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PFAS Management Sub-Plan

Blamey Barracks
Kapooka (BBK)
EPBC 2023/09649

April 2026

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PFAS Management Sub-Plan
Blamey Barracks Kapooka (BBK)
EPBC 2023/09649

RRJV

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Declaration of Accuracy

	Name	Date	Signature
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Approved by:	Michael Martin	29/04/2026	pp Julie Porter.

WSP acknowledges that every project we work on takes place on First Peoples lands.
We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.

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Abbreviations

Acronyms and Abbreviations

Key Term or Abbreviations	Definition
ACM	Asbestos Containing Material
ADF	Australian Defence Force
ADH	Australian Datum Height
AMP	Defence Asbestos Management Plan, version 5.2 (15 December 2023)
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
BH	Borehole
mbgl	Metres below ground level
BBK	Blamey Barracks Kapooka
BM	Base Manager
CAP	Construction Area Plan
CAPRA	Construction Area Plan Risk Assessment
CAR	Corrective Action Request
CMF	PFAS Construction Maintenance Framework (2025)
CMS	Corporate Management System
CPB	CPB Contractor's Pty Ltd
CoPC	Contaminant of Potential Concern
CSR	Contaminated Site Records
DCARM	Directorate Contamination Assessment Remediation Management
DCCEEW	Department of Climate Change, Energy, Environment and Water
DCM	Defence Contamination Manual
DCMM	Defence Contaminated Management Manual
DEEP	Directorate of Estate Engineering Policy, Department of Defence
DEHPD	Directorate of Environment and Heritage Policy Development, Department of Defence
DEPAC	Directorate of Environmental Planning, Assessment and Compliance
DERMS	Directorate of Environmental Resource Management and Sustainability
EGV	Ecological Guideline Values
PCA	Pre-construction Contamination Assessment

Key Term or Abbreviations	Definition
PFASIMB	PFAS Investigation Management Branch (Department)
DSI	Detailed Site Investigation (DSI) Contamination
EAR	Environment Assessment Report (DEPAC)
ECC	Environmental Clearance Certificate (DEFENCE)
EMOS	Estate Maintenance and Operations Services
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA	Environment Protection Authority (NSW)
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Cth)
ER	Environmental Report
ERAT	Environmental Risk Assessment Tool (DEFENCE)
ESdat	Environmental Data Management Software
ESM	Defence Environment and Sustainability Manager
EWMS	Environmental Work Method Statement
CSR	Garrison Estate Management System, Environmental Factor Management - Contaminated Sites Records (GEMS EFM-CSR).
HH	Human Health
HIL	Health Investigation Levels
LIA	Living In Accommodation
LOR	Limit of Reporting
MCC	Managing Contractor Contract
MCC-1	Defence's Managing Contractor Contract MCC-1 2021
MUD	Multi User Depot
NATA	National Association of Testing Authorities
NEM	Natural Excavated Material
NEMP	National Environmental Management Plan (PFAS) V3.0
NDD	Non-Destructive Digging
ONE HSE	Health Safety Environment RRJV Create and Maintain a Strong Culture
PFAS	Per- and Poly-fluoro-alkyl substances
PFOA	Perfluorooctanoic acid

Key Term or Abbreviations	Definition
PFOS	Perfluorooctanoic sulphonate
PMAP	PFAS Management Area Plan
PMCA	Project Manager Contract Administrator
PMCF	PFAS Management Construction Framework (DEFENCE)
PPMM	Pollution Prevention Manual (DEFENCE)
PMSB	PFAS Management Sub-Plan
PSI	Preliminary Site Investigation
RAP	Remedial Action Plan
RRJV	Riverina Redevelopment Joint Venture, a joint venture between CPB Contractor's and Downer in their capacity as the Managing Contractor (MC) for the Project
RRP	Riverina Redevelopment Program comprising three Redevelopment Projects, one each at AWMA, RBW and BBK
SAC	Site Assessment Criteria
SEG	Security Estate Group
SEH	Significant Environmental Hazards
SEPs	Site Environmental Plan(s)
SMP (BLUE BOOK)	NSW Sediment Management (Blue Book)
SS	Surface Soil
SWMS	Safe Work Method Statement
UFP	Unexpected Finds Protocol
URB	User Requirement Brief
UXO	Unexploded Ordnance
VENM	Virgin Excavated Natural Material
WQMP	Water Quality Management Plans

1 Overview

1.1 Project

An overarching Environmental Management Plan (EMP) has been developed for Blamey Barracks Kapooka (BBK) Redevelopment Project[1] to demonstrate how the Riverina Redevelopment Program (RRP) will be constructed to minimise its environmental impact. The works are being delivered by the Riverina Redevelopment Joint Venture (RRJV), a joint venture between CPB Contractors and Downer. The CPB Contractors Environmental Management System (EMS) will be adopted by the joint venture.

The overarching EMP outlines how we will achieve acceptable environmental outcomes on the Blamey Barracks Kapooka (BBK) redevelopment project by the application of the Environmental Management System (EMS) for Planning and Delivery Phase. The EMP forms part of the Project Management System (PMS) and addresses both design and construction relation aspects of the project.

1.2 Purpose

The purpose of this per-and polyfluoroalkyl substances (PFAS) Management Plan is to outline required practices for assessing, handling, reusing, storing, tracking, and disposing of PFAS-impacted soil, sediment, or water within the BBK Project.

The plan provides frameworks that allow construction activities associated with the BBK Redevelopment Project, to carried out while safely managing PFAS-impacted materials. The plan establishes controls to manage and reduce risks associated with PFAS contamination to onsite workers, the public, and surrounding environments.

1.3 Structure of this plan

This PFAS Management Sub-Plan (PMSB) forms part of the EMP documentation. It has been prepared to address PFAS management on the BBK Redevelopment Project as part of the Riverina Redevelopment Program (RRP).

During the construction process, RRJV will manage risks associated with PFAS contamination within the proposed redevelopment areas at BBK in accordance with the required Defence and Non-Defence legislation and guidelines (as listed in Section 3). This plan details the management and reuse requirements for PFAS impacted soils generated by construction activities associated with the project in order to fulfill RRJV's strategy to maximise retention of spoil material on site in line with Defence's Waste Minimisation Policy.

The Department of Climate Change Environment Energy and Water (DCCEEW) has issued conditions of approval. The approval conditions relevant to this PMSB are listed in Table 1.1. These conditions will be implemented to meet the environmental permit conditions and Defence policy obligations for the Project.

[1] RRJV "Environmental Management Plan, Project name: EST02036 Blamey Barracks Kapooka Redevelopment" Rev 9 dated 12/07/2024

Table 1.1 DCCEEW conditions of approval

DCCEEW (EPBC Permit number 2023/09649) management of PFAS contaminants	PFAS sub-plan reference
1 Prior to the commencement of the Action, the approval holder must prepare and submit to the department any relevant PFAS management plans that set out how harm to protected matters from PFAS contaminants during construction will be avoided and mitigated. In preparing PFAS management plans, the approval holder must be consistent with the following documents: **a** The National Environment Protection (Assessment of Site Contamination) Measure 1999(Cth). **b** The PFAS National Environmental Management Plan (PFAS NEMP); and **c** The National Water Quality Management Strategy.	Section 3.2
2 Where there are multiple PFAS management plans managing the risk from PFAS contaminants during construction, the approval holder must articulate in a cover note and/or the PFAS management plans how the plans work together to provide a complete and integrated response to the management of PFAS contaminants during construction.	Section 1.1 and 1.2
3 When providing the department with the PFAS management plans or any revised versions, the approval holder must provide for each plan a letter of endorsement from a suitably qualified and experienced environmental practitioner of their assessment of the adequacy of the PFAS management plan to protect the environment from an action on Commonwealth land.	This PFAS management plan has been prepared by suitably qualified and experienced environmental practitioner from WSP.
4 The approval holder must implement the PFAS management plans.	Section 1.2 and Section 6.1
5 By implementing the PFAS management plans, the approval holder must prevent any avoidable harm to protected matters and mitigate unavoidable and accidental harm to protected matters.	Section 6.1
6 All commitments, including environmental outcomes, management measures, corrective measures, trigger values and performance indicators in the PFAS management plans must be SMART and based on referenced or included evidence of effectiveness. The PFAS management plans must be	Section 1.3 and Section 12 Julie Porter is a principal environmental engineer with over 25 years environmental engineering experience in Australia and the UK, providing leadership to significant site decommissioning, demolition and contaminated land remediation projects. Education: BSc Civil and

DCCEEW (EPBC Permit number 2023/09649) management of PFAS contaminants	PFAS sub-plan reference
consistent with the Environmental Management Plan Guidelines and must include: **a** Details of the relevant protected matters and a reference to EPBC Act approval conditions to which the plan refers. **b** A table of commitments made in the plan to achieve the environmental outcomes, and a reference to where these commitments are detailed in the plan. **c** Details of: **i** Contamination screening and work element specific risk assessments that will be performed to characterise cut material and site water for beneficial reuse in the Action area or offsite disposal. **ii** A protocol for beneficial reuse of cut material and site water within or between work elements of the Action to minimise the risks of PFAS mobilisation and dispersion, in accordance with 'Section 12: Reuse of PFAS-contaminated materials including soils and water' of the PFAS NEMP. **iii** Materials and stockpile management and dust control in accordance with 'Section 10: On-site stockpiling, storage and containment' of the PFAS NEMP. **iv** Off-site disposal of soil and/or construction water, in accordance with 'Section 11: Transport of PFAS-contaminated material' and 'Section 14: PFAS disposal to landfill'. **v** Dewatering, surface water, and/or construction water management, including how the freshwater 95% species protection criteria for PFOS, PFOA and/or PFHxS, as specified in the PFAS NEMP, will be implemented to ensure that water discharged from the Action area does not impact downstream receptors; and **vi** How the HIL C (public open space) values will be used for assessing human health risks.	Environmental Engineering, University of Newcastle-upon-Tyne, UK. Natalie is an associate environmental scientist with ten years' experience in contaminated site assessment, including site assessments where the primary contaminant of concern is PFAS. Natalie has worked for various clients across several industries including transport, oil and gas, Defence, and property development. Education: Bachelor of Geosciences (University of Wollongong), Masters of Environmental Management (Charles Sturt University).

DCCEEW (EPBC Permit number 2023/09649) management of PFAS contaminants	PFAS sub-plan reference
d Deporting and review mechanisms to demonstrate compliance with the commitments made in the plan. **e** An assessment of risks relating to achieving the environmental outcomes and risk management strategies that will be applied to address identified risks. **f** Details of the qualifications and experience of the environmental consultants involved in preparing the PFAS management plans and the reviewers and approvers of the plans.	
7 The approval holder must ensure that following the completion of the Action, there is a PFAS management plan in place for the Blamey Barracks Kapooka military area that provides for the ongoing management of any residual contamination in the Action area, including risk assessment, contingency planning, remediation actions and monitoring.	Table 12.1 item P22
8 Within 20 business days after the completion of the Action, the approval holder must provide details of the PFAS management plan required under condition 19.	Table 12.1 item P24

1.4 Reporting and review mechanisms

Environmental objectives and targets are determined by the PMS and are adopted by the RRJV as SMART Key Performance Indicators (KPIs)[2]. The lead and lag indicators are tracked through reporting within the Synergy system which provides real-time PowerBI displays. These displays provide the opportunity to readily review and assess the effectiveness of the controls in the EMP Sub Plans. This has the potential to prevent the occurrence of environmental incidents and potential actions taken by the regulators. In addition, the Construction Manager and Project Environmental Resource (or delegates) will conduct monthly audits, record findings and set actions in Synergy. The key KPI's relevant to this PMSP are presented in Table 1.2 and Table 1.3.

[2] RRJV "Environmental Management Plan, Project name: EST02036 Blamey Barracks Kapooka Redevelopment" Rev 9 dated 12/07/2024

Within this PMSB an activity is a specific, planned task or operation that is within the scope of the project or ongoing operations and that has been assessed for potential environmental impacts. Within this PMSB activities include:

- Spoil Management (Section 8.1):
  - Soil reuse (Section 8.1.1 to 8.1.4
  - Off-site disposal (Section 8.1.5)
  - Temporary stockpiling (Section 8.1.6).
- Onsite water management (Section 9):
  - Groundwater dewatering (Section 9.1)
  - Perched groundwater dewatering (Section 9.2)
  - Surface water management (Section 9.3).

Table 1.2 Environmental KPIs – leading indicators

KPI	Target	When	How measured	Accountability (1)
Compliance with EPBC Act conditions of approval.	100%	Pre and post activity reports	Pre post activity audits Synergy / Monthly reporting via env dashboards	Construction Manager or Delegate
PFAS Management of Contaminates	100%	Prior to activity commencement / quarterly reviews	Compliance with Sub Plan 17 PFAS Management	Construction Manager or Delegate
Environmental management review of Work Packs	100%	Prior to activity commencement / quarterly reviews	Work Pack sign-off/ Review register	Project Engineer
Environmental. Audits	90% of scheduled audits completed.	As per project obligations and (minimum 1 per annum)	Synergy / Monthly reporting via env dashboards	Project Environmental Representative
Action Management	>80% of all environmental actions raised are completed on time.	Each month	Synergy / Monthly env dashboards	Project Environmental Resource (or delegate)

(1) Breaches of the sub plan management measures will be recorded in the incident register and managed under the continual improvement process

Table 1.3 Environmental KPIs – lagging indicators

KPI	Target	Time Frame	How measured	Accountability
Materials Management-contamination mobilisation	Zero	Ongoing	Implementation of Sub Plans Soil Water and PFAS Management Plans	Construction Manager or Delegate
Number of unauthorised discharges (1)	Zero	At all times	Implementation of Sub Plan 7 Soil and Water Management.	Construction Manager
% of waste reused or recycled	80% of waste	12 months	Implementation of Sub Plan 15 Waste Management.	Project Environmental Resource

(1) Monitoring will comply with the project requirements reuse and discharge criteria of PFAS NEMP 3.0 and the CMF as well as any recommendations made by the Contamination Consultant. Monitor will be completed following large rain events.

2 Site description

Blamey Barracks Kapooka, BBK is located approximately 9.5 km south-west of Wagga Wagga in western NSW, accessible via Camp Access Road from the Olympic Highway. BBK contains facilities for training, for housing Base personnel and recruits, and for housing the families of Base personnel. These facilities are clustered in the southern and eastern areas of BBK, with the majority of the Base being devoted to a large, open training area that includes minimal manmade structures and large areas devoid of vegetation.

BBK has a total area of approximately 1,990 ha (19.9 km^2). The area of disturbance associated with these works represents only a small fraction of the total Base area, consisting of approximately 25 ha (0.25 km^2) concentrated within the south-east of the Base. The BBK project site plan and construction footprint are illustrated in Figure 2.1

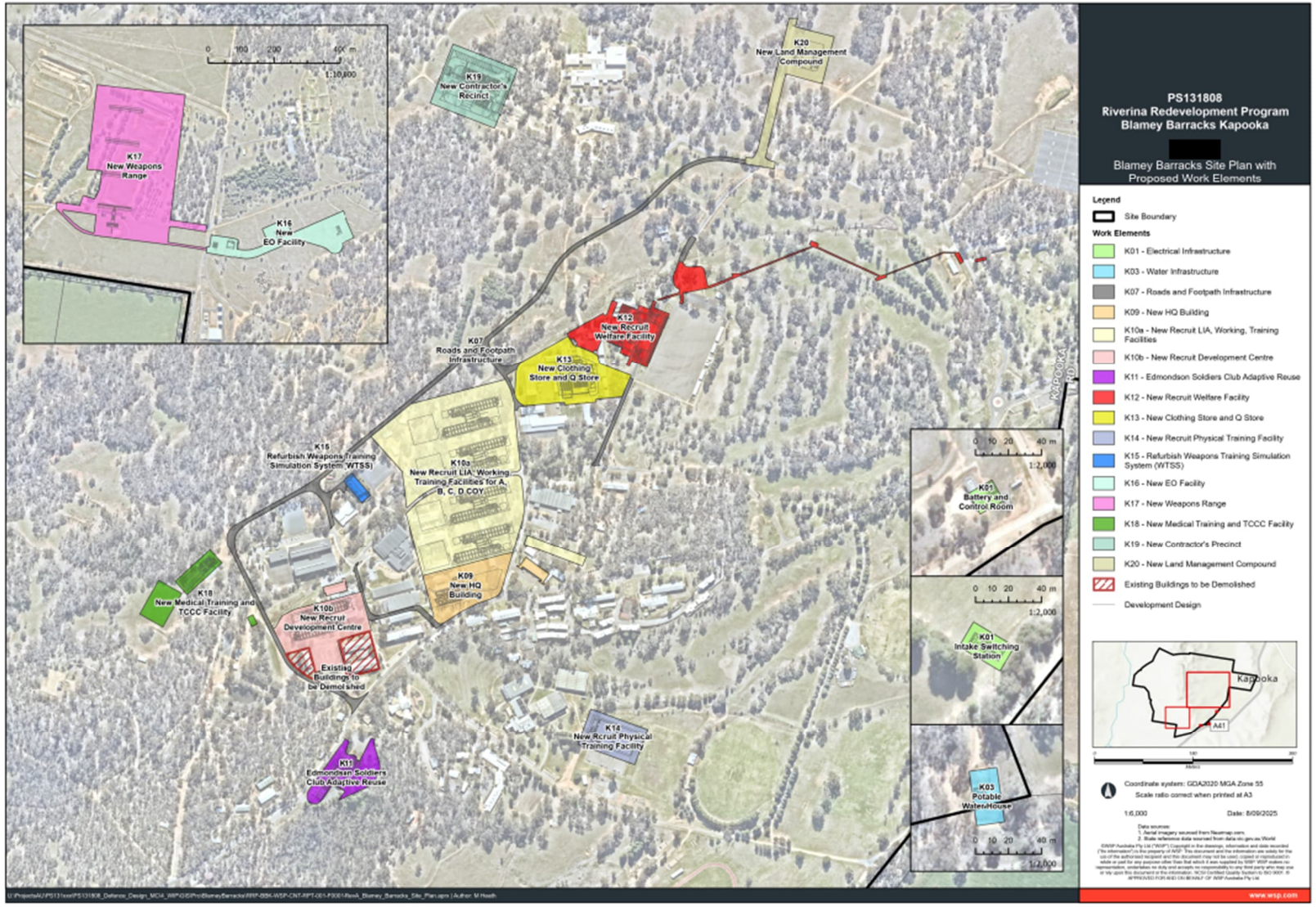

Figure 2.1 BBK site plan and construction footprint

Historical contamination investigations have confirmed widespread PFAS contamination in soil has been detected at Blamey Barracks Kapooka (BBK). RRJV's strategy is to maximise reuse and retention of spoil material onsite during the BBK redevelopment works is in line with Defence's Waste Minimisation Policy.

2.1 Summary of PFAS contamination

PFAS contamination at BBK and in the surrounding area has been confirmed and attributed to the historical use of Aqueous film-forming foam (AFFF) at the Site for training purposes, incident control and reuse of wastewater. The BBK PFAS Management Area Plan (PMAP) 2021 summarises the comprehensive PFAS investigations for PFAS undertaken at the Site.

Key PFAS source areas were determined at the following locations:

- The Current Fire Station (inside the footprint of the proposed action)
- The Former Fire Training Areas (outside the footprint of the proposed action)
- Irrigated areas (including the decommissioned golf course) using treated wastewater effluent from the wastewater treatment plant (outside the footprint of the proposed action).

The primary location of interest that the proposed action will require consideration during construction activities is the current Fire Station and surrounding grassed areas located in the new Recruit Welfare Facility (K12) location. Those areas are on the eastern side of BBK where surface water runoff feeds into Kapooka Creek. Leachability testing of soil indicated potential for discharge of PFAS to surface water and groundwater from those areas (BBK PMAP).

Base-wide PFAS assessments and ongoing groundwater monitoring have identified the presence of PFAS impacted groundwater. As no shallow groundwater conditions (<5 mbgl) were encountered, groundwater samples were not collected beneath the proposed disturbance areas during the PCA 2023 investigations.

3 PFAS legislation and guidelines

3.1 Legislation

The contamination investigation, assessment and management strategies will be implemented in accordance with the following Commonwealth and State Legislation:

- Environmental Protection and Biodiversity Act 1999
- The Protection of the Environment Operations Act 1997 (POEO Act)
- The *Contaminated Land Management Act 1997* (CLM Act).

3.2 Defence guidelines

The contamination investigation, assessment and management strategies for excavated soil have been developed in accordance with the following Defence framework and guidelines:

- Department of Defence PFAS Construction and Maintenance Framework, May 2025
- Department of Defence, Contamination Management Manual, Amended June 2021
- Department of Defence, Contamination Management Manual, Amended June 2021, Annex B – Technical Guidance on Investigation and Assessment Types
- Department of Defence, Contamination Management Manual, Amended June 2021, Annex L – Guidance on Data Management.

The Defence 2019, Smart Infrastructure Handbook (SMARTi Handbook) is a key reference for environmental quality compliance at BBK.

3.2.1 Defence contamination management manual (Defence, 2021)

The Defence Contamination Management Manual (DCMM, Defence, 2021) provides the framework for both Defence personnel and contractors where Defence activities (for example, redevelopment works) may interface with contamination present on the Defence estate. The DCMM includes several technical guidance documents in a series of annexures (A to L) which relate to specific Defence activities and contamination management issues (for example, Fire Training Grounds and Data Management).

3.2.2 Defence PFAS construction and maintenance framework (Defence, 2025)

Defence has developed the PFAS Construction Management Framework (CMF) to inform the management of PFAS-impacted soils encountered during construction and maintenance activities. The CMF also informs the management of PFAS-impacted water and construction & demolition waste. The CMF guidance provides four soil classes with management options based on the potential risk of PFAS concentrations. The soil management category definitions are listed in Table 3.1. The current version of the PFAS Framework at the time of this risk assessment is Version 4.0 published in May 2025. PFAS impacted soils on the Defence Estate will be managed in accordance with the CMF.

Key PFAS parameters used to characterise contamination and develop management/disposal requirements are Perfluorooctane sulfonic acid (PFOS) and Perfluorohexane sulfonic acid (PFHxS). The combined concentration of these two parameters (PFOS+PFHxS) is used by Defence to characterise the level of PFAS contamination on the Defence Estate. Concentrations of PFOS+PFHxS detected during project assessments have been characterised with reference to the CMF. The CMF indicates that soils to be disturbed during the construction works can be categorised as described in Table 3.1.

Table 3.1 Defence PFAS soil contamination categories (Defence 2025)

Category	Guideline	Risk and management options	Notes
Category 4	Excavated soils with PFOS + PFHxS concentrations less than 0.005 mg/kg(1).	— Reuse within works area or other area on-base without further assessment or mitigation. — Offsite disposal/treatment in accordance with state/territory requirements.	If material cannot be reused and offsite disposal/treatment is required, additional analysis or analysis at a lower laboratory limit of reporting (LOR) might be required by the jurisdiction or waste receiver.
Category 3	Excavated soils with PFOS + PFHxS concentrations less than 1 mg/kg but greater than 0.005 mg/kg[1].	— Reuse within works area with or without mitigation measures. — Reuse on-base with or without mitigation. — Off-base disposal/treatment in accordance with state/territory requirements.	Reuse risk assessment must be provided to demonstrate no increased or unacceptable risk to human health and the environment from proposed option, and support decision whether mitigation measures are required or not required. Mitigation may be required to minimise risk of PFAS migration and human health or ecological exposure.
Category 2	Excavated soils with PFOS + PFHxS concentrations less than 20 mg/kg but greater than 1 mg/kg[2].	— Reuse on works site with strong mitigation measures — Reuse on base with strong mitigation measures — On-base remediation/ management under a RAP — Off-base disposal/treatment — To an appropriately licenced facility, in accordance with state/territory requirements.	Reuse risk assessment must be provided to demonstrate no increased or unacceptable risk to human health or the environment from proposed option. Strong mitigation (such as encapsulation or engineered capping) required to minimise risk of PFAS migration and human health or ecological exposure. Notify PFAS Investigation and Management Branch (PFASIMB) if Category 2 soils are encountered.
Category 1	Excavated soils with PFOS + PFHxS concentrations of 20 mg/kg[3] or more.	— Off-base disposal/treatment to appropriately licenced facility, in accordance with state/territory requirements. — On-base remediation/ management under a RAP	Soils containing > 50 mg/kg sum of PFOS, PFHxS and PFOA cannot be reused or sent to landfill. It must be sent offsite to a licenced facility for destruction. Notify PFASIMB if Category 1 soils are encountered.

(1) Standard LOR in accordance with PFAS NEMP 3.0, and representative of widespread ambient concentrations in soil across the Defence estate.

(2) Human health investigation level for direct soil contact for public open space (HIL C), PFAS NEMP 3.0.

(3) Human health investigation level for direct soil contact for industrial land use (HIL D), PFAS NEMP 3.0.

3.2.3 BBK PMAP (2021)

The preparation of the BBK PFAS Management Area Plan (PMAP) 2021 included a comprehensive investigation of PFAS contamination at the Base and the surrounding area. In addition to the above Defence PFAS guidelines, the excavated soil material will be managed in accordance with the proposed management strategies detailed in this report and in the BBK PFAS Management Area Plan (PMAP 2021).

3.3 Non-defence guidelines

In addition to the above, this PFAS management plan has been completed in general accordance with the requirements of:

- NEMP 2025. *PFAS National Environmental Management Plan 3.0*. National Chemicals Working Group of the Heads of EPA Australia and New Zealand March 2025.
- National Water Quality Management Strategy (NWQMS).
- ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines.

The NEMP 2.0 was updated in 2025 to NEMP 3.0. The PFAS National Environmental Management Plan (NEMP 3.0) provides extensive guidance for managing PFAS in the environment, including standards and criteria for a wide range of PFAS-containing substances to protect environmental values. For the updated NEMP 3.0 it is noted that: -

- The overall framework and assessment approach for reuse of PFAS remains unchanged (Section 12 in both NEMP 2.0 and NEMP 3.0).
- The decision Tree for Reuse has been adopted unchanged in NEMP 3.0.
- In NEMP 3.0 there is now a standalone Section (18.3) on assessing PFAS leachability in sub-section 18.3.3. The Defence CMF was subsequently updated in May 2025.

The NEMP 3.0 also refers to and is consistent with the detailed guidance provided in the National Water Quality Management Strategy (NWQMS) and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality on achievement of catchment water quality objectives as they relate to toxicants such as PFAS that may reach aquatic environments.

3.3.1 NEMP 3.0 Decision tree

The NEMP 3.0 decision tree (see Figure 3.1 below) will support a Preliminary PFAS risk assessment of the material from each Work Element area within the BBK redevelopment footprint. The CMF PFAS contamination categories will steer earthworks planning and controls during the construction. Refer to Table 3.1 for PFAS Categories extracted from the CMF.

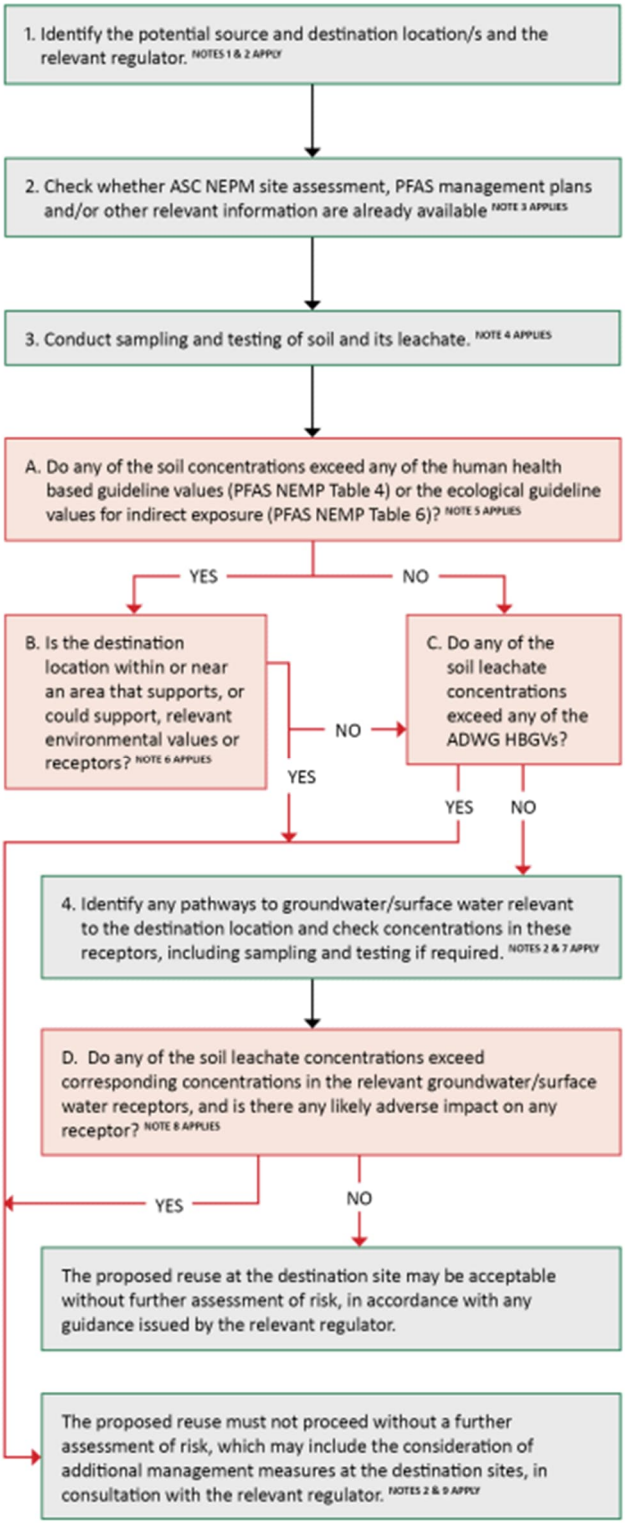

Figure 3.1 Decision tree for reuse of soil and water in construction sites (Source NEMP 3.0)

Step 2 - Check whether site assessments need to be updated to 'reference against' all known source area profiles and known potential contaminants of concern.

Step 3 - Destination (receiving environment) contamination profile should be equal (or higher) than the subject material.

3.3.2 IChEMS

In addition to the above legislation and guidelines, the Industrial Chemicals Environmental Management Standard – IChEMS (DCCEEW, 2025) will be considered, if required. If category 2 PFAS soil is disturbed during the Project works, the development of a RAP would be required and the RAP should consider the specifications in the IChEMS.

4 Scope

This Sub Plan addresses PFAS management for the BBK construction footprint.

Each work excavation activity will complete the NEMP 3.0 decision tree (refer to Figure 3.1). A Preliminary PFAS Risk Assessment (refer Appendix A) developed for BBK will contribute to the development of reuse options and application of the management PFAS principles in the CMF.

- The RRJV will review the NEMP 3.0 PFAS decision tree to assess the PFAS risk and determine if additional mitigations are required for each Work Element prior to construction. The objective is to conduct preliminary evaluation of the existing data and assess PFAS risk for each Work Element, with the aim to identify if there are additional requirements to prepare a Defence compliant risk assessment.
- After consideration of the NEMP 3.0 decision tree, the material in each Work Element will be categorised under the CMF to steer earthworks planning and controls during the proposed action. Refer to Table 3.1 for PFAS Categories sourced from the CMF. Excavated soil from construction will be classified into four categories based on analytical results and understanding of the source and destination characteristics, refer to the Contamination Screen Risk Assessment in Table 5.3.
- Please note, the Preliminary PFAS Risk Assessment (Appendix A) was finalised in 90% Detailed Design Review in December 2023. Some references within this document have now been superseded (such as the Construction and Maintenance Framework was updated to V4.0 in May 2025). The PFAS Risk Assessment will be updated prior to commencing construction. This update will also include additional testing, due to be completed in mid-2026.

These assessments will aid in determining the PFAS contamination risk in soil and water and develop the relevant mitigations for individual Work Element PFAS risks.

The purpose of Reuse of spoil material aims to limit the offsite movement of PFAS contaminated soils, whilst minimising contamination risks to clean or sensitive environments. The RRJV will seek management approval from the relevant Base stakeholders, including the Base Manager (BM), Defence Environment and Sustainability Manager (ESM) and PFAS Investigation and Management Branch (PFASIMB) for Category 1, 2 and 3 contaminated materials (see Table 3.1). Table 4.1 below identifies hazards of reuse of contaminated PFAS soils and the potential impacts.

Due to the variability in soil waste classifications, the Stockpile Management Strategy (provided in the RRJV EMP) will be implemented during the delivery phase to provide appropriate segregation and tracking of soil following excavation procedures. The presence of PFAS reduces the options for reuse or disposal. Reuse onsite may be permissible subject to the preliminary PFAS Risk Assessment (refer to the extract of the Preliminary PFAS Risk Assessment Tool in Figure 7.1). This is in accordance with Defence guidance and endorsement from Defence technical authorities including BM and ESM in consultation with PFASIMB.

There has been significant ongoing PFAS monitoring by the PFAS Management Area Plan (PMAP). The PMAP team provide ongoing support, and the project will continue to liaise with the PMAP to share PFAS data, new technology and innovations to minimise the risk of spreading PFAS.

5 Known PFAS contamination across BBK

5.1 Source areas

As identified in the BBK PMAP (2021), PFAS contamination on and in the vicinity of BBK has been attributed to the historic use of Aqueous film-forming foam (AFFF) for minor training purposes, incident control and reuse of wastewater at the following locations:

- The Current Fire Station (inside the footprint of the proposed action)
- The Former Fire Training Areas (outside the footprint of the proposed action)
- Irrigated areas (including the decommissioned golf course) using treated wastewater effluent from the wastewater treatment plant (outside the footprint of the proposed action).

Therefore, the primary location of interest that will require consideration during construction activities is the current Fire Station and surrounding grassed areas located in the new Recruit Welfare Facility (K12) location.

5.2 Historical PFAS contamination data summary

Contamination assessments conducted for the project have identified PFAS as the primary contaminant of concern within the project area. The Pre-Construction Assessment (PCA) 2023 summarised historical investigation data for the proposed project redevelopment footprint to characterise the impacts of PFAS where soils would be disturbed. Sample locations are referenced with prefix BH (borehole locations) and SS (surface soil).

5.2.1 Soil

5.2.1.1 Human health and ecological criteria (PFAS NEMP 3.0)

Key findings of historical assessments for soil include:

- Soil contaminant concentrations were reported below human health Site Assessment Criteria (SAC) in all samples analysed across the proposed redevelopment area.
- Ecological exceedances (as reported in PCA, 2023) were detected within some of the proposed WEs, including:
  - Recruit Welfare Facility, BH38_0.5, reported 1.4 mg/kg sum of PFOS + PFHxS, above the 1.0 mg/kg guideline value.
  - Recruit Welfare Facility, BH36 (at sample depths of 0.1, 0.5 and 1.5), BH37 (at sample depths of 0.1, 0.5, 1.5 and 2.5), BH38 (at sample depths of 0.1 and 2.5), BH39 (at sample depths of 0.1, 0.5 and 1.5), BH40 (at sample depths of 0.1, 0.5 and 1.5), SS20 and SS22, reported concentrations between 0.011 to 1.0 mg/kg sum of PFOS+PFHxS, above the 0.01 mg/kg guideline value.
  - Medical Training Facilities, BH28_0.5 reported 0.39 mg/kg sum of PFOS + PFHxS, above the 0.01 mg / kg guideline value.
  - Weapons training area (EO storage), BH41_2.5 reported 0.049 mg/kg sum of PFOS+PFHxS, above the above the 0.01 mg/kg guideline value.
  - The Q Store warehouse, BH54 and BH55 reported 0.12 to 0.83 mg/kg sum of PFOS+PFHxS, above the above the 0.01 mg/kg guideline value.

- Fitness Training Facility and Gym, BH58 and BH59 reported concentrations between 0.012 to 0.023 mg / kg sum of PFOS+PFHxS, above the above the 0.01 mg/kg guideline value.

5.2.1.2 Defence PFAS construction and maintenance framework categories

Key analytical results from the historical investigations for soil are summarised as follows:

- No PFAS Category 1 soils have been identified in project disturbance areas.
- Testing has identified isolated detections of Category 2 (High Risk) soils at the Fire Station and fire training areas (historical sampling location BH38 within the fire station area).
- Interpreted PFAS categories for each area and work element are shown on the PFAS Heat Maps (Section 11).

5.2.2 Leachate

Leachability analysis was undertaken on selected soil samples to assess on site management requirements and risks associated with spoil reuse.

Key findings of historical assessments for leachability include:

- Medical Training Facilities, BH28_0.5 reported 0.1 ug/L sum of PFOS+PFHxS leaching potential, above the 0.07 ug/L guideline value.
- Recruit Welfare Facility, SS20 and SS23 reported 0.13 to 0.19 ug/L sum of PFOS+PFHxS leaching potential, above the 0.07 ug/L guideline value.
- Recruit Welfare Facility, BH37, BH38, BH39 reported 10.0 to 57.0 ug/L sum of PFOS+PFHxS leaching potential, above the 0.07 ug/L guideline value.
- The Q store warehouse, BH54 reported 4.7 to 85.0 ug/L sum of PFOS+PFHxS leaching potential, above the 0.07 ug/L guideline value.
- Fitness Training Facility and Gym, BH58 and BH59 reported 0.08 to 0.67 ug/L sum of PFOS+PFHxS leaching potential, above the 0.07 ug/L guideline value.

5.2.3 Groundwater

Base-wide PFAS assessments and ongoing groundwater monitoring have identified the presence of PFAS impacted groundwater. Groundwater is not a major transport pathway for PFAS from Base with detections of PFAS above laboratory LOR only recorded in some perched water wells around the Wastewater Treatment Plant on-Base, perched water well MW601 along Kapooka Creek off-Base and one detection within groundwater in MW008 on the northern tip off-Base near to the Former Commandants House area.

As no shallow groundwater conditions (<5 mbgl) were encountered, groundwater samples were not collected beneath the proposed disturbance areas during the PCA 2023 investigations. It is considered unlikely that shallow groundwater (<2 mbgl) will be encountered during construction.

The maximum design excavation levels (3.5mbgl) are not expected to extend to the depth of regional groundwater >10mbgl. Since the construction process will be predominantly a fill program, it is unlikely the project works will impact on groundwater. If groundwater is encountered in large volumes, the water will be stored in containers and tested to determine contamination. If PFAS contamination exceeds NEMP 3.0 guidelines, the water will be stored in enclosed containers until offsite disposal and treatment occurs at a licenced waste facility. As per the Unexpected Finds Protocol, (Appendix H, provided in the RRJV EMP).

5.2.4 Requirement for further assessment

The PCA 2023 identified areas where insufficient soil data was available to determine the PFAS contamination status within the proposed redevelopment area.

These included:

- **Current Fire Station precinct.** Detailed, high - resolution assessment of the extent of PFAS impacts in the vicinity of the current Fire Station will be completed as an integrated response between the proposed action, PFASIMB and PMAP implementation at BBK. Management of this known source zone will be controlled by the contaminated site legislation and guidance process.
- **Land management compound**. Due to the timing of design process and the staging site investigations, soil samples were not obtained in this area. A review of the environmental context of the area did not identify sensitive or vulnerable ecological values, nor significant potential for contamination sources. Assessment of soils and PFAS risk assessments will be conducted to inform construction plans and management measures for the source and destination of material used in this work area.
- **Utilities corridors.** Generally, sub-surface utilities trenches and associated features do not generate large volumes of surplus materials, and excavations are conducted under non-destructive digging protocols for protection of assets. During these works, erosion and sediment controls and materials tracking, including off-Base waste disposal, will adhere to the RRJV EMP and construction area plans (CAPs).
- **Stormwater detention basin.** Due to the timing of design process of hydrology modelling and the staging of PCR site investigations, an incomplete dataset was generated for this area. As the area is intrinsically linked to water retention and water quality, it is considered to have sensitive ecological value and requires sufficiently protective assessment of soils to inform construction plans and management measures for the source and destination of material used in the work area.
- Work elements for 100% FDR have since been updated to include the following WE locations which require additional testing:
  - K01 Battery and Control Room
  - K01 Intake Switching Station
  - K03 Potable Water House
  - K11 Edmondson Soldiers Club Adaptive Reuse
  - K13 New Clothing Store and Q Store
  - K14 New Recruit Training Facility
  - K18 New Medical Training and TCCC Facility
  - K19 New Contractors Precinct
  - K20 New Land Management Compound.
- For these areas, supplementary sampling and analysis will be assessed per the NEMP 3.0 decision tree, the PFAS Risk Assessment and the PFAS calculator tool, in accordance with the BBK EMP PFAS Management Controls.

5.2.5 Human health site adopted criteria

The proposed construction activities present a risk through the potential movement of contaminated soils or water which may be required when:

- Excavating natural materials prior to pavement construction or services works
- Dewatering / decanting of groundwater
- Demolition of existing structures and buildings that may have contained PFAS materials.

The NEMP 3.0 Health Investigation Levels (HILs) will be adopted as site assessment criteria (SAC). The proposed work elements at the sites have mixed current and proposed future land uses. The adopted screening criteria for each work element are therefore derived based on the proposed redevelopment works and the potential human health scenarios described in NEMP 3.0.

Accordingly, should the RRP construction work encounter PFAS, the RRJV's approach to managing PFAS risks will be in accordance with this site-specific Environmental Management Plan Sub-Plan 17 PFAS Management. For health management of the effects of PFAS, the RRJV's occupational health and hygiene system will be implemented.

All PFAS related investigations and interactions will be in accordance with the relevant guidance documents, i.e. NEMP 3.0 and CMF. Provided works are undertaken in accordance with these applicable guidelines then the risks should be manageable.

Appropriate occupational hygiene measures are to be implemented to minimise exposure of site workers to PFAS contamination during works.

5.2.6 PFAS occupational exposure risks

No soil contamination concentrations were recorded above relevant SAC protective of human health were identified, however, as PFAS poses potential risks to human health and ecological receptors, exposure controls are recommended during the construction process. The controls that will be implemented to prevent occupational exposure to PFOS / PFOA contamination are outlined in the Work Health and Safety (WHS) Exposure Human Health Risk Assessment (HHRA) for PFAS (PFAS NEMP, 2025) and are summarised in Table 5.1.

During construction, if unknown contaminated material is identified it will be managed in accordance with the Unexpected Finds Protocol, as outlined in the EMP (Appendix H).

Table 5.1 Exposure controls for PFAS

Control	Accountability
Ensuring hands and face are washed prior to eating, even if gloves are worn	Supervisory staff, Subcontractors
Use disposal coveralls where risk of contaminating clothing exists.	Supervisory staff, Subcontractors
Use of water-proof disposable nitrile gloves (either instead of or in conjunction with other gloves)	Supervisory staff, Subcontractors
Use of P2 dust masks associated with use of a water truck that is spraying water drawn from areas where the triggers are exceeded	Supervisory staff, Subcontractors
If skin contact with contaminated water above the trigger level is unavoidable, ensure sleeves are rolled down and wet clothing is changed immediately post-work activities	Supervisory staff, Subcontractors

5.2.7 Ecological site adopted criteria

The ecological guideline values (EGV) are used to assess and investigate potential risks to aquatic and terrestrial ecosystems. The use of EGV takes into account any additional guidance on ecological protection by relevant environmental regulators, along with the extensive guidance provided in the NEMP 3.0 and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality framework on considerations for monitoring, site assessment, sampling and analysis.

The following interim ecological soil guideline values consider both direct exposure and indirect exposure:

- The **direct exposure ecological soil guideline** applies specifically to protection of organisms that live within, or in close contact with soil, such as earthworms and plants. This direct exposure value can be used to assess the possibility of direct harm to these organisms. Other factors important for assessing exposure, for example bioaccumulation, leaching and off-site transport, must be accounted for, by including other lines of investigation
- The **indirect exposure ecological soil guideline** accounts for the various pathways through which organisms can be exposed whether or not they are in direct contact with PFAS contaminated soil (i.e. exposure through the food chain).

When assessing contaminated sites, the potential for multiple exposure pathways affecting sensitive receptors will be considered in order to develop a robust conceptual site model and implement effective management controls.

The BBK conceptual site model assessments Soil and Leachate Concentrate assessments can be reviewed in Contamination Screen Risk Assessment in Table 5.3. These will be used as an indicator to compare levels of PFAS contaminants at BBK with the appropriate levels required to protect against human and ecological harm, refer to NEMP 3.0 Chapter 8 PFAS Environmental guideline values.

Site specific PFAS risk assessments will be conducted for each work element stage as per PFAS Risk Assessment Tool (Figure 7.1) and as discussed in Section 7.5.

A summary of PFAS Contamination Screen Risk Assessments is located in Table 5.2 and Table 5.3below. Details of the bulk earthworks cut and fill volumes for the BBK Project are presented in Appendix B.

Table 5.2 Hazards and potential impacts of reuse of PFAS impacted spoil material

Hazards of reuse of contaminated soils	Impacts of Inappropriate or unsuitable reuse of contaminated soil
Excavation -Construction Temporary Stockpiling	— Spread of Contamination across the landscape. — Potential impacts on environmental values, both on and off base, such as surface water and groundwater quality, aquatic species, and matters of national environmental significance. — Potential for PFAS contamination of clean sites. — New contamination and remobilisation of PFAS. — Potential human exposure based on land use. — **Contamination of perched ground water table.**
Relocation and reuse of Contaminated Soils	— Potential for cross-contamination -spread of PFAS across the base. — Proposed reuse may create new potential pathways to human health or sensitive environmental receptors. — **Potential human exposure based on land use.**

Hazards of reuse of contaminated soils	Impacts of Inappropriate or unsuitable reuse of contaminated soil
Disposal costs of Demolition and Contaminated soils and debris to approved landfill	— Impact of any spread of contamination due to vehicle movements associated with off base management of disposal process. — **Risk of contaminated material being managed at unapproved landfill or dumped as unauthorised fill.**
Clearing and grubbing	— Increased sediment load in run off impacting on aquatic fauna and flora. — Disturbance and mobilisation of PFAS following rain events — Disturbance of PFAS contaminated vegetation, roots; and — **Mobilisation of PFAS in surface and via the perched ground water table.**

Table 5.3 PFAS Contamination screen risk assessment

Area	Cut or Fill	Soil Concentrate Leachate Concentrate	Maximum CMF Category	Design and Construction PFAS Mitigation	Additional Management Measure
Northern Ring Road	**Fill**	— Indirect Exposure	Cat 4	TEC nearby the construction zone, up topographic gradient, but requires some clearance. No existing stormwater system. Fill material built under Hard pavement.	**No surplus** material. Current ground surface acceptable to receive suitable fill from comparable work areas, or appropriate off-Base sources. Sources could include work element K9, K10, K10 and K18. Erosion and sediment control per RRJV EMP to be adhered to.
K07 Road between LIAs	**Cut**	— Indirect Exposure	Cat 4	Intensively developed area, sealed surfaces, and stormwater system. Minimal remnant vegetation in vicinity. Hard pavement	**Surplus** can be used as fill in other Cat 4 work areas, no appreciable mass loading or increase to risk profile anticipated. Materials tracking registers per RRJV EMP to be adhered to.
K09 New HQ Building	**Cut**	— Indirect Exposure	Cat 4	Intensively developed area, sealed surfaces, and stormwater system.	**Surplus** can be used as fill in other Cat 4 work areas, no appreciable mass loading or increase to risk profile anticipated. Materials tracking registers per RRJV EMP to be adhered to

Area	Cut or Fill	Soil Concentrate Leachate Concentrate	Maximum CMF Category	Design and Construction PFAS Mitigation	Additional Management Measure
K10 LIA carparks	**Fill**	— Indirect Exposure	Cat 4	Intensively developed area, sealed surfaces Minor developed area with unsealed grassed surfaces, and stormwater system monitor discharge points. Fill material built under Hard pavement	**No surplus material**. Current ground surface acceptable to receive suitable fill from comparable work areas, or appropriate off-Base sources. Sources could include work element K9, K10, K10 and K18 Erosion and sediment control per RRJV EMP to be adhered to.
K10 LIA Alpha & Bravo Company	**Cut**	— Indirect Exposure	Cat 4	Intensively developed area, sealed surfaces, and stormwater system.	**Surplus** can be used as fill in other Cat 4 work areas – most notably LIA C&D - no appreciable mass loading or increase to risk profile anticipated. Materials tracking registers per RRJV EMP to be adhered to.
K10 LIA Charlie & Delta Company	**Fill**	— Indirect Exposure	Cat 4	Intensively developed area, sealed surfaces, and stormwater system. Minimal remnant vegetation in vicinity. Fill material built under Hard pavement	**No surplus material**. Current ground surface acceptable to receive suitable fill from comparable work areas – Sources could include work element K9, K10, K10 and K18- or appropriate off-Base sources. Erosion and sediment control per RRJV EMP to be adhered to.
K10 LIA West	**Cut**	— Indirect Exposure	Cat 4	Intensively developed area, sealed surfaces, and stormwater system. Minimal remnant vegetation in vicinity.	**Surplus** can be used as fill in other Cat 4 work areas, no appreciable mass loading or increase to risk profile anticipated. Materials tracking registers per RRJV EMP to be adhered to.
K12 New Recruit Welfare Facility	**Fill**	— Indirect Exposure — ADWG	Cat 3, Cat 2	Intensively developed area sealed with stormwater system.to divert runoff to dentation basin for monitoring prior to discharge to mitigate contamination of Kapooka Creek. Fill material built under Hard pavement	**No surplus material**. Prior to importation of fill, current ground surface to be used in land forming in the work area specifically under sealed surfaces (roads, pavement, engineered concrete slab) and not in vicinity of drainage lines or stormwater systems. If not practicable, material should be disposed of off-Base as waste under NSW EPA Waste Regulation. Additional material sources could include work element K9, K10, K10 and K18.

Area	Cut or Fill	Soil Concentrate Leachate Concentrate	Maximum CMF Category	Design and Construction PFAS Mitigation	Additional Management Measure
					Category 2 area (current fire station precinct) identified adjacent to the New Recruit Welfare Facility, to be segregated and managed as an integrated response with PMAP implementation project (under contaminated sites protocols and roles). Ensure management is in accordance with NEMP 3 0 and CMF. A soil reuse risk assessment (CMF, Appendix A) needs to be prepared for PFASIMB review.
K13 New clothing & Q-Store	**Fill**	— Indirect Exposure — ADWG	Cat 3	Intensively developed area with sealed with stormwater system.to divert runoff to dentation basin for monitoring prior to discharge -to mitigate contamination of Kapooka Creek. Fill material built under Hard pavement	**No surplus material**. Prior to importation of fill, current ground surface to be used in land forming in the work area specifically under sealed surfaces (roads, pavement, engineered concrete slab) and not in vicinity of drainage lines or stormwater systems. If not practicable, material should be disposed of off-Base as waste under NSW EPA Waste Regulation. Category 2 area (current fire station precinct) to be segregated and managed as an integrated response with PMAP implementation project (under contaminated sites protocols and roles). Ensure management is in accordance with NEMP 3 0 and CMF. A soil reuse risk assessment (CMF, Appendix A) needs to be prepared for PFASIMB review.
K14 New Recruit Physical Training Facility	**Fill**	— Indirect Exposure — ADWG	Cat 3	Intensively developed area, sealed surfaces, and stormwater system. Minimal remnant vegetation in vicinity Fill material built under Hard pavement	**No surplus material.** Prior to importation of fill, current ground surface to be used in land forming in the work area specifically under sealed surfaces (roads, pavement, engineered concrete slab) and not in vicinity of drainage lines or stormwater systems. Sources could include work element K9, K10, K10

Area	Cut or Fill	Soil Concentrate Leachate Concentrate	Maximum CMF Category	Design and Construction PFAS Mitigation	Additional Management Measure
					and K18 If not practicable, material should be disposed of off-Base as waste under NSW EPA Waste Regulation Ensure management is in accordance with NEMP 3 0 and CMF. A soil reuse risk assessment (CMF, Appendix A) needs to be prepared for PFASIMB review.
K16 EO Storages facility	**Fill**	— Indirect Exposure	Cat 4	Remnant vegetation near the construction zone requires some clearance. Unsealed grassed surfaces. Existing stormwater system discharges off base. Fill material built under Hard pavement	**No surplus material**. Current ground surface acceptable to receive suitable fill from comparable work areas, or appropriate off-Base sources. Sources could include work element K9, K10, K10 and K18. Erosion and sediment control per RRJV EMP to be adhered to.
K17 New Weapons Range Facility	**Cut**	— Indirect Exposure	Cat 4	Remnant vegetation near the construction zone requires some clearance. Unsealed grassed surfaces. No existing stormwater system.	**Surplus** can be used as fill in other Cat 4 work areas – most notably the range road - no appreciable mass loading or increase to risk profile anticipated. Materials tracking registers per RRJV EMP to be adhered to
K18 New Medical Training & TCCC Facility	**Cut**	— Indirect Exposure — ADWG	Cat 3	TEC nearby the construction zone, up topographic gradient, but requires some clearance. Drainage line down topographic gradient.	**Surplus** cannot be used as fill in work areas <Cat 3, preferentially to be used in land forming in the Medical Training work area specifically under sealed surfaces (roads, pavement, engineered concrete slab) and not in vicinity of drainage lines or stormwater systems. If not practicable, material should be disposed of off-Base as waste under NSW EPA Waste Regulation. A soil reuse risk assessment (CMF, Appendix A) needs to be prepared for PFASIMB review.

Area	Cut or Fill	Soil Concentrate Leachate Concentrate	Maximum CMF Category	Design and Construction PFAS Mitigation	Additional Management Measure
K19 New Contractor's Precinct	**Fill**	— Indirect Exposure	Cat 4	Minor developed area with unsealed grassed surfaces, and drainage lines down topographic gradient. Fill material built under Hard pavement	**No surplus material.** Current ground surface acceptable to receive suitable fill from comparable work areas, or appropriate off-Base sources. Sources could include work element K9, K10, K10 and K18 Erosion and sediment control per RRJV EMP to be adhered to.
K20 New Land Management Compound	**Fill**	Data gap in assessment, however up topographic gradient of known PMAP source zones		Minor developed area with unsealed grassed surfaces, and drainage lines down topographic gradient. Fill material built under Hard pavement	**No surplus material**. Current ground surface may be acceptable to receive suitable fill from comparable work areas, or appropriate off-Base sources. Sources could include work element K9, K10, K10 and K18 Sampling and assessment to be conducted prior to earthworks.
Heritage Walk	**Fill**	— Indirect Exposure	Cat 4	Remnant vegetation near the construction zone requires some clearance. Unsealed grassed surfaces to replace with fill and hard pavement. No existing stormwater system.	**No surplus material**. Current ground surface acceptable to receive suitable fill from comparable work areas, or appropriate off-Base sources. Sources could include work element K9, K10, K10 and K18. Erosion and sediment control per RRJV EMP to be adhered to.

6 PFAS management

6.1 PFAS roles and responsibilities

6.1.1 Base stakeholders

The management of contaminated land and groundwater is predominantly managed by two directorates within Defence, as follows:

- PFASIMB undertakes the investigation and management of PFAS contamination hazards, as well as supporting impacted communities. This includes the development of the PMAP (BBK PFAS Management Area Plan) and ongoing monitoring programs.
- DCARM manages multiple contamination programs, including the Regional Contamination Investigation Program (RCIP), which undertakes a 'whole of property' investigation, definition of nature and extent and risk appraisal of contamination hazards (generally excluding PFAS) on the Defence Estate.

6.1.2 Project environmental resource

The Project Environmental Resource is responsible for updating this plan to reflect changes to environmental, legal and other requirements, as required.

The Project Environmental Resource (or delegate) will have approval authority for all environmental risk assessment types to ensure environmental risks and opportunities are adequately raised and addressed.

6.1.3 Contractors' representative

The people responsible for managing, documenting and reporting on PFAS issues for the project are:

- The Contractor's *Site Manager* or delegate, who is responsible for ensuring that all requirements of the requirements in this PFAS Management Sub-Plan (PMSB) are met during the project.
- The Contractor's *Site Supervisor* or delegate, who is responsible for ensuring the strategies and procedures prescribed in the PMSB are implemented at the site in accordance with the specified requirements.
- RRJV's *Construction Manager*, or delegate who is responsible for reviewing compliance with the PMSB and development of actions to address non-conformance.
- All other site personnel are responsible for implementing strategies and procedures prescribed in the PMSB, as applicable to their work activities.

6.2 Environmental training requirements

ALL personnel involved in implementing the PMSB, including Defence staff, contractors and subcontractors, must receive and have appropriate environmental training relevant to the environmental obligations outlined in this plan. This ensures that individuals are aware of their responsibilities under the EPBC Act and are equipped to support effective management of PFAS.

Environmental awareness training should be provided to all persons involved in project implementation to make them familiar of their responsibilities under this PSMB. The awareness training cover:

- Staff and contractor's environmental responsibility under the PMSB.
- Procedural requirements of the PMSB.
- Reporting environmental issues and preparation of non-conformance register.
- Unexpected find protocol.
- Emergency preparedness and response.

Site inductions are mandatory prior to accessing the BBK project site areas. All contractors must complete a Defence National base Induction via ServiceConnect, covering health and safety protocols, conditions of entry, and site-specific environmental sensitivities.

Training records must be maintained and include the name of the trainee, date and type of training, trainer's qualifications, and a summary of the training content.

6.3 Emergency contacts and procedures

The project will maintain a current list of emergency contacts responsible for managing environmental emergencies. These individuals will have the authority to stop work or direct works to ensure an effective emergency response and minimise risks to personnel, property, and the environment. The contact list will be reviewed regularly and updated as needed to reflect changes in site personnel, contractors, or organisational responsibilities. This list must be clearly displayed on-site and accessible to all staff and contractors, and will include:

- Environmental Manager
- Site Supervisor
- Base Services Contractor Representative
- Emergency Services (Police, Ambulance, Fire)
- Wagga Wagga City Council Environmental Officer
- Directorate of Environmental and Heritage Policy Development (dehpd.policy@defence.gov.au).

7 PFAS risk assessment

7.1 PFAS risk assessment process

A PFAS risk assessment for Defence is required to provide an assessment of the risk associated with the reuse of soil at a specific location that may affect the existing human health and/or ecological risk within that proposed area. The assessment includes a comparison of PFOS+PFHxS concentrations and the total mass in the soils to be reused (source soils) and the surface soils at the proposed reuse location.

A risk assessment is needed to 'demonstrate no increase in, or unacceptable risks to human health and/or environment from proposed management options' (Defence, 2025). If it is determined that reuse of Category 2 and Category 3 soils is a preferred management option and has Base stakeholder approval, a soil reuse risk assessment is required to demonstrate it will not result in an increased or unacceptable risk to human health and the environment. Appendix A in the Defence PFAS Framework (Defence, 2025) provides further considerations for soil reuse risk assessment., including considerations for the work area, the source soil characterisation, the receiving locations and mitigation measures.

- A risk assessment is needed to 'demonstrate that any risks from the additional PFAS load at the receiving location are acceptable' (Defence 2025). Risk assessment is required when the volume of soil to be managed exceeds 10 m^3 and based on the four Defence PFAS-based soil categories which were presented.

The PFAS Risk Assessment process and the NEMP 3.0 PFAS decision tree (refer to Figure 3.1 in Appendix A) will be used to assess the PFAS contamination for each work element prior to construction or demolition and adopted human health and ecological criteria will also be considered during the following processes.

Previous studies including the BBK PFAS Management Area Plan (PMAP, 2021) identified PFAS source areas at BBK, with those of highest level of impact at the:

- The Current Fire Station (inside the footprint of the proposed action)
- The Former Fire Training Areas (outside the footprint of the proposed action)
- Irrigated areas (including the decommissioned golf course) using treated wastewater effluent from the wastewater treatment plant (outside the footprint of the proposed action).

Those areas are on the eastern side of BBK where surface water runoff feeds into Kapooka Creek. Leachability testing of soil indicated potential for discharge of PFAS to surface water and groundwater from those areas (Jacobs, 2019).

7.2 Identified potential site risks

The primary objective of a PFAS risk assessment for Defence is to determine whether the reuse of soil at a specific location affects the existing human health and/or ecological risk at that location. The assessment requires a comparison of PFOS+PFHxS concentrations and the total mass in the soils to be reused (source soils) and the surface soils at the proposed reuse location.

The following risks have been identified:

- Due to PFAS chemical properties and dispersive behaviour in the environment, PFAS compounds may be detected in soil and laterally widespread from primary PFAS sources (e.g. fire training areas). Works such as the proposed redevelopment at BBK can generate large volumes of spoil which may be impacted by low concentrations of PFAS and will require careful management
- The presence of PFAS narrows the options for reuse or disposal of such spoil. Reuse on-site may be permissible subject to siting options, a rigorous risk assessment process in accordance with Defence PFAS guidance and approval by the relevant Defence technical authorities

- Options for the management of high PFAS concentrations in spoil (such as disposal, treatment or remediation) are limited and costly
- Low concentrations of PFAS could occur in other areas where data gaps exist, and spoil generated during construction will require management (e.g. soil reuse on-site).
- Human health risks to construction and maintenance workers from direct contact with soil or perched water in impacted source zones
- Human health risks to off Base residents from consumption of home grown produce irrigated with impacted surface water from and near to Kapooka Creek. Preliminary precautionary advice was provided by NSW government agencies to individual properties
- Human health risks for recreational fishers due to consumption of fish and yabbies from Kapooka Creek, Sandy Creek and the Murrumbidgee River.
- Direct and indirect exposure of ecological receptors from impacted surface water, sediment and soil and exposure of terrestrial groundwater dependant ecosystems to PFAS impacted groundwater.

7.3 PFAS risk management measures

This PMSB considers the risks associated with the potential PFAS concentrations in soils across the site as highlighted in the PFAS Heat Maps (Section 11). These risks are explored in Table 5.3.

Additional risk assessments are required when the volume of soil to be managed exceeds 10 m^3 and based on the four Defence PFAS-based soil categories which were presented in Table 3.1. These risk assessments will be completed before and during the construction phase, for example once soil has been excavated and transported to the stockpile locations.

In accordance with the Defence Construction and Maintenance Framework - Guidance for managing the risks of PFAS contamination for works on the Defence estate (version 4.0, May 2025), managing the ‘off work site, on Base’ reuse of PFAS-contaminated materials must consider the following:

- The concentration and total load of PFAS in the materials, especially where large volumes are involved.
- Whether the additional PFAS load at the proposed site changes the risk at or from the proposed reuse site.
- The characteristics of the reuse site, in particular:
  - Pre-existing PFAS impacts at the proposed site
  - Site drainage: where does surface water flow or accumulate? Where do stormwater channels drain? In which direction does any groundwater flow? How high is the water table?
  - Proximity to the Defence property boundary: What is the risk of any contaminated water, resulting from the reuse, migrating from the Defence site?
- The risks to sensitive receptors, including direct and indirect receptors, which may be on and off-Base.

Cumulative effects of discharging or irrigating with PFAS contaminated water over time or from multiple projects.

Table 7.1 Represents potential onsite PFAS associated risks

Risk Management	Risk Description	Potential Management Measures
01	Historical use of PFAS has created several source areas at BBK and perched groundwater has been identified at some of the locations. There is potential for a clay layer to occur below the perched aquifer(s), as part of the Lachlan Formation, which limits the vertical migration of contaminants between the perched and deep aquifer. Jacobs (2018a) indicated that the hydraulic properties of the clay found on the Property are considered to substantially attenuate vertical hydraulic connectivity between the ground surface and the underlying permeable horizons. However, it is not known if this clay layer is continuous across the Property. Regional groundwater is understood to be located within the deep aquifer (from 48 mbgl) within the Lachlan and Cowra formations. If construction activities interact with regional groundwater and thereby exposing groundwater to PFAS contamination in shallow soils, there may be a risk of increased groundwater contamination.	It is understood that proposed construction excavation depths are not likely to contact the regional groundwater. However, there may be instances where perched groundwater in intersected during the construction phase. In the event that this occurs it is recommended that: — Works should be temporarily halted to determine the nature and extent of the intersection of groundwater. — Further sampling and assessment should be undertaken of both the soil and groundwater to determine if the intersected groundwater poses a risk to workers onsite or if the disturbed soil might pose a risk of leaching into the perched groundwater. — Local groundwater should not be used for construction purposes (i.e. dust suppression, concreting, other construction purposes). For proposed deep excavations, an understanding of the PFAS concentrations within the soil will be beneficial to inform the risk that PFAS impacted soil may interact with groundwater. Depending on the nature and extent of the groundwater intersected there may be a requirement for dewatering to occur. Overall, it is unlikely that construction activities will interact with groundwater; however, if deep excavations are required then there is the potential for perched groundwater to be intersected.
02	Movement of PFAS impacted soil to areas without PFAS (i.e. ‘clean’ areas) could increase the risk profile of the site and potentially pose a risk to nearby sensitive receptors.	Movement of PFAS impacted soil to areas without PFAS (i.e. ‘clean’ areas) could increase the risk profile of the site and potentially pose a risk to nearby sensitive receptors. As outlined in the DCMM – Annex C, contaminated material should not be stockpiled in areas that have previously been identified as clean.

Risk Management	Risk Description	Potential Management Measures
		No stockpiling should occur without a detailed sampling program that assesses: Quality of the source material. Quality of the soil in areas within the footprint of stockpiles. The Preliminary PFAS risk assessment is required if the potential change in risk associated with the placement of spoil in new areas (stockpile or reuse) is required. The PFAS risk assessment process can be informed using the PFAS calculator provided in Appendix C. If PFAS impacted soil is placed in previously 'clean' areas, there may be an increased risk of impacts to surrounding receptors.
03	During the construction phase, temporary stockpiles will be required as part of the cut and fill process. If the stockpiling process is not carried out under best practices the risk of PFAS leaching into the surrounding environment increases.	Due to the long-term nature of the project, some soil may be stockpiled for extended periods and will likely suffer reduced viability due to loss of organic matter and nutrients, as often occurs when stockpiled for greater than 3–6 months. Most of the soils are expected to be stockpiled for 1–1.5 years and soils stripped from other areas would be stockpiled for the duration of the Project. Recommended measures to be included in the EMP relating to soil stockpiling include: — Soil materials of different quality should be stockpiled separately. — Temporary soil bunds built up around stockpiles to prevent runoff and leaching of potentially contaminated stockpiles. — Covering of stockpiles of contaminated soil may be required (particularly if hydrocarbon impacts are observed or if PFAS impacted); the need will be determined on a case-by-case basis. — Minimise trafficking and compaction of stockpiles. — Maintain suitable stockpile height to avoid compaction and minimise handling of soil.

Risk Management	Risk Description	Potential Management Measures
		— Vegetation cover of long-term topsoil stockpiles with native plant community types to minimise water logging and generation of anaerobic conditions within the stockpile, to help maintain topsoil biological viability and to create a seed store.
04	PFAS contamination is a major reputational risk for the Defence estate currently and has widespread public documentation. Should PFAS contamination be increased or spread across the Defence estate, an increase in reputational risk is likely.	All PFAS related investigations and interactions should be in accordance with the relevant guidance documents. PFASIMB Estate Management to be consulted throughout the project. Provided works are undertaking in accordance with the applicable guidelines then the risks should be manageable.
05	Unexpected finds - interaction with Category 1 PFAS impacted soil/groundwater.	Further remediation may be required where intrusive works encounter highly contaminated soil. It is understood that further sampling and analysis will be carried out during the construction phase. Should analytical data indicate high levels of PFAS (Category 1) a remedial action plan may be required to be developed which may include a requirement for stabilisation processes to be implemented.

7.4 The NEMP decision tree

The NEMP 3.0 decision tree will support the Preliminary PFAS risk assessment of the material from each Work Element. The CMF PFAS contamination categories will steer earthworks planning and controls during the construction.

The RRJV will review the NEMP 3.0 PFAS decision tree to further assess the PFAS risk and determine if additional mitigations are required for each Work Element prior to construction. The objective is to conduct preliminary evaluation of the existing data and assess PFAS risk for each Work Element, with the aim to identify if there are additional requirements to prepare a Defence compliant risk assessment.

After consideration of the NEMP 3.0 decision tree, the material in each Work Element will be categorised under the CMF to steer earthworks planning and controls during the proposed action. Excavated soil from construction will be classified into four categories based on analytical results and understanding of the source and destination characteristics, refer to the Contamination Screen Risk Assessment in Figure 7.1.

7.5 The preliminary risk assessment tool

The preliminary Risk Assessment tool comparison tool can be reviewed in Figure 7.1 and refer to document number RRP-BBK-GLO-CNT-RPT-002.

- PFAS Risk Comparison- can be used to derive:
- The mass of PFHxS + PFOS after reuse
- And the percentage change in mass of PFHxS + PFOS at the reuse location.

Data for both the receiving area and the source material information can be fed into the calculator as an initial step to aid in the assessment of change in PFAS risk, if any, associated with the reuse of spoil.

Sum PFHxS + PFOS			
Source material:			
spoil volume		m3	volume of soil excavated, area x depth
bulk density		kg/m3	specific to soil type, e.g. clay loam = 1500
soil weight	0	kg	spoil volume x bulk density
Sum PFHxS + PFOS concentration		mg/kg	calculated 95% upper confidence limit (UCL), based on recent testing
PFHxS + PFOS mass in spoil	0	mg	UCL Sum PFHxS + PFOS concentration x soil weight
PFHxS + PFOS mass in spoil	0	kg	convert mg/kg to kg
Soil at reuse location:			
depth of existing PFAS contamination		m	based on recent soil testing
footprint of existing PFAS contamination within reuse area		m2	estimate of reuse area with existing PFAS contamination, based on recent testing
volume of PFAS contamination	0	m3	depth x area of footprint
bulk density		kg/m3	specific to soil type, e.g. clay loam = 1500
soil weight	0	kg	spoil volume x bulk density
Sum PFHxS + PFOS concentration		mg/kg	calculated 95% upper confidence limit (UCL), based on recent testing
PFHxS + PFOS mass in reuse area	0	mg	UCL Sum PFHxS + PFOS concentration x soil weight
PFHxS + PFOS mass in reuse area	0	kg	convert mg/kg to kg
Comparison:			
combined mass of PFHxS + PFOS after reuse	0	kg	PFHxS + PFOS mass in source material + existing PFHxS + PFOS mass at reuse location
percentage change in mass of PFHxS + PFOS	#DIV/0!	%	PFHxS + PFOS mass in spoil compared to PFHxS + PFOS mass at reuse location

Figure 7.1 Preliminary risk assessment – calculator tool

If the PFAS quality of the source material to be reused and the existing PFAS quality of soils at the reuse locations are similar, then there is a lower chance that the PFAS risk at the reuse location will change significantly due to the placement of construction spoil.

8 Construction earthworks

Due to factors such as topography, utilities, geotechnical, flooding, stormwater, the proposed action is primarily a net filling activity; meaning that the existing ground surface will be below new cover material and construction of clean pavement, concrete slab or unsealed surface will be emplaced at the completion of construction.

The nature and extent of major earthworks required for each work area, including a description regarding the maximum extent either below ground level (BGL) or above ground level (AGL) and an excerpt of detail design drawings (major cut activities are highlighted with row shading). This is presented in the detailed design bulk earth works drawings.

The Contamination Screen Risk Assessment and management measures are summarised in Section 7, and includes soil and leachate concentrates, the PFAS CMF Category and the environmental context for each Work Element (environmental features, land use history, presence of any vulnerable ecological values). Also shown are additional management measures to be adopted during construction activities of the proposed action which includes potential source locations for fill materials on BBK. This table will inform the Construction Area Plans (CAPs) and individual PFAS Site Assessments as they are developed.

8.1 Spoil management

Where possible, the preference is to reuse soils in accordance with the Defence PFAS Framework. Soils likely to be encountered by this project are suitable to be reused as backfill within the section of trench from which they were excavated, and as incorporated in design elements subject to geotechnical suitability and design reinstatement requirements.

8.1.1 PFAS Category 2 soils

PFAS category 2 soils are limited to the fire station which is located adjacent to the proposed redevelopment area (soil investigation location BH38 at a depth of 0.5mbgl). Additional soil testing is proposed to delineate the extent of Category 2 soils at this locality. Generation of excess spoil from this area should be avoided.

If temporary stockpiling of PFAS category 2 soils is required, the soil from this area will be temporarily stockpiled within the pre-classified Category 2 area for reuse and will not be relocated. Where PFAS Category 2 Soils are to be temporary stockpiled beside trenches for periods of more than 8 hours, or when rainfall (>30 mm in 24 hours) is predicted, temporary stockpiles must be covered by a tarpaulin or plastic sheeting to prevent infiltration and/or runoff. Additional erosion and sediment control measures will be installed.

If reuse is not appropriate, due to design levels or geotechnical considerations, a risk assessment will be undertaken by a suitably qualified person to evaluate the alternative options.

Reuse of Category 2 soils within the work area is subject to reuse risk assessment (CMF, Appendix A) and strong mitigation measures. Due to category 2 soils being encountered within the proposed work area, additional delineation and sampling in the area (near BH38) and a remedial action plan (RAP) for the area will be recommended.

8.1.2 PFAS Category 3 soils

PFAS Category 3 soils may be suitable for reuse on the work sites and elsewhere on-base subject to reuse risk assessment (CMF, Appendix A) and Base approvals) with the following management/mitigation measures:

- Reuse locations should be sited (at least 25 m) away from drains and water bodies, unless a risk assessment indicates appropriate mitigations are in place for placement within 25 m.
- Erosion and sediment control measures should be employed (including revegetation following placement).
- Reuse locations must be agreed with Base stakeholders.

Mitigation measures (such as placement under pavements, capping or treatment to reduce leachability) may be required if potential pathways exist and there are potential high sensitivity receptors. The overall load of PFAS in the total volume of soil shall also be considered when assessing the risk. In addition to Base approvals, Defence PFASIMB shall review and approve this plan and will be consulted further during Delivery Phase if deemed necessary.

8.1.3 PFAS Category 4 soils

As noted in the PCA and PFAS Risk Assessment (2025), PFAS Category 4 soils can be reused within the work sites with no additional mitigation procedures or elsewhere on-base (subject to base approvals) providing that the risk to human health or the environment is not increased or results in an unacceptable risk.

8.1.4 PFAS Contamination heat maps

PFAS ‘heat maps’ are a valuable tool to understand the contamination risk of PFAS across BBK. The data was collated from RRJV site investigations and information in the Defence ESdat system. The Heat Maps have been developed from all available data in 2023. Heat maps are shown in Section 11.

The PCA identified data gaps due to work element design changes, the indicating a need for additional contamination assessments during the construction phase at the below locations:

- K01 Battery and Control Room
- K01 Intake Switching Station
- K03 Potable Water House
- K07 Ring Road and drainage swale
- K09 HQ building
- K11 Edmondson Soldiers Club Adaptive Reuse
- K12 New Recruit Physical Training Facility
- K13 New Clothing Store and Q Store
- K14 New Medical Training and TCCC Facility
- K18 New Medical Training and TCCC Facility
- K19 Contractor’s Precinct
- K20 Land Management compound
- Kapooka Heritage Trail.

The work element assessments will include a site assessment and PFAS Risk Assessment, and additional site testing in accordance with the NEMP 3.0 and the CMF guidance. The RRJV will continue to work closely with the ESM and PFASIMB during the construction phase to identify these requirements.

Unexpected Finds may be present between the sampling sites and further analysis, and ongoing testing will occur during construction as per the Unexpected Finds Protocol, located in the EMP (Appendix H).

The BBK PFAS heat maps are shown in Section 11.

8.1.5 Off-site disposal

The NSW Waste Management Hierarchy will be employed to first avoid interaction with contamination, then reuse of contaminated materials where appropriate refer to Sub Plan 15 Waste Management section in the EMP.

Where reuse of materials is not viable or geotechnically suitable, some off-base disposal may be required. PFASIMB can be consulted but are not an approving authority for off-site disposal. No soils, demolition materials or groundwater are to be disposed of off-base without prior approval from Defence. Where approved and meeting the nominated landfill criteria, PFAS impacted soils must be removed from base and disposed of at an appropriately licenced landfill as contaminated soil in accordance with *NSW Waste Classification Guidelines*. It is the preference of Defence to reuse soil material where possible. The reuse target of non-contaminated waste by 80%.

PFAS-contaminated materials, including waste PFAS-containing products, are considered to be Dangerous Goods Class 9. The associated waste descriptions must include a reference to the PFAS present, sufficient to accurately reflect the nature of the waste. Where multiple waste codes apply, the waste must be reported using the description PFAS contaminated materials, including PFAS-containing waste products and contaminated containers.

Waste disposal is not supported on the Defence Estate, except under exceptional circumstances, and is subject to approval by the Defence with supporting documentation. The BBK Project is predominately a fill program and reuse onsite is the preferred option.

8.1.6 Temporary stockpiling

The DCMM, Annex C Planning to Minimise and Manage Stockpiling sets out mandatory requirements when undertaking construction, demolition and excavation activities where excess soil (i.e. spoil) may be generated or where existing stockpiles are located within the Project work area. These areas have been identified, and further details are included in the Stockpile Strategy in the EMP.

Temporary Stockpile locations have been identified in Figure 8.1 and are included in the Site Environmental Plan (SEP). These locations will be refined at each work element construction stage. All spoil removed and temporarily stockpiled as part of the Project works will be tested, tracked and documented.

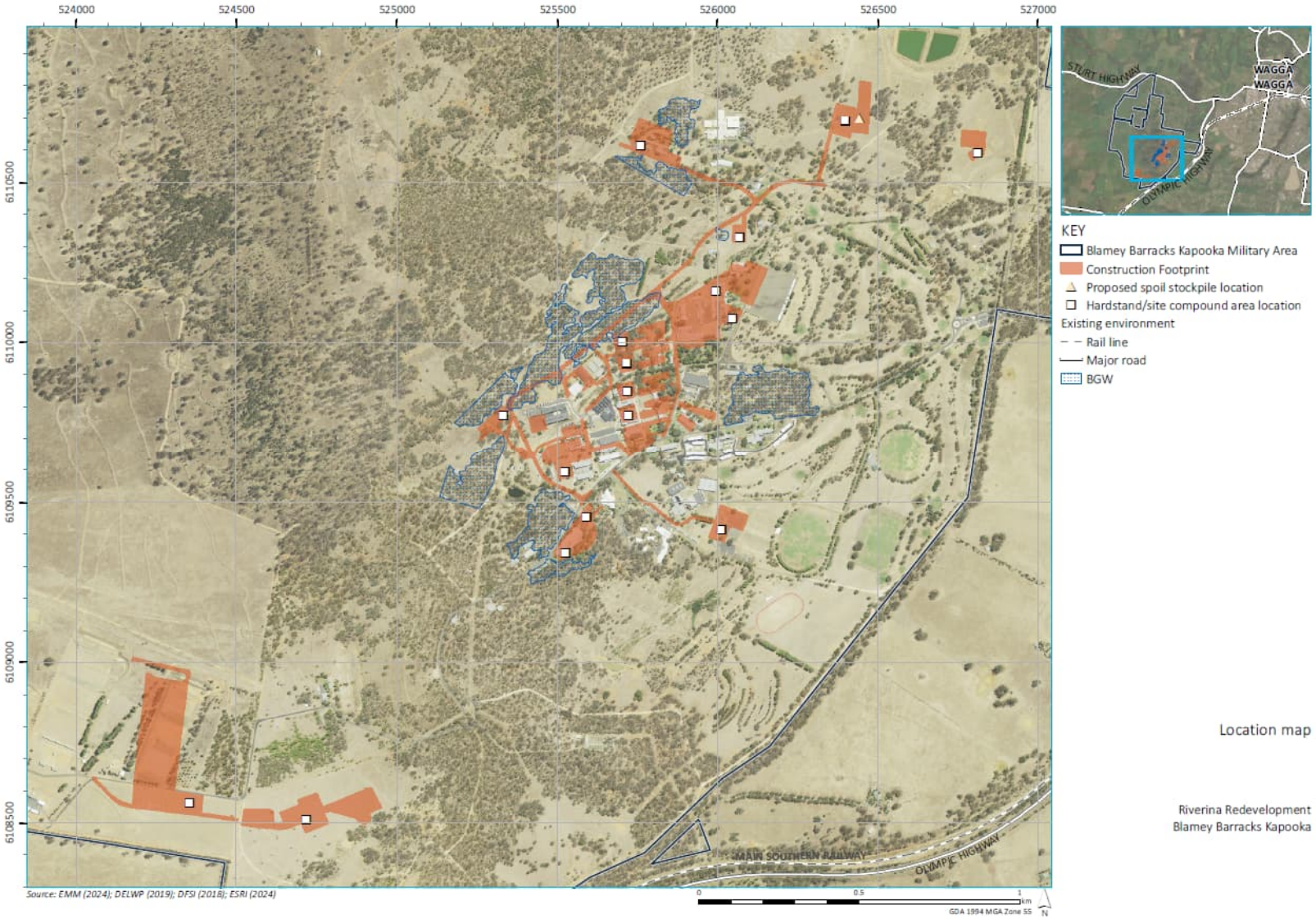

Figure 8.1 BBK site compounds and temporary stockpile locations

Due to the variability in soil waste classifications, material tracking, segregation protocols and stockpile management procedures will be established and documented in the EMP and implemented during the Delivery Phase including:

- Procedures for the importation of materials such as Virgin Excavated Natural Material (VENM), Excavated Natural Material (ENM) and fill material to attain design levels, or for backfill in service trenches will ensure that the material is suitable prior to acceptance on-site.
- Stockpiling Management minimum requirements for short-medium and long-term temporary stockpiling of PFAS impacted Material (No longer than 2 years).
- Preparation of stockpile sites will be undertaken to minimise potential contamination of underlying and surrounding areas including uncontrolled runoff. Generally, this involves keeping stockpiles dry by installing covering and base layers and bunding. The level of management required will depend on contamination category.
- Monitor track source location and do not mix PFAS contaminated materials.
- All reuse locations are to be provided to GEMS ESdat system for contaminated material monitoring.
- The Project will provide the data to DCARM and update ESdat system.
- Include GPS coordinates: Where soil has been removed from and where the soil is placed.
- Include Soil volumes: To be provided by excavation contractor.

The Project will provide the data to DCARM and update ESdat system.

8.1.7 Importing VENM material

Material tracking will be conducted to track source and destination of each load with a plan updated daily with location and source of all materials with stockpiles identified on site with signage and stockpile reference numbers. Refer to Defence reference documents for further details, refer to the RRJV Stockpile Strategy included in the EMP (Appendix J).

9 Onsite water management

All water on site that has contacted impacted materials shall be managed as PFAS impacted, unless otherwise confirmed by laboratory analysis.

PFAS impacted water must not be discharged directly to surface waters or drains.

Management measures to be implemented for rainfall/runoff water management comprise:

- Bunding or other measures, to direct surface runoff from away from works areas, interim stockpile areas and reuse areas (whilst filling is in progress).
- Program excavation works to coincide with forecast dry periods, where practical. Avoid opening up of large areas of exposed soil where periods of extended rainfall are forecast.
- Rainfall captured within the operational works and stockpile areas which has contacted PFAS Category 3 materials or where water quality data indicated elevated PFAS levels shall be managed as described in Section 9.3.
- Place impervious covers on temporary stockpiles containing PFAS Category 2 or 3 materials when extended rain is forecast to minimise infiltration and contaminated runoff.
- No non potable water – i.e. dams or storage basins must not be used for dust suppression on roads and tracks, vehicle washdowns or dewatering without a PFAS contamination risk assessment.

Water management categories for the proposed action have been defined as groundwater, perched water, and surface water, each presented below regarding their nature and interaction potential during construction. During construction, unexpected water sources that may be odorous, aesthetically unsuitable, will be managed in accordance with the Unexpected Finds Protocol, as outlined in the EMP (Appendix H).

9.1 PFAS contaminated groundwater

Groundwater is likely to be restricted to fractures within the metasediments and granite, with some groundwater also likely to occur in the weathered material and colluvium in the lower slope areas, above the fractured rock.

Groundwater was not encountered during drilling. A limited number of existing groundwater monitoring wells exist in the vicinity of the siting options investigated. These monitoring wells were gauged and the standing water levels was either >5 mbgl or the monitoring well was dry.

Perched water was identified in groundwater monitoring well prefix MW601 along the Kapooka Creek flow path off-Base. Water in MW601 is hosted in colluvial soils at 13.0 mbgl associated with Kapooka Creek. Below this is a consistent clay layer from 25.0 to 30.0 mbgl, which appears sufficiently continuous to act as an aquiclude, reducing the risk of migration of PFAS impacted perched water from Kapooka Creek downwards into the regional groundwater.

Overall, it is unlikely that the proposed action will interact with groundwater. The PMAP (2021) notes that perched water lenses have not migrated into regional groundwater, indicating the efficacy of the residual clay overburden acting as an aquiclude to the underlying shale. Being a confined aquifer, the water bearing zone in the shale formation is more likely to be encountered at approximately >30.0 mbgl. Based on this understanding, during construction activities, groundwater is not considered a receptor nor a secondary transport mechanism for contamination management purposes (PMAP 2021).

Since the construction process will be predominantly a fill program, it is unlikely the Project works will impact on groundwater. If groundwater is encountered in large volumes, the water will be stored in containers and tested. If PFAS contamination exceeds NEMP 3.0 guidelines, the stored water will remain in enclosed containers until offsite disposal and treatment occurs at a licenced waste facility.

This will require approval from the BM and PFASISM Branch.

9.2 Perched groundwater lenses

During Base-wide investigation, perched water lenses have been identified in surficial colluvial soils attributed to isolated vertical infiltration from infrastructure and natural drainage lines. Likely to be consistent with topography of the Base – that is, accumulating from vertical infiltration of rainwater surface flow at the base of slopes - by their nature perched water lenses have low productivity and are discontinuous.

As the proposed action is located at lower elevation to the east of the BBK ridgeline, perched water may be intersected during earthworks. Based on current understanding of ground conditions, it is anticipated that perched water infiltration rates into excavations will be less than evaporation forces. Where surplus pooling occurs, water will be tested and removed from the excavations and managed as per Section 9.1.

9.3 Surface water

As detailed in the Contamination Management Strategy (RRJV, 2023) stormwater will be diverted around excavations to the extent possible and tied into relevant existing stormwater infrastructure (per NSW Government (2004) “Blue Book” Managing Urban Stormwater: Soils and Construction, 4th Ed).

If bulk removal of construction water is required from excavations, water will be reused on site or stored in tanks and transport to a suitably licensed liquid waste facility as per the NEMP 3.0. management protocols (refer to Table 9.1). The project will consult with and seek endorsement from the BM or PFASIMB.

Table 9.1 Construction water management controls

Pfas management control	Testing requirements
Construction water management – general requirements	
All extracted groundwater (such as during dewatering) must be managed as PFAS impacted water. Similarly, any captured rainfall or runoff that comes in contact with PFAS Category 1, 2, or 3 soils must be managed as PFAS impacted water.	Not applicable
PFAS impacted water must not be discharged directly to surface waters or drains.	
Construction water management – run off controls	
Divert stormwater runoff from entering open excavations, earthworks or stockpile areas.	Not applicable
Install sediment barriers along the borders of work areas, stockpiles and along surface water drains.	
Bunding or other measures, to direct surface runoff away from works areas, interim stockpile areas and beneficial reuse areas (whilst filling is in progress).	
Adopt construction methods which minimise generation of PFAS impacted sediment, water or slurry during earthworks, as far as reasonably practicable.	
Program excavation works to coincide with forecast dry periods, where practical.	

Pfas management control	Testing requirements
Avoid opening up of large areas of exposed soil where periods of extended rainfall are forecast.	
Place temporary covers (tarps/plastic) on stockpiles containing PFAS Category 2 and 3 materials during the wet season or when extended rainfall is forecast, to minimise infiltration and contaminated runoff.	
If dust control is required, regularly and lightly water work areas and stockpiles but avoid excess watering that produces free water run-off.	
When breaking into a sewer or stormwater system, contamination controls will focus on preventing the discharge of pollutants and managing any wastewater generated to protect human health and the environment. I.e. site isolation to contain spills, prevention of hazardous materials from entering drains, collection and proper disposal or treatment of all water and debris and monitoring water quality.	
Hydrotesting water (used for testing the integrity of the stormwater and sewer pipes).	
Management of water where total volume < 1000L	
Water can be infiltrated near to the work site or subject to approval by Base stakeholders to another adjacent area without testing. This only applies when the water is removed from and returned to the environment in the same location and at the same time, and runoff is prevented	No monitoring proposed
Management of rainwater tanks. pits, swimming pools etc to be demolished	
Existing site water features that are not in direct contact with the soil, i.e. rainwater storage for roof run-off, concrete lined swimming pools/pits etc will be reused onsite for dust suppression of irrigation.	No monitoring proposed
Management of minor water inflow i.e. service trench/foundation excavations (via rainfall or inflow of perched GW) - Options	
Option A1 – manage water in-situ (pump and dam) within the excavations utilising the shallow utility excavations as a channel for in-situ re-infiltration. A collection point would be installed upstream (likely less than 15 m) of the active work zone within the trench and the water would be pumped from the active construction area to the collection point. Once the excavation and backfill is complete, the collected water would be allowed to locally percolate back into the soil profile within the trench. Option A2 – sequence the excavation works so that water can be progressively over pumped into nearby excavations (likely less than 20 m).	No monitoring proposed

Pfas management control	Testing requirements
Water in any given collection area must not be allowed to overflow. That is, the rate of percolation must exceed inflow.	
Option B – manage water ex-situ, by pumping into temporary storage tank/dam, and tested. Surplus water would be used as dust suppression, depending on water analysis results. This strategy will be subject to approval by Base stakeholders.	Option B will require testing and approval from E&S in consultation with PFASIMB.
Option C – manage water ex-situ, by pumping into temporary tank storage, and tested. Surplus water would be disposed off-site to a suitably licensed facility, depending on water analysis results.	One sample collected per reuse batch. Criteria for off-site disposal - NSW disposal guidelines for water
Management of water following heavy rainfall event - Options	
In addition to the controls listed above under 'Surface Water Management', surplus surface water in sludge ponds, swimming pools where the water is not in contact with soil would be managed by pumping into temporary storage. Surplus water would be used as dust suppression, applied to land via controlled sprinkling or for off-site disposal, depending on water analysis results. Reuse for dust suppression or land application via controlled sprinkling will be subject to approval by Base stakeholders and any condition for approval.	No monitoring proposed
Infiltration/soak away method (subject to temporary works design). This strategy will be subject to approval by Base stakeholders.	No monitoring proposed
In addition to the controls listed above under 'Surface Water Management', surplus surface water would be managed by pumping into temporary tank storage and tested. Surplus water would be disposed off-site to a suitably licensed facility, depending on water analysis results.	One sample collected per disposal batch. Criteria for off-site disposal – NSW disposal guidelines for water
Additional Contingency Options for Water Management during Construction	
Disposal of surplus water to water treatment plant, and discharge of treated water to stormwater. There is currently no treatment options available on-base. Would be subject to engagement of a water treatment contractor (high capital cost). This strategy will be subject to approval by Base stakeholders.	One sample collected per discharge event. Water criteria for discharge of treated water: ANZG (2026 update) Ecological Water Quality 95% species protection: — 0.9 ug/L PFOS PFAS NEMP 3.0 Ecological Water Quality 95% species protection: — 220 ug/L PFOA. PFAS NEMP 3.0 Recreational Water Quality — 2 ug/L sum of PFOS + PFHxS — 10 ug/L PFOA.
Management of sewage during construction by pumping downstream of the area where the pipe is cut/worked on without impacting on the quality	No Monitoring proposed

10 Soil reuse

Reuse of PFAS contaminated materials is best practice, where practicable. Reuse of materials avoids the need for stockpiling, which can save costs associated with ongoing stockpile management and monitoring. While reuse of materials helps to achieve Defence's sustainability goals, reuse must not lead to an unacceptable risk to human health, the environment, or an increase in risk at or near the proposed reuse site (CMF, 2025).

The preferred management approach for excess material will be reuse on BBK subject to the Preliminary PFAS Risk Assessments as shown in Table 5.3, this will include the following site assessments:

- Potential for pre-existing 'background' PFAS impacts at the destination site and potential to add to the overall mass of PFAS in the receiving area.
- If the receiving environment already contains PFAS, whether the addition of more PFAS to that system increases the potential for harm.
- Current and likely future land uses at the destination site.
- Hydrogeology at the destination site, including erosion, runoff and infiltration rates, nature of the aquifer systems, the potential for these to be impacted and the actual and potential beneficial uses of groundwater.
- Proximity of the destination site to pathways such as open drains, storm water systems, water bodies, including groundwater, and to sensitive environmental receptors, groundwater-dependent ecosystems and sensitive animals.
- Potential for the receiving environmental conditions to accelerate mobilisation of PFAS in the contaminated material or in existing PFAS at the site.
- Consideration of the pathways posing a risk to human health (HH) and / or the environment include:
  - Transport risk of PFAS to surface water and groundwater through leaching from PFAS-contaminated material
  - Bioaccumulation in plants and animals, in particular, those consumed by humans and animals.

Potential risks associated with non-PFAS hazardous substance contamination such as asbestos, hydrocarbons and metals, will also be considered in assessing the suitability of spoil for retention and reuse.

Examples of potential reuse includes:

- Where there is an existing need for soil for purposes such as landscaping, construction works and roadworks.
- Placing contaminated soil in a location without a need is considered to be waste disposal.
- Use as fill material in commercial/industrial developments with minimal access to soil.
- Use as fill beneath sealed surfaces, including but not limited to car parks/roads/paving/runways.
- Use as construction fill on road embankments, noting that risks should be assessed for stormwater runoff that may mobilise PFAS.
- Use as fill material in areas where background PFAS levels present a similar or higher contamination risk profile, providing that the volume of contaminant in the soil to be added is substantially less than the total mass of the contamination already present in that area.
- Reuse as construction material, e.g. bricks, rammed earth and gabions, noting the need to consider PFAS leachability.

Details of all reuse locations are to be documented and provided to DCARM to be considered in future updates of the BBK PMAP:

- GPS coordinats to be provided which show where soil has been removed from and where the soil is placed.
- Soil volumes to be provided by excavation Contractor's.
- The Project will provide the data to DCARM and update ESdat system.

Material tracking will be conducted to track source and destination of each load with a plan updated daily with location and source of all materials with stockpiles identified on site with signage and stockpile reference numbers. Refer to Defence reference documents for further details, DCMM, CMF and the RRJV Stockpile Strategy in the EMP.

11 BBK construction footprint PFAS heat maps

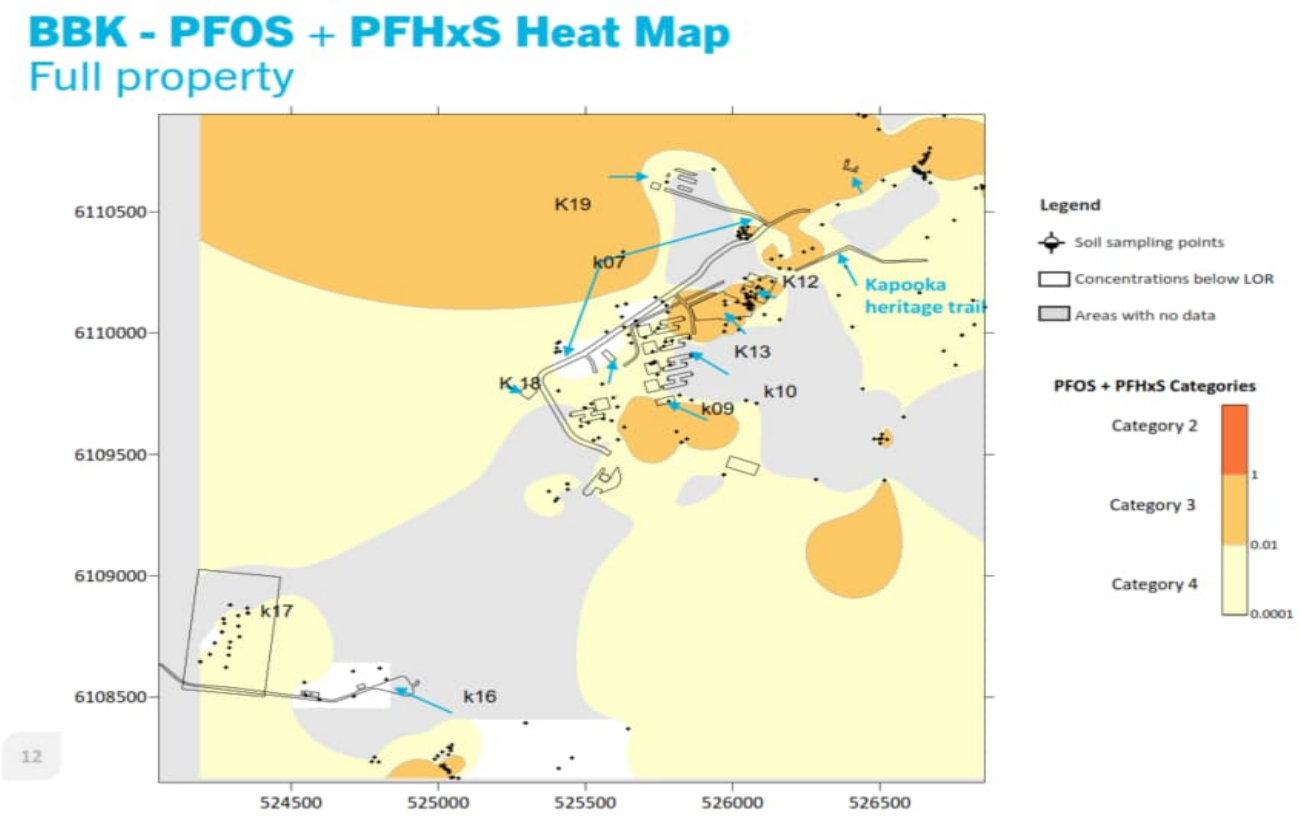

Figure 11.1 PFAS heat maps – whole of site known PFAS contamination

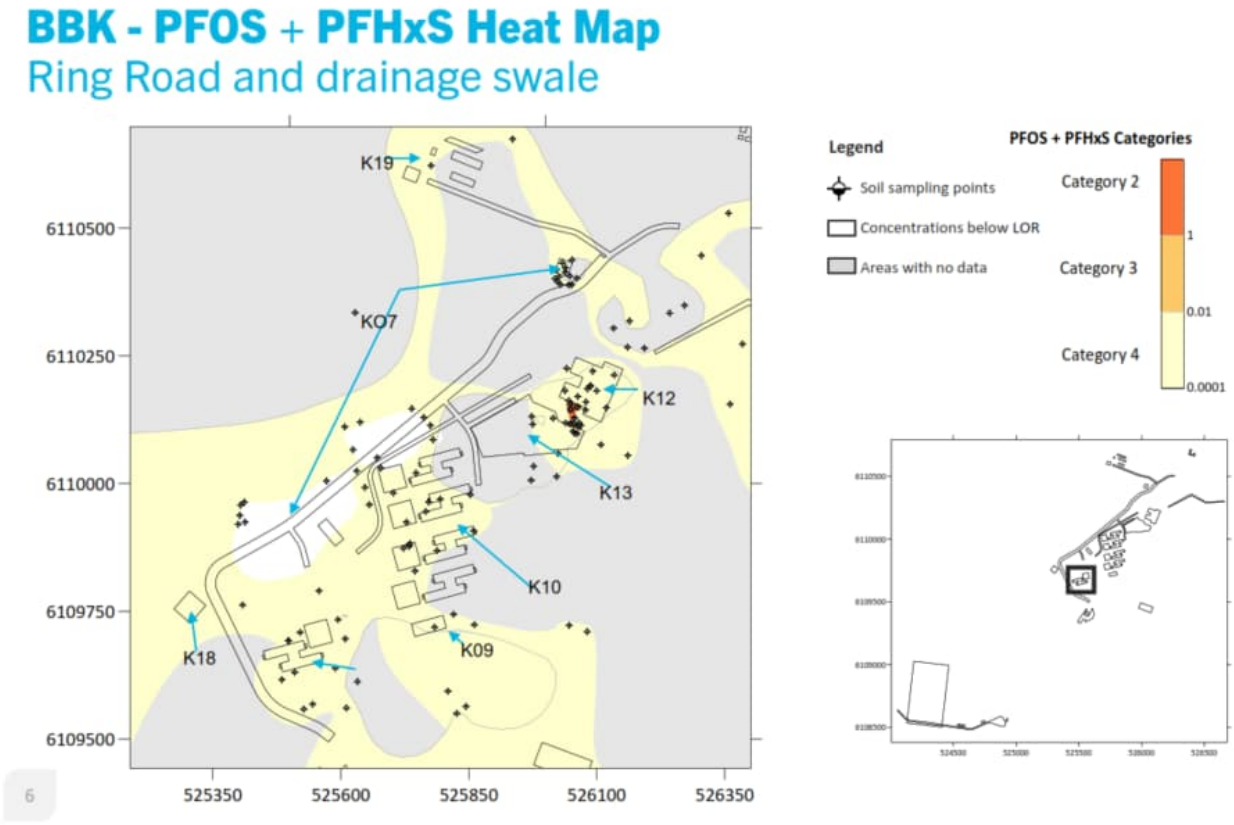

Figure 11.2 PFAS heat map -Known PFAS contamination on Ring Road and Drainage swales locations

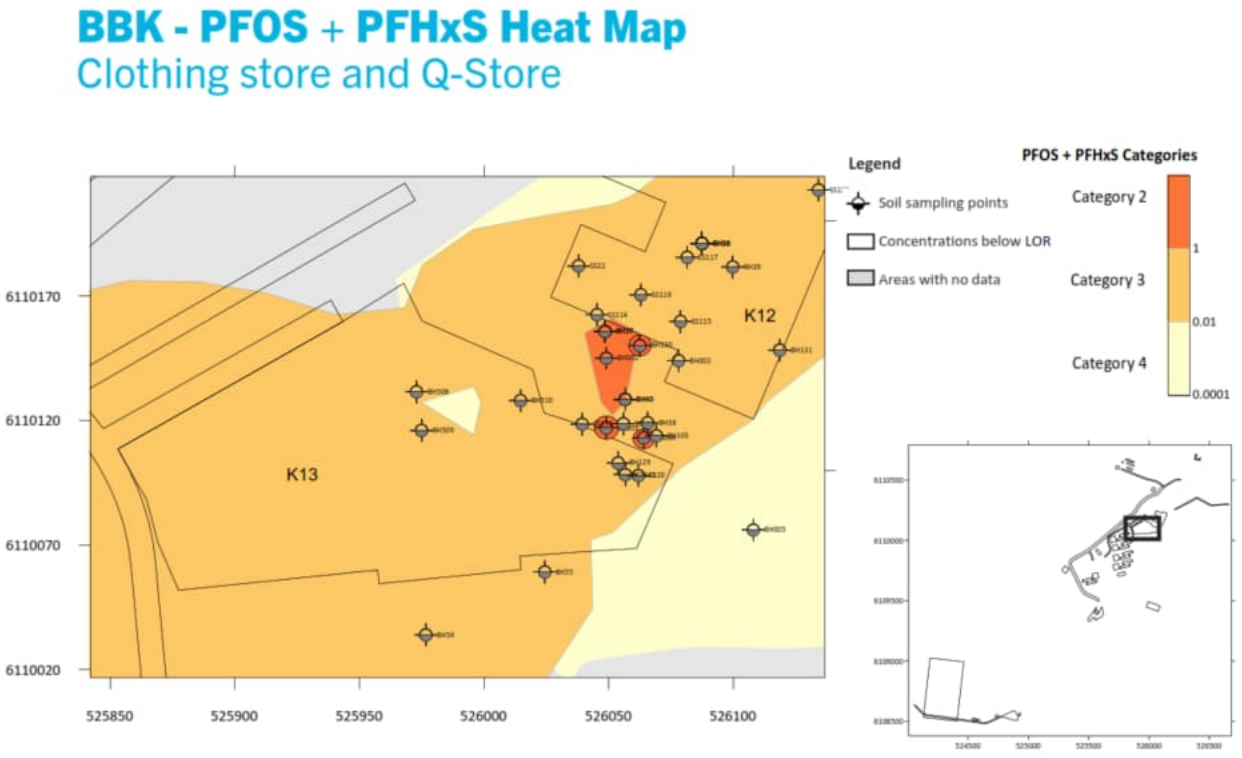

Figure 11.3 PFAS Heat Maps known PFAS contamination at the old clothing and Q store location (new Recruit Welfare Facility location (K12)

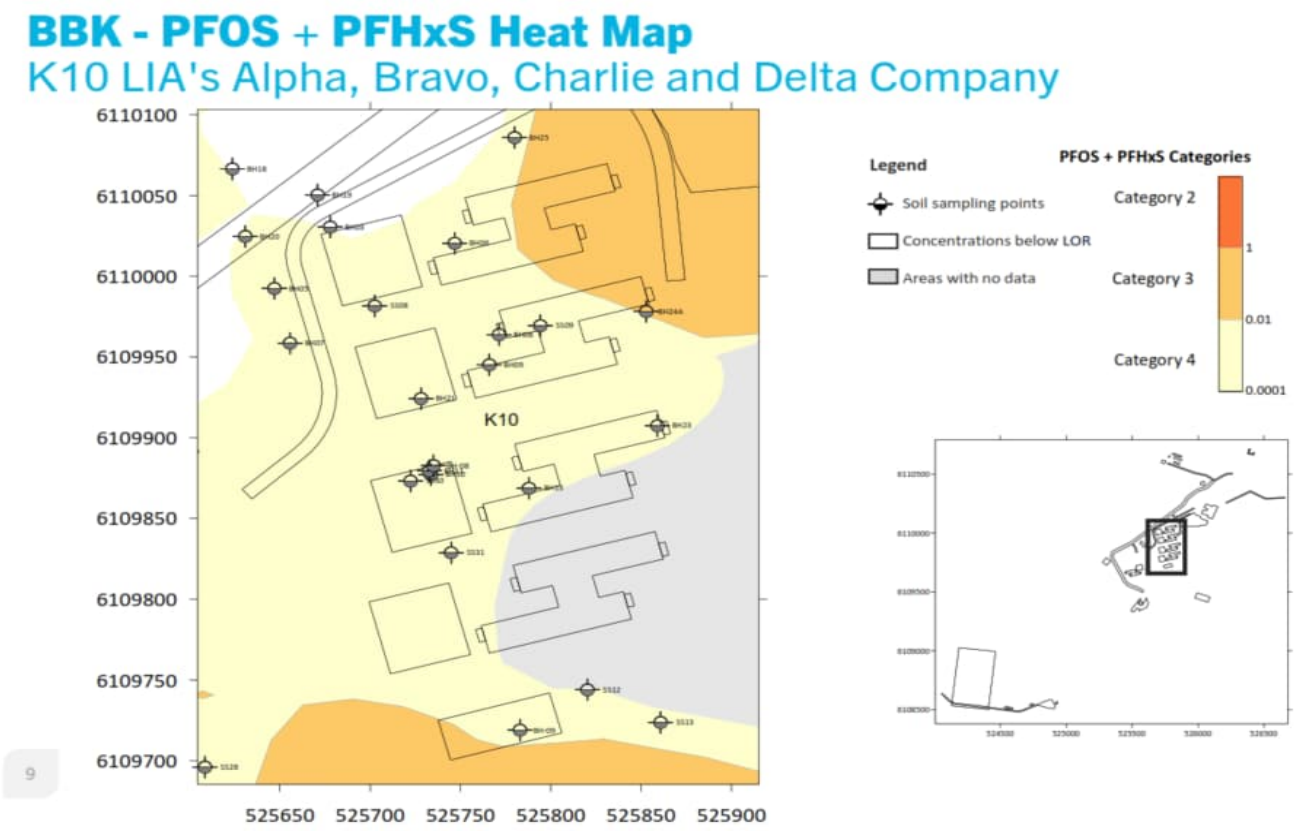

Figure 11.4 PFAS heat maps known PFAS contamination at the new LIA Locations (ABCD)

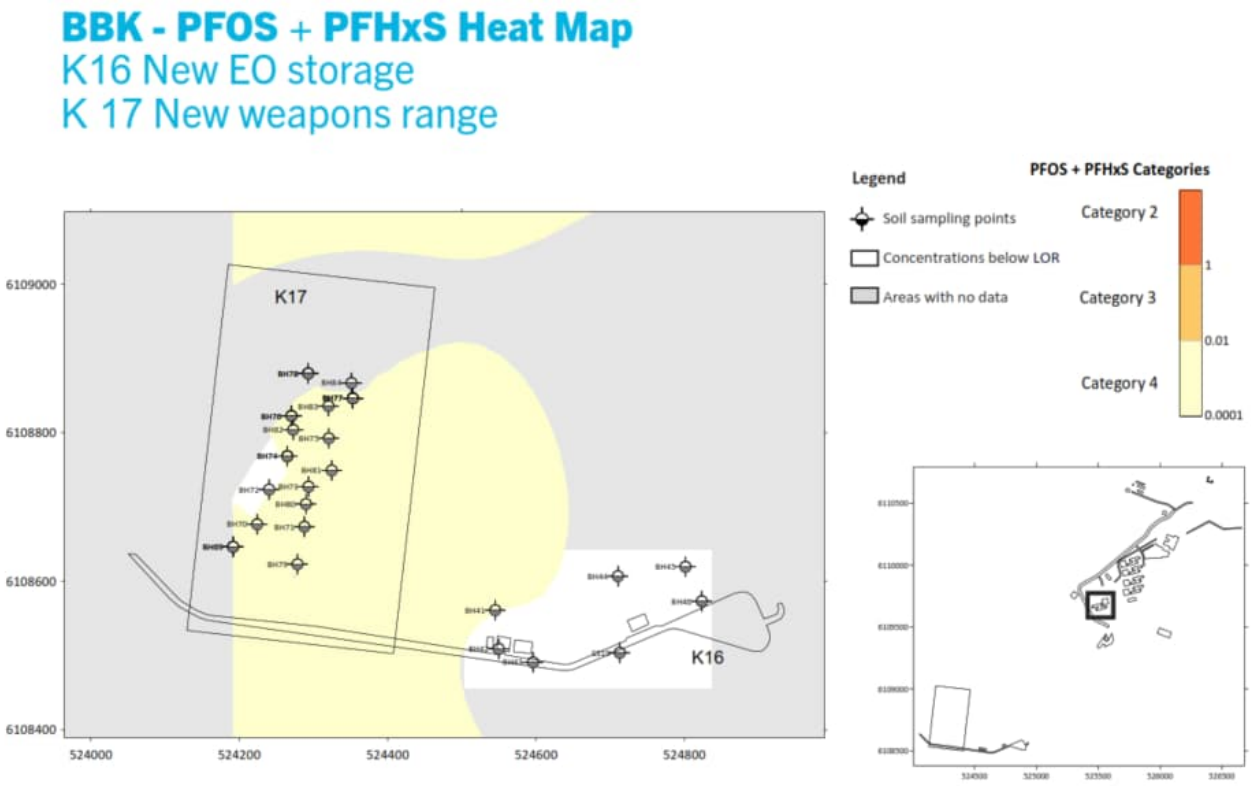

Figure 11.5 PFAS Heat Maps known PFAS contamination at the EO Storage and the Weapons Training Area

12 PFAS management controls

Controls to manage PFAS contamination in soil and water aims to reduce PFAS contamination risk to the lowest acceptable rating achievable, and these controls will be implemented before any relevant works commence. Elimination of the hazard is the first preference of control, followed by engineering, then administrative controls. Typical controls to manage PFAS on this Project are shown in Table 12.1.

Table 12.1 Controls used to manage PFAS

Ref.	Control	Accountability
P01	Ensure all PFAS Soil and Water risks are considered as part of the development of CAPs. Collation of Test report information, in the form of an analysis certificate from a NATA accredited laboratory or an equivalent international laboratory will be provided to PMCA as a condition precedent to completion. Review Risk Assessments provide ECC if required.	Construction Manager Project Environmental Resource Project Engineer
P02	**PFAS Site Assessment** Review the known PFAS contamination data, including contamination assessments, Heat maps and Preliminary Site Investigation (PSI) Detailed Site Investigation (DSI) and Preconstruction Site Assessments (PCA) assessments. Under the CMF the Human health investigation level for direct soil contact for public open space (HIL C), PFAS NEMP 3.0 has been adopted as the lower concentration range for Category 2 soils. If Category 2 soils are disturbed the risk associated with exceedances of HIL C will be documented in an RAP. Review PFAS Management Area Plan[3] For all individual excavations - Complete NEMP Decision Tree Preliminary, PFAS Risk Assessment (refer Appendix A) and apply the management principles of CMF. Include Leaching of PFAS from soils as part of an assessment to consider if the soil reuse presents a potential unacceptable risk. (applicable for all Category levels as part of risk assessment). Determine if ECC is required Review contamination Category of PFAS (Appendix A) Aim for Acceptable scenarios where soil reuse does not add to or increase the concentration, load or flux, or lead to an unacceptable environmental risk.	Construction Manager Project Environmental Resource Project Engineer
P03	**PFAS Testing** All samples to be tested by NATA Accredited Laboratory using methods based on NEPM. Laboratory suite for PFAS analysis in accordance with CMF Appendix D. Review BBK PMAP to determine preferred management option.	Project Environmental Resource

3 https://www.defence.gov.au/Environment/PFAS/docs/Kapooka/Reports/202106BlameyBarracksKapookaManagementAreaPlan

Ref.	Control	Accountability
	Review[4] Defence PFAS Construction Management Framework	
P04	For health management of the effects of PFAS, the RRJV's occupational health and hygiene system will be implemented. Elimination of the risks to a worker's health and safety must be sought in the first instance. Ensuring hands and face are washed prior to eating, even if gloves are worn Use disposal coveralls where risk of contaminating clothing exists. Use of water-proof disposable nitrile gloves (either instead of or in conjunction with other gloves). Use of P2 dust masks associated with use of a water truck that is spraying water drawn from areas where the triggers are exceeded. Wet clothing is changed immediately post work activities. If masks become wet, these should be removed and changed for dry mask immediately. If skin contact with contaminated water above the trigger level is unavoidable, ensure sleeves are rolled down and wet clothing is changed immediately post-work activities. Refer to: RRJV WHS Plan (RRP-GLO-GLO-RRJV-PRM-PLN-3000)	Construction Manager Project Environmental Resource Project Engineer
P05	**Site investigation - PFAS Sludge Slurry- dewatering** ***NDD or Hydrovac process may mobilise PFAS in slurry.*** For NDD works conducted within the WE footprint the slurry waste will be managed based on the following risk ranking: **a** Low risk – NDD using potable water in Category 4 area **b** Medium risk – NDD using potable water in Category 3 area **c** High Risk – Insufficient data or area identified as Category 2 during further investigation. **Contain all slurry and dewater** Slurry assigned as medium or high risk will be stored within the designated stockpile areas on an impervious surface with adequate bunding to contain slurry and seepage water. For slurry assigned as low risk, a bunded temporary infiltration holding area will be established within the golf course area (east of Trent Street). The holding area is identified on the heat maps as Category 4 and is located away from the perennial, ephemeral and intermittent drainage lines identified in the PMAP. Following initial settlement of the water component the material will be transferred to one of the designated stockpile areas. Store in covered waste skips / drying beds to allow for evaporation of PFAS contaminated water. Test residual spoil to determine reuse options.	Construction Manager Project Environmental Resource Project Engineer Site Supervisor

4 https://www.defence.gov.au/business-industry/industry-governance/defence-pfas-construction-maintenance-framework

Ref.	Control	Accountability
	Do not use contaminated PFAS water in construction, i.e., dust suppression and concrete batching. Seek approval from Base Management and ESM for suitable reuse locations.	
P06	**Construction and Demolition Waste Management** Review the known PFAS contamination data, including contamination assessments, heat maps and PSI DSI assessments. **PMAP** Determine if Building materials have been in direct contact with PFAS concentrate via the application of PFAS containing foams. Conduct risk assessment to determine risk on below: — Operating structures in trade waste treatment plants — Or sewage treatment plants — Tanks pipes — Porous building materials — Fire training sites - Mockups — Vegetation immediately adjacent to training area — Concrete asphalt pavement used for training. — Incident response locations where PFAS containing foam was used. Swab testing can be used according to instructions from the laboratory to indicate surface contamination that may indicate cleaning is needed prior to disposal, or disposal as hazardous waste. Generally, green waste/mulch derived from construction and maintenance activities (e.g., grass, leaves, tree pruning's) does not require PFAS analysis or management if it is to be reused on base. While not a preferred option, if green waste/mulch is to be sent offsite for disposal or reuse, it must be tested and managed in accordance with specific state/territory and facility requirements. Vegetation that is to be removed from a source area (CSR) or any drainage line down gradient of a source area may require testing and management. In these circumstances, contact PFASIMB to discuss requirements.	Construction Manager Project Environmental Resource Project Engineer
P07	**Disposal Construction & Demolition** Waste to be disposed to a commercial landfill, must be classified in accordance with standard practice and the waste regulations for EPA NSW. Vegetation from non-primary contamination sites – remove roots prior to disposal. Consider project waste reuse option target of 80%. Determine if Toxicity Characteristics Leaching Procedure (TCLP), Australian Standard Leaching Procedure (ASLP) or Total Oxidizable Precursor Assay (TOPA) assessment is required. Landfill must be licensed to accept PFAS contaminated material.	Construction Manager Project Environmental Resource Project Engineer

Ref.	Control	Accountability
	Waste Transfer certificates will be completed and included in the project Waste Tracking Monitoring Register.	
P08	**Reuse of construction & Demolition waste** Review Soil categorisation reports – Review Heat Maps known contamination testing, DSP And PSI assessments and PMAP to determine contamination category. Complete Risk assessment- NEMP decision tree Preliminary, PFAS Risk Assessment (refer Appendix A) and apply the management principles of CMF to determine no increased or unacceptable risk to human health or receptors. Any reuse on base must be for a purpose and agreed following consultation with the base ADES/ESM and other relevant stakeholders. Determine if reuse options comply with NSW EPA requirements. Reuse should not increase the level of environmental risk posed by PFAS impacted materials in their current pre work state. Source approval from ESM advise PFASIMB.	Construction Manager Project Environmental Resource Project Engineer
P09	**Soil Reuse.** Reuse is only where there is an existing need for soil on same site for landscaping, construction works, roadworks, etc. Putting contaminated soil in a location without such existing need, is considered to be waste disposal. Refer to: PFAS National Environmental Management Plan (NEMP 3.0) and CMF.	Environment Manager
P10	**Soil Reuse- assessment to include** Review Soil categorisation reports. Review Heat Maps known contamination testing, DSP PSI PCA and PMAP. Assessments to determine contamination category in accordance with CMF. Any reuse on base must be for a beneficial purpose and agreed following consultation with the base ADES / ESM and other relevant stakeholders. Confirm the volume of soil available to be reused cannot be utilised on the original works site. Determine if the reuse option is considered to be beneficial to the project. If the engineering properties of the spoil, make it unsuitable for reuse on the works site. Reuse on the receiving site will achieve a better environmental outcome. Reuse must not be proposed in areas where there are likely exposure pathways to potentially sensitive receptors i.e., drainage lines / wetlands. i.e.– ‘high-sensitivity’ locations will be subject to an assessment of environmental risk, including the potential for bioaccumulation of PFAS in the receiving environment. Source approval by Defence ESM and PFASIMB.	Construction Manager Project Environmental Resource Project Engineer

Ref.	Control	Accountability
P11	**Reuse option (Small Volume less 10 m3)** Review Soil categorisation reports – Review Heat Maps known contamination testing, DSP PSI PCA and PMAP assessments to determine contamination category. Determine Total volume of soil being managed for the project/works is less than 10 m3. This will usually be appropriate and acceptable to reinstate the soil at the work site without testing. Small tasks footpath repairs / installation of signage. Do not apply to known PFAS contaminated sites. Seek advice from ESM.	Construction Manager Project Environmental Resource Project Engineer
P12	**Soil Reuse options (Large volume greater 10 m3)** Determine soil / spoil volume for removal. Review Soil categorisation reports – Review Heat Maps known contamination testing, DSP PSI PCA and PMAP assessments to determine contamination category. Complete a risk assessment- NEMP Decision Tree Preliminary PFAS Risk Assessment (refer Appendix A) and apply the management principles of CMF to determine no increased or unacceptable risk to human health or receptors. Consult PFASIMB during assessment of reuse options and design and advice. Source approval from ESM and endorsement from the PFASIMB. Validation of earthworks must occur at HOTO for each work element – including specification layering, capping, compaction and any other specifications. Reuse will not be proposed in areas where there are likely exposure pathways to potentially sensitive receptors i.e., drainage lines / wetlands.	Construction Manager Project Environmental Resource Project Engineer
P13	**Dilution-mixing PFAS contaminated soils** Dilution of PFAS contaminated soil must not be used in the management strategy for creation of suitable reuse material. Preventing an increase in the total mass, or ‘load’ of PFAS being added to the receiving environment becomes cumulative increasing the overall Category.	Construction Manager Project Environmental Resource Project Engineer
P14	**Offsite source of soil reuse** Prevent an increase in the total mass, or ‘load’ of PFAS being added to the receiving environment which will increase the overall Category. Review Soil categorisation reports – Review Heat Maps known contamination testing, DSP PSI and PMAP assessments to determine contamination category. Material must be VENM/ENM certified. Reuse of spoil only if the volume of soil available cannot be utilised on the works site. Only if reuse is considered to be beneficial to the site.	Construction Manager Project Environmental Resource Project Engineer

Ref.	Control	Accountability
	If the engineering properties of the soil, make it unsuitable for reuse on the current works site. Reuse on the receiving site will achieve a better environmental outcome.	
P15	**Temporary Stockpiles (see EMP)** Review Soil categorisation reports – Review Heat Maps known contamination testing, DSP PSI PCA and PMAP assessments to determine contamination category. Complete Risk assessment- NEMP decision tree Preliminary, PFAS Risk Assessment (refer Appendix A) and apply the management principles of CMF to determine no increased or unacceptable risk to human health or receptors. Review BBK PMAP to determine preferred management option. Soils with PFOS + PFHxS of 20 mg/kg or more must be excavated and treated or temporarily stockpiled for later treatment with Defence approved stabilisation materials. The design of the stockpile cell must be impermeable and prevent leaching. PFAS Contaminated material will not be stockpiled in areas that have previously been identified as clean. All Stockpiles are to be removed within 2 years. No stockpiling will occur without a detailed sampling program to assesses: Quality of the source material and the Quality of the soil in areas within the footprint of stockpiles. Stockpiles source locations and testing will be tracked to prevent spreading PFAS across the site. Reference -DCCM Annex C. Review BBK EMP.	Construction Manager Project Environmental Resource Project Engineer
P16	**Tracking Reuse soil stockpiles on base** Contractor must provide soil movement tracking data to locations & volumes and testing results monthly. Any stockpile locations on bse must be for a beneficial purpose and agreed following consultation with the base ADES / ESM and other relevant stakeholders. Data be uploaded monthly into RRJV Soil Reuse Register. The location of the reuse site and management information is to be entered into GEMS by the project at handover/takeover of the project. This could be as an amendment to the CSR through the data load tool. The provision of a spatial data layer with the geographic extent of the reuse area attached to the site information will be used by Defence to inform future planning. Confirm with ESM this procedure via ECC and advise PFASIMB. Notify DCARM to update ESdat.	Construction Manager Project Environmental Resource

Ref.	Control	Accountability
P17	**PFAS Contamination Surface Water Management** Review Soil categorisation reports – Review Heat Maps known contamination testing, DSP PSI and PMAP assessments to determine contamination category. Conduct PFAS Risk Assessment (Appendix A) to determine the bioaccumulation risk in the receiving environment Conduct PFAS Risk Assessment to determine the bioaccumulation risk in the receiving environment, and any further testing requirements. If exceedances are identified the water will be stored in enclosed containers until offsite disposal and treatment occurs at a licenced facility in accordance with the Unexpected Finds Protocol, as outlined in the EMP (Appendix H). Calculate the measurable difference in the receiving environment – Surface/ground water soils and biota. Seek Approval from ESM. Seek advice from PFASIMB. Offsite disposal will occur following storage in enclosed containers compliance with receiving facility license requirements. Review NSW EPA permits transport interstate if required.	Construction Manager Project Environmental Resource Project Engineer
P18	**Diversion –Storm water** Divert storm water around site excavation Complete Dewatering Permit. Align with current storm water systems on base. Identify locations in SEPs for each work element. Dewatering plan to include testing and treatment for PFAS levels prior to discharge. Monitor rain events to prevent overland flows- check infrastructure to ensure intact. Confirm ESM approval and endorsement from the PFASIMB. Refer Sub Plan 7 Soil and Water.	Construction Manager Project Environmental Resource Project Engineer
P19	**PFAS mobilisation impacts on Ground Water.** Review Soil categorisation reports – Review Heat Maps known contamination testing, DSP PSI PCA and PMAP assessments to determine contamination category. Complete Risk assessment- NEMP 3.0 decision tree, Preliminary PFAS Risk Assessment (refer Appendix A) and apply the management principles of NEMP 3.0 to determine there will be no increased or unacceptable risk to human health or receptors. Contingency measures in the event that a shallow, perched groundwater aquifer is encountered. Stop Work – Notify Defence ESM / BM- engage specialist to advise best practice management options.	Construction Manager Project Environmental Resource Project Engineer

Ref.	Control	Accountability
	Monitor site drainage / Hydrology systems – include assessments of groundwater flow. Monitor the height of the water table on site. Do not use PFAS contaminated soil (reuse) as fill or burial within 2.0 m of the seasonal maximum ground water level.	
P20	**Minimise mobilisation in PFAS in groundwater.** Use specialist equipment such as continuous flight auger (CFA) piles which are vibration free and cast in place with a single continuous hollow stemmed auger. Concrete is pumped through the hollow stem absorbing the groundwater. The rectification of damaged pits as part of the redevelopment will reduce the ingress of potentially PFAS contaminated water entering the Stormwater and Sewer systems. Explore reusing and relining existing stormwater and sewer lines where possible instead of replacing excavation is reduced, while providing a new structurally lined pipe works.	Construction Manager Project Environmental Resource Project Engineer
P21	**Identify Data Gaps -Additional PFAS assessments may be required.** Site assessment and PFAS risk assessment will be completed. Additional site testing if required. Liaise with ESM and PFASIMB.	Construction Manager Project Environmental Resource
P22	**Data collation and Reporting to DCARM PFASIMB** Update data GEMS ESdat. Designated RRJV Construction Administrator to upload all environmental data from each work element phase. Confirm at completion HOTO.	Construction Manager Project Environmental Resource
P23	**Contractor Stakeholder Community Engagement Strategy (CSCES)** To be developed prior to construction. Refer to section 5.1 of BBK EMP.	Contractor's Representative Project Environmental Resource
P24	**Close out of this PFAS Management Sub-Plan** Within 20 business days after the completion of the works, RRJV to confirm that all data has been submitted to DCARM PFASIMB to allow future updates of the BBK PMAP.	Project Environmental Resource (or delegate)

13 PFAS Specific Monitoring

The PFAS monitoring will include:

- Data collection.
- Review of the conceptual site model, to characterise the nature of PFAS that may be present.
- Map the distribution and spatial extent of PFAS in the area of interest.
- Characterise likely temporal variations associated with environmental patterns, including seasonal and intermittent weather variations.
- Inform the development of a catchment model or conceptual site model identifying transport, fate and exposure pathways.
- Enable comparison against all relevant screening criteria.
- Characterise the extent of any adverse impacts on the environment or human health.
- Establish an inventory/working group team to include the PFASIMB, PMAP and Defence ADES / ESM to review and assess reports, current modelling and reporting.

Establish baseline sample monitoring that will be undertaken at stormwater assets to determine surface water quality.

During the construction phase, monitoring for PFAS contamination in groundwater and spoil will be undertaken in accordance with the Materials Management Procedure (MMP) (RRP-GLO-GLO-RRJV-CON-PLN-0001) and the Dewatering Plan (RRP-GLO-GLO-RRJV-ENV-PLN-0001)

Ongoing monitoring of these sampling points will continue throughout the Project duration.

Monitoring Plans will comply with the requirements for Project reuse and discharge criteria of the PFAS NEMP 3.0 and the Defence CMF and may include recommendations made by the Contamination and Erosion Sediment Control Consultant.

During construction monitoring for PFAS contamination, in ground water and spoil, will be undertaken in accordance with the EMP. Monitoring will comply with the project requirements reuse and discharge criteria of PFAS NEMP 3.0 and the CMF as well as any recommendations made by the Contamination Consultant.

Where monitoring determines non-compliance to be a risk or to have occurred, an incident report and corrective actions are raised in Synergy.

Monitoring and analysis of data will be carried out by a competent person. Evidence of competence will be retained.

It is the accountability of the Project Environmental Resource to ensure all monitoring is performed according to these requirements.

Where remediation of areas of elevated PFAS contamination can be efficiently implemented as part of infrastructure works, the planning and development of any remediation options should be undertaken in consultation with PFASIMB. Details of PFAS monitoring are provided in Table 13.1.

Table 13.1 BBK PFAS monitoring

Parameter	Type	Frequency
Nature of the source and potential contribution from precursors to risk (qualitative assessment) I.E Determine PFAS contamination risk level prior to commencing soil disturbance Site Risk assessment	Risk Assessment prior to commencing works As per NEMP 3.0 Decision Tree	Prior to commencing each work element
Determine mass load and flux of PFAS to, within and from the site I.E Baseline Water sampling Ground and Stormwater Assets to be conducted prior to works commencing	Section 7.5 of Schedule B2 (Guideline on Site Characterisation) of the ASC NEPM, the PFAS-specific sampling and analysis guidance in the PFAS NEMP 3.0, and any requirements of the relevant regulator	Prior to commencing each work element
Stockpile management- Testing for PFAS including leachates at Temporary stockpile locations from Category 1 2 3 & 4 Locations in high-risk area	Section 7.5 of Schedule B2 (Guideline on Site Characterisation) of the ASC NEPM, and any requirements of the relevant regulator	Additional stockpiles Prior to Reuse of high-risk material (Cat 2-3)
Review Adsorption onto, and leaching from, sediments Ie Leachate Management- near water ways drainage lines Identify Direct or indirect contamination risk Compliance with Ecological guideline values Erosion Sediment Basins	Section 7.5 of Schedule B2 (Guideline on Site Characterisation) of the ASC NEPM, the PFAS-specific sampling and analysis guidance in the PFAS NEMP 3.0 Section Chapter 7, and any requirements of the relevant regulator	6 monthly.
Groundwater discharge / leaching to surface water i.e. Monitor volume of leachate / Surface water runoff / groundwater / surface water storage areas Monitor following large rain events. Prepare dewatering plan if over 80% capacity	Section 7.5 of Schedule B2 (Guideline on Site Characterisation) of the ASC NEPM, the PFAS-specific sampling and analysis guidance in the PFAS NEMP 3.0 Section Chapter 7, and any requirements of the relevant regulator	As required
Bioaccumulation and biomagnification in the food chain Compliance with Ecological guideline values for soil, Surface water and Groundwater Wastewater discharge with potential for accumulation in biosolids and discharge in the treated effluent from dewatering process	Section 7.5 of Schedule B2 (Guideline on Site Characterisation) of the ASC NEPM, the PFAS-specific sampling and analysis guidance in the PFAS NEMP 3.0 Section Chapter 7, and any requirements of the relevant regulator	Prior to initiating the Dewatering permit.

Parameter	Type	Frequency
Reuse of construction water runoff, including recycled water		
Drying Beds, from Non Destructive digging Ensure material has evaporated Monitor residual spoil to determine reuse	Section 7.5 of Schedule B2 (Guideline on Site Characterisation) of the ASC NEPM, the PFAS-specific sampling and analysis guidance in the PFAS NEMP 3.0 Section Chapter 7, and any requirements of the relevant regulator	As required
Review PFAS Area Map monitoring data, including Bore monitoring to determine impacts from site disturbance	Section 7.5 of Schedule B2 (Guideline on Site Characterisation) of the ASC NEPM, the PFAS-specific sampling and analysis guidance in the PFAS NEMP 3.0 Section Chapter 7, and any requirements of the relevant regulator	s required
Offsite disposal to landfill including demolition waste at risk of PFAS contamination. All materials need to be sampled and classified as per NSW EPA Waste Classification Guidelines	NATA accredited sampling protocol NEMP 3.0 Chapter 7 Section 14.6 of PFAS NEMP. Waste transfer Certificates NSW EPA	As required

14 Plan of monitoring

A location plan for monitoring will be provided at staged intervals in the CAP for each Work Element.

15 Limitations

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Appendix A

Preliminary PFAS risk assessment

Riverina Redevelopment Program

Preliminary PFAS Risk Assessment

Project(s): EST02025 Blamey Barracks Kapooka Redevelopment

Document issue:	90% DDR Final Issue	1 Dec 2023
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Riverina Redevelopment Joint Venture

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Rev	Date	Description	Changes since last revision	Prepared by	Checked by	Approved by
1	02/11/2023	Draft 90% DDR Submission (to PMCA)	-	EMM	Sue Mahon	Katie Malvaso
2	01/12/2023	90% DDR Final Issue	Minor edits. Updated Heat maps	EMM	Sue Mahon	Katie Malvaso

Contents

Acronyms and Abbreviations

Reference	Definition
ADF	Australian Defence Force
ASC NEPM	National Environment Protection (Assessment of Contamination) Measure 1999
AWMA	Albury Wodonga Military Area
BBK	Blamey Barracks Kapooka
CDR	Concept Design Report
CoPC	Contaminant of potential concern
EMM	EMM Consulting Pty Limited
EO	Explosive Ordnance
HEPA	Heads of EPAs Australia and New Zealand
LEP	Local Environment Plan
MPFR	Master Plan Feasibility Review
PCA	Pre-construction Contamination Assessment
PFAS	Per- and polyfluoroalkyl substances
RBW	RAAF Base Wagga
RRJV	Riverina Redevelopment Joint Venture
RRP	Riverina Redevelopment Project
SSB	Defence Site Selection Board
UCL	Upper confidence limit
WE	Work element

A. Introduction

A.1 Background

1. The Riverina Redevelopment Joint Venture (RRJV) was formed by CPB Contractors and Downer to undertake the Riverina Redevelopment Project (RRP) at three Defence establishments:
   a East and South Bandiana within the Albury Wodonga Military Area (AWMA)
   b Blamey Barracks Kapooka (BBK)
   c RAAF Base Wagga (RBW).
2. The scope of the Riverina Redevelopment Project (RRP) comprises major upgrades and/or replacement of existing infrastructure and facilities at each of these sites. EMM Consulting Pty Limited (EMM) was engaged by RRJV to provide a range of services in support of the RRP, including contamination.
3. A Pre-construction Contamination Assessment (PCA) was prepared to present the outcomes of site investigations conducted during 30% Concept Design Review (CDR) within the preferred siting options selected following the Site Selection Board (SSB) workshop.
4. Site investigations were initially divided into two stages:
   a Stage 1A: contamination sampling co-located with geotechnical investigations to provide a preliminary assessment of the contamination status of the various building siting areas.
   b Stage 1B: main contamination investigation addressing building siting areas, supplementing data generated during Stage 1A investigations to address data gaps identified during the desktop contamination review, specifically gaps related to siting options presented in the RRJV 5% Master Plan and Feasibility Review (MPFR).
5. The third stage of contamination investigation (Stage 1C) for each Defence property is yet to be completed but will fill data gaps that were identified following completion of the Stage 1B assessment (EMM 2023). The primary objectives of the proposed Stage 3 investigations will be to:
   a refine the understanding and assessment of contamination risk at proposed services alignments and new work elements added since the Stage 1B investigation presented in the 30% CDR, utilising both existing data and data generated by the site investigation program
   b address data gaps identified in the Stage 1A and 1B investigations reported in the 30% CDR.
6. The proposed Stage 1C contamination investigation has not been undertaken at this stage and the data gaps identified in Stage 1A and Stage 1B remain. Consequently, this preliminary assessment of per- and polyfluoroalkyl substances (PFAS) risk associated with the proposed reuse of construction spoil at BBK has been based on the existing available data set. Additional data obtained as part of future contamination investigations would assist in refining this preliminary assessment.

A.2 PFAS at BBK

7. Previous studies identified PFAS source areas at BBK, with those of highest level of impact at the Fire Station, fire training areas, buried waste areas south of the Wastewater Treatment Plant (WTP) and the fire training pad. Those areas are on the eastern side of BBK where surface water runoff feeds into Kapooka Creek. Leachability testing of soil indicated potential for discharge of PFAS to surface water and groundwater from those areas (Jacobs 2019).
8. Potential risks identified by Jacobs (2019) included:
   a Human health risks to construction and maintenance workers from direct contact with soil or perched water in impacted source zones.
   b Human health risks to off Base residents from consumption of home grown produce irrigated with impacted surface water from and near to Kapooka Creek. Preliminary precautionary advice was provided by NSW government agencies to individual properties.
   c Human health risks for recreational fishers due to consumption of fish and yabbies from Kapooka Creek, Sandy Creek and the Murrumbidgee River.
   d Direct and indirect exposure of ecological receptors to impacted surface water, sediment and soil.
   e Exposure of terrestrial groundwater dependant ecosystems to PFAS impacted groundwater and perched water.
9. Potential project risks associated with PFAS contamination at BBK include:
   a Due to their chemical properties and dispersive behaviour in the environment, PFAS compounds may be detected in soil and laterally widespread from primary PFAS sources (e.g. fire training areas). Works such as the proposed redevelopment at BBK can generate large volumes of spoil which may be impacted by low concentrations of PFAS and will require careful management.
   b The presence of PFAS narrows the options for reuse or disposal of such spoil. Beneficial re-use on-site may be permissible subject to siting options, a rigorous risk assessment process in accordance with Defence PFAS guidance and approval by the relevant Defence technical authorities.
   c Options for the management of high PFAS concentrations in spoil (such as disposal, treatment or remediation) are limited and costly.
   d Low concentrations of PFAS could occur in other areas where data gaps exist, and spoil generated during construction will require management (e.g. beneficial reuse on-site).
10. Due to the likelihood of the RRP generating PFAS-contaminated spoil during proposed construction activities at BBK and RRJV's decision to reuse spoil on Base (based on reputational and budget reasons), a Defence-compliant risk assessment is required to determine whether the human health and/or ecological risk from PFAS contamination would be altered as a direct result of the spoil reuse.
11. Table 1 outlines the estimated cut and fill soil volumes associated with each work element.

Table 1: BBK Cut and fill volumes

Area	Work Element Reference	Cut	Fill	Delta	Cut or fill
Medical training	WE 6.4 - Confirm location	1673	879	794	Cut
Northern Ring Road	WE 1.10	4647	27178	-22531	Fill
LIA West		4343	4217	126	Cut
Road between East and West LIA's	WE 1.10	726	217	509	Cut
HQ	WE 3.1/3.2	2698	1010	1688	Cut
LIA carpark 1		949	1198	-249	Fill
LIA carpark 2		663	817	-154	Fill
LIA's A&B (Alpha & Bravo Company)	WE 4.2	24081	9754	14327	Cut
LIA's C&D (Charlie and Delta Company)	WE 4.2	6266	26112	-19846	Fill
LIA carpark 3		182	389	-207	Fill
Clothing Store	WE 2.5	2652	12613	-9961	Fill
Multi Function & nearby roads	WE 2.1	4787	8304	-3517	Fill
WTTS		134	593	-459	Fill
Civil berm 1 Park Drive		101	117	-16	Fill
Civil berm 2 Park Drive		0	105	-105	Fill
Contractors Precinct	WE 2.4	3635	5562	-1927	Fill
Fire tanks		355	84	271	Cut
Land Management	WE 2.7	2	4341	-4339	Fill
Borrow Pit		16466	2031	14435	Cut
Heritage Walk		257	1679	-1422	Fill
Kapooka Drive		0	459	-459	Fill
Fitness Facility	WE 6.1 - Confirm location	1338	2492	-1154	Fill
		0	38	-38	Fill
		0	265	-265	Fill
Range	WE 7.1	25753	72182	-46429	Fill
Range Road	WE 1.10	1111	3244	-2133	Fill
EO		277	58	219	Cut
EO		0	228	-228	Fill
EO		1853	2	1851	Cut
Total		**104949**	**186168**	**-81219**	Fill

Source: RRJV October 2023

A.3 Relevant guidance

12. Reuse of construction spoil aligns with the following policies and guidance documents:

    a National Waste Policy 2018 and associated National Waste Hierarchy.

    b Defence's Environmental Policy, specifically Strategic Aim 1 which states: "*Defence will deliver a sustainable estate across Defence maritime, land and aerospace areas, activities and operations*".

    c The objectives of Defence's Waste and Sustainable Procurement Program which include "improve resource recovery".

    d The design and construction sustainability requirements of the Smart Infrastructure Handbook, which include consideration of "*strategies to minimise materials consumption, minimise demolition waste and avoid stockpiling through staged planning, adaptive reuse of buildings, infrastructure or assets, and reuse of materials*".

13. The management of PFAS contaminated materials on Defence Estate is governed by specific guidance, primarily:

    a Defence PFAS Construction and Maintenance Framework, Guidance for managing the risks of PFAS contamination for works on the Defence estate (Version 3.0, 2021)

    b Defence Contamination Management Manual (March 2018, amended June 2021), Annex C – Planning to Minimise and Manage Stockpiling.

    c PFAS National Environmental Management Plan (Version 2.0, January 2020).

14. A Draft Version 3.0 of the NEMP was released for comment in February 2019 but the finalised version has not been released. Feedback and responses to the Draft NEMP 3.0 are provided in the Ancillary Document to the PFAS National Environmental Management Plan Version 2.0.

15. A PFAS Management Area Plan (PMAP) was developed for BBK in June 2021 "to manage the elevated risks of PFAS contamination on and emanating from Blamey Barracks Kapooka" (Defence 2021).

A.4 Objective

16. The primary objective of a PFAS risk assessment for Defence is to determine whether the beneficial reuse of soil at a specific location affects the existing human health and/or ecological risk at that location. The assessment requires a comparison of PFOS+PFHxS concentrations and the total mass in the soils to be reused (source soils) and the surface soils at the proposed reuse location.

17. PFAS impacted soils on the Defence Estate must be managed in accordance with the Defence PFAS Construction and Maintenance Framework (Version 3.0, 2021). The framework describes beneficial reuse of PFAS contaminated materials as best practice and recommends a need for additional risk assessment depending on the concentration of PFOS+PFHxS in the soils. Soil contamination is defined in the Defence PFAS Construction and Maintenance Framework by four soil categories (Table 2).

18. However, with the existing data gaps that are discussed in the sections below, the specific objective of this document is to present a preliminary evaluation of the existing data to assess PFAS risk on a work element basis and identify additional requirements to prepare a Defence compliant risk assessment when the data become available.

Table 2: Defence PFAS soil contamination categories

Category	Guideline	Risk and management options
Category 4	Excavated soils with PFOS+PFHxS concentrations less than 0.01 mg/kg	**Acceptable risk reuse on site or on base without assessment or mitigation** unless: • a previous site assessment suggests otherwise • soil volumes >1,500 m^3 • reuse is in a high-sensitivity area.
Category 3	Excavated soils with PFOS+PFHxS concentrations less than 1 mg/kg but greater than 0.01 mg/kg[1]	**Moderate risk reuse with assessment and mitigation.** Category 3 soil can be reused within the works site with no additional mitigation procedures or on-base (subject to Base approvals) if the risk to human health or the environment, as determined by a suitably qualified person(s), is not increased or otherwise results in unacceptable risk. Some mitigation may be required if potential pathways exist and there are potential high sensitivity receptors. The overall load of PFAS in the total volume of soil should also be considered when assessing the risk.
Category 2	Excavated soils with PFOS+PFHxS concentrations less than 20 mg/kg but greater than 1 mg/kg[2]	**High risk treat and/or contain** Category 2 soil can be reused within the works site provided that exposure to receptors is minimised. This should consider both direct exposure at the site and the potential for PFAS transport due to leaching. If reuse is not appropriate on the works site, then an assessment of risk should be undertaken by a suitably qualified person(s) to evaluate the following options: off-base disposal to an appropriately licensed landfill, or on-base encapsulation, containment and/or treatment. If treatment is required, this needs to be guided by a RAP.
Category 1	Excavated soils with PFOS+PFHxS concentrations of 20 mg/kg[3] or more	**Unacceptable risk offsite (destroy or landfill) or onsite (options identified through a RAP)** Category 1 soil must be managed to address the risk. Options may include off-base disposal to an appropriately licenced facility or on-site management guided by a RAP. Soil at concentrations >50 mg/kg should be sent for destruction at a licensed facility. DPFASR can provide advice. If the excavated soil is required to be temporarily stockpiled for later treatment, refer to DCMM Annex C

1 Interim soil – ecological indirect exposure for all land uses (PFAS NEMP 3.0)

2 Human health - direct soil contact for public open space (PFAS NEMP 3.0)

3 Human health - direct soil contact for industrial land use (PFAS NEMP 3.0)

B. Site details

B.1 Site setting

19. Blamey Barracks Kapooka (BBK), Property ID 0315, is approximately 5 km east of Wagga Wagga NSW, bordered in the north by the Sturt Highway and in the east and south by the Olympic Highway (Figure 1, Figure 2).

20. BBK is owned by the Commonwealth of Australia and includes the Army Recruit Training Centre (ARTC), which has two training wings:

- 1st Recruit Training Battalion, for regular and reserve Army units
- Army Adventurous Training Wing, for training leaders.

21. Over 5,000 Army recruits (Regular and Reserve) are trained at BBK annually. Recruits are housed at Blamey Barracks which has approximately 220 buildings, including accommodation for 1,800 Defence staff.

B.2 Project redevelopment work elements

22. The RRP scope comprises major upgrades and/or replacement of existing infrastructure and facilities. Specific work elements (WEs) are designated for redevelopment activities at BBK and presented in Figure 3.

B.3 Surrounding land use

23. BBK is surrounded by a mix of land uses and development including:

a Primary production – west and north-west, cleared grassland with farms for cattle and sheep grazing or grain growing.

b Residential – adjacent to north-east boundary, large rural residential properties, rural fire station, sports fields and church. Hobby farms – horses, poultry, fruit, vegetables.

c Residential – 3.6 km east, suburbs of Wagga Wagga; 1.8 km south, Uranquinty.

d Conservation – east, narrow strip of forested areas on ridge.

e Recreation – north-east, Pomingalarna Reserve.

f Quarrying – 1 km east, Hansons Quarry, active; north-west, minor historical quarry.

B.4 Geology

24. The geology underlying the Base consists of Ordovician aged metamorphic and sedimentary rocks that abuts Silurian age granite in the west. Soils on Base are primarily composed of clays with intermixed silt, and some sands and gravel (Jacobs 2019). Colluvial soils are thinner in the north of the Base where the geology is dominated by alluvial deposits associated with the Murrumbidgee River.

B.5 Hydrology

25. Groundwater has been reported at 3.76–7.5 m below ground level in monitoring bores near the water treatment plant (WTP) effluent ponds; although regional groundwater is at much greater depths and the shallow water encountered near the WTP ponds is inferred to be perched due to the influence of the ponds (Jacobs 2019).

26. BBK is within the Murrumbidgee catchment, approximately 1.3 km south-south-east of the Murrumbidgee River, which flows east to west. Flow in the Murrumbidgee River is regulated by Water NSW through water releases from Blowering and Burrinjuck dams.

27. Surface water from the Cantonment area runs overland and/or through open channels to Kapooka Creek, an unlined channel along the eastern boundary of the Base, which transitions into a series of dams and low-lying areas through the residential areas of San Isidore.

28. Areas west of the ridge, including the former quarry and training areas south and south-west on the Base, drain west towards Sandy Creek. All surface water from the Base ultimately flows north via tributaries to the Murrumbidgee River, although most pathways are ephemeral (Jacobs 2019).

B.6 Human health and ecological risk assessment (Jacobs 2021)

29. Investigations conducted in the vicinity of the base by Jacobs (2019) detected concentrations of PFAS compounds in soil, sediment, groundwater and surface water, with potential transport of PFAS from source areas, mainly via surface water run-off, to off-Base areas including Kapooka Creek. Jacobs (2021) subsequently conducted a human health and ecological risk assessment (HHERA) to evaluate potential risks to human health and ecosystems in the off-Base study area.

30. The stated objectives of the HHERA were to:

a Quantitatively assess the potential risks to human health related to exposure to PFAS within the Study Area as identified in the DSI (Jacobs 2019).

b Qualitatively assess the potential for terrestrial and aquatic ecological risks related to exposure to PFAS for receptors within the Study Area as identified in the DSI (Jacobs 2019).

c Assist in guiding the remediation and/or risk management measures that may be considered as part of the PFAS Management Area Plan (PMAP).

31. The HHERA addressed human health and environmental risk issues relevant to PFAS in the investigated environmental media, targeting the identified potential and complete source-pathway-receptor linkages through collection of soil, sediment, surface water, groundwater, terrestrial biota (home-grown fruits, vegetables and poultry eggs for human consumption as well as grass and fodder for livestock feed) and aquatic biota (fish and crustaceans used both for human consumption and preyed on by aquatic feeding birds).

32. The HHERA did not consider potential risks of PFAS in spoil from construction during the RRP.

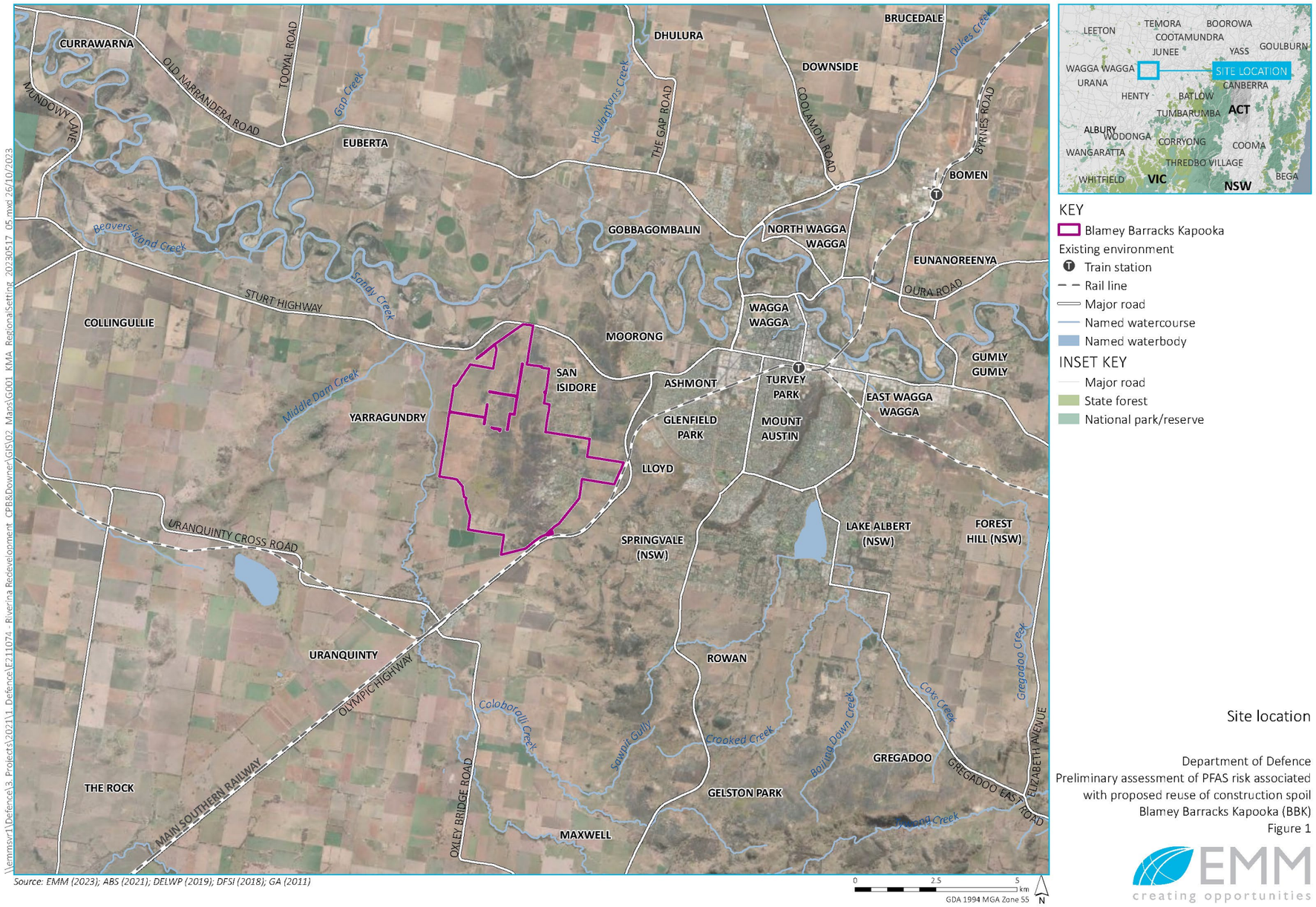

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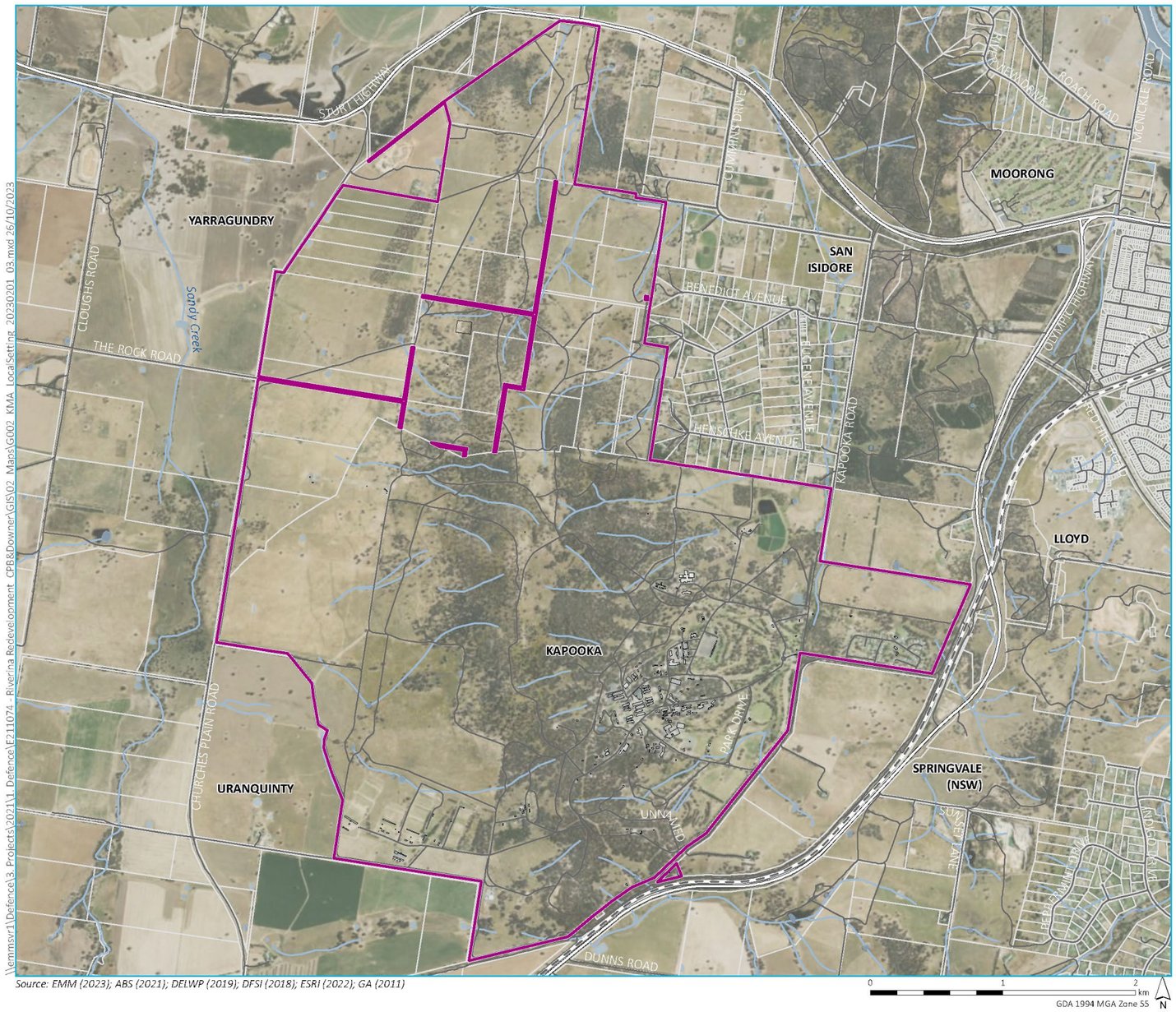
Figure 1: Site location



Site layout

Department of Defence
Preliminary assessment of PFAS risk associated with proposed reuse of construction spoil
Blamey Barracks Kapooka (BBK)
Figure 2

creating opportunities

Figure 2: Site layout

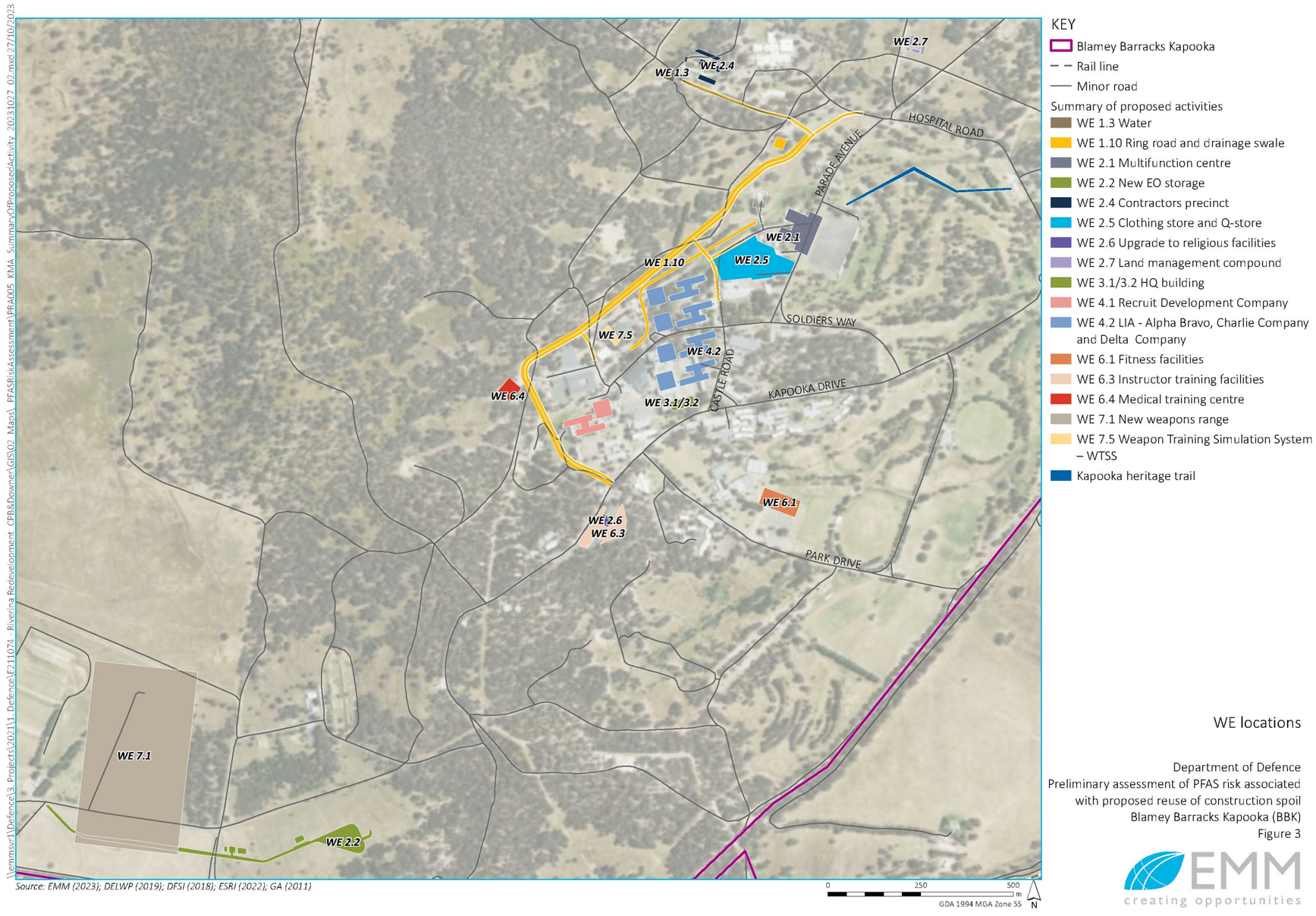


Figure 3: WE locations

C. PFAS risk profile

33. In accordance with the *Defence Construction and Maintenance Framework - Guidance for managing the risks of PFAS contamination for works on the Defence estate* (version 3.0, August 2021), managing the 'off work site, on Base' beneficial reuse of PFAS-contaminated materials must consider the following:

a The concentration and total load of PFAS in the materials, especially where large volumes are involved.

b Whether the additional PFAS load at the proposed site changes the risk at or from the proposed reuse site.

c The characteristics of the reuse site, in particular:

i Pre-existing PFAS impacts at the proposed site.

ii Site drainage: where does surface water flow or accumulate? Where do stormwater channels drain? In which direction does any groundwater flow? How high is the water table?

iii Proximity to the Defence property boundary: What is the risk of any contaminated water, resulting from the reuse, migrating from the Defence site?

d The risks to sensitive receptors, including direct and indirect receptors, which may be on and off-Base.

e Cumulative effects of discharging or irrigating with PFAS contaminated water over time or from multiple projects.

34. Additional risk assessment is required when the volume of soil to be managed exceeds 1,500 m3 and based on the four Defence PFAS-based soil categories which were presented in Table 2. These risk assessments should be completed during the construction phase once soil has been excavated and transported to the stockpile locations (once these have been confirmed).

35. A risk assessment is needed to 'demonstrate that any risks from the additional PFAS load at the receiving location are acceptable' (Defence 2021).

C.1 Source material

C.1.1 Soil quality

36. Construction spoil will be generated from various locations during the redevelopment of BBK, with soil sourced from areas excavated for the foundations of new buildings and where the existing subsurface infrastructure, water, power and sewer, will be upgraded or replaced.

37. Specific work elements (WEs) are designated for redevelopment activities at BBK, with spoil potentially generated during construction activities under each WE. Dividing the source of construction spoil between each WE is deemed appropriate to account for the current level of uncertainty around spoil volumes from different construction areas at BBK. The designated WE groups at BBK are:

a WE 1.3/WE 2.4

b WE 1.10

c WE 2.1

d WE 2.2

e WE 2.5

f WE 2.6/6.3

g WE 2.7

h WE 4.1

i WE 4.2/3.1/3.2

j WE 6.1

k WE 6.4

l WE 7.5

m Kapooka Heritage trail

38. The soil at some of these locations has previously been sampled by consultants during historical investigations between 2017 and 2020 and/or more recently by EMM during the Stage 1A and/or Stage 1B investigations. The historical analytical data considered for this report is presented in Attachment 1. Since soil-based contamination can change over time due to natural processes, there is inherent uncertainty associated with PFAS sample data generated more than a few years ago. For this reason, the data from historical investigations undertaken prior to 2020 have not been used to inform the preliminary risk assessment, and the most recent data generated during the Stage 1A and Stage 1B investigations (2022) are the most relevant.

39. During Stage1A/1B investigations, soils were sampled from 75 boreholes and surface locations at BBK, with a combined total of 180 primary samples analysed for PFOS+PFHxS concentrations, split between the WE as follows, and presented in Figure 3:

a WE 1.10: 34 samples (23 non detects)

b WE 2.1: 22 samples (0 non detects)

c WE 2.2: 12 samples (10 non detects) – too few data points

d WE 2.4: 4 samples (4 non detects) – too few data points

e WE 2.5: 8 samples (1 non detect) – too few data points

f WE 2.6: 9 samples (5 non detects) – too few data points

g WE 3.1 / 3.2: 2 samples (0 non detects) – too few data points

h WE 4.1: 14 samples (4 non detects)

i WE 4.2: 25 samples (6 non detects)

j WE 7.1: 44 samples (28 non detects)

k Kapooka Heritage Trail: 6 samples (0 non detects) – too few data points

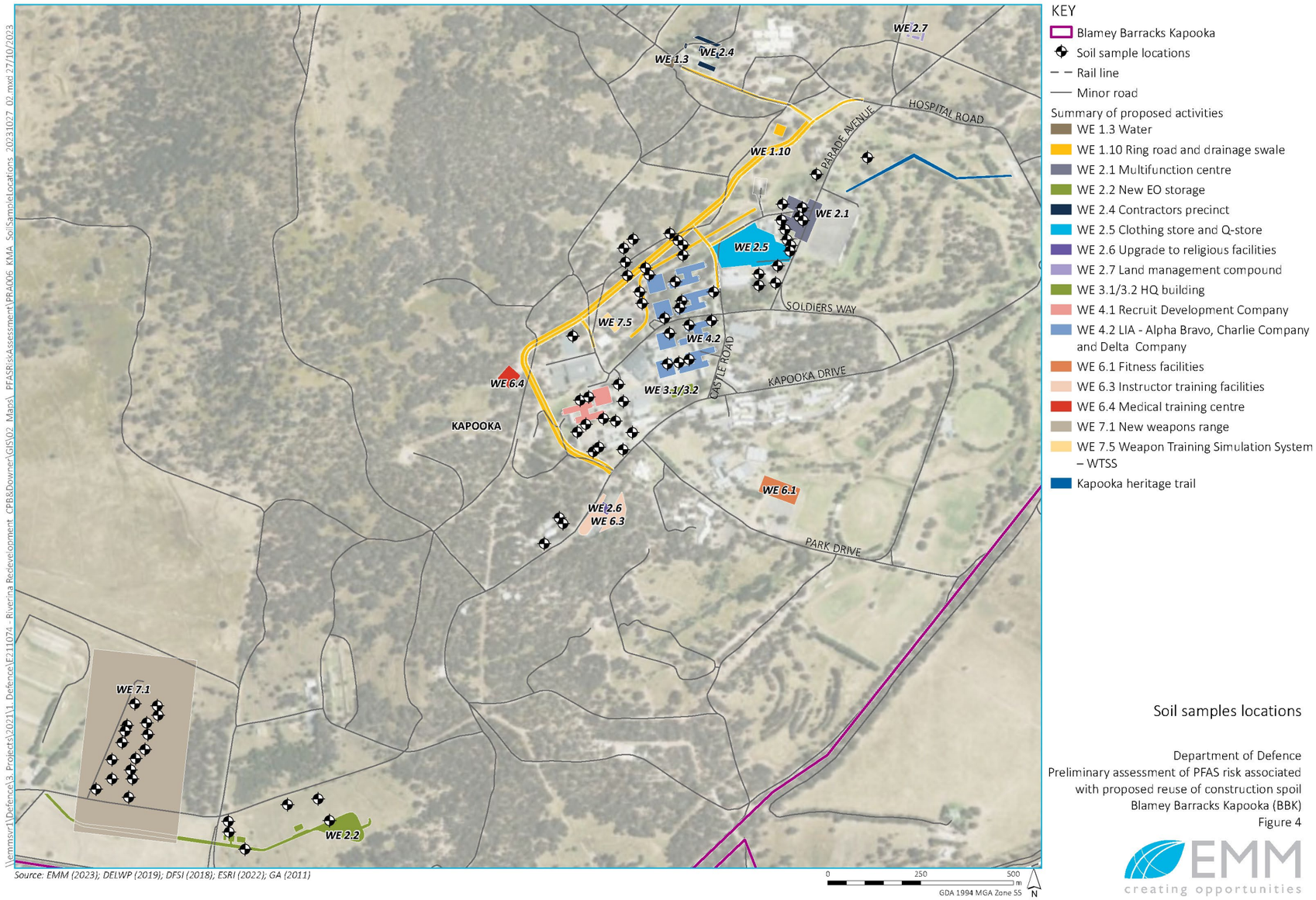


Figure 4: Soil sample locations

40. There were no samples collected since 2020 within the remainder of the WEs, as these WEs were not included on the RRP during the Stage 1A and/or Stage 1B investigation.

41. More than 10 distinct sample data points per group is the minimum required to calculate upper confidence limits (UCLs) within the widely used US EPA's ProUCL software, and more data points provide more accurate UCLs. As indicated above, three of the WE have too few data points to generate a meaningful UCL. The other WE groups have sufficient number of samples to calculate a UCL although there are a high number of non-detects for some WEs which could skew the data outputs. The additional sampling and analysis proposed by EMM for Stage 1C would provide a greater number of data points to calculate meaningful UCLs.

42. In the absence of UCLs, an alternative approach is to use the maximum PFOS+PFHxS concentration reported for each WE group as an indicator of overall PFOS+PFHxS contamination in spoil. This approach provides a conservative concentration based on the worst-case scenario (where the maximum PFOS+PFHxS concentration in each WE is assumed to be representative of the PFOS+PFHxS concentrations within the total volume of spoil generated in each WE area). However, we know that soil contamination data are almost always spatially variable and, in the absence of sufficient sample data to assess the variability by generating strong UCLs, using the maximum PFOS+PFHxS concentration may unknowingly provide an overestimate of the actual PFOS+PFHxS content of the spoil and could lead to a greater level of waste management and/or treatment than is required. Conversely, the maximum PFOS+PFHxS concentration could be an underestimate (if unsampled areas have higher concentrations) and could lead to insufficient management to manage the inherent risk of PFAS concentration in spoil.

43. As an example, the current PFOS+PFHxS concentration data for the WE listed above were used to calculate UCLs (where possible) and maximum concentrations (Table 3). The results for WE 2.1 indicate the benefit of having sufficient sampling data to calculate a robust UCL, whereby the UCL indicates a lower level of PFAS category (3) compared to using the maximum (Category 2). This difference could have major implications for soil management and potential reuse options.

Table 3: Comparison of maximum and upper confidence limit (UCL) PFOS+PFHxS concentrations

WE Group	Number of samples	Maximum PFOS+PFHxS concentration	95% UCL (ProUCL)	Defence PFAS Category
WE 1.10	34	0.0009	0.0006	Category 4 (max) Category 4 (UCL)
WE 2.1	22	1.4	0.524	Category 2 (max) Category 3 (UCL)
WE 2.2	12	0.0001	Insufficient number of samples	Category 4 (max)
WE 2.4	4	All non-detects	Insufficient number of samples	Insufficient number of samples
WE 2.5	8	0.83	Insufficient number of samples	Category 3 (max)
WE 2.6	9	0.39	Insufficient number of samples	Category 3 (max)
WE 3.1 / 3.2	2	0.0013	Insufficient number of samples	Category 4 (max)
WE 4.1	14	0.023	0.0139	Category 3 (max) Category 3 (UCL)
WE 4.2	25	0.0036	0.0015	Category 4 (max) Category 4 (UCL)
WE 7.1	44	0.0059	0.0019	Category 4 (max) Category 4 (UCL)
Kapooka Heritage Trail	6	0.0411	Insufficient number of samples	Category 3 (max)

44. Additionally, the vertical and lateral distribution of sampling and analytical data must reflect the specific construction area footprints where the spoil will be generated, to provide a reasonable estimate of the PFAS concentrations likely to be encountered as part of the redevelopment works. Having sample data from a WE but in areas that will not be excavated is not sufficiently location specific to inform the development of a robust risk assessment.

C.2 Reuse location

45. A critical aspect of a Defence-compliant PFAS risk assessment is understanding the existing PFAS risk at the proposed reuse location(s). Without this knowledge, the assessment of potential change in PFAS risk due to the placement of the spoil cannot be undertaken.

C.2.1 Soil quality

46. The locations proposed for reuse of construction spoil have not been finalised. Soil analysis may have previously been undertaken on samples collected from areas at or close to the reuse locations (once they are decided) and which may provide an initial indication of PFAS risk. However, further sampling and analysis is required to fully characterise the PFOS+PFHxS concentrations at the proposed reuse locations once they are selected.

47. Without a clear understanding of the existing level of PFOS+PFHxS in groundwater at the selected reuse locations and down gradient, it is not possible to assess the potential change in PFAS risk resulting from the placement of spoil.

C.2.2 Groundwater quality

48. Like soil quality indicated above, the absence of defined areas for the reuse of construction spoil means that although existing groundwater quality at or close to the reuse locations may have been assessed previously, further targeted sampling and analysis of groundwater associated with the reuse locations (once determined) will be necessary to provide an accurate indication of PFAS risk to groundwater due to placement of PFAS contaminated spoil.

49. Without a clear understanding of the existing level of PFOS+PFHxS in groundwater at the selected reuse locations and down gradient, it is not possible to assess the potential change in PFAS risk resulting from the placement of spoil.

C.2.3 Potential receptors

50. The risk assessment needs to account for potential PFAS risks to receptors that could be exposed to PFAS in or near the proposed reuse locations. The existing PFAS risk needs to be compared to the new risk once the reuse material has been placed to determine whether the risks have changed, and whether the risks are acceptable under the relevant Defence PFAS guidelines.

C.2.3.1 Human

51. Jacobs (2019) identify the on- and off-Base human receptors as:

a Defence personnel and contractors who work on the Base

b maintenance and construction workers (on- and off-Base)

c private property residents (off-Base)

d recreational users of land (e.g. sporting ovals) off-Base.

52. Depending on the locations and methods used for reuse of construction spoil, any or all these human receptors could be exposed to PFAS associated with the spoil placement.

C.2.3.2 Biota

53. Biota occurring on the Base and potentially at or near the spoil reuse locations are expected to comprise terrestrial flora and fauna (on and off-Base) and aquatic organisms in surface water bodies (on- and off-Base).

54. Depending on the locations and methods used for reuse of construction spoil, any or all these ecological receptors could be exposed to PFAS associated with the spoil placement.

C.3 PFAS risk comparison

55. Given there are data gaps with regards to the analytical categorisation of both the source soil and the receiving area, EMM has developed a PFAS Calculator Tool (Attachment 3). This tool can be used to derive:

a combined mass of PFHxS + PFOS after reuse

b percentage change in mass of PFHxS + PFOS at the reuse location.

Once future sampling data become available for both the receiving area and the source material this information can be fed into the calculator as an initial step to aid in the assessment of change in PFAS risk, if any, associated with the reuse of spoil.

56. If the PFAS quality of the source material to be reused and the existing PFAS quality of soils at the reuse locations are similar, then there is a lower chance that the PFAS risk at the reuse location will change significantly due to the placement of construction spoil. However, until the quality of the source material and the intended reuse locations are known, the PFAS risk is also unknown.

57. Without understanding the anticipated spoil volumes and the specific PFAS quality (i.e. UCL concentration in mg/kg and mass in kg) of the spoil from the different source locations and existing PFAS quality of the surface soils in the proposed reuse locations, it is not possible to assess the potential change in PFAS risk due to the proposed placement of spoil.

58. A final decision on the precise location of the temporary stockpiles is yet to be made and no analytical data are available for the receiving area. Until analytical data for the soils in the receiving area are available, it is not possible to assess whether human and/or ecological receptors at and/or near the placement areas could be at greater risk of PFAS exposure as a direct result of spoil placement. Locations of proposed investigation areas are included in Figure 5.

59. During the construction phase, an approach that involves several stockpiles of varying soil quality will be managed and categorised using a sampling program. These analytical results will be used in the PFAS calculator tool provided in Attachment 3.

60. Without knowledge of the proposed locations and methods for the placement of construction spoil, it is not possible to assess whether groundwater at and/or near the spoil placement areas and receiving environments on-Base and off-Base could be at greater risk of PFAS exposure as a direct result of spoil placement.

Figure 5: Proposed stockpile investigation areas - BBK

D. PFAS risk management measures

61. During the construction phase of the project a detailed construction environment management plan (CEMP) will be prepared and implemented across the site. It is expected that the CEMP considers risks associated with the potential PFAS concentrations in soils across the site and highlighted in Attachment 1 – Heat Maps. The following potential risks along with mitigation measures may be implemented to ensure that PFAS impacted soil does not create an unnecessary risk to human health and the environment.

62. PFAS substances are highly persistent and shown to bioaccumulate. These compounds have been shown to be toxic to fish and some animals. Some studies have shown human health impacts to humans.

D.1 Potential PFAS associated risks

63. Table 4 below presents potential onsite PFAS associated risks that should be considered by the construction contractor and integrated into the CEMP.

Table 4: Potential PFAS related project risks and management measures

Risk / Management ID	Risk description	Potential management measures
01	Historical use of PFAS has created several source areas at BBK and perched groundwater has been identified at some of the locations. There is potential for a clay layer to occur below the perched aquifer(s), as part of the Lachlan Formation, which limits the vertical migration of contaminants between the perched and deep aquifer. Jacobs (2018a) indicated that the hydraulic properties of the clay found on the Property are considered to substantially attenuate vertical hydraulic connectivity between the ground surface and the underlying permeable horizons. However, it is not known if this clay layer is continuous across the Property. Regional groundwater is understood to be located within the deep aquifer (from 48 m bgl) within the Lachlan and Cowra formations. If construction activities interact with regional groundwater and thereby exposing groundwater to PFAS contamination in shallow soils, there may be a risk of increased groundwater contamination.	It is understood that proposed construction excavation depths are not likely to contact the regional groundwater. However, there may be instances where perched groundwater in intersected during the construction phase. In the event that this occurs it is recommended that: • works should be temporarily halted to determine the nature and extent of the intersection of groundwater • further sampling and assessment should be undertaken of both the soil and groundwater to determine if the intersected groundwater poses a risk to workers onsite or if the disturbed soil might pose a risk of leaching into the perched groundwater • local groundwater should not be used for construction purposes (i.e. dust suppression, concreting, other construction purposes) • for proposed deep excavations, an understanding of the PFAS concentrations within the soil will be beneficial to inform the risk that PFAS impacted soil may interact with groundwater • depending on the nature and extent of the groundwater intersected there may be a requirement for dewatering to occur. Overall, it is unlikely that construction activities will interact with groundwater; however, if deep excavations are required then there is the potential for perched groundwater to be intersected.
02	Movement of PFAS impacted soil to areas without PFAS (i.e. 'clean' areas) could increase the risk profile of the site and potentially pose a risk to nearby sensitive receptors.	As outlined in the DCMM – Annex C, contaminated material should not be stockpiled in areas that have previously been identified as clean. No stockpiling should occur without a detailed sampling program that assesses: • quality of the source material • quality of the soil in areas within the footprint of stockpiles. To develop a Defence-compliant PFAS risk assessment, the potential change in risk associated with the placement of spoil in new areas (stockpile or reuse) is required. The PFAS risk assessment process can be informed using the PFAS calculator provided in Attachment 3. If PFAS impacted soil is placed in previously 'clean' areas, there may be an increased risk of impacts to surrounding receptors.
03	During the construction phase, temporary stockpiles will be required as part of the cut and fill process. If the stockpiling process is not carried out under best practices the risk of PFAS leaching into the surrounding environment increases.	Due to the long-term nature of the project, some soil may be stockpiled for extended periods and will likely suffer reduced viability due to loss of organic matter and nutrients, as often occurs when stockpiled for greater than 3–6 months. Most of the soils are expected to be stockpiled for 1–1.5 years and soils stripped from other areas would be stockpiled for the duration of the Project. Recommended measures to be included in the CEMP relating to soil stockpiling may include: • soil materials of different quality should be stockpiled separately • temporary soil bunds built up around stockpiles to prevent runoff and leaching of potentially contaminated stockpiles • covering of stockpiles of contaminated soil may be required (particularly if hydrocarbon impacts are observed); the need will be determined on a case-by-case basis • minimise trafficking and compaction of stockpiles • maintain suitable stockpile height to avoid compaction • minimise handling of soil • vegetation cover of long-term topsoil stockpiles with native plant community types to minimise water logging and generation of anaerobic conditions within the stockpile, to help maintain topsoil biological viability and to create a seed store.
04	PFAS contamination is a major reputational risk for the Defence estate currently and has widespread public documentation. Should PFAS contamination be increased or spread across the Defence estate, an increase in reputational risk is likely.	All PFAS related investigations and interactions should be in accordance with the relevant guidance documents. Provided works are undertaking in accordance with the applicable guidelines then the risks should be manageable.
05	Unexpected finds - interaction with Category 1 PFAS impacted soil/groundwater	Further remediation may be required where intrusive works encounter highly contaminated soil. It is understood that further sampling and analysis will be carried out during the construction phase. Should analytical data indicate high levels of PFAS (Category 1) a remediation action plan may be required to be developed which may include a requirement for stabilisation processes to be implemented.

E. Next steps

64. Without sufficient spatial coverage of targeted PFAS sampling and analysis of soils in redevelopment areas where excavated soils will require reuse elsewhere on Base and of soils and groundwater in areas where excavated soils are proposed to be reused, it is not possible to assess the existing level of PFAS risk. Consequently, it is also not possible to specifically assess any potential change in PFAS risk at the proposed spoil reuse locations, which is the main objective of Defence compliant PFAS risk assessments. Notwithstanding, the existing data have been reviewed to evaluate the relevant Defence PFAS Category within specific WE areas (Table 2).

65. Several additional steps are required to inform a Defence-compliant PFAS risk assessment:

a Conduct sufficient sampling and PFAS analysis on soils to be excavated during redevelopment activities at BBK to enable characterisation of the excess material to be beneficially reused. Sampling density should reflect the spatial extent and volume of soil to be reused.

b Use soil quality data (from bullet 1 above) and volumes of soil (Table 1) for each location to calculate the PFAS content (95% UCL in mg/kg and total mass in kg).

c Conduct sufficient sampling and PFAS analysis on surface soils at the proposed reuse location(s). Sampling density should reflect the spatial extent of the proposed reuse footprint, and critical areas adjacent to the reuse location, especially down gradient.

d Conduct sufficient sampling and PFAS analysis on groundwater within and down gradient of the reuse footprint to assess existing PFAS contamination (if any) and potential for increased risk from reused materials.

e Assess existing PFAS content (95% UCL in mg/kg and total mass in kg) for surface soils at the proposed reuse location and, together with the PFAS content of the material being reused (bullet 3), calculate the combined PFAS content (95% UCL in mg/kg and total mass in kg) of the reuse material added to the existing surface soils at the reuse location.

f Assess whether the additional PFAS content from the reused material will alter the existing PFAS risk at the reuse location. Assess whether sensitive receptors adjacent to and down gradient of the reuse location are at greater risk due to the reuse of material.

g Depending on the PFAS risk category of material to be reused, design appropriate control measures to adequately mitigate and manage the potential runoff, leaching and infiltration of PFAS into soils, groundwater and surface waters from the material being reused, with an overall aim of minimising impacts to the local environment.

F. Limitations

66. EMM Consulting Pty Limited (EMM) has prepared this document for the sole use of Riverina Redevelopment Joint Venture and for a specific and agreed purpose and scope, as expressly stated in this document. No other party should rely on this document without the prior written consent of EMM. EMM undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. This document has been prepared based on the project Brief, the scope of work approved by RRJV and EMM's experience, having regard to assumptions that EMM can reasonably be expected to make in accordance with sound professional principles. EMM may also have relied upon information provided by the Department of Defence, the broader RRP design team, stakeholders and other third parties to prepare this document, some of which may not have been verified.

67. Subject to the above conditions, this document may be transmitted, reproduced or disseminated only in entirety. EMM accepts no liability of any kind for any unauthorised use of any of the content of this document and EMM reserves the right to seek compensation for any such unauthorised use. This document was prepared for the specific purpose described herein. RRJV may, at its discretion, use the report to inform regulators and the public.

68. From a technical perspective, the subsurface environment at any site may present substantial uncertainty. It is a heterogeneous, complex environment, in which small subsurface features or changes in geologic and hydrogeologic conditions can have substantial impacts on water and chemical movement.

69. This preliminary assessment of PFAS risk is based on the documentation, information and data made available to EMM during the 5% MPFR, 30% CDR and 50% SDR design stages, as referenced in this report.

70. The site investigations conducted to support this preliminary assessment of PFAS risk were undertaken in September 2022 during the 30% CDR design stage and assessed scope items and proposed building footprints that were preferred at that time. As such, further investigation is required to address data gaps associated with changes in design that have occurred since the Stage 1A and Stage 1B site investigations.

71. EMM's professional opinions are based upon its professional judgement, experience, and training. These opinions are also based upon data supplied by third parties and data derived from the testing and analysis described in this document. It is possible that additional testing and analysis might produce different results and/or different opinions. EMM believes that its opinions are reasonably supported by the sampling and analysis that have been done, and that those opinions have been developed according to the professional standard of care for the environmental consulting profession in this area at the date of this document. That standard of care may change with advancements in professional practice, new methods and techniques of investigation, sampling, analysis and remediation, and changes in applicable statues and/or guidelines may develop in the future, which might produce different results.

G. References

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80. National Environment Protection Council 1999, National Environmental Protection (Assessment of Site Contamination) Measure 1999, National Environment Protection Council as amended 15 May 2013, Comlaw No. F2013C00288.

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82. Standards Australia AS/NZ 1999, Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil – Volatile Substances, AS4482.2:1999, Standards Australia, Sydney.

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Attachment 1. Historical analytical results

	PFAS - Perfluoroalkyl Sulfonic Acids				PFAS	
	Perfluorohexane sulfonic acid (PFHxS)		Perfluorooctane sulfonic acid (PFOS)		Sum of PFHxS and PFOS	
	mg/kg	µg/L	mg/kg	µg/L	mg/kg	µg/L
EQL	0.0001	0.02	0.0001	0.01	0.0001	0.01
PFAS NEMP 2020 Residential with garden/accessible soil (HIL A)	0.007	-	0.007	-	0.007	-
PFAS NEMP 2020 Public open space (HIL C)	1	-	1	-	1	-
PFAS NEMP 2020 Industrial/ commercial (HIL D)	20	-	20	-	20	-
PFAS NEMP 2020 Ecological indirect exposure	-	-	0.01	-	-	-
Defence CMF 2021 Table 2 Soil Category 1	-	-		-	20	-
Defence CMF 2021 Table 2 Soil Category 2	-	-	-	-	1	-
Defence CMF 2021 Table 2 Soil Category 3	-	-	-	-	0.01	-
Defence CMF 2021 Table 2 Soil Category 4	-	-	-	-	0.01	-
PFAS NEMP 2020 Unlined Landfill Acceptance Criteria	20	0.07	20	0.07	20	0.07
PFAS NEMP 2020 Clay/Single Composite Lined Landfill Acceptance Criteria	50	0.7	50	0.7	50	0.7
PFAS NEMP 2020 Double Composite Landfill Acceptance Criteria	50	7	50	7	50	7

Site ID	Project ID	Field ID	WE	Source	Location Code	Date	Depth	Matrix Description	X Coord	Y Coord	Location Alt. Name	Location Type	Location Purpose	Sample Type						
0315	NSW_0315_PFASOMP_22	0315_SD103_221103	Kapooka Heritage trail	Defence Esdat	SD103	3/11/2022			526271.3818	6110348.608		SD		Normal	0.0003	-	0.0063	-	0.0066	-
0315	NSW_0315_PFASOMP_22	0315_SD103_20211026	Kapooka Heritage trail	Defence Esdat	SD103	26/10/2021			526271.3818	6110348.608		SD		Normal	0.0006	-	0.014	-	0.0146	-
0315	NSW_0315_PFASOMP_22	0315_SD103_20220428	Kapooka Heritage trail	Defence Esdat	SD103	28/04/2022			526271.3818	6110348.608		SD		Normal	0.0012	-	0.0163	-	0.0175	-
0315	NSW_0315_PFASOMP_22	0315_SD136_221103	Kapooka Heritage trail	Defence Esdat	SD136	3/11/2022			526132.986	6110304.051		SD	PFAS_OMP	Normal	<0.0002	-	0.003	-	0.003	-
0315	NSW_0315_PFASOMP_22	0315_SD136_20211026	Kapooka Heritage trail	Defence Esdat	SD136	26/10/2021			526132.986	6110304.051		SD	PFAS_OMP	Normal	0.0004	-	0.0046	-	0.005	-
0315	NSW_0315_PFASOMP_22	0315_SD136_20220427	Kapooka Heritage trail	Defence Esdat	SD136	27/04/2022			526132.986	6110304.051		SD	PFAS_OMP	Normal	0.0018	-	0.0393	-	0.0411	-
0315		0315_BH76_0.5_221025	WE 7.1	EMM	BH76	25/10/2022	0.4 - 0.5		524270.295	6108822.598		BH		Normal	<0.0001	-	0.0001	-	0.0001	-
0315		315_BH01_0.1_221018	WE 1.10	EMM	BH01	18/10/2022	0 - 0.1		525637.8469	6110120.137		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH01_0.5_221018	WE 1.10	EMM	BH01	18/10/2022	0.4 - 0.5		525637.8469	6110120.137		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH01_1.5_221018	WE 1.10	EMM	BH01	18/10/2022	1.4 - 1.5		525637.8469	6110120.137		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH02_0.1_221018	WE 1.10	EMM	BH02	18/10/2022	0 - 0.1		525738.5708	6110146.801		BH		Normal	<0.0001	-	0.0008	-	0.0008	-
0315		315_BH02_0.5_221018	WE 1.10	EMM	BH02	18/10/2022	0.4 - 0.5		525738.5708	6110146.801		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH02_1.5_221018	WE 1.10	EMM	BH02	18/10/2022	1.4 - 1.5		525738.5708	6110146.801		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH03_0.1_221018	WE 4.2	EMM	BH03	18/10/2022	0 - 0.1		525677.9434	6110030.527		BH		Normal	<0.0001	-	0.0001	-	0.0001	-
0315		315_BH03_0.5_221018	WE 4.2	EMM	BH03	18/10/2022	0.4 - 0.5		525677.9434	6110030.527		BH		Normal	<0.0001	-	0.0001	-	0.0001	-
0315		315_BH03_1.5_221018	WE 4.2	EMM	BH03	18/10/2022	1.4 - 1.5		525677.9434	6110030.527		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH04_0.1_221019	WE 1.10	EMM	BH04	19/10/2022	0 - 0.1		525774.9103	6110113.649		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH04_0.5_221019	WE 1.10	EMM	BH04	19/10/2022	0.4 - 0.5		525774.9103	6110113.649		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH04_2.5_221019	WE 1.10	EMM	BH04	19/10/2022	2.4 - 2.5		525774.9103	6110113.649		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH05_0.1_221018	WE 4.2	EMM	BH05	18/10/2022	0 - 0.1		525647.0495	6109992.465		BH		Normal	<0.0001	-	0.0004	-	0.0004	-
0315		315_BH05_0.5_221018	WE 4.2	EMM	BH05	18/10/2022	0.4 - 0.5		525647.0495	6109992.465		BH		Normal	<0.0001	-	0.0004	-	0.0004	-
0315		315_BH06_0.1_221019	WE 4.2	EMM	BH06	19/10/2022	0 - 0.1		525746.8649	6110020.462		BH		Normal	0.0004	-	0.0031	-	0.0035	-
0315		315_BH06_0.5_221019	WE 4.2	EMM	BH06	19/10/2022	0.4 - 0.5		525746.8649	6110020.462		BH		Normal	0.0002	-	0.0012	-	0.0014	-
0315		315_BH06_1.5_221019	WE 4.2	EMM	BH06	19/10/2022	1.4 - 1.5		525746.8649	6110020.462		BH		Normal	<0.0001	-	0.0002	-	0.0002	-
0315		315_BH07_0.1_221018	WE 1.10	EMM	BH07	18/10/2022	0 - 0.1		525655.6977	6109958.616		BH		Normal	<0.0001	-	0.0002	-	0.0002	-
0315		315_BH07_0.5_221018	WE 1.10	EMM	BH07	18/10/2022	0.4 - 0.5		525655.6977	6109958.616		BH		Normal	<0.0001	-	0.0002	-	0.0002	-
0315		315_BH07_1.5_221018	WE 1.10	EMM	BH07	18/10/2022	1.4 - 1.5		525655.6977	6109958.616		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH08_0.1_221019	WE 4.2	EMM	BH08	19/10/2022	0 - 0.1		525771.3875	6109963.833		BH		Normal	<0.0001	-	0.0012	-	0.0012	-
0315		315_BH08_0.5_221019	WE 4.2	EMM	BH08	19/10/2022	0.4 - 0.5		525771.3875	6109963.833		BH		Normal	0.0003	-	0.0002	-	0.0005	-
0315		315_BH08_1.5_221019	WE 4.2	EMM	BH08	19/10/2022	1.4 - 1.5		525771.3875	6109963.833		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH09_0.1_221019	WE 4.2	EMM	BH09	19/10/2022	0 - 0.1		525766.0518	6109945.217		BH		Normal	0.0005	-	0.0031	-	0.0036	-
0315		315_BH09_0.5_221019	WE 4.2	EMM	BH09	19/10/2022	0.4 - 0.5		525766.0518	6109945.217		BH		Normal	0.0003	-	0.0008	-	0.0011	-
0315		315_BH09_1.5_221019	WE 4.2	EMM	BH09	19/10/2022	1.4 - 1.5		525766.0518	6109945.217		BH		Normal	0.0001	-	0.0002	-	0.0003	-
0315		315_BH10_0.1_221019	WE 4.2	EMM	BH10	19/10/2022	0 - 0.1		525733.7062	6109877.105		BH		Normal	<0.0001	-	0.0004	-	0.0004	-
0315		315_BH11_0.1_221019	WE 4.2	EMM	BH11	19/10/2022	0 - 0.1		525732.8024	6109879.547		BH		Normal	0.0001	-	0.0002	-	0.0004	-
0315		315_BH11_0.5_221019	WE 4.2	EMM	BH11	19/10/2022	0.4 - 0.5		525732.8024	6109879.547		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH11_1.5_221019	WE 4.2	EMM	BH11	19/10/2022	1.4 - 1.5		525732.8024	6109879.547		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH13_0.1_221019	WE 1.10	EMM	BH13	19/10/2022	0 - 0.1		525787.9672	6109868.744		BH		Normal	0.0001	-	0.0005	-	0.0006	-
0315		315_BH16_0.1_221018	WE 1.10	EMM	BH16	18/10/2022	0 - 0.1		525607.5812	6110111.018		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH16_0.5_221018	WE 1.10	EMM	BH16	18/10/2022	0.4 - 0.5		525607.5812	6110111.018		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH17_0.1_221019	WE 1.10	EMM	BH17	19/10/2022	0 - 0.1		525761.9295	6110129.212		BH		Normal	<0.0001	-	0.0001	-	0.0001	-
0315		315_BH17_0.5_221019	WE 1.10	EMM	BH17	19/10/2022	0.4 - 0.5		525761.9295	6110129.212		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH18_0.1_221018	WE 1.10	EMM	BH18	18/10/2022	0 - 0.1		525623.7594	6110066.501		BH		Normal	0.0001	-	0.0002	-	0.0003	-
0315		315_BH18_0.5_221018	WE 1.10	EMM	BH18	18/10/2022	0.4 - 0.5		525623.7594	6110066.501		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH18_1.5_221018	WE 1.10	EMM	BH18	18/10/2022	1.4 - 1.5		525623.7594	6110066.501		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH19_0.1_221018	WE 1.10	EMM	BH19	18/10/2022	0 - 0.1		525670.9863	6110050.398		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH19_0.5_221018	WE 1.10	EMM	BH19	18/10/2022	0.4 - 0.5		525670.9863	6110050.398		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH20_0.1_221018	WE 1.10	EMM	BH20	18/10/2022	0 - 0.1		525630.9278	6110024.672		BH		Normal	<0.0001	-	0.0001	-	0.0001	-
0315		315_BH20_1.5_221018	WE 1.10	EMM	BH20	18/10/2022	1.4 - 1.5		525630.9278	6110024.672		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH21_0.1_221019	WE 4.2	EMM	BH21	19/10/2022	0 - 0.1		525728.193	6109924.253		BH		Normal	<0.0001	-	0.0007	-	0.0007	-
0315		315_BH21_0.5_221019	WE 4.2	EMM	BH21	19/10/2022	0.4 - 0.5		525728.193	6109924.253		BH		Normal	0.0002	-	0.0001	-	0.0004	-
0315		315_BH21_1.5_221019	WE 4.2	EMM	BH21	19/10/2022	1.4 - 1.5		525728.193	6109924.253		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH23_0.1_221019	WE 4.2	EMM	BH23	19/10/2022	0 - 0.1		525859.0304	6109907.467		BH		Normal	<0.0001	-	0.0003	-	0.0003	-
0315		315_BH23_0.5_221019	WE 4.2	EMM	BH23	19/10/2022	0.4 - 0.5		525859.0304	6109907.467		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH25_0.1_221019	WE 1.10	EMM	BH25	19/10/2022	0 - 0.1		525780.0232	6110085.909		BH		Normal	<0.0001	-	0.0004	-	0.0004	-
0315		315_BH25_0.5_221019	WE 1.10	EMM	BH25	19/10/2022	0.4 - 0.5		525780.0232	6110085.909		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH07_0.1_220913	WE 1.10	EMM	BH-07	13/09/2022	0 - 0.1		525571.9414	6110004.987		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH07_0.5_220913	WE 1.10	EMM	BH-07	13/09/2022	0.4 - 0.5		525571.9414	6110004.987		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH07_1.0_220913	WE 1.10	EMM	BH-07	13/09/2022	0.9 - 1		525571.9414	6110004.987		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH07_3.0_220913	WE 1.10	EMM	BH-07	13/09/2022	2.9 - 3		525571.9414	6110004.987		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH08_0.1_220914	WE 4.2	EMM	BH-08	14/09/2022	0 - 0.1		525735.0885	6109882.757		BH		Normal	<0.0001	-	0.0007	-	0.0007	-
0315		0315_BH08_0.5_220914	WE 4.2	EMM	BH-08	14/09/2022	0.4 - 0.5		525735.0885	6109882.757		BH		Normal	<0.0001	-	0.0002	-	0.0002	-
0315		0315_BH09_0.1_220914	WE 3.1/3.2	EMM	BH-09	14/09/2022	0 - 0.1		525782.9869	6109718.932		BH		Normal	0.0002	-	0.0011	-	0.0013	-
0315		0315_BH09_0.5_220914	WE 3.1/3.2	EMM	BH-09	14/09/2022	0.4 - 0.5		525782.9869	6109718.932		BH		Normal	<0.0001	-	0.0002	-	0.0002	-
0315		0315_BH05_0.1_220913	WE 2.4	EMM	BH-05	13/09/2022	0 - 0.1		525776.2657	6110622.345		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH05_0.5_220913	WE 2.4	EMM	BH-05	13/09/2022	0.4 - 0.5		525776.2657	6110622.345		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH05_1.0_220913	WE 2.4	EMM	BH-05	13/09/2022	0.9 - 1		525776.2657	6110622.345		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH05_2.0_220913	WE 2.4	EMM	BH-05	13/09/2022	1.9 - 2		525776.2657	6110622.345		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH27_0.5_221025	WE 2.6	EMM	BH27	25/10/2022	0.4 - 0.5		525404.6096	6109318.319		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH27_1.5_221025	WE 2.6	EMM	BH27	25/10/2022	1.4 - 1.5		525404.6096	6109318.319		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH27_2.5_221025	WE 2.6	EMM	BH27	25/10/2022	2.4 - 2.5		525404.6096	6109318.319		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH28_0.1_221025	WE 2.6	EMM	BH28	25/10/2022	0 - 0.1		525438.567	6109378.221		BH		Normal	0.0002	-	0.0007	-	0.0009	-
0315		0315_BH28_0.5_221025	WE 2.6	EMM	BH28	25/10/2022	0.4 - 0.5		525438.567	6109378.221		BH		Normal	0.039	-	0.35	-	0.39	-
0315		0315_BH28_2.5_221025	WE 2.6	EMM	BH28	25/10/2022	2.4 - 2.5		525438.567	6109378.221		BH		Normal	<0.0001	-	0.0001	-	0.0001	-
0315		0315_BH29_0.1_221025	WE 2.6	EMM	BH29	25/10/2022	0 - 0.1		525439.5066	6109356.038		BH		Normal	<0.0001	-	0.0001	-	0.0001	-
0315		0315_BH29_0.5_221025	WE 2.6	EMM	BH29	25/10/2022	0.4 - 0.5		525439.5066	6109356.038		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH29_2.5_221025	WE 2.6	EMM	BH29	25/10/2022	2.4 - 2.5		525439.5066	6109356.038		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH36_0.1_221025	WE 2.1	EMM	BH36	25/10/2022	0 - 0.1		526087.3698	6110191.051		BH		Normal	0.0023	-	0.18	-	0.18	-
0315		0315_BH36_0.5_221025	WE 2.1	EMM	BH36	25/10/2022	0.4 - 0.5		526087.3698	6110191.051		BH		Normal	0.0038	-	0.16	-	0.17	-
0315		0315_BH38_0.1_221025	WE 2.1	EMM	BH38	25/10/2022	0 - 0.1		526065.5755	6110119.028		BH		Normal	0.0015	-	0.044	-	0.046	-
0315		0315_BH38_0.5_221025	WE 2.1	EMM	BH38	25/10/2022	0.4 - 0.5		526065.5755	6110119.028		BH		Normal	0.59	-	0.81	-	1.4	-
0315		0315_BH38_1.5_221025	WE 2.1	EMM	BH38	25/10/2022	1.4 - 1.5		526065.5755	6110119.028		BH		Normal	0.0001	-	0.0002	-	0.0003	-

	PFAS - Perfluoroalkyl Sulfonic Acids				PFAS	
	Perfluorohexane sulfonic acid (PFHxS)		Perfluorooctane sulfonic acid (PFOS)		Sum of PFHxS and PFOS	
	mg/kg	µg/L	mg/kg	µg/L	mg/kg	µg/L
EQL	0.0001	0.02	0.0001	0.01	0.0001	0.01
PFAS NEMP 2020 Residential with garden/accessible soil (HIL A)	0.007	-	0.007	-	0.007	-
PFAS NEMP 2020 Public open space (HIL C)	1	-	1	-	1	-
PFAS NEMP 2020 Industrial/ commercial (HIL D)	20	-	20	-	20	-
PFAS NEMP 2020 Ecological indirect exposure	-	-	0.01	-	-	-
Defence CMF 2021 Table 2 Soil Category 1	-	-		-	20	-
Defence CMF 2021 Table 2 Soil Category 2	-	-	-	-	1	-
Defence CMF 2021 Table 2 Soil Category 3	-	-	-	-	0.01	-
Defence CMF 2021 Table 2 Soil Category 4	-	-	-	-	0.01	-
PFAS NEMP 2020 Unlined Landfill Acceptance Criteria	20	0.07	20	0.07	20	0.07
PFAS NEMP 2020 Clay/Single Composite Lined Landfill Acceptance Criteria	50	0.7	50	0.7	50	0.7
PFAS NEMP 2020 Double Composite Landfill Acceptance Criteria	50	7	50	7	50	7

Site ID	Project ID	Field ID	WE	Source	Location Code	Date	Depth	Matrix Description	X Coord	Y Coord	Location Alt. Name	Location Type	Location Purpose	Sample Type						
0315		0315_BH38_2.5_221025	WE 2.1	EMM	BH38	25/10/2022	2.4 - 2.5		526065.5755	6110119.028		BH		Normal	0.0051	-	0.37	-	0.38	-
0315		0315_BH40_0.5_221025	WE 2.1	EMM	BH40	25/10/2022	0.4 - 0.5		526056.5853	6110128.481		BH		Normal	0.0045	-	0.19	-	0.2	-
0315		0315_BH40_1.5_221025	WE 2.1	EMM	BH40	25/10/2022	1.4 - 1.5		526056.5853	6110128.481		BH		Normal	0.075	-	0.26	-	0.33	-
0315		315_SS20_221017	WE 2.1	EMM	SS20	17/10/2022	0 - 0.1		526061.8713	6110097.857		SS		Normal	0.0015	-	0.023	-	0.025	-
0315		315_SS21_221017	WE 2.1	EMM	SS21	17/10/2022	0 - 0.1		526041.1977	6110225.563		SS		Normal	0.0003	-	0.01	-	0.01	-
0315		315_SS22_221017	WE 2.1	EMM	SS22	17/10/2022	0 - 0.1		526037.8846	6110181.988		SS		Normal	0.0006	-	0.03	-	0.031	-
0315		315_SS23_221017	WE 2.1	EMM	SS23	17/10/2022	0 - 0.1		526092.0981	6110219.871		SS		Normal	0.0005	-	0.01	-	0.011	-
0315		0315_BH36_1.5_221025	WE 2.1	EMM	BH36	24/10/2022	1.4 - 1.5		526087.3698	6110191.051		BH		Normal	0.27	-	0.013	-	0.28	-
0315		0315_BH36_2.5_221025	WE 2.1	EMM	BH36	24/10/2022	2.4 - 2.5		526087.3698	6110191.051		BH		Normal	0.049	-	0.0003	-	0.049	-
0315		0315_BH41_0.1_221024	WE 2.2	EMM	BH41	24/10/2022	0 - 0.1		524544.985	6108560.909		BH		Normal	<0.0001	-	0.0001	-	0.0001	-
0315		0315_BH41_2.5_221024	WE 2.2	EMM	BH41	24/10/2022	2.4 - 2.5		524544.985	6108560.909		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH42_0.5_221024	WE 2.2	EMM	BH42	24/10/2022	0.4 - 0.5		524549.8525	6108508.773		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH42_2.5_221024	WE 2.2	EMM	BH42	24/10/2022	2.4 - 2.5		524549.8525	6108508.773		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH43_0.1_221024	WE 2.2	EMM	BH43	24/10/2022	0 - 0.1		524595.9751	6108490.793		BH		Normal	<0.0001	-	0.0001	-	0.0001	-
0315		0315_BH43_0.5_221024	WE 2.2	EMM	BH43	24/10/2022	0.4 - 0.5		524595.9751	6108490.793		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH44_0.1_221020	WE 2.2	EMM	BH44	20/10/2022	0 - 0.1		524710.3992	6108606.705		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH44_1.5_221020	WE 2.2	EMM	BH44	20/10/2022	1.4 - 1.5		524710.3992	6108606.705		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH45_0.1_221020	WE 2.2	EMM	BH45	20/10/2022	0 - 0.1		524801.4119	6108619.432		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH45_0.5_221020	WE 2.2	EMM	BH45	20/10/2022	0.4 - 0.5		524801.4119	6108619.432		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH45_2.4_221020	WE 2.2	EMM	BH45	20/10/2022	2.3 - 2.4		524801.4119	6108619.432		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		315_BH46_0.5_221020	WE 2.2	EMM	BH46	20/10/2022	0.4 - 0.5		524823.5056	6108573.015		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH37_2.5_221025	WE 2.1	EMM	BH37	25/10/2022	2.4 - 2.5		526048.4659	6110155.675		BH		Normal	0.26	-	0.77	-	1	-
0315		0315_BH40_0.1_221025	WE 2.1	EMM	BH40	25/10/2022	0 - 0.1		526056.5853	6110128.481		BH		Normal	0.0054	-	0.06	-	0.065	-
0315		0315_BH54_0.1_221025	WE 2.5	EMM	BH54	25/10/2022	0 - 0.1		525976.6154	6110033.89		BH		Normal	0.0021	-	0.18	-	0.18	-
0315		0315_BH54_0.5_221025	WE 2.5	EMM	BH54	25/10/2022	0.4 - 0.5		525976.6154	6110033.89		BH		Normal	0.017	-	0.81	-	0.83	-
0315		0315_BH55_0.5_221025	WE 2.5	EMM	BH55	25/10/2022	0.4 - 0.5		526024.3246	6110059.15		BH		Normal	0.0024	-	0.12	-	0.12	-
0315		0315_BH57_0.5_221025	WE 4.1	EMM	BH57	25/10/2022	0.4 - 0.5		525497.6483	6109692.125		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH57_1.5_221025	WE 4.1	EMM	BH57	25/10/2022	0.4 - 0.5		525497.6483	6109692.125		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH39_0.1_221025	WE 2.1	EMM	BH39	25/10/2022	0 - 0.1		526099.7301	6110181.589		BH		Normal	0.007	-	0.42	-	0.43	-
0315		0315_BH39_0.5_221025	WE 2.1	EMM	BH39	25/10/2022	0.4 - 0.5		526099.7301	6110181.589		BH		Normal	0.005	-	0.37	-	0.37	-
0315		0315_BH39_1.5_221025	WE 2.1	EMM	BH39	25/10/2022	1.4 - 1.5		526099.7301	6110181.589		BH		Normal	0.057	-	0.55	-	0.61	-
0315		0315_BH57_0.1_221025	WE 4.1	EMM	BH57	25/10/2022	0 - 0.1		525497.6483	6109692.125		BH		Normal	<0.0001	-	0.0001	-	0.0001	-
0315		0315_BH77_0.5_221025	WE 4.1	EMM	BH57	25/10/2022	0 - 0.1		525497.6483	6109692.125		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH58_0.1_221025	WE 4.1	EMM	BH58	25/10/2022	0 - 0.1		525594.4925	6109733.661		BH		Normal	<0.0001	-	0.0018	-	0.0018	-
0315		0315_BH58_0.5_221025	WE 4.1	EMM	BH58	25/10/2022	0.4 - 0.5		525594.4925	6109733.661		BH		Normal	0.0083	-	0.004	-	0.012	-
0315		0315_BH59_0.1_221025	WE 4.1	EMM	BH59	25/10/2022	0 - 0.1		525632.4034	6109612.451		BH		Normal	0.0001	-	0.023	-	0.023	-
0315		0315_BH60_0.1_221025	WE 1.10	EMM	BH60	25/10/2022	0 - 0.1		525527.6926	6109558.516		BH		Normal	<0.0001	-	0.0009	-	0.0009	-
0315		0315_BH60_0.5_221025	WE 1.10	EMM	BH60	25/10/2022	0.4 - 0.5		525527.6926	6109558.516		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH61_0.1_221025	WE 4.1	EMM	BH61	25/10/2022	0 - 0.1		525509.6793	6109630.43		BH		Normal	0.0001	-	0.0024	-	0.0025	-
0315		0315_BH61_0.5_221025	WE 4.1	EMM	BH61	25/10/2022	0.4 - 0.5		525509.6793	6109630.43		BH		Normal	<0.0001	-	0.0011	-	0.0011	-
0315		0315_BH62_0.5_221025	WE 4.1	EMM	BH62	25/10/2022	0.4 - 0.5		525589.1246	6109638.967		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH76_1.5_221025	WE 7.1	EMM	BH76	25/10/2022	0.4 - 0.5		524270.295	6108822.598		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH77_0.1_221025	WE 7.1	EMM	BH77	25/10/2022	0.4 - 0.5		524352.96	6108846.22		BH		Normal	<0.0001	-	0.0002	-	0.0002	-
0315		0315_BH82_0.1_221025	WE 7.1	EMM	BH82	25/10/2022	0 - 0.1		524272.7034	6108803.739		BH		Normal	0.0004	-	0.0011	-	0.0015	-
0315		0315_BH82_1.5_221025	WE 7.1	EMM	BH82	25/10/2022	0 - 0.1		524272.7034	6108803.739		BH		Normal	<0.0001	-	0.0002	-	0.0002	-
0315		0315_BH82_0.5_221025	WE 7.1	EMM	BH82	25/10/2022	0.4 - 0.5		524272.7034	6108803.739		BH		Normal	<0.0001	-	0.0004	-	0.0004	-
0315		315_SS24_221017	WE 4.1	EMM	SS24	17/10/2022	0 - 0.1		525484.6829	6109615.973		SS		Normal	<0.0001	-	0.0011	-	0.0011	-
0315		315_SS25_221017	WE 4.1	EMM	SS25	17/10/2022	0 - 0.1		525560.3653	6109646.701		SS		Normal	<0.0001	-	0.0037	-	0.0037	-
0315		315_SS26_221017	WE 1.10	EMM	SS26	17/10/2022	0 - 0.1		525544.9335	6109568.116		SS		Normal	<0.0001	-	0.0008	-	0.0008	-
0315		315_SS27_221017	WE 1.10	EMM	SS27	17/10/2022	0 - 0.1		525610.7625	6109560.721		SS		Normal	<0.0001	-	0.0003	-	0.0003	-
0315		315_SS28_221017	WE 4.1	EMM	SS28	17/10/2022	0 - 0.1		525608.5947	6109696.026		SS		Normal	<0.0001	-	0.0025	-	0.0025	-
0315		315_SS29_221017	WE 4.1	EMM	SS29	17/10/2022	0 - 0.1		525520.3829	6109708.696		SS		Normal	0.0002	-	0.004	-	0.0042	-
0315		0315_BH37_0.1_221025	WE 2.1	EMM	BH37	25/10/2022	0 - 0.1		526048.4659	6110155.675		BH		Normal	0.005	-	0.38	-	0.38	-
0315		0315_BH37_0.5_221025	WE 2.1	EMM	BH37	25/10/2022	0.4 - 0.5		526048.4659	6110155.675		BH		Normal	0.004	-	0.23	-	0.24	-
0315		0315_BH37_1.5_221025	WE 2.1	EMM	BH37	25/10/2022	1.4 - 1.5		526048.4659	6110155.675		BH		Normal	0.025	-	0.34	-	0.36	-
0315		0315_BH53_0.1_221025	WE 2.5	EMM	BH53	25/10/2022	0 - 0.1		525971.8003	6110006.401		BH		Normal	0.0004	-	0.0008	-	0.0012	-
0315		0315_BH53_0.5_221025	WE 2.5	EMM	BH53	25/10/2022	0.4 - 0.5		525971.8003	6110006.401		BH		Normal	<0.0001	-	0.0001	-	0.0001	-
0315		0315_BH53_1.5_221025	WE 2.5	EMM	BH53	25/10/2022	1.4 - 1.5		525971.8003	6110006.401		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH56_0.1_221025	WE 2.5	EMM	BH56	25/10/2022	0 - 0.1		526021.5523	6110013.578		BH		Normal	0.0003	-	0.0007	-	0.001	-
0315		0315_BH56_0.5_221025	WE 2.5	EMM	BH56	25/10/2022	0.4 - 0.5		526021.5523	6110013.578		BH		Normal	0.0003	-	0.0001	-	0.0005	-
0315		0315_BH69_0.1_221024	WE 7.1	EMM	BH69	24/10/2022	0 - 0.1		524191.6855	6108646.366		BH		Normal	<0.0001	-	0.001	-	0.001	-
0315		0315_BH69_0.5_221024	WE 7.1	EMM	BH69	24/10/2022	0.4 - 0.5		524191.6855	6108646.366		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH69_1.5_221024	WE 7.1	EMM	BH69	24/10/2022	1.4 - 1.5		524191.6855	6108646.366		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH70_0.1_221025	WE 7.1	EMM	BH70	25/10/2022	0 - 0.1		524224.0958	6108676.555		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH70_1.5_221025	WE 7.1	EMM	BH70	25/10/2022	1.4 - 1.5		524224.0958	6108676.555		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH70_2.5_221025	WE 7.1	EMM	BH70	25/10/2022	2.4 - 2.5		524224.0958	6108676.555		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH71_0.1_221024	WE 7.1	EMM	BH71	24/10/2022	0 - 0.1		524287.8358	6108673.279		BH		Normal	<0.0001	-	0.002	-	0.002	-
0315		0315_BH71_0.5_221024	WE 7.1	EMM	BH71	24/10/2022	0.4 - 0.5		524287.8358	6108673.279		BH		Normal	<0.0001	-	0.0002	-	0.0002	-
0315		0315_BH71_1.5_221024	WE 7.1	EMM	BH71	24/10/2022	1.4 - 1.5		524287.8358	6108673.279		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH72_0.5_221025	WE 7.1	EMM	BH72	25/10/2022	0.4 - 0.5		524240.2492	6108723.312		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH72_1.5_221025	WE 7.1	EMM	BH72	25/10/2022	1.4 - 1.5		524240.2492	6108723.312		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH72_2.5_221025	WE 7.1	EMM	BH72	25/10/2022	2.4 - 2.5		524240.2492	6108723.312		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH73_0.1_221025	WE 7.1	EMM	BH73	25/10/2022	0 - 0.1		524293.3536	6108727.273		BH		Normal	<0.0001	-	0.0001	-	0.0001	-
0315		0315_BH73_0.5_221025	WE 7.1	EMM	BH73	25/10/2022	0.4 - 0.5		524293.3536	6108727.273		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH73_2.5_221025	WE 7.1	EMM	BH73	25/10/2022	2.4 - 2.5		524293.3536	6108727.273		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH74_0.1_221025	WE 7.1	EMM	BH74	25/10/2022	0 - 0.1		524264.7767	6108768.383		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH74_0.5_221025	WE 7.1	EMM	BH74	25/10/2022	0.4 - 0.5		524264.7767	6108768.383		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH74_1.5_221025	WE 7.1	EMM	BH74	25/10/2022	1.4 - 1.5		524264.7767	6108768.383		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH75_0.1_221025	WE 7.1	EMM	BH75	25/10/2022	0 - 0.1		524320.6674	6108792.409		BH		Normal	<0.0001	-	0.0059	-	0.0059	-
0315		0315_BH75_0.5_221025	WE 7.1	EMM	BH75	25/10/2022	0.4 - 0.5		524320.6674	6108792.409		BH		Normal	0.0002	-	0.0001	-	0.0003	-
0315		0315_BH75_2.5_221025	WE 7.1	EMM	BH75	25/10/2022	2.4 - 2.5		524320.6674	6108792.409		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH77_2.5_221025	WE 7.1	EMM	BH77	25/10/2022	2.4 - 2.5		524352.96	6108846.22		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-

	PFAS - Perfluoroalkyl Sulfonic Acids				PFAS	
	Perfluorohexane sulfonic acid (PFHxS)		Perfluorooctane sulfonic acid (PFOS)		Sum of PFHxS and PFOS	
	mg/kg	µg/L	mg/kg	µg/L	mg/kg	µg/L
EQL	0.0001	0.02	0.0001	0.01	0.0001	0.01
PFAS NEMP 2020 Residential with garden/accessible soil (HIL A)	0.007	-	0.007	-	0.007	-
PFAS NEMP 2020 Public open space (HIL C)	1	-	1	-	1	-
PFAS NEMP 2020 Industrial/ commercial (HIL D)	20	-	20	-	20	-
PFAS NEMP 2020 Ecological indirect exposure	-	-	0.01	-	-	-
Defence CMF 2021 Table 2 Soil Category 1	-	-		-	20	-
Defence CMF 2021 Table 2 Soil Category 2	-	-	-	-	1	-
Defence CMF 2021 Table 2 Soil Category 3	-	-	-	-	0.01	-
Defence CMF 2021 Table 2 Soil Category 4	-	-	-	-	0.01	-
PFAS NEMP 2020 Unlined Landfill Acceptance Criteria	20	0.07	20	0.07	20	0.07
PFAS NEMP 2020 Clay/Single Composite Lined Landfill Acceptance Criteria	50	0.7	50	0.7	50	0.7
PFAS NEMP 2020 Double Composite Landfill Acceptance Criteria	50	7	50	7	50	7

Site ID	Project ID	Field ID	WE	Source	Location Code	Date	Depth	Matrix Description	X Coord	Y Coord	Location Alt. Name	Location Type	Location Purpose	Sample Type						
0315		0315_BH78_0.1_221026	WE 7.1	EMM	BH78	26/10/2022	0 - 0.1		524292.9429	6108879.762		BH		Normal	0.0001	-	0.0012	-	0.0013	-
0315		0315_BH78_1.5_221026	WE 7.1	EMM	BH78	26/10/2022	1.4 - 1.5		524292.9429	6108879.762		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH78_2.5_221026	WE 7.1	EMM	BH78	26/10/2022	2.4 - 2.5		524292.9429	6108879.762		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH79_0.1_221024	WE 7.1	EMM	BH79	24/10/2022	0 - 0.1		524278.5026	6108622.845		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH79_0.5_221024	WE 7.1	EMM	BH79	24/10/2022	0.4 - 0.5		524278.5026	6108622.845		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH79_1.5_221024	WE 7.1	EMM	BH79	24/10/2022	1.4 - 1.5		524278.5026	6108622.845		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH80_0.1_221024	WE 7.1	EMM	BH80	24/10/2022	0 - 0.1		524289.8303	6108703.882		BH		Normal	<0.0001	-	0.0016	-	0.0016	-
0315		0315_BH80_0.5_221024	WE 7.1	EMM	BH80	24/10/2022	0.4 - 0.5		524289.8303	6108703.882		BH		Normal	0.0001	-	<0.0001	-	0.0001	-
0315		0315_BH81_0.1_221025	WE 7.1	EMM	BH81	25/10/2022	0 - 0.1		524324.6494	6108749.147		BH		Normal	<0.0001	-	0.0004	-	0.0004	-
0315		0315_BH81_0.5_221025	WE 7.1	EMM	BH81	25/10/2022	0.4 - 0.5		524324.6494	6108749.147		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH83_0.1_221025	WE 7.1	EMM	BH83	25/10/2022	0 - 0.1		524320.2371	6108835.661		BH		Normal	<0.0001	-	0.0006	-	0.0006	-
0315		0315_BH83_0.5_221025	WE 7.1	EMM	BH83	25/10/2022	0.4 - 0.5		524320.2371	6108835.661		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH83_1.5_221025	WE 7.1	EMM	BH83	25/10/2022	1.4 - 1.5		524320.2371	6108835.661		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH84_0.1_221025	WE 7.1	EMM	BH84	25/10/2022	0 - 0.1		524351.2851	6108866.852		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH84_0.5_221025	WE 7.1	EMM	BH84	25/10/2022	0.4 - 0.5		524351.2851	6108866.852		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-
0315		0315_BH84_1.5_221025	WE 7.1	EMM	BH84	25/10/2022	1.4 - 1.5		524351.2851	6108866.852		BH		Normal	<0.0001	-	<0.0001	-	<0.0001	-

Attachment 2. BBK PFAS Soil Heat Maps

Riverina Redevelopment Project Joint Venture
PFOS + PFHxS Soil Category Heat Maps

Blamey Barracks Kapooka

28 November 2023

Assumptions for heat maps development

- Heat maps were based on all available data in the Defence Esdat system. Downloaded from Defence ESdat 15/10/2023.
- Concentrations below laboratory quantification limit (< LQ) were not considered in any category (areas indicated by the color white)
- The most conservative category was adopted at each borehole (BH) location, considering the highest concentration of PFOS + PFHxS.
- Interpolations have been made using kriging method and Surfer ® software.
- Interpolation were made using all the data available, inside and outside the work elements (WE).
- Category 4 was considered from 0.0001 to 0.01 mg/kg of PFOS + PFHxS
- Constructions footprints are indicative, pending official plans.

Limitations of use

- Subsurface soils are an heterogenous and anisotropic media and pollutant transport within this media is highly variable. Therefore, although the presented heat map illustrates the spatial variation of PFOs+PFHxS concentrations they will very possible not be an actual reflection of the real in-situ conditions.
- All interpolations have been based on available data. PFOs+PFHxS hotspots may be present in areas between boreholes where no data has been collected (areas indicated by the color grey).

Blamey Barracks Kapooka (BBK)

EMM
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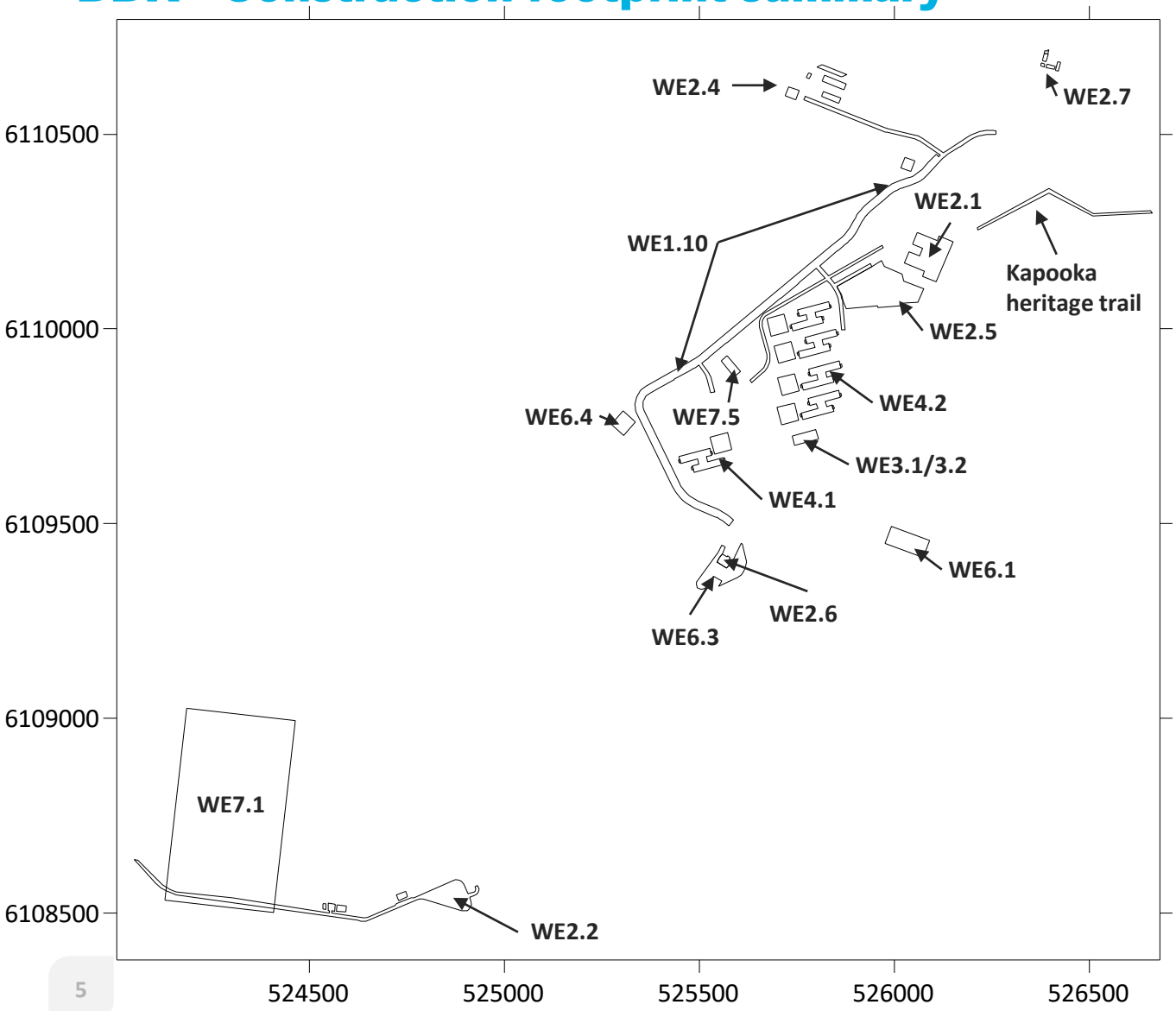
BBK - Construction footprint summary



WE 1.3 Water

WE 1.10 Ring Road and drainage swale

WE 2.1 Multi Function centre

WE 2.2 New EO storage

WE 2.4 Contractors precinct

WE 2.5 Clothing store and Q-store

WE 2.6 Upgrade to religious facilities

WE 2.7 Land Management compound

WE 3.1/3.2 HQ building

WE 4.1 Recruit Development Company

WE 4.2 LIA's Alpha, Bravo, Charlie and Delta Company

WE 6.1 Fitness facilities

WE 6.3 Instructor training facilities

WE 6.4 Medical training centre

WE 7.1 New weapons range

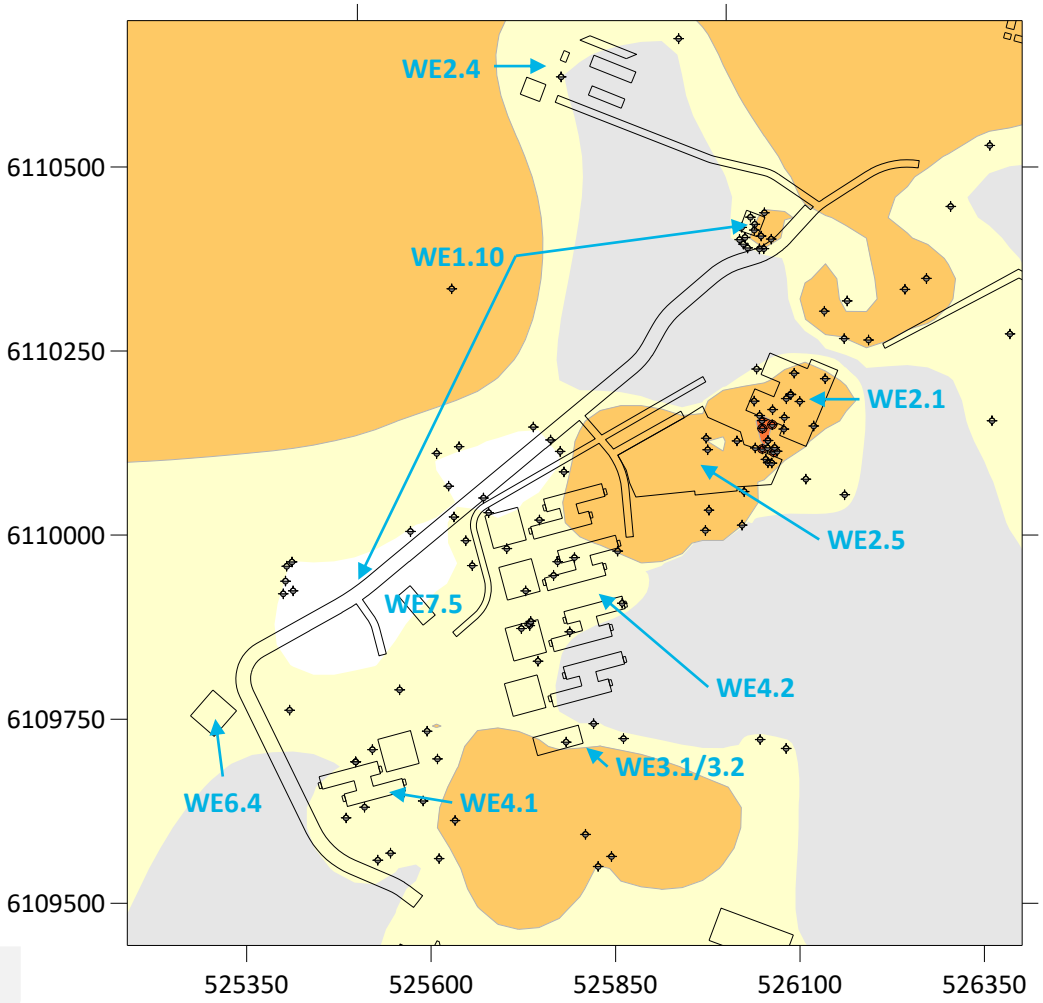
WE 7.5 Weapon Training Simulation System – WTSS

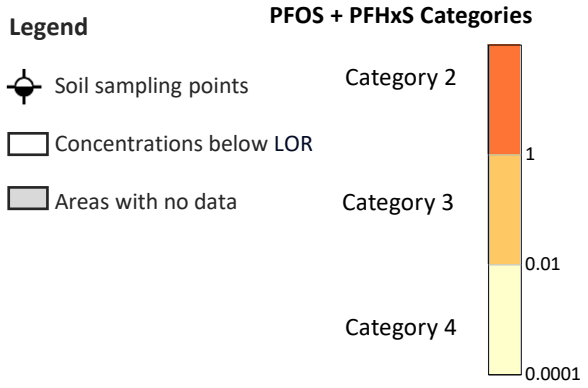
Kapooka Heritage trail

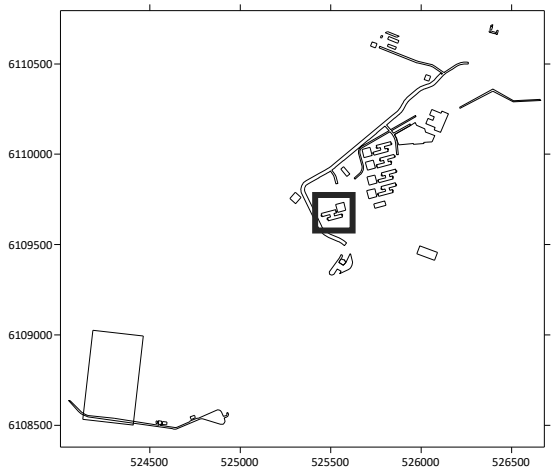
EMM creating opportunities

BBK - PFOS + PFHxS Heat Map

WE 1.10 Ring Road and drainage swale



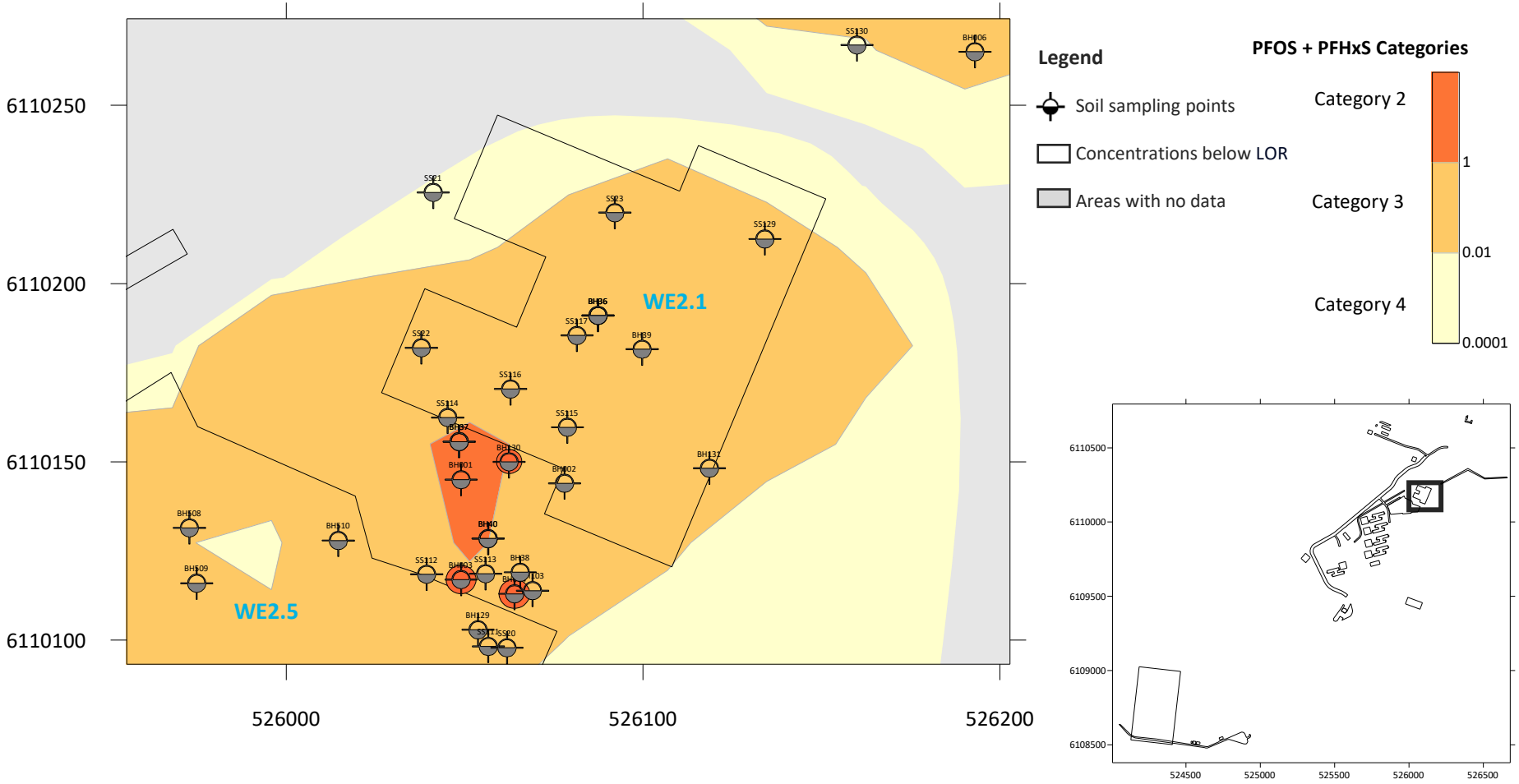




EMM
creating opportunities

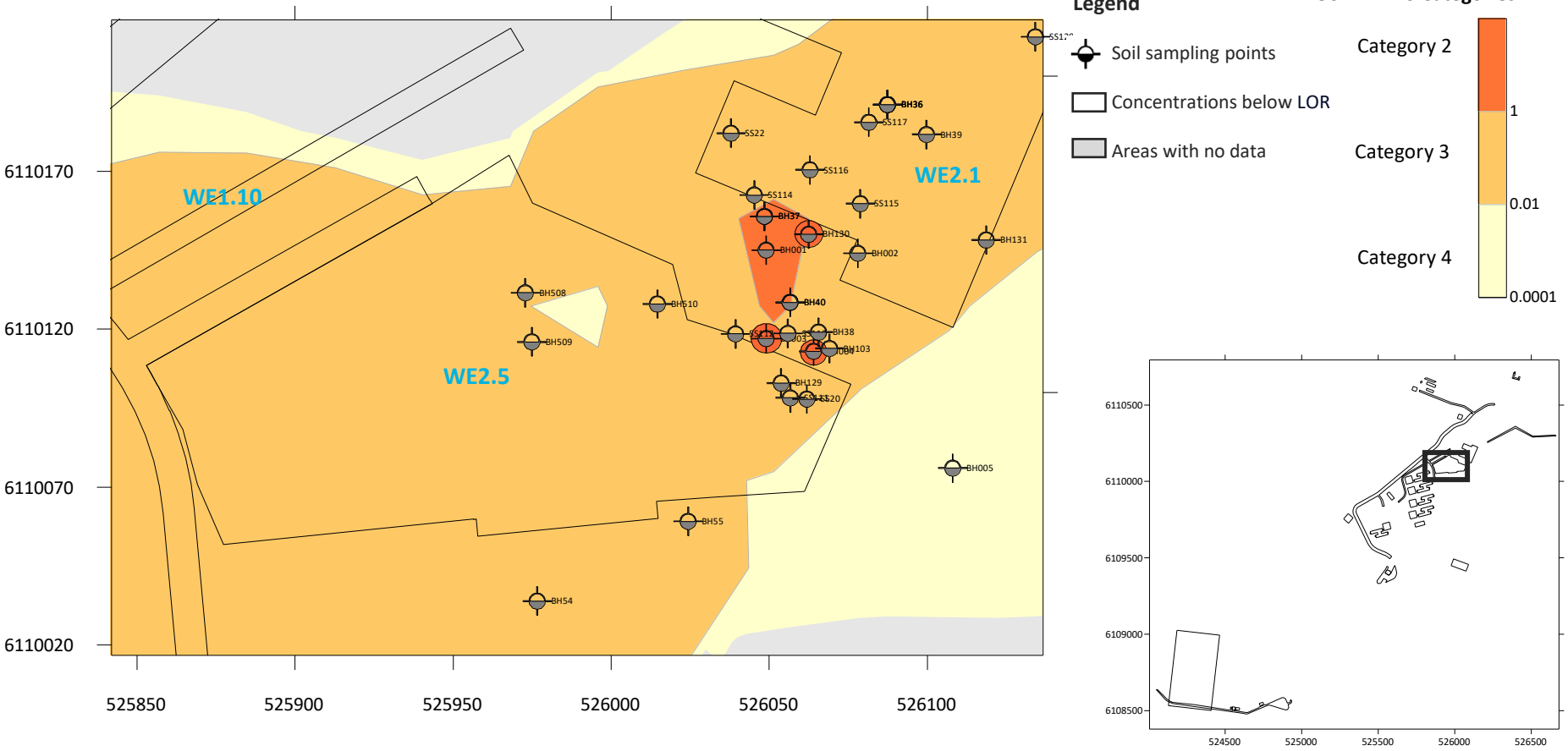
BBK - PFOS + PFHxS Heat Map

WE 2.1 Multi function centre



creating opportunities

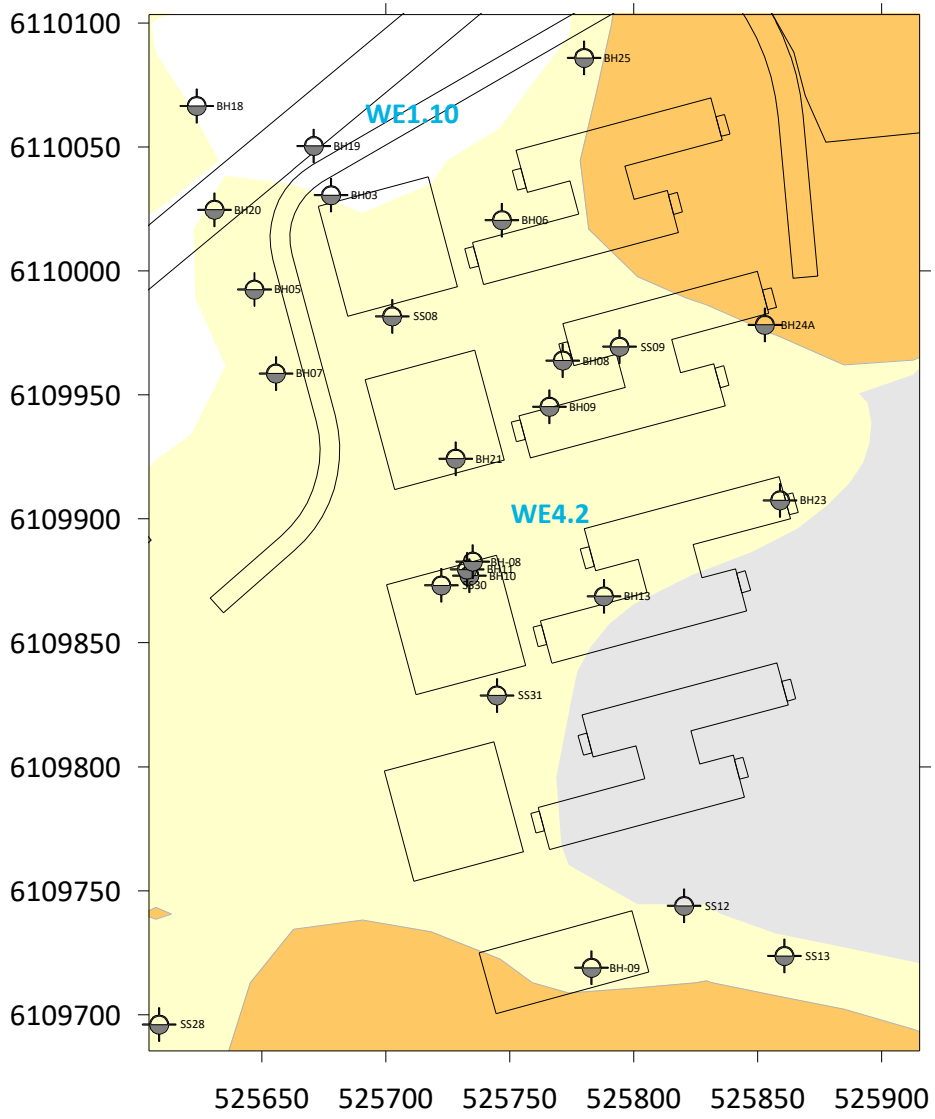
BBK - PFOS + PFHxS Heat Map
WE 2.5 Clothing store and Q-Store



EMM
creating opportunities

BBK - PFOS + PFHxS Heat Map

WE 4.2 LIA's Alpha, Bravo, Charlie and Delta Company



Legend

- Soil sampling points
- Concentrations below LOR
- Areas with no data

PFOS + PFHxS Categories

Category 2

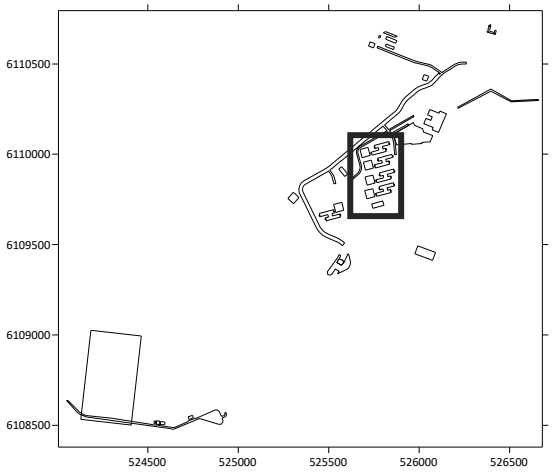
Category 3

Category 4

1

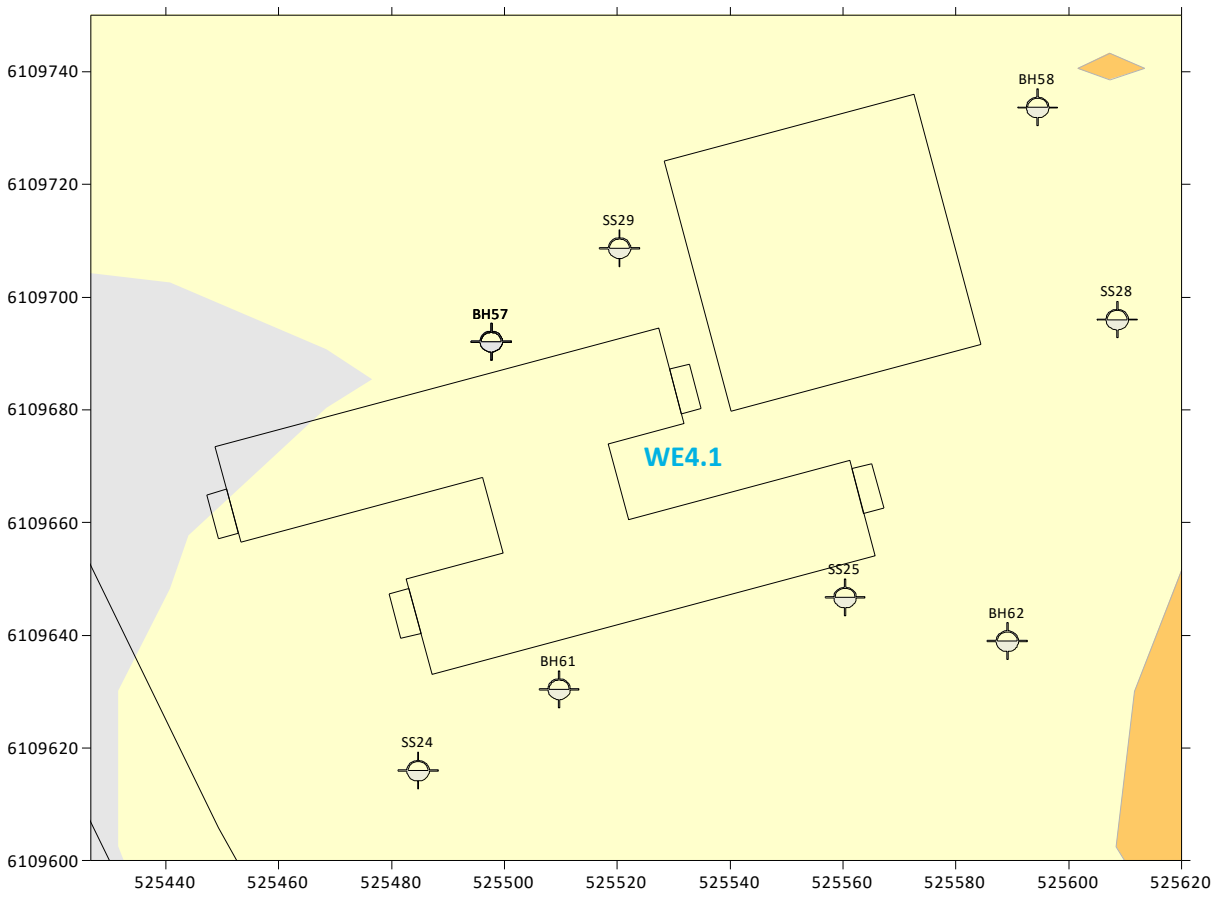
0.01

0.0001



creating opportunities

BBK - PFOS + PFHxS Heat Map
WE 4.1 Recruit Development Company



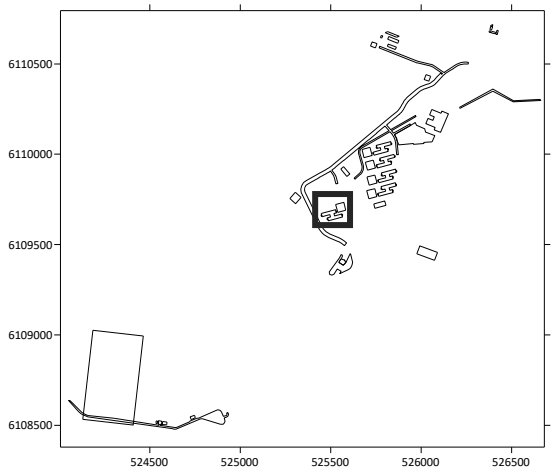
Legend

- Soil sampling points
- Concentrations below LOR
- Areas with no data

PFOS + PFHxS Categories

- Category 2
- Category 3
- Category 4

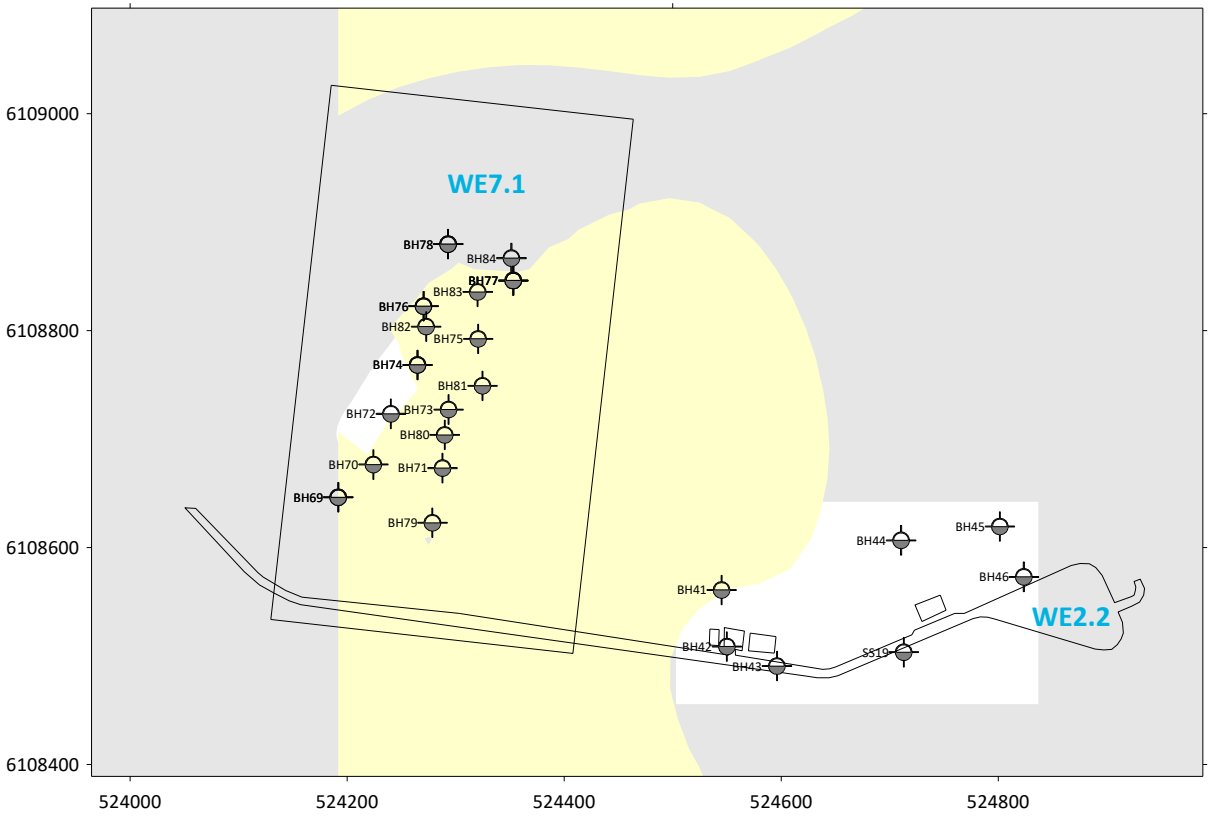
1
0.01
0.0001

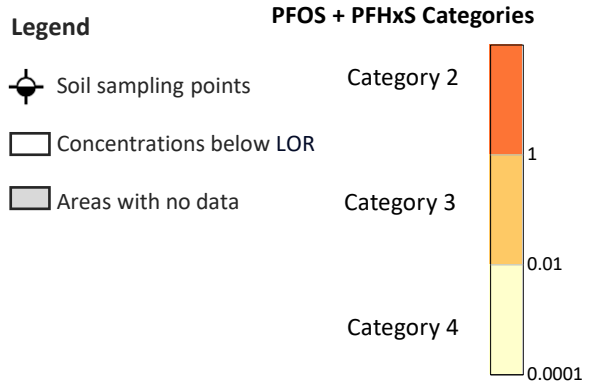


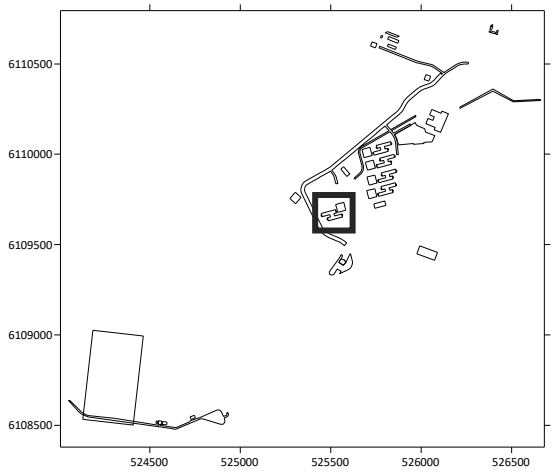
EMM
creating opportunities

BBK - PFOS + PFHxS Heat Map

WE 2.2 New EO storage
WE 7.1 New weapons range

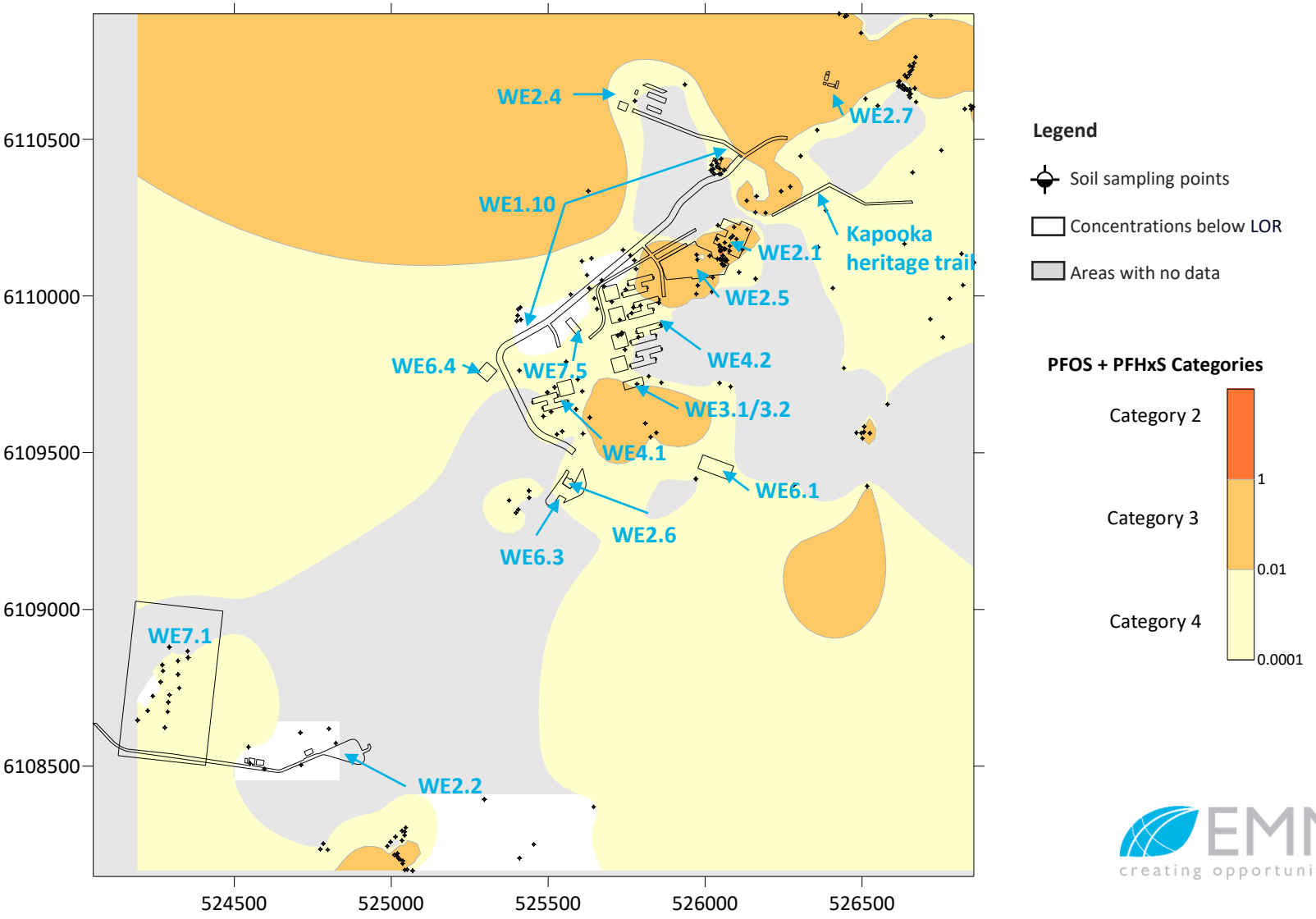






EMM
creating opportunities

BBK - PFOS + PFHxS Heat Map
Full property



EMM
creating opportunities

BBK - Areas with no data or insufficient data within footprint

- WE 1.3 Water
- WE 1.10 Ring Road and drainage swale WE 2.4 Contractors precinct
- WE 2.6 Upgrade to religious facilities
- WE 2.7 Land Management compound
- WE 3.1/3.2 HQ building
- WE 6.1 Fitness facilities
- WE 6.3 Instructor training facilities
- WE 6.4 Medical training centre
- WE 7.5 Weapon Training Simulation System – WTSS
- Kapooka Heritage trail

Attachment 3. PFAS Calculator Tool

Provided separately as electronic file – excel document

PFAS Calculator Tool

Sum PFHxS + PFOS

Source material:			
spoil volume		m3	volume of soil excavated, area x depth
bulk density		kg/m3	specific to soil type, e.g. clay loam = 1500
soil weight	0	kg	spoil volume x bulk density
Sum PFHxS + PFOS concentration		mg/kg	calculated 95% upper confidence limit (UCL), based on recent testing
PFHxS + PFOS mass in spoil	0	mg	UCL Sum PFHxS + PFOS concentration x soil weight
PFHxS + PFOS mass in spoil	0	kg	convert mg/kg to kg
Soil at reuse location:			
depth of existing PFAS contamination		m	based on recent soil testing
footprint of existing PFAS contamination within reuse area		m2	estimate of reuse area with existing PFAS contamination, based on recent testing
volume of PFAS contamination	0	m3	depth x area of footprint
bulk density		kg/m3	specific to soil type, e.g. clay loam = 1500
soil weight	0	kg	spoil volume x bulk density
Sum PFHxS + PFOS concentration		mg/kg	calculated 95% upper confidence limit (UCL), based on recent testing
PFHxS + PFOS mass in reuse area	0	mg	UCL Sum PFHxS + PFOS concentration x soil weight
PFHxS + PFOS mass in reuse area	0	kg	convert mg/kg to kg
Comparison:			
combined mass of PFHxS + PFOS after reuse	0	kg	PFHxS + PFOS mass in source material + existing PFHxS + PFOS mass at reuse location
percentage change in mass of PFHxS + PFOS	#DIV/0!	%	PFHxS + PFOS mass in spoil compared to PFHxS + PFOS mass at reuse location

*** Assess significance of percentage change in mass of PFHxS + PFOS at the reuse location.
*** Assess implications of change in PFHxS + PFOS relative to sensitive receptors at, near and down gradient of the reuse area.
*** Justify reuse of spoil relative to change in PFHxS + PFOS at the reuse location and any additional risk to receptors.
*** Consider controls, mitigation and management strategies to minimise additional risks.
*** Consider the need for ongoing monitoring to confirm conclusions regarding risks.

Appendix B

Bulk earthworks key plan (Cut and Fill)

LEGEND

- PROPOSED BUILDING PAD
- BULK EARTHWORKS PAD LEVEL
- PROPOSED MAJOR BULK CONTOUR
- PROPOSED MINOR BULK CONTOUR
- SITE BOUNDARY
- 444.50 — EXISTING CONTOURS
- EXISTING CONTOURS (MINOR)
- + BE00.000 — PROPOSED BULK EARTHWORKS LEVEL
- BELOW THE LINE ITEM
- N1 — REFER NOTE 1 FOR DETAILS

BULK EARTHWORKS CUT/FILL

-15.0 -5.0 -3.0 -2.5 -2.0 -1.5 -1.0 -0.5 0.0

CUT

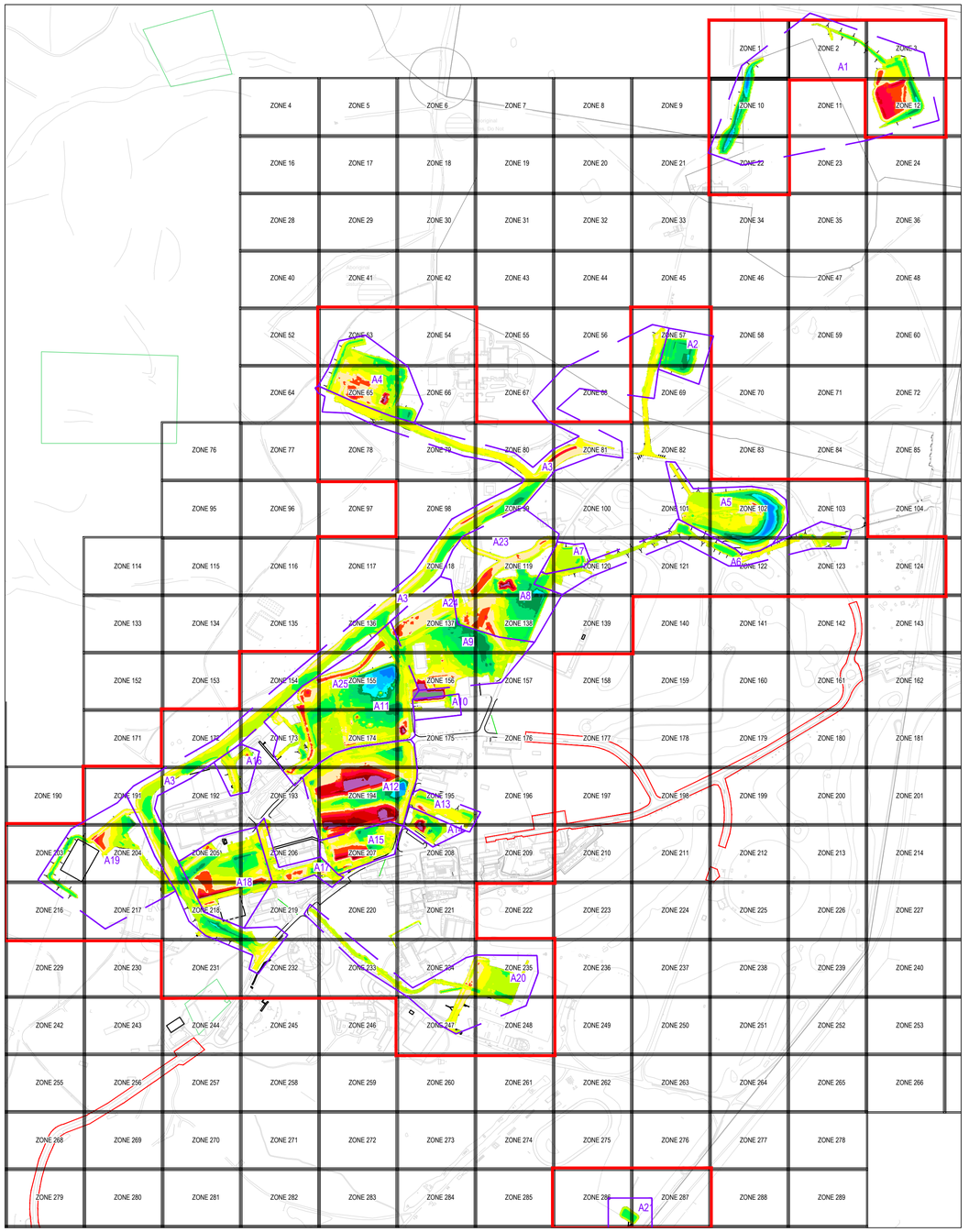
FILL

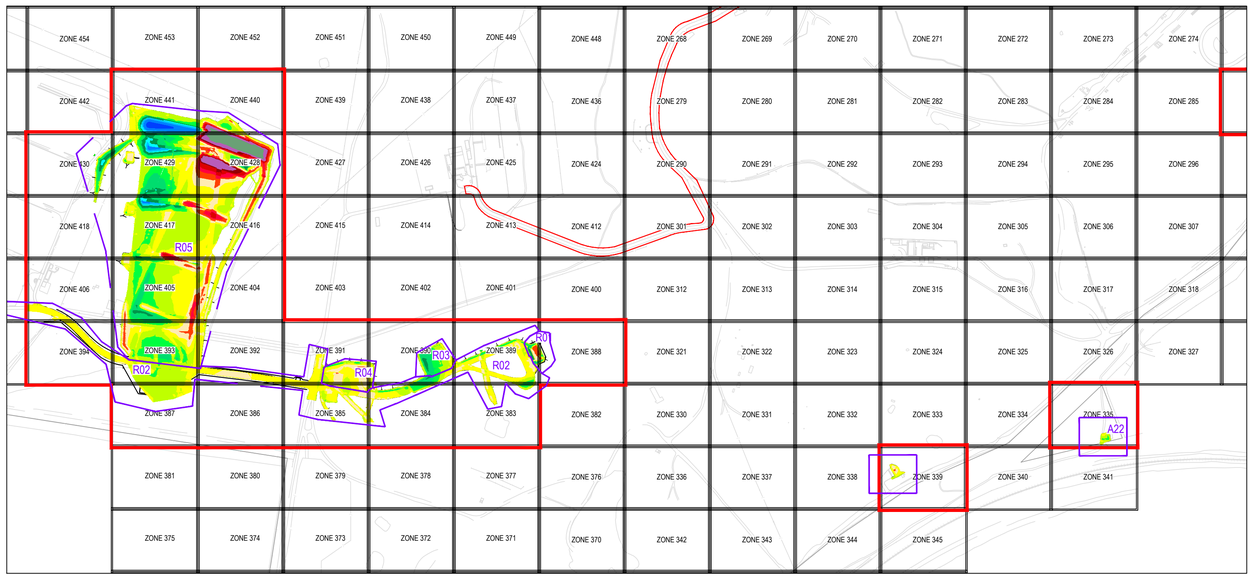
15.0 5.0 3.0 2.5 2.0 1.5 1.0 0.5 0.0

CUT/FILL BETWEEN EXISTING SURFACE (NO STRIPPING) AND DESIGN BULK SURFACE LEVEL
- BULK SURFACE CONSISTS OF THE FINISHED SURFACE MODEL WITH BOXING OF ROAD PAVEMENTS ONLY AND BUILDING CONSTRUCTION PADS

QUANTITIES

ZONE	CUT	FILL	BALANCE m3
A1	6863	7311	448
A2	0	4293	4293
A3	8753	12487	3734
A4	4253	3537	-716
A5	1384	11474	10090
A6	360	1737	1377
A7	160	843	683
A8	8426	9755	1329
A9	5264	10751	5487
A10	1033	6	-1027
A11	7213	21754	14541
A12	29057	6811	-22246
A13	615	418	-197
A14	1080	995	-85
A15	4176	1120	-3056
A16	308	100	-208
A17	1237	269	-968
A18	5177	4200	-977
A19	1587	2035	448
A20	1514	1487	-27
A21	0	428	428
A22	5	51	46
A23	104	3	-101
			13296
R01	339	311	-28
R02	4232	2605	-1627
R03	25	1760	1735
R04	1539	245	-1294
R05	44313	32606	-11707
			-12921





AMENDMENTS:

REV	DATE	REVISION DETAILS
00	12/04/2024	ISSUED FOR CONSTRUCTION
01	29/05/2024	ISSUED FOR CONSTRUCTION
02	17/07/2024	ISSUED FOR CONSTRUCTION
03	07/04/2025	ISSUED FOR CONSTRUCTION
04	16/06/2025	ISSUED FOR CONSTRUCTION
05	11/07/2025	ISSUED FOR CONSTRUCTION

PLOT DATE & TIME:

KEYPLAN:

CONSULTANT: wsp http://www.wsp.com TO BE PRINTED IN COLOUR

MANAGING CONTRACTOR: Downer Relationships creating success | CPB CONTRACTORS — Riverina Redevelopment Joint Venture

CLIENT: Australian Government Defence

DO NOT SCALE DRAWINGS.
ALL DIMENSIONS ARE TO BE VERIFIED ON SITE

DEFENCE PROJECT: RIVERINA REDEVELOPMENT PROGRAM

PROJECT LOCATION: BLAMEY BARRACKS KAPOOKA

DRAWN:	DESIGNED:	CHECKED:	APPROVED:
DP	DP	SN	SN

ISSUED FOR CONSTRUCTION

TITLE: CIVIL ENGINEERING
GLOBAL
BULK EARTHWORKS KEY PLAN

DRAWING NUMBER: RRP-BBK-GLO-WSP-CVL-DWG-20010
CONTRACT PROJECT W.E. ORG. DISC. DOC. SHEET No.

REVISION: 05

Appendix C

PFAS Calculation tool

PFAS Calculator Tool

Sum PFHxS + PFOS

Source material:			
spoil volume		m3	volume of soil excavated, area x depth
bulk density		kg/m3	specific to soil type, e.g. clay loam = 1500
soil weight	0	kg	spoil volume x bulk density
Sum PFHxS + PFOS concentration		mg/kg	calculated 95% upper confidence limit (UCL), based on recent testing
PFHxS + PFOS mass in spoil	0	mg	UCL Sum PFHxS + PFOS concentration x soil weight
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Soil at reuse location:			
depth of existing PFAS contamination		m	based on recent soil testing
footprint of existing PFAS contamination within reuse area		m2	estimate of reuse area with existing PFAS contamination, based on recent testing
volume of PFAS contamination	0	m3	depth x area of footprint
bulk density		kg/m3	specific to soil type, e.g. clay loam = 1500
soil weight	0	kg	spoil volume x bulk density
Sum PFHxS + PFOS concentration		mg/kg	calculated 95% upper confidence limit (UCL), based on recent testing
PFHxS + PFOS mass in reuse area	0	mg	UCL Sum PFHxS + PFOS concentration x soil weight
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*** Consider the need for ongoing monitoring to confirm conclusions regarding risks.

About Us

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