 3.3 and 5 mbgl to assess shallow groundwater conditions at and in the vicinity of the FFTA. In the groundwater sampling events (May, June and August 2020), low flow (peristaltic pump) sampling method was used to sample groundwater from the bottom of the monitoring bore screened interval.

The soil sampling strategy was appropriate and adequate to characterise the PFAS placement layer, as part of the validation works.

Similarly, the overall sampling strategy was appropriate and adequate to characterise the various media on the FFTA and No Scrape Area.

Well construction

Acceptable.

FFTA and No Scrape Area

The 11 monitoring bores were installed to depths of 3.3 to 5 mbgl, with screen intervals of 2.5 to 3 m placed in graded filter sand. Bores were constructed of 50 mm diameter unplasticized polyvinyl chloride pipe with 0.5 mm slotted screen fitted with an end cap. A bentonite seal of approximately 0.5 m thickness was placed above the screen and the well backfilled with drilled spoil to the ground surface.

Sample collection method

Acceptable.

PFAS MEA

Soil: Sample collection was by hand from push tube sleeve of the soil boreholes advanced using a drill rig. All push tube sleeves were disposable.

FFTA and No Scrape Area

Soil: Collection of surface soil grab samples were by hand from the decontaminated trowel, and test pit samples by hand either directly from freshly excavated soil or from the middle of the excavator bucket to reduce the potential for cross contamination from the excavation bucket.

Groundwater: The monitoring bores were installed by solid flight augers. The wells were developed using either a pump or disposable bailer to ensure a good interface across the slotted screen section with the groundwater bearing strata, and to ensure removal of introduced drilling water (where relevant) after the installation of the wells. The wells were left for a minimum of one week to stabilise prior to sampling (Ramboll, 2017). Samples were collected with low flow peristaltic pump with new silicon tubing for each well.

Decontamination procedures

Acceptable.

Ramboll indicated that sampling equipment (including interface meter and water quality meter) was decontaminated by rinsing with a dilute solution of Alconox® (PFAS-free detergent) followed by rinsing with deionised water (PFAS-free water) provided by the laboratory. Drilling equipment was generally decontaminated with fresh water between locations. Dedicated disposable nitrile gloves were reportedly used for each new sample.



Sampling and Analysis Plan and Sampling Methodology

Auditor's Opinion

Sample handling and containers

Soil and groundwater samples (for PFAS analysis) were placed in laboratory-supplied plastic jars and bottles (comprised of polypropylene or high-density polyethylene, HDPE). Samples were chilled in non-chemical-based ice which had been double-bagged (polyethylene plastic) and secured to avoid meltwater from contacting sample containers in the Esky™ during storage and subsequent transport to the laboratory (Ramboll, 2021).

Acceptable.

Chain of Custody (COC)

Completed chain of custody forms were provided in the reports.

Acceptable. A spot check of COC was conducted and the COC was found to be filled-in appropriately.

Detailed description of field screening protocols

Groundwater: Field parameters were measured during well purging and sampling.

Acceptable

Calibration of field equipment

Groundwater: The Ramboll (2017) report stated that calibration certificates of water quality meter equipment was provided, and Appendix 8 of Ramboll (2017) report contained calibration certificates for the water quality meter, oil/water interface meter, multi-parameter water meter, peristaltic pump, and micropurge flow cell dated May, June and August 2017.

The calibration certificates for every equipment used in the monitoring programs were not provided (e.g. interface meter and low flow pump calibration certificates for August 2017 GME were missing) in the Ramboll (2017) report.

While it cannot be verified that all groundwater monitoring equipment was sufficiently calibrated, the auditor notes that the comparable groundwater results were measured in the GMEs and this suggests the absence of systematic data errors associated with field equipment.

Sampling logs

Soil: Borehole logs were provided within the reports (Ramboll 2017 and 2021) indicating sample depth, lithology and contamination (odour and staining, as observed).

Groundwater: Field sampling logs from August 2017 were provided, indicating standing water level (SWL), field parameters, methodology and observations.

No groundwater field sampling log was provided for the May and June 2017 monitoring events in Ramboll (2017) report. However, data from the May and June 2017 GMEs were presented in the result tables. While, this indicated that provision of field documentation could be improved, this omission is not considered to alter the overall conclusions made in the audit.

Table 4.3: QA/QC – Field and Lab Quality Assurance and Quality Control

Field and Lab QA/QC

Auditor's Opinion

Field quality control samples

PFAS MEA

Soil: In the Ramboll (2021) investigation, field duplicates/triplicates were sampled at a rate of approximately one in 20. Rinsate blanks were collected at a frequency of one per day, and field reagent blank and field blank was collected per sample batch.

One (1) intra-laboratory ASLP duplicate was analysed together with the 14 primary ASLP samples. In addition, two duplicate samples were analysed by the TCLP method in addition to the ASLP method to compare leaching results. The ASLP/TCLP duplicate analyses exceeded the duplicate frequency rate of one in 10.

The number of field (blind and split) duplicates collected during the Ramboll (2021) investigation was not in accordance with the PFAS NEMP 2.0. In addition, inter-laboratory ASLP/TCLP duplicates were not collected and analysed.

The 2017 soil and groundwater investigation was conducted prior to the issue of PFAS NEMP 1.0 in January 2018. The collection of field duplicates for the 2017 investigation are considered adequate as compliant with the NEPM requirement of 1 in 20 samples.

The lack of rinsate blanks (2018) was not considered to affect the quality of the data since soil samples were directly placed into PFAS-free laboratory supplied jars using dedicated disposable nitrile gloves for each new sample.

The lack of trip blanks and spikes were which not considered to be an issue as PFAS is not a volatile compound. Given that other QC measures were adopted as part of the investigation and the consistency of the results, the non-compliance was not considered to be significant in the context of the audit overall.



Field and Lab QA/QC

Auditor's Opinion

FFTA and No Scrape Area

Soil: In the Ramboll (2017) investigation, a total of four field duplicates and triplicates were sampled for 26 primary soil samples. One rinsate blank sample was collected.

In the Ramboll (2018) investigation, one duplicate was sampled in four in-situ primary grab samples analysed for TCLP for PFAS compounds.

With the exception of one rinsate blank sample collected and analysed in October 2017, no rinsate and trip blanks were not collected during the 2017 and 2018 investigations. Rinsate blanks were not collected during the 2018 soil investigation because Ramboll did not adopt a decontamination procedure during the soil sampling events

Groundwater: In the Ramboll (2017) investigation, of the 22 groundwater samples collected in May, June and August 2017, a total of 3 duplicate and 2 triplicate samples were submitted for analysis.

A split groundwater duplicate was not collected in the May 2017 GME even though a blind duplicate was collected. No rinsate sample was collected in the May 2017 GME as well.

Three rinsate samples were collected and analysed during the June and August 2017 monitoring events.

Field quality control results

The results of field quality control samples were generally within appropriate limits. The following exceptions are noted:

Soil: In the Ramboll (2017) investigation, RPDs for intra-laboratory soil duplicate sample for PFOS, sum of PFOS, sum of PFHxS and PFOS, and sum of PFAS were outside the acceptable limits (60.7 to 82.5%). The RPDs for inter-laboratory soil duplicate samples for PFOS ranged between 112 and 132%

In the Ramboll (2021) investigation, RPDs for inter-laboratory soil duplicate samples for PFOS, and sum of PFOS and PFHxS were 118% and 113%, respectively. Ramboll indicated that that exceedances in soil are likely due to the heterogeneous nature of the fill materials in the mixed PFAS material layer. RPDs were calculated between the intra-laboratory duplicate samples by the ASLP and TCLP methods to compare leaching results, and reported minor exceedances (between 60.7% and 75%) for PFOS, and sum of PFOS and PFHxS.

The soil rinsate samples analysed reported concentrations below the LOR for all analytes.

Groundwater: In the Ramboll (2017) investigation, RPDs for inter-laboratory groundwater duplicate samples for PFHxS and PFHpA were 75% and 91%, respectively. Ramboll indicated that the minor RPD exceedances were likely attributed to sample heterogeneity. The primary sample indicated the highest PFHxS concentration and the inter-laboratory duplicate sample indicated the highest PFHpA concentration (however no site criteria existed for PFHpA). None of the duplicate samples are from monitoring bores located at or near the PFAS MEA.

The groundwater rinsate samples analysed reported concentrations below the LOR for all analytes.

Overall, in the context of the dataset reported, the elevated RPD results are not considered significant and the field quality control results are acceptable.

NATA registered laboratory and NATA endorsed methods

Laboratories used included: ALS Environmental, Eurofins MGT and EnviroLab

Laboratory certificates were NATA stamped.

Acceptable.

Analytical methods

Analytical methods were included in the laboratory test certificates. Both EnviroLab and ALS Environmental provided brief method summaries of in-house NATA accredited methods used based on United States Environmental Protection Agency (USEPA) for extraction and analysis in accordance with the NEMP 2.0.

Acceptable



Field and Lab QA/QC

Auditor's Opinion

Holding times

Acceptable

Review of the COCs and laboratory certificates indicate that the holding times had been met. Ramboll also reported that holding times have been met.

Practical Quantitation Limits (PQLs)

Soil:

Soil: PQLs were less than the threshold criteria for the contaminants of concern.

Overall, the PQLs are considered to be acceptable.

Groundwater: PQLs were less than the threshold criteria for the contaminants of concern with the following exception:

Groundwater:

Perfluorooctane sulfonate (PFOS) PQL ranged between 0.0003 to 0.01 µg/L (Ramboll, 2017) was above the NEMP 2.0 99% species protection guideline value of 0.00023 µg/L.

The PQLs do not materially affect the outcome of the audit.

Ultra trace analysis was not conducted for PFOS to obtain the lower PQL for PFOS, and the higher laboratory's PQL was adopted as a screening level in accordance with guidance from the NEMP 2.0.

Laboratory quality control samples

Acceptable.

Laboratory quality control samples including laboratory control samples, matrix spikes, surrogate spikes, blanks, internal standards and duplicates were undertaken by the laboratory at appropriate frequencies except for ES1716939 - matrix spike frequency for PFAS by liquid chromatography - mass spectrometry (LC/MS/MS) was below the NEPM (2013) Schedule B3 and ALS QC Standard (Ramboll, 2017).

Laboratory quality control results

The results of laboratory quality control samples were generally within appropriate limits, with the following exceptions: (Ramboll, 2017)

In the context of dataset reported, the number of samples collected and the relative consistency of results between sampling events, the non-conformances are not considered significant and the laboratory quality control results are acceptable.

Soil

- In three batches of samples, matrix spike (MS) recoveries for selected PFAS compounds could not be determined as the background level was greater than or equal to 4x spike level.
- Holding time for sample SS105 was 12 days overdue (with no reason was provided for this).
- In one batch of samples, surrogate recoveries were less than lower data quality objective.

Groundwater

- In one batch of samples, MS recoveries for PFHxS and PFOS could not be determined as the background level was greater than or equal to 4x spike level.

Data Quality Indicators (DQI) and Data Evaluation (completeness, comparability, representativeness, precision, accuracy)

Predetermined DQIs were set in the Douglas Partners report for laboratory analyses including field blanks, field duplicates, internal laboratory QC samples, COC documentation and laboratory NATA accreditation. These were discussed with regard to the five category areas. There was limited discussion regarding actions required if data do not meet the expected objectives.

An assessment of the data quality with respect to the five category areas has been undertaken by the auditor and is summarised below.



In considering the data as a whole, the auditor concludes that:

- While the number of field quality control samples collected was not in full compliance with guidelines and omissions in documentation were identified, the results were generally consistent indicating the data is likely to be representative of the overall conditions on the audit site.
- Data is likely to be reasonably comparable for each sampling and analytical event, noting that different sampling methodology and laboratories were adopted.
- Primary and secondary laboratories provided sufficient information to conclude that the dataset was generally precise. Ramboll adopted the higher of the duplicate results in their assessment and interpretation of contamination.
- Samples were collected using suitable procedures, and field and laboratory blank / spike samples were all considered acceptable. The data is considered accurate and was relied upon for this audit.



5.0 Environmental Quality Objective

The overall environmental objective of the PFAS MEA is to place the PFAS-impacted soil at a depth such that the PFAS contamination did not pose an unacceptable risk to human health and ecosystem.

This is achieved by assessing the PFAS MEA contamination status and/or configuration to understand the risk posed to relevant receptors and protected environmental value of soil, groundwater and surface water. This includes evaluation against:

- Environmental quality criteria protecting human health and ecosystem (refer to **Section 5.1**).
- The separation distance, vertically and laterally, between the contamination to human receptors (e.g. residents living above the PFAS MEA) and ecological receptors (e.g. surface water and groundwater beneath and down-gradient of the PFAS MEA).
- Leachability potential for PFAS contamination to migrate from the soil into the water table after placement.

The Validation Report also presented its own validation requirements of the PFAS MEA and this is discussed in **Section 7.2** below.

5.1 Environmental Quality Criteria

The auditor has assessed the PFAS MEA contamination status against the following guideline (endorsed by EPA):

- PFAS National Environmental Management Plan Version 2 [PFAS NEMP 2.0 or NEMP] (HEPA 2020).

Based on the proposed development the criteria for 'residential with garden/accessible soil' was referred to as it is the most sensitive land use proposed at the PFAS MEA. The environmental quality criteria adopted in this audit are:

- Human health guideline values:
 - Drinking water quality and recreational water quality guideline value (Table 1 of NEMP for groundwater and surface water).
 - Residential with garden/assessable soil health investigation level (HIL) A (Table 2 of NEMP for soil).
- Ecological Assessment:
 - 99% freshwater species protection (Table 5 of NEMP for groundwater and surface water). The auditor adopted the conservative approach and considered Eastern Creek to be a slightly to moderately disturbed ecosystem. Therefore, in line with guidance from Australian and New Zealand Guidelines for Fresh and Marine Water Quality framework and Section 8.6.3 of PFAS NEMP, due to bioaccumulation and biomagnification nature of PFAS, the next higher level of protection was adopted (i.e. 99% instead of 95%). As indicated in Table 5 of NEMP, for this audit, the laboratory detection limit for PFOS can be adopted 'as default' as the guideline value for 99% species protection is generally below the limit of reporting (LOR).



Furthermore, the auditor notes that the NEPM 99% value is likely to be conservative and consideration was also given to an updated 0.05 µg/L PFOS for 99% species protection level derived by Batley et. al. (2018) ² in this audit, however, it must be noted that this ecological protection value is in draft and has not been endorsed by EPA.

- Ecological direct exposure and ecological indirect exposure for all land uses (Table 3 of NEMP for soil).

The environmental quality criteria referenced by the Auditor are consistent with the Validation Acceptance Criteria (VAC) adopted by assessment consultant, with the exception of the following:

- Ecological criteria for Eastern Creek. Ramboll (2021) adopted 95% level of species protection (instead of 99% level of species protection) for screening soil leachate results for PFOS and PFOA. Ramboll considered this to be “*conservative as aquatic receptors are not expected to be directly exposed to the leachate*” (page 20). However, this is not considered to materially affect the audit, as the Tier 2 assessment of aquatic risks conducted by Ramboll considered both 95% and 99% species protection guideline levels.

² Batley, G.E., van Dam, R.A., Broadgate, K.E., et al, *Application of revised methodologies for default guideline value derivations: PFOS in freshwater*, Presented at SETAC North America 39th Annual Meeting. Abstract book available from: <https://www.setac.org/store/ViewProduct.aspx?id=13373145>



6.0 PFAS Material Emplacement Area

6.1 Overview

The PFAS MEA covers an area of 1.81 ha, irregularly shaped as it is wider in the south compared to the north. It was generally constructed with three horizons comprising:

- Overlying VENM soil.
- PFAS material placement layer (PFAS placement layer).
- Underlying VENM soil. As indicated in Appendix 5 of the Validation Report, this horizon was not always present as there were areas where PFAS placement layer was placed directly above the natural soil (stripped surface).

The Validation Report stated that a Remediation Action Plan (RAP) was not prepared for the construction of the PFAS MEA and no design drawing or specification was provided. The PFAS MEA was constructed as part of the overall site development which raised the surface from a natural soil base. The PFAS MEA is not lined or capped with any engineered liner or barrier.

Ramboll presented multiple lines of evidence to define and demonstrate the environmental aspect of the PFAS MEA and this is outlined in **Table 6.1** below. They also validated the PFAS MEA against the NEMP material reuse requirements and their recommendations from 2018 (refer to **Section 6.8**).

Table 6.1: PFAS MEA – Verification Works of Key Elements

Element	Multiple Lines Evidence	Key Outcome and Comments
Thickness of the VENM layer overlying the PFAS placement layer	Survey data (refer to Section 6.2)	Average VENM thickness: 3.3 m.
	Stratigraphic information from the validation soil boreholes (refer to Section 6.3).	VENM thickness range: 3.1 m (at BH03 and BH09) to 3.6 m (at BH08).
	Ramboll state that additional material such as topsoil, gravel road base, leveling sand, concrete and/or turf are likely to have been placed above the site surface as part of the construction of the buildings and structures, adding to the thickness of the overlying material above the PFAS placement layer.	The auditor considers this to be consistent with the environmental quality criteria and the thickness of the VENM across the MEA is likely to be similar to the thickness observed at the validation boreholes.
	Ramboll indicate that where less than 3 m of VENM was identified, these areas were filled with additional VENM to reach the 3 m depth. The areas (including PFAS MEA) within the former aerodrome with VENM fill greater than 3 m are shown in Attachment 9 and 10 (Appendix A). The cut and fill data presented in Attachment 9 and 10 are based on data provided by Craig and Rhodes (who is managing the construction at the Nirimba Field development).	Anecdotally, thickness is likely to be thicker than indicated by the survey and the borehole data.



Element	Multiple Lines Evidence	Key Outcome and Comments
Nature of PFAS impacted soil	<u>Encapsulated material</u> Soil and leachate results from material originated from FFTA and No Scrape Area (refer to Section 6.4).	<u>PFAS placement layer</u> Average PFAS placement layer thickness: 0.4 m. PFAS placement layer thickness range: 0.1 m (at BH02) to 0.7 m (at BH05). PFAS concentrations (from the validation boreholes) exceeding the ecological and human health guideline values were measured (refer to Section 6.5). The results are consistent with the PFAS contamination identified during FFTA assessment (refer to Section 6.4).
	<u>Validation Boreholes</u> Soil results (refer to Section 6.5.1). Leachate results (refer to Section 6.5.2).	As the validation criteria were not met, further work including risk screening assessment was undertaken as part of the Validation Report (refer to Section 7.0). Overall, the risk to human health and ecological receptors are considered by the auditor to be low and acceptable (refer to Section 7.3).
Depth to groundwater from base of PFAS impacted soil	Survey data (refer to Section 6.2)	Average separation distance between groundwater and base of PFAS placement layer: 1.9 m.
	Stratigraphic information from the validation soil boreholes (refer to Section 6.3).	Range of separation distance between groundwater and base of PFAS placement layer: 1.5 m (at BH11) to 2.4 m (at BH09).
	Groundwater levels (refer to Section 6.6).	The base of the PFAS placement layer was concluded to be less than 2 m above the seasonal maximum groundwater level on average. As the validation criterion was not met, further work including a PFAS in groundwater fate and transport review was undertaken as part of the Validation Report (refer to Section 8.0). Overall, the auditor considers that the potential for PFAS contamination at the MEA to migrate to Eastern Creek is low (refer to Section 8.1).
Nature of Groundwater	Groundwater analytical results (refer to Section 6.7)	PFAS groundwater concentrations exceeding the ecological and human health guideline values were not measured at monitoring bores located within the PFAS MEA. Groundwater impact was only measured at BH107 (located outside of PFAS MEA). PFAS in groundwater fate and transport review was undertaken as part of the Validation Report (refer to Section 8.0). Overall, the auditor considers that the potential for PFAS contamination at the MEA to migrate to Eastern Creek is low (refer to Section 8.1).



6.2 Survey Data

The Validation Report indicated that the site surface (i.e. elevation of the overlying VENM horizon above the PFAS placement layer) was surveyed at least three times:

- November 2020 – initial survey before and after the deposition of PFAS placement layer. As indicated by Ramboll, the November 2020 survey information of the PFAS placement layer was used as a reference to assist Ramboll with their field sampling methodology. This is provided as Appendix 5 of the Validation Report.
- 16 Dec 2020 – a survey was conducted to establish the site surface level at the time of soil validation field works. Following this, additional VENM was deposited at the site above the PFAS placement layer.
- 12 February 2021 – a final survey was conducted after all VENM importation and compaction was completed. This is provided as Appendix 9 of the Validation Report, which is presented as Attachment 11 (**Appendix A**).

The auditor notes that there are no as-built cross-sections (showing the final elevations of various PFAS MEA horizons and subsurface features) provided in the Validation Report.

Overall, the auditor considers that the available survey data to be adequate. The lack of final as-built cross-sections meant that there is more reliance on the observations from the 14 validation boreholes.

6.3 Stratigraphy

The sub-surface profile of the PFAS MEA, based on the findings of the validation soil testing conducted at the site in December 2020, is summarised in **Table 6.2**.

Table 6.2: Stratigraphy based on the logs of the validation soil bores

Approximate depth (mbgl) [#]	Subsurface Profile
0.0 to 1.9 - 3.5	FILL (imported overlying VENM): gravelly/sandy clay, orange-brown with shale gravels, cobbles and boulders, moderate plasticity, dry, hard.
1.9 - 3.5 to 2.5 - 3.7	FILL (PFAS placement layer): dark brown silty clay, moderate plasticity, dry, firm, presence of organic matter such as grass and roots with a weak 'swampy' odour.
2.5 - 3.7 to 3.2 - 4.5	FILL (imported underlying VENM) where present: brown gravelly clay, high plasticity, moist with some shale gravels, cobbles and boulders.
3.2 - 4.5 to 5 (maximum depth of assessment)	CLAY (natural soil): orange/brown, moderate to high plasticity, moist with some rootlets.

Note:

- Metres below ground level below site surface surveyed in December 2020. (Later, more VENM was placed at the PFAS MEA to raise the site surface, therefore, the approximate final depths to PFAS placement layer are generally greater than the depths listed in this table. Refer to **Section 6.3**.)

No sign of contamination was visually observed by Ramboll (2021).

Based on the preliminary site survey conducted in November 2020, the VENM fill layer was not present at selected locations (which was not targeted by the subsequent 14 validation locations) between the PFAS placement layer and the underlying natural strip level.

The auditor notes that weathered shale was logged at around 4 m below the natural surface in groundwater monitoring bore BH107, located south-west of the PFAS MEA.



As the overlying VENM was placed across the entire PFAS MEA and levelled to form a new surface for the entire residential development, the overlying VENM between and around the 14 validation soil bores was inferred by Ramboll to be similar thickness (refer to Attachment 8, **Appendix A**). Based on the nature and overall site topography at the residential development, the auditor concurs with Ramboll's conclusion about the thickness of VENM between the validation boreholes.

6.4 Soil and Leachate Analytical Results – Source of PFAS Impacted Layer

6.4.1 Soil

The material encapsulated (i.e. the PFAS placement layer) was surface fill soil (0 to 0.2 mbgl) identified with elevated PFOS and sum of PFOS and PFHxS concentrations from FFTA and No Scrape Area, mixed with imported geotechnically suitable VENM.

The Validation Report stated that a total of 4,600 m³ of material from FFTA and the No Scrape Area was excavated. Post blending, the estimated volume of PFAS impacted soil placed in the PFAS MEA is approximately 9,000 m³. This implies that 4,400 m³ of VENM was used in the blending. This material from FFTA and No Scrape Area was described as sandy silt and gravelly silty clay (Ramboll 2017).

A summary of the soil analytical results from FFTA and No Scrape Area is shown in **Table 6.3** below and Attachment 3 (**Appendix A**).

Table 6.3: Summary of soil analytical results from FFTA and No Scrape Area (mg/kg)

Analyte	No. of samples	No. of detections	Maximum concentration (mg/kg)	No. of samples exceeding NEMP ecological guideline value	No. of samples exceeding NEMP human health investigation level (HIL A)
PFOS	30 ¹	27	0.147	0 (for direct ecological exposure) 5 (for indirect ecological exposure)	—
PFOA	30 ¹	11	0.001	0 (for direct ecological exposure)	0
Sum of PFOS and PFHxS	29 ²	25	0.149	—	6

Notes:

1. 26 primary samples and 4 duplicate samples.
2. 26 primary samples and 3 duplicate samples.

6.4.2 Leachate

Leachability assessment was also conducted (Ramboll 2018) on the PFAS-impacted fill soil to assess the potential for PFAS contamination to migrate into groundwater from the soil medium. They were analysed for Toxicity Characteristics Leachate Procedure (TCLP) analysis (pH of 5) and the results of the leachability test are provided in **Table 6.4** below.

**Table 6.4: Summary of TCLP soil leachability analytical results (µg/L)**

Analyte	No. of detection	Maximum concentration (µg/L)	Exceeding NEMP ecological guideline value	Exceeding NEMP drinking water guideline value	Exceeding NEMP recreational water guideline value
PFOS	5	0.60	GS115 (0.49) [#] QC01 (0.45) [#] GS116 (0.04) GS117 (0.05) GS118 (0.60) [#]	—	—
PFOA	0	<0.01	0	0	0
Sum of PFOS and PFHxS	5	0.62	—	GS115 (0.61) QC01 (0.61) GS116 (0.04) GS117 (0.05) GS118 (0.62)	0

Note:

[#] Exceed both NEMP and Batley *et. al.* (2018) PFOS 99% species protection of 0.5 µg/L.

This indicated that if the leaching occurs, the leachate generated from the PFAS-impacted material poses a potential risk to the environment and human health (if groundwater is extracted for drinking water purposes).

6.5 Soil and Leachate Analytical Results - Validation Boreholes

6.5.1 Soil

Table 6.5 below summarises the analytical soil results from the validation soil bores drilled to intersect the PFAS placement layer.

Table 6.5: Summary of soil validation results from PFAS MEA (mg/kg)

Analyte	No. of samples	No. of detections	Maximum concentration	No. of samples exceed NEMP ecological guideline value	No. of samples exceed NEMP human health investigation level (HIL A)
PFOS	39 ¹	10	0.024	0 (for direct ecological exposure) 10 (for indirect ecological exposure)	—
PFOA	39 ¹	1	0.0002	0 (for direct ecological exposure)	0
Sum of PFOS and PFHxS	39 ¹	10	0.024	—	10

Notes:

1. 35 primary samples and 4 duplicate samples.



All soil concentrations exceeding the NEMP ecological and human health screening levels were from samples of the PFAS placement layer at depth and they were:

- BH02_3.6
- BH04_2.7
- BH05_2.5
- BH07_2.7
- BH08_2.5
- BH09_2.2
- BH14_3.4

Their locations are indicated in Attachment 5 (**Appendix A**). Further risk assessment was conducted to evaluate the elevated soil PFAS results and this is discussed in **Section 8.0**. It must be noted that PFAS compounds are not volatile and do not pose an inhalation risk to human health.

All results from VENM samples and natural soil samples above or below the PFAS placement layer were either below the adopted criteria or laboratory limit of reporting. This indicated that the VENM and natural soil above and below the PFAS placement layer were unlikely to be unacceptable for proposed sensitive (such as residential or primary school) land use at the site.

6.5.2 Leachate

Table 6.6 below summarises the analytical leachate (ASLP and TCLP) analytical results from the validation soil samples collected from the PFAS placement layer.

Table 6.6: Summary of leachate analytical results (µg/L)

Analyte	No. of samples	No. of detections	Maximum concentration	No. of samples exceed NEMP ecological guideline value	No. of samples exceed NEMP drinking water guideline value	No. of samples exceed NEMP recreational water guideline value
PFOS						
(ASLP)	15 ¹	11	0.93	11	—	—
(TCLP)	2 ²	2	0.47	2	—	—
PFOA						
(ASLP)	15 ¹	3	0.02	0	0	0
(TCLP)	2 ²	2	0.02	0	0	0
Sum of PFOS and PFHxS						
(ASLP)	15 ¹	11	0.96	—	10	0
(TCLP)	2 ²	2	0.51	—	2	0

Notes:

1. 14 primary samples and 1 duplicate sample (ASLP).
2. 2 primary samples (TCLP).



Leachate concentrations above the drinking water guideline levels were reported. The auditor notes that, with the availability of reticulated water supply, groundwater and surface water at and near the vicinity of the PFAS MEA is not used for drinking water purposes and therefore, this environmental value is not considered to be realised or relevant for the site. It must be noted that PFAS compounds are not volatile and do not pose an inhalation risk to human health.

As shown in Attachment 6 (**Appendix A**), the leachate concentrations indicated that there may potentially be an unacceptable risk to ecological receptors if the leachate migrates to the aquifer or surface water body. Further discussion on the assessment of risk to aquatic receptor, namely Eastern Creek, is presented in **Section 8.0** below.

6.6 Groundwater Levels

The Validation Report indicated that the depth to groundwater in the vicinity of the PFAS MEA was 1.6 to 2.2 mBTC measured during the most recent August 2017 monitoring event. This is generally consistent with groundwater depth of 'typically' less than 2 mbgl previously reported in the Environ (2013) audit report. As the final surface at PFAS MEA was raised, the actual depth to groundwater would be higher.

There were two groundwater monitoring bores (BH110 and BH111) within PFAS MEA and one bore (BH107) in the vicinity of the PFAS MEA (refer to Attachment 7, **Appendix A**). BH107 was installed in June 2017, while BH110 and BH111 were installed in August 2017 (Ramboll 2017). The groundwater gauging data from the three bores are tabulated in **Table 6.7**.

Table 6.7: Groundwater elevations from June and August 2017

Gauging Date	BH107 (mAHD)	BH110 (mAHD)	BH111 (mAHD)	Average (mAHD)
21 June 2017	19.10	Yet to be installed	Yet to be installed	Not applicable
10 August 2017	18.84	17.63	18.08	18.18

Based on the measured levels, the inferred groundwater flow direction is to the west towards Eastern Creek beneath the PFAS MEA. BH107 was located up-hydraulic gradient of PFAS MEA and BH110 and BH111 were inferred to assess the groundwater migrating off-site from the PFAS MEA.

Ramboll acknowledged that higher rainfall was measured in June 2017 (monthly total of 133 mm compared to monthly total of 20 mm in August 2017) which resulted in groundwater levels rising by approximately 0.2 m; but they adopted the groundwater levels measured during August 2017 to validate the PFAS MEA because it was the only available data for BH110 and BH111. The auditor notes the higher standing water level from June 2017 for BH107 was not considered in the development of the groundwater contours presented in Attachment 7, **Appendix A** (i.e. the most conservative approach was not adopted) and therefore, the water table in the south-eastern section of PFAS MEA could be even higher (i.e. shorter separation distance between water table and PFAS placement layer).

The Validation Report concluded that the base of the PFAS placement layer was inferred to be less than 2 m above the seasonal maximum groundwater level on average. Refer to **Section 9.0** for further discussion.

A review of NSW registered bore database was conducted by Ramboll on 5 March 2021 and they did not identify any registered groundwater bores within a 1.5 km radius of the former aerodrome (refer to Appendix 13 of the Validation Report). Environ (2013) audit report indicated that there were three registered bores located within a 5 km radius of the Nirimba Fields. There is no groundwater abstraction bore located in the vicinity or down-gradient of PFAS MEA between PFAS MEA and Eastern Creek.



6.7 Analytical Results - Groundwater

Groundwater analytical results from BH107, BH110 and BH111 measured during the August 2017 GME are summarised below in **Table 6.8** and Attachment 4 (**Appendix A**).

Table 6.8: Summary of groundwater investigation analytical results (µg/L)

Analyte	No. of Detection	Maximum concentration (µg/L)	Exceeding NEMP ecological guideline value	Exceeding NEMP drinking water guideline value	Exceeding NEMP recreational water guideline value
PFOS	1	0.22	BH107 (0.22) [#]	—	—
PFOA	1	0.013	0	0	0
Sum of PFOS and PFHxS	2	0.79	—	BH107 [^] (0.79)	0

Note:

[#] Exceed both NEMP and Batley *et. al.* (2018) PFOS 99% species protection of 0.05 µg/L.

[^] BH107 is located outside of PFAS MEA (i.e. off-site).

It should be noted that the groundwater sampled from BH110 and BH111, both located within the PFAS MEA, did not report concentrations exceeding the ecological and human health guideline values.

Further discussion on the assessment of risk to groundwater receptors is presented in **Section 8.0**.

BH109, located south-east of FFTA and the No Scrape Area, is considered up-hydraulic gradient from the FFTA and No Scrape Area. The auditor notes that BH109 reported the following concentrations in the August 2017 monitoring event:

- 0.0099 µg/L PFOS, above NEMP 99% species protection ecological guideline value.
- 0.166 µg/L Sum PFHxS and PFOS, above the NEMP drinking water guideline value.

6.8 Validation Requirements

Given that a RAP was not prepared for the PFAS MEA, the validation requirements of PFAS MEA were listed in Section 7 of Validation Report (Ramboll 2021). They are derived from Section 12.2 of NEMP 'Reuse requiring consultation with the environmental auditor' and previous recommendations from Ramboll (2018) assessment. These requirements are listed and discussed below in **Table 6.9**. This audit also considers the validation program in light of the environmental objective of the PFAS MEA discussed in **Section 5.0**

**Table 6.9: Compliance with validation requirement**

Source of Validation Requirement	Validation Requirement adopted in the Validation Report	Validation Met?	Discussions
Section 12.2 of NEMP (Material Reuse Requirements)	Fill or burial less than 2.0 m above the seasonal maximum groundwater level.	No	The bottom of the PFAS placement layer has been inferred on average to be less than 2.0 m above the seasonal groundwater water table. Refer to Section 6.5 for discussion on groundwater separation distances and Section 8.0 for further discussion on potential contaminant migration. Overall, the potential risk for PFAS to migrate from PFAS placement layer to Eastern Creek is considered low and acceptable.
	Reuse within 200 metres of a surface water body or wetland area	Yes	There is no surface water body or wetland area located within 200 m of the PFAS MEA.
	Reuse in (or in the vicinity of and able to be transported to) areas which can be identified with any of the nine matters of national environmental significance protected under the <i>Environment Protection and Biodiversity Conversation Act</i> (EPBC Act), and areas of environmental significance as identified in specific jurisdictions.	Yes	There is no national environmental significance at or in the vicinity of the PFAS MEA.
	Fill, burial or reuse in locations potentially affected by reasonably foreseeable future rises in groundwater or sea level, or near stormwater drains.	No	As part of the housing estate development, concrete stormwater drainage lines are to be constructed at the PFAS MEA. As the drains are new (installed to modern standards), the likelihood of leaks is considered to be low. Furthermore, if there are leakages, the scale and volume of leakage from the stormwater drains should be small and localised. The auditor concurs with this assessment and considers that the potential for additional leaching from PFAS placement layer due to stormwater drains is likely to be low. Refer to Section 6.5 for further discussion on the groundwater levels at the PFAS MEA.
	Reuse on agricultural land.	Yes	There is no agricultural land use at the PFAS MEA.
	Reuse as fill in residential developments	No	As indicated in Attachment 12 (Appendix A), a portion of the PFAS MEA is proposed to be used as residential development and the assessment of risk has been conducted for the subsurface PFAS placement layer. Refer to Section 7.0 for further discussion.



Source of Validation Requirement	Validation Requirement adopted in the Validation Report	Validation Met?	Discussions
	Reuse as fill on public open space/parkland/recreational land	No	As indicated in Attachment 12 (Appendix A), western portion of the PFAS MEA is proposed to be used as recreational land. The assessment of risk associated with the subsurface PFAS placement layer has been conducted for residential land use (which is more sensitive than recreational land use). Refer to Section 7.0 for further discussion.
	Inclusion in compost, fertilisers or soil conditioners.	Yes	PFAS material was not used in compost, fertilisers or soil conditioners at the PFAS MEA.
Recommendations from Ramboll (2018)	Shallow surface soil with the No Scrape Area are to be excavated and mixed with geotechnically more suitable and PFAS impacted soil for placement at depth as follows:		
	The mixed soil when placed remains within the original vicinity of the No Scrape Area.	No	The mixed soil was placed at PFAS MEA which is located approximately 440 m north-east of the No Scrape Area.
	The mixed soil when placed are not within the vicinity of any proposed stormwater drains.	No	Refer to comments above in relation to stormwater drains.
	The mixed soil when placed are at least 1 m above current site level, which equates to approximately 2 m above current groundwater level.	No	The bottom of the PFAS placement layer has been inferred on average to be less than 2.0 m above the seasonal groundwater water table. Refer to Section 6.5 for discussion on groundwater separation distances and Section 8.0 for further discussion on potential contaminant migration.
	At least 3 m of VENM is placed on top of the mixed soil when placed to form the final site surface.	Yes	Based on the final site surface levels and the stratigraphy observed in the validation soil bores, the overall thickness of the VENM overlying the PFAS placement layer was inferred to be at least 3 m. Refer to Section 6.2 and 6.3 and Attachment 9 and 10 (Appendix A).
	The mixed soil be placed at least 750 m away from Eastern Creek.	No	The distance between the PFAS MEA and Eastern Creek is approximately 550 m, which is less than the validation requirement. Refer to Section 8.0 for further discussion on potential contaminant migration. The auditor notes that Section 8 of Ramboll (2018) actually stated greater than 800 m (not 750 m) but overall, this inconsistency does not change the validation outcome.
	Groundwater extraction for any purposes is not permitted within the new development.	Yes	The Validation Report stated that groundwater extraction is not allowed within the new development. The auditor notes that reticulated water supply is readily available in the new residential development.



Source of Validation Requirement	Validation Requirement adopted in the Validation Report	Validation Met?	Discussions
	Between 4 to 6 m of VENM is imported to raise site levels across the new development to infill the existing drainage channels whilst installing a new drainage network within imported VENM discharging directly to Eastern Creek.	—	No information was presented in the Validation Report about this requirement because it is not considered relevant to PFAS MEA as there is no drainage channels within the PFAS MEA. The auditor concurs with this and notes that former drainage channels at the former aerodrome site external to PFAS MEA were documented in Attachment 9 and 10 (Appendix A) to be backfill with VENM greater than 3 m.
	Site redevelopment activities will be undertaken to be protective of construction workers from the observed concentrations of PFAS.	Yes	Construction Environmental Management Plan (CEMP) was reported in the Validation Report to been used to manage site development works. The Validation Report recommended that a CEMP be prepared for the development of school located in the western portion of the PFAS MEA.

6.9 Auditor's Opinion

Overall, the validation of the PFAS MEA was considered to be generally adequate and sufficient. The validation evaluated the location, depth and risk to human and ecological receptor associated with the PFAS MEA for the proposed sensitive land use. Where the validation criteria were not met, further works including a risk screening assessment and PFAS in groundwater fate and transport review were undertaken as part of the Validation Report.



7.0 Assessment of Risk

A screening assessment of the PFAS results from the validation sampling program was presented as Appendix 8 of the Validation Report. This screening assessment reviewed the PFOS concentration reported in the soil and leachate.

7.1 Human Health

The screening assessment indicated that indirect and direct pathways for human exposure do not exist due to the presence of the VENM.

Based on a minimum VENM thickness of 3 m, the auditor concurs that exposure to the PFAS impacted soil will be effectively managed, and that risks to future receptors (including site residents and future intrusive workers) will be low. These conclusions assume the presence of a consistent VENM layer of minimum 3 m thickness across the full MEA. The auditor's assessment of VENM thickness is presented in **Section 6.3**.

As indicated in **Section 6.6**, groundwater beneath the PFAS MEA measured concentrations less than the human health guideline levels indicating that there is no unacceptable risk. Furthermore, with the availability of reticulated water supply at the new residential development, the depth to water table and groundwater is not permitted to be extracted, the exposure pathway for groundwater at PFAS MEA is not considered to be realised.

The risk of residual material being excavated and retained on-site is considered low as:

- The potential for future disturbance during works such as the maintenance or installation of subsurface utility services and swimming pools, is considered low due to the burial of the PFAS impacted soil at depth.
- Where future works deeper than 3 m are proposed, a development consent would be required. The presence of the MEA will be noted on the SAS that will be issued to Council. Council is required to note the presence of the SAS on the Planning Certificate.
- In addition, the Validation Report states that Blacktown Council requires that all other excavations deeper than 0.6 m (or deeper than 3 m for complying development i.e. pool) would require development approval.
- Given that the majority of the site has or will be developed into low density residential lots, if there are any disturbance to the PFAS impacted material, it is likely to be localised in nature and not widespread.
- Due to the high organic content of the PFAS-impacted soil, any material excavated would need to be mixed with VENM soil for geotechnical purposes, thus, the extent of PFAS contamination would be reduced due to dilution.
- Where PFAS is inadvertently excavated, then notification to the Council or the EPA is required through the Complying Development process.



7.2 Ecology

7.2.1 Terrestrial

The assessment of terrestrial ecological risk presented in the screening assessment refers to the indirect exposure guideline value for lowered sensitivity sites in the NEMP (140 µg/kg PFOS). Despite reference to this value in the NEMP, the use of the 140 µg/kg criterion is not considered directly relevant to the assessment of pathways to terrestrial ecosystems. The 140 µg/kg criterion was developed by Canadian Council of Ministers of the Environment (CCME) considering a pathway of leaching and migration to off-site surface water (and may not be protective for this pathway, as the acceptable concentration in PFOS freshwater inherent in the derivation is different from the screening values for the protection of aquatic ecosystems in the NEMP). Risks to aquatic receptors are discussed further in **Section 8.2.2** below.

While the adopted 140 µg/kg criterion is of limited relevance to the assessment of risks to terrestrial ecological receptors, the conclusion that risks to terrestrial ecological receptors will be low and acceptable is considered to be supported by the available data. The risk is assessed to be low on the following basis:

- Given the nature of the intended development, and the relatively small extent of the impacted area, it is qualitatively concluded that there is limited habitat potential, and limited potential for higher-order predators to source a significant portion of their diet from the area.
- Furthermore, because the PFAS impacted material is present at depth, exposure to terrestrial ecological receptors will be minimal. The driving pathway behind the indirect guideline value (10 µg/kg) is uptake into soil invertebrates (e.g. earthworms), and subsequent ingestion by small insectivorous mammals. Soil invertebrates will be most common at the surface or in shallow soil; earthworms will have a relatively greater exposure to soil at depth, however, even earthworms have limited exposure to soil below 60 cm depth.
- While deep-rooted trees may have some potential to be exposed to soil at the depth of the PFAS impacted material, the overall concentration to which deep-rooted trees would be lower than the concentrations within the PFAS impacted layer, as uptake would occur across the root zone. As the maximum concentration is only around two times above the indirect guideline value (10 µg/kg), overall exposure concentrations for deep-rooted trees are qualitatively assessed to be below this value. The maximum measured concentrations are also below available CCME screening levels offering protection to plants and herbivores (which may feed on plant material).

7.2.2 Aquatic

The conclusion that risks to aquatic ecological receptors is low and acceptable is supported by the available assessment as follows:

- The estimated groundwater concentrations (at the source) based on leaching and mixing calculations are similar to the presented background concentrations in the area. Given the very long estimated timeframes to reach the creek, and the likely attenuation of concentrations along the flowpath, any additional contribution from the site above background conditions is assessed to be negligible.
- The adopted 99% species protection level is likely to be conservative. The groundwater concentrations are noted to be below the draft updated 99% species protection level presented by Batley et al. (2018)³ (0.05 µg/L). The Batley et al. (2018) values address some key technical issues identified with the initial draft values which are currently listed in the PFAS NEMP; specifically, they account for the observed bimodality in the toxicity data and therefore reduce the extrapolation error in the derived values, particularly for the derived 95% and 99% protection levels.

³ Batley, G.E., van Dam, R.A., Broadgate, K.E., et al, *Application of revised methodologies for default guideline value derivations: PFOS in freshwater*, Presented at SETAC North America 39th Annual Meeting. Abstract book available from: <https://www.setac.org/store/ViewProduct.aspx?id=13373145>



7.3 Auditor's Opinion

Potential risks associated with residual PFAS emplaced at depth have been assessed; the assessment has considered the identified potential receptors associated with the site, which include:

- Human health (including site residents and intrusive workers).
- Terrestrial ecological receptors.
- Aquatic ecological receptors.

The auditor considers that the risks to these receptors associated with residual PFAS emplaced at depth are low and acceptable.



8.0 Contamination Migration Potential

The suitability of reuse of the PFAS impacted soil within the PFAS MEA included assessment of the transport of PFAS to groundwater through leaching from the material and migration to surface water in Eastern Creek. Potential transport pathways via dust and surface erosion were not considered complete on the basis of the cover of over 3 m VENM and did not warrant further assessment.

The consultant assessed PFAS leaching and transport of via the following lines of evidence:

- Sampling and leaching testing of PFOS in soil emplaced in the PFAS MEA. PFOA and PFHxS were not assessed on the basis they were reported at concentrations less than or close to LOR in soil and leachate.
- Fate and transport modelling via calculations of: (a) leaching of PFAS from soil in the MEA via infiltration and groundwater recharge, and subsequent mixing with groundwater underlying the MEA; (b) further attenuation in groundwater migrating from the MEA to the creek within the broader site via dispersion and sorption. These calculations used a range of simplifying assumptions, literature values (infiltration rate of developed site, aquifer porosity and hydraulic conductivity, groundwater mixing zone) and site-specific data (leachable PFAS concentrations, rainfall, geometry of MEA). A sensitivity analysis was undertaken for key parameters and uncertainty in predictions considered based on this.
- Consideration of background PFAS concentrations in groundwater as measured at a monitoring well upgradient of the former source area.

The consultant assessed that (referring also to discussion in **Section 7.0**):

- Risk to human health receptors associated with PFAS migration from PFAS MEA is low and acceptable on the basis that there is not a complete exposure pathway.
- Risk to aquatic ecological receptors associated with PFAS migration from PFAS MEA is low and acceptable. It is noted that estimated groundwater concentrations underlying the MEA (i.e. at the source) based on leaching and mixing calculations are similar or below the presented background concentrations in the area. Further attenuation of PFAS within the site via dispersion and sorption is predicted during transport from the MEA, with very long estimated timeframes estimated to reach the creek.

The consultant stated that guidelines provided in NEMP 2.0 regarding reuse and storage of impacted material will need to be followed to ensure the future stability of the MEA and avoid any preferential flow paths due to subsurface stormwater drainage and service infrastructure during development activities.

8.1 Auditors Opinion

Potential migration of PFAS from the PFAS MEA has been assessed. The assessment demonstrates that PFAS has the potential to mobilise and migrate from the MEA via groundwater towards the creek at very low levels similar to site background concentrations. Under some conservative modelling scenarios, predicted concentrations under the MEA may be slightly higher than site background levels, however, further attenuation of PFAS within the site via dispersion and sorption will occur. Subject to maintaining the integrity of the MEA and overlying VENM, the auditor considers that there is sufficient evidence to support the consultant's conclusion that the migration of PFAS from the MEA represents a low and acceptable level of risk, and that any additional contribution from the site above background conditions is negligible.



9.0 Compliance with Regulatory Guidelines and Directions

The auditor has used guidelines currently approved by the EPA under section 105 of the NSW *Contaminated Land Management Act 1997*. The environmental aspects and items excluded from this audit are discussed in **Section 1.3**.

The investigation was generally conducted in accordance with State Environmental Planning Policy (SEPP) 55 Planning Guidelines and reported in accordance with the EPA (2020) *Consultants Reporting on Contaminated Land*. The checklist included in that document has been referred to. The EPA's Checklist for Site Auditors using the EPA Guidelines for the NSW Site Auditor Scheme 2017 (October 2017) has also been referred to.

9.1 Notification

Ramboll did not indicate in the Validation Report that the remedial works i.e. placement at depth, associated with the PFAS MEA require any consent from regulatory authority. The auditor has not been provided further detail on any associated notification to Council in relation to the retention works undertaken.

Consultation with NSW EPA was conducted as the PFAS placement layer was identified to be less than 2 m above the seasonal maximum groundwater level. The outcome of this is not known.

9.2 Development Approvals

The Development Consents for the various subdivision approvals included the following consent conditions:

'A NSW Environment Protection Authority accredited Site Auditor shall review the validation report and submit to Council a Site Audit Statement. The Site Audit Statement shall verify that the investigation, remediation and validation was carried out in accordance with the aforementioned guidelines and that the site is suitable for proposed use'.

'Prior to the issue of a Subdivision Certificate, an EPA recognised accredited geoscientist is to validate the site as suitable for residential development in accordance with the strict residential use criteria as set out in the National Environment Protection (Assessment of Site Contamination) Measures (NEPM) 1999 as amended 2013'.

The auditor confirms that this Site Audit Report and the associated Site Audit Statement are considered to address these conditions with respect to investigation, remediation and validation undertaken with respect to PFAS contamination.

9.3 Waste Disposal

While waste disposal is excluded from this audit, no waste or surplus material was documented in the Validation Report to be generated or disposed at the audit site.

9.4 VENM and Other Imported Materials

As stated in **Section 1.3**, this site audit does not include the review of VENM or any other material imported to the site, other than the thickness of VENM fill placed over the PFAS placement layer.



9.5 Licenses

The Validation Report did not indicate that licences were required for works associated with the PFAS MEA.



10.0 Conclusions and Recommendations

Ramboll (2021) consider that the:

- *“potential risks to human-health are not present as exposure pathways are not complete”*.
- *“potential direct and indirect exposure risks to terrestrial and aquatic ecological receptors were low and acceptable”*.
- *“the PFAS MEA is... suitable for future low-density residential with garden and accessible soil with respect to the PFAS material placement layer”*.

Based on the information presented in the Validation Report and observations made on-site, the auditor concludes that:

- The nature and extent of the PFAS material emplacement layer has been appropriately determined.
- The risk to human health and the environment posed by the PFAS material emplacement layer is acceptable, given the current configuration of the material emplacement area, for the current and approved uses.

Extraction of groundwater for any purpose with the PFAS MEA was documented in the Validation Report to not be permitted.

The site audit statement will be provided to the council and will be noted on the Planning Certificate.

The auditor concurs with the Validation Report's recommendations that a CEMP is prepared for the development of the portion of the proposed primary school located within PFAS MEA.



11.0 Other Relevant Information

This audit was conducted on the behalf of Defence Housing Australia for the purpose of assessing whether the nature and extent of per-and poly-fluoroalkyl substances (PFAS) contamination has been appropriately determined to assess the suitability and appropriateness of the validation report prepared for the PFAS MEA i.e. a “Site Audit” as defined in Section 4 (definition of a ‘site audit’ (b)(i and v)).

This summary report may not be suitable for other uses. Ramboll Australia Pty Ltd included limitations in their report. The audit must also be subject to those limitations. The auditor has prepared this document in good faith, but is unable to provide certification outside of areas over which the auditor had some control or is reasonably able to check.

In drawing conclusions, the auditor used reasonable care to avoid reliance upon data and information that may be inaccurate, however a degree of uncertainty is inherent in all subsurface investigations and there remains the possibility that variations may occur between sample locations. The audit and this report are limited by and rely upon the scope of the review, and the information provided by the Defence Housing Australia and their consultants and representatives through documents provided to the auditor. The auditor’s conclusions presented in this report are therefore based on the information made available to them and arising from their own observations conducted during the audit. If the auditor is unable to rely on any of those documents, the conclusions of the audit could change.

It is not possible in a Site Audit Report to present all data which could be of interest to all readers of this report. Readers are referred to the referenced reports for further data. Users of this document should satisfy themselves concerning its application to, and where necessary seek expert advice in respect to, their situation.



Appendix A: Attachments

Attachment 1: Site Location and Layout (Current)

Attachment 2: Site Location and Historical Site Layout (2017)

Attachment 3: Previous Soil PFOS and PFHxS + PFOS Criteria Exceedances – FFTA (Ramboll 2017)

Attachment 4: Previous Groundwater PFOS and PFHxS + PFOS Criteria Exceedances – FFTA (Ramboll 2017)

Attachment 5: Soil Validation Exceedances

Attachment 6: Leachate Validation Exceedances

Attachment 7: Inferred Groundwater Elevation (Ramboll 2017)

Attachment 8: Depth at Time of Validation – Final Site Level

Attachment 9: Schofields Overall Cut/Fill Plan and Areas of Interest

Attachment 10: Schofields Fill > 3 m and Areas of Interest

Attachment 11: PFAS Work as Executed Plan, Schofields Aerodrome Development Stage 6E

Attachment 12: Master Plan, Schofields Aerodrome Development

Attachment 13: Akuna Vista Nirimba Fields Master Plan (accessed from <https://akunavista.com.au/>)

Attachment 14 – Survey Plan for PFAS MEA



Legend

- PFAS Material Emplacement Area at depth/Validation Area
- Approximate Former Schofields Aerodrome site boundary
- Approximate location of Remediation Former Fire Fighting Training Area (FFTA)
- 'No Scrape Area' Area not suitable for top soil re-use (moved to placement area)

Figure 1: Site Location and Layout (Current)
PFAS Validation Report - Former Schofields Aerodrome

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Legend

- PFAS Material Emplacement Area at depth/Validation Area
- Approximate Former Schofields Aerodrome site boundary
- Approximate location of Remediation Former Fire Fighting Training Area (FFTA)
- 'No Scrape Area' Area not suitable for top soil re-use (moved to placement area)

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Figure 2: Site location and Historical Site layout (2017)
PFAS Validation Report - Former Schofields Aerodrome

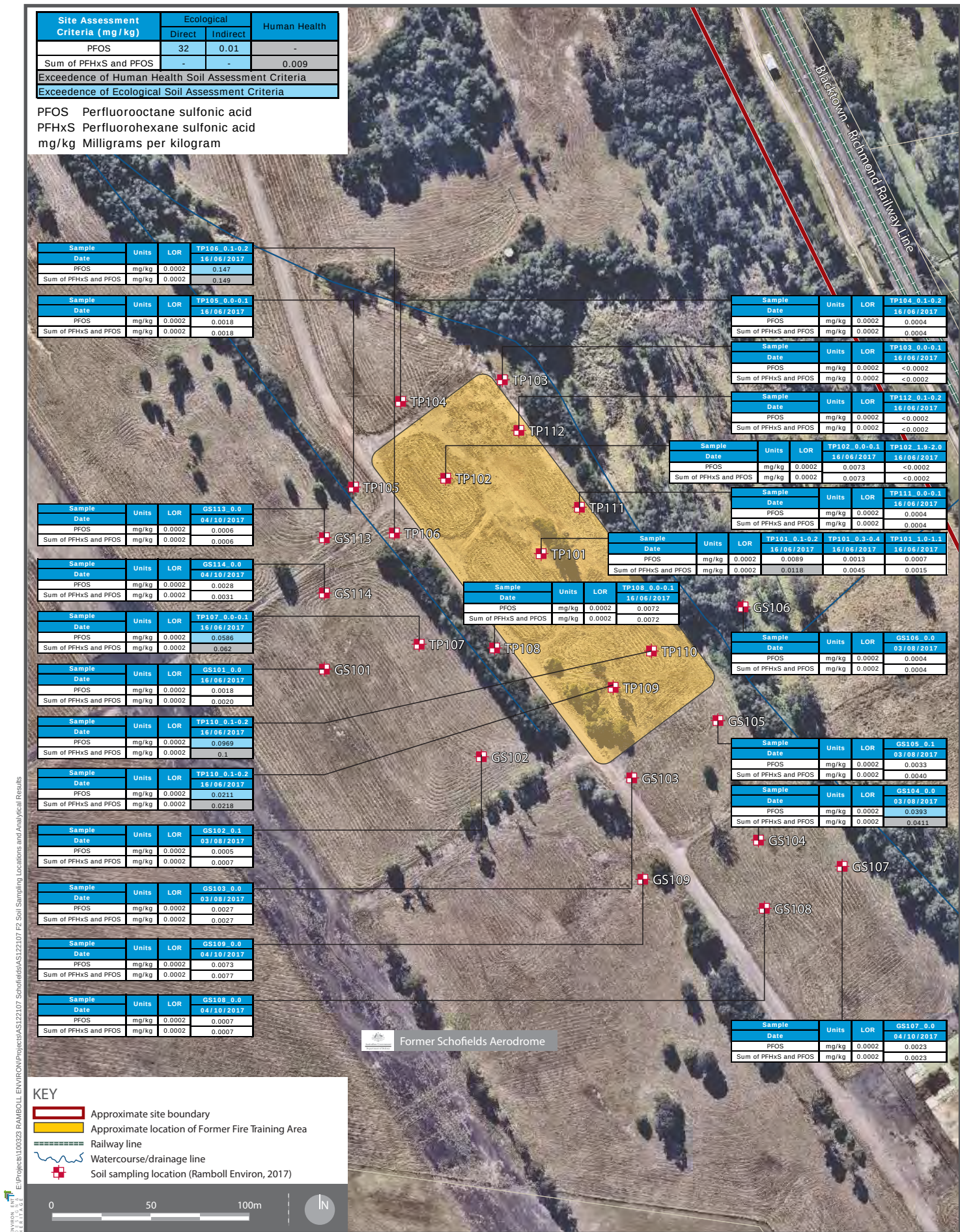


Figure 3: Previous Soil PFOS and PFHxS + PFOS Criteria Exceedances – FFTA (Ramboll 2017)

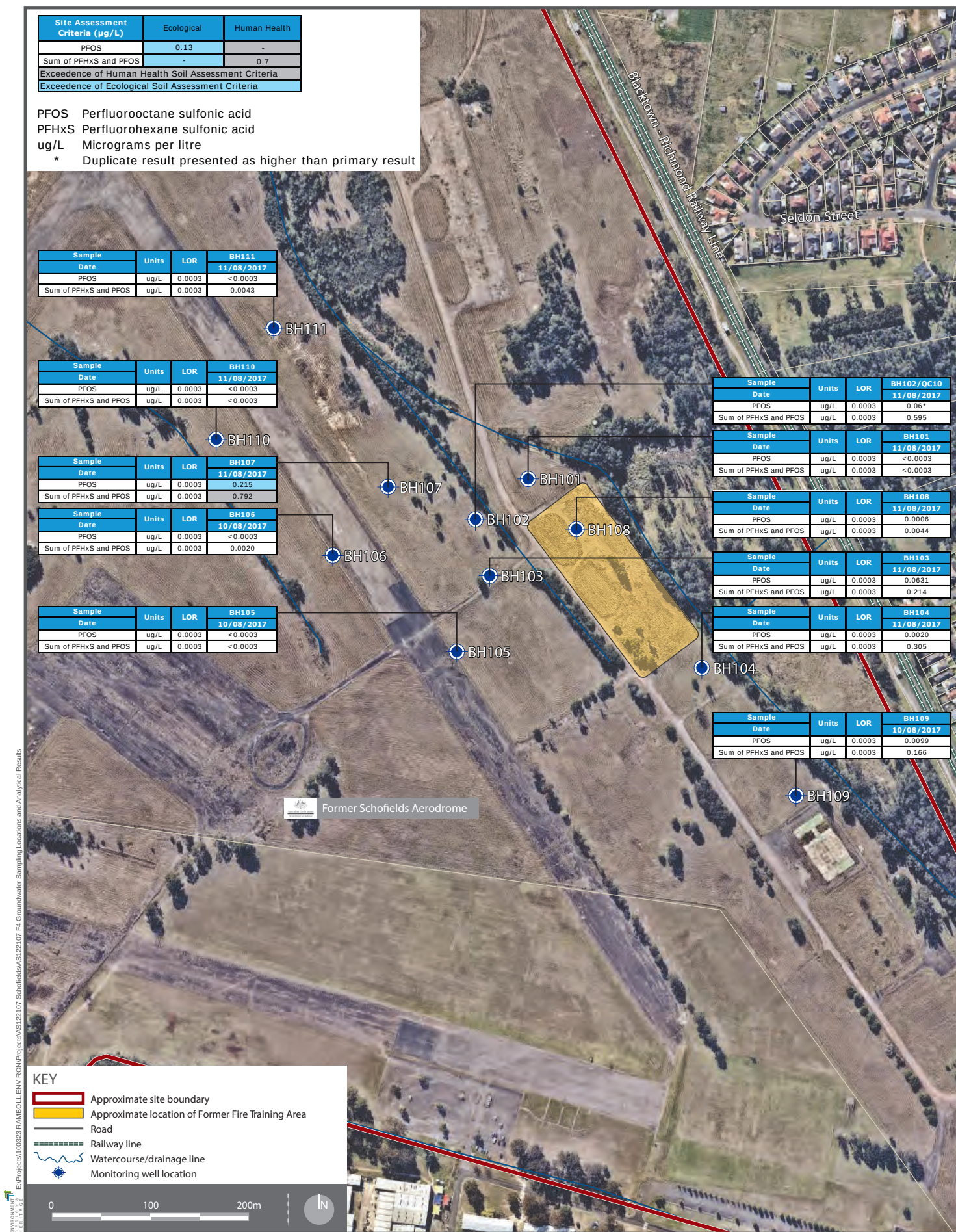
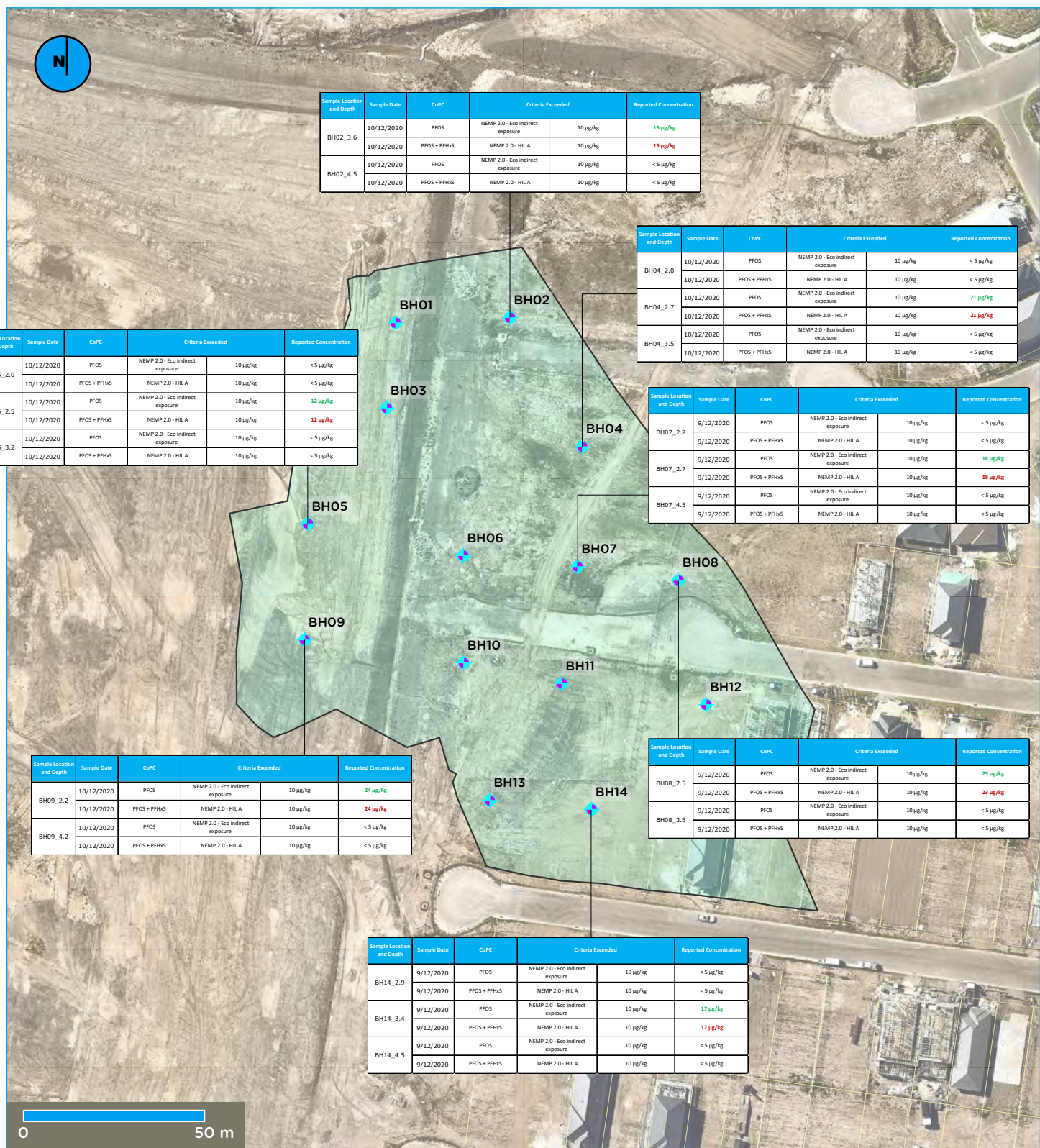


Figure 4: Previous Groundwater PFOS and PFHxS + PFOS Criteria Exceedances – FFTA (Ramboll 2017)
 PFAS Validation Report - Former Schofields Aerodrome



RAMBOLL AUSTRALIA - GIS MAP file : SchofieldsPASVAL GIS POOL - SchofieldsPASVAL GIS POOL MO06 SoilVal v2 | 22/01/2021

Aerial photography by Nearmap, flown 06/12/2020

Legend

-  Borehole locations
-  PFAS Material Placement Area at depth/Validation Area

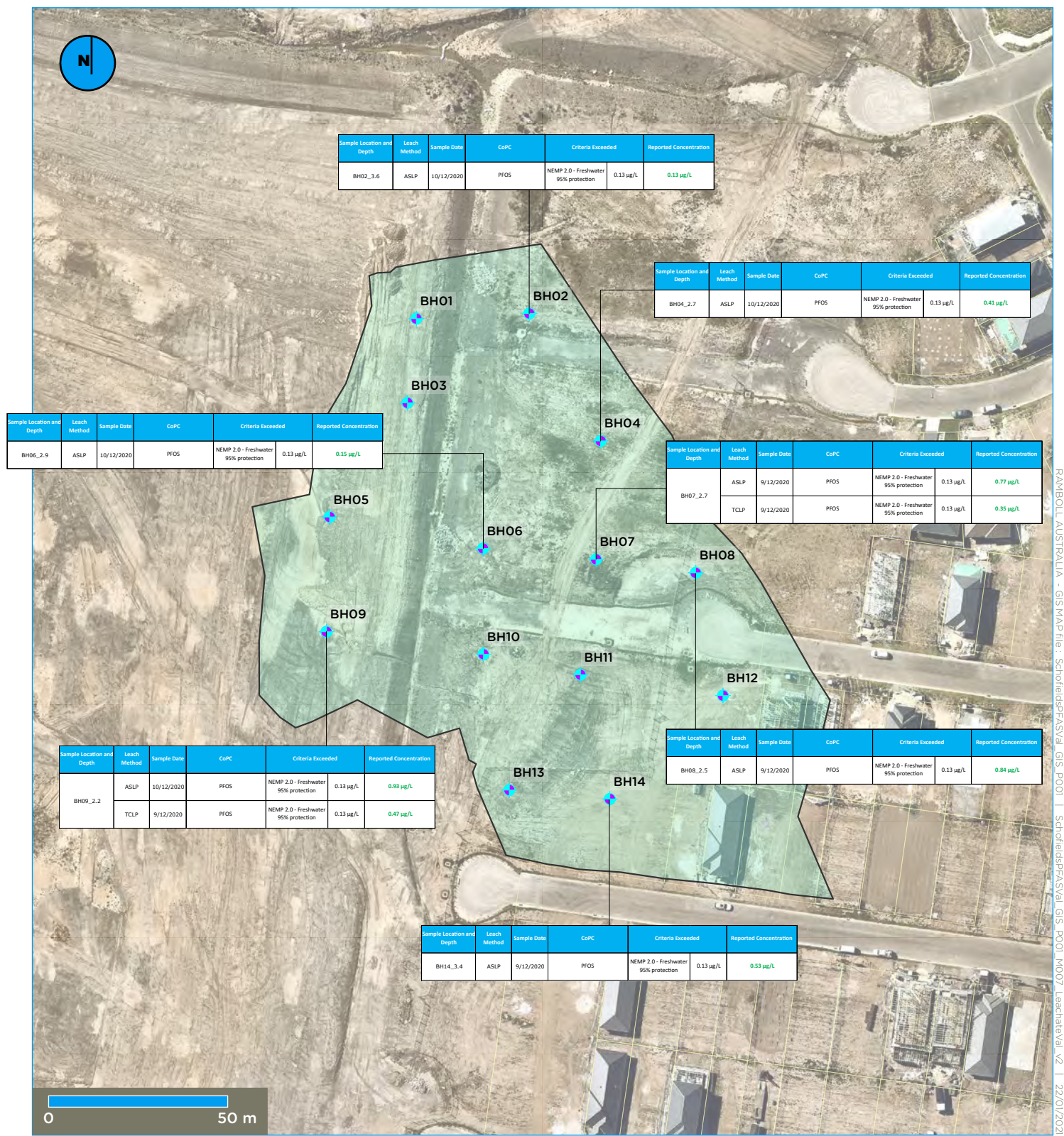
Concentration in **red** font exceed the adopted NEMP 2.0 Human Health Values for Residential use with gardens.

Concentration in **green** exceed the adopted NEMP 2.0 Ecological Indirect Exposure.

Note: Where exceedances have been identified in the PFAS placed material, other results where tested above and below are presented for further information.

Figure 5: Soil Validation Exceedances

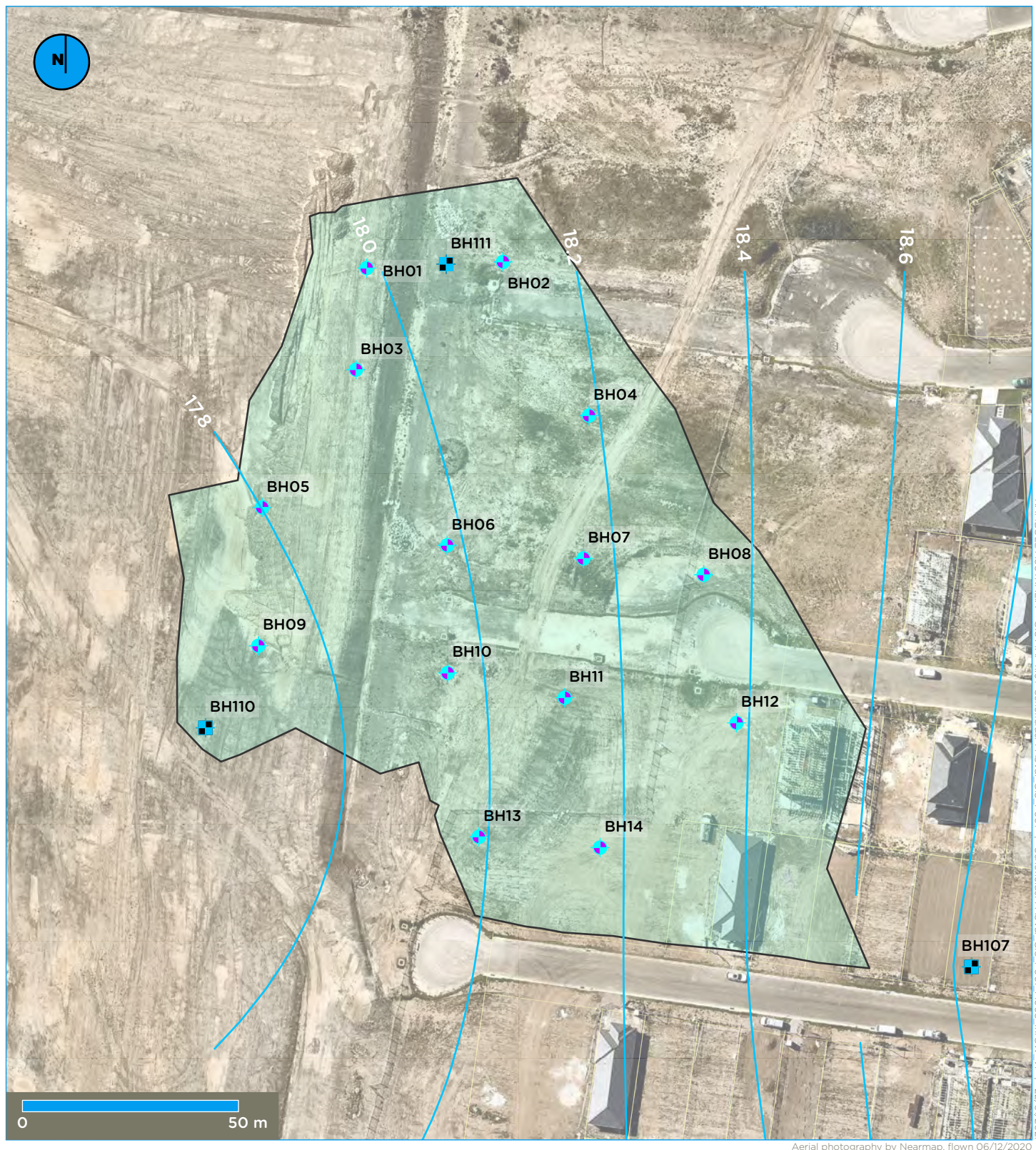
PFAS Validation Report - Former Schofields Aerodrome



RAMBOLL AUSTRALIA - GIS MAP file - SchofieldsPFASVal GIS POOI | SchofieldsPFASVal GIS POOI MO07 LeachateVal v2 | 22/01/2021

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Figure 6: Leachate Validation Exceedances
PFAS Validation Report - Former Schofields Aerodrome

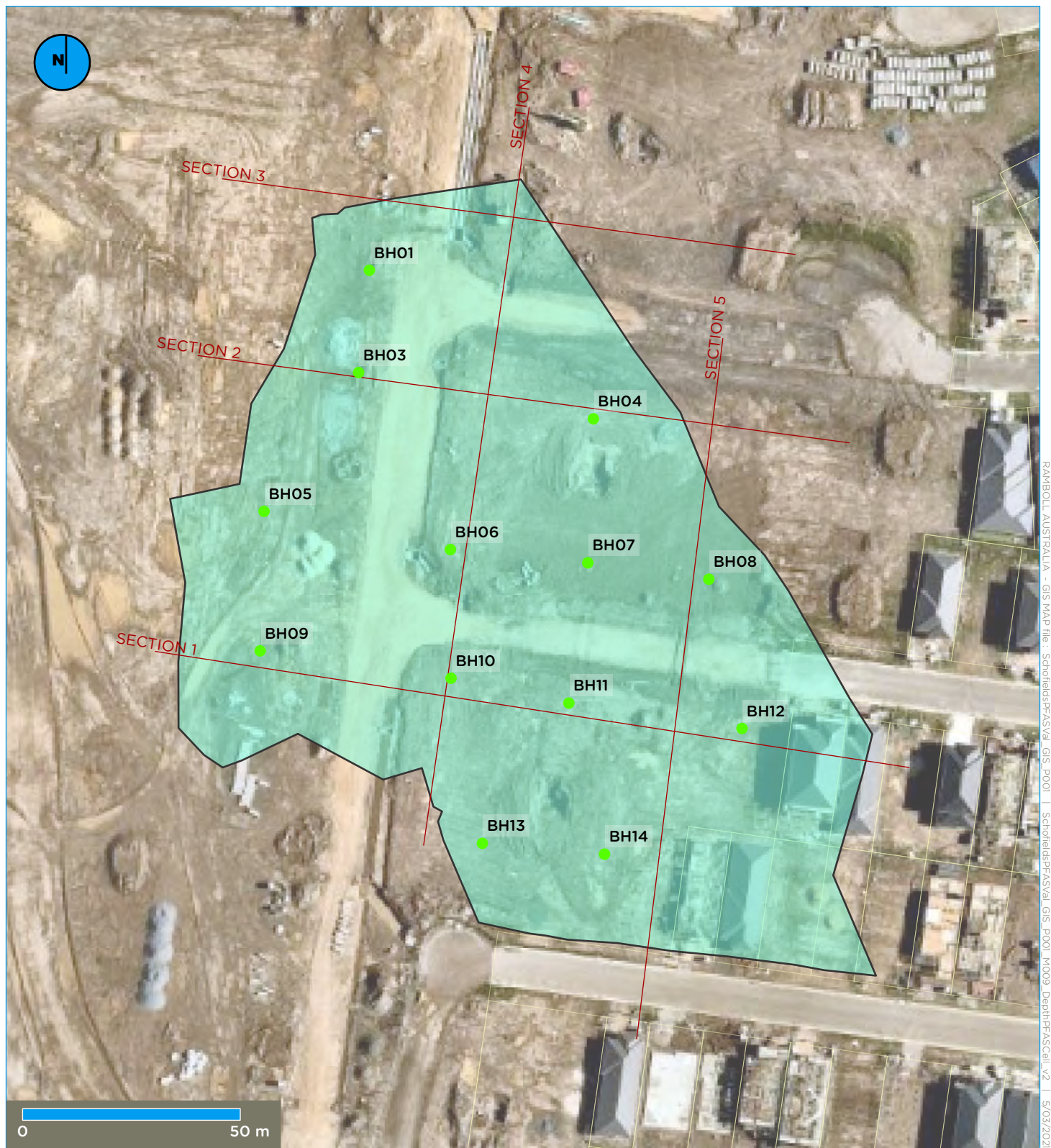


Legend

-  Borehole locations
-  Ramboll 2017 groundwater monitoring wells
-  Ramboll 2017 groundwater contours
-  Validation area/PFAS material cell

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Figure 7: Inferred Groundwater Elevation (Ramboll 2017)
PFAS Validation Report - Former Schofields Aerodrome

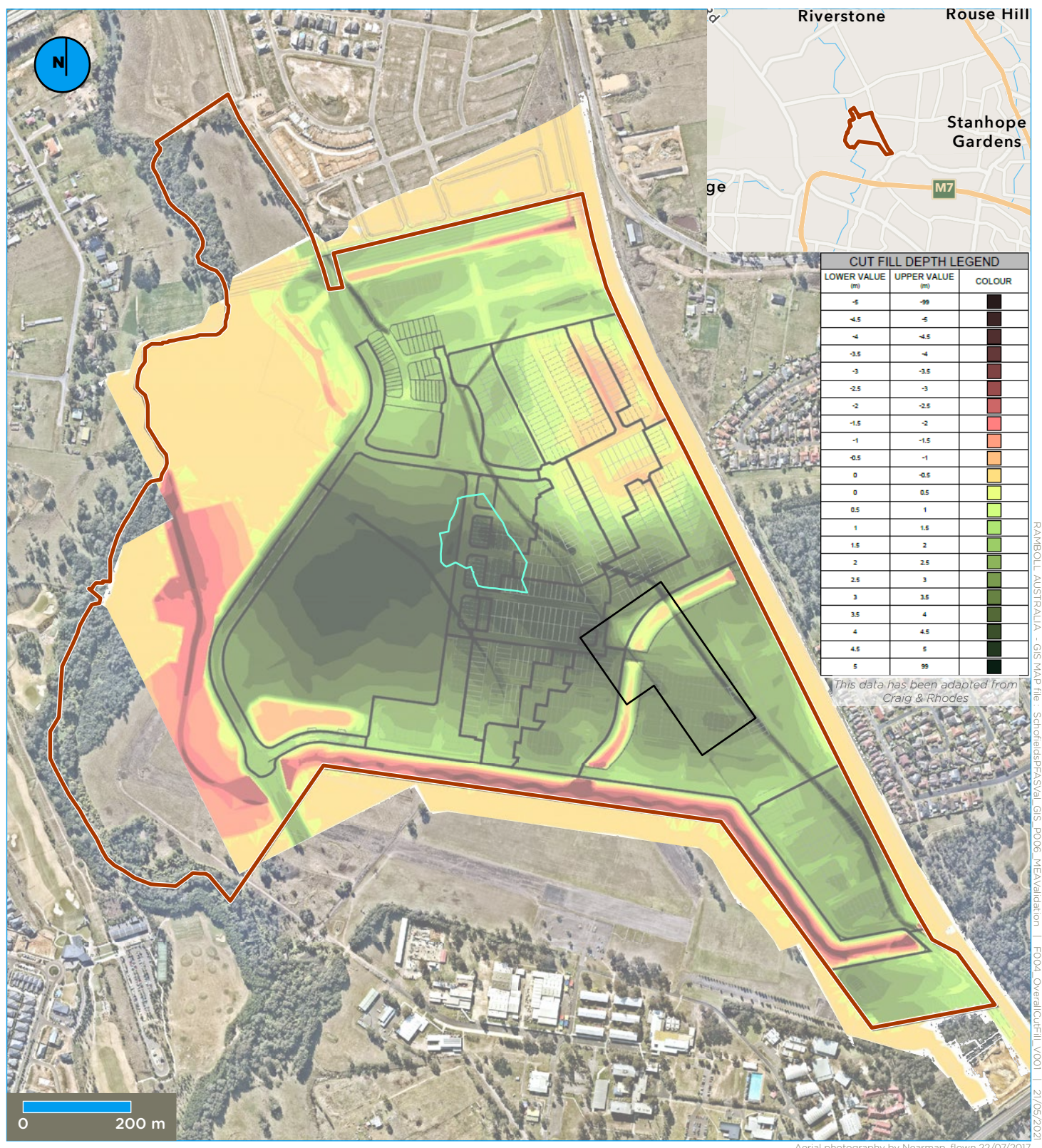


Legend

- Depth of PFAS Material Below Final Site Level >3.0 m
- PFAS Material Placement Area / Validation Area
- Original PFAS Material Placement Area Cross-Sections

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Figure 8: Depth at time of validation - Final Site Level
PFAS Validation Report - Former Schofields Aerodrome



Legend

- Approximate Former Schofields Aerodrome site boundary
- 'No Scrape Area' - Area not suitable for top soil re-use (moved to placement area)
- PFAS Material Emplacement Area at depth

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Figure 9 : Schofields Overall Cut/Fill Plan and Areas of Interest
PFAS MEA Validation Report - Former Schofields Aerodrome



Legend

- Approximate Former Schofields Aerodrome site boundary
- 'No Scrape Area' - Area not suitable for top soil re-use (moved to placement area)
- PFAS Material Emplacement Area at depth
- > 3 m fill

This data has been adapted from Craig & Rhodes

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Figure 10 : Schofields fill > 3m and Areas of Interest
PFAS MEA Validation Report - Former Schofields Aerodrome



FOR INFORMATION

1 Comm	C	12.02.21	ISSUED FOR INFORMATION	P.F.	P.F.	   	Authorised for issue by:	Principal:	Project:	 	ABN 77 050 209 991 ACN 050 209 991 Suite 7.01, Level 7, 3 Rider Boulevard, Rhodes, NSW, 2138 PO Box 3220, Rhodes NSW 2138 Tel. 9669-1855 reception@crrhodes.com.au www.craigandrhodes.com.au © Craig & Rhodes Pty Ltd			Drawing Title PFAS WORK AS EXECUTED PLAN	
	B	11.02.21	ISSUED FOR INFORMATION	P.F.	P.F.			L.G.A. BLACKTOWN CITY COUNCIL	SCHOFIELDS AERODROME DEVELOPMENT STAGE 6E		Scale: AS SHOWN	Datum: AHD	C&R Ref: 1784	Drawing Ref: 1784C-CC-SK-0360	Revision C
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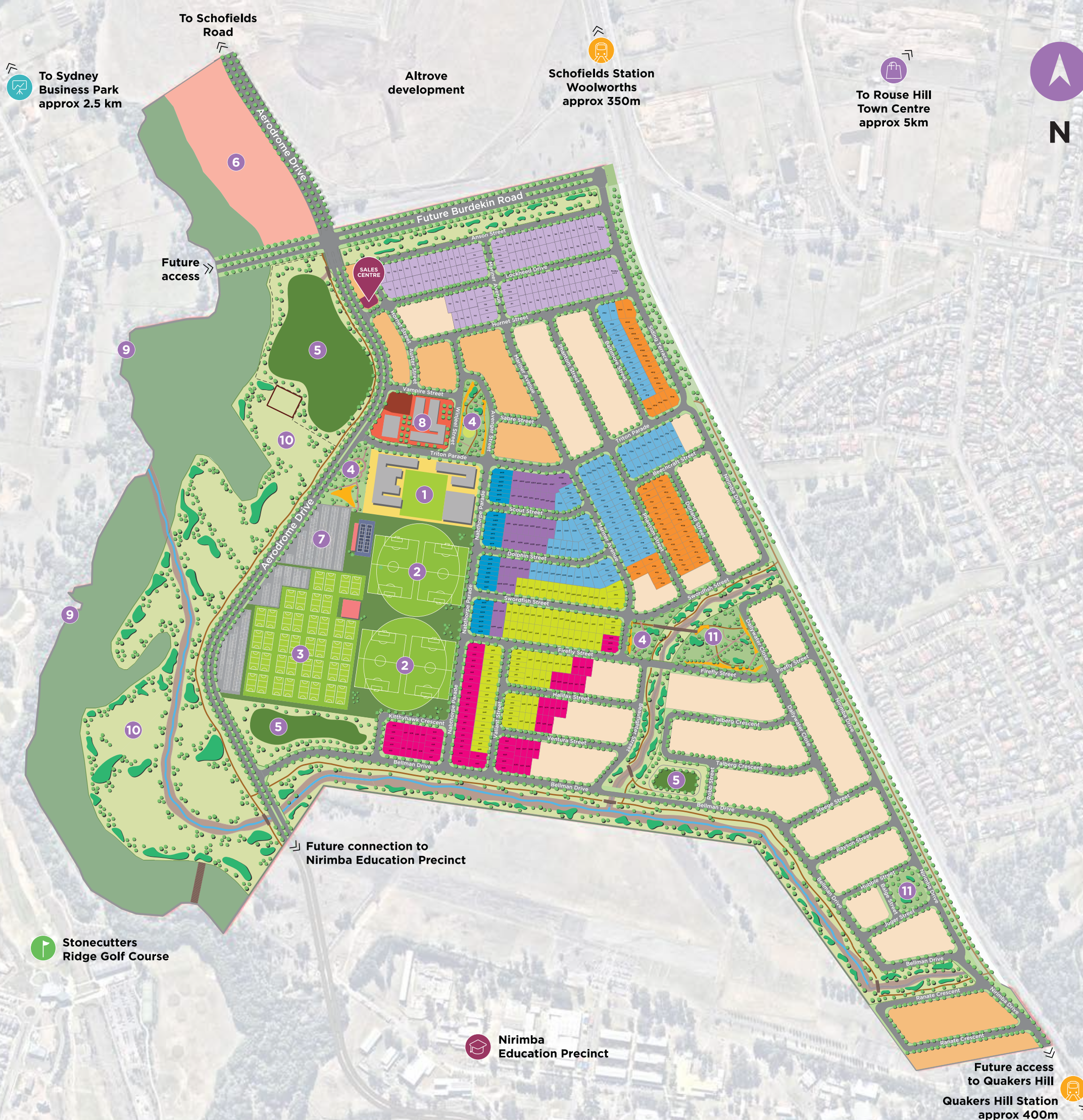


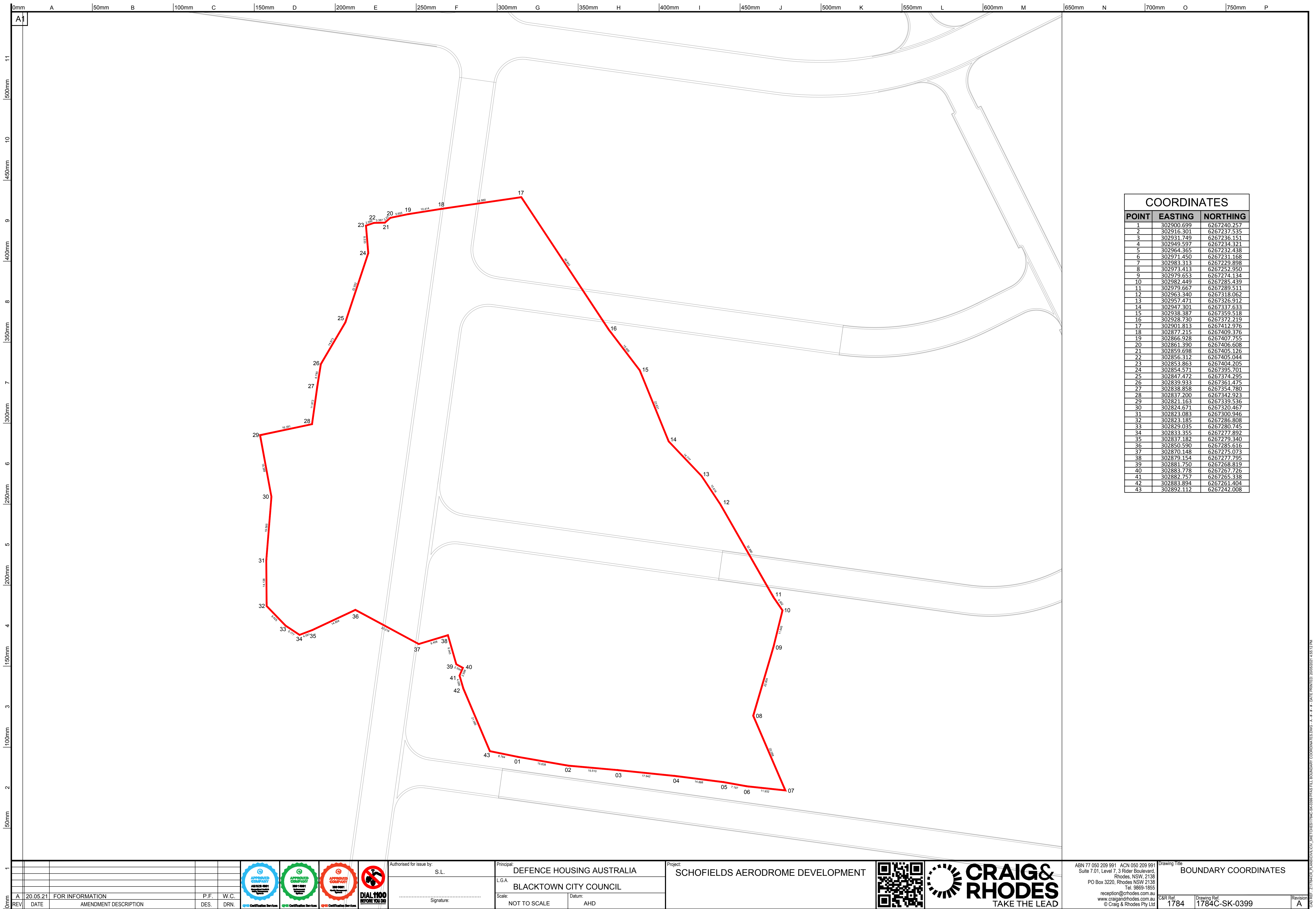
- 1 Proposed Primary School
- 2 Playing Field
- 3 Netball Courts
- 4 Playgrounds
- 5 Stormwater
- 6 Environmental Living Lots
- 7 Recreation Facility Carpark
- 8 Akuna Vista Local Centre
- 9 Eastern Creek
- 10 Nature Reserve
- 11 Park

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COORDINATES

POINT	EASTING	NORTHING
1	302900.699	626724.255
2	302916.301	626726.737
3	302929.409	626723.951
4	302949.597	626723.321
5	302964.365	626723.248
6	302971.450	6267231.168
7	302983.313	6267229.898
8	302985.413	6267252.950
9	302979.623	6267253.334
10	302982.449	6267285.439
11	302979.667	6267289.511
12	302963.340	6267318.062
13	302957.471	6267326.912
14	302947.301	6267337.633
15	302939.687	6267350.518
16	302928.730	6267372.191
17	302901.813	6267412.976
18	302877.215	6267409.376
19	302866.928	6267407.755
20	302861.390	6267406.608
21	302868.698	6267406.226
22	302856.112	6267405.404
23	302853.863	6267404.205
24	302854.571	6267395.701
25	302847.472	6267374.295
26	302839.933	6267361.475
27	302838.858	6267350.780
28	302830.000	6267340.923
29	302821.163	6267339.536
30	302824.671	6267320.467
31	302823.083	6267300.946
32	302823.135	6267286.808
33	302823.055	6267280.704
34	302823.357	6267278.892
35	302837.182	6267275.340
36	302850.590	6267285.616
37	302870.148	6267275.073
38	302879.154	6267277.795
39	302881.750	6267268.819
40	302883.778	6267267.726
41	302882.358	6267267.336
42	302883.894	6267261.044
43	302892.112	6267242.008



Appendix B: EPA Guidelines



Guidelines made or approved by the EPA under section 105 of the *Contaminated Land Management Act 1997*

(as of: 30 June 2020)

Section 105 of the *Contaminated Land Management Act 1997* (CLM Act) allows the EPA to make or approve guidelines for purposes connected with the objects of the Act. The EPA must consider these guidelines whenever they are relevant. Other people must also consider the guidelines, namely accredited site auditors when conducting a site audit, contaminated land consultants when investigating, remediating, validating and reporting on contaminated sites, those responsible for land contamination with a [duty to notify](#) the EPA.

A current list of guidelines made or approved by the EPA under the CLM Act appears below.

Guidelines made by the EPA

- Assessment and management of hazardous ground gases: Contaminated land guidelines (PDF 4MB)
- Guidelines for the vertical mixing of soil on former broad-acre agricultural land (PDF 148KB)
- Sampling design guidelines (PDF 2MB)
- Guidelines for assessing banana plantation sites (PDF 586KB)
- Consultants reporting on contaminated land: Contaminated land guidelines (PDF 1MB)
- Guidelines for assessing former orchards and market gardens (PDF 172KB)
- Guidelines for the NSW Site Auditor Scheme, 3rd edition (PDF 999KB)
- Guidelines for the assessment and management of groundwater contamination (PDF 604KB)
- Guidelines on the duty to report contamination under the Contaminated Land Management Act 1997 (PDF 412KB)
- Guidelines that refer to the
 - Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC, October 2000), are replaced as of 29 August 2018 by the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, August 2018), with the exception of the water quality for primary industries component, which still refer to the ANZECC & ARMCANZ (2000) guidelines
 - National Environment Protection (Assessment of Site Contamination) Measure 1999 are replaced as of 16 May 2013 by the National Environment Protection (Assessment of Site Contamination) Measure 1999 (April 2013).

Guidelines approved by the EPA

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, ANZG (August 2018)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 3, Primary Industries - Rationale and Background Information (ANZECC & ARMCANZ (October 2000)
- Composite sampling, Lock, W. H., National Environmental Health Forum Monographs, Soil Series No.3, 1996, SA Health Commission, Adelaide. Email enHealth.Secretariat@health.gov.au for a copy of this publication.
- Environmental health risk assessment: Guidelines for assessing human health risks from environmental hazards, Department of Health and Ageing and EnHealth Council, Commonwealth of Australia (June 2012)
- National Environment Protection (Assessment of Site Contamination) Measure 1999 (April 2013)* (NEPM ASC)
- Guidelines for the Assessment and Clean Up of Cattle Tick Dip Sites for Residential Purposes, NSW Agriculture and CMPS&F Environmental (February 1996)
- Australian Drinking Water Guidelines, National Health and Medical Research Council (NHMRC) and Natural Resource Management Ministerial Council of Australia and New Zealand (2011)

*The NEPM ASC was amended on 16 May 2013.



Appendix C: Interim Site Audit Advice

2 March 2021

[REDACTED]
Defence Housing Australia
Suite 2, Level 2/287 Elizabeth Street
Sydney NSW 2000

Dear [REDACTED]

**Re: Interim Site Audit Advice No. 1: Detailed Site Investigation
PFAS Material Emplacement Area, Nirimba Drive, Schofields NSW**

1. Introduction and Background

As a NSW Environmental Protection Authority (EPA) accredited Contaminated Site Auditor, I have been engaged by Defence Housing Australia (DHA) to undertake an Audit in relation to a PFAS Material Emplacement Area (MEA), Nirimba Drive, Schofields NSW. The PFAS MEA (the 'Site') is located within a larger newly constructed residential development known as the Nirimba Fields (formerly the Schofields Aerodrome). The non-statutory Audit has been commissioned by DHA to confirm the nature and extent of contamination (limited to PFAS) associated with the PFAS MEA and the appropriateness of the Validation Report to confirm that the emplacement does not pose a risk to human health or the environment.

This Interim Audit Advice (IAA) has been prepared to determine the appropriateness of the Validation Report.

The Auditor has reviewed the following report provided by DHA:

- 'PFAS Validation Report, Former Schofields Aerodrome', draft, revision D4, prepared by Ramboll Australia Pty Ltd (Ramboll) dated 12 February 2021. This is hereafter referred to as the Validation Report.

Historically, the site had been used as the Schofield Aerodrome which included a Fire Training Area. It is understood that material removed from the Fire Training Area was placed with the PFAS MEA. A Site Audit Report dated September 2013 and a Site Audit Statement (GN481) were issued prior to the encapsulation works.



2. Auditor's Initial Comments

The comments provided in this IAA are high-level comments and responses are required to enable us to continue with the Audit. As such, it is expected that further detailed comments will be sent following receipt and review of that information and as the Audit continues.

Auditor comments on Appendix 8 'Screening Assessment of Potential Risks from the PFAS Impacted Soil Layer' will be provided under separate cover.

Based on a review of the Validation Report against the requirements specified in the *Guidelines for the NSW Site Auditor Scheme (3rd edition)* (NSW EPA, 2017) and the *Consultants Reporting on Contaminated Land* (NSW EPA, 2020), the following items require clarification or amendments:

1. As the Validation Report is for the PFAS MEA area, please provide information about the PFAS MEA, instead of information for the former fire training area (FFTA) and the former Schofields aerodrome. For example:
 - Land parcel details specifically for the PFAS MEA.
 - Land zoning for former fire training area is presented.
 - Previous land use.
 - Depth to groundwater, based on three groundwater monitoring bores (off-site BH107 and on-site BH110 and BH111).
2. What is the total volume of material from FFTA and 'No Scrape Area' placed in the PFAS MEA?
3. The 90 % species protection level for highly disturbed ecosystems (going to 95 % for bio cumulative compounds) can be used as screening levels if agreement can be obtained from relevant stakeholders which would include the NSW EPA and the local Council. Without stakeholder agreement the 95%/99% species protection level should be used.
4. The cross-sections (Section 2 to Section 5) provided in Appendix 5 indicated that the bottom level of the PFAS MEA (red line) is located below the strip level (green line) in selected locations. Please clarify whether this is correct.
5. Table 9-1 indicates that the surveyed elevation information provided in Appendix 5 is dated 30 November 2020, which indicates that the information presented in Appendix 5 is superseded as there were two other survey events conducted on 16 December 2020 and 12 February 2021. The Validation Report should include as-built cross-sections of the PFAS MEA using the most current survey data for all surfaces showing:
 - Final site surface (after placement of VENM and PFAS layer).
 - Top of PFAS layer.
 - Bottom of PFAS layer.
 - Strip natural surface (before any VENM or PFAS layer was added).
 - 14 validation bore holes (BH01 to BH14).
 - Subsurface services (stormwater, sewer, gas, electricity, etc.).
 - Inferred groundwater level.
6. Please check and update Section 10.1.2 with the correct month listed for the groundwater monitoring event (GME) and the groundwater monitoring well used in the discussion i.e. there is no GME conducted in October 2017 (assume this should be August 2017), and should this be BH106 or BH107 or both?
7. Section 10.1.2 states that the highest groundwater elevations observed across the three GMEs (2017) were used to approximate the groundwater standing water level for the PFAS MEA. This is inconsistent with Figure 7 which does not adopt the highest SWL measured at BH107. The approximate standing water levels in Table 10-1 are not the most conservative scenario based on the available data.
8. Please present meteorological evidence to support Ramboll's interpretation that the "SWL measured taken across the three GMEs in 2017 is considered an appropriate estimate for the seasonal maximum SWL below the MEA" (page 23).



9. Appendix 7 is titled 'Ramboll Validation Elevations and PFAS Material Survey Comparison' however, it is not referenced or discussed within the report. It is also unclear how the data in Appendix 7 are related to Table 10-1. The data needs to be appropriately explained so that the validation process can be understood by the auditor. Please use the most recent survey data in the calculations.
10. A spot check of Appendix 7 was conducted and the Supplied Survey's surface level (mAHD), level of top of layer (mAHD) and level of bottom of layer (mAHD) data do not match the data presented in Appendix 5 for their position (section no, chainage). However, as noted in Item 5 above, the survey data provided in Appendix 5 are from 30 November 2020 which is superseded.
11. The Quality Assurance and Quality Control (QAQC) presented in Section 11 are lacking the following items:
 - DSO and DSI discussions
 - The QAQC assessment was stated to be based on NEPM only. The QAQC requirements of PFAS NEMP 2.0 must also be considered.
 - The reduced sampling density adopted was stated to be based on "*the objective of the targeted validation works and ... judgement approach based on the proposed land use*". Given that the proposed land use is sensitive use (low density residential and primary school), more justification or supporting evidence is required to substantiate the reduction.
12. Based on the discussions in Section 7.3 Validation Requirements, the validation requirements of the PFAS MEA are the items listed in Section 7.1 and Section 7.2. Therefore, Section 12 should be revised to discuss compliance (or non-compliance whichever is relevant) for all validation requirements from Section 7.1 and Section 7.2 (not just a few).
13. Bore log for BH09 (Appendix 4) is missing sampling details.
14. Please renumber the figures as there are two Figure 3's and two Figure 7's.
15. It appears that that most recent registered bore search was conducted in 1997 (based on Environ 2013 Site Audit Report). Please consider conducting one in the Validation Report.
16. Section 13 Conceptual Site Model (CSM), Section 14 Conclusions and Recommendations and Executive Summary should be revised based on the auditor's comments presented in this letter.



3. Closure

If you have any comments or questions, please do not hesitate to contact the undersigned at [REDACTED] or via mobile on [REDACTED]

Yours sincerely,

[REDACTED]

[REDACTED]
[REDACTED]

SYS/MP

Technical Limitations and Uncertainty – Ramboll Pty Ltd included limitations in their report. The Interim Audit Advice must also be subject to those limitations. The Auditor has prepared this document in good faith but is unable to provide certification outside of areas over which the Auditor had some control or is reasonably able to check. The Auditor has relied on the documents referenced in preparing the Auditors' opinion. If the Auditor is unable to rely on any of those documents, the conclusions of the audit could change. It is not possible in a Site Audit Report to present all data which could be of interest to all readers of this report. Readers are referred to the referenced reports for further data. Users of this document should satisfy themselves concerning its application to, and where necessary seek expert advice in respect to, their situation.

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16 March 2021

[REDACTED]
Defence Housing Australia
Suite 2, Level 2/287 Elizabeth Street
Sydney NSW 2000

Dear [REDACTED]

**Re: Interim Site Audit Advice No. 2: Screening Assessment of
Potential Risks from PFAS Impacted Soil Layer
PFAS Material Emplacement Area, Nirimba Drive, Schofields NSW**

1. Introduction

As a NSW Environmental Protection Authority (EPA) accredited Contaminated Site Auditor, I have been engaged by Defence Housing Australia (DHA) to conduct a Section B site contamination audit of the PFAS Material Emplacement Area (MEA).

PFAS MEA (the site or audit site) is located within a proposed new residential development at Nirimba Drive, Schofields, NSW 2763 (the Nirimba Fields). The Nirimba Fields has a total area of 141 hectare and is the former Schofields Aerodrome.

The site is proposed to be redeveloped into low density residential properties, a road, a primary school and playing fields.

2. Background

The site is located within the Blacktown City Council (Council) area at the centre of the Nirimba Fields. It is currently vacant and being constructed as part of the overall housing development.

Ramboll Environ Australia Pty Ltd (Ramboll) were engaged by DHA to undertake investigations to characterise and validate the constructed PFAS MEA, and to draw conclusions regarding the suitability of the site for the proposed low density residential land use.

I have been provided with the following documents prepared by Ramboll for review:

- *Former Schofields Aerodrome, Quakers Hill, NSW: Screening Assessment of Potential Risks from the PFAS Impacted Soil Layer*, draft D1, prepared by Ramboll Environ Australia Pty Ltd (Ramboll) dated 29 January 2021. This is hereafter referred to as the Screening Assessment.

This letter report is provided as Appendix 8 of the *PFAS Validation Report*, Former Schofields Aerodrome, draft revision D5, prepared by Ramboll dated 5 March 2021. This is hereafter referred to as the Validation Report. This letter report is also provided as Appendix 8 of the Validation Report (draft revision D4) dated 12 February 2021.

I have already provided my initial high-level comments of the Validation Report (revision D4) in my interim audit advice (IAA) no. 1 dated 2 March 2021.



The purpose of this letter is to provide comment on the Screening Assessment (i.e. Appendix 8 of the Validation Report) and sections of the Validation Report relevant to Appendix 8.

3. Auditor's comments

The auditor, with the assistance of her expert support team members, has completed a review of the Screening Assessment against:

- The requirements specified in the NSW EPA *Guidelines for the NSW Site Audit Scheme (3rd Edition)* (NSW EPA 2017).
- *Consultants Reporting on Contaminated Land, Contaminated Land Guidelines* (NSW EPA 2020).
- *National Environment Protection (Assessment of Site Contamination) Measure 1999* as amended 2013 (NEPC 2013).
- *PFAS National Environmental Management Plan* (NEMP), Version 2.0 (HEPA 2020).
- *Environmental Health Risk Assessment: Guidelines for Assessing Human Health Risks from Environmental Hazards* (enHealth 2012).

Based on a review of the Screening Assessment (Appendix 8 of the Validation Report) and sections of the Validation Report, the following items require clarification or amendments:

1. **Confirmation of VENM thickness:** Section 2 (Source Area Description) indicates that the development plans include 3 m of clean VENM placed above the PFAS impacted material. However, earlier it is stated that the PFAS impacted soil is at an **average** depth of 3 below ground surface and Table 12-1 of the Validation Report indicated a minimum of 3 m of VENM. Please be consistent when discussing the thickness of VENM placed above the PFAS placement layer.
2. **Human Health risks:** Based on a minimum required VENM thickness of 3 m, the auditor concurs that exposure to the PFAS impacted soil will be effectively managed, and that risks to future receptors (including site residents and future intrusive workers) will be low. This conclusion is contingent on a minimum 3 m VENM thickness being achieved across the whole area. If impacts are present at less than 3 m, it would need to be assumed that these could be brought to the surface during future soil disturbance (e.g. swimming pool construction), and it is likely that in this scenario it would not be possible to exclude risks in a low density residential scenario, as even the low PFAS concentrations measured in the PFAS impacted layer may pose unacceptable risks when pathways of uptake (e.g. into home-grown produce and chickens) are considered.
3. **Risks to terrestrial ecosystems (use of 140 µg/kg):** Despite reference to this value in the NEMP, the use of the 140 µg/kg criterion is not considered directly relevant to the assessment of pathways to terrestrial ecosystems. The 140 µg/kg criterion was developed by CCME considering a pathway of leaching and migration to off-site surface water (and may not be protective for this pathway, as the acceptable concentration in PFOS freshwater inherent in the derivation is different from the screening values for the protection of aquatic ecosystems in the NEMP) Regardless, this pathway has been assessed in alternate manner through the assessment of leaching, dilution and off-site migration in Appendix 8, Section 6.
4. **Risks to terrestrial ecosystems - overall conclusions:** While the adopted 140 µg/kg criterion is of limited relevance to the assessment of risks to terrestrial ecological receptors, the conclusion that risks to terrestrial ecological receptors will be low and acceptable is considered to be supported by the available data.



5. **PFOS 99% species protection level:** Consider the draft updated 99% species protection level presented by Batley et al. (2018)¹ (0.05 µg/L) in relation to the evaluation of the risk to aquatic ecosystems. The Batley et al. (2018) values address some key technical issues identified with the initial draft values which are currently listed in the PFAS NEMP; specifically, they account for the observed bimodality in the toxicity data and therefore reduce the extrapolation error in the derived values, particularly for the derived 95% and 99% protection levels.
6. **Risks to aquatic ecosystems - overall conclusions:** The conclusion that risks to aquatic ecological receptors is supported by the available assessment, subject to further clarification in response to the auditor's comments provided throughout this letter.
7. **Validation Report Section 10.1.2:** Noting the update/response to the comment on historical SWLs and rainfall, could Ramboll also add a comment on the annual rainfall in 2017 (not just June 2017) relative to the long-term average. A cursory glance of Bureau of Meteorology (BOM) rainfall data suggests that June 2017 may have been slightly drier relative to the long term average rainfall – a simple sensitivity/uncertainty analysis in Appendix 8 could address this (refer comment below).
8. **Stormwater Lines:** Further to discussion of stormwater lines in Validation Report Section 12.4 and Section 2 of the Screening Assessment, please consider additional potential development requirements such as the installation of stormwater infiltration pits or pavement where some leakage could occur – a simple sensitivity/uncertainty analysis could address this (refer comment below).
9. **Leaching and dilution calculations:** There should be some form of sensitivity or uncertainty analysis – e.g., there are several parameters that are from the literature or judgement-based rather than site-specific (like net infiltration and K) or could change (rainfall) or might be quite conservative (e.g. plume depth). A reasonable range of parameters and predicted concentrations should then be presented or discussed at least. Some specific further comments are below.
10. **Table 6-1 Net annual infiltration rates:**
 - Check the annual rainfall rate – we make it about 717 mm.
 - Check units for annual rainfall – this should be cm/year. Also check the calculation with 70% reduction – we get a different value (it should use the reduced infiltration value ^2). Please check / re-do the subsequent calculations in Table 6-1 (and in Tables 6-3, 6-4).
 - Equation 6.1, Table 6-1: The calculated infiltration rate looks lower than typical for groundwater recharge (with correction of units – refer comment above) – equating to about 0.1% recharge. Is this plausible?
11. **Equation 6.2 & 6.4:** If used as presented, the Darcy velocity term (Vd) should not include porosity (i.e. “Darcy velocity” is not the same as “seepage velocity”).
12. Depending on the outcomes from the above comments, perhaps consider also evaluating the dilution attenuation factor (DAF) concept referenced in Schedule B5c of ASC NEPM as a supporting line of evidence to better support the conclusions of very low levels of PFAS at the receptor in this Screening Assessment (Appendix 8 of Validation Report).
13. **Uncertainty and sensitivity:** The discussion on PFAS fate and transport is useful. Acknowledging the uncertainty in PFAS behaviour, depending on the outcomes from the above comments, consider whether it would be worth doing a simple retardation calculation in line with

¹ Batley, G.E., van Dam, R.A., Broadgate, K.E., et al, *Application of revised methodologies for default guideline value derivations: PFOS in freshwater*, Presented at SETAC North America 39th Annual Meeting. Abstract book available from: <https://www.setac.org/store/ViewProduct.aspx?id=13373145>



industry guidance and literature (e.g. ITRC 2020 fact sheets) as a qualitative supporting line of evidence to better support the conclusions.

14. References: Add reference to ITRC (2020).

4. Closure

Please revise the Screening Assessment (and Validation Report) to address the comments above. Ultimately, following finalisation of the Validation Report, I have been engaged to provide a Section B Site Audit Statement and Site Audit Report about the appropriateness of the Validation Report and the nature and extent of PFAS contamination associated with the PFAS MEA.

If you have any comments or questions, please do not hesitate to contact the undersigned at [REDACTED] or via mobile on [REDACTED]

Yours sincerely,

[REDACTED]

[REDACTED]
[REDACTED]

AW/KR/MP

Technical Limitations and Uncertainty – Ramboll Environ Australia Pty Ltd included limitations in their report. The Interim Audit Advice must also be subject to those limitations. The Auditor has prepared this document in good faith but is unable to provide certification outside of areas over which the Auditor had some control or is reasonably able to check. The Auditor has relied on the documents referenced in preparing the Auditors' opinion. If the Auditor is unable to rely on any of those documents, the conclusions of the audit could change. It is not possible in a Site Audit Report to present all data which could be of interest to all readers of this report. Readers are referred to the referenced reports for further data. Users of this document should satisfy themselves concerning its application to, and where necessary seek expert advice in respect to, their situation.

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30 March 2021

██████████
Defence Housing Australia
Suite 2, Level 2/287 Elizabeth Street
Sydney NSW 2000

Dear ██████████

**Re: Interim Site Audit Advice No. 6: PFAS Validation Report
(Draft D5) and Screening Assessment of Potential Risks
from the PFAS Impacted Soil Layer (Draft D2)
PFAS Material Emplacement Area, Nirimba Drive, Schofields NSW**

1. Introduction

As a NSW Environmental Protection Authority (EPA) accredited Contaminated Site Auditor, I have been engaged by Defence Housing Australia (DHA) to undertake an Section B site contamination audit in relation to a PFAS Material Emplacement Area (MEA), Nirimba Drive, Schofields NSW.

PFAS MEA (the site or audit site) is located within a proposed new residential development at Nirimba Drive, Schofields, NSW 2763 (the Nirimba Fields), which is the former Schofields Aerodrome. This non-statutory Audit is to confirm the nature and extent of contamination (limited to PFAS) associated with the PFAS MEA and the appropriateness of the Validation Report to confirm that the emplacement does not pose a risk to human health or the environment.

The site is proposed to be redeveloped into low density residential properties, a road, a primary school and playing fields.

2. Background

The site is located within the Blacktown City Council (Council) area at the centre of the Nirimba Fields. It is currently vacant and being constructed as part of the overall housing development.

Ramboll Environ Australia Pty Ltd (Ramboll) were engaged by DHA to undertake investigations to characterise and validate the constructed PFAS MEA, and to draw conclusions regarding the suitability of the site for the proposed low density residential land use.

The table below lists the documents for PFAS MEA provided to auditor for review:

Document	Corresponding Auditor's Interim Advice
Ramboll (2021a) <i>PFAS Validation Report, Former Schofields Aerodrome</i> , draft revision D4, 12 February 2021.	<i>Interim Site Audit Advice No. 1: Detailed Site Investigation</i> , dated 2 March 2021 (ref: S18612_LET01_Rev0)



Document	Corresponding Auditor's Interim Advice
Ramboll (2021b) <i>Former Schofields Aerodrome, Quakers Hill, NSW: Screening Assessment of Potential Risks from the PFAS Impacted Soil Layer</i> , draft D1, 29 January 2021. This is Appendix 8 of the <i>PFAS Validation Report</i> .	<i>Interim Site Audit Advice No. 2: Screening Assessment of Potential Risks from PFAS Impacted Soil Layer</i> , dated 16 March 2021 (ref: S18612_LET02_Rev0)

Subsequently, the two documents listed in the table above were revised and the auditor was provided with the following documents for review:

- Ramboll (2021c) *PFAS Validation Report, Former Schofields Aerodrome*, draft revision D5 dated 5 March 2021. This is hereafter referred to as the Validation Report.
- Ramboll (2021d) *Former Schofields Aerodrome, Quakers Hill, NSW: Screening Assessment of Potential Risks from the PFAS Impacted Soil Layer*, draft D2 dated 22 March 2021. This is hereafter referred to as the Screening Assessment.
- Ramboll's responses to auditor's comments from Interim Site Audit Advice No. 1 and 2, provided in spreadsheet titled 'Auditor Comments Register_Rev1.xlsx'. This is hereafter referred to as 'Ramboll's Responses'.

The purpose of this letter is to provide comment on the Validation Report (draft D5), Screening Assessment (draft D2) and Ramboll's Responses.

3. Auditor's comments

Based on a review of the Validation Report, Screening Assessment and Ramboll's Responses against the requirements specified in the *Guidelines for the NSW Site Auditor Scheme (3rd edition)* (NSW EPA, 2017) and the *Consultants Reporting on Contaminated Land* (NSW EPA, 2020), the following items require clarification or amendments:

1. **Legal Description (Lot and DP):** All addresses for the parcel of lands within the audit site need to be presented in the SAR/SAS and therefore, this information is required.
2. **Zoning:** Please provide land zoning information for the PFAS MEA (the site) itself and not for areas in the vicinity of the MEA.
3. **Previous land use:** Please include site history information for the PFAS MEA (instead of the wider former aerodrome).
4. **Registered bore search:** Please present the results or summary of the groundwater bore search conducted on 5 March 2021, as the information provided in Table 4-1 is vague and not helpful in understanding whether groundwater is utilised.
5. **Level of species protection:** The auditor notes that PFAS NEMP 95% species protection level was adopted in the Validation Report because "*aquatic receptors are not expected to be directly exposed to the leachate*" (page 20), however, the Screening Assessment presented in Appendix 8 of the Validation Report has considered both 95% and 99% species protection guideline values. For the purpose of the audit, the auditor will be adopting the 99% species protection guideline value in the assessment of risk.
6. **Base of PFAS placement layer:** Ramboll's Responses stated that all localised mounds of strip level (green line shown in cross-section 2 to 5 in Appendix 5) are removed prior to the placement of PFAS material (red line). Does this mean that in the selected areas the natural topography was stripped (localised mounds), PFAS material was placed directly onto the natural topography (i.e. no VENM was placed between the PFAS material [red line] and natural soil ([green line])?



7. **Survey levels:** Where are the survey levels from 16 December 2020 presented? Is this the survey eastings, northings and RL data of the collars of the fourteen validation boreholes (presented in Appendix 4 bore logs)?
8. **Thickness of overlying VENM:** Appendix 5 (WEM November 2020 survey data) indicated that there are areas where VENM thickness above PFAS MEA was less than 3 m (for example, Section 1 chainage 45, 50, 55 and Section 4 chainage 50, 55, 60). Additional VENM was then imported and the validation of the thickness of overlying VENM was based on February 2021 survey data from 13 validation locations (soil bores BH01, BH03 to BH14). However, none of the 13 discrete validation locations correspond to the locations where VENM thickness was less than 3 m prior to importation of extra fill and it is unclear whether a 3 m VENM thickness has been achieved across the full area. The auditor notes that there are no as-built cross-sections of the PFAS MEA available in the Validation Report.

Please provide confirmation of the minimum thickness of VENM overlying the impacted material across the full area (i.e., not just at the validation locations), including clarification of how this was calculated incorporating the final survey results. This is critical as the risk profile of the PFAS MEA is dependent on the thickness of the VENM above the PFAS placement layer.
9. **QAQC:** The DQIs presented in Table 9-1 and sampling and analysis methodology assessment presented in Table 11-2 do not appear to be consistent with QAQC guidance provided in PFAS NEMP 2.0. For example: In accordance with Section 18.3 of PFAS NEMP, blind and split duplicates should be collected at a lower rate than 1 in 20 samples and a rinsate blank is not discussed.
10. **QAQC:** The discussion on the adoption of a reduced sampling density presented in Table 11-1 indicated that this was because there was greater level of confidence in the PFAS placement layer depth and extent based on the WEM site level (November 2020) survey information. However, discussion in Section 10.1.2 (last paragraph page 26) stated that the WEM survey was found to be 'inaccurate', which seems contradictory. Please clarify or provide more supporting information to justify the reduced sampling density.
11. **Validation requirements:** Please amend as discussion in Section 12 does not include all Ramboll material reuse requirements listed in Section 7.2. For example, no discussion was presented about requirements associated with groundwater extraction, VENM placement to infill drainage channels and protection of construction workers.
12. **Site suitability for proposed land use:** Section 14.3 would also benefit with a discussion on why an Environmental Management Plan (EMP) is not required for the PFAS MEA. Is there a mechanism in place to ensure that the PFAS MEA is not disturbed in the future?
13. **EPA Notification:** Confirming that discussions were held between Ramboll and the NSW EPA on 17th March 2021 regarding notification of the re-use of PFAS and placement within 2m of groundwater. What further notification is proposed, please outline.
14. **Appendix 2 Table 5:** Please check the sample dates as they are listed as October 2020.



4. Closure

If you have any comments or questions, please do not hesitate to contact the undersigned at [REDACTED] or via mobile on [REDACTED]

Yours sincerely,

[REDACTED]

[REDACTED]

[REDACTED]

AW/KR/SYS/MP

Technical Limitations and Uncertainty – Ramboll Environ Australia Pty Ltd included limitations in their report. The Interim Audit Advice must also be subject to those limitations. The Auditor has prepared this document in good faith but is unable to provide certification outside of areas over which the Auditor had some control or is reasonably able to check. The Auditor has relied on the documents referenced in preparing the Auditors' opinion. If the Auditor is unable to rely on any of those documents, the conclusions of the audit could change. It is not possible in a Site Audit Report to present all data which could be of interest to all readers of this report. Readers are referred to the referenced reports for further data. Users of this document should satisfy themselves concerning its application to, and where necessary seek expert advice in respect to, their situation.

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13 April 2021

██████████
Defence Housing Australia
Suite 2, Level 2/287 Elizabeth Street
Sydney NSW 2000

Dear ██████████

**Re: Interim Site Audit Advice No. 8: PFAS Validation Report
(Draft D6)
PFAS Material Emplacement Area, Nirimba Drive, Schofields NSW**

1. Introduction

As a NSW Environmental Protection Authority (EPA) accredited Contaminated Site Auditor, I have been engaged by Defence Housing Australia (DHA) to undertake an Section B site contamination audit in relation to a PFAS Material Emplacement Area (MEA), Nirimba Drive, Schofields NSW.

PFAS MEA (the site or audit site) is located within a proposed new residential development at Nirimba Drive, Schofields, NSW 2763 (the Nirimba Fields), which is the former Schofields Aerodrome. This non-statutory Audit is to confirm the nature and extent of contamination (limited to PFAS) associated with the PFAS MEA and the appropriateness of the Validation Report to confirm that the emplacement does not pose a risk to human health or the environment.

The site is proposed to be redeveloped into low density residential properties, a road, a primary school and playing fields.

2. Background

The site is located within the Blacktown City Council (Council) area at the centre of the Nirimba Fields. It is currently vacant and being constructed as part of the overall housing development.

Ramboll Environ Australia Pty Ltd (Ramboll) were engaged by DHA to undertake investigations to characterise and validate the constructed PFAS MEA, and to draw conclusions regarding the suitability of the site for the proposed low density residential land use.

The table below lists the documents for PFAS MEA provided to auditor for review:

Document	Corresponding Auditor's Interim Advice
Ramboll (2021a) <i>PFAS Validation Report, Former Schofields Aerodrome</i> , draft revision D4, 12 February 2021.	<i>Interim Site Audit Advice No. 1: Detailed Site Investigation</i> , dated 2 March 2021 (ref: S18612_LET01_Rev0)



Document

Corresponding Auditor's Interim Advice

Ramboll (2021b) *Former Schofields Aerodrome, Quakers Hill, NSW: Screening Assessment of Potential Risks from the PFAS Impacted Soil Layer*, draft D1, 29 January 2021.
This is Appendix 8 of the *PFAS Validation Report*.

Interim Site Audit Advice No. 2: Screening Assessment of Potential Risks from PFAS Impacted Soil Layer, dated 16 March 2021 (ref: S18612_LET02_Rev0)

Ramboll (2021c) PFAS Validation Report, Former Schofields Aerodrome, draft revision D5 dated 5 March 2021.

Interim Site Audit Advice No. 6: PFAS Validation Report (Draft D5) and Screening Assessment of Potential

Ramboll (2021d) *Former Schofields Aerodrome, Quakers Hill, NSW: Screening Assessment of Potential Risks from the PFAS Impacted Soil Layer*, draft D2 dated 22 March 2021. This is Appendix 8 of the *PFAS Validation Report* and hereafter referred to as the *Screening Assessment*.

Risks from PFAS Impacted Soil Layer (Draft D2), dated 30 March 2021 (ref: S18612_LET05_Rev0)

Subsequently, the Validation Report was revised, and the auditor was provided on 12 April 2021 with the following documents for review:

- Ramboll (2021e) *PFAS Validation Report, Former Schofields Aerodrome*, draft revision D6 dated 8 April 2021. This is hereafter referred to as the Validation Report.
- Ramboll's responses to auditor's comments from Interim Site Audit Advice No. 6, provided in spreadsheet titled 'Auditor Comments Register_PFAS MEA Rev2.xlsx'. This is hereafter referred to as 'Ramboll's Responses'.

The purpose of this letter is to provide comment on the Validation Report (draft D6) and Ramboll's Responses.

3. Auditor's comments

Based on a review of the Validation Report, and Ramboll's Responses against the requirements specified in the *Guidelines for the NSW Site Auditor Scheme (3rd edition)* (NSW EPA, 2017) and the *Consultants Reporting on Contaminated Land* (NSW EPA, 2020), the following items require clarification or amendments:

- 1. Base of PFAS placement layer:** Ramboll has clarified that in some areas, mixed PFAS/VENM material (i.e. PFAS layer) was placed directly above the natural soil with a layer of VENM in between (e.g. Cross-section 2 to 5 of Appendix 5). It is recommended that this be discussed in Section 10 as it relates to the configuration of the PFAS MEA. (The auditor notes that the validation requirements for PFAS MEA discussed in Section 7 do not include mandatory VENM to be placed between PFAS layer and underlying natural soil.)
- 2. Thickness of overlying VENM:** Based on the discussion provided in Section 10.1.2, it is noted that other than the survey data from the thirteen validation soil bores, there is no survey information provided in the report to confirm the thickness of the overlying VENM across the entire PFAS MEA. We note that the final site surface survey data from February 2021 is available however, there is no definitive survey data for the top of PFAS layer post-placement (i.e. the WEM survey, as stated by Ramboll, "was used as a reference to assist in defining the sampling methodology only"). This limitation will be discussed in the SAR. In addition, this means that there is likely to be a requirement to provide the SAR/SAS to Council. I note that the last SAR/SAS also recommended this.
- 3. Site suitability for proposed land use:** Section 14.3 indicated that one of the reasons an EMP is not required is because "the risk, in the unlikely event disturbance of the PFAS MEA layer was



to occur, is also low if subsequently this material is present at shallower depths." Please clarify this as concentrations from the PFAS layer above NEMP human health residential criteria were reported (refer to Section 10.2.1) if there are pathways for direct and indirect human exposures exist.

4. **EPA Notification:** Section 14.3 has been revised to discuss consultation with EPA. Consider revision of the executive summary associated with EPA consultation.

4. Closure

If you have any comments or questions, please do not hesitate to contact the undersigned at [REDACTED] or via mobile on [REDACTED]

Yours sincerely,

[REDACTED]

[REDACTED]

[REDACTED]

SYS/MP

Technical Limitations and Uncertainty – Ramboll Environ Australia Pty Ltd included limitations in their report. The Interim Audit Advice must also be subject to those limitations. The Auditor has prepared this document in good faith but is unable to provide certification outside of areas over which the Auditor had some control or is reasonably able to check. The Auditor has relied on the documents referenced in preparing the Auditors' opinion. If the Auditor is unable to rely on any of those documents, the conclusions of the audit could change. It is not possible in a Site Audit Report to present all data which could be of interest to all readers of this report. Readers are referred to the referenced reports for further data. Users of this document should satisfy themselves concerning its application to, and where necessary seek expert advice in respect to, their situation.

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28 April 2021

██████████
Defence Housing Australia
Suite 2, Level 2/287 Elizabeth Street
Sydney NSW 2000

Dear ██████████

**Re: Interim Site Audit Advice No. 9: Screening Assessment of
Potential Risks from the PFAS Impacted Soil Layer
PFAS Material Emplacement Area, Nirimba Drive, Schofields NSW**

1. Introduction

As a NSW Environmental Protection Authority (EPA) accredited Contaminated Site Auditor, I have been engaged by Defence Housing Australia (DHA) to undertake a Section B site contamination audit in relation to a PFAS Material Emplacement Area (MEA), Nirimba Drive, Schofields NSW.

PFAS MEA (the site or audit site) is located within a proposed new residential development at Nirimba Drive, Schofields, NSW 2763 (the Nirimba Fields), which is the former Schofields Aerodrome. This non-statutory Audit is to confirm the nature and extent of contamination (limited to PFAS) associated with the PFAS MEA and the appropriateness of the Validation Report to confirm that the emplacement does not pose a risk to human health or the environment.

The site is proposed to be redeveloped into low density residential properties, a road, a primary school and playing fields.

2. Background

The site is located within the Blacktown City Council (Council) area at the centre of the Nirimba Fields.

Ramboll Environ Australia Pty Ltd (Ramboll) were engaged by DHA to undertake investigations to characterise and validate the constructed PFAS MEA, and to draw conclusions regarding the suitability of the site for the proposed low density residential land use.

The table below lists the documents for PFAS MEA provided to auditor for review:

Document	Corresponding Auditor's Interim Advice
Ramboll (2021a) <i>PFAS Validation Report, Former Schofields Aerodrome</i> , draft revision D4, 12 February 2021.	<i>Interim Site Audit Advice No. 1: Detailed Site Investigation</i> , dated 2 March 2021 (ref: S18612_LET01_Rev0)



Document

Corresponding Auditor's Interim Advice

Ramboll (2021b) <i>Former Schofields Aerodrome, Quakers Hill, NSW: Screening Assessment of Potential Risks from the PFAS Impacted Soil Layer</i>, draft D1, 29 January 2021. This is Appendix 8 of the <i>PFAS Validation Report</i>.	<i>Interim Site Audit Advice No. 2: Screening Assessment of Potential Risks from PFAS Impacted Soil Layer</i>, dated 16 March 2021 (ref: S18612_LET02_Rev0)
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Subsequently, the two documents listed in the table above were revised and the auditor was provided with the following document for review:

- Ramboll (2021c) *Former Schofields Aerodrome, Quakers Hill, NSW: Screening Assessment of Potential Risks from the PFAS Impacted Soil Layer*, draft F2 dated 16 April 2021. This is hereafter referred to as the Screening Assessment.

The purpose of this letter is to provide comment on the Screening Assessment (draft F2).

3. Auditor's Comments and Closure

Based on the auditor's review of the revised Screening Assessment, there is no further comment provided for this document. Please finalise the draft memorandum.

If you have any comments or questions, please do not hesitate to contact the undersigned at [REDACTED] or via mobile on [REDACTED]

Yours sincerely,

[REDACTED]

[REDACTED]

[REDACTED]

SYS/MP

Technical Limitations and Uncertainty – Ramboll Environ Australia Pty Ltd included limitations in their report. The Interim Audit Advice must also be subject to those limitations. The Auditor has prepared this document in good faith but is unable to provide certification outside of areas over which the Auditor had some control or is reasonably able to check. The Auditor has relied on the documents referenced in preparing the Auditors' opinion. If the Auditor is unable to rely on any of those documents, the conclusions of the audit could change. It is not possible in a Site Audit Report to present all data which could be of interest to all readers of this report. Readers are referred to the referenced reports for further data. Users of this document should satisfy themselves concerning its application to, and where necessary seek expert advice in respect to, their situation.

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18 May 2021

██████████
Defence Housing Australia
Suite 2, Level 2/287 Elizabeth Street
Sydney NSW 2000

Dear ██████████

**Re: Interim Site Audit Advice No. 13: PFAS MEA Validation
Report (Draft D8)
PFAS Material Emplacement Area, Nirimba Drive, Schofields NSW**

1. Introduction

As a NSW Environmental Protection Authority (EPA) accredited Contaminated Site Auditor, I have been engaged by Defence Housing Australia (DHA) to undertake an Section B site contamination audit in relation to a PFAS Material Emplacement Area (MEA), Nirimba Drive, Schofields NSW.

PFAS MEA (the site or audit site) is located within a proposed new residential development at Nirimba Drive, Schofields, NSW 2763 (the Nirimba Fields), which is the former Schofields Aerodrome. This non-statutory Audit is to confirm the nature and extent of contamination (limited to PFAS) associated with the PFAS MEA and the appropriateness of the Validation Report to confirm that the emplacement does not pose a risk to human health or the environment.

The site is proposed to be redeveloped into low density residential properties, a road, a primary school and playing fields.

2. Background

The site is located within the Blacktown City Council (Council) area at the centre of the Nirimba Fields.

Ramboll Environ Australia Pty Ltd (Ramboll) were engaged by DHA to undertake investigations to characterise and validate the constructed PFAS MEA, and to draw conclusions regarding the suitability of the site for the proposed low density residential land use.

The table below lists the documents for PFAS MEA provided to auditor for review:

Document	Corresponding Auditor's Interim Advice
Ramboll (2021a) <i>PFAS Validation Report, Former Schofields Aerodrome</i> , draft revision D4, 12 February 2021.	<i>Interim Site Audit Advice No. 1: Detailed Site Investigation</i> , dated 2 March 2021 (ref: S18612_LET01_Rev0)



Document	Corresponding Auditor's Interim Advice
Ramboll (2021b) <i>Former Schofields Aerodrome, Quakers Hill, NSW: Screening Assessment of Potential Risks from the PFAS Impacted Soil Layer</i> , draft D1, 29 January 2021. This is Appendix 8 of the <i>PFAS Validation Report</i> .	<i>Interim Site Audit Advice No. 2: Screening Assessment of Potential Risks from PFAS Impacted Soil Layer</i> , dated 16 March 2021 (ref: S18612_LET02_Rev0)
Ramboll (2021c) PFAS Validation Report, Former Schofields Aerodrome, draft revision D5 dated 5 March 2021. Ramboll (2021d) Former Schofields Aerodrome, Quakers Hill, NSW: Screening Assessment of Potential Risks from the PFAS Impacted Soil Layer, draft D2 dated 22 March 2021. This is Appendix 8 of the <i>PFAS Validation Report</i> and hereafter referred to as the Screening Assessment.	<i>Interim Site Audit Advice No. 6: PFAS Validation Report (Draft D5) and Screening Assessment of Potential Risks from PFAS Impacted Soil Layer (Draft D2)</i> , dated 30 March 2021 (ref: S18612_LET06_Rev0)
Ramboll (2021e) <i>PFAS Validation Report, Former Schofields Aerodrome</i> , draft revision D6 dated 8 April 2021	<i>Interim Site Audit Advice No. 8: PFAS Validation Report (Draft D6)</i> , dated 13 April 2021 (ref: S18612_LET08_Rev0)

Subsequently, the Validation Report was revised, and the auditor was provided with the following documents for review:

- Ramboll (2021f) *PFAS MEA Validation Report, Former Schofields Aerodrome*, draft revision D8 dated 3 May 2021. This is hereafter referred to as the Validation Report.
- Ramboll's responses to auditor's comments from Interim Site Audit Advice No. 8, provided in spreadsheet titled 'Auditor Comments Register_PFAS MEA Rev3.xlsx'. This is hereafter referred to as 'Ramboll's Responses'.

The purpose of this letter is to provide comment on the Validation Report (draft D8) and Ramboll's Responses.

3. Auditor's Comments

Based on a review of the Overview Letter and Ramboll's Responses, the follow minor amendments and clarification are requested to assist with the preparation of the Site Audit Statement and Site Audit Report:

1. **VENM thickness:** It is recommended that Figure 8 and 9 of PFAS Assessment Overview Letter (Draft D4) showing the VENM thickness at the former aerodrome (including PFAS MEA) be included in the Validation Report; and clarification be presented within the report to explain how the figures were compiled.
2. **Council development approval:** Please confirm whether development approval from Blacktown Council is required for excavations greater than 0.6 m or 3 m within the residential development. Section 12.3 indicated 3 mbgl, however, Ramboll's Responses indicated 0.6 mbgl.
3. **Survey boundary of PFAS MEA:** Please provide a survey plan (eastings and northings) of the PFAS MEA (i.e. audit site).



4. Closure

Please address the minor comments above and finalise the Validation Report.

If you have any comments or questions, please do not hesitate to contact the undersigned at [REDACTED] or via mobile on [REDACTED]

Yours sincerely,

[REDACTED]

[REDACTED]

[REDACTED]

SYS/MP

Technical Limitations and Uncertainty – Ramboll Environ Australia Pty Ltd included limitations in their report. The Interim Audit Advice must also be subject to those limitations. The Auditor has prepared this document in good faith but is unable to provide certification outside of areas over which the Auditor had some control or is reasonably able to check. The Auditor has relied on the documents referenced in preparing the Auditors' opinion. If the Auditor is unable to rely on any of those documents, the conclusions of the audit could change. It is not possible in a Site Audit Report to present all data which could be of interest to all readers of this report. Readers are referred to the referenced reports for further data. Users of this document should satisfy themselves concerning its application to, and where necessary seek expert advice in respect to, their situation.

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Appendix D: List of Street Addresses and Current/Proposed Land Parcels within the PFAS MEA (as of 6 April 2021)



Street Address	Primary Plan/Lot Plan	Development Stage Reference	Type
14 Dolphin Street, Nirimba Fields NSW 2763	2240/DP1252015	Stage 3	Constructed
16 Dolphin Street, Nirimba Fields NSW 2763	2241/DP1252015	Stage 3	Constructed
9 Swordfish Street, Nirimba Fields NSW 2763	2318/DP1252016	Stage 3	Constructed
11 Swordfish Street, Nirimba Fields NSW 2763	2317/DP1252016	Stage 3	Constructed
13 Swordfish Street, Nirimba Fields NSW 2763	2316/DP1252016	Stage 3	Constructed
15 Swordfish Street, Nirimba Fields NSW 2763	2315/DP1252016	Stage 3	Constructed
17 Swordfish Street, Nirimba Fields NSW 2763	2314/DP1252016	Stage 3	Constructed
To be announced (TBA)	6318/DP1266450	Stage 6d	Under construction
TBA	6318/DP1266450	Stage 6d	Under construction
TBA	6319/DP1266450	Stage 6d	Under construction
TBA	6320/DP1266450	Stage 6d	Under construction
TBA	6328/DP1266450	Stage 6d	Under construction
TBA	6329/DP1266450	Stage 6d	Under construction
TBA	6330/DP1266450	Stage 6d	Under construction
TBA	6331/DP1266450	Stage 6d	Under construction
TBA	6332/DP1266450	Stage 6d	Under construction
TBA	6333/DP1266450	Stage 6d	Under construction
TBA	6334/DP1266450	Stage 6d	Under construction
TBA	6335/DP1266450	Stage 6d	Under construction



Street Address	Primary Plan/Lot Plan	Development Stage Reference	Type
TBA	6336/DP1266450	Stage 6d	Under construction
TBA	6337/DP1266450	Stage 6d	Under construction
TBA	6338/DP1266450	Stage 6d	Under construction
TBA	6339/DP1266450	Stage 6d	Under construction
TBA	6405/DP1267749	Stage 6e	Under construction
TBA	6406/DP1267749	Stage 6e	Under construction
TBA	6407/DP1267749	Stage 6e	Under construction
TBA	6408/DP1267749	Stage 6e	Under construction
TBA	6409/DP1267749	Stage 6e	Under construction
TBA	6410/DP1267749	Stage 6e	Under construction
TBA	6411/DP1267749	Stage 6e	Under construction
TBA	6412/DP1267749	Stage 6e	Under construction
TBA	6413/DP1267749	Stage 6e	Under construction
TBA	6414/DP1267749	Stage 6e	Under construction
TBA	6415/DP1267749	Stage 6e	Under construction
TBA	6416/DP1267749	Stage 6e	Under construction
TBA	6417/DP1267749	Stage 6e	Under construction
TBA	6418/DP1267749	Stage 6e	Under construction
TBA	6419/DP1267749	Stage 6e	Under construction



Street Address	Primary Plan/Lot Plan	Development Stage Reference	Type
TBA	6420/DP1267749	Stage 6e	Under construction
TBA	6421/DP1267749	Stage 6e	Under construction
980 - District Park – Unique Property Reference Number (UPRN) - 4967086		Stage 6G	Part of residual lot
School Site - UPRN - 4967127		Stage 6G	Part of residual lot

Source: Data provided by DHA to the auditor on 6 April 2021.



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