



Site Audit Report

Former Sewage Treatment Plant and Landfill 2, Former Schofields
Aerodrome, Triton Parade, Nirimba Fields, NSW 2763

Audit Number: MP169_04

6 March 2023



Document Information

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Nirimba Fields, NSW 2763
Audit Number: MP169_04**

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Contents

List of Acronyms	v
1.0 Introduction.....	1
1.1 Audit Objective	1
1.2 Scope of the Audit.....	1
1.3 Audit Exclusions	3
1.4 Previous Site Audit.....	3
2.0 Site Details.....	4
2.1 Location.....	4
2.2 Zoning.....	4
2.3 Adjacent Uses.....	4
2.4 Current Site Condition.....	4
2.5 Proposed Development.....	5
3.0 Site History	6
4.0 Summary of Previous Audits and Environmental Investigations	8
5.0 Environmental Setting.....	11
5.1 Stratigraphy.....	11
5.2 Hydrogeology	11
5.3 Surface water.....	13
5.4 Auditor's Opinion	13
6.0 Evaluation of Quality Assurance and Quality Control	14
7.0 Environmental Quality Criteria.....	18
7.1 Soil.....	18
7.2 Water	18
7.3 Consultants Environmental Quality Criteria.....	19
8.0 Evaluation of Soil Analytical Results	20
8.1 Soil Analytical Results.....	20
8.1.1 Sewage Treatment Plant (STP).....	20
8.1.2 Landfill 2.....	20
8.1.3 Leachate Analysis	21
8.2 Auditor's Opinion	22



9.0	Evaluation of Groundwater Analytical Results	23
9.1	Groundwater Analytical Results	23
9.2	Auditor's Opinion	24
10.0	Evaluation of Surface Water Analytical Results	25
10.1	Surface Water Analytical Results	25
10.2	Auditor's Opinion	26
11.0	Evaluation of Conceptual Site Model	27
12.0	Assessment of Risk	28
13.0	Contamination Migration Potential	29
14.0	Compliance with Regulatory Guidelines and Directions	30
14.1	Notification	30
14.2	Development Approvals	30
14.3	Waste Disposal	30
14.4	VENM and Other Imported Materials	30
14.5	Licenses	30
15.0	Conclusions and Recommendations	31
16.0	Other Relevant Information	32

Tables in text

Table 4-1: Summary of audit and assessment events	8
Table 5-1: Generalised Stratigraphy (Ramboll 2023)	11
Table 5-2: Site-Specific Hydrogeology for Nirimba Fields (including the audit site)	12
Table 6-1: Summary of Investigations	14
Table 6-2: QA/QC – Sampling and Analysis Methodology Assessment	14
Table 6-3: QA/QC – Field and Lab Quality Assurance and Quality Control	16
Table 7-1: Soil Environmental Quality Criteria	18
Table 7-2: Water Environmental Quality Criteria	19
Table 8-1: Summary of STP Soil Results	20
Table 8-2: Summary of Landfill 2 Soil Results	21
Table 8-3: Statistical summary of PFOS leachate concentrations	21
Table 9-1: Summary of Groundwater Analytical Results	23
Table 10-1: Surface Water Sampling Rounds	25
Table 10-2: Summary of Surface Water Analytical Results	26
Table 11-1: Review of the Conceptual Site Model	27



Appendices

Appendix A: Attachments

Appendix B: EPA Guidelines

Appendix C: Interim Site Audit Advice



List of Acronyms

Acronym	Definition	Acronym	Definition
Measures		ASLP	Australian Standard Leaching Procedure
%	per cent	BH	Borehole
µg/L	Micrograms per Litre	CEMP	Construction Environmental Management Plan
ha	Hectares	CLM Act	NSW Contaminated Land Management Act 1997
km	Kilometres	COC	Chain of Custody
m	Metres	CSM	Conceptual Site Model
mAHD	Metres Australian Height Datum	DHA	Defence Housing Australia
mbgl	Metres Below Ground Level	DP	Deposited Plan
mbtoc	Metres Below Top of Casing	DQI	Data Quality Indicator
mg/kg	Milligrams per Kilogram	DQO	Data Quality Objective
mg/L	Milligrams per Litre	EMP	Environmental Management Plan
mV	Millivolts	EPA	NSW Environment Protection Authority
µS/cm	Micro Siemens per Centimetre	FFTA	Former Fire Training Area
General		HDPE	High Density
AEC	Area of Environmental Concern	HEPA	Heads of Environmental Protection Authorities
AFFF	Aqueous Film Forming Foam	HIL	Health Investigation Level
ANZECC	Australia and New Zealand Environment Conservation Council	IAA	Interim Audit Advice
ANZG	Australian and New Zealand Guidelines	LF2	Landfill 2
ARMCANZ	Agriculture and Resources Management Council of Australia and New Zealand	MEA	Material Emplacement Area
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure	MW	Monitoring Well



Acronym	Definition
NATA	National Association of Testing Authorities
NEMP	National Environmental Management Plan
NHMRC	National Health and Medical Research Council
NSW	New South Wales
PFAS	Per-and poly-fluoroalkyl substances
PFHpS	Perfluoroheptanesulfonic acid
PFHxS	Perfluorohexane sulfonate
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonate
pH	A measure of acidity, hydrogen ion activity
PID	Photoionisation detector
PQL	Practical Quantitation Limit

Acronym	Definition
QA/QC	Quality Assurance/Quality Control
RAAF	Royal Australian Air Force
RAN	Royal Australian Navy
SAQP	Sampling Analysis and Quality Plan
SAR	Site Audit Report
SAS	Site Audit Statement
SEPP	State Environmental Planning Policy
STP	Sewage Treatment Plant
UCL	Upper Confidence Limit
USEPA	United States Environmental Protection Agency
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 former Sewage Treatment Plant (STP) and Landfill 2 (LF2) located within a new residential development at the new suburb of Nirimba Fields (Nirimba Fields), New South Wales (NSW) 2763.

As shown in Attachment 1 and 2 (**Appendix A**), the former STP and LF2 (the site or audit site) is located at the south-western corner of the Nirimba Fields housing estate. The larger Nirimba Fields housing estate has an approximate total area of 135 hectares, and it was previously the Schofields Aerodrome. The audit site is approximately 3.68 hectares. It should be noted that LF2 extended off-site, but this audit only covers the western portion LF2 located within the former Schofields Aerodrome (refer to Attachment 1 and 2 (**Appendix A**)).

External to the audit site (i.e., STP and LF2), the former Schofields Aerodrome comprises of the following areas:

- Already developed/sold residential lots.
- Per- and polyfluoroalkyl substances (PFAS) Material Emplacement Area (MEA).
- Former fire flight training area (FFTA).
- No Scrape Area, North of Swale.
- No Scrape Area, South.
- PFAS Remaining Site Area.

1.1 Audit Objective

The audit was conducted to provide an independent review by an Environment Protection Authority (EPA) accredited site auditor of whether the nature and extent of PFAS contamination at the audit site has been appropriately determined and to assess the suitability and appropriateness of the validation report prepared for the audit site, 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).

The audit is voluntary and is not being undertaken as part of an existing development application (DA) and is therefore non-statutory.

1.2 Scope of the Audit

Details of the audit are:

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

Request/Commencement Date: 11 February 2021

Auditor: [REDACTED]

Accreditation No.: [REDACTED]

The scope of the audit included:

- Review of the following reports:
 - PFAS Assessment Overview Letter - Former Schofields Aerodrome/Nirimba Fields, Quakers Hill NSW, draft D5, prepared by Ramboll dated 21 May 2021 (referred to as 'Ramboll 2021a').
 - Sampling and Analysis Quality Plan, Remaining Site Area PFAS Validation, Former Schofields Aerodrome, draft D4, prepared by Ramboll dated 21 July 2021 (referred to as 'Ramboll 2021d').



- PFAS Validation Report - Former Schofields Aerodrome Remaining Site Area, final F1, prepared by Ramboll dated 21 October 2021 (referred to as 'the PFAS Remaining Site Area Validation Report' or 'Ramboll 2021e').
- Sampling, Analysis & Quality Plan - Former Sewage Treatment Plant (STP) and Landfill 2 Supplementary Investigations, draft D1, prepared by Ramboll dated 17 March 2022 (referred to as 'Ramboll 2022b' or 'the SAQP').
- Addendum Report, Former Schofields Aerodrome - Sewage Treatment Plant and Former Landfill 2 Supplementary Investigation, draft D1, prepared by Ramboll dated 31 May 2022 (referred to as 'Ramboll 2022c').
- PFAS Validation Report - Former Schofields Aerodrome Sewage Treatment Plant and Former Landfill 2, Revision D2, prepared by Ramboll dated 19 August 2022 (referred to as 'Ramboll 2022d').
- PFAS Validation Report - Former Schofields Aerodrome Sewage Treatment Plant and Former Landfill 2, Revision D3, prepared by Ramboll dated 6 October 2022 (referred to as 'Ramboll 2022e').
- PFAS Validation Report - Former Schofields Aerodrome Sewage Treatment Plant and Former Landfill 2, Revision F1, prepared by Ramboll dated 7 February 2023 (referred to as 'Ramboll 2023' or 'the Validation Report')
- The following reports were provided to the auditor for information only as these were prepared either prior to the auditor's engagement for the wider Nirimba Fields; or prepared for areas external to 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').
 - 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 MEA Validation Report, Former Schofields Aerodrome, final, revision F1, prepared by Ramboll 21 May 2021 (referred to as 'Ramboll 2021b').
 - PFAS Validation Report, Former Schofields Aerodrome – No Scrape Area, North of Swale, final, revision F1, prepared by Ramboll dated 22 June 2021 (referred to as 'Ramboll 2021c').
 - Remediation Action Plan, Former Schofields Aerodrome, No Scrape Area, South, draft D3, prepared by Ramboll dated 12 January 2022 (referred to as 'Ramboll 2022a').
- A site visit by the auditor conducted on 3 March 2023.
- Discussions with DHA and Ramboll who undertook the investigation and validation works.

During the course of the audit, letters of Interim Audit Advice (IAA) were issued by the auditor. IAA specific for the audit site only are provided in **Appendix C**:

- Interim Site Audit Advice No. 23 dated 22 March 2022.
- Interim Site Audit Advice No. 24 dated 7 June 2022.
- Interim Site Audit Advice No. 25 dated 15 September 2022.
- Interim Site Audit Advice No. 26 dated 17 October 2022.



1.3 Audit Exclusions

The following aspects of the environment or items are excluded from this Section B site contamination audit:

- Only the nature and extent of PFAS contamination at the former STP and LF2 (the audit site) associated with historical site activities and site use as an aerodrome, 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 1.4**).
- Only the former STP and the western portion of the former LF2 (the audit site) are assessed as part of this audit. All other areas within the wider Nirimba Fields housing estate and the eastern off-site portion of former LF2 are excluded such as:
 - Already developed/sold residential lots.
 - PFAS MEA
 - FFTA
 - No Scrape Area, North of Swale.
 - No Scrape Area, South.
 - PFAS Remaining Site Area.
- The validation and review of the surplus or waste material generated or removed from the audit site.

1.4 Previous Site Audit

The former Schofields aerodrome (including the audit site, PFAS MEA, FFTA, 'No Scrape Area' and PFAS Remaining Site Area) were previously audited by another auditor and a Section A Site Audit Report and a Site Audit Statement (GN481) were issued in September 2013:

- Site Audit Report – Part of Former Schofields Aerodrome, Lot 400 in DP1171596, audit number GN481, prepared by ENVIRON Australia Pty Ltd (Environ). This is referred to as 'Environ 2013'.

In the wider Nirimba Fields housing estate, three Site Audit Reports and Site Audit Statements have recently been completed by the auditor for areas external to the audit site to date:

- Site Audit Report, PFAS MEA, Former Schofields Aerodrome, off Mariner Avenue, Schofields, NSW 2762 and Site Audit Statement dated 22 June 2021 (reference: MP169_01).
- Site Audit Report, No Scrape Area, North of Swale, Former Schofields Aerodrome, off Mariner Avenue, Schofields NSW 2762 and Site Audit Statement dated 25 June 2021 (reference: MP169_02).
- Site Audit Report, Remaining Site Area, Former Schofields Aerodrome, off Mariner Avenue, Schofields NSW 2762 and Site Audit Statement dated 22 October 2021 (reference: MP169_03).



2.0 Site Details

2.1 Location

The audit site locality is shown on Attachment 1, and 2 (**Appendix A**).

The site details are as follows:

Street address: Former Schofields Aerodrome, Triton Parade, Nirimba Fields NSW 2763.

Identifier: Part Lot 2 Deposited Plan (DP) 1285594

Local Government: Blacktown City Council

Owner: DHA

Audit Area: Approximately 3.68 ha

A survey plan of the audit site is provided as Attachment 12 (**Appendix A**).

2.2 Zoning

In accordance with the Blacktown Local Environmental Plan 2015 (current version for 1 December 2022 to date), the current zoning of the site is:

- SP2 - Infrastructure
- C2 – Environmental Conservation The riparian corridor of Eastern Creek zoned as ‘C2 – Environmental Conservation’ is shown in Attachment 9 and 10 (Appendix A) which were prepared in 2019 as the former land zone ‘E2 – Environmental Conservation’.

2.3 Adjacent Uses

Based on the information provided in the Validation Report, the surrounding site uses include:

- North – Vacant land (grass covered vegetation) used as sediment basin as part of the Nirimba Fields housing estate’s public open space. There is a drainage swale drain located to the north of LF2 which channels stormwater from the developed residential areas located north-east of the audit site to the sediment basin located north of the site.
- East – Access road and off-site vacant land (cleared field) which was part of the former Schofields Aerodrome.
- South – Eastern Creek, riparian vegetation and Stonecutters Ridge Golf Club.
- West – Eastern Creek, Stonecutters Ridge Golf Club and a new residential development.

The closest sensitive ecological receptor was Eastern Creek located along the western and southern site boundary. Previous site drainage channels of the former aerodrome had been filled in. Eastern Creek forms part of the South Creek Catchment that flows into the Hawkesbury River approximately 12.8 km north-northwest of the site.

2.4 Current Site Condition

The Validation Report indicated that the audit site was vacant land (open space and riparian zone of Eastern Creek). Site photographs of the STP and Eastern Creek from January, February and March 2022 are provided in Appendix A of the Validation Report and an aerial photograph of the audit site from October 2021 is provided as the background of Attachment 1 and 2 (**Appendix A**).



The audit site was free of stockpiled soil. There is a road (extension of Colebee Street) located on-site orientated roughly northwest-southeast separating STP from LF2.

Low-density residential houses and suburban access roads had been constructed at the Nirimba Fields housing estate to the north-east of the audit site.

At the time of the auditor's site visit on 3rd March 2023, conditions were generally consistent with those noted in the Validation Report i.e., vegetated open space. Part of the riparian corridor had been cleared of weeds with replanting works associated with the Voluntary Planning Agreement being undertaken at the time of the site visit. Some surface debris (plastic waste) was noted over the surface adjacent to the banks of the creek in the cleared areas.

2.5 Proposed Development

As shown in Attachment 9 and 10 (**Appendix A**), the former Schofields Aerodrome was being developed into a new residential estate called Nirimba Fields. The development master plan provided as Attachment 11 (**Appendix A**) for Nirimba Fields comprised residential lots, a primary school, playing fields, netball courts, parkland and commercial/retail facilities.

The audit site is proposed to remain as open space and as a riparian zone of Eastern Creek. For the purposes of this audit, the land use scenario was assumed as 'public open space' land use.



3.0 Site History

The high-level site history of the former Schofields Aerodrome was summarised in the Validation Report (Ramboll 2023) and PFAS Assessment Overview Letter (Ramboll 2021a) 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 purposes at the FFTA. A separate section of the former aerodrome was used as a migrant hostel. A piggery, 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.
- 1999 – Demolition of the former infrastructures at STP.
- 2002 – Remediation works undertaken at STP and three former landfills, including LF2. LF2 waste was excavated, screened and removed off-site to a licensed landfill.
- 2018 to current – Land clearing to facilitate construction of the Nirimba Fields residential estate which included land surface raising earthworks to mitigate flooding risk from Eastern Creek.

The audit site was previously the STP and a landfill. It was understood that PFAS-contaminated material may have been treated or present in the audit site. Prior to use as a STP and or a landfill, the audit site had not been developed. The site has been vacant since the early 2000s after the completion of the decommissioning and/or remediation works.

Ramboll (2021a) reported the following information about the historical activities undertaken at the audit site:

- The STP mainly treated effluent as follows:
 - External sources to the former aerodrome – former RAN apprentice training facility or campus located south-east of the audit site which operated from 1956 to 1993. After 1993, the training facility became the Blacktown campus of the University of Western Sydney.
 - Internal sources of the former aerodrome - former hangar building and associated amenity buildings.
- LF2 was filled with the following waste:
 - Domestic non-putrescible waste.
 - Car parts.
 - Metal pipes and sheets.
 - Asbestos cement sheet fragments mixed with soil.



The following remediation works were reported to have been conducted at the audit site in 2002 (Ramboll 2021a):

- STP – Demolition of STP infrastructure (such as the pump house, clarifier and sedimentation tanks) and excavation and off-site disposal of metal, asbestos and organic compound contaminated material. The filtered STP media was excavated and placed as a stockpile at the northern portion of the former aerodrome (i.e., outside the audit site) as discussed in the Site Audit Report for Remaining Site Areas dated 22 October 2021 (SAS MP169_03).
- LF2 – Landfilled waste material was excavated, screened via a trommel screen and disposed off-site to a licensed landfill. Of the excavated material screened, approximately 55% was validated and used to backfill the excavation at depths greater than 1 m. Clean validated Virgin Excavated Natural Material (VENM) was then imported and used as backfill above the screened material.

Historic photographs of STP and LF2 are presented in Attachment 4 of the PFAS Assessment Overview Letter (Ramboll 2021a).

Based on Figure 7 of PFAS Validation Report for Former Schofields Aerodrome Remaining Site Area (Ramboll 2021e), scraped topsoil from the original ground surface of the Remaining Site Areas (i.e., main housing estate located north-east of audit site) was not applied over the audit site.

In the auditor's opinion, the site history review conducted provides an adequate indication of past activities. The auditor notes that the remedial activities conducted in 2002 did remove the primary sources of PFAS contamination (i.e. landfill waste in LF2 and treated sewage media at STP) from the audit site, even though validation for removal of PFAS impacts was not undertaken.



4.0 Summary of Previous Audits and Environmental Investigations

A summary of the audit and environmental investigations conducted to date that are relevant to the audit site (as well as the wider former Schofields Aerodrome) is presented in **Table 4-1**.

Table 4-1: Summary of audit and assessment events

Date	Activity	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 was 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	<u>No Scrape Area (FFTA)</u> A targeted PFAS environmental assessment was conducted at the FFTA because AFFF was used. This included soil, sediment, and shallow groundwater testing within and around the FFTA. The PFAS impacted soil from FFTA has been placed in PFAS MEA external to the current audit site.	Ramboll 2017.
May 2018	<u>No Scrape Area (FFTA)</u> 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 could be excavated, mixed with geotechnically suitable VENM soil (because of its high organic content) and placed at PFAS MEA.	Ramboll 2018.



Date	Activity	Reference
May 2018 to December 2020	<u>No Scrape Area and PFAS MEA</u> Excavation of material from FFTA and 'No Scrape Area' and placement of material into PFAS MEA.	Ramboll 2021b.
December 2020	<u>PFAS MEA</u> Validation works conducted of PFAS MEA on 9 and 10 December 2020. This included advancement of 14 soil bores (via push tubes drilling method) and collection and analysis of soil validation samples for PFAS compounds.	Ramboll 2021b.
March to April 2021	<u>No Scrape Area North of Swale</u> Validation works conducted on 'No Scrape Area North of Swale' area on 30 March and 1 April 2021. This included advancement of 17 soil bores (via push tube drilling method) and collection and analysis of soil validation samples for PFAS compounds.	Ramboll 2021c.
March to June 2021	<u>PFAS Remaining Site Area (including STP and LF2)</u> A desktop site history review was conducted to identify potential PFAS-associated activities or PFAS sources at the former aerodrome. This work identified eight areas of environmental concern (AECs) (which included former STP and LF2) which warranted further investigation. A Sampling and Analysis Quality Plan (SAQP) was prepared to detail the soil and groundwater assessment and validation program.	Ramboll 2021a and 2021d.
June to September 2021	<u>PFAS Remaining Site Area (including STP and LF2)</u> Validation works conducted at the PFAS Remaining Site Area between 28 June 2021 and 2 September 2021. The auditor notes that the investigation covered an area larger than the audit site. This included collection and analysis of the following samples for PFAS compounds: - soil samples at 407 locations (including 206 new soil bores and 12 new groundwater monitoring bores) across eight AECs, background areas, 'finished' topsoil (at current site surface) and stockpiles of scraped topsoil (from former site surface). Of the 407 locations, 18 sampling locations were at the former STP and 22 sampling locations at former LF2 (i.e., a total of 40 sampling locations within the audit site). 13 groundwater samples from 12 newly-installed groundwater monitoring bores (MW01 to MW12) and one existing monitoring bore (MW13). Soil bore PLF_BH100 was converted into MW12. The existing bore MW13 was not installed by Ramboll and it is an unknown bore as there is no documentation or information available for this bore. Ramboll considered MW13 to be serviceable and it was gauged and sampled. Of the 13 groundwater monitoring bores assessed, only MW08 is located within the audit site. The PFAS Remaining Site Area Validation Report (Ramboll 2021e) concluded that <i>"risks to ecological health may be present in the STP area where exceedances of the ecological indirect exposure guideline were reported and the extent of impact was not delineated. Further assessment in this area would be required to quantify the potential risks to ecological health."</i>	Ramboll 2021e.



Date	Activity	Reference
December 2021 to April 2022	<u>Former STP and LF2 (i.e. audit site)</u> A SAQP was prepared to conduct further investigation recommended in the PFAS Remaining Site Area Validation Report (Ramboll 2021e) and the site investigation undertaken was reported in the Addendum Report. This included (refer to Attachment 2, 5.1 and 5.2, Appendix A): • Advancement of 4 hand-auger boreholes (LF2_HA01 to LF2_HA04) adjacent to LF2. • Advancement of 12 hand-auger boreholes (STP_HA01 to STP_HA12) along Eastern Creek shoreline downslope of STP and LF2. • Four rounds of surface water grab sampling at three locations along Eastern Creek to assess the surface water quality. Sampling was conducted on 23 December 2021, 25 January 2021, 23 February 2022 and 25 March 2022 (noting that not all locations were sampled each round): ▪ EC_SW01 – Eastern Creek down-stream of the audit site. ▪ EC_SW02 – A tributary of Eastern Creek up-stream of the audit site. Selected due to the inaccessibility of sampling locations immediately up-stream of the audit site. ▪ EC_SW03 – Eastern Creek approximately 1.2 km up-stream of the audit site. Selected due to the inaccessibility of sampling locations immediately up-stream of the audit site.	Ramboll 2022b, 2022c and 2023



5.0 Environmental Setting

Following a review of the reports provided, a summary of the site stratigraphy, hydrogeology and hydrology was compiled as follows.

5.1 Stratigraphy

Ramboll (2023) reported that the geology at the audit site comprised alluvial sediments consisting of gravel, sand, silt and clay at the surface (around 4 to 6 m thick) overlying Bringelly Shales of the Wianamatta Group. This is consistent with the sub-surface stratigraphy encountered during validation works as summarised in **Table 5-1**.

Table 5-1: Generalised Stratigraphy (Ramboll 2023)

Approximate Depth (mbgl)	Subsurface Profile
Bank of Eastern Creek	
0.0 to 0.15	FILL (reworked natural soil): light brown to brown silty clay, minor rootlets. Anthropogenic waste such as golf balls and plastic wrappings were identified near the creek and they may be deposited during flooding events.
0.15 to 1	CLAY: orange, brown, moist to very moist and some rootlets.
Within STP and LF2	
0 to 1.5	FILL (reworked natural soil): silty CLAY, damp to moist, occasional granite and ironstone fragments, some anthropogenic waste present on surface.
1.5 to 3 (maximum depth of assessment)	Silty CLAY: dark brown, brown, orange, minor rootlets, moist.

Foundations of a former road were encountered at approximately 0.2 mbgl near the current asphalt road present on-site (extension of Colebee Street).

No VENM was imported and placed at the audit site to raise the ground surface (refer to Figure 7 of the PFAS Remaining Site Area Validation Report; Ramboll 2021e).

5.2 Hydrogeology

As indicated in **Table 4-1**, 12 new groundwater monitoring bores (MW01 to MW12) were installed in 2021 within the wider Nirimba Fields. Together with a previously unidentified bore (labelled as MW13 by Ramboll), a total of 13 bores were gauged and sampled.

None of the 13 groundwater monitoring bores are located within the audit site. As indicated in Attachment 6 (**Appendix A**), MW08 is located closest to the audit site. Therefore, for an overall understanding of the groundwater regime, the groundwater data from the wider Nirimba Fields was reviewed. Summary of hydrogeological setting is presented in **Table 5-2**.

**Table 5-2: Site-Specific Hydrogeology for Nirimba Fields (including the audit site)**

Aspect	Details
Saturated Geological Layers	Clay, silty clay, weathered shale.
Depth to Water	0.88 mbtoc in MW03 to 5.74 mbtoc in MW11 (2.33 mbtoc in MW08).
Groundwater elevation	15.51 mAHD in MW04 to 25.54 mAHD in MW02 (17.23 mAHD in MW08).
Hydraulic Conductivity	0.0002 m/day (average literature value for clay materials based on Domenico and Schwartz 1990).
Effective Porosity	6% (literature value for clay materials based on Heath 1983).
Groundwater calculated velocity	0.000002 m/day.
Interpreted Flow Direction	Overall, west towards Eastern Creek (with a north-westerly flow inferred at the audit site). Refer to Attachment 7 (Appendix A).
Groundwater Quality	- Dissolved oxygen ranged from 0.28 mg/L (MW08) to 3.88 mg/L (MW02). - Electrical conductivity ranged from 619 μS/cm (MW08) to 28,134 μS/cm (MW03). Calculated total dissolved solids ranged from 403 mg/L (MW08) to 18,284 mg/L (MW03) – average 9,325 mg/L and median 10,569 mg/L which indicated that the groundwater is too saline to be used for drinking water purposes. - Redox potential ranged from 96.4 mV (MW08) to 124.2 mV (MW03). - pH ranged from 6.31 (MW05) to 7.33 (MW08). - Temperature ranged from 14.3 °C (MW09) to 20.2 °C (MW05) with 16.4 °C at MW08.

Note:

Data from July 2021 groundwater assessment conducted at the wider Nirimba Fields (Ramboll 2021e)

A review of NSW registered bore database conducted by Ramboll in 2021 identified that no registered groundwater extraction bores were documented within a 1 km of the audit site boundary (refer to Appendix H of the PFAS Remaining Site Area Validation Report). All registered bores within 1 km were for monitoring purposes. The search conducted by Ramboll reported similar results in 2022 (refer to Appendix F of the Validation Report).

The auditor notes that:

- The groundwater elevations (approximately 16 to 26 mAHD) measured in July 2021 at Nirimba Fields were generally consistent with the elevations observed in 2017 (approximately 18 to 21 mAHD).
- The lowest salinity measured, based on total dissolved solids, was at MW08 and MW09 located adjacent to Eastern Creek. This suggests that the groundwater/surface water interaction may be occurring at the riparian area beside Eastern Creek, which includes part of the audit site. Ramboll (2021e) inferred that the low salinity at MW08 and MW09 may be because Eastern Creek is a losing stream.
- The auditor acknowledges that groundwater is unlikely to be extracted for use at the site (which is proposed for recreational use) due to the high salinity and low yield of the aquifer.



5.3 Surface water

There is no surface water body located in the audit site. Eastern Creek is located at the western and southern boundaries of the audit site. This creek is part of South Creek Catchment and it flows towards the north, past the wider Nirimba Fields and discharges into the Hawkesbury River approximately 12.8 km to the north-northwest. Upstream of Nirimba Fields, Eastern Creek is reported to flow past industrial sites (including Eastern Creek landfill).

Water from Eastern Creek was not documented in the Validation Report to be extracted for human consumption, irrigation or preparation of food products. Ramboll (2023) indicated that there is potential that parts of Eastern Creek may be occasionally used for recreational swimming purposes.

Surface water from Eastern Creek and its tributary was sampled four times between December 2021 and March 2022 (refer to **Table 4-1**) and the following physiochemical parameters (measured ex-situ) were observed:

- Dissolved oxygen – 3.5 to 5.5 mg/L.
- Electrical conductivity – 163 to 1,231 $\mu\text{S}/\text{cm}$ (approximately 105 to 788 mg/L salinity).
- pH – 7.3 to 8.0 pH unit.
- Redox – -21.5 to 179.4 mV.
- Temperature – 20 to 26° C.

5.4 Auditor's Opinion

The auditor considers that adequate stratigraphic, hydrogeological and hydrological information has been provided to provide context for the audit to characterise the audit site.



6.0 Evaluation of Quality Assurance and Quality Control

The auditor has assessed the overall quality of the data by reviewing information presented in the following reports supplemented by field observations:

- The Validation Report (Ramboll 2023).
- PFAS Validation Report - Former Schofields Aerodrome Remaining Site Area (Ramboll 2021e).

Table 6-1 presents a summary of the field investigation undertaken for this audit.

Table 6-1: Summary of Investigations

Investigation	Attachments in Appendix A	Media	Analytical Data Obtained
Supplementary investigation (Ramboll 2023)	Attachment 3 and 4	Soil	PFAS
	Attachment 5.1 and 5.2	Surface water	PFAS
Part of site-wide investigation (Ramboll 2021e)	Attachment 3	Soil	PFAS
	Attachment 6 and 7	Groundwater	PFAS

The auditor notes that soil data from STP and LF2 collected pre-December 2021 as part of the site-wide investigation reported in PFAS Validation Report - Former Schofields Aerodrome Remaining Site Area (Ramboll 2021e) was presented together with the data from the wider Nirimba Fields. This dataset was reviewed by the auditor as part of the audit of Remaining Site Area (completed in October 2021 as discussed in **Section 1.4**) and the data was concluded to be generally accurate and reliable for the purpose of an audit. For brevity, this dataset was not reviewed again in this audit report.

At the time of sampling, the NSW EPA 1995 Sampling Guideline was current and was applied accordingly. The auditor notes that since that time, that the new NSW EPA Sampling Guidelines (August 2022) were issued in August 2022. The new guidelines were not applied during this audit however given the proposed use as ongoing open space recreational uses and extent of the investigations, the auditor considers that the sampling densities are adequate. The auditor's quality assurance / quality control (QAQC) review of the supplementary investigation conducted in December 2021 and early 2022 is summarised in **Table 6-2** and **Table 6-3**.

Table 6-2: QA/QC – Sampling and Analysis Methodology Assessment

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
Data Quality Objectives (DQO) Ramboll (2022b and 2023) defined specific DQOs in accordance with the seven steps process outlined in NSW EPA (2017) Guidelines for the NSW Site Auditor Scheme.	The DQOs presented in the Ramboll SAQP and Validation Report are considered appropriate for the investigations undertaken.
Sampling pattern, locations, and sampling density Soil and surface water sampling was undertaken in accordance with the SAQP for the site (Ramboll 2022b).	The number of sampling locations specified in the SAQP was exceeded during validation. It is noted that the selection of surface water sampling locations was limited by access and the locations were selected as close to the audit site as practicable.



Sampling and Analysis Plan and Sampling Methodology

Auditor's Opinion

Soil: Samples were analysed based on areas where concentrations recorded previously were above the adopted ecological criteria, with 48 primary samples analysed from 16 locations over the 3.68 ha.

These investigation locations and the sampling density are considered to adequately target the main areas of concern.

Surface water: Surface water in down- and upstream locations of Eastern Creek were sampled over four sampling rounds, with 10 primary samples analysed from 3 locations. Ramboll note that sample location EC_SW02 was collected from a tributary of Eastern Creek approximately 485 m upstream because of overgrown vegetation. The second upstream sample was collected approximately 1 km away from the site because of access constraints.

Sample depths

Soil: Hand auger holes were advanced to 1 mbgl. Samples were collected from the current ground surface, 0.5 mbgl, 1 mbgl and at any change of lithology or when staining, odours or anthropogenic material was observed.

This sampling strategy is appropriate and adequate to characterise the stratigraphy and presence of PFAS contamination at the audit site.

Surface water: No sample depth is recorded for surface water.

Sample collection method

Acceptable.

Soil: Soil samples were collected from the hand auger cutting blades.

Surface water: Surface water samples were collected by filling a metal (steel/aluminium) bucket with creek water before decanting into sample containers *ex-situ*.

Decontamination procedures

Acceptable.

Ramboll indicated that reusable sampling equipment was decontaminated by rinsing with a solution of Alconox® (PFAS-free detergent) and deionised water. Dedicated disposable nitrile gloves were reportedly used for each new sample.

Sample handling and containers

The field program has considered the appropriate measures for PFAS sampling.

Soil and surface water samples were placed in laboratory-supplied plastic jars and bottles (comprised 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.

Chain of Custody (COC)

Completed chain of custody forms were provided in the Validation Report.

A spot check of the COC by the auditor indicates that the COCs were generally appropriately filled in and signed.

Detailed description of field screening protocols

Acceptable.

Soil: During the first round of sampling, soil samples were placed into a plastic bag and sealed for screening with a photo-ionisation detector (PID) for the presence of volatile contaminants.

Surface water: Water quality parameters (dissolved oxygen, pH, electrical conductivity, redox potential and temperature) were measured *in-situ* prior to sample collection if possible. Where direct access to the creek was not possible, parameters were measured *ex-situ* from the sampling bucket.

Calibration of field equipment

Acceptable.

Calibration certificates were provided for the water quality meter and PID, dated 22 December 2021, 24 January 2022, 23 February 2022 and 23 March 2022.

Sampling logs

Acceptable.



Sampling and Analysis Plan and Sampling Methodology

Auditor's Opinion

Soil: A general description of soil encountered during the investigation, including borehole logs presenting the 'Borehole south of LF2 average representation' and 'Borehole south of STP average representation', are provided within the report. Photographic logs of the general lithology were provided in Appendix A of the Validation report (Ramboll 2023).

Surface water: Surface water field sampling records were not provided, however photographic logs of the surface water were provided in Appendix A of the Validation report (Ramboll 2023).

Table 6-3: QA/QC – Field and Lab Quality Assurance and Quality Control

Field and Lab QA/QC

Auditor's Opinion

Field quality control samples**Soil:**

56 primary samples, 6 field duplicate samples and 2 field triplicate samples were collected. The number of field triplicate samples is below the SAQP and PFAS National Environmental Management Plan (NEMP) acceptance criteria of one duplicate sample per 10 primary PFAS samples.

Surface water:

10 primary samples, 7 field duplicates and 1 field triplicate were collected. The number of field triplicate samples is below the SAQP and PFAS NEMP acceptance criteria of one duplicate sample per 10 primary PFAS samples.

Sampling was conducted over 7 days. 2 field blanks were collected during the investigation. No soil or water trip blanks were collected during the sampling events.

A rinsate blank was collected during each day of sampling as seven rinsate blanks were collected during the investigation.

Overall, the field quality control samples are considered adequate for the investigation.

The number of field triplicate samples collected was generally below the acceptance criteria. However, the number of field duplicate samples were greater than the acceptance criteria. While the reduction in the number of field triplicate is not ideal, overall, the numbers of field samples were collected are considered sufficient. Furthermore, the highest concentration measured amongst the primary and field samples were used in the assessment.

Field quality control results

Adequate.

The results of field quality control samples were within appropriate limits.

National Association of Testing Authorities (NATA) registered laboratory and NATA endorsed methods

Adequate.

NATA registered laboratories used were Eurofins | mgt (primary) and Envirolab (secondary). Laboratory certificates were all NATA stamped.

Analytical methods

Adequate.

Analytical methods were included in the laboratory test certificates. Both Envirolab and Eurofins 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 PFAS NEMP.

Holding times

Adequate.

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

Practical Quantitation Limits (PQLs)

Adequate.



Field and Lab QA/QC

Auditor's Opinion

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

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

Laboratory quality control samples

Adequate.

The laboratory quality control samples including laboratory control samples, matrix spikes, surrogate spikes, blanks, internal standards and duplicates were undertaken by the primary and secondary laboratory at the appropriate frequency.

Laboratory quality control results

The results of the laboratory quality control samples were within appropriate limits, with the following exception:

In the context of the dataset reported and the number of samples analysed, the non-conformances are not considered significant, and the laboratory quality control results are acceptable.

Soil:

- There was one fail in a duplicate Perfluoroheptanesulfonic acid (PFHpS) from Eurofins where the RPD reported passes Eurofins Environment Testing's QC – Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of the relevant report.

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

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

An assessment of the data with respect to the five category areas was discussed in Section 10.2 of the Validation report.

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

- Samples were collected using suitable procedures with appropriate field quality control samples (such as rinsate and field blanks).
- The results of field quality control samples are generally consistent, indicating the data is likely to be representative of the overall conditions on the audit site. Ramboll adopted the higher of the duplicate results in their assessment and interpretation of contamination.
- The laboratory analysis was undertaken by NATA registered laboratories using accredited analytical methods. Primary and secondary laboratories have provided sufficient information to conclude that the dataset is generally precise.
- Samples were collected using suitable procedures and met the sampling density specified in the SAQP.
- The data was generally considered accurate and was relied upon for this audit.



7.0 Environmental Quality Criteria

The auditor has assessed the PFAS contamination status with reference to the PFAS NEMP 2.0 (Heads of Environment Protection Authorities [HEPA] 2020). This guideline is referred to as 'the PFAS NEMP' or 'the NEMP'.

The auditor notes that draft PFAS NEMP 3.0 has been released for public consultation. While it is not finalised or formally adopted by NSW EPA, the draft PFAS NEMP 3.0 is considered in the audit when interpreting the audit conclusions.

7.1 Soil

Based on the proposed development, the environmental quality criteria adopted in this audit are presented in **Table 7-1** and they are derived from:

- Human health guideline values:
 - Public open space health investigation level (HIL C) (Table 2 of the NEMP).
- Ecological guideline values:
 - Ecological direct exposure and ecological indirect exposure for all land uses (Table 3 of the NEMP).

There are new soil guideline values from draft PFAS NEMP 3.0, which are 0.005 mg/kg PFOA for assessing ecological indirect exposure and for assessing the protection of reptiles via direct contact.

Table 7-1: Soil Environmental Quality Criteria

Chemical of Concern	NEMP HIL C – Public Open Space (mg/kg)	NEMP Ecological Direct Exposure (mg/kg)	NEMP Ecological Indirect Exposure (mg/kg)
Sum of perfluorooctane sulfonate (PFOS) and perfluorohexane sulfonate (PFHxS)	1	—	—
Perfluorooctanoic acid (PFOA)	10	10	—
PFOS	—	1	0.01

Notes:

HIL- Health investigation level.

mg/kg - milligram/kilogram.

— = no applicable criterion.

7.2 Water

The groundwater and surface water environmental quality criteria adopted in this audit are presented in **Table 7-2** and are derived from:

- Human health guideline values:
 - Recreational water quality guideline value (Table 1 of the NEMP).



- Ecological guideline values:
 - 99% freshwater species protection (Table 5 of the NEMP). 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 the 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 PQL.
 - As the NEMP 99% value is likely to be conservative, consideration was also given to an updated value of 0.05 µg/L for PFOS for 99% species protection level derived by Batley et. al. (2018)¹ This ecological protection value is in draft and has not been endorsed by EPA.

As leachate concentrations were also used to assess the potential risk to human health and ecosystems, the same water guideline values are adopted to assess leachate.

The auditor notes that there are no new ecological and human health and guideline value for groundwater in the draft PFAS NEMP 3.0. The auditor notes that there is no new ecological and human health and guideline value for surface water in the draft PFAS NEMP 3.0.

Table 7-2: Water Environmental Quality Criteria

Chemical of Concern	NEMP Ecological – Freshwater 99% Species Protection (µg/L)	NEMP Ecological – Freshwater 95% Species Protection (µg/L)	NEMP – Recreational Water Quality Guideline Value (µg/L)	Batley <i>et al.</i> 2018 ¹ – Freshwater 99% Species Protection (µg/L)
Sum of PFOS and PFHxS	—	—	2	—
PFOA	19	220	10	—
PFOS	0.00023	0.13	—	0.05

Notes:

µg/L – microgram/litre

— = no applicable criterion.

7.3 Consultants Environmental Quality Criteria

The environmental quality criteria referenced by the auditor are consistent with those adopted by Ramboll (2023).

The auditor notes that Ramboll has conservatively applied the criterion for 'Sum of PFOS and PFHxS' as for the individual criterion for PFOS and for PFHxS. This has not resulted in any material change in the conclusion of the Validation Report. The Validation Report (at time of writing) has also noted that draft PFAS NEMP 3.0 is released for public consultation.

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>



8.0 Evaluation of Soil Analytical Results

8.1 Soil Analytical Results

Soil results from the investigation and validation works conducted at STP and LF2 have been assessed against the environmental quality criteria. No sign of contamination (such as staining or odour) was observed by Ramboll (2021e and 2023).

8.1.1 Sewage Treatment Plant (STP)

Table 8-1 summarises the analytical soil results from the assessment and validation works conducted at the STP. The STP sampling locations are shown in Attachment 2 (**Appendix A**).

Table 8-1: Summary of STP Soil Results

Analyte	No. of samples ¹	No. of detections ¹	Maximum concentration (mg/kg)	No. of samples exceed NEMP human health investigation level (HIL C)	No. of samples exceed NEMP ecological guideline values – indirect exposure	No. of samples exceed NEMP ecological guideline values – direct exposure
Sum of PFHxS and PFOS	86	32	0.033	0	—	—
PFOS	86	32	0.1	—	21	0
PFOA	86	2	0.0007	0	—	0

Notes:

1. 73 primary samples and 13 duplicate samples.

mg/kg – milligram/kilogram.

— = no applicable criterion.

All results were reported below the adopted human health criteria and the direct ecological guideline values. There were 21 results from 12 sampling locations (refer to Attachment 3, **Appendix A**) measured above the indirect ecological guideline value. The elevated concentrations were located around the west and south (down slope) of the STP adjacent to Eastern Creek. The majority of the locations reporting impacts were located within the upper 0.5 mbgl.

Further discussion about the assessment of risk associated with the measured concentrations is presented in **Section 12.0**.

8.1.2 Landfill 2

Table 8-2 summarises the analytical soil results from the assessment and validation works conducted at LF2. LF2 sampling locations are shown in Attachment 2 (**Appendix A**).

**Table 8-2: Summary of Landfill 2 Soil Results**

Analyte	No. of samples ¹	No. of detections ¹	Maximum concentration (mg/kg)	No. of samples exceed NEMP human health investigation level (HIL C)	No. of samples exceed NEMP ecological guideline values – indirect exposure	No. of samples exceed NEMP ecological guideline values – direct exposure
Sum of PFHxS and PFOS	82	11	0.145	0	—	—
PFOS	82	9	0.14	0	6	0
PFOA	82	0	<0.005	0	—	0

Notes:

1. 66 primary samples and 16 duplicate samples.

mg/kg – milligram/kilogram.

— = no applicable criterion.

All results were reported below the adopted human health criteria and the direct ecological guideline values. There were six results from six sampling locations (refer to Attachment 3, **Appendix A**) measured above the indirect ecological guideline value. Majority of elevated concentrations were located around a small area at the west (down slope) of the LF2 within 1 m depth.

Further discussion about the assessment of risk associated with the measured concentrations is presented in **Section 12.0**.

8.1.3 Leachate Analysis

Australian Standard Leaching Procedure (ASLP) was conducted on 50 soil samples.

All PFOA results were below the ecological guideline value of 19 µg/L (99% species protection) and recreational guideline value of 10 µg/L. All sum of PFHxS and PFOS concentrations were below the adopted recreational guideline value as well.

PFOS was reported at concentrations above the adopted water ecological guideline values and subsequently, Ramboll conducted statistical analysis on the PFOS ASLP concentrations and a summary of the statical data is presented in **Table 8-3**.

Table 8-3: Statistical summary of PFOS leachate concentrations

Parameters	PFOS
Number of samples	50
Number of detections	43
Number of results above 0.05 µg/L ecological criterion (Batley <i>et al.</i> 2018)	30
Minimum (µg/L)	<0.01
Maximum (µg/L)	0.41
Mean (µg/L)	0.10



Parameters	PFOS
95% upper confidence limit (UCL) (µg/L)	0.13
Standard deviation (µg/L)	0.09

The 95% UCL for leachable PFOS is 0.13 µg/L that is above the freshwater 99% species protection (Batley *et al.* 2018) guideline value. The data indicates that there is potential for PFOS in the soil to leach and that the leachate could pose a risk to aquatic receptors.

Ramboll did note that the ASLP methodology (conducted at pH of 5) could be over-conservative and *“likely to overrepresent the concentrations of PFAS likely to leach under natural conditions at the site”*. Ramboll also noted that the aquatic guideline value is intended to be applied at the receptor (at point of discharge) whereas the leachability results are indicative of conditions of the soil at point of sampling. Therefore, the leachate concentrations observed are likely to decrease during migration (via groundwater flow) towards Eastern Creek.

Further discussion about the assessment of risk associated with the measured concentrations is presented in **Section 12.0**.

8.2 Auditor's Opinion

In reviewing the analytical results, the auditor notes the following:

- All PFAS concentrations were below the adopted human health and ecological direct exposure soil guideline values. This indicates that the risk to human health and direct toxicity risk to terrestrial ecosystems are acceptable.
- PFOS concentrations were reported above the ecological indirect exposure guideline value. This indicates that there is potentially a risk to secondary consumers of the terrestrial organisms (via bioaccumulation). This is evaluated further by Ramboll and discussed in **Section 12.0**.
- Based on soil leachability tests, there is a potential for PFOS to leach from the soil to groundwater and ultimately migrate to the aquatic water body. This result was reviewed together with groundwater and surface water (Eastern Creek) analytical results presented in **Section 9.0** and **Section 10.0**.
- There are new soil guideline values from draft PFAS NEMP 3.0, which are 0.005 mg/kg PFOA for assessing ecological indirect exposure and for assessing the protection of reptiles via direct contact. As indicated in **Table 8-1** and **Table 8-2**, no concentrations in soil were reported above these guideline values. There are no new ecological or human health and guideline values for water from draft PFAS NEMP 3.0 to evaluate the leachate results against.

In the auditor's opinion, the soil analytical results are consistent with the site history and field observations. The auditor is satisfied that the soil is sufficiently characterised for the purposes of validation. Further evaluation of land suitability and risk to ecological receptors are discussed in **Section 12.0**.



9.0 Evaluation of Groundwater Analytical Results

9.1 Groundwater Analytical Results

As indicated in **Section 5.2**, none of the 13 groundwater monitoring bores located at Nirimba Fields are located within the audit site. However, for a more holistic view, the review of groundwater condition at audit site included MW07, MW08 and MW09, which are the three nearest bores located respectively to the north, northeast and northwest of the audit site.

Groundwater analytical results from MW07, MW08 and MW09 monitored in July 2021 are summarised below in **Table 9-1** and Attachment 6 (**Appendix A**).

Table 9-1: Summary of Groundwater Analytical Results

Analyte	No. of samples ¹	No. of detections ¹	Maximum concentration (µg/L)	No. of samples exceed NEMP ecological freshwater 99% species protection	No. of samples exceed NEMP ecological freshwater 95% species protection	No. of samples exceed Freshwater 99% species protection (Batley <i>et al.</i> 2018)	No. of samples exceed NEMP Recreational Water Quality Guideline Value
Sum of PFHxS and PFOS	5	4	0.02	—	—	—	0
PFOS	5	3	0.0043	3 ²	0	0	—
PFOA	5	0	<0.01	0	0	—	0

Notes:

1. 3 primary samples and 2 duplicate samples.

2. 2 primary samples (MW08 and MW09) and QC421 (blind duplicate of MW08).

µg/L – microgram/litre.

— = no applicable criterion.

PFOS concentrations above the NEMP ecological guideline value (99% species protection) were measured in MW08 and MW09 only. This NEMP ecological value 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) of 0.05 µg/L. Batley *et al.* (2018) presents a draft updated 99% species protection level (0.05 µg/L PFOS) which addresses 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.

No concentration exceeding the NEMP ecological guideline value for 95% species and human health recreational water guideline value were recorded.



It should be noted that off-site bores MW11 and MW12, both located near the eastern site boundary of the wider Nirimba Fields as shown in Attachment 6 and 7 (**Appendix A**), are considered to indicate 'background' condition of up-gradient groundwater migrating from the east onto Nirimba Fields itself. The auditor notes that the following concentrations were measured at these bores in July 2021 (Ramboll 2021e):

- MW11 with 0.01 µg/L PFOS, above NEMP 99% species protection ecological guideline value (this is the highest concentrations measured at Nirimba Fields).
- MW12 with 0.0017 µg/L PFOS, above NEMP 99% species protection ecological guideline value.

This suggests the PFOS levels observed at the audit site (STP and LF2) may be associated with background PFAS concentrations in area. The elevated PFOS leachability results from soil samples discussed in **Section 8.1.3** were not observed in the groundwater concentrations.

9.2 Auditor's Opinion

In the auditor's opinion, the groundwater at the audit site did not indicate elevated concentrations above the ecological and human health criteria. The PFAS levels observed at the audit site are likely to reflect 'background' concentrations migrating onto Nirimba Fields from the east. The groundwater results observed on-site are consistent with those obtained for the soil i.e., low PFAS levels.



10.0 Evaluation of Surface Water Analytical Results

10.1 Surface Water Analytical Results

Four rounds of surface water sampling were conducted at three sampling locations at Eastern Creek and its tributary as shown in **Table 10-1**.

Table 10-1: Surface Water Sampling Rounds

Date	Down-stream (Eastern Creek)	Up-stream (tributary of Eastern Creek)	Up-stream (Eastern Creek)
	EC_SW01	EC_SW02	EC_SW03
23 December 2021	Yes	Yes	No
25 January 2022	Yes	Yes	Yes
23 February 2022	No	Yes	Yes
25 March 2022	Yes	Yes	Yes

Notes:

Yes – location was sampled.

No – location was not sampled.

All surface water analytical results from EC_SW01, EC_SW02 and EC_SW03 are summarised in **Table 10-2** and Attachments 5.1 and 5.2 (**Appendix A**).

PFOS concentrations in surface water were reported above the NEMP ecological guideline value (99% species protection) at all sampling locations. The NEMP ecological value is likely to be highly conservative. Batley *et al.* (2018) presents a draft updated 99% species protection level of 0.05 µg/L for PFOS above the NEMP value of 0.00023 µg/L. No concentrations of PFOS were reported above the draft updated 99% species protection level presented by Batley *et al.* (2018) of 0.05 µg/L with only one result (EC_SW03 from 25 March 2022) measured at the same concentration as this ecological criterion. No concentration of PFOS exceeding the NEMP ecological guideline value for 95% species and human health recreational water guideline value were recorded.

**Table 10-2: Summary of Surface Water Analytical Results**

Analyte	No. of samples	No. of detections	Maximum concentration (µg/L)	No. of samples exceed NEMP ecological freshwater 99% species protection	No. of samples exceed NEMP ecological freshwater 95% species protection	No. of samples exceed Freshwater 99% species protection (Batley <i>et al.</i> 2018)	No. of samples exceed NEMP Recreational Water Quality Guideline Value
Sum of PFHxS and PFOS	18 ¹	17 ²	0.08	—	—	—	0
PFOS	18 ¹	17 ²	0.05	17 ²	0	0	—
PFOA	18 ¹	15 ³	0.04	0	0	—	0

Notes:

1. 10 primary samples, 7 intra-laboratory and 1 inter-laboratory duplicate samples.
2. 9 primary samples, 7 intra-laboratory and 1 inter-laboratory duplicate samples.
3. 8 primary samples, 6 intra-laboratory and 1 inter-laboratory duplicate samples.

µg/L – microgram/litre.

— = no applicable criterion.

EC_SW02 and EC_SW03 are located up-stream of the audit site and are considered to be representative of 'background' surface water conditions. This surface water flows from the east and south towards to the audit site. The auditor notes that EC_SW02 and EC_SW03 consistently reported higher or the same PFAS concentrations as EC_SW01 and this suggests that the PFAS levels observed downstream of the audit site may be associated with background PFAS concentrations (from up-stream) and not associated with contamination from the audit. PFOS, observed at elevated levels in leachability results from soil samples discussed in **Section 8.1.3** were not reflected in the surface water results.

10.2 Auditor's Opinion

In the auditor's opinion, the Eastern Creek surface water at the audit site does not indicate elevated PFAS concentrations above the ecological and human health criteria. The PFAS levels observed at Eastern Creek are likely to reflect 'background' concentrations of the area, as measured in the sampling locations upstream of the audit site. This is consistent with the outcomes of the groundwater review.



11.0 Evaluation of Conceptual Site Model

A conceptual site model (CSM) is a representation of the source, pathway and receptor linkages at a site. A CSM was developed by Ramboll (2023) for the audit site. **Table 11-1** provides the auditor's review of the CSM.

Table 11-1: Review of the Conceptual Site Model

Element of CSM	Consultant	Auditor Opinion
Contaminant source and mechanism	Discussion on the potential sources of PFAS contamination are presented in Ramboll (2021a) Overview Letter. The sources of PFAS contamination are not listed in the CSM presented in Table 5-1 and Table 12-1 of the Validation Report.	Overall, based on the information presented, the sources of contamination are adequately identified for the audit site. A detailed site history was compiled and reviewed to identify potential sources of PFAS contamination in line with the approach suggested in PFAS NEMP 2.0 (and NEMP 3.0). As indicated in the Validation Report, it was documented separately (Ramboll 2021a). The sources of PFAS contamination were found to be selected features present at the audit site, namely former STP and LF2 (refer to Section 3.0). Transport mechanism such as overland runoff and leaching (from soil to groundwater) has been identified.
Affected media	• Soil. • Sediment. • Surface water. • Groundwater.	Adequately identified.
Exposure pathways	• Direct contact/ingestion. • Inhalation. • Overland run-off. • Leaching.	Adequately identified for PFAS contamination in soil, sediment, groundwater and surface water.
Receptor identification	• Residents (on-site and off-site). • On-site groundwater user. • On-site and off-site construction and maintenance worker. • Ecological receptors: ▪ Flora and fauna. ▪ Eastern Creek. ▪ Groundwater	The human and ecological receptors have been generally identified. Future recreational users were not listed, but this is not material to the audit as the more sensitive on-site and off-site residents (i.e. likely users of the public open space) were listed.



12.0 Assessment of Risk

Historical remediation works conducted at the audit site removed the sources of PFAS contamination (e.g., former landfill waste, former filter media from the STP) and as such, there are no ongoing sources of PFAS remaining at the site.

No direct harm to terrestrial organisms was identified, however, soil concentrations reported above the ecological indirect exposure PFOS guideline value reported at selected locations indicates that there may be the potential for PFOS bioaccumulation through the food chain and therefore a potential risk to secondary consumers. Ramboll (2023) concludes that the bioaccumulation risk is low given the sporadic and localised low-level of PFOS contamination (associated with indirect exposure guideline) which implies that *“it is unlikely that dietary intake of secondary consumers present at the site could be sustained by just impacted soil locations”*. The auditor concurs that the ecological risk of associated with PFOS in soil is low due to the sporadic and localised low-level of PFOS contamination.

Based on assessment of results against relevant guidelines and consideration of the overall investigation, it is the auditor’s opinion that the overall risk to human health and the environment is low and acceptable. The auditor also notes that there are no additional soil, groundwater or surface water impacts identified when the data is compared against the guideline values present in the draft PFAS NEMP 3.0.



13.0 Contamination Migration Potential

Consistent with the time since PFAS impacts occurred (pre-1993) and since the remediation works were undertaken (2002) to remove the primary PFAS sources and given the clay-dominated natural geology, there is little indication that PFAS contamination has migrated to groundwater and surface water.

Ramboll (2023) acknowledges that while there is no information available for the sediment within Eastern Creek, the erosion of the banks of Eastern Creek adjacent to STP and LF2 and risk of surface run-off and leaching from PFAS-impacted soil are likely to be limited due to:

- *“high amount of vegetation adjacent to the creek.*
- *stiff cohesive nature of the natural clay base.*
- *slow flowing velocity at the creek.*
- *High plasticity, fine grained, firm clay.”*

Given that the relatively low concentrations of PFAS detected in soil, are sporadic and localised, the auditor considers that the potential for PFAS to leach to groundwater to be negligible. PFAS concentrations observed in groundwater in the vicinity of the audit site and in surface water confirmed this and confirmed that impacts in groundwater are unlikely to pose a risk to aquatic ecosystem. The auditor agrees that lack of mobilisation PFAS impacts into groundwater (also discussed in **Section 13.0**) suggests that creek sediment is also unlikely to be impacted.

In the auditor's opinion, there is no evidence of significant migration of contamination and little potential for future migration.



14.0 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 (**Appendix B**).

The investigation was generally conducted in accordance with State Environmental Planning Policy (SEPP) 55 Remediation of Land² (which was current at the time of investigation) and reported in accordance with the NSW EPA (2020) *Consultants Reporting on Contaminated Sites Contaminated Land Guidelines*. 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.

14.1 Notification

Ramboll did not indicate in the Validation Report whether the validation works (which was investigative in nature) required any consent from regulatory authorities. The auditor has not been provided further detail on any associated notification to Council in relation to the works undertaken.

14.2 Development Approvals

There are no development applications/approvals associated with the site audit area documented in the Validation Report.

14.3 Waste Disposal

Waste disposal is excluded from this audit and therefore, no information about waste disposal was documented in the Validation Report. It is understood that no waste disposal has been undertaken since 2002.

14.4 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.

14.5 Licenses

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

² SEPP 55 has been repealed and is now superseded by the State Environmental Planning Policy (Resilience and Hazards) 2021.



15.0 Conclusions and Recommendations

Ramboll (2023) considers that the:

- *“... PFAS compounds are present in the creek from upgradient sources.”*
- *“any relatively minor contribution (if indeed present) from the Site Investigation Area [i.e. the audit site] does not appear to be causing a negative impact on water quality in the [Eastern] Creek.*
- *...contamination in shallow shows was investigated and analytical data acquired did not exceed Tier 1 human health criteria selected to be protective of public open space.*
- *... [PFAS] concentrations in soil are not impacting on the Creek.*
- *...groundwater impacts have not been identified.*
- *The objectives of validation investigation ... has been meet and no further investigation is considered to be required.*
- *No ongoing site management is considered to be required to render the site suitable for the land use going forward.*
- *The area that was subject to this validation assessment... is suitable for its proposed future land uses of:*
 - *SP2 – infrastructure (classified road, drainage, education establishment, footpath, local road)*
 - *C2 – environmental conservation”*

Based on the information presented in the Validation Report and the auditor's review of the other parts of Schofields Aerodrome external to the audit site, the auditor concludes that:

- The nature and extent of the PFAS contamination has been appropriately determined.
- The risk to human health and the environment posed by the soil and groundwater are considered to be acceptable for the proposed recreational/public open space use. Extraction of groundwater for any purpose within the audit site was documented in the Validation Report to be not proposed or not likely due to the high salinity and poor yield from clayey aquifer.

The site audit statement will be provided to the Blacktown City Council and as a result the presence of the site audit statement will be noted on the Planning Certificate.



16.0 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 former Sewage Treatment Plant and Landfill 2 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 Client and their consultants and representatives through documents provided to the auditor. The Audit is based on a review of the subsurface condition of the site at the time of assessment, as described in the assessment reports attached to the Audit report and site inspections conducted by the auditor and their representatives. 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: Schofields PFAS Eastern Creek and STP/LF2 Sample Locations

Attachment 2: Schofields PFAS STP/LF2 Soil Sample Locations

Attachment 3: Schofields PFAS STP/LF2 Soil Sample Exceedances

Attachment 4: Schofields PFAS STP/LF2 Soil Leachate Exceedances

Attachment 5.1: Schofields PFAS Eastern Creek Surface Water Sample Detections

Attachment 5.2: Schofields PFAS Eastern Creek Surface Water Sample Detections

Attachment 6: Former Schofields Aerodrome Groundwater Monitoring Wells Locations and Groundwater Guideline Exceedances

Attachment 7: Former Schofields Aerodrome Contoured Groundwater Elevations

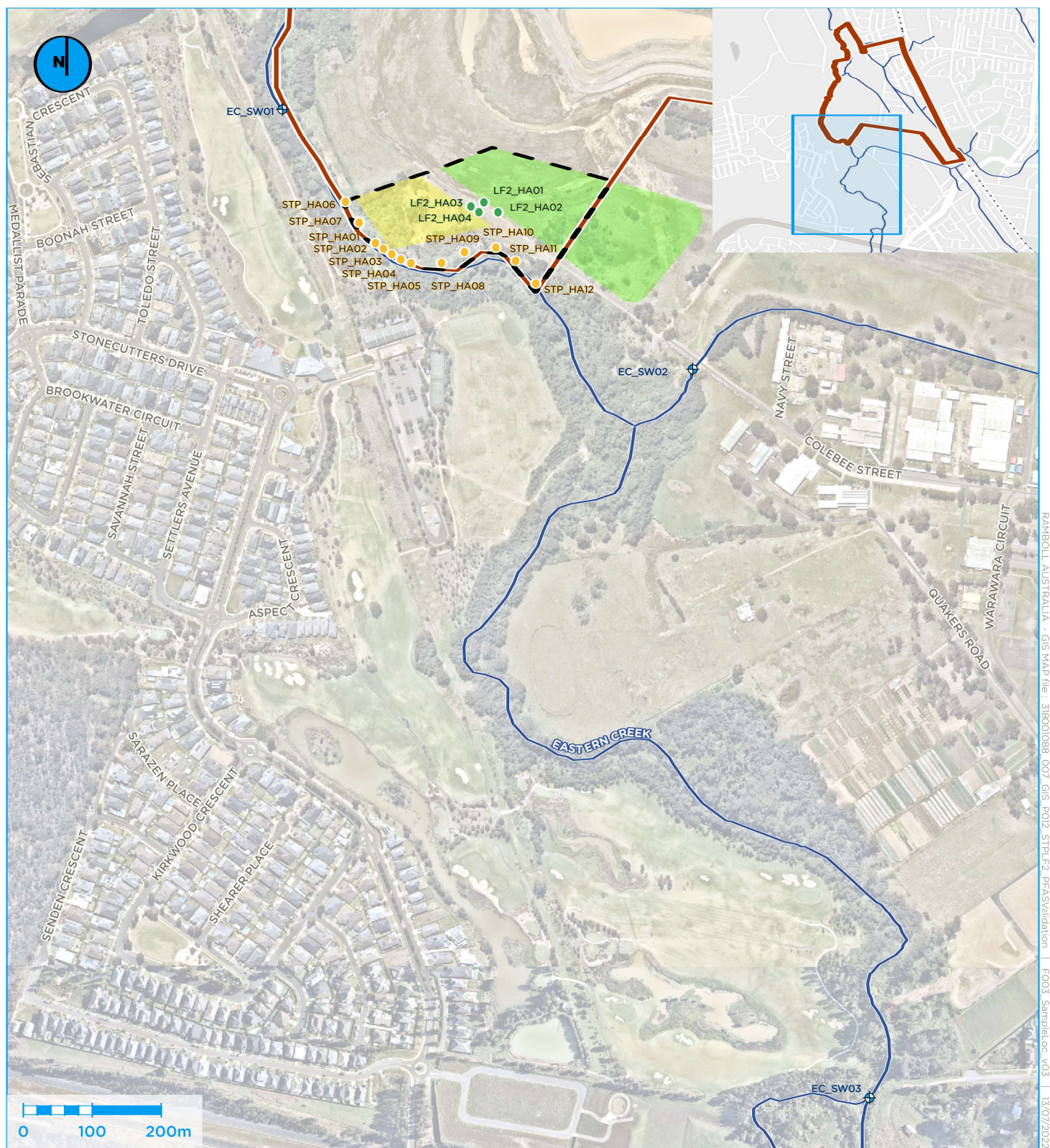
Attachment 8: Background Drainage Lines and VENM Thickness Investigation Locations and Soil Guideline Exceedances

Attachment 9: Staging Plan – Current Zoning Aerial

Attachment 10: Staging Plan – Proposed Zoning Aerial

Attachment 11: Akuna Vista, Nirimba Fields, Master Plan

Attachment 12: Survey Plan of Former Sewage Treatment Plant and Landfill 2

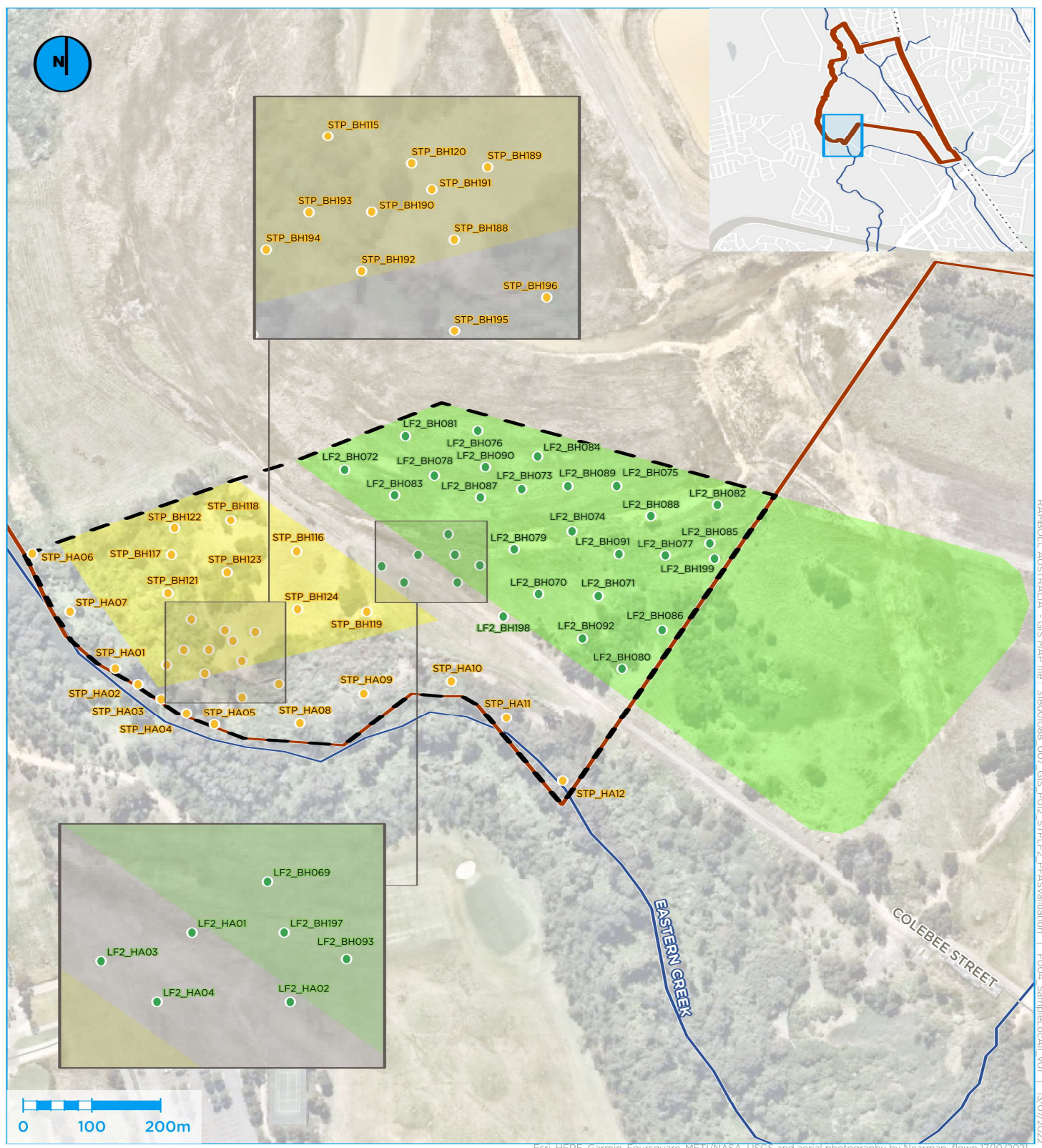


Legend

- Approximate site boundary (comprising majority of Former Schofields Aerodrome)
- LF2 sample location
- STP sample location
- ⊕ Surface water sample
- Former landfill (LF2)
- Former sewage treatment plant (STP)
- Site investigation area (3.63 ha)
- Waterway (NSW Spatial Service, 2022)

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Figure 1 : Schofields PFAS Eastern Creek and STP/LF2 Sample Locations
Former Schofields Aerodrome – STP and LF2 Supplementary PFAS Validation Investigation



Legend

- Approximate site boundary (comprising majority of Former Schofields Aerodrome)
- LF2 sample location
- STP sample location
- Former landfill (LF2)
- Former sewage treatment plant (STP)
- Site investigation area (3.63 ha)
- Waterway (NSW Spatial Service, 2022)

Figure 2 : Schofields PFAS STP/LF2 Soil Sample Locations

Former Schofields Aerodrome – STP and LF2 Supplementary PFAS Validation Investigation

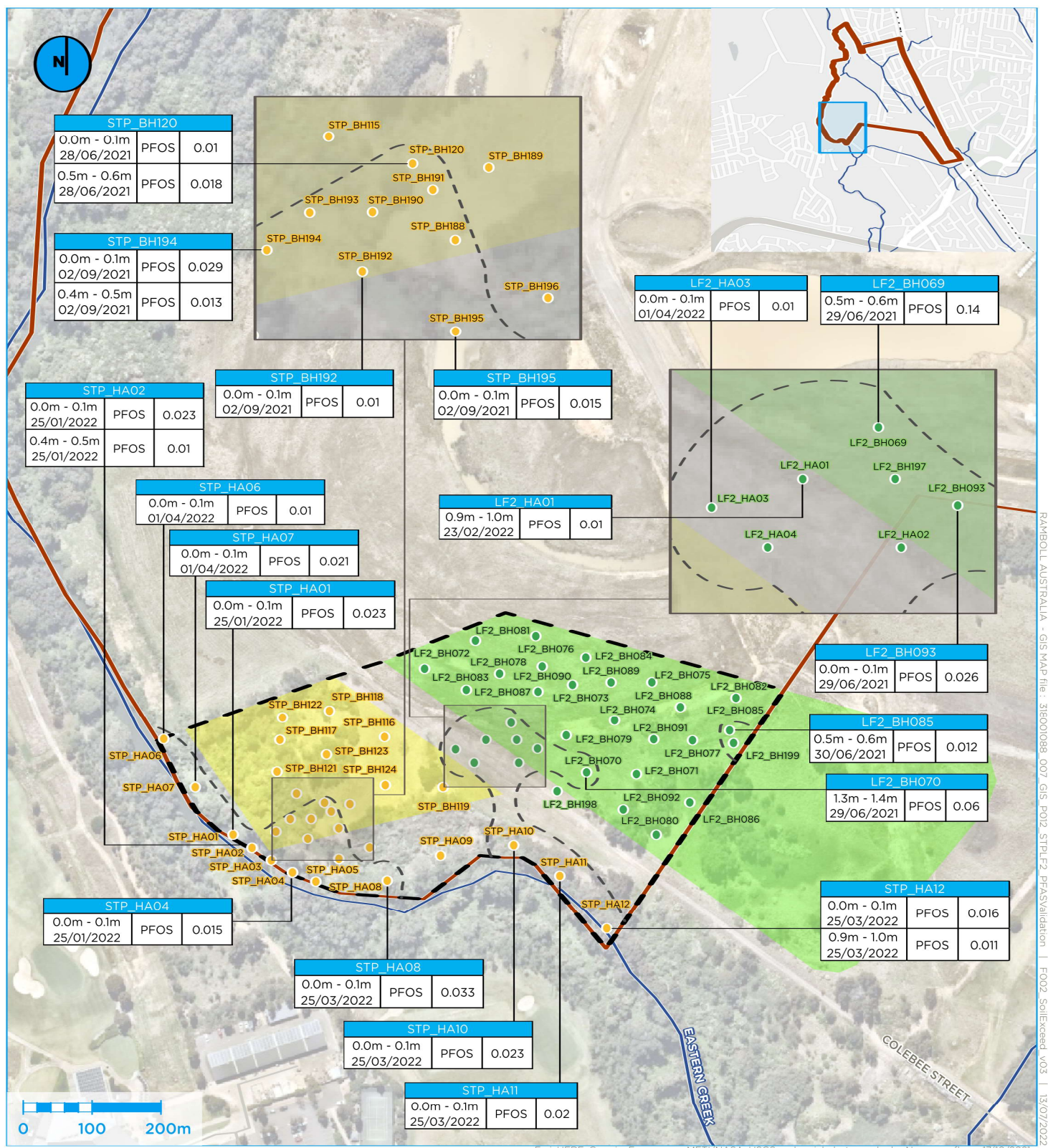


Figure 3 : Schofields PFAS STP/LF2 Soil Sample Exceedances

Former Schofields Aerodrome – STP and LF2 Supplementary PFAS Validation Investigation



-  Approximate site boundary (comprising majority of Former Schofields Aerodrome)
-  LF2 sample location
-  STP sample location
-  Former landfill (LF2)
-  Former sewage treatment plant (STP)
-  Site investigation area (3.63 ha)
-  Waterway (NSW Spatial Service, 2022)

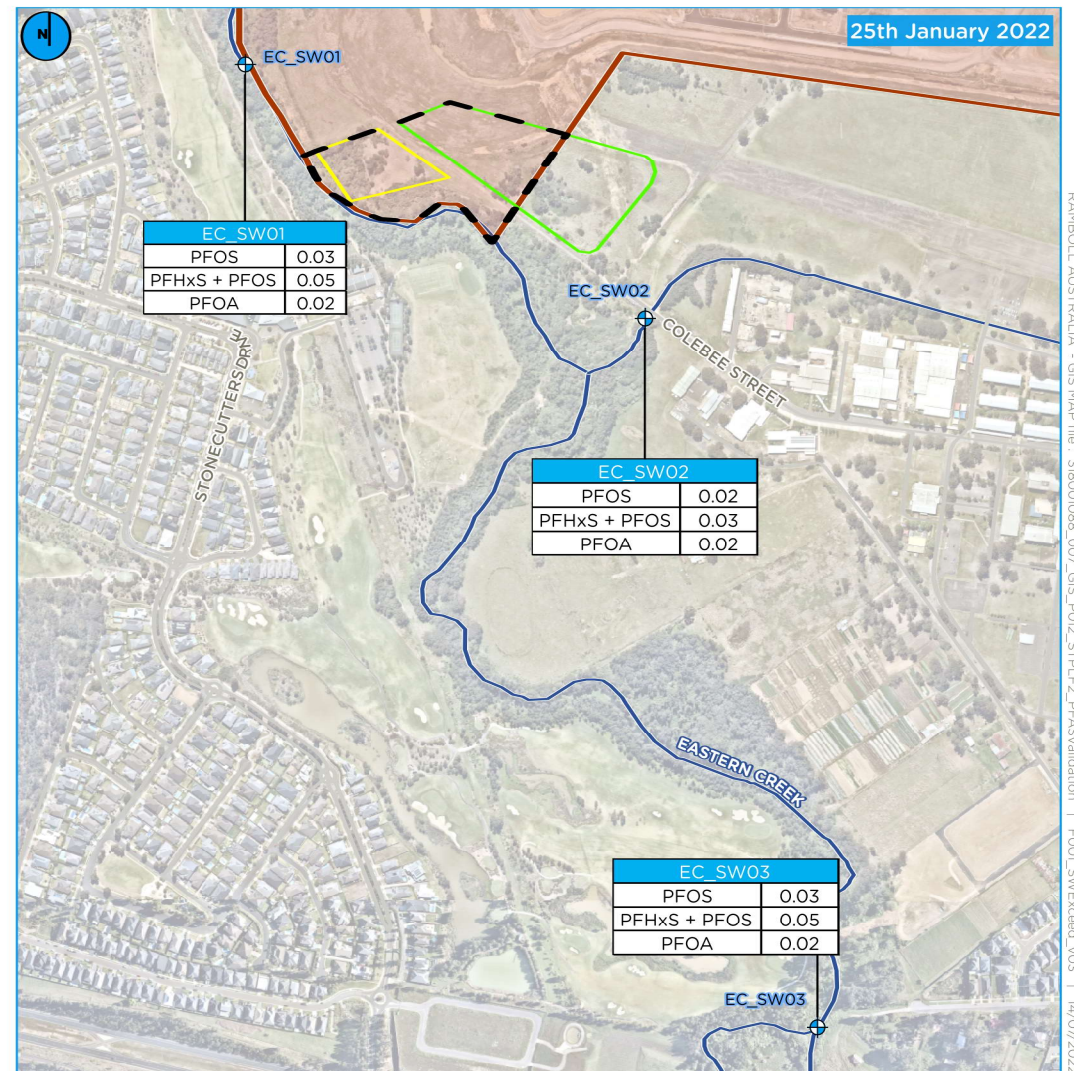
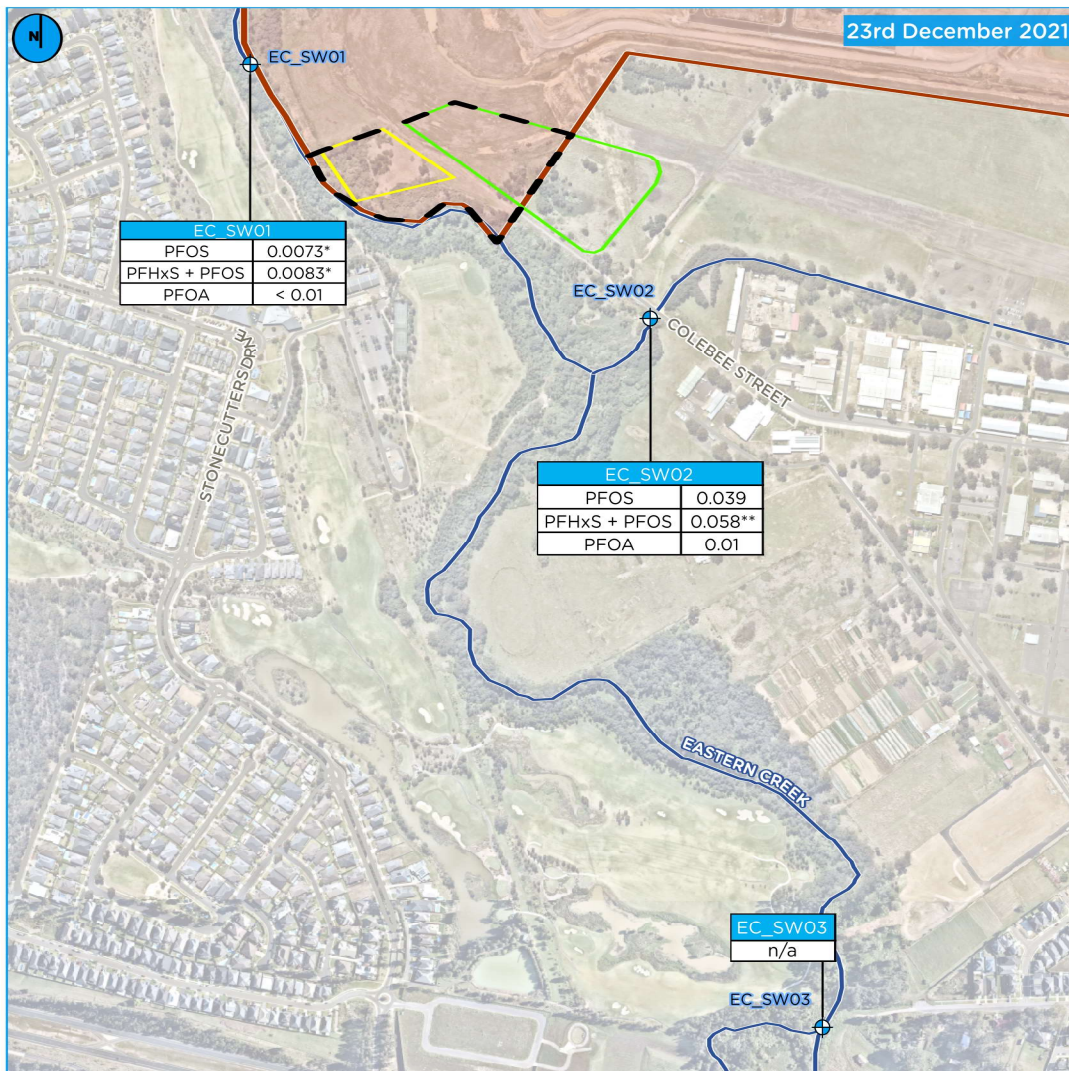
Exceedance Criteria

Depth	Date	CoPC	Batley et al. (2018)
		PFOS	0.05 µg/L

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3,000

Figure 4 : Schofield's PFAS STP/LF2 Soil Leachate Exceedances

Former Schofields Aerodrome - STP and LF2 Supplementary PFAS Validation Investigation



Legend

- Approximate site boundary (comprising majority of Former Schofields Aerodrome)
- Surface water sample
- Former landfill (LF2)
- Former sewage treatment plant (STP)
- Site investigation area (3.63 ha)
- Waterway (NSW Spatial Service, 2022)

Surface Water Detection - Limit of Reporting (LOR)

COPCs	LOR
PFOS	
Sum (PFHxS + PFOS)	0.0001 µg/l
Perfluorooctanoic acid (PFOA)	0.01 µg/l

n/a = not assessed (samples unable to be collected on sample date)

*Note the intra-lab duplicate (QC200) result was used for some of the detections as it is higher than the primary sample.

**Note the inter-lab duplicate (QC100) result was used for some of the detections as it is higher than the primary sample.

A4
1:10,000

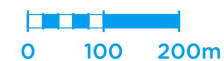
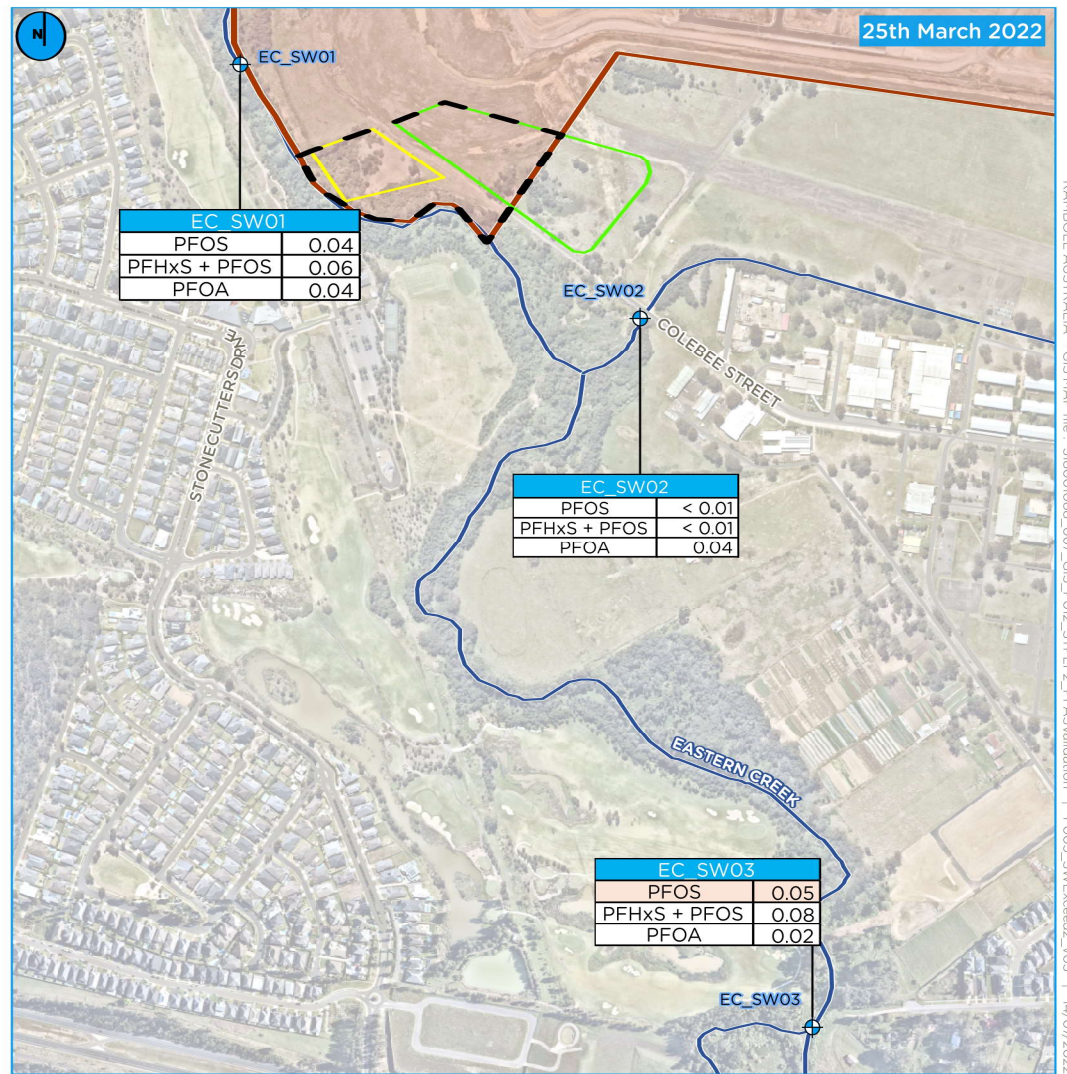
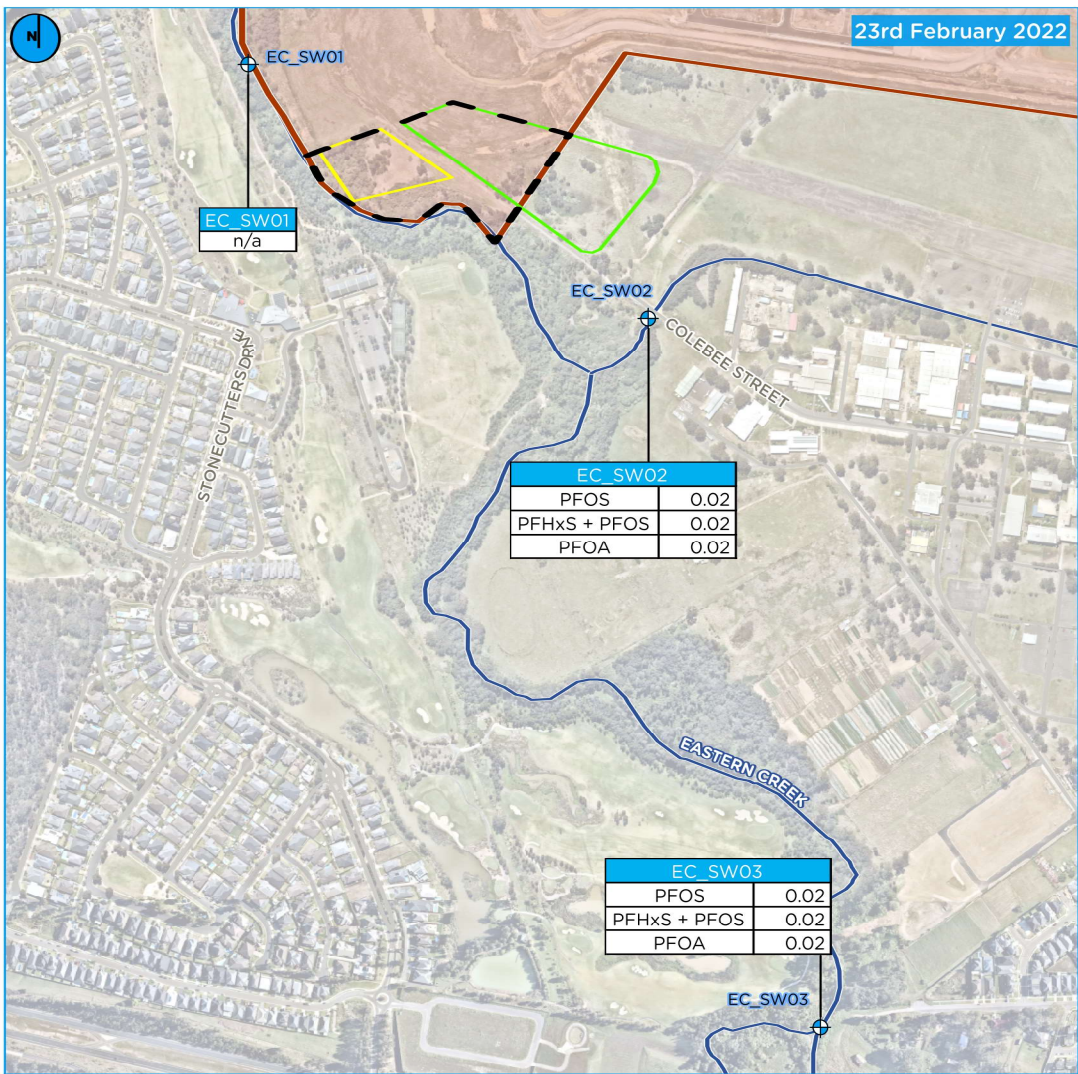


Figure 5.1 : Schofields PFAS Eastern Creek Surface Water Sample Detections

Former Schofields Aerodrome - STP and LF2 Supplementary PFAS Validation Investigation



Legend

- Approximate site boundary (comprising majority of Former Schofields Aerodrome)
- Surface water sample
- Former landfill (LF2)
- Former sewage treatment plant (STP)
- Site investigation area (3.63 ha)
- Waterway (NSW Spatial Service, 2022)

Surface Water Detection - Limit of Reporting (LOR)

COPCs	LOR
PFOS	
Sum (PFHxS + PFOS)	0.0001 µg/l
Perfluorooctanoic acid (PFOA)	0.01 µg/l

n/a = not assessed (samples unable to be collected on sample date)

Exceeds Batley et al. (2018) PFOS criteria of 0.05 ug/l

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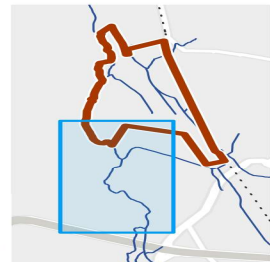
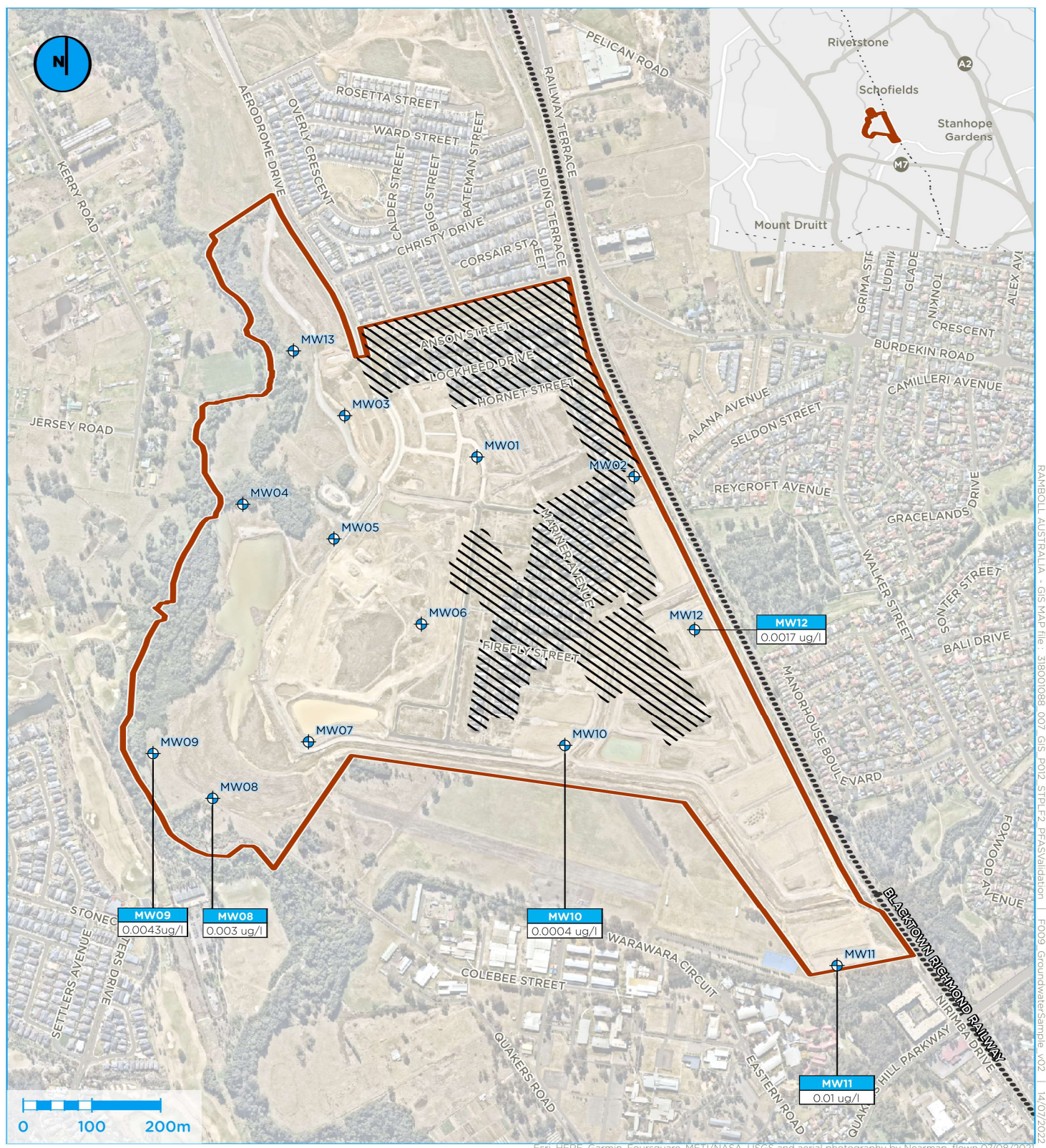


Figure 5.2 : Schofields PFAS Eastern Creek Surface Water Sample Detections

Former Schofields Aerodrome - STP and LF2 Supplementary PFAS Validation Investigation



Legend

- Approximate site boundary (comprising majority of Former Schofields Aerodrome)
- ▨ Excluded area
- + Monitoring well

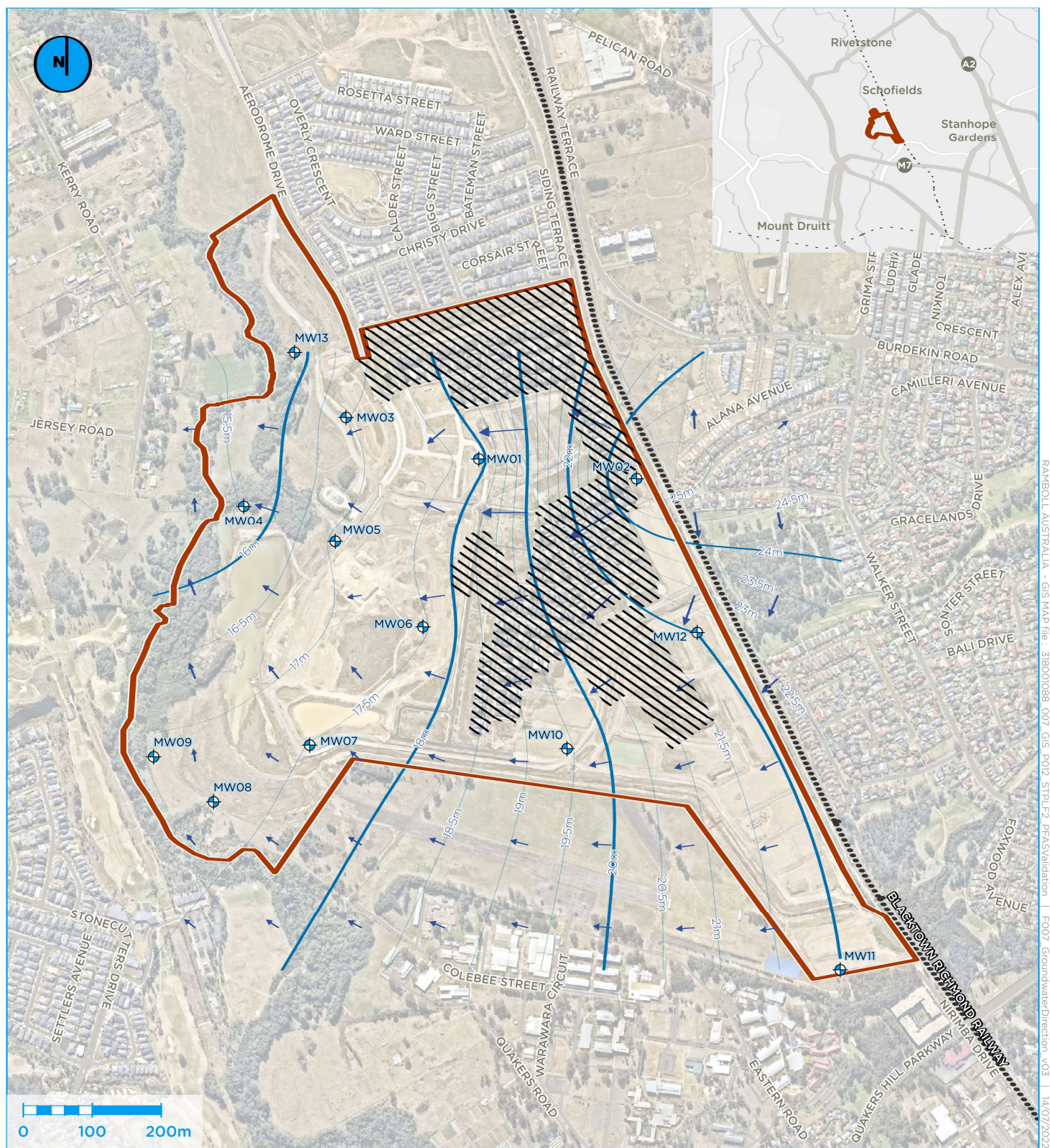
Exceedance Criteria

Sample Date	CoPC	DOEE 2016 FRESHWATER 99%
8/07/2021	PFOS	0.00023 ug/l

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Figure 6: Former Schofields Aerodrome Groundwater Monitoring Well Locations and Groundwater Guideline Exceedances (Figure from Ramboll 2021b)

Former Schofields Aerodrome – STP and LF2 Supplementary PFAS Validation Investigation

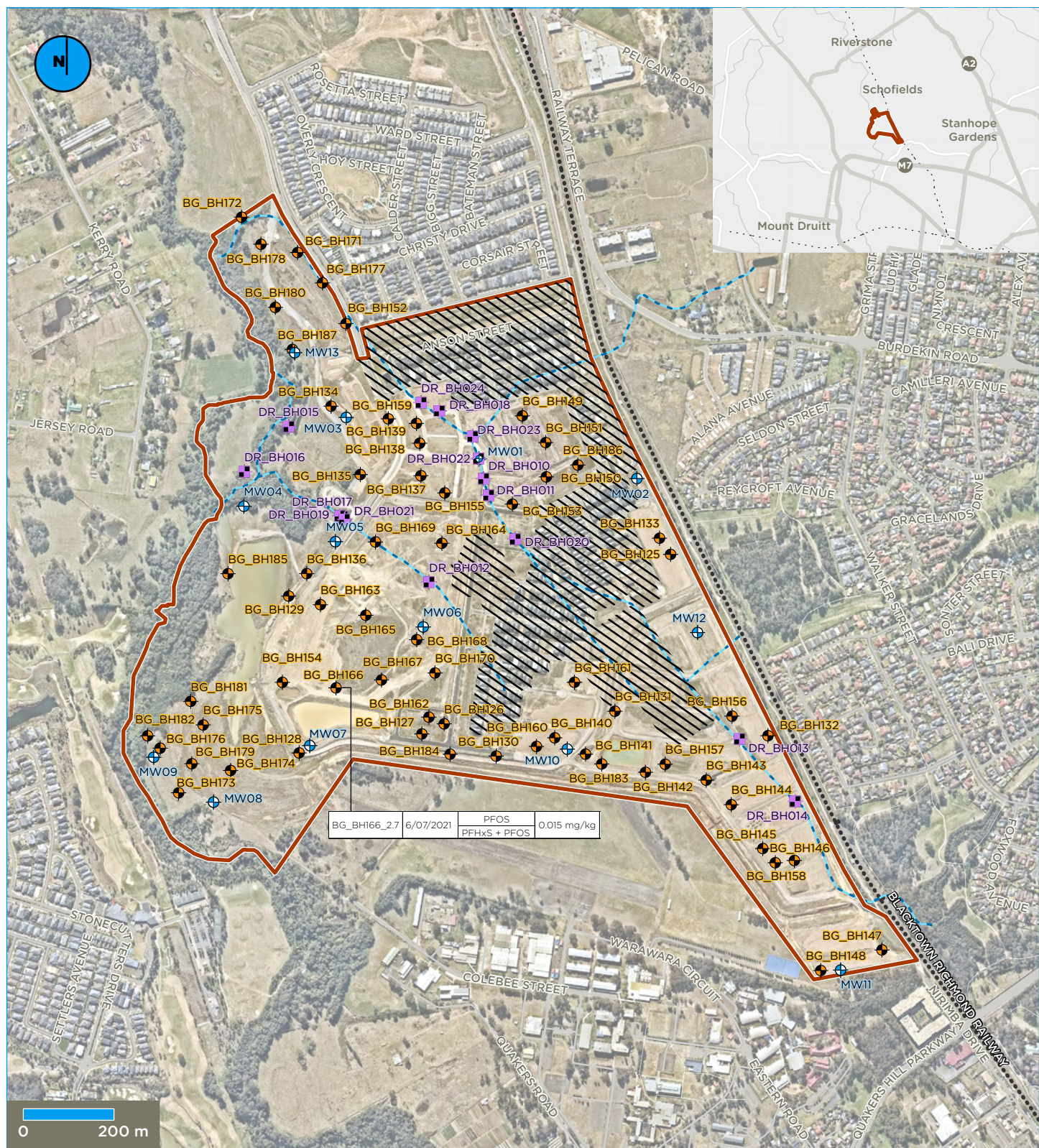


Legend

- Approximate site boundary (comprising majority of Former Schofields Aerodrome)
- Excluded area
- + Monitoring well
- Groundwater contour (mAHD)
 - 0.5m contour
 - 2m contour
 - Inferred groundwater flow direction

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Figure 7 : Former Schofields Aerodrome Contoured Groundwater Elevations (Figure from Ramboll 2021b)
Former Schofields Aerodrome – STP and LF2 Supplementary PFAS Validation Investigation



Legend

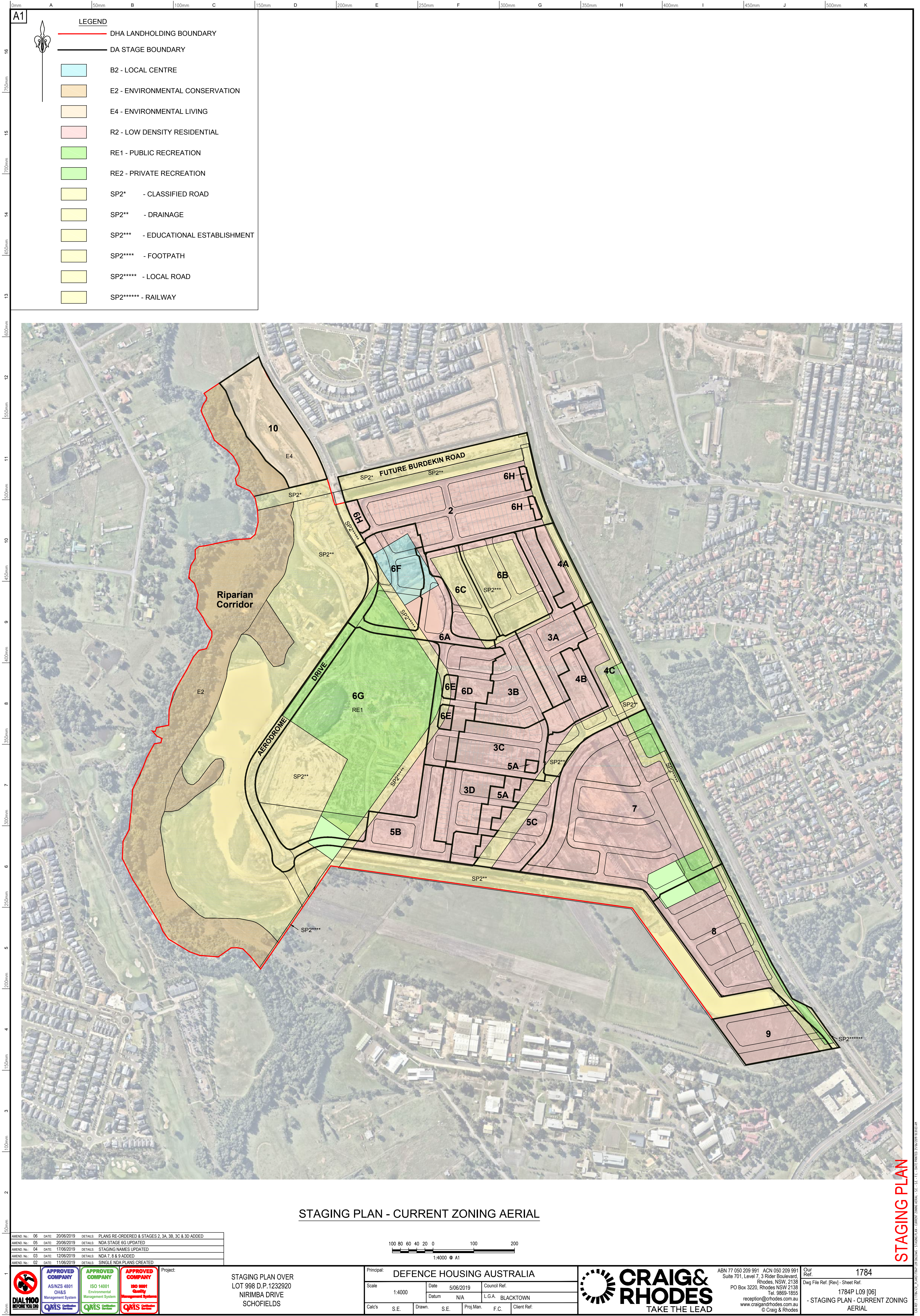
- Approximate site boundary (comprising majority of Former Schofields Aerodrome)
- Excluded area
- Background sample
- ⊕ Monitoring well
- ⊕ Drainage line borehole
- Former drainage channels

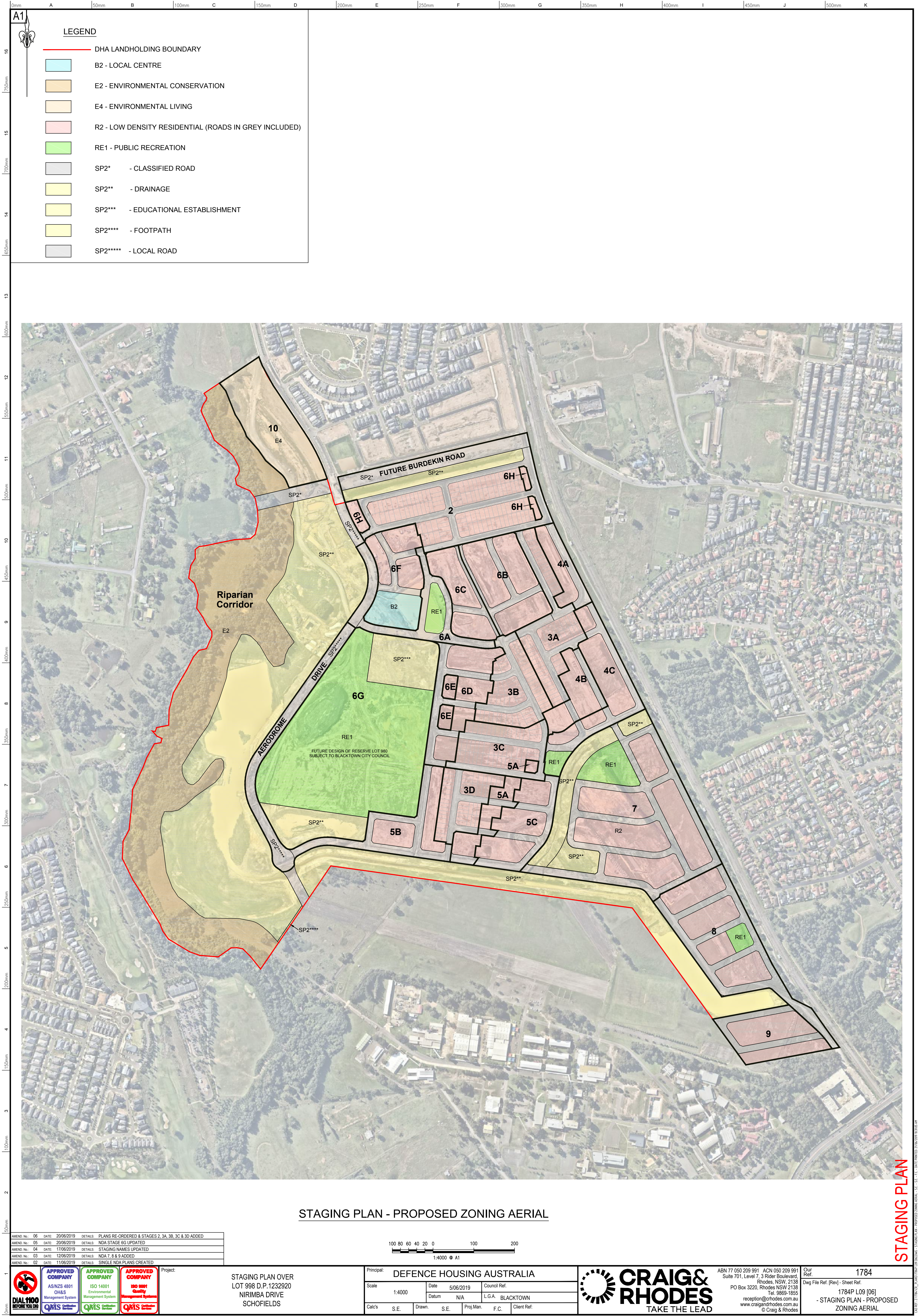
Exceedance Criteria

Sample Location and Depth (m)	Sample Date	CoPC	Adopted Criteria Exceeded		Reported Concentration
		PFOS	HEPA HIL A SOIL 2020	0.01 mg/kg	
			HEPA EGV SOIL INDIRECT 2020	0.01 mg/kg	
		PFHxS + PFOS	HEPA HIL A SOIL 2020	0.01 mg/kg	

Figure 4a: Background, Drainage Lines and VENM Thickness Investigation Locations and Soil Guideline Exceedances

PFAS Remaining Site Area Validation Report - Former Schofields Aerodrome







AKUNA VISTA

NIRIMBA FIELDS

- Release 1
- Release 2
- Release 3
- Release 4
- Release 5
- Release 6
- Release 7
- Release 8
- Smaller Lot Residential
- Future Residential
- Environmental Living Lots

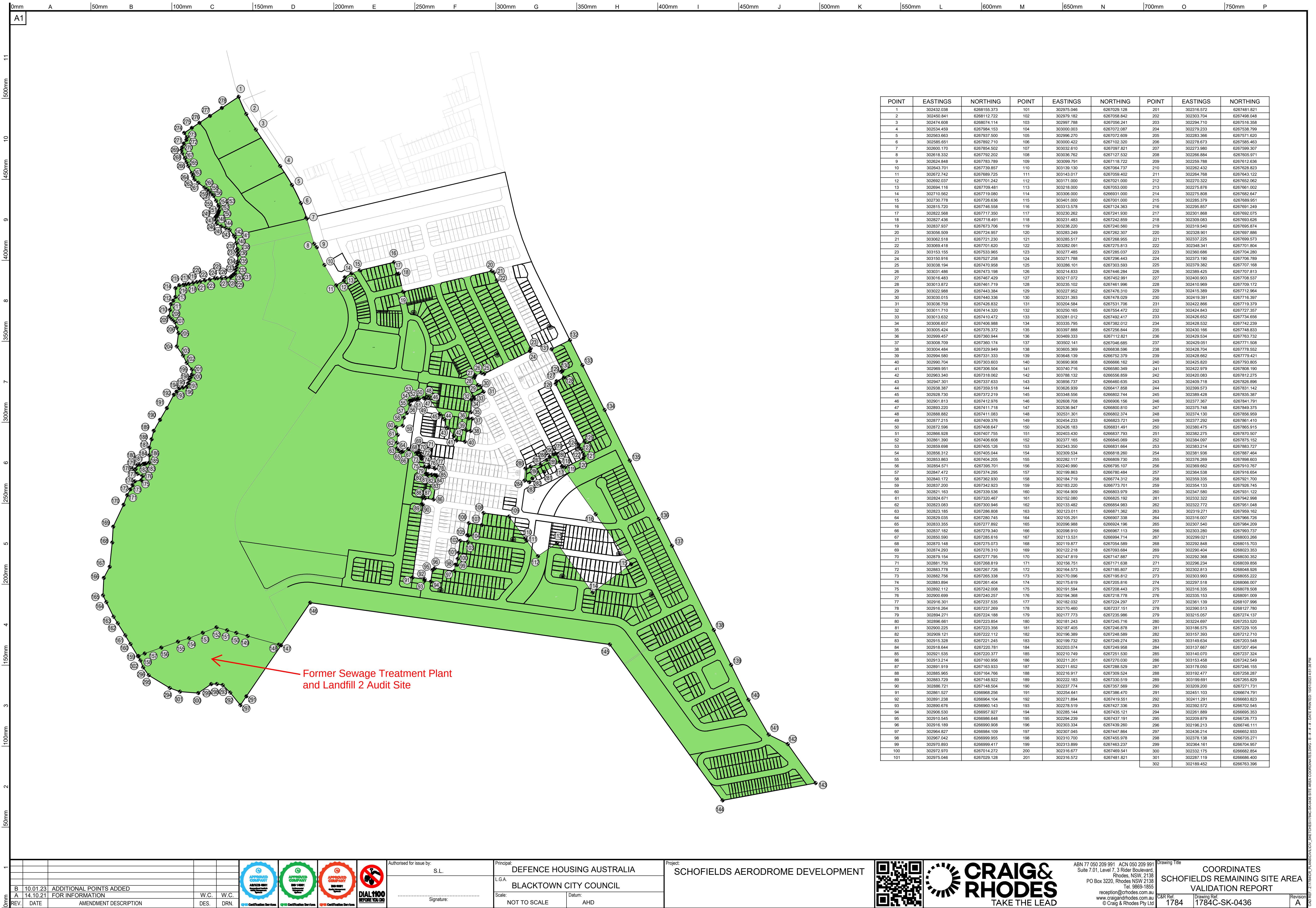
- 1 Proposed Primary School
- 2 Playing Field
- 3 Netball Courts
- 4 Playgrounds
- 5 Stormwater
- 6 Environmental Living Lots
- 7 Recreation Facility Carpark
- 8 Akuna Vista Local Centre
- 9 Eastern Creek
- 10 Nature Reserve
- 11 Park

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POINT	EASTINGS	NORTHING	POINT	EASTINGS	NORTHING	POINT	EASTINGS	NORTHING
1	302432.038	6268155.373	101	302975.046	6267029.128	201	302316.572	6267481.821
2	302450.841	6268112.722	102	302979.182	6267058.842	202	302303.704	6267498.048
3	302474.608	6268074.114	103	302997.788	6267056.241	203	302294.710	6267516.358
4	302534.459	6267984.153	104	303000.003	6267072.087	204	302279.233	6267538.799
5	302593.863	6267892.710	105	303006.270	6267102.329	205	302263.396	6267571.620
6	302585.651	6267854.502	106	303000.422	6267102.329	206	302278.673	6267585.463
7	302600.170	6267792.202	107	303032.610	6267097.821	207	302273.980	6267599.307
8	302618.332	6267783.789	108	303036.762	6267127.532	208	302266.884	6267605.971
9	302624.848	6267739.857	109	303099.791	6267118.722	209	302259.788	6267612.636
10	302643.701	6267726.636	110	303139.130	6267064.737	210	302262.432	6267628.823
11	302672.742	6267701.242	111	303143.017	6267059.402	211	302264.768	6267643.122
12	302692.037	6267709.481	112	303171.000	6267053.000	212	302270.322	6267652.062
13	302694.116	6267718.080	113	303216.000	6267053.000	213	302275.876	6267661.002
14	302710.862	6267726.636	114	303206.000	6266931.000	214	302275.808	6267662.947
15	302730.778	6267746.558	115	303401.000	6267001.000	215	302285.379	6267689.951
16	302815.720	6267718.491	116	303313.578	6267124.363	216	302295.857	6267691.249
17	302822.568	6267739.857	117	303230.262	6267241.930	217	302301.868	6267692.075
18	302827.436	6267673.706	118	303231.483	6267242.859	218	302309.083	6267693.626
19	302837.937	6267724.957	119	303238.220	6267262.307	219	302319.540	6267695.874
20	303056.509	6267721.230	120	303283.249	6267268.955	220	302328.901	6267697.886
21	303062.518	6267701.620	121	303285.517	6267275.813	221	302337.225	6267699.573
22	303069.418	6267753.965	122	303282.091	6267286.037	222	302348.341	6267701.804
23	303133.155	6267752.258	123	303271.788	6267296.443	223	302360.696	6267704.290
24	303150.916	6267470.958	124	303286.101	6267303.593	224	302373.190	6267706.789
25	303038.194	6267473.198	125	303214.833	6267446.284	225	302379.382	6267707.168
26	303031.486	6267467.429	126	303217.072	6267452.991	226	302389.425	6267707.813
27	303016.483	6267461.719	127	303235.102	6267461.996	227	302400.903	6267708.537
28	303013.872	6267443.384	128	303227.952	6267476.310	228	302410.969	6267709.172
29	303022.988	6267440.336	129	303231.393	6267478.029	229	302415.389	6267712.964
30	303030.015	6267426.832	130	303204.584	6267531.708	230	302419.391	6267716.397
31	303036.759	6267414.320	131	303250.165	6267554.472	231	302422.866	6267719.379
32	303011.710	6267410.472	132	303281.012	6267492.417	232	302424.843	6267727.357
33	303013.832	6267406.988	133	303335.795	6267382.012	233	302428.652	6267734.656
34	303006.657	6267376.372	134	303397.888	6267256.844	234	302430.166	6267748.833
35	303005.424	6267360.944	135	303409.333	6267112.821	235	302429.534	6267763.732
36	302990.457	6267360.174	136	303502.141	6267046.685	236	302429.051	6267771.508
37	303008.709	6267329.949	137	303605.369	6266938.596	237	302428.704	6267778.552
38	303004.484	6267331.333	138	303648.139	6266752.379	238	302428.662	6267779.421
39	302994.580	6267303.603	139	303690.908	6266666.162	239	302425.820	6267793.805
40	302990.704	6267305.504	140	303740.716	6266556.859	240	302422.978	6267808.190
41	302989.851	6267319.062	141	303788.132	6266540.635	241	302409.718	6267812.375
42	302983.340	6267359.518	142	303826.939	6266417.858	242	302399.573	6267831.142
43	302947.301	6267372.219	143	303848.556	6266382.721	243	302389.428	6267835.387
44	302938.387	6267412.976	144	303808.708	6266906.156	244	302377.367	6267841.791
45	302928.730	6267411.718	145	302536.947	6266800.810	245	302375.748	6267849.375
46	302901.813	6267411.083	146	302531.301	6266802.374	246	302374.130	6267856.959
47	302893.220	6267409.376	147	302454.233	6266823.721	247	302377.292	6267861.410
48	302886.882	6267406.647	148	302408.183	6266831.031	248	302380.475	6267865.916
49	302877.215	6267407.755	149	302403.430	6266837.793	249	302382.275	6267870.507
50	302872.596	6267406.608	150	302377.165	6266845.069	250	302384.087	6267875.152
51	302866.628	6267405.126	151	302343.350	6266831.664	251	302383.214	6267883.727
52	302861.390	6267405.044	152	302309.534	6266818.260	252	302381.936	6267887.464
53	302859.698	6267404.205	153	302282.117	6266809.730	253	302376.269	6267896.603
54	302856.312	6267395.701	154	302240.990	6266795.107	254	302369.662	6267910.767
55	302853.863	6267374.295	155	302199.863	6266780.484	255	302364.538	6267916.654
56	302854.571	6267362.930	156	302184.719	6266774.512	256	302359.335	6267921.700
57	302847.472	6267342.923	157	302180.032	6266774.512	257	302354.133	6267926.145
58	302840.172	6267339.536	158	302164.909	6266803.979	258	302347.580	6267931.122
59	302837.200	6267320.467	159	302152.080	6266825.192	259	302332.322	6267942.968
60	302831.163	6267300.946	160	302133.482	6266854.983	260	302322.772	6267951.048
61	302824.671	6267286.808	161	302123.011	6266871.362	261	302319.271	6267959.162
62	302823.083	6267280.745	162	302105.291	6266907.338	262	302316.007	6267966.726
63	302823.185	6267277.892	163	302096.988	6266924.196	263	302307.540	6267984.209
64	302829.035	6267279.340	164	302098.910	6266967.113	264	302303.280	6267993.737
65	302833.355	6267285.616	165	302113.531	6266994.714	265	302299.021	6268003.266
66	302837.182	6267275.073	166	302119.877	6267054.589	266	302292.848	6268015.703
67	302850.590	6267276.310	167	302122.216	6267093.684	267	302290.404	6268023.353
68	302870.148	6267277.795	168	302147.819	6267147.887	268	302292.368	6268030.352
69	302874.293	6267268.819	169	302156.751	6267171.638	269	302296.234	6268039.856
70	302879.154	6267267.726	170	302164.573	6267185.807	270	302302.813	6268048.926
71	302881.750	6267265.338	171	302170.096	6267195.812	271	302303.993	6268055.222
72	302883.778	6267261.404	172	302175.619	6267205.816	272	302297.518	6268066.007
73	302882.756	6267242.008	173	302191.594	6267208.443	273	302316.335	6268078.508
74	302883.894	6267240.257	174	302194.368	6267218.778	274	302335.153	6268091.009
75	302892.112	6267237.535	175	302210.749	6267224.297	275	302361.139	6268107.996
76	302900.699	6267237.269	176	302211.201	6267236.529	276	302390.513	6268127.700
77	302916.301	6267224.198	177	302216.652	6267309.524	277	302392.368	6268142.137
78	302916.264	6267223.854	178	302218.917	6267330.519	278	302399.021	6268157.003
79	302894.271	6267223.356	179	302222.183	6267357.569	279	302401.103	6268168.823
80	302896.661	6267222.112	180	302254.641	6267386.470	280	302411.291	6268182.923
81	302900.225	6267221.245	181	302271.894	6267419.551	281	302411.291	6268197.700
82	302909.121	6267220.781	182	302278.519	6267427.336	282	302411.291	6268212.964
83	302915.328	6267220.377	183	302285.144	6267435.121	283	302411.291	6268228.713
84	302918.644	6267216.956	184	302294.239	6267437.191	284	302411.291	6268244.549
85	302921.535	6267163.903	185	302303.334	6267439.260	285	302411.291	6268260.713
86	302921.614	6267164.766	186	302307.045	6267447.864	286	302411.291	6268276.886
87	302891.919	6267148.922	187	302313.899	6267455.978	287	302411.291	6268293.059
88	302885.965	6267148.504	188	302316.672	6267469.541	288	302411.291	6268309.232
89	302883.729	6267148.504	189	302316.672	6267481.821	289	302411.291	6268325.404
90	302886.721	6266968.256	190	302316.672	6267481.821	290	302411.291	6268341.576
91	302881.527	6266964.104	191	302316.672	6267481.821	291	302411.291	6268357.748
92	302881.238	6266964.104	192	302316.672	6267481.821	292	302411.291	6268373.920
93	302890.676	6266960.143	193	302316.672	6267481.821	293	302411.291	6268390.092
94	302906.530	6266957.927	194	302316.672	6267481.821	294	302411.291	6268406.264
95	302910.545	6266968.648	195	302316.672	6267481.821	295	302411.291	6268422.436
96	302916.189	6266960.908	196	302316.672	6267481.821	296	302411.291	6268438.608
97	302984.827	6266984.109	197	302316.672	6267481.821	297	302411.291	6268454.780
98	302967.042	6266999.955	198	302316.672	6267481.821	298	302411.291	6268470.952
99	302970.893	6267014.272	199	302316.672	6267481.821	299	302411.291	6268487.124
100	302972.970	6267029.128	200	302316.672	6267481.821	300	302411.291	6268503.296
101	302975.046	6267029.128	201	302316.672	6267481.821	301	302411.291	6268519.468
						302	302411.291	6268535.640



Appendix B: EPA Guidelines



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

(EPA webpage last updated 12 August 2022)

Section 105 of the 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; and 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)
- Contaminated land sampling design guidelines part 1 – application (PDF 3.3MB)
- Contaminated land sampling design guidelines part 2 – interpretation (PDF 1MB)
- 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 (Australia and New Zealand Environment Conservation Council [ANZECC], October 2000), are replaced as of 29 August 2018 by the Australian and New Zealand Guidelines (ANZG) 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 & Agriculture and Resources Management Council of Australia and New Zealand (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) (ASC NEPM).

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 Environmental Protection (Assessment of Site Contamination) Measure 1999, (April 2013)* (ASC NEPM 1999)
- 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, NHMRC and Natural Resource Management Ministerial Council of Australia and New Zealand (2011)

*The ASC NEPM was amended on 16 May 2013.



Appendix C: Interim Site Audit Advice

22 March 2022

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

Dear ██████████

Re: Interim Site Audit Advice No. 23: Sampling, Analysis and Quality Plan (draft D1) Former Sewage Treatment Plant (STP) and Landfill 2 Supplementary Investigations, Former Schofields Aerodrome, Nirimba Fields NSW

1. Introduction

As a NSW Environmental Protection Authority (EPA) accredited Contaminated Land Management Site Auditor, I have been engaged by Defence Housing Australia (DHA) to conduct a non-statutory Section B site contamination audit of the former Sewage Treatment Plant (STP) and Landfill 2 (the site), which are located within the former Schofields Aerodrome. The site is approximately 2.4 hectare.

The former Schofields aerodrome is approximately 135 hectares, and it has been developed into a new low density residential estate with suburban road network, retail/business, a school and recreational areas called Nirimba Fields. It is located within the Blacktown City Council (Council) area. Due to its historical use as a former aerodrome, it was identified to be impacted with per- and polyfluoroalkyl substances (PFAS) contamination.

2. Background

The site is currently open space and riparian zone adjacent to Eastern Creek and it is proposed to remain as such (i.e., recreational public open space land use).

The former Schofields aerodrome (including the site, PFAS MEA, Remaining Site Area, 'No Scrape Area South of Swale' and 'No Scrape Area North of Swale') were previously audited by another auditor and a Section A Site Audit Report and a Site Audit Statement (GN481) were issued in September 2013.

Ramboll Environ Australia Pty Ltd (Ramboll) were engaged by DHA to undertake investigations to assess and characterise the nature and extent of PFAS contamination at the site, and to draw conclusions regarding the suitability of the site for low density residential land uses.

Given that the remainder of the former aerodrome external to former STP and Landfill 2 (including PFAS MEA, Remaining Site Area, No Scrape Area South and No Scrape Area North of Swale) are assessed, reported and audited separately, they are not discussed further in this letter.



The auditor was provided with the following document for review:

- Ramboll (2022) *Sampling, Analysis & Quality Plan, Former Sewage Treatment Plant (STP) and Landfill 2 Supplementary Investigations*, draft D1 dated 17 March 2022. This is hereafter referred to as 'the SAQP'.

The purpose of this letter is to provide comments on the SAQP (draft D1).

3. Auditor's Comments

The auditor has completed a review of the SAQP (draft D1) 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).

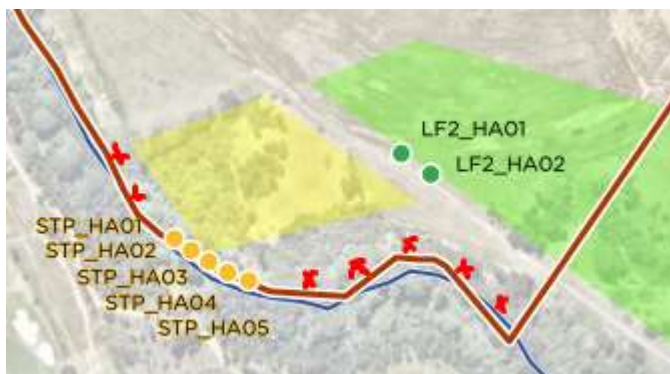
Based on a review of the SAQP (draft D1), the following items require clarification or amendments:

1. **Section 1.1:** For completeness, it is recommended that it is stated that the investigation conducted by Ramboll (2021b) did not identify soil concentrations above the human health-based criteria for public open space (recreational land use) at former STP and Landfill 2.
2. **Section 1.2:** "(ii) assessment of Eastern Creek waters and sediment near to the former STP and LF2". There is no sediment sampling proposed in this SAQP and therefore, it is not clear how sediment in Eastern Creek is to be assessed.
3. **Section 1.3:** Based on the discussion with Ramboll on 7 March 2022, it is understood that the up-stream surface water (Eastern Creek) sampling location was not accessible and therefore EC_SW02 (at eastern tributary of Eastern Creek) and EC_SW03 were collected. The auditor notes that EC_SW02 and EC_SW03 are located a fair distance way from Landfill 2 and former STP. It is recommended that a closer up-stream surface water sample (to STP and Landfill 2) be collected where possible (in addition to EC_SW02 and EC_SW03 to confirm repeatability as these locations have already been sampled). While the location of EC_SW02 and EC_SW03 are not ideal, the auditor notes that EC_SW02 and EC_SW03 can provide some "regional/background" information about the water quality at Eastern Creek.
4. **Section 1.4:** Please update as SEPP 55 has been revoked and replaced by Resilience and Hazards SEPP.
5. **Table 2-1:**
 - Please check the geographical coordinates provided as it does not appear to be located near former STP and Landfill 2.
 - As the site is defined as former STP and Landfill 2, please amend the zoning information provided.
6. **Section 2.1:** It is understood that 'the site' for this SAQP is former STP and Landfill 2 (areas of interest). To avoid confusion, please differentiate when describing the wider former Schofields Aerodrome compared to 'the site' in Table 2-2.
7. **Table 2-2:** As groundwater investigation was conducted by Ramboll in July 2021, it is recommended that the more recent information be referenced instead of Ramboll 2017 data from five years ago.
8. **Section 2.3:** The site assessment (PFAS validation) works conducted and reported by Ramboll 2021b should also be referenced as it contains the more recent soil and groundwater investigation works conducted in 2021.



9. **Table 3-1:** Please re-format Table 3-1 as word appear to be missing 'Surface *water*'.
10. **Section 4 Step 3:** Should appropriate guidelines for surface water be included as well?
11. **Section 4 Step 5:** Please amend typographical error with SPI.
12. **Section 5.2:** Please check Table 5-1 as the discussion in Section 5.2 refers to PFAS NEMP health-based guideline values.
13. **Section 5.3:** Please check as the second paragraph is not consistent with the first sentence of Section 5.3.
14. **Table 5-2:** It is recommended that Table 5-2 be consistent with Table 6-2 of PFAS Validation Report (Ramboll 2021b). E.g. 19 µg/L PFOA is derived from NEMP 2.0.
15. **Table 5-2:** This table is titled 'groundwater and leachate' assessment criteria. Please rename it is not stated that groundwater and leachate sampling are proposed in this SAQP.
16. **Table 6-1:** 'STP_BH192_0.0' (not STP_BH192_0.1) is shown in Table 3n of PFAS Validation Report (Ramboll 2021b) to measure elevated PFOS concentration.
17. **Section 6.1:** Please provide more information about the soil sampling locations and the rationale for selecting their locations. If the purpose of the soil sampling is to delineate soil impacts already identified within STP and Landfill 2 (i.e., locations listed in Table 6-1), then existing sampling locations where contamination was detected should be shown in Figure 1 to show the extent of delineation.

If the purpose is to assess soil condition along the banks of Eastern Creek (along potential migration pathway from STP and Landfill 2), then, it is recommended that more sampling locations (spread out along Eastern Creek) be assessed (e.g. refer to marked-up map below).



18. **Section 6.1:** How far are STP_HA01 to STP_HA05 away from the Eastern Creek water edge? Are LF2_HA01 and LF2_HA02 located within or external to Landfill 2?
19. **Section 6.4:** It is stated that soil samples are to be analysed for PFAS suite (30 compounds only). Is leachability testing to be conducted on these soil samples as well? It is noted that soil leachate data was referenced in Section 9 and it is not clear if it is referring to this SAQP field program.
20. **Section 8.3:** Please check as there is no Section 4.3 in this report.



4. Closure

Please address the comments above, revise the SAQP and complete the sampling program.

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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10 June 2022

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

Dear [REDACTED]

Re: Interim Site Audit Advice No. 24: Addendum Report (draft D1) Former Sewage Treatment Plant (STP) and Landfill 2 Supplementary Investigation, Former Schofields Aerodrome, Nirimba Fields NSW

1. Introduction

As a NSW Environmental Protection Authority (EPA) accredited Contaminated Land Management Site Auditor, I have been engaged by Defence Housing Australia (DHA) to conduct a non-statutory Section B site contamination audit of the former Sewage Treatment Plant (STP) and former Landfill 2 (the site), which are located within the former Schofields Aerodrome.

The former Schofields aerodrome is approximately 135 hectares, and it has been developed into a new low density residential estate with suburban road network, retail/business, a school and recreational areas called Nirimba Fields. It is located within the Blacktown City Council (Council) area. Due to its historical use as a former aerodrome, it was identified to be impacted with per- and polyfluoroalkyl substances (PFAS) contamination.

2. Background

The site is currently open space and riparian zone adjacent to Eastern Creek and it is proposed to remain as such (i.e., recreational public open space land use).

The former Schofields aerodrome (including the site, PFAS MEA, Remaining Site Area, 'No Scrape Area South of Swale' and 'No Scrape Area North of Swale') were previously audited by another auditor and a Section A Site Audit Report and a Site Audit Statement (GN481) were issued in September 2013.

Ramboll Environ Australia Pty Ltd (Ramboll) were engaged by DHA to undertake investigations to assess and characterise the nature and extent of PFAS contamination at the former Schofields aerodrome and to draw conclusions regarding the suitability of the site for low density residential land uses.

Given that the remainder of the former Schofields aerodrome external to former STP and Landfill 2 (including PFAS MEA, Remaining Site Area, No Scrape Area South and No Scrape Area North of Swale) are assessed, reported and audited separately, they are not discussed further in this letter.



The auditor was provided with the following document for review:

- Ramboll (2022) *Addendum Report, Former Schofields Aerodrome - Sewage Treatment Plant (STP) and Landfill 2 Supplementary Investigation*, draft D1 dated 31 May 2022. This is hereafter referred to as 'the Addendum Report'.

The purpose of this letter is to provide comments on the Addendum Report (Ramboll 2022).

3. Auditor's Comments

The auditor has completed a review of the Addendum Report (Ramboll 2022) 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).
- Ramboll (2022) *Sampling, Analysis & Quality Plan, Former Sewage Treatment Plant (STP) and Landfill 2 Supplementary Investigations*, draft D1 dated 17 March 2022. This is hereafter referred to as 'the SAQP'.

Based on a review of the SAQP (draft D1), the following items require clarification or amendments:

1. **Section 1:** The 'Site Investigation Area' adopted in this report is shown in Figure 1 to be a rectangular-shaped area of approximately 26 ha. As the ultimate objective is to achieve a Section B SAS/SAR for STP and Landfill 2, which were excluded from 'the audit site' as shown in Figure 1a of Ramboll's PFAS Remaining Site Area Validation Report dated 21 October 2021, it is recommended that the 'Site Investigation Area' (i.e. STP and Landfill 2) is the same area which was previously excluded (refer to marked up screen shot of Figure 1a of Ramboll's PFAS Remaining Site Area Validation Report below):



This way the entire former Schofields Aerodrome will be eventually audited.

2. **Table 2-1:** As discussed in Item 1 above, please amend the Table 2-1 to reflect STP and Landfill 2 (i.e. the portion of former Schofields Aerodrome left to be audited).
3. **Table 2-1:** Site elevation of approximately 18 mAHd is listed. Given that the Site Investigation Area is vast, please clarify where/what this elevation refers to: STP, Landfill 2, Eastern Creek, etc.? Perhaps a range can be provided e.g. elevation at STP and Landfill 2 to an elevation at Eastern Creek.
4. **Table 2-1:** Please check as planning zone 'C4-environmental living' does not appear to apply to the Site Investigation Area, STP and Landfill 2.



5. **Section 2.1:** The information presented in Table 2-2 is general information for the wider former Schofields Aerodrome. Please also clarify the site specific setting information (i.e. STP, Landfill 2 and eastern Creek adjacent to STP/Landfill 2) to support the sampling locations selected.
6. **Section 5.2:** “*Less sensitive criteria (HIL D) would also be applicable for proposed commercial areas...*”. Please clarify as the auditor is not aware that STP or Landfill 2 are proposed for commercial use.
7. **Section 5.3:** My understanding is that the supplementary investigation is to delineate contamination that poses an ‘ecological’ hazard to terrestrial and aquatic receptors and that ecological criteria (not landfill acceptance criteria) are the most relevant criteria to assess potential impacts from leachate concentrations.
8. **Section 6.1:** For context, please include some justification or rationale for the upstream sampling locations:
 - SW02 located on a tributary of Eastern Creek (not Eastern Creek itself).
 - SW03 located approximately 1 km away from STP and Landfill 2.
9. **Section 7.1.1:** Are there any lithological logs for the 16 boreholes (1 m deep)?
10. **Section 7.1.1:** Please include discussion about:
 - The average and maximum depth of the fill (reworked natural).
 - Whether any anthropogenic or industrial waste was observed (especially at LF2_HA01 to LF2_HA04 targeting Landfill 2).
11. **Section 7.2.2:** For completeness, it should be stated that the one exceedance of Batley et. al.’s PFOS criterion (99% species protection) at EC_SW03 was measured on 25 March 2022, only.
12. **Table 7-2:** The lowest pH shown in Table 5 is 7.33 pH unit measured at EC_SW01 on 25 March 2022.
13. **Section 7.2.3, Table 7-3 and Table 1b:** As discussed in Item 7, please revise the tables and discussion to assess leachate analytical results against ecological criteria (not landfill acceptance criteria).
14. **Section 8:** Appendix B only includes a calibration certificate for PID dated 24 January 2022. Please also provide the PID calibration certificates from the soil sampling work conducted in February 2022 and March 2022.
15. **Table 8-1 Sampling density:** Please discuss why there were:
 - Six soil field duplicates but only two soil field triplicates.
 - Seven surface water field duplicates but only one surface water field triplicate.

The number of field triplicate is not in accordance with Section 18.3 of PFAS NEMP 2.0 and Section 7.1 of draft SAQP dated 17 March 2022.
16. **Table 8-2 Field quality control samples:** As discussed in Item 15 above, the number of field triplicate samples (for soil and surface water) does not meet the PFAS NEMP 2.0 and draft SAQP (dated 17 March 2022) requirements of 1 per 10 primary samples. Please provide some rationale (refer to Item 15 above).
17. **Table 8-2:** Section 7.1 of draft SAQP dated 17 March 2022 indicated that water trip blank samples and soil trip blank samples are to be analysed as part of the field QC samples. Was this conducted?
18. **Section 9.1:** Please amend the sentence to state “*No results exceeded the adopted human health criteria for PFAS Sum of PFOS and PFHxS and PFOA for public open space land use of 1 mg/kg and 10 mg/kg respectively.*” A sentence should also be included to indicate that there no results exceeded the ecological direct exposure criteria.



19. **Section 9.1:** As indicated in Figure 3, the soil sampling locations with elevated results are located around the west, south-west and south of STP and Landfill 2 towards the boundary of the site at Eastern Creek (not just at the southern portion of Landfill 2).
20. **Section 9.3:** Please revise the discussion to assess against PFAS NEMP ecological criteria (instead of PFAS NEMP landfill acceptance criteria as we are not evaluating the material for off-site disposal to a landfill).
21. **Section 9.4:** In addition to Figure 6 (contoured groundwater elevation), for completeness, please also include Figure 5 (Former Schofields Aerodrome Groundwater Monitoring Well Locations and Groundwater Guideline Exceedances) to show groundwater concentrations from 'PFAS Validation Report Remaining Site Area' (F1) dated 21 October 2021.
22. **Section 9.5 'Is the soil impacted?':** Discussion presented confirmed that the PFAS impacts in soil do *"not preclude the identified future public open space land use"*. Please provide justification for why this is the case given that:
- PFAS contamination was recorded in the top 0.1 m of the soil profile where organisms live.
 - Public open space (parkland) supports terrestrial organisms (e.g. secondary consumers) with more wildlife than say residential land use.
23. **Section 9.5 Linkages:** Figure 6 shows that the groundwater flow direction at STP and Landfill 2 (Site Investigation Area) is north-west (rather than west).
24. **Section 9.5 Linkages:** The auditor is not disputing that the surface water data has not indicated contamination at Eastern Creek directly linked to STP and Landfill 2, however is requesting more lines of evidence as to why the PFAS-impacted soil adjacent to Eastern Creek is not expected to cause contamination to Eastern Creek in the future. Perhaps discussion on soil types, age of contamination, historical remediation conducted, soil concentrations measured down-slope of STP/Landfill 2 compared to concentrations measured at STP/Landfill 2, etc. can be included.
25. **Section 11:** Please check as the reference list indicated that the SAQP for SP and Landfill 2 Areas is dated 20 July 2022.
26. **Validation Report:** This report is indicated to be an addendum to Ramboll's 'PFAS Validation Report Remaining Site Area (F1)' dated 21 October 2021. The auditor expects a validation report (similar to the ones prepared for Remaining Areas, North of Swale, etc.) to be prepared for STP and Landfill 2 (i.e. audit site) which will discuss all the soil, groundwater, surface water, leachate results, QAQC of the relevant data, risks to human and ecological health, site suitability for its proposed use and whether there is a need for ongoing site management.

4. Closure

Please address the comments above and revise the Addendum 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]



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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15 September 2022

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

Dear ██████████

Re: Interim Site Audit Advice No. 25: PFAS Validation Report (draft D2) Former Sewage Treatment Plant (STP) and Landfill 2 Supplementary Investigation, Former Schofields Aerodrome, Nirimba Fields NSW

1. Introduction

As a NSW Environmental Protection Authority (EPA) accredited Contaminated Land Management Site Auditor, I have been engaged by Defence Housing Australia (DHA) to conduct a non-statutory Section B site contamination audit of the former Sewage Treatment Plant (STP) and former Landfill 2 (the site), which are located within the former Schofields Aerodrome.

The former Schofields aerodrome is approximately 135 hectares, and it has been developed into a new low density residential estate with suburban road network, retail/business, a school and recreational areas called Nirimba Fields. It is located within the Blacktown City Council (Council) area. Due to its historical use as a former aerodrome, it was identified to be impacted with per- and polyfluoroalkyl substances (PFAS) contamination.

2. Background

The site is currently open space and riparian zone adjacent to Eastern Creek and it is proposed to remain as such (i.e., recreational public open space land use).

The former Schofields aerodrome (including the site, PFAS MEA, Remaining Site Area, 'No Scrape Area South of Swale' and 'No Scrape Area North of Swale') were previously audited by another auditor and a Section A Site Audit Report and a Site Audit Statement (GN481) were issued in September 2013.

Ramboll Environ Australia Pty Ltd (Ramboll) were engaged by DHA to undertake investigations to assess and characterise the nature and extent of PFAS contamination at the former Schofields aerodrome and to draw conclusions regarding the suitability of the site for low density residential land uses.

Given that the remainder of the former Schofields aerodrome external to former STP and Landfill 2 (including PFAS MEA, Remaining Site Area, No Scrape Area South and No Scrape Area North of Swale) are assessed, reported and audited separately, they are not discussed further in this letter.



The auditor was provided with the following document for review:

- Ramboll (2022) *PFAS Validation Report, Former Schofields Aerodrome - Sewage Treatment Plant (STP) and Landfill 2*, draft D2 dated 19 August 2022. This is hereafter referred to as 'the Validation Report'.

The purpose of this letter is to provide comments on the draft Validation Report (Ramboll 2022).

3. Auditor's Comments

The auditor has completed a review of the draft Validation Report (Ramboll 2022a) 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).

The auditor notes that the draft Validation Report has addressed all of the auditor's comments from IAA24 dated 10 June 2022. Based on a review of the draft Validation Report (draft D2), the following items require clarification or amendments:

1. **Section 1.2 and 1.3:** The objectives and scope of works listed are referring to the supplementary investigation. Please revise as this report is the PFAS validation report for the 'Site Investigation Area' concluding on site suitability (which will form the basis for the SAR/SAS).
2. **Section 1.4:** In line with advice from NSW EPA, please add a note indicating that there are new NSW EPA Sampling Design Guidelines dated August 2022, however, as the fieldwork was conducted prior to August 2022, former Sampling Design Guidelines from 1995 are referenced because they were valid at time of assessment.
3. **Table 2-1:** Please check as a review of SIX Map conducted by the auditor on 12/9/2022 indicated that the Site Investigation Area (audit site) is part Lot 2/DP1285594 with a street address of Triton Parade, Nirimba Fields.
4. **Table 3-1 On-site wells:** Groundwater data (mbtoc) from October 2021 was reported (2nd and 3rd paragraphs). Please check as there was no groundwater monitoring event conducted in October 2021.
5. **Table 3-1 Background groundwater quality:** Please revise the information presented to ensure consistency with Table 3-1 of Remaining Site Area PFAS Validation Report dated 21/10/2021 while present the results of the WaterNSW search conducted in 2022.
6. **Section 4.2:** When were the STP and LF2 decommissioned (last paragraph)?
7. **Table 5-1:**
 - Please replace 'Area of Interest' in the title with 'Site Investigation Area' and check the font as both 'Y' and 'N' are in bold.
 - Please check as direct contact/ingestion for sediment is not considered to be relevant, however, its risk is discussed to be low and acceptable in the SPR assessment comments in the same row.
8. **Table 5-1 Sediment:** The risk screening assessment documented in the PFAS Validation Overview letter (draft D5) dated 21 May 2021 mainly focuses on risk associated with emplacing the mixed sediment/soil (sourced from the former drainage channels within the PFAS Remaining Area adjacent to the FFTA) onto other areas in PFAS Remaining Area. The PFAS Overview letter does not discuss sediment within Eastern Creek and the auditor is not aware of any sediment data available for Eastern Creek. New discussion is recommended to indicate the potential for sediment in Eastern Creek to be impacted from soil erosion from land, etc.



- 9. Section 6:** For completeness, please indicate that the DQOs are for the supplementary investigation conducted in the Site Investigation Area only.
- 10. Section 7.3:** It is documented that Eastern Creek is not expected to be used for recreational use. This is inconsistent with Section 6.3 of Remaining Site Area PFAS Validation Report dated 21/10/2021 which states that “*Eastern Creek, some parts of which may be used recreationally*”. If there is new data that indicates that recreational use is not relevant, please include this.
- 11. Section 7.3:** While it is noted that there is no groundwater monitoring bore located within the ‘Site Investigation Area’, Section 11.4 discussed groundwater results measured in the vicinity and therefore, groundwater criteria should be included.
- 12. Section 8.1:** “*The soil PFAS results obtained from the 2021 validation works are summarised in Table 6-1*”. Please amend this sentence to: The soil PFAS results obtained from the 2021 validation works (*pre-supplementary investigation*) are summarised in Table 8-1.
- 13. Table 8-1:** There is one detection for PFHxS (i.e. STP_BH188_0.0 field triplicate sample with 0.0002 mg/kg) in the STP area which is not included in this table.
- 14. Section 9.1.1:** It appears that Ramboll discussed stratigraphy from supplementary investigation only. Consistent with Appendix D, please revise Section 9.1.1 to show a generalised site stratigraphy based on **all** soil investigations conducted at the Site Investigation Area.
- 15. Section 9.1.1 / Appendix D:**
- Should Appendix D be referenced?
 - The ‘LF2 average representation’ log and ‘STP average representation’ log seems to be describing the lithology encountered during the supplementary investigation targeting banks of Eastern Creek (i.e., not the STP and LF2 itself). This needs to be clearly stated on the logs.
 - Please check as the logs provided for LF2_BH## and STP_BH## are not the same logs provided in Appendix E of Remaining Site Area PFAS Validation Report dated 21/10/2021. None of the logs were signed off as checked, whereas ‘APW’ had checked the logs in Appendix E of the 2021 Validation Report.
 - The bore log for LF2_BH071 is missing information.
- 16. Section 9.2:**
- Please amend the formatting as a sentence is shown as a subsection title.
 - Please update reference as Section 7.2.1 and 7.2.2 do not discuss exceedances for soil and surface water.
- 17. Section 9.2.2:** Please update referencing to Table 9-2, instead of Table 7-2.
- 18. Section 9.2.3:**
- Please update referencing to Table 9-3, instead of Table 7-3.
 - Please provide the 95% ProUCL output for the data presented in Table 9-3.
 - Only leachate PFOS results were discussed. Given that there is a surface water/groundwater PFOA criteria, PFOA should also be discussed.
- 19. Section 10.1:** It is recommended that the first sentence be amended to be: “A quality assurance and quality control (QA/QC) assessment of the *supplementary* sampling program is presented in Table 10-1 and Table 10-2”.
- 20. Section 10.2:**
- Please update referencing to Table 10-3, instead of Table 8-3 (1st paragraph).
 - Please update table references within Table 10-3.
- 21. Section 11:** Please replace ‘area of interest’ with ‘Site Investigation Area’.
- 22. Section 11.1:** “*No results exceeded the ecological criteria for Sum of PFOS...*” Please amend to state “sum of PFOS and PFHxS”.



24. Figure 3 Soil Sample Exceedances:

- STP_HA02 (0.0 to 0.1 m) PFOS result should be 0.023 mg/kg, not 0.022 mg/kg.
- LF2_BH069 (0.5 to 0.6 m) PFOS result should be 0.14 mg/kg, not 0.014 mg/kg.

25. Table 1a and 1b: LF2_HA03, LF2_HA04, STP_HA06 and STP_HA07 were sampled on 4 January 2022 or 1 April 2022? Different dates are shown for these four sampling locations. Note: Ramboll's COC in Appendix C indicated that the samples were sampled on 4 January 2022, but the samples were received by the laboratory on 5 April 1:52 pm (for Eurofins Lab report 877890-L and 877890-S). Please check and revise Table 1a, Table 1b and Table 3a; and Section 6 Step 4 DQO (temporal boundaries) as required.

26. Section 11.1: This section only discusses the results from the supplementary soil sampling (post-December 2021) in relation to STP (penultimate paragraph). What about Landfill2?

27. Section 11: Should soil leachability results (refer to Section 9.2.3) and Figure 4 be discussed?

28. Figure 4 Soil Leachate Exceedances:

- HEPA 2018 Landfill unlined ASLP guideline value is listed as the criterion adopted. This is inconsistent with Table 1b. Please also refer to Item 7 of the auditor's IAA24 (ref: S18612_LET24_Rev0).
- STP_HA01 (0.9 to 1.0 m) should also include an exceedance for PFOS (0.06 µg/L).
- STP_HA01 (0.9 to 1.0 m) sum of PFHxS and PFOS concentration should be 0.09 µg/L, not 0.37 µg/L.
- STP_HA03 (0.4 to 0.5 m) should also include an exceedance for PFOS (0.06 µg/L).
- Missing data for STP_HA07 which reported exceedance in Table 1b.
- STP_HA08 (0.9 to 1.0 m) should also include an exceedance for PFOS (0.06 µg/L).

29. Section 11.4: Please update referencing to Figure 6 and 7 (not Figure 7 and 8).

30. Table 12-1:

- Please replace 'Area of Interest' in the title with 'Site Investigation Area' and check the font as both 'Y' and 'N' are in bold.
- There are footnote 1 ('soil' row) and 2 ('surface water' row), but there is no footnote text provided.

31. Table 12-1 Sediment: As per Item 8 above, the risk screening assessment documented in the PFAS Validation Overview letter (draft D5) dated 21 May 2021 (Ramboll 2021a) does not discuss sediment within Eastern Creek. New discussion is recommended to indicate the potential for sediment in Eastern Creek to be impacted. Perhaps discussion presented in Section 12.2 can be used to evaluate sediment.

32. Table 12-1 Groundwater: Perhaps the groundwater concentrations from MW08 (closest bore to STP/Landfill 2) can be discussed to indicate that the result was less than the Batley *et. al.* water 99% species protection criterion. Based on Figure 7, the auditor notes that groundwater at Site Investigation Area will eventually reach Eastern Creek at a location north-west of the Site Investigation Area and therefore, this ecological pathway is still considered to be 'complete'.

33. Section 12.1: Please check formatting of the text. Based on the Ramboll's email dated 30 June 2022, the text was in bullets for ease of reading/understanding.

34. Section 12.1 PFOS 95% UCL calculation:

- 'All STP&LF2 PFOS 95% UCL.xlsx' provided in Appendix E, which indicated a mean of 0.0069 mg/kg PFOS, does not seem to show a 95% UCL_{arithmetic mean} of 0.01 mg/kg.
- Two files are provided as Appendix E ('All STP&LF2 PFOS 95% UCL.xlsx' and 'All STP&LF2 PFOS 95% No hotspot.xlsx') and it is not clear which UCL output is relevant or what is the difference between the two.
- It is recommended that the discussion be revised to clearly explain what PFOS data was used in the calculations, and what was the outcome (mean, median, 95% UCL_{arithmetic mean}).



36. Section 12.2: “Soil concentrations measured down-slope from the STP/LF2 area presented in Ramboll 2021 did not identify PFS guideline exceedances.” Please clarify which sampling location is this referring to. Based on Figure 4c of Remaining Site Area PFAS Validation Report dated 21/10/2021:

- there are no sampling locations down-slope of LF2
- STP_BH195 (outside of STP footprint) reported 0.015 mg/kg PFOS above PFAS NEMP ecological criterion.

37. Section 13: It is recommended that this sentence be amended to state “... did not exceed Tier 1 human health criteria selected to be protective of public open spaces” (2nd paragraph).

38. Section 13: A clear statement indicating Ramboll's conclusion on the site suitability of STP and LF2 (audit site) for its proposed use is required (i.e. similar to Section 12.3 of Remaining Site Area PFAS Validation Report dated 21/10/2021).

4. Closure

Please address the comments above and revise the draft 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/HY/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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17 October 2022

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

Dear ██████████

Re: Interim Site Audit Advice No. 26: PFAS Validation Report (draft D3) Former Sewage Treatment Plant (STP) and Landfill 2 Supplementary Investigation, Former Schofields Aerodrome, Nirimba Fields NSW

1. Introduction

As a NSW Environmental Protection Authority (EPA) accredited Contaminated Land Management Site Auditor, I have been engaged by Defence Housing Australia (DHA) to conduct a non-statutory Section B site contamination audit of the former Sewage Treatment Plant (STP) and former Landfill 2 (the site), which are located within the former Schofields Aerodrome.

The former Schofields aerodrome is approximately 135 hectares, and it has been developed into a new low density residential estate with suburban road network, retail/business, a school and recreational areas called Nirimba Fields. It is located within the Blacktown City Council (Council) area. Due to its historical use as a former aerodrome, it was identified to be impacted with per- and polyfluoroalkyl substances (PFAS) contamination.

2. Background

The site is currently open space and riparian zone adjacent to Eastern Creek and it is proposed to remain as such (i.e., recreational public open space land use).

The former Schofields aerodrome (including the site, PFAS MEA, Remaining Site Area, 'No Scrape Area South of Swale' and 'No Scrape Area North of Swale') were previously audited by another auditor and a Section A Site Audit Report and a Site Audit Statement (GN481) were issued in September 2013.

Ramboll Environ Australia Pty Ltd (Ramboll) were engaged by DHA to undertake investigations to assess and characterise the nature and extent of PFAS contamination at the former Schofields aerodrome and to draw conclusions regarding the suitability of the site for low density residential land uses.

Given that the remainder of the former Schofields aerodrome external to former STP and Landfill 2 (including PFAS MEA, Remaining Site Area, No Scrape Area South and No Scrape Area North of Swale) are assessed, reported and audited separately, they are not discussed further in this letter.



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

Document	Corresponding Auditor's Interim Advice
Ramboll (2022a) <i>PFAS Validation Report, Former Schofields Aerodrome - Sewage Treatment Plant (STP) and Landfill 2</i> , draft D2 dated 19 August 2022	Interim Site Audit Advice No. 25: PFAS Validation Report (draft D2), dated 15 September 2022 (ref: S18612_LET25_Rev0)

Subsequently, the report listed in the table above was revised and the auditor was provided with the following document for review:

- Ramboll (2022b) *PFAS Validation Report, Former Schofields Aerodrome - Sewage Treatment Plant (STP) and Landfill 2*, draft D3 dated 6 October 2022. This is hereafter referred to as 'the Validation Report'.
- Ramboll's responses to auditor's comments from Interim Site Audit Advice No. 25, provided in spreadsheet titled 'Auditor Comments Register DHA STP & LF2 Validation RReport_15 September 2022.xlsx'. This is hereafter referred to as 'Ramboll's Responses'.

The purpose of this letter is to provide comments on the draft Validation Report (Ramboll 2022b).

3. Auditor's Comments

The auditor has completed a review of the draft Validation Report (Ramboll 2022b) 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).

Based on a review of the draft Validation Report (draft D3), the following items require clarification or amendments:

- Section 1.4 and 7:** It is also worth mentioning that draft PFAS NEMP 3.0 has been released for consultation.
- Section 7.3:** Please clarify as there is no information provided about whether Eastern Creek is or is not used for recreational purposes. If there is uncertainty, it is recommended that PFAS recreational water quality guideline values from PFAS NEMP 2.0 be adopted.
- Section 9:** While it is acknowledged that draft PFAS NEMP 3.0 is released for public consultation and it is not finalised nor endorsed by NSW EPA, it is new state of knowledge and therefore, adopting a conservative approach, the draft guideline values should be considered when interpreting the results and conclusions. This is to prevent any issues from arising in the future.
- Section 9.2.3:** Please reference the 95% ProUCL output (soil leachate data) presented in Appendix E.
- Table 1a, 1b and 3a - LF2_HA03, LF2_HA04, STP_HA06 and STP_HA07:** In relation to Item 25 of IAA#25, the sampling dates for the four sampling locations were not confirmed by Ramboll, as the tables were not included in the Validation Report (draft D3) for the auditor to review. The auditor notes that Figure 3 indicated the samples were collected on 1 April 2022 which is inconsistent with Section 6 Step 4 DQO (temporal boundaries) of 23 December 2021 to 25 March 2022.
- Section 12.1:** "...was at the indirect exposure guideline value (0.01* mg/kg)." Is there a footnote missing from page 31 as an asterisk is added.



7. **Section 12.1:** Please amend as PFOS soil concentrations for STP and LF2 (from 2021 and 2022) as tabulated as 'µg/L' instead of 'mg/kg' in Appendix E.
8. **Survey plan:** Similar to Craig & Rhodes's figure titled 'Coordinates Schofields Remaining Site Area Validation Report' drawing ref: 1784C-SK-0436, please provide a survey plan showing coordinates for each corner of the audit site (i.e. STP and LF2) to be attached to the site audit statement.

4. Closure

Please address the 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

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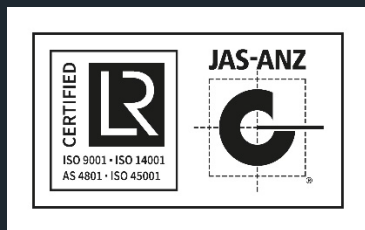
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