

Appendix H

Sampling and Analysis Quality Plans



Sampling and Analysis Quality Plan

**Jervis Bay Range Facility & HMAS Creswell
PFAS Ongoing Monitoring Program**

Department of Defence

12 March 2025

→ The Power of Commitment

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1. Introduction

Department of Defence (Defence) engaged GHD Pty Ltd (GHD) to prepare this Sampling and Analysis Quality Plan (SAQP) to support the per- and poly-fluoroalkyl substance (PFAS) Ongoing Monitoring Plan (OMP) as detailed in the PFAS Management Area Plan (PMAP) (Defence, 2020) at Jervis Bay Range Facility (JBRF) and His Majesty's Australian Ship (HMAS) Creswell (herein collectively referred to as the 'Bases'), as well as the broader Management Area. The Management Area is defined in the PFAS PMAP and refers to onsite areas of HMAS Creswell and JBRF, as well as some of the surrounding areas of Wreck Bay community lands and Booderee National Park. The Management Area has been defined based on surface water catchment areas, as the catchment areas have been demonstrated to be the primary focus areas for PFAS management associated with the Bases, and includes the Mary's Creek catchment, Flat Rock Creek catchment, Captains Lagoon catchment and a portion of the Summercloud Creek catchment. The Bases to be investigated as part of this SAQP are presented on Figure 1, Appendix A.

1.1 Objectives

The purpose of the OMP is to set out requirements for the collection of adequate data to identify and evaluate:

- Spatial, and temporal (including seasonal) variability of PFAS in the environment.
- Changes to sources, transport pathways and/or receptors, described as a conceptual site model (CSM) for the base.
- Whether risks to human and ecological receptors require review.
- The influence that risk management activities at the base, as outlined in the PMAP have had on PFAS in the environment, and whether the identified changes trigger an action and/or review.

The data collected may be used to inform where new risk management actions may be required, or to support a determination that remediation has been completed so far as reasonably practicable.

The purpose of this SAQP is to document the procedures that will be used to obtain data of sufficient quality to meet the objectives of the OMP and to facilitate the ongoing monitoring program.

1.2 Scope of works

The following scope of works are proposed to meet the objectives stated in Section 1.1:

- Develop Data Quality Objectives (DQOs) in accordance with the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended in 2013 (ASC NEPM) to ensure that field investigations and analyses are undertaken in a way that enables the collection and reporting of reliable data.
- Determine the basis of the assessment including details of the guidelines, policies and legislation that the investigation has been developed for.
- Outline the proposed sampling strategy and methodology to meet the DQOs.
- Outline the proposed analytical program and rationale for sampling.
- Define the Quality Assurance and Quality Control (QA/QC) protocols.
- Specify the reporting requirements to meet the overall project objectives.

Additional sampling locations have been included in this SAQP, in addition to those detailed in the OMP. These are detailed with rationale in Section 4.1

1.3 Guidelines and legislation

This SAQP has been developed with reference to the following guidelines and legislation:

- Australian and New Zealand Guidelines (ANZG) (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality.
- Department of Defence (2018, amended 2021). *Contamination Management Manual – Annex L Data Management*.
- Department of Defence (2018, amended 2021). *Contamination Management Manual – Annex K Management of PFAS Contamination*.
- Department of Defence (2022). *PFAS Investigation and Management, Guidance Document E Standard PFAS Analytical Suite*.
- Department of Health (DoH) (2017). *Health Based Guidelines Values for PFAS for use in site investigation in Australia*.
- Heads of Environmental Protection Authorities (HEPA) (2020). *PFAS National Environmental Management Plan (NEMP), Version 2.0* (HEPA, 2020).
- National Environment Protection Council (NEPC) (1999, amended 2013). *National Environment Protection (Assessment of Site Contamination) Amendment Measure (NEPM) (No. 1)*.
- National Health and Medical Research Council (NHMRC) (2019). *Guidance on PFAS in Recreational Water*.
- Standards Australia (1998). *AS/NZ 5667:1998 Water Quality – Sampling*.

1.4 Limitations

This report has been prepared by GHD for Department of Defence and may only be used and relied on by Department of Defence for the purpose agreed between GHD and Department of Defence as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than Department of Defence arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

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2. Site and environmental setting

2.1 Site details

A summary of the site identification details is provided in Table 1 and the site locality is shown on Figure 1, Appendix A.

Table 1 Site identification summary

Information	Details
Street Address	JBRF accessed off Jervis Bay Road, Jervis Bay, JBT 2540. HMAS Creswell accessed off College Road, Jervis Bay, JBT 2540.
Latitude and Longitude	Approximate centre of JBRF runways: -35.145799, 150.696237. Approximate centre of HMAS Creswell Base: -35.128741, 150.706023.
Site Area	JBRF is approximately 313 hectares (Ha), and HMAS Creswell is approximately 274 Ha.
Military Area (Property ID)	Jervis Bay – HMAS Creswell – ACT_0020. – JBRF – ACT_0021.
Local Government Area	Jervis Bay Territory.
Traditional custodians	Koori people, now primarily represented by the Wreck Bay Aboriginal Community.
Current Land Use	HMAS Creswell is an active Royal Australian Navy (RAN) base and training facility (including on-site accommodation and offices), and JBRF is an active airfield and training facility with associated infrastructure.
Surrounding land use	Land uses surrounding the JBRF and HMAS Creswell facilities include the following: – North: To the north of JBRF is Booderee National Park (BNP) and Jervis Bay Village¹ is followed by HMAS Creswell. To the north of HMAS Creswell is Jervis Bay (including Jervis Bay Marine Park (JBMP)), Hyams Beach (and village) and Vincentia residential areas. – East: Bushland of BNP (including Telegraph Creek, Green Patch and Iluka camping grounds), beyond which is the Pacific Ocean. – South: To the south of HMAS Creswell is Jervis Bay Village¹ and an area of BNP, followed by Jervis Bay Road and JBRF. Wreck Bay community lands and Wreck Bay Village residential area lie south of JBRF. This area belongs to the Wreck Bay community and is referred to herein as the 403 lands. – West: Bushland of BNP², including Lake Windermere (potable water supply) and Lake McKenzie, Caves Beach, Bherwerre Barrier, beyond which is the estuary of St George's Basin.

Table Notes:

1 - Jervis Bay Village is a residential community with a primary school, police station, local store and the offices of WBACC, BNP and Jervis Bay Territory Administration (JBTA).

2 - Wreck Bay Aboriginal Community Council (WBACC), own the lands, which are leased and managed by BNP.

2.2 Environmental setting

Table 2 provides a summary of the sites environmental setting, with further detail provided in various GHD reports (see Section 6).

Table 2 Environmental setting summary

Item	Description
Climate	The Jervis Bay region has an oceanic climate, with the Bases located on a coastal peninsula. The following was recorded at JBRF airfield station (ID 068264 - 2018 to January 2025): – Temperature: generally moderate, with the mean maximum temperature ranging from 16.6 °C to 25.3 °C – Rainfall: generally evenly spread throughout the year, with mean monthly rainfall ranging between 78 to 208 mm. The highest volume of rainfall typically occurring between March and July. – Wind direction is variable, both daily (morning and afternoons) and seasonally, with no discernible primary wind direction.
Topography and site drainage	JBRF and HMAS Creswell are located on the southern peninsula of Jervis Bay Territory. The JBRF airfield is located on the ridgeline known as the Bherwerre Peninsula at an elevation of approximately 50 m Australian height datum (m AHD). HMAS Creswell is located on a headland between Hyams Beach and Captains Beach at an elevation of approximately 30 m AHD, on the foreshore of Jervis Bay. Surface water runoff from JBRF and HMAS Creswell is generally likely to flow into natural features such as creeks and lagoons via open shallow drains and underground culverts (discussed further under 'hydrology').
Hydrology	Surface water flows at the site are noted to be complex, and variable in flow regime based on topographic and temporal changes. There is estimated to be over 20 different small catchments and creek lines, with JBRF located at the top of the catchment area on the plateau. Runoff from JBRF that travels to the north flows into Jervis Bay via incised valley creeks through HMAS Creswell from two main drainage catchments (Flat Rock Creek and Captains Lagoon). JBRF also drains southwards via Mary Creek into Wreck Bay. Summercloud Creek is located to the east of Mary Creek and drains to Summercloud Bay. These creeks are characterised by a series of swamps and wetlands, where standing water is often present. Approximate surface water catchment areas are shown on Figure 2 in Appendix A. It is noted that surface water flows through wetland areas, as well as through the Clay Pools (also referred to as 'the unnamed pools') located south-west of JBRF runways adjacent to the south-western site boundary, are challenging to characterise and are therefore not well understood.
Soil landscape	Although the Office of Environment and Heritage has developed soil and landscape maps for many parts of NSW and ACT, there are no soil and landscape maps currently available for the Jervis Bay area. The natural soil encountered within the site during the DSI (GHD, 2019) was generally dominated by brown/grey sands, sandy clay and clayey sands (Pleistocene sediments and Holocene sediments). Most investigation locations encountered bedrock from near surface to depths of 2.5 m below ground level (m bgl).
Acid sulfate soils (ASS)	With reference to <i>The Land and Water Conservation Acid Sulfate Soil Risk Map</i> (1997), Huskisson (Tulau, M.J., 1997a) and <i>Sussex Inlet</i> (Tulau, M.J., 1997b), JBRF and HMAS Creswell are described as follows in relation to ASS: – JBRF: no known occurrences of ASS materials, and land management activities are not likely to be affected by ASS materials. – The main base areas of HMAS Creswell: no known occurrences of ASS, however there is the potential for ASS to be present around Flat Rock Creek and Captains Lagoon: • The Flat Rock Creek area and the north-west of the former golf course: a low probability of ASS, with ASS potentially found in an estuarine/back swamp environment and at near surface (between 0 to 1 m bgl). • Captains Lagoon: high probability of ASS in the bottom sediments, and there may be a severe environmental risk if bottom sediments are disturbed by activities such as dredging. The map also describes the area surrounding the lagoon as having a low probability of

Item	Description
	ASS. These are described as originating from both estuarine and aeolian environments, and potentially found at depths of up to 1 m bgl.
Geology	With reference to the <i>Geoscience Map of Jervis Bay Territory and Beecroft Peninsula</i> (1:25,000) (Abell, R.S., 1992), both JBRF and HMAS Creswell are underlain by the following geological units: – Quaternary, Holocene sediments – Grey-white and yellow-light brown sand. – Quaternary, Pleistocene sediments – Pale grey leached quartz sand veneering yellow-brown feldspathic sand with podzolic soil profiles. – Tertiary, Ferruginous quartz gravel. – Tertiary, White kaolinitic clay - weathered Permian dolerite. – Late Permian, Porphyritic dolerite - dykes and sills. – Early Permian, Snapper Point Formation (known locally as the Jervis Bay Sandstone, or Snapper Rock) – Quartz pebbly sandstone and minor conglomerate. Exposed sandstone and conglomerate can be observed in sections of JBRF and around the upper catchment of Mary Creek. The geology encountered during the DSI (GHD, 2019) was consistent with the published information above. Fill material, comprising both imported and re-worked natural material, was also encountered predominantly around the JBRF facility.
Hydrogeology	Based on the results of the DSI (GHD, 2019) and SEI (GHD, 2022a) reports, the following terminology has been adopted to describe the hydrogeological units identified at the Base: – ‘upper aquifer’ - unconfined and includes Pleistocene and Holocene sediments and the upper weathered and highly fractured portion of the Permian sandstone bedrock. Considered to be recharged by rainfall that subsequently discharges to down-gradient wetland systems and surface water. Tidally-influenced in coastal areas of HMAS Creswell. – ‘lower aquifer’ - comprises the deeper, more competent bedrock of the Permian sandstones. It behaves as a fractured rock aquifer where groundwater flow is controlled by secondary features i.e. joints, faults and primary features such as bedding planes. Groundwater modelling and interpolated contours indicate an upward head gradient from the lower aquifer to the upper aquifer in coastal areas of the Base, particularly in the vicinity of Flat Rock Creek. Groundwater flow for both aquifers is generally consistent with the topography, with highest groundwater elevations near the RAN School of Ship Survivability and Safety (RAN SSSS). Groundwater flow in the upper aquifer is radial predominantly to the north, west and south, with an easterly component towards Captains Lagoon at HMAS Creswell, and is inferred to discharge to surface water features. The upper and lower aquifers are connected; however: – The reduced hydraulic conductivity of the lower aquifer relative to the upper aquifer means that groundwater flow will occur preferentially through the upper aquifer. Contaminant migration would therefore generally be restricted in the lower aquifer, except where bedrock fracturing might provide a preferential migration pathway. – The upper aquifer is not expected to be hydraulically connected to Lake McKenzie and Lake Windermere to the west of the site. – Results from some investigation locations were indicative of perched groundwater at JBRF. However, the occurrences were isolated and discontinuous.
Groundwater and surface water use	JBRF, HMAS Creswell and Wreck Bay Village are supplied with mains water from the Jervis Bay Water Treatment Plant (WTP) located east of RAN SSSS, which sources water from Lake Windermere. The supply pipe and distribution pipes are predominantly underground, and traverse Booderee National Park and JBRF to/from the WTP. GHD conducted a community survey in July 2017 (GHD, 2017) regarding groundwater and surface water use, with the following results: – All respondents use mains supplied water for drinking purposes. – No groundwater wells were reported, recorded or licenced for potable abstraction. – On occasion, some members of the community use surface water for drinking and recreational (swimming) purposes.

Item	Description
Ecology	Terrestrial ecology JBRF and HMAS Creswell is surrounded by Booderee National Park. Open forest and woodland comprise the majority of vegetation at HMAS Creswell (55.4% of the site). JBRF has been described as predominantly dry heath scrubland (45.7% of the site), with wet heath/sedgeland, ponds, wetlands and maintained areas comprising 33.1% of the area (SKM, 2006). GHD undertook an ecological assessment of the site in March 2021. A total of 79 terrestrial vertebrate species were recorded across the site, including threatened and migratory species. Aquatic ecology Generally speaking, aquatic habitat is limited within the footprint of JBRF and HMAS Creswell Bases. The Clay Pools directly south of JBRF are home to a large population of eastern long neck turtles, as well as dense communities of rushes and sedges. The area contains permanent water, and so also contains a variety of macroinvertebrates such as dragonflies, caddisflies and water skaters. HMAS Creswell is located within a Special Purpose Zone of the JBMP, which supports a wide variety of landforms and aquatic habitats. The region supports over 230 algae, hundreds of invertebrate species, over 210 reef fish species, sharks, rays, many marine mammals, birds and reptiles, including several threatened species.
Heritage	Jervis Bay has a long history of indigenous Australian settlement. The Aboriginal community of Wreck Bay is located south of JBRF, and the Jervis Bay area is of high heritage and cultural significance to this community. Booderee is home to the Yuin and Koori people of Wreck Bay. The Wreck Bay settlement was established by Koori people in the early 1900s. Koories favoured the area because of strong traditional and cultural ties, proximity to both the bush and the sea for the collection of food and other resources, and distance from non-Aboriginal settlements (Renwick, 2000).

2.3 Conceptual site model

The conceptual site model (CSM) is presented in the PMAP which summarised the linkages between sources, exposure pathways and receptors. Further assessments of risk exposure pathways are presented in the DSI (GHD, 2019a), HHERA (GHD, 2019b) and the ERA (GHD, 2020a).

2.3.1 Sources

The CSM identified several sources of PFAS which was divided into two distinct groups:

- Primary sources of PFAS: identified as areas of PFAS contamination where aqueous film forming foam (AFFF) was used or stored, for example, a fire training area.
- Secondary sources of PFAS: identified as areas containing an accumulation of PFAS contamination in the environment, such as in soil, sediment, groundwater or surface water, which has migrated from a primary source area.

The PFAS source areas have been identified through previous investigations, including the DSI (GHD, 2019a) and Supplementary DSI (GHD, 2020b). These potential source areas are referred to as areas of environmental concern (AECs) and have been identified in Table 3 below and Figure 2, Appendix A.

Table 3 Summary of identified PFAS source zones associated with the management area

AEC	Base area	Area activity	Historic / ongoing source?	Catchment / Inferred discharge area ¹
AEC A	JBRF	RAN SSSS – Used for fire training exercises, which have historically used AFFF containing PFAS.	Historic, with ongoing secondary sources from impacted environmental media.	– Captains Lagoon – Mary Creek
AEC B	JBRF	Wetland areas downgradient of the RAN SSSS, prior to the site boundary. Receiving water body for PFAS impacted surface water runoff, which has acted as a 'sink' and now secondary source area for PFAS impacts.	Historic, with ongoing secondary sources from impacted environmental media.	– Mary Creek
AEC C	JBRF	Former Fire Training Area (FFTA), now the parachute training school – Historically used for fire training exercises, which used and stored AFFF containing PFAS. A portion of this area is occupied by the new Helicopter Aircrew Training System (HATS) facility.	Historic, with ongoing secondary sources from impacted environmental media.	– Captains Lagoon – Flat Rock Creek
AEC D	JBRF	Former hanger building - a former building that was reportedly 'exploded or demolished', and it was assumed that legacy AFFF may have been used in an emergency situation as a fire suppressant.	Historic, with potential ongoing secondary sources from impacted environmental media.	– Captains Lagoon
AEC H	JBRF	Former hydrocarbon drum disposal area 'South of Kalkarra Pad' (previously remediated) – PFAS not assessed during remediation works for the area, however waste products may have been associated with former firefighting activities at JBRF.	Historic.	– Flat Rock Creek
-	JBRF	Remaining areas of JBRF not associated with an AEC, which are shown to contain PFAS in soils and surface water from legacy AFFF disposal areas.	Ongoing secondary sources from impacted environmental media.	– Captains Lagoon – Flat Rock Creek
AEC E	HMAS Creswell	HMAS Creswell former golf course - Currently irrigated using treated effluent, which contains PFAS.	Ongoing.	– Flat Rock Creek
AEC F	HMAS Creswell	HMAS Creswell Fire Station – historic storage and use of AFFF containing PFAS for firefighting and training purposes.	Historic, with ongoing secondary sources from impacted environmental media.	– Flat Rock Creek
AEC G	HMAS Creswell	HMAS Creswell Sewage Treatment Plant - processes wastewater from all of JBT, including wastewater originating from JBRF.	Ongoing.	– Captains Lagoon
-	HMAS Creswell	Remaining areas of HMAS Creswell - Currently irrigated using treated effluent, which contains PFAS.	Ongoing.	– Flat Rock Creek – Captains Lagoon

Table Notes:

1 – Inferred discharge area for both surface water and groundwater.

2.3.2 Migration pathways

PFAS can travel from a source to human or environmental receptors via transport pathways, such as surface water, groundwater and stormwater. The primary transport pathways of PFAS from the above source areas are via groundwater and surface water pathways. The PFAS migration pathways at the Bases and surrounding management area can be summarised as:

- Surface runoff containing PFAS contaminated water and sediment, along established surface drains and informal drainage routes (including wetland areas).
- Vertical migration from soil (and to a lesser extent, concrete) to groundwater.
- Migration of groundwater to a discharge area, including standing water bodies, creeks and wetland areas.
- Sewage infrastructure that links JBRF to the STP at HMAS Creswell - effluent, groundwater and surface water from fire training grounds can enter sewers and migrate rapidly via this mechanism, effectively short circuiting slower groundwater migration.
- Active distribution of PFAS impacted waters via effluent irrigation system.

Other catchment areas in or adjacent to the Management Area that do not contain any identified AECs and are not identified in Table 3 are:

- Telegraph Creek.
- Summercloud Creek.
- Lake McKenzie and Lake Windermere Catchments.

2.3.3 Receptors and risk

The following potential receptors associated with the catchment area include:

- Human health:
 - JBRF and HMAS Creswell personnel and site users (including intrusive maintenance workers).
 - Booderee National Park workers and recreational users (off-site).
 - Residents of Jervis Bay village and Wreck Bay village (off-site).
- Ecology and environment:
 - On and off-site terrestrial ecological receptors (flora and fauna).
 - On and off-site groundwater and surface water aquatic ecology (flora and fauna).
- Human health:
 - Wreck Bay residence.
 - JBRF and HMAS Creswell personnel and site users (including intrusive maintenance workers).

Potentially elevated risk associated with PFAS contamination from the Base to receptors as identified in the HHRA (GHD, 2019b) and ERA (GHD, 2020a) can be summarised as:

- Human health:
 - Drinking surface water from Mary Creek by Wreck Bay community members.
 - Recreational use of Mary Creek by Wreck Bay community members.
 - Consumption of aquatic invertebrates from Mary Creek by Wreck Bay community members.
 - Consumption of terrestrial mammalian offal by Wreck Bay community members.
 - Consumption of aquatic invertebrates from Flat Rock Creek and Captains Lagoon by recreational users of Booderee National Park.
 - Consumption of finfish from Captains Lagoon by recreational users of Booderee National Park.

- Ecological health (refer to the ERA (GHD, 2020a) for specific ecological exposure groups):
 - JBRF: food chain exposure for terrestrial and aquatic higher-order birds, aquatic mammals (headwaters of Mary Creek only), reptiles and amphibians. Direct contact for flora and fauna in aquatic environments associated with Mary Creek headwaters.
 - HMAS Creswell: food chain exposure for reptiles and amphibians. Direct contact for flora and fauna in aquatic environments.
 - Captains Lagoon: food chain exposure for middle-order birds, mammals, reptiles and amphibians. Direct contact for flora and fauna in aquatic environments.
 - Flat Rock Creek: food chain exposure for lower-order birds, and reptiles and amphibians. Direct contact for flora and fauna in aquatic environments.
 - Mary Creek: food chain exposure for middle-order birds, mammals, reptiles and amphibians. Direct contact for flora and fauna in aquatic environments.

In addition to the potentially elevated risks identified in the HHRA/ERA outlined above, investigations undertaken since the HHRA and ERA have identified the following 'unknown', 'possible' or 'likely' SPR linkages that warrant or potentially warrant further investigation:

- Migration of impacted soils and/or sediments in runoff to the Clay Pools, and subsequent direct contact or ingestion and bioaccumulation by Wreck Bay community members.
- Surface water migration to discharge area, and subsequent direct contact or ingestion, and bioaccumulation by Residents of Jervis Bay village (off-site).
- Active distribution of PFAS impacted waters via sewerage network and/or effluent irrigation system, and subsequent direct contact or ingestion, and bioaccumulation by BNP workers and recreational users (off-site), residents of Jervis Bay village and Wreck Bay village (off-site), and on and off-site ecological receptors.
- Direct contact or ingestion of impacted groundwater onsite, and bioaccumulation by onsite ecological receptors.
- Groundwater migration to discharge areas, and subsequent direct contact or ingestion, and bioaccumulation by Booderee National Park workers and recreational users (off-site).

3. Data quality assessment

3.1 Data quality objectives

The Data Quality Objective (DQO) process is an iterative planning approach used to define the type, quantity and quality of data that is needed to inform decisions relating to the environmental condition of a site. The seven step DQO process:

- Clarifies the study objective.
- Defines the most appropriate collection of data as relevant to the study objective.
- Determined the conditions from which to collect data.
- Specifies tolerable limits on decision errors, which will be used as the basis for establishing the quantity and quality of data, needed to support the decision.

The DQOs for monitoring are presented in Table 4. They have been prepared in line with the DQO process as outline in the ASC NEPM (Schedule B2) (NEPC, 2013).

Table 4 Data quality objectives

Process	Description
Step 1: State the problem	The Bases have legacy PFAS contamination in a range of environmental media, at concentrations which may pose an unacceptable risk to some human health and ecological receptors. Management measures (including remediation works) are therefore required to mitigate the identified potential risks. The overarching project objective is to transition the Bases from investigation and management under the PMAP (specific to PFAS management) to ongoing monitoring as per standard Defence protocols. The 'problem' as it stands is that a robust, site wide data set is required to meet both the objectives outlined above. Specifically, assessment of temporal changes in PFAS concentrations are required to assist in informing management measures instigated at the Bases, and to justify transition to standard monitoring protocols. This will allow (if required) the update and refinement of the CSM, human health and ecological risk assessment and inform management decisions by Defence and state agencies.
Step 2: Identify the decision/goal of the study	This OMP is aimed at resolving the following broad principal study questions: 1. What are the changes and trends in the nature, extent and magnitude of PFAS concentrations in the groundwater and surface water within the Management Area? 2. Has the nature, extent and magnitude of PFAS concentrations changed significantly to warrant a revision of the HHRA and/or ERA? 3. Has the nature, extent and magnitude of PFAS concentrations changed significantly to warrant refinement of any existing management measures?
Step 3: Identify the information inputs	The following inputs are required to resolve the principal study questions outlined in Step 2, and confirm that the conclusions of the HHRA and ERA remain valid: – PFAS concentrations in groundwater, surface water and sediment from previous and future monitoring events. – Field data (i.e. groundwater standing water levels, physio-chemical parameters, flow, colour and turbidity) on groundwater, surface water and field descriptions of sediment. – Weather conditions preceding sampling events, particularly rainfall events. – Site status and land use scenarios and whether these have changed. – An appropriate statistical evaluation of the data including short and long term trends, in particular for surface water and groundwater concentrations (where there are sufficient data points). – Comparison of data sets to relevant endorsed assessment levels (Refer to Section 4.5).
Step 4: Define the boundaries of the study	The spatial boundaries of the study are identified as the lateral extent of the PFAS Management Area. The timeframe for the study is three years from implementation of the OMP, after which the OMP will require formal review (noting an annual general review is also required). Data collected from previous OMP events and site investigations will also be included as part of this investigation. The frequency of the sampling is defined in Section 4.

Process	Description
Step 5: Develop the analytical approach/decision rules	The analytical and field data will be used to assess changes to the nature, extent and magnitude of PFAS in surface water, groundwater and sediment to broadly assess the effectiveness of implemented management measures. Two approaches will be used: – Step 1 – Tier 1 screening assessment: The analytical data will be compared to the relevant assessment levels presented in Section 4.5 including consideration of laboratory error margins. – Step 2 – Trend and site wide population assessment: new data will be compared to the concentrations recorded during prior monitoring events to evaluate changes at individual locations and in population groups defined by catchment area and the location in source, pathway or receptor zones. The overall assessment objective is to determine if there is a change in the site risk profile, and whether revision of the HHRA / ERA or implemented management measures is warranted. Specifically, this includes the following decision outcomes: – If concentrations of PFAS demonstrate discernible increasing trends and/or new data is outside of the existing population data set, trigger actions as outlined in the OMP shall be considered. – If concentrations of PFAS demonstrate stable or declining trends, meet the OMP cessation trigger, and do not pose any unacceptable risks to identified receptors, then no further action is required other than to complete the period of monitoring specified.
Step 6: Specify performance or acceptance criteria	The potential for significant decision errors will be minimised by completing a robust data validation (quality assurance / quality control [QA/QC]) program in accordance with the requirements of the OMP (and any subsequent SAQPs). Data quality indicators (DQIs) will be applied to assess the usability of the data prior to making decisions, based on precision, accuracy, representativeness, comparability and completeness. The ASC NEPM (NEPC, 2013) and PFAS NEMP (HEPA, 2020) details the various metrics that can be used to assess data in terms of these DQIs, and the adopted DQIs for this investigation are defined in Section 3.2. If detections of PFAS are reported in field blanks or rinsate blanks, then consideration of potential for cross contamination between sample locations and what impact this has on conclusions of trends is required.
Step 7: Develop the plan for obtaining data	The OMP provides guidance for preparing a SAQP that is required for each monitoring event, including scope of work, sampling methodologies, monitoring locations and PFAS assessment levels. The SAQP should be developed in response to the principal study questions outlined in Step 2, to meet these DQOs, and to comply with the monitoring plan outlined in the OMP. To maintain the integrity and reliability of data the following measures should be adopted: – Field and analytical data are collected in accordance with the PFAS NEMP (HEPA, 2020) and the ASC NEPM (NEPC, 2013). – Field personnel should be trained and have sufficient experience to complete the fieldwork to an acceptable standard, as per the protocols outlined in the OMP / SAQP. – Robust field and laboratory quality assurance/quality control protocols are to be adopted, outlined in the SAQP. – Use laboratories that are National Association of Testing Authorities (NATA) accredited for PFAS analysis and ensure laboratory limits of reporting (LORs) are suitable to meet the relevant adopted assessment levels outlined in Section 4.5. This SAQP is intended to meet the requirements of the OMP and provides the methods that shall be used to obtain data of sufficient quality.

3.2 Assessment of data quality

The acceptance criteria for DQIs are based on the DQOs outlined in Section 3.1 and are provided in Table 5.

Table 5 DQI acceptance criteria

DQI	Acceptance criteria
Field QA/QC	
Field program	Fieldwork is to be undertaken by suitably experienced field staff in accordance with the sampling procedures outlined in this SAQP.
Rinsate blank samples (where sampling equipment is reused)	Rinsate blank samples should be collected at a rate of one per day of monitoring and analysed for PFAS. The concentration of PFAS should be less than the laboratory LOR.
Trip blank samples	Trip blank samples for PFAS should be submitted to the laboratory at a rate of one per batch. The concentration of PFAS should be less than the laboratory LOR.
Intra- and inter-laboratory duplicates	Intra- and inter-laboratory duplicates are each to be collected and analysed at a rate of 1 in 10 primary samples. The relative percentage differences (RPDs) are to be calculated for all primary and field duplicate pairs and will be considered acceptable based on the following RPD limits: - 200% for concentrations within 1 to 10 times the analyte LOR. - 50% for concentrations within 10 to 30 times the analyte LOR. - 30% for concentrations greater than 30 times the analyte LOR.
Laboratory QA/QC	
Laboratory duplicates	Laboratory duplicate sample RPDs are to be less than: - 20% for high level concentrations (i.e. greater than 20 times the analyte LOR). - 50% for medium level concentrations (i.e. between 10 and 20 times the analyte LOR).
Matrix spikes	Matrix spike recoveries are to be in the range of 70 to 130% of the theoretical recovery or as nominated in the laboratory's QC report.
Method blanks	Method blank samples are to have a concentration less than the laboratory LOR.
Laboratory control samples	The recovery of laboratory control samples are to be within the laboratories' specified range for the particular analyte or analytical suite.

4. Sampling rationale and methodology

4.1 The OMP

The OMP (Defence, 2020) outlines the requirements for the monitoring works to be undertaken and provides the basis for the preparation of this SAQP. With consideration that this is the fifth year of monitoring, a continuation of existing monitoring schedule is adopted. This SAQP is for the first of the 2025 biannual events (Autumn), the Spring event will be undertaken in October.

The scope of works presented in this SAQP is consistent with that presented in the OMP with the exception of the following updates.

Table 6 *Deviations from OMP*

Location	Deviation	Rationale
0020_MW001	Update to sampling location (rather than gauging only).	Boundary location and mass flux transect (Lower Flatrock Creek).
0020_MW008	Add location to OMP.	Mass flux transect (Lower Flatrock Creek).
0020_MW052		PFAS characterisation on groundwater flow divide.
0020_MW055		Mass flux transect (Lower Captains Lagoon).
0020_MW056		
0020_MW057		
0020_MW058		
0020_MW059		Mass flux transect (Lower Flatrock Creek).
0020_MW068		
0020_MW104	Update to sampling location (rather than gauging only).	Insufficient data collected at this location previously to establish baseline conditions.
0020_MW108	Add location to OMP.	Mass flux transect (Lower Flatrock Creek).
0020_SW054		Pathway - AEC F and AEC to Flat Rock Creek.
0020_SW057		Pathway - Jervis Bay village to Captains Lagoon.
0021_MW018		Boundary well to BNP.
0021_MW020		Boundary well to Clay Pools.
0021_MW021		Boundary well to Lakes catchment area.
0021_MW060		Mass flux transect - AEC B.
0021_MW061		Added in April 2024 by AECOM Within proposed remedial area of AEC A.
0021_MW062		Added in April 2024 by AECOM. Within proposed remedial area of AEC A.
0021_MW063		Mass flux transect - AEC A.
0021_MW064		
0021_MW065		
0021_MW070		
0021_MW071		Mass flux transect - AEC B.
0021_MW072		
0021_MW127		
		Mass flux transect - Upper Captains Lagoon.

Location	Deviation	Rationale
0021_MW134		
0021_MW150	Update to sampling location (rather than gauging only).	Source zone - AEC A. The depth of this location is 5 m bgl, screened in sandstone bedrock. Location required to assess vertical distribution.
0021_MW153	Update to sampling location (rather than gauging only).	Source zone - AEC A - rock. The depth of this location is 5 m bgl, screened in sandstone bedrock. Location required to assess vertical distribution.
0021_MW160	Add location to OMP.	Boundary well to the lakes catchment area.
0021_MW163		Mass flux transect - Upper Flat Rock Creek, and boundary location.
0021_MW164		Potential source area - wider JBRF, upgradient of Flat Rock Creek.
0021_SD011		Assess potential changes to Mary Creek at site boundary.
0021_SD188		Receptor environment - clay at Summercloud creek used for ceremonial purposes.
0021_SW012	Include as sampling location.	Upstream of 0021_SW153 and included to supplement dataset alongside 0021_SW153 (noting that access to 0021_SW153 may be limited during the monitoring due to construction works).
0021_SW153	Add location to OMP.	Added in 2024 by AECOM.
0021_SW188		Receptor environment - seepage of groundwater at Summercloud creek.
0021_SW211		New location - Receptor environment, more practical than SW051.
0021_SW212		New location – Bherwerre Barrier, to supplement dataset when no access to 0021_MW115 due to flooding.
0021_MW131	Update to sampling location (rather than gauging only).	Boundary location and mass flux transect (Lower Flatrock Creek).

A summary of the number of locations to be included in this event is provided in Table 7. All monitoring locations are presented on figures in Appendix A and tabulated in Appendix B. It is noted that off-site monitoring locations will require the agreement of the WBACC and Booderee National Parks prior to the monitoring event.

Table 7 *Number of monitoring locations*

Media	Total number of locations
Groundwater	86
Surface water	78
Sediment	64
Tanks (OTH)	6
<i>Total # locations</i>	234

4.2 Sample collection and handling

4.2.1 Groundwater sampling

The groundwater sampling methodology is presented in Table 8.

Table 8 Groundwater sampling methodology

Item	Description
Technical guidelines	Australian Standard 5667:1998 <i>Water Quality – Sampling, Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples</i> (AS 5667.1:1998). Australian Standard 5667:1998 <i>Water Quality – Sampling, Part 11: Guidance on the Sampling of Groundwaters</i> (AS 566.11:1998). ASC NEPM (NEPC, 2013). PFAS NEMP (HEPA, 2020).
Field screening and gauging	The monitoring wells will be gauged in each monitoring well prior to collection of groundwater samples using a decontaminated oil/water interface probe to measure standing water level (SWL) and assessed for the potential presence of LNAPL (light non-aqueous phase liquid) and DNAPL (dense non-aqueous phase liquid). In addition, the base depth of the monitoring wells will be measured. Depth measurements will be referenced to the top of well casing as an established datum.
Field chemistry and sampling	A groundwater sample will be collected from each well using no-purge methodology with HydraSleeves™, which will be installed within the screened interval of the wells. New HydraSleeves™ will be used for biannual sampling event. It is noted that prior to the initial sampling round, or when HydraSleeves™ must be re-deployed, the HydraSleeves™ will need to be installed in the well before sampling for a minimum of: – 4 hours when deployed with bottom weights only. – 24 hours when deployed with top and bottom weights. The timeframes outlined above are to allow for re-stabilisation of the standing water level in the well following a disturbance. Care should be taken to avoid placing the base of the HydraSleeves™ at the base of the monitoring well, where a build-up of sediment may be present. The installation depth of the HydraSleeves™ is to be recorded (generally as HydraSleeve™ collar depth in mbTOC). During the monitoring event, if a groundwater well is found to not contain a HydraSleeve™ the procedure is as follows: – If time or access restraints are present, a sample will be collected using a dedicated, disposable high-density polyethylene (HDPE) bailer. It is noted that in this instance, a minimum of three well volumes should be removed and water removal continued until stabilisation of water quality parameters is achieved. If recharge is insufficient and there is a risk of the well becoming dry, a sample can be collected prior to this. – If there are no time or access restraints, the HydraSleeve™ will be re-deployed and the minimum timeframes outlined above, depending on deployment set up, will need to be achieved before sampling. Field parameters (pH, electrical conductivity (EC), oxygen redox potential (redox), dissolved oxygen (DO) and temperature) will be measured and recorded for all groundwater locations prior to sample collection. In addition, observations of water quality such as the colour, turbidity level, and the presence/absence of odour or sheen will be recorded. Retrieved groundwater samples will immediately be filled from the HydraSleeve™ into laboratory supplied containers suitable for the requested analyses. The sample containers will be labelled with the job number, sample identification and date collected.
Decontamination	Prior to and following the collection of each groundwater sample, all non-disposable sampling equipment will undergo decontamination including: – Washing of equipment with phosphate/PFAS-free detergent (Liquinox) and/or – Rinsing of equipment with laboratory supplied PFAS-free water.
Quality assurance and quality control (QA/QC)	The following field QA/QC samples will be collected and analysed for PFAS (standard suite) as part of the groundwater sampling program: – One intra-laboratory duplicate per ten primary samples. – One inter-laboratory duplicate per ten primary samples. – One rinsate sample per day of sampling. – One trip blank per batch.

4.2.2 Surface water sampling

The surface water sampling methodology is presented in Table 9, which will be used for the biannual OMP event.

Table 9 Surface water sampling methodology

Item	Description
Technical guidelines	Australian Standard 5667:1998 <i>Water Quality – Sampling, Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples</i> (AS 5667.1:1998). Australian Standard 5667:1998 <i>Water Quality – Sampling, Part 6: Guidance on the Sampling of rivers and streams</i> (AS 566.6:1998). ASC NEPM (NEPC, 2013). PFAS NEMP (HEPA, 2020).
Field chemistry and sampling	A surface water sample will be collected as a 'grab sample' mid-way through the water column or approximately 0.5 m below the surface at the individual surface water sampling locations. If the reachable water column is less than 0.5 m deep, the sample will be collected from at least half the water depth, and care should be taken to avoid surface films entering the sample. If the water column is greater than 0.5 m deep, the sample should be taken 20 to 30 cm below the surface of the water. Each individual sample will be collected into a new laboratory-supplied, unpreserved sample container with new nitrile gloved hands. An extendable sampling pole may be used for easier sample collection. Field parameters (pH, EC, redox, DO and temperature) will be measured and recorded for all groundwater locations. In addition, observations of water quality such as the flow (flowing or not flowing), colour, turbidity level, and the presence/absence of odour or sheen will be recorded. The sample containers will be labelled with the job number, sample identification and date collected.
Quality assurance and quality control (QA/QC)	The following field QA/QC samples will be collected and analysed for PFAS (standard suite) as part of the surface water sampling program: – One intra-laboratory duplicate per ten primary samples. – One inter-laboratory duplicate per ten primary samples. – One rinsate sample per day of sampling (where applicable). – One trip blank per batch.

4.2.3 Sediment sampling

The sediment sampling methodology is presented in Table 10, which will be used for the biannual OMP event.

Table 10 Sediment sampling methodology

Item	Description
Technical guidelines	ASC NEPM (NEPC, 2013). PFAS NEMP (HEPA, 2020). Australian Standard 5667:1999 <i>Water Quality – Sampling, Part 12: Guidance on sampling of bottom sediments</i>.
Field chemistry and sampling	Sediment samples are to be representative of potentially deposited sediments and collected from a depth from within the water body using a hand trowel to a maximum depth of 0.3m below the sediment surface. If this is not possible (due to embankment instability and/or high surface water depth), samples will be collected using a hand auger. A new laboratory supplied container will be used at each location for collection of samples and the sample containers will be labelled with the job number, sample identification and date collected. Description of each sampling location and the sample material will be recorded on the field notes.

Item	Description
Decontamination	If re-usable sampling equipment is used, then prior to and following the collection of each sediment sample the equipment must undergo decontamination including: – Washing of equipment with phosphate/PFAS-free detergent (Liquinox) and/or – Rinsing of equipment with laboratory supplied PFAS-free water.
Quality assurance and quality control (QA/QC)	The following field QA/QC samples will be collected and analysed for PFAS (standard suite) as part of the sediment water sampling program: – One intra-laboratory duplicate per ten primary samples. – One inter-laboratory duplicate per ten primary samples. – One rinsate sample per day of sampling (where applicable). – One trip blank per batch.

4.2.4 Infrastructure tank water sampling

The tank water sampling methodology is presented in Table 11, which will be used for the biannual OMP event.

Table 11 Infrastructure tank sampling methodology

Item	Description
Technical guidelines	Australian Standard 5667:1998 <i>Water Quality – Sampling, Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples</i> (AS 5667.1:1998). ASC NEPM (NEPC, 2013). PFAS NEMP (HEPA, 2020).
Field chemistry and sampling	Tank and open pit water grab samples will be collected using the sampling methodology provided below for each location: – OTH001 (Training Water Holding Tank [S415]): Use a bailer to collect water from the opening at the top of the tank, accessed via a ladder. – OTH002 (Fire Main Water Tank [S416]): Use a bailer to collect water from the opening at the top of the tank, accessed via a ladder. – OTH003 (Surface water Oil Separator Reclaim Pit [S426]): Use peristaltic pump to collect water from the open pit. – OTH004 (DCTU Holding Tank [S439]): Collect water from tap connected to tank. – OTH005 (S440 Pit Tank): Use peristaltic pump to collect water from the underground tank. – OTH006 (DLSTRU [S481]): Collect water from open sump tank below unit, directly into sampling containers, or with aid of sampling pole. Field parameters (pH, EC, redox, DO and temperature) will be measured and recorded for all sampling locations. In addition, observations of water quality such as the flow (if present), colour, turbidity level, and the presence/absence of odour or sheen will be recorded.
Quality assurance and quality control (QA/QC)	The following field QA/QC samples will be collected and analysed for PFAS (standard suite) as part of the surface water sampling program: – One intra-laboratory duplicate per ten primary samples. – One inter-laboratory duplicate per ten primary samples. – One rinsate sample per day of sampling (where applicable). – One trip blank per batch.

4.2.5 Sample handling and transport to laboratory

Following collection of each batch of samples, samples will be immediately stored in a cool, dark environment (esky) prior to being forwarded to the NATA accredited analytical laboratory within the specified holding times along with a standardised chain of custody (COC) form. Analyses will be undertaken on a standard turnaround time of five business days, and analytical results will be emailed to GHD as a compiled report from the laboratory (as Esdat files and PDF report).

4.2.6 Calibration

Prior to use in the field, all field instruments (i.e. water quality meter, interface probe) are to be calibrated by the equipment supplier to optimise the accuracy of the measurements taken. The calibration certificate from the equipment supplier will be checked by the field team to confirm the field instruments are in good working condition.

All calibration certificates for equipment hired will be collected as part of the field documentation and presented as an attachment in the Sampling Event Report.

4.2.7 Waste management

The proposed groundwater sampling methodology utilising HydraSleeves™ is not considered to generate a volume of liquid waste that requires management or disposal.

All solid waste, comprising of dedicated sampling equipment (i.e. HydraSleeves™, bailers, gloves etc) and general rubbish will be collected and disposed in general waste bins present on-site.

4.3 Analytical suite and laboratory analysis methods

4.3.1 Laboratory NATA accreditation details

The NATA accredited laboratories selected for this monitoring program are as follows:

- Primary laboratory: Australian Life Science (ALS) Environmental, Smithfield, New South Wales (NATA Accreditation No. 825).
- Secondary laboratory: Eurofins, Girraween, New South Wales (NATA Accreditation No. 1261).

4.3.2 Analytical schedule

All groundwater, surface water, tank water and sediment samples collected as part of the monitoring program will be submitted for standard level analysis of the standard 28 PFAS suite, except for the following locations listed in Table 12.

Table 12 Locations with low level analysis of standard 28 PFAS suite.

Location type	Monitoring zone	Location ID
Surface water	Lake Windermere	0021_SW036
		0021_SW037
		0021_SW038
		0021_SW040
Groundwater	Lake McKenzie	0021_MW129
		0021_MW135
		0021_MW136
		0021_MW137
	Lake Windermere	0021_MW130
		0021_MW138
		0021_MW139
		0021_MW140

Standard level laboratory limit of reporting (LOR) is considered to be <0.01 – 0.1 ug/L and <0.0002 – 0.001 mg/kg. Low level laboratory LOR is considered to be <0.0003 – 0.002 ug/L.

4.3.3 Validation of analytical results

After completion of a monitoring event, analytical results will be reviewed and may need to be validated to confirm the original results if a QAQC discrepancy is considered possible. This would be achieved by requesting re-analysis of a sample by the laboratory or, if required, re-sampling and analysis. GHD would seek approval from Defence prior to mobilisation to site for re-sampling.

4.4 Data management

4.4.1 Sample nomenclature

All sample naming will be in accordance with the Defence Contamination Management Manual (DCMM), specifically Annex L (Data Management). Sample IDs will follow the nomenclature below:

PPPP_XX000_YYMMDD

Where for this monitoring program:

- PPPP = Property ID = '0020' for HMAS Creswell and '0021' for JBRF.
- XX = Location type, e.g. 'MW' for monitoring well or 'SW' for surface water.
- 000 = Three-digit sample number = e.g. '027'.
- YYMMDD = Sample date by year, month then day, e.g. '240801'.

The above example would provide a sample ID (at HMAS Creswell) of '0020_MW027_240801.'

QA/QC samples will be labelled in accordance with DCMM Annex L, as per the following nomenclature:

- Intra-laboratory duplicate (blind): PPPP_QC1XX_YYMMDD.
- Inter-laboratory duplicate (split): PPPP_QC2XX_YYMMDD.
- Rinsate blank: PPPP_QC3XX_YYMMDD.
- Trip blank: PPPP_QC5XX_YYMMDD.

4.4.2 Defence ESdat requirements

All field and analytical data collected as part of this monitoring program will be uploaded, stored and managed in the Defence Environmental Data Management System (EDMS) in accordance with DCMM Annex L using ESdat software. After completion of a monitoring event, field and analytical data will be uploaded into ESdat prior to submission of the factual report for the sampling event.

4.5 Adopted screening criteria

The relevant guidelines and legislation reviewed at the time of this report to define the adopted screening criteria are outlined in Section 1.3.

The adopted screening criteria to assess the PFAS data in this monitoring program for human health and ecological receptors as per the OMP is presented in Table 13.

Table 13 Summary of adopted screening criteria

Media	Receptor	Guideline
Groundwater and surface water	Ecology	NEMP (2020) – freshwater and marine water 95% species protection.
	Human health	NEMP (2020) – Drinking water (Applicable to surface water locations in Lake Windermere only).
		NEMP (2020) – Recreational.

With the exception of Lake Windemere, the groundwater and surface water assessed in the monitoring program is not used as a primary source of potable water. Drinking water guidelines have therefore been adopted for surface water locations representative of Lake Windemere only. The ADWG (2024) are currently the same as the NEMP (2020) drinking water guidelines.

To date, screening criteria have not been endorsed by Australian regulators for PFAS in sediments. The absence of a screening criteria for sediment is not a significant data gap, as risk assessments completed for the site and surrounds did not identified that direct contact with PFAS in sediment was a risk-driving exposure pathway. The presence of PFAS in sediment will be assessed qualitatively as it constitutes ongoing source of PFAS to surface water.

4.6 Quality assurance / quality control sampling

4.6.1 Field duplicate and inter-laboratory duplicate samples

Intra-laboratory (blind) and inter-laboratory (split) duplicates are to be collected and analysed for PFAS in accordance with the PFAS NEMP 2.0 (HEPA, 2020) at a minimum frequency of 1 in 10 primary samples.

4.6.2 Rinsate samples

Rinsate blank samples are to be collected at a rate of one per day of monitoring where re-usable sampling equipment has been used (e.g. interface probe, trowel). The rinsate blank sample is collected by pouring laboratory supplied deionised water over the decontaminated sampling equipment into the appropriate sampling container for PFAS analysis.

4.6.3 Trip blank samples

Trip blank samples will be used to estimate the amount of contamination introduced during the transport and storage of samples from the time of sampling to the time of analysis. Trip blanks are laboratory supplied and will be collected at a rate of 1 sample per fieldwork and analysed for PFAS at standard LOR.

4.7 Field documentation

4.7.1 Field notes

All sampling locations for each monitoring round will have an accompanying field record which will include information specific to the location type. This information is summarised in Table 14.

Table 14 Summary of fieldwork documentation

Media	Information to be recorded
Groundwater	– Standing water level and depth of well measurements. – Date, time and field staff present. – Field parameters (pH, EC, redox, DO and temperature). – Observations of colour, turbidity, presence/absence of odour or sheen. – Intra- or inter-laboratory duplicates collected (if applicable). – Other comments (i.e. access) (if applicable).
Surface water	– Date, time and field staff present. – Field parameters (pH, EC, redox, DO, temperature and turbidity). – Observations of colour, turbidity, presence/absence of odour or sheen. – Environmental observations such as weather, temperature, slope and erosion. – Hydrological observations such as flow (flowing or not flowing) and estimated width and depth of water body with photographs of each sample point. – Intra- or inter-laboratory duplicates collected (if applicable). – Other comments (i.e. access) (if applicable).

Media	Information to be recorded
Sediment samples	– Depth of sample from sediment surface level. – Observations of colour, soil type, moisture, presence/absence of odour or sheen. – Environmental observations such as weather, temperature, slope and erosion. – Intra- or inter-laboratory duplicates collected (if applicable). – Other comments (i.e. access) (if applicable).

All calibration certificates for equipment hired during fieldwork will be collected and presented in the Sampling Event Report as part of the field documentation.

4.7.2 Sample labels

Sample containers will be labelled with the following identification:

- Project number.
- Sample identification (as per the nomenclature outlined in Section 4.4).
- Sampler name.
- Sample collection date.

4.7.3 Chain of Custody (COC) forms

For each batch of samples prepared in the field, a COC form will be completed and sent with the samples to the laboratory. The COC form will include information such as the project number and name, sample identification and date, requested analyses and will be signed by the field staff representative. Upon receipt of samples at the laboratory, the COC will be signed by a laboratory staff member.

If additional samples are collected during monitoring based on field observations which are not from sampling locations included in this SAQP, GHD will seek approval from Defence for analysis of these samples.

5. Reporting

5.1 Sampling event report

After each monitoring event, information, field and laboratory data will be documented in a Sampling Event Report prepared in accordance with Defence *PFAS Ongoing Monitoring Program Reporting Guidance* (Defence, 2024) and will include:

- The scope of works undertaken including constraints and assumptions.
- Deviations from SAQP/OMP and associated implications (if any).
- Sampling methodology.
- PFAS screening criteria.
- Evaluation of the quality assurance and quality control to assess the adequacy for interpretative use.
- Summary of the field observations including weather conditions, surface water, visual and olfactory.
- Results and discussions including field parameters and analytical results, with comparison to historical conditions and screening criteria, and consideration of results and other information against OMP triggers.
- Conclusions and summary of key findings.
- Figures presenting management area, site layout and source areas (including CSR ids) surface water flow direction, PFAS distribution figures for each media.
- A tabulated summary of field observations and parameters and laboratory analytical results which includes comparison with the adopted assessment criteria.
- Attachments for all field and laboratory documentation, such as:
 - Field records for groundwater, sediment and surface water monitoring locations.
 - Equipment calibration certificates.
 - Chain of custody forms.
 - Laboratory analytical certificates.

5.2 Ongoing monitoring report

At the end of a specified period (typically 12 months but may vary) the whole data set (including the current and historic data) will be reviewed, and an Ongoing Monitoring Report prepared.

The Ongoing Monitoring Report will report on the objectives of the OMP, as outlined in Section 1.

The Ongoing Monitoring Report will be prepared in accordance with the Defence *PFAS Ongoing Monitoring Program Reporting Guidance* (Defence, 2024) and will include:

- A summary of deviations to the requirements of the SAQP (if applicable).
- A summary of any changes to the condition of the monitoring network that may affect the integrity of the data collected, or which may require repair, reinstatement or decommissioning.
- Contextual and ancillary information that has occurred in the broader management area that may affect monitoring results, such as remediation projects, infrastructure projects and weather events.
- Figures which present all sampling locations and site-specific hydrogeological features.
- A tabulated summary of laboratory analytical results for the specified period which includes comparison with the adopted assessment criteria.
- A QA/QC assessment and evaluation.
- Data interpretation, including trends in groundwater concentration, gradient and flow directions.

- Assessment of statistically based trends that may inform decision making during review of the OMP, including whether:
 - A review of the CSM is required.
 - The risk profile has changed across the site or at a specific location.
 - An OMP or PMAP review is required.
- Overall summary of the changes and extent of PFAS and whether monitoring has met the objectives of the OMP.
- Assessment of data against triggers detailed in the OMP and recommendations for responses.
- Inclusion of the following information as attachments:
 - Previous OMP factual reports.
 - This SAQP.

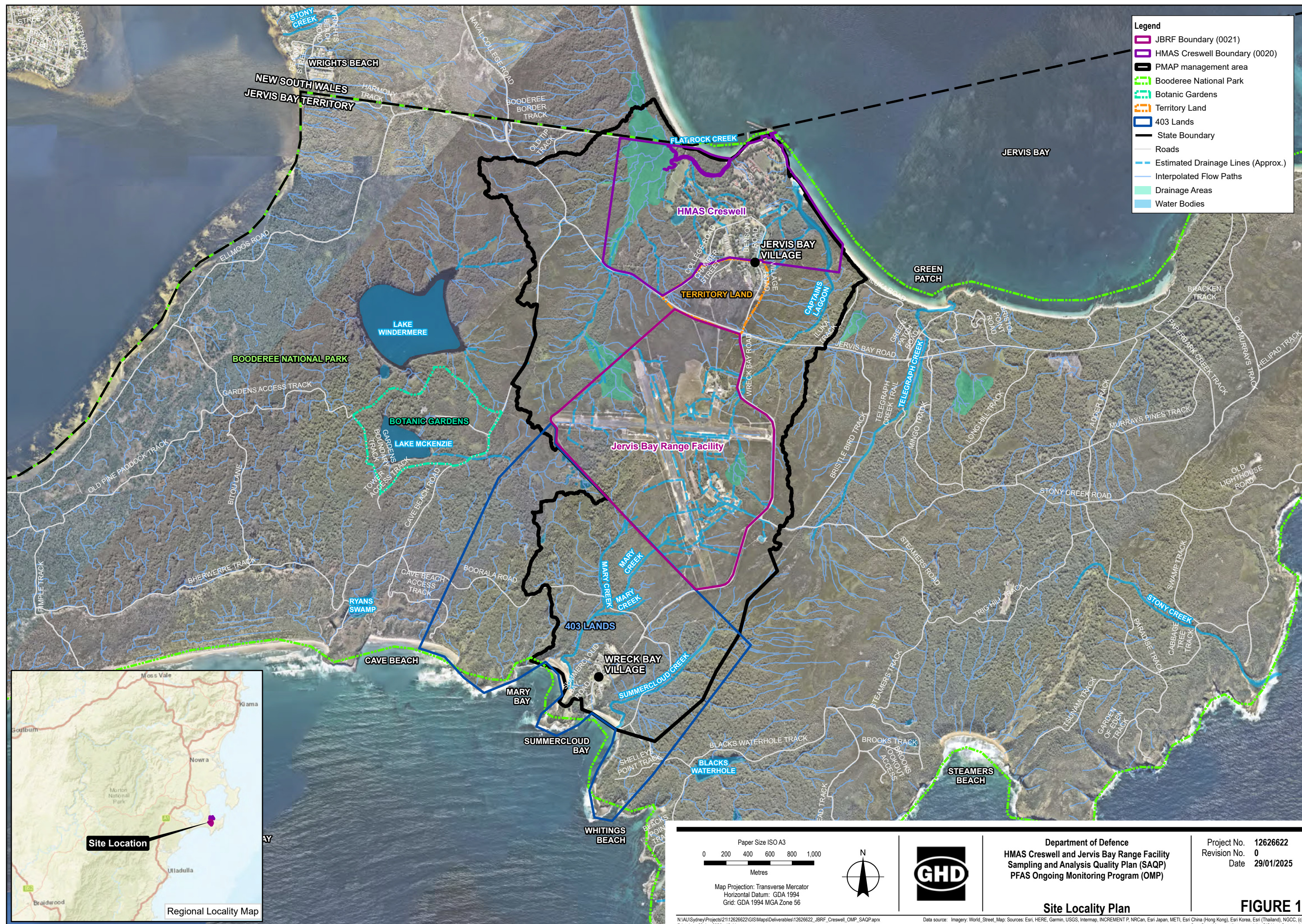
6. References

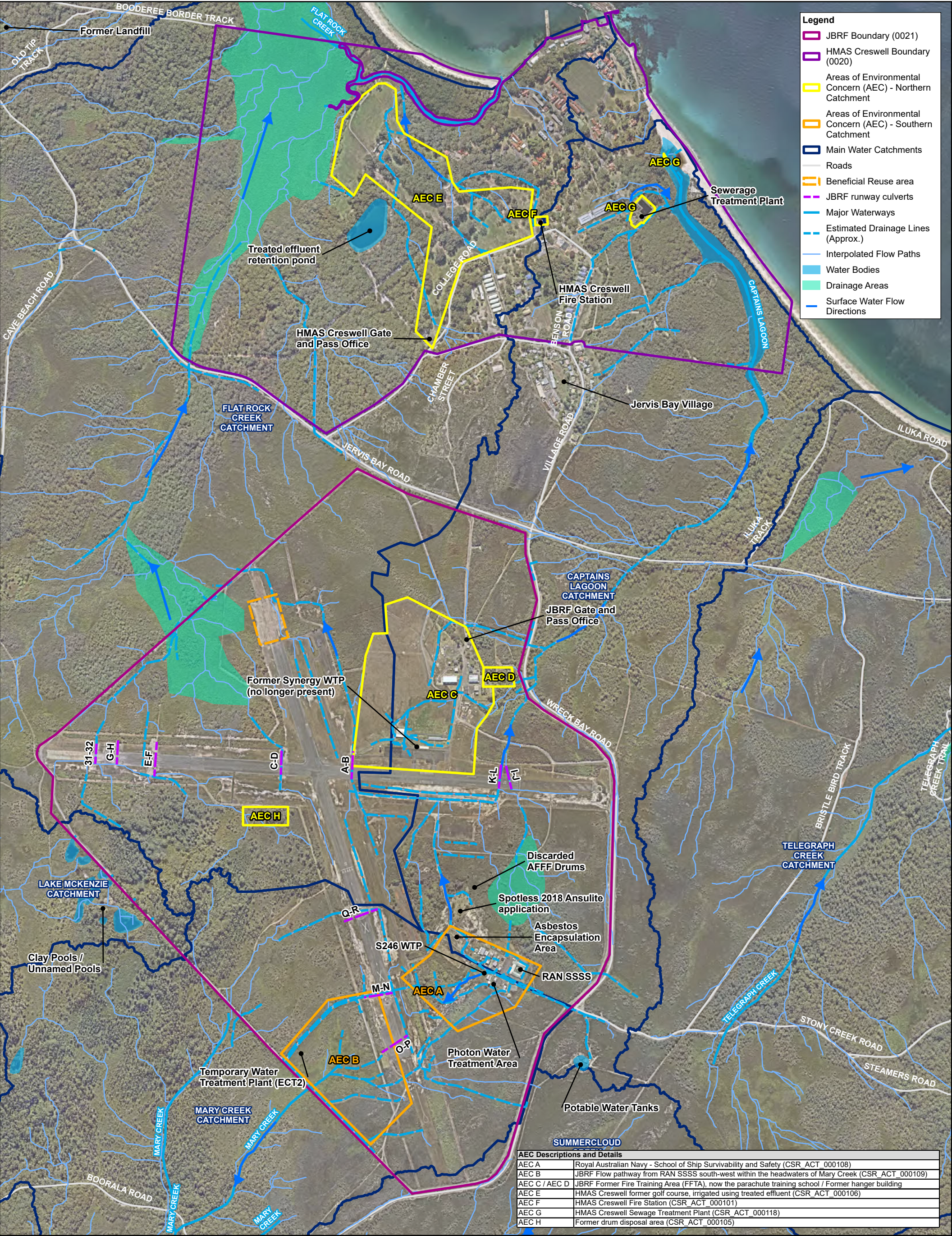
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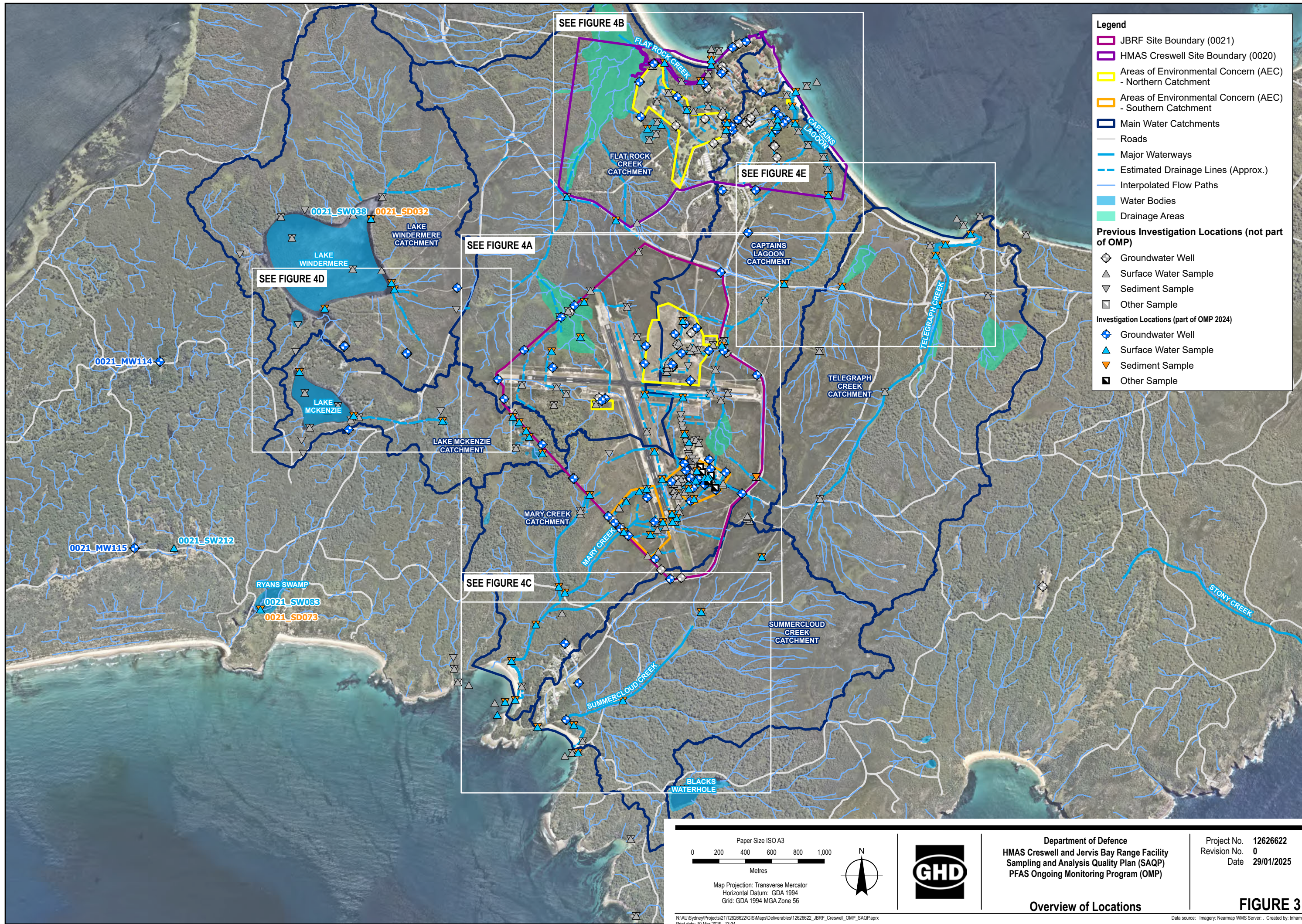
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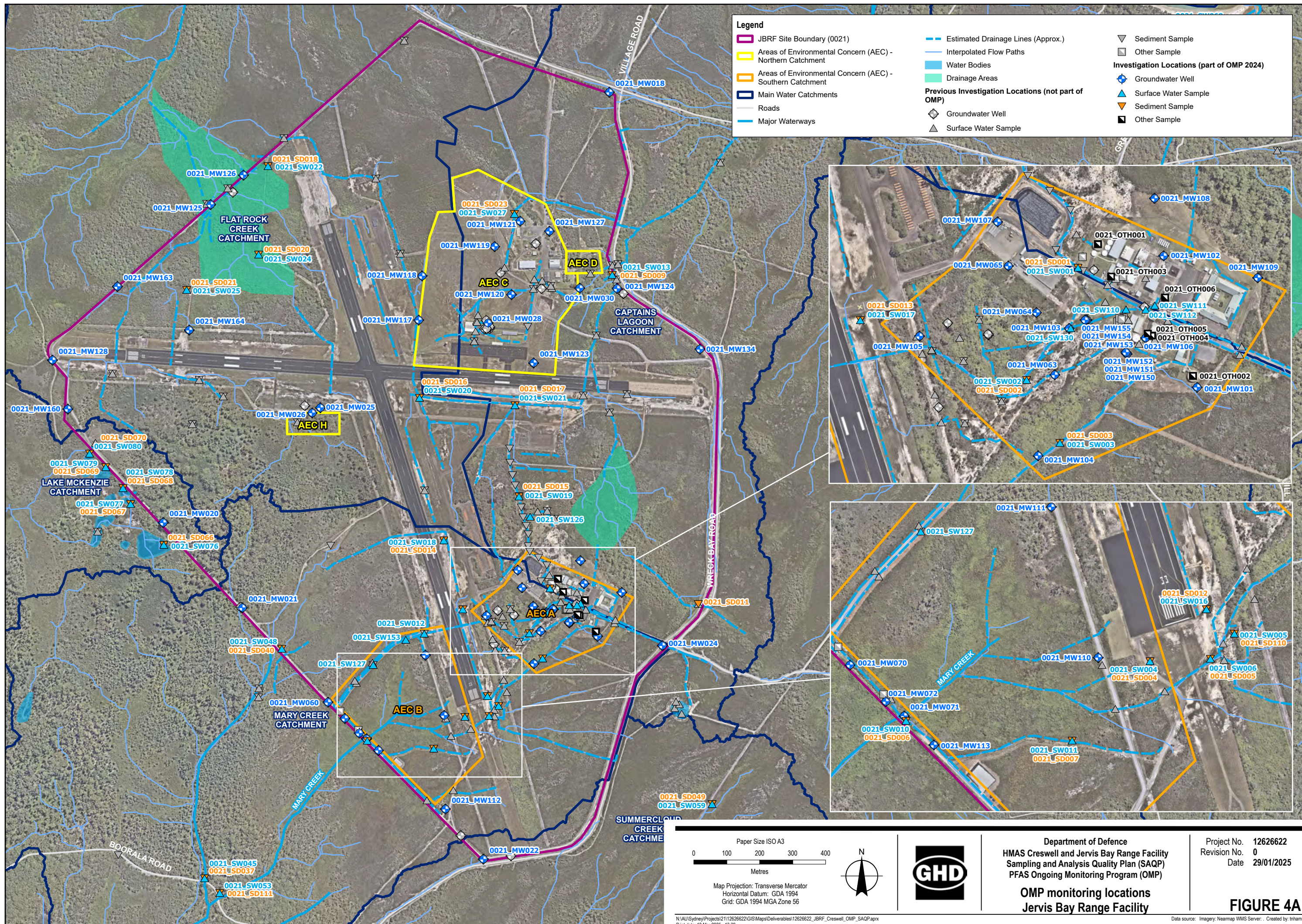
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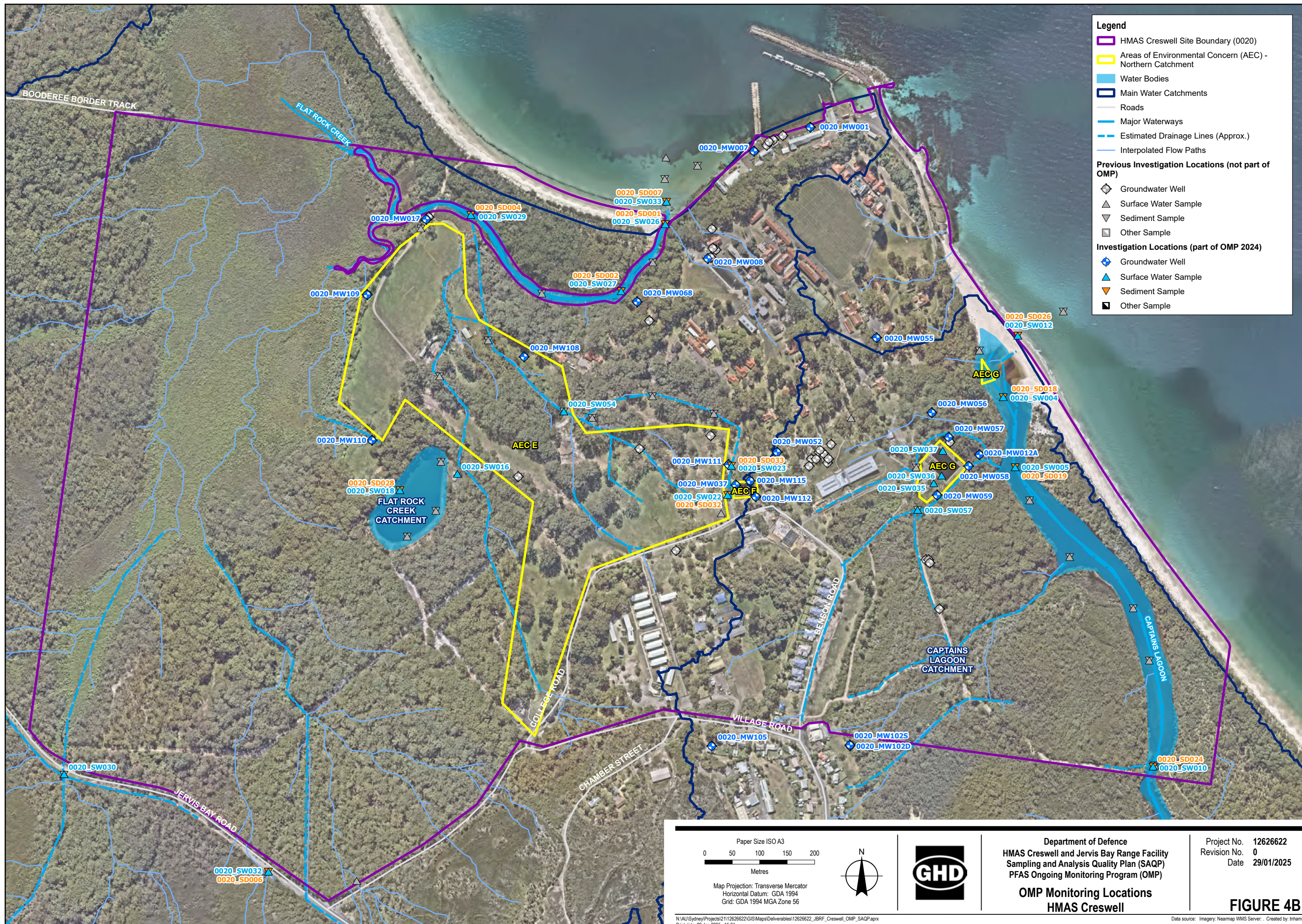
Figures

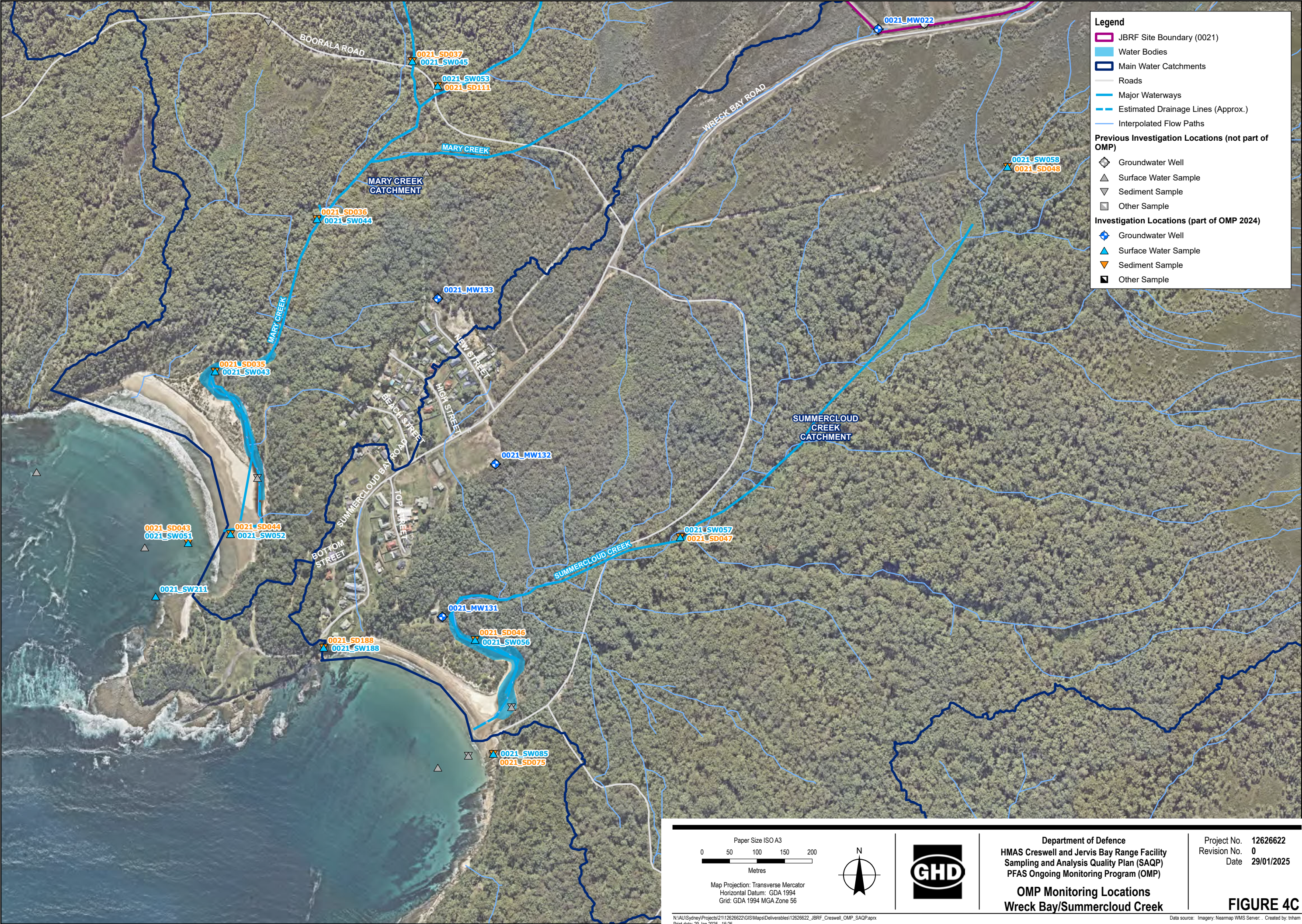


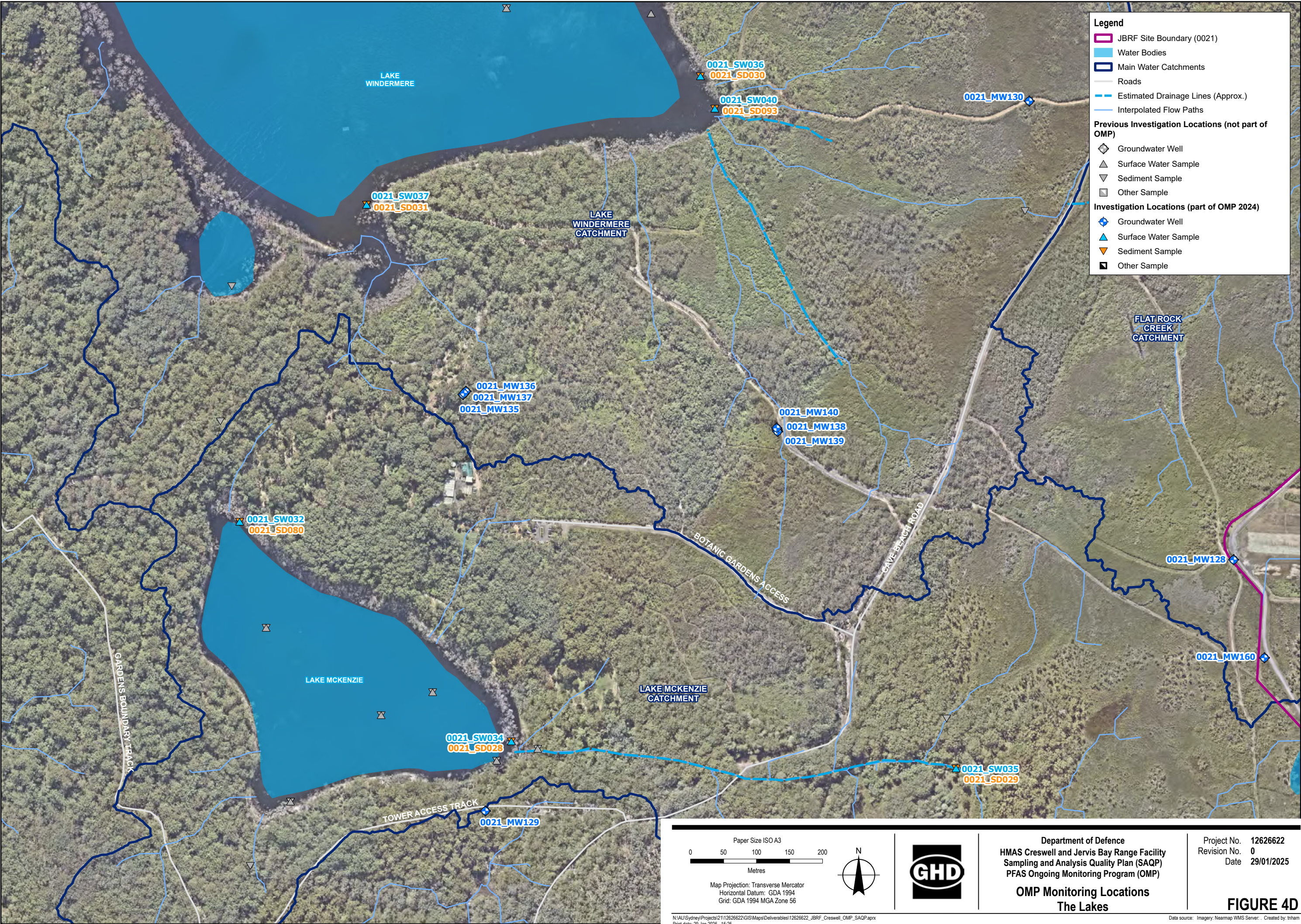


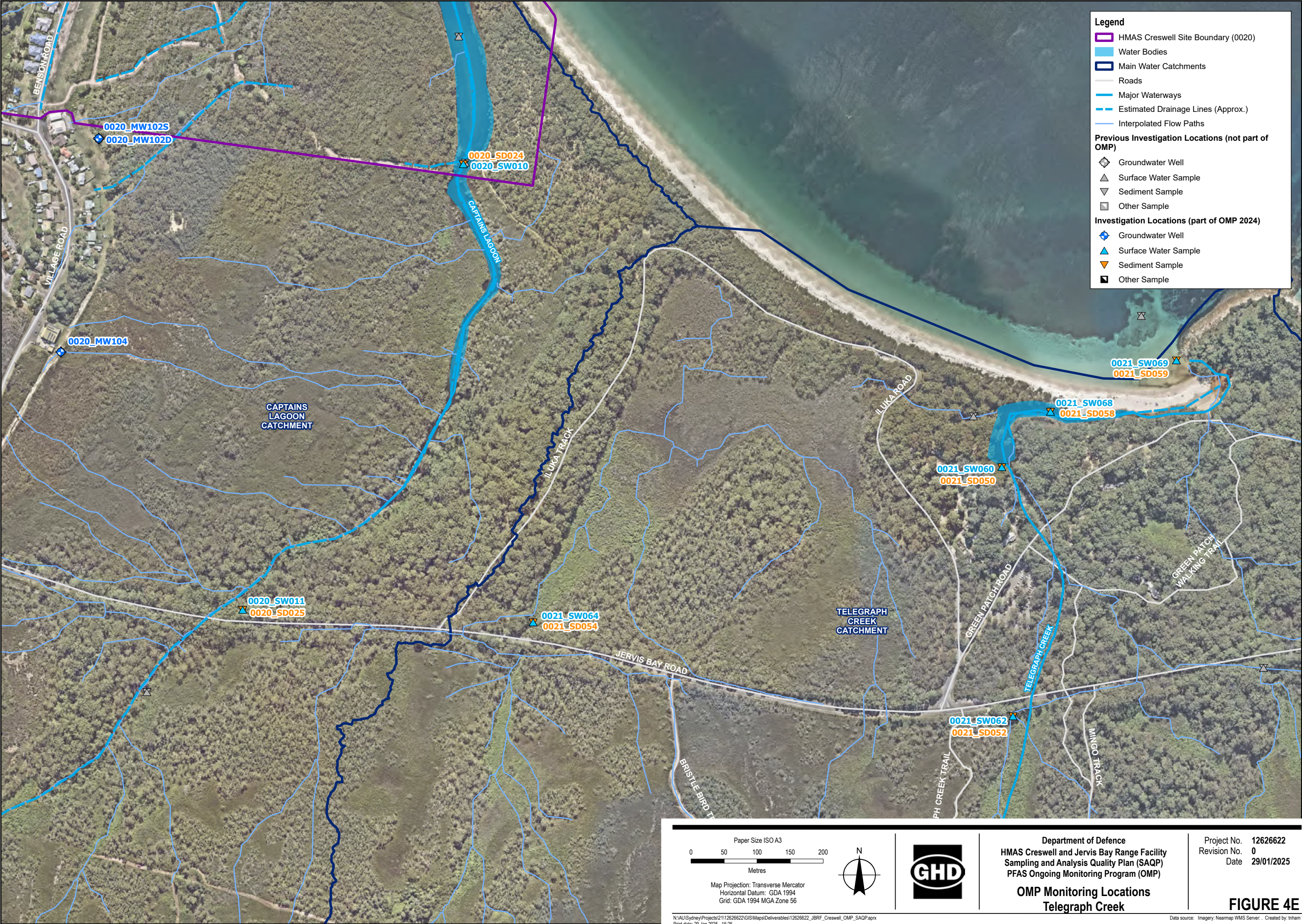












Appendix B

OMP sampling locations

Table B 1 *Groundwater sampling locations*

Area	Monitoring Zone ¹	Location ID	Historical ID	Easting	Northing	Top of casing elevation (m AHD)	Screen interval (m bgl)	Reference Figure
HMAS Creswell	HMAS Creswell	0020_MW001	CRMW1, CR_MW1	291055.973	6110951.983	2.91	UN - 5.99	Figure 4B
		0020_MW007	MW10, 0020_MW10, MW010	290953.549	6110908.313	2.68	0.75 - 3.75	Figure 4B
		0020_MW008		290869.482	6110712.769	16.793	UN	Figure 4B
		0020_MW017	MW017	290356.824	6110784.230	1.998	2.0 - 5.0	Figure 4B
		0020_MW055		291176.672	6110568.705	16.199	1.6 - 3.6	Figure 4B
		0020_MW056		291277.242	6110432.172	8.055	1.1 - 4.1	Figure 4B
		0020_MW068		290740.920	6110634.150	12.91	4.7 - 7.7	Figure 4B
	AEC E	0020_MW108	E_MW03	290535.033	6110533.974	9.305	1.0 - 2.0	Figure 4B
		0020_MW109	E_MW04	290249.359	6110647.078	3.632	1.0 - 2.0	Figure 4B
		0020_MW110	E_MW05	290258.269	6110381.933	8.024	1.0 - 2.0	Figure 4B
	AEC F	0020_MW037		290920.419	6110300.515	31.099	3.0 - 6.0	Figure 4B
		0020_MW052		290995.578	6110360.290	27.662	0.7 - 2.2	Figure 4B
		0020_MW111	F_MW01	290907.196	6110337.651	27.018	1 - 3	Figure 4B
		0020_MW112	F_MW02	290956.700	6110279.210	31.546	1.0 - 4.0	Figure 4B
		0020_MW115		290946.710	6110307.990	31.26	1.8 - 4.8	Figure 4B
	AEC G	0020_MW012	MW12, MW012A	291364.036	6110355.680	3.901	3.0 - 6.0	Figure 4B
		0020_MW057		291307.942	6110387.453	6.05	0.8 - 3.8	Figure 4B
		0020_MW058		291344.189	6110334.919	6.131	2.0 - 5.0	Figure 4B
		0020_MW059		291287.010	6110282.037	10.065	1.0 - 3.0	Figure 4B
	Captains Lagoon	0020_MW102D	CL_MW02, 0020_MW102	291128.354	6109825.853	35.392	2.8 - 8.8	Figure 4B
		0020_MW102S	CL_MW02A, 0020_MW102A	291128.241	6109826.993	35.388	1.0 - 2.0	Figure 4B
		0020_MW104	CL_MW04	291070.956	6109503.606	47.422	4.0 - 10.0	Figure 4E
		0020_MW105	CL_MW05	290876.680	6109825.061	52.044	6.0 - 12.0	Figure 4B
JBRF	AEC A	0021_MW063		290655.768	6107566.497	68.68	0.7 - 5.0	Figure 4A
		0021_MW064		290633.558	6107642.063	68.26	0.7 - 5.0	Figure 4A
		0021_MW065		290599.451	6107698.659	68.15	1.0 - 5.0	Figure 4A

Area	Monitoring Zone ¹	Location ID	Historical ID	Easting	Northing	Top of casing elevation (m AHD)	Screen interval (m bgl)	Reference Figure
		0021_MW101	A_MW01	290828.470	6107551.279	75.084	1.0 - 2.0	Figure 4A
		0021_MW102	A_MW02	290787.901	6107710.981	72.299	1.0 - 1.8	Figure 4A
		0021_MW103	A_MW03	290673.210	6107622.859	68.856	1.0 - 2.0	Figure 4A
		0021_MW104	A_MW04	290635.551	6107468.217	69.524	1.0 - 2.0	Figure 4A
		0021_MW105	A_MW05	290491.579	6107613.423	64.291	1.0 - 2.0	Figure 4A
		0021_MW106	A_MW06	290766.014	6107611.265	72.928	1.0 - 2.5	Figure 4A
		0021_MW107	A_MW07	290586.379	6107752.175	67.191	1.0 - 4.0	Figure 4A
		0021_MW108	A_MW08	290776.799	6107780.714	70.443	1.0 - 2.5	Figure 4A
		0021_MW109	A_MW09	290902.001	6107684.325	74.47	1.0 - 4.0	Figure 4A
		0021_MW150		290743.400	6107591.730	71.51	3.0 - 5.0	Figure 4A
		0021_MW151		290742.660	6107592.810	71.58	2 - 3	Figure 4A
		0021_MW152		290742.080	6107593.740	71.54	1 - 2	Figure 4A
		0021_MW153		290694.930	6107632.960	69.36	2.85 - 4.85	Figure 4A
		0021_MW154		290693.650	6107632.930	69.35	2 - 3	Figure 4A
		0021_MW155		290692.530	6107633.050	69.23	0.75 - 2	Figure 4A
	AEC B	0021_MW060		290010.902	6107351.267	56.46	0.7 - 3.0	Figure 4A
		0021_MW070		290062.002	6107301.998	55.07	UN	Figure 4A
		0021_MW071		290127.795	6107240.119	51.63	UN	Figure 4A
		0021_MW072		290105.450	6107257.561	52.19	UN	Figure 4A
		0021_MW110	B_MW01	290363.295	6107310.967	60.049	1 - 2	Figure 4A
		0021_MW111	B_MW02	290306.443	6107493.884	61.117	1 - 2	Figure 4A
		0021_MW112	B_MW03	290367.053	6107026.943	62.949	1.0 - 2.5	Figure 4A
		0021_MW113	B_MW04	290163.822	6107204.885	52.785	1.0 - 2.0	Figure 4A
	AEC C	0021_MW117	C_MW01	290286.037	6108510.839	56.91	1.0 - 2.0	Figure 4A
		0021_MW118	C_MW02	290296.314	6108644.899	56.183	1.0 - 3.0	Figure 4A
		0021_MW119	C_MW03	290516.502	6108733.952	56.601	1.0 - 2.0	Figure 4A
		0021_MW120	C_MW04	290567.691	6108588.091	55.585	1.0 - 3.0	Figure 4A

Area	Monitoring Zone ¹	Location ID	Historical ID	Easting	Northing	Top of casing elevation (m AHD)	Screen interval (m bgl)	Reference Figure
		0021_MW121	C_MW05	290593.764	6108811.096	55.68	0.8 - 2.8	Figure 4A
		0021_MW123	C_MW07	290634.696	6108380.753	57.968	1.0 - 2.8	Figure 4A
	JBRF	0021_MW020		289511.025	6107896.296	62.15	5.0 - 8.0	Figure 4A
		0021_MW021		289751.053	6107637.677	60.365	5.0 - 8.0	Figure 4A
		0021_MW022		290482.222	6106874.883	67.159	3.8 - 6.8	Figure 4A
		0021_MW024		291025.305	6107522.890	80.537	6 - 9	Figure 4A
		0021_MW025		289987.817	6108244.758	60.769	2 - 5	Figure 4A
		0021_MW026	MW10	289962.765	6108229.124	60.795	4.75 - 7.75	Figure 4A
		0021_MW028	0021_MW08, MW8	290496.309	6108501.849	57.816	3.0 - 6.0	Figure 4A
		0021_MW030	MW6	290774.537	6108607.883	52.959	7.0 - 9.8	Figure 4A
		0021_MW125	FC_MW01	289654.800	6108861.450	48.13	1.0 - 3.0	Figure 4A
		0021_MW126	FC_MW02	289754.280	6108950.770	47.1	6.0 - 9.0	Figure 4A
		0021_MW127	FC_MW03	290682.480	6108780.580	54.49	4.0 - 7.0	Figure 4A
		0021_MW128	LM_MW01	289175.060	6108389.365	57.051	2.3 - 5.3	Figure 4A
		0021_MW160		289221.681	6108240.792	59.011	3.0 - 6.0	Figure 4A
		0021_MW163		289372.054	6108612.776	53.015	0.9 - 2.9	Figure 4A
		0021_MW164		289589.895	6108480.526	54.039	1.0 - 3.0	Figure 4A
	Captains Lagoon	0021_MW018		290864.247	6109202.482	50.001	5.0 - 8.0	Figure 4A
		0021_MW124	CL_MW01, 0020_MW101	290887.738	6108606.804	49.826	1.0 - 2.8	Figure 4A
	Telegraph Creek	0021_MW134	TC_MW01	291139.191	6108422.681	59.307	4.0 - 7.0	Figure 4A
403 lands	Mary Creek	0021_MW131	MC_MW02	-	-	4.767	4.0 - 7.0	Figure 4C
		0021_MW132	MC_MW03	-	-	26.593	5.5 - 11.5	Figure 4C
		0021_MW133	MC_MW04	-	-	34.361	4.0 - 10.0	Figure 4C
BNP	Bherwerre Barrier	0021_MW114	BB_MW01	286611.121	6108524.481	12.325	4 - 7	Figure 3
		0021_MW115	BB_MW02	286419.100	6107109.342	5.007	1 - 4	Figure 3
	Lake McKenzie	0021_MW129	LM_MW02	288041.834	6108008.845	47.694	26.0 - 30.6	Figure 4D
		0021_MW135	LM_MW03A	288008.000	6108639.520	47.54	31.27 - 40.27	Figure 4D

Area	Monitoring Zone ¹	Location ID	Historical ID	Easting	Northing	Top of casing elevation (m AHD)	Screen interval (m bgl)	Reference Figure
		0021_MW136	LM_MW03B	288012.420	6108644.530	47.633	20.05 - 26.05	Figure 4D
		0021_MW137	LM_MW03C	288009.670	6108641.470	47.708	5.05 - 11.05	Figure 4D
	Lake Windermere	0021_MW130	LW_MW01	288865.496	6109084.007	56.255	26.0 - 35.0	Figure 4D
		0021_MW138	LW_MW02A	288483.690	6108586.100	52.2	31.4 - 40.4	Figure 4D
		0021_MW139	LW_MW02B	288484.480	6108583.610	52.22	14.6 - 20.6	Figure 4D
		0021_MW140	LW_MW02C	288483.130	6108588.770	52.07	6.0 - 12.0	Figure 4D

Table Notes:

1 – Refer to Table 3 for catchment areas for each monitoring zone

Note: Historical ID, Eastings, Northings, Top of Casing Elevation and Screen Interval are sourced from the Defence ESdat database.

UN = Unknown

Table B 2 Surface water sampling locations

Area	Monitoring zone ¹	Location ID	Historical ID	Easting	Northing	Reference figure
HMAS Creswell	AEC E	0020_SW016	E_IRRIGATION_03	290413.700	6110320.660	Figure 4B
		0020_SW018	E_SW01	290309.190	6110291.120	Figure 4B
		0020_SW054	-	290607.550	6110434.400	Figure 4B
	AEC F	0020_SW022	F_SW01	290905.520	6110282.520	Figure 4B
		0020_SW023	F_SW02	290912.600	6110335.640	Figure 4B
	AEC G	0020_SW035	G_SW01	291280.770	6110303.610	Figure 4B
		0020_SW036	G_SW02	291295.140	6110317.650	Figure 4B
		0020_SW037	G_SW03	291297.200	6110362.770	Figure 4B
		0020_SW057	-	291251.460	6110255.210	Figure 4B
	Captains Lagoon	0020_SW004	CL_SW01	291407.300	6110460.470	Figure 4B
		0020_SW005	CL_SW02	291429.040	6110332.850	Figure 4B
		0020_SW012	CL_SW12	291433.740	6110572.470	Figure 4B
	Flatrock Creek	0020_SW026	FC_SW01	290792.130	6110775.460	Figure 4B
		0020_SW027	FC_SW02	290711.880	6110653.450	Figure 4B
		0020_SW029	FC_SW04	290438.300	6110792.310	Figure 4B

Area	Monitoring zone ¹	Location ID	Historical ID	Easting	Northing	Reference figure
JBRF	AEC A	0020_SW033	FC_SW14	290794.330	6110816.420	Figure 4B
		0021_SW110	-	290742.283	6107645.754	Figure 4A
		0021_SW111		290777.142	6107650.561	Figure 4E
		0021_SW112		290766.145	6107645.481	Figure 4A
		0021_SW126		290624.000	6107914.000	Figure 4A
		0021_SW130		290675.000	6107623.000	Figure 4A
	AEC A/B	0021_SW001	AB_SW01	290683.950	6107696.480	Figure 4A
		0021_SW002	AB_SW02	290621.530	6107560.200	Figure 4A
		0021_SW003	AB_SW03	290662.010	6107483.790	Figure 4A
		0021_SW004	AB_SW04	290426.130	6107306.540	Figure 4A
		0021_SW005	AB_SW05	290528.500	6107340.000	Figure 4A
		0021_SW006	AB_SW06	290499.460	6107309.510	Figure 4A
	AEC B	0021_SW010	B_SW01	290129.980	6107234.120	Figure 4A
		0021_SW011	B_SW02	290331.580	6107210.140	Figure 4A
		0021_SW012	B_SW03	290302.870	6107558.970	Figure 4A
		0021_SW127	-	290148.000	6107464.000	Figure 4A
		0021_SW153	-	290246.730	6107540.370	Figure 4A
	JBRF	0021_SW016	DC_SW01	290494.610	6107369.610	Figure 4A
		0021_SW017	DC_SW02	290419.840	6107632.750	Figure 4A
		0021_SW018	DC_SW03	290362.060	6107842.210	Figure 4A
		0021_SW019	DC_SW04	290590.230	6107975.270	Figure 4A
		0021_SW020	DC_SW05	290288.470	6108274.910	Figure 4A
		0021_SW021	DC_SW06	290578.190	6108252.420	Figure 4A
	Captains Lagoon	0021_SW013	CL_SW09	290873.110	6108648.010	Figure 4A
	Telegraph Creek	0021_SW068	TC_SW09	292568.590	6109413.150	Figure 4E
	Flatrock Creek	0021_SW022	FC_SW06	289828.770	6108977.950	Figure 4A
		0021_SW024	FC_SW08	289800.400	6108709.600	Figure 4A
		0021_SW025	FC_SW09	289581.990	6108602.420	Figure 4A
		0021_SW027	FC_SW11	290576.620	6108832.990	Figure 4A

Area	Monitoring zone ¹	Location ID	Historical ID	Easting	Northing	Reference figure
	Mary Creek	0021_SW048	MC_SW06	289870.790	6107513.250	Figure 4A
	Lake McKenzie	0021_SW032	LM_SW01	287669.770	6108446.980	Figure 4D
		0021_SW034	LM_SW03	288081.200	6108114.260	Figure 4D
	Lake Windermere	0021_SW037	LW_SW02	287861.990	6108927.060	Figure 4D
		0021_SW040	LW_SW05	288389.420	6109072.680	Figure 4D
403 lands	Mary Creek	0021_SW043	MC_SW01	-	-	Figure 4C
		0021_SW044	MC_SW02	-	-	Figure 4C
		0021_SW045	MC_SW03	-	-	Figure 4C
		0021_SW051	MC_SW09	-	-	Figure 4C
		0021_SW052	MC_SW10	-	-	Figure 4C
		0021_SW053	MC_SW11	-	-	Figure 4C
	Unnamed Water Bodies	0021_SW076	UN2_SW01	-	-	Figure 4A
		0021_SW077	UN2_SW02	-	-	Figure 4A
		0021_SW078	UN2_SW03	-	-	Figure 4A
		0021_SW079	UN2_SW04	-	-	Figure 4A
		0021_SW080	UN2_SW05	-	-	Figure 4A
		0021_SW085	UN3_SW05	-	-	Figure 4C
	Summercloud Creek	0021_SW056	SC_SW01	-	-	Figure 4C
		0021_SW057	SC_SW02	-	-	Figure 4C
		0021_SW058	SC_SW03	-	-	Figure 4C
		0021_SW059	SC_SW04	-	-	Figure 4A
		0021_SW188	-	-	-	Figure 4C
	Wreck Bay	0021_SW211	-	-	-	Figure 4C
BNP	Lake McKenzie	0021_SW035	LM_SW04	288754.650	6108073.370	Figure 4D
	Lake Windermere	0021_SW036	LW_SW01	288367.610	6109121.670	Figure 4D
		0021_SW038	LW_SW03	288212.170	6109606.520	Figure 3
	Telegraph Creek	0021_SW060	TC_SW01	292494.990	6109329.250	Figure 4E
		0021_SW062	TC_SW03	292511.830	6108952.300	Figure 4E
		0021_SW064	TC_SW05	291785.650	6109094.410	Figure 4E

Area	Monitoring zone ¹	Location ID	Historical ID	Easting	Northing	Reference figure
	Captains Lagoon	0021_SW069	TC_SW10	292759.140	6109490.850	Figure 4E
		0020_SW010	CL_SW07	291680.090	6109787.760	Figure 4E
		0020_SW011	FC_SW05	291346.100	6109113.370	Figure 4E
	Flatrock Creek	0020_SW030	FC_SW05	289697.860	6109773.990	Figure 4B
		0020_SW032	FC_SW13	290069.730	6109596.410	Figure 4B
	Ryan's Swamp	0021_SW083	UN3_SW03	-	-	Figure 3
	Bherwerre Barrier	0021_SW212	-	286718.410	6107109.790	Figure 3

Table Notes:

1 – Refer to Table 3 for catchment areas for each monitoring zone

Note: Historical ID, Eastings, Northings, Top of Casing Elevation and Screen Interval are sourced from the Defence ESdat database.

UN = Unknown

Table B 3 *Sediment sampling locations*

Area	Monitoring Zone ¹	Location ID	Historical ID	Easting	Northing	Figure Reference
HMAS Creswell	AEC E	0020_SD028	E_SD01	290309.190	6110291.120	Figure 4B
		0020_SD032	F_SD01	290905.540	6110282.540	Figure 4B
	Captains Lagoon	0020_SD033	F_SD02	290912.600	6110335.640	Figure 4B
		0020_SD018	CL_SD01	291407.300	6110460.470	Figure 4B
		0020_SD019	CL_SD02	291429.040	6110332.850	Figure 4B
		0020_SD025	CL_SD08	291346.100	6109113.370	Figure 4E
		0020_SD026	CL_SD12	291433.740	6110572.470	Figure 4B
	Flatrock Creek	0020_SD001	FC_SD01	290792.130	6110775.460	Figure 4B
		0020_SD002	FC_SD02	290711.880	6110653.450	Figure 4B
		0020_SD004	FC_SD04	290438.300	6110792.310	Figure 4B
		0020_SD007	FC_SD14	290794.330	6110816.420	Figure 4B
JBRF	AEC A/B	0021_SD001	AB_SD01	290683.950	6107696.480	Figure 4A
		0021_SD002	AB_SD02	290621.530	6107560.200	Figure 4A
		0021_SD003	AB_SD03	290662.010	6107483.790	Figure 4A
		0021_SD004	AB_SD04	290426.130	6107306.540	Figure 4A

Area	Monitoring Zone ¹	Location ID	Historical ID	Easting	Northing	Figure Reference
		0021_SD005	AB_SD06	290499.460	6107309.510	Figure 4A
		0021_SD110		290528.500	6107340.000	Figure 4A
	AEC B	0021_SD006	B_SD01	290129.980	6107234.120	Figure 4A
		0021_SD007	B_SD02	290331.580	6107210.140	Figure 4A
	JBRF	0021_SD012	DC_SD01	290494.610	6107369.610	Figure 4A
		0021_SD013	DC_SD02	290419.840	6107632.750	Figure 4A
		0021_SD014	DC_SD03	290362.060	6107842.210	Figure 4A
		0021_SD015	DC_SD04	290590.230	6107975.270	Figure 4A
		0021_SD016	DC_SD05	290288.470	6108274.910	Figure 4A
		0021_SD017	DC_SD06	290578.190	6108252.420	Figure 4A
	Captains Lagoon	0021_SD009	CL_SD09	290873.110	6108648.010	Figure 4A
		0021_SD011	CL_SD11	291134.200	6107649.000	Figure 4A
	Flatrock Creek	0021_SD018	FC_SD06	289828.770	6108977.950	Figure 4A
		0021_SD020	FC_SD08	289800.400	6108709.600	Figure 4A
		0021_SD021	FC_SD09	289581.990	6108602.420	Figure 4A
		0021_SD023	FC_SD11	290576.620	6108832.990	Figure 4A
	Mary Creek	0021_SD040	MC_SD06	-	-	Figure 4A
		0021_SD035	MC_SD01	-	-	Figure 4C
403 lands		0021_SD036	MC_SD02	-	-	Figure 4C
		0021_SD037	MC_SD03	-	-	Figure 4C
		0021_SD043	MC_SD09	-	-	Figure 4C
		0021_SD044	MC_SD10	-	-	Figure 4C
		0021_SD066	UN2_SD01	-	-	Figure 4A
	Unnamed Water Bodies	0021_SD067	UN2_SD02	-	-	Figure 4A
		0021_SD068	UN2_SD03	-	-	Figure 4A
		0021_SD069	UN2_SD04	-	-	Figure 4A
		0021_SD070	UN2_SD05	-	-	Figure 4A
		0021_SD075	UN3_SD05	-	-	Figure 4C
	Summercloud Creek	0021_SD046	SC_SD01	-	-	Figure 4C

Area	Monitoring Zone ¹	Location ID	Historical ID	Easting	Northing	Figure Reference
		0021_SD047	SC_SD02	-	-	Figure 4C
		0021_SD048	SC_SD03	-	-	Figure 4C
		0021_SD188		-	-	Figure 4C
	Wreck Bay	0021_SD111		-	-	Figure 4C
BNP	Lake McKenzie	0021_SD028	LM_SD03_WW	288081.200	6108114.260	Figure 4D
		0021_SD029	LM_SD04	288754.650	6108073.370	Figure 4D
		0021_SD080	LM_SD01	287669.770	6108446.980	Figure 4D
	Lake Windermere	0021_SD030	LW_SD01	288367.610	6109121.670	Figure 4D
		0021_SD031	LW_SD02	287861.990	6108927.060	Figure 4D
		0021_SD032	LW_SD03	288212.170	6109606.520	Figure 3
		0021_SD093	LW_SD05	288389.420	6109072.680	Figure 4D
	Telegraph Creek	0021_SD050	TC_SD01	292494.990	6109329.250	Figure 4E
		0021_SD052	TC_SD03	292511.830	6108952.300	Figure 4E
		0021_SD054	TC_SD05	291785.650	6109094.410	Figure 4E
		0021_SD058	TC_SD09	292568.590	6109413.150	Figure 4E
		0021_SD059	TC_SD10	292759.140	6109490.850	Figure 4E
	Captains Lagoon	0020_SD024	CL_SD07	291680.090	6109787.760	Figure 4B
	Flatrock Creek	0020_SD006	FC_SD13	290069.730	6109596.410	Figure 4B
	Summercloud Creek	0021_SD049	SC_SD04	291176.250	6107041.830	Figure 4A
	Ryan's Swamp	0021_SD073	UN3_SD03	-	-	Figure 3

Table Notes:

1 – Refer to Table 3 for catchment areas for each monitoring zone

Note: Historical ID, Eastings, Northings, Top of Casing Elevation and Screen Interval are sourced from the Defence ESdat database.

UN = Unknown

Table B 4 *Tank sampling locations*

Media	Area	Monitoring Zone	Location ID	Historical ID	Easting	Northing	Figure Reference
Tank surface water	JBRF	AEC A	0021_OTH001	A_S415_SW05	290708.100	6107725.080	Figure 4A
			0021_OTH002	A_S416_SW02	290823.460	6107565.010	Figure 4A
			0021_OTH003	A_S426_SW01	290724.240	6107685.500	Figure 4A
			0021_OTH004	A_S439_SW03	290773.710	6107613.960	Figure 4A
			0021_OTH005	A_S440_SW01	290768.630	6107616.290	Figure 4A
			0021_OTH006	A_S481_SW04	290789.590	6107660.100	Figure 4A



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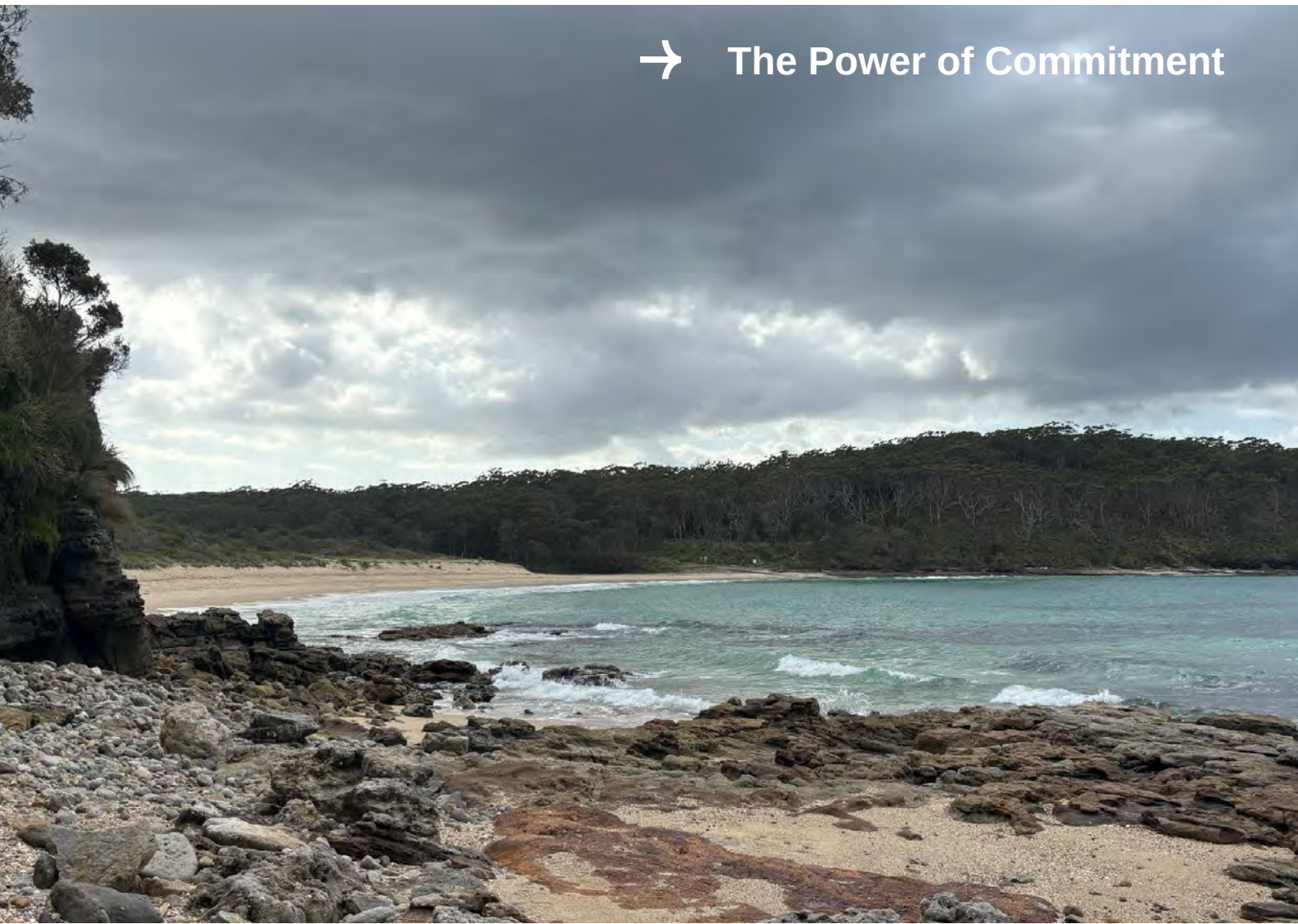


Sampling and Analysis Quality Plan

**Jervis Bay Range Facility & HMAS
Creswell PFAS Ongoing Monitoring Plan**

Department of Defence

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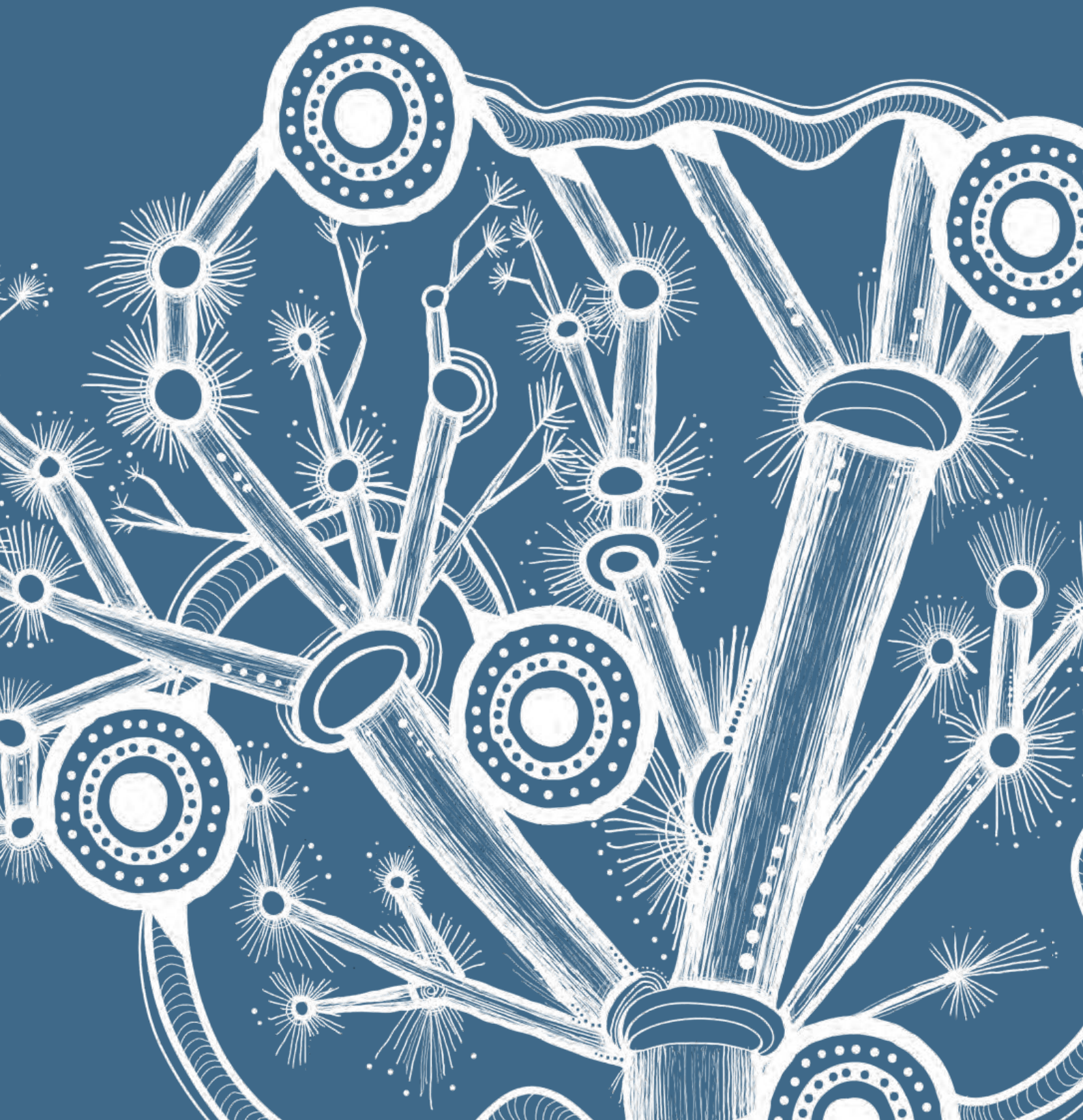
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Acknowledgement of Country

GHD acknowledges Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land, water and sky throughout Australia on which we do business. We recognise their strength, diversity, resilience and deep connections to Country. We pay our respects to Elders of the past, present and future, as they hold the memories, knowledges and spirit of Australia. GHD is committed to learning from Aboriginal and Torres Strait Islander peoples in the work we do.



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1. Introduction

1.1 Overview

In September 2025, Defence prepared a per- and poly-fluoroalkyl substances (PFAS) Management Area Plan (PMAP) (Defence, 2025a) for managing risks to human health and the environment from contamination associated with Jervis Bay Range Facility (JBRF) and His Majesty's Australian Ship (HMAS) Creswell Bases and surrounding areas (hereafter collectively referred to as the 'sites', and the broader 'Management Area'). An important requirement of the PMAP is to undertake ongoing monitoring of PFAS in the environment, which is detailed in the Ongoing Monitoring Plan (OMP) (Defence, 2025b).

Department of Defence (Defence) engaged GHD Pty Ltd (GHD) to prepare this Sampling and Analysis Quality Plan (SAQP) to support monitoring works in accordance with the OMP (Defence, 2025b).

The Management Area comprises the sites and the surrounding areas of Wreck Bay community lands and Booderee National Park. The Management Area has been defined based on surface water catchment areas, as the catchment areas have been demonstrated to be the primary focus areas for PFAS management associated with the sites. The Management Area and surface water catchment areas to be monitored as per this SAQP are displayed on Figure 1 in Appendix A.

This OMP SAQP revision incorporates the updates to the ongoing monitoring program outlined in the OMP (Defence, 2025b) and replaces the previous OMP SAQP dated 12 March 2025.

1.2 Purpose

The purpose of the OMP (Defence, 2025b) is to set out requirements for the collection of adequate data to identify and evaluate:

- Spatial and temporal (including seasonal) variability of PFAS in the environment.
- Changes to sources, transport pathways and/or receptors, described as a conceptual site model (CSM) for the sites.
- Whether risks to human and ecological receptors require review.
- The influence that risk management activities at the sites, as outlined in the PMAP (Defence, 2025a), have had on PFAS in the environment.
- Whether the identified changes trigger an action and/or review.

The purpose of this SAQP is to document the procedures that will be used to obtain data of sufficient quality to meet the objectives of the OMP (Defence, 2025b) and to facilitate the ongoing monitoring program.

1.3 Objectives

The objectives of this SAQP are to outline the:

- Scope of work.
- Sampling methodology.
- Quality assurance and quality control (QA/QC) measures.
- Data collection and management requirements for this program.

1.4 Scope of work

The following scope of work are proposed to meet the objectives:

- Develop Data Quality Objectives (DQOs) in accordance with the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended in 2013 (ASC NEPM) to ensure that field investigations and analyses are undertaken in a way that enables the collection and reporting of reliable data.

- Determine the basis of the assessment including details of the guidelines, legislation and performance measures for the monitoring program.
- Outline the proposed sampling strategy and analytical program to meet the DQOs.
- Define the Quality Assurance and Quality Control (QA/QC) protocols.
- Specify the reporting requirements to meet the overall project objectives.

1.5 Guidelines and legislation

This SAQP has been developed with reference to the following guidelines and legislation:

- Australian and New Zealand Guidelines (ANZG) (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.
- Defence (2018, Amended June 2021). *Contamination Management Manual*.
- Heads of EPA (HEPA) Australia and New Zealand (2025). *PFAS National Environmental Management Plan Version 3.0*.
- National Environment Protection Council (NEPC) (2013). *National Environmental Protection (Assessment of Site Contamination) Measure (NEPM)*.
- National Health and Medical Research Council (NHMRC) (2011) *Australian Drinking Water Guidelines (ADWG) Paper 6 National Water Quality Management Strategy*, updated June 2025, Version 4.0.
- NHMRC (2019) *Guidance on Per and Polyfluoroalkyl Substances in Recreational Water*.
- Standards Australia (1998) *AS/NZ 5667:1998 Water Quality – Sampling*.

1.6 Limitations

This report has been prepared by GHD for Department of Defence and may only be used and relied on by Department of Defence for the purpose agreed between GHD and Department of Defence as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Department of Defence arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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2. Site and environmental setting

2.1 Site details

A summary of the sites identification details is presented in Table 1.

Table 1 Site identification summary

Information	Details
Street address	JBRF accessed off Jervis Bay Road, Jervis Bay, JBT 2540. HMAS Creswell accessed off College Road, Jervis Bay, JBT 2540.
Latitude and Longitude	Approximate centre of JBRF runways: -35.145799, 150.696237. Approximate centre of HMAS Creswell Base: -35.128741, 150.706023.
Site area	JBRF is approximately 313 hectares (Ha), and HMAS Creswell is approximately 274 Ha.
Military area (Property ID)	Jervis Bay – HMAS Creswell – ACT_0020. – JBRF – ACT_0021.
Local Government Area	Jervis Bay Territory.
Traditional custodians	Koori people, now primarily represented by the Wreck Bay Aboriginal Community.
Current land use	HMAS Creswell is an active Royal Australian Navy (RAN) base and training facility (including on-site accommodation and offices), and JBRF is an active airfield and training facility with associated infrastructure.
Surrounding land use	Land uses on and surrounding the JBRF and HMAS Creswell facilities, within and surrounding the Management Area, include the following per each surface water catchment area: – Captains Lagoon and Flatrock Creek: At the top of the catchment is JBRF airfield and a portion of the RAN School of Ship Survivability and Safety (RAN SSSS). To the north of JBRF is Booderee National Park (including Jervis Bay Road) and Jervis Bay Village ¹, followed by HMAS Creswell. To the north of HMAS Creswell is Jervis Bay (including Jervis Bay Marine Park), Hyams Beach (and village) and Vincentia residential areas. Bushland of Booderee National Park lies to the east (including Telegraph Creek, Green Patch and Iluka camping grounds) beyond which is the Pacific Ocean, as well as to the west of the site. – Mary Creek and Summercloud Creek: The RAN SSSS and a portion of the JBRF airfield is located at the top of the catchment. Wreck Bay community lands and Wreck Bay Village residential area lie south of JBRF. This area belongs to the Wreck Bay community and is referred to as 'the 403 lands'. – The Lakes: The top of the catchment is located on the western corner of JBRF, and is predominantly remnant bushland. West of the JBRF boundary is the 'Clay Pools', followed by bushland of Booderee National Park (a portion of which is owned by Wreck Bay Aboriginal Community Council [WBACC], and is leased and managed by Booderee National Park), including Lake Windermere (potable water supply) and Lake McKenzie, Caves Beach, Bherwerre Barrier. Westwards, beyond the Bherwerre Barrier, is the estuary of St George's Basin.

Table Notes:

1 - Jervis Bay Village is a residential community with a primary school, police station, local store and the offices of WBACC, BNP and Jervis Bay Territory Administration (JBTA).

2.2 Environmental setting

A summary of the sites environmental setting is presented in Table 2.

Table 2 Environmental setting summary

Item	Description
Climate	The Jervis Bay region has an oceanic climate, with the sites located on a coastal peninsula. The following was recorded at JBRF airfield station (ID 068264 – 2018 to March 2023) and sourced from the Bureau of Meteorology (Climate Data Online, 2025): – Temperature: generally moderate, with the mean maximum temperature ranging from 15.6 °C to 26.4 °C (JBRF airfield station - ID 068264: 2018 to March 2023). – Rainfall: generally evenly spread throughout the year, with the highest volume of rainfall typically occurring during the month of June (mean monthly rainfall amount of 164 mm). – Wind direction is variable, both daily (morning and afternoons) and seasonally, with no discernible primary wind direction.
Topography and site drainage	JBRF and HMAS Creswell are located on the southern peninsula of Jervis Bay Territory. The JBRF airfield is located on the ridgeline of a landmass known as the Bherwerre Peninsula at an elevation of approximately 50 m Australian height datum (m AHD). HMAS Creswell is located on a headland between Hyams Beach and Captains Beach at an elevation of approximately 30 m AHD, on the foreshore of Jervis Bay. Surface water runoff from JBRF and HMAS Creswell is generally likely to flow into natural features such as creeks and lagoons via open shallow drains and underground culverts (discussed further under 'hydrology').
Hydrology	Surface water flows at the sites are noted to be complex, and variable in flow regime based on topographic and temporal changes. There is estimated to be over 20 different small catchments and creek lines, with JBRF located at the top of the catchment area on the plateau. Runoff from JBRF that travels to the north flows into Jervis Bay via incised valley creeks through HMAS Creswell from two main drainage catchments (Flat Rock Creek and Captains Lagoon). JBRF also drains southwards via Mary Creek into Wreck Bay. Summercloud Creek is located to the east of Mary Creek and drains to Summercloud Bay. These creeks are characterised by a series of swamps and wetlands, where standing water is often present. Approximate surface water catchment areas are shown on Figure 2 in Appendix A. It is noted that surface water flows through wetland areas, as well as through the Clay Pools (also referred to as 'the unnamed pools') located south-west of JBRF runways adjacent to the south-western site boundary, are challenging to characterise and are therefore not well understood.
Soil landscape	A review of the mapped soil landscapes (Geological Survey of NSW, 2025) indicates the following stratigraphic units are present at the sites: – JBRF: The majority of the runway areas are reportedly underlain by 'coastal deposits' (dune facies - marine deposited and aeolian-reworked coastal sand dunes; partially consolidated) and by 'residual deposits' (a weakly consolidated regolithic residuum such as soil or saprolite mostly developed in-situ as a result of advanced weathering and/or pedogenesis) in some eastern areas. An area of 'residual deposits – ferruginous' (principally haematite) is mapped within the southern extent of the north-south runway, and an area of Snapper Point Formation sandstone is mapped in the north-eastern portion. – HMAS Creswell: The headland and ridgeline of HMAS Creswell is shown to be underlain by 'coastal deposits' (dune facies - as per above description) with outcrops of Snapper Point Formation sandstone at the southern extent of HMAS Creswell. The eastern and western extent of HMAS Creswell is mapped as coastal deposits (bedrock-mantling dune facies - marine-deposited and aeolian-reworked fine- to coarse-grained quartz-lithic sand with abundant carbonate, sporadic humic debris in stabilised dunes). Some alluvium (unconsolidated alluvial clay, silt, sand, and gravel deposits) is shown in the upper reaches of Captains Lagoon. The natural soil encountered within the sites during the Detailed Site Investigation (DSI) (GHD, 2019a) was generally dominated by brown/grey sands, sandy clay and clayey sands (Pleistocene sediments and Holocene sediments). Most investigation locations encountered bedrock from near surface to depths of 2.5 m below ground level (m bgl).
Acid sulfate soils (ASS)	With reference to <i>The Land and Water Conservation Acid Sulfate Soil Risk Map</i> (1997), Huskisson (Tulau, M.J., 1997a) and Sussex Inlet (Tulau, M.J., 1997b), JBRF and HMAS Creswell are described as follows in relation to ASS: – JBRF: no known occurrences of ASS materials, and land management activities are not likely to be affected by ASS materials.

Item	Description
	– The main base areas of HMAS Creswell: no known occurrences of ASS, however there is the potential for ASS to be present around Flat Rock Creek and Captains Lagoon: • The Flat Rock Creek area and the north-west of the former golf course: a low probability of ASS, with ASS potentially found in an estuarine/back swamp environment and at near surface (between 0 to 1 m bgl). • Captains Lagoon: high probability of ASS in the bottom sediments, and there may be a severe environmental risk if bottom sediments are disturbed by activities such as dredging. The map also describes the area surrounding the lagoon as having a low probability of ASS. These are described as originating from both estuarine and aeolian environments, and potentially found at depths of up to 1 m bgl.
Geology	With reference to the <i>Geoscience Map of Jervis Bay Territory and Beecroft Peninsula</i> (1:25,000) (Abell, R.S., 1992), both JBRF and HMAS Creswell are underlain by the following geological units: – Quaternary, Holocene sediments – Grey-white and yellow-light brown sand. – Quaternary, Pleistocene sediments – Pale grey leached quartz sand veneering yellow-brown feldspathic sand with podzolic soil profiles. – Tertiary, Ferruginous quartz gravel. – Tertiary, White kaolinitic clay - weathered Permian dolerite. – Late Permian, Porphyritic dolerite - dykes and sills. – Early Permian, Snapper Point Formation (known locally as the Jervis Bay Sandstone, or Snapper Rock) – Quartz pebbly sandstone and minor conglomerate. Exposed sandstone and conglomerate can be observed in sections of JBRF and around the upper catchment of Mary Creek. The geology encountered during the DSI (GHD, 2019a) was consistent with the published information above. Fill material, comprising both imported and re-worked natural material, was also encountered predominantly around the JBRF facility.
Hydrogeology	Based on the results of the DSI (GHD, 2019a) and Supplementary Environmental Investigation (SEI) (GHD, 2022a) reports, the following terminology has been adopted to describe the hydrogeological units identified at the sites: – ‘Upper aquifer’ - unconfined and includes Pleistocene and Holocene sediments and the upper weathered and highly fractured portion of the Permian sandstone bedrock. Considered to be recharged by rainfall that subsequently discharges to down-gradient wetland systems and surface water. Tidally-influenced in coastal areas of HMAS Creswell in the Flatrock Creek and Captains Lagoon catchments, and likely to be tidal in coastal areas of Telegraph Creek catchment. No coastal groundwater assessment has been undertaken in Mary Creek or Summercloud Creek catchments. – ‘Lower aquifer’ - comprises the deeper, more competent bedrock of the Permian sandstones. It behaves as a fractured rock aquifer where groundwater flow is controlled by secondary features i.e. joints, faults and primary features such as bedding plane s. Groundwater modelling and interpolated contours indicate an upward head gradient from the lower aquifer to the upper aquifer in coastal areas of the sites, particularly in the vicinity of Flat Rock Creek. Groundwater flow for both aquifers is generally consistent with the topography, with highest groundwater elevations near the RAN SSSS. Groundwater flow in the upper aquifer is radial predominantly to the north, west and south, with an easterly component towards Captains Lagoon at HMAS Creswell, and is inferred to discharge to surface water features. The upper and lower aquifers are connected; however: – The reduced hydraulic conductivity of the lower aquifer relative to the upper aquifer means that groundwater flow will occur preferentially through the upper aquifer. Contaminant migration would therefore generally be restricted in the lower aquifer, except where bedrock fracturing might provide a preferential migration pathway. – The upper aquifer is not expected to be hydraulically connected to Lake McKenzie and Lake Windermere to the west of the sites. – Results from some investigation locations were indicative of perched groundwater at JBRF. However, the occurrences were isolated and discontinuous.
Groundwater and surface water use	JBRF, HMAS Creswell and Wreck Bay Village are supplied with mains water from the Jervis Bay Water Treatment Plant (WTP) located east of RAN SSSS, which sources water from Lake Windermere. The supply pipe and distribution pipes are predominantly underground, and traverse Booderee National Park and JBRF to/from the WTP. GHD conducted a community survey in July 2017 (GHD, 2017) regarding groundwater and surface water use, with the following results:

Item	Description
	– All respondents use mains supplied water for drinking purposes. – No groundwater wells were reported, recorded or licenced for potable abstraction. – On occasion, some members of the community use surface water for drinking and recreational (swimming) purposes.
Ecology	Terrestrial ecology JBRF and HMAS Creswell is surrounded by Booderee National Park. Open forest and woodland comprise the majority of vegetation at HMAS Creswell (55.4% of the site). JBRF has been described as predominantly dry heath scrubland (45.7% of the site), with wet health/sedgeland, ponds, wetlands and maintained areas comprising 33.1% of the area (SKM, 2006). GHD undertook an ecological assessment of the site in March 2021. A total of 79 terrestrial vertebrate species were recorded across the sites, including threatened and migratory species. Aquatic ecology Generally speaking, aquatic habitat is limited within the footprint of JBRF and HMAS Creswell sites. The Clay Pools directly south of JBRF are home to a large population of eastern long neck turtles, as well as dense communities of rushes and sedges. The area contains permanent water, and so also contains a variety of macroinvertebrates such as dragonflies, caddisflies and water skaters. HMAS Creswell is located within a Special Purpose Zone of the JBMP, which supports a wide variety of landforms and aquatic habitats. The region supports over 230 algae, hundreds of invertebrate species, over 210 reef fish species, sharks, rays, many marine mammals, birds and reptiles, including several threatened species.
Heritage	Jervis Bay has a long history of indigenous Australian settlement. The Aboriginal community of Wreck Bay is located south of JBRF, and the Jervis Bay area is of high heritage and cultural significance to this community. Booderee is home to the Yuin and Koori people of Wreck Bay. The Wreck Bay settlement was established by Koori people in the early 1900s. Koori people favoured the area because of strong traditional and cultural ties, proximity to both the bush and the sea for the collection of food and other resources, and distance from non-Aboriginal settlements (Renwick, 2000).

2.3 Conceptual site model

This section provides an outline of the PFAS sources, transport pathways for migration of PFAS from a source area, and potential receptors such as humans and ecosystems that may be exposed to PFAS from the sites.

Conceptual site model (CSM) cross sections and source-pathway-receptor linkages are provided in the PMAP (Defence, 2025a).

2.3.1 Source areas and transport pathways

Source areas can be primary or secondary. Primary sources are generally areas of PFAS contamination where aqueous film forming foam (AFFF) was used or stored, for example, a fire training area. Secondary source areas contain an accumulation of PFAS contamination in the environment, such as in soil, sediment, or surface water bodies, which has migrated from a primary source area. These source areas are also referred to as 'areas of environmental concern' (AECs).

PFAS can travel from a source to human or environmental receptors via transport pathways, in media such as surface water, groundwater and stormwater. The PFAS transport pathways identified at and surrounding JBRF and HMAS Creswell include:

- Stormwater and surface water: where rain flows through the PFAS source areas and then into the stormwater drains, or informal drainage routes on the sites and then into the surrounding creeks and wetland areas.
- Groundwater: where rain infiltrates through the PFAS source areas into the underlying groundwater table and then flows through the shallow soils and deeper bedrock into the surrounding creeks and wetland areas.
- Sewage infrastructure: where PFAS impacted water can enter the sewer system, travel into and through the sewage treatment plant (STP) and is then irrigated on the former golf course and Quarter Deck areas of the sites.

A particular feature of the sites and the surrounding area is the complex interaction between the surface water and the shallow groundwater. During periods of high rainfall, the groundwater table in the wetland areas on the sites

and in surrounding areas can rise to the surface, or 'daylight', and mix with the surface water. During the drier periods surface water in the wetlands will recharge the underlying shallow groundwater.

In the 2020 PMAP (Defence), six source areas were prioritised for risk management based on the amount of PFAS they contained. Since then, additional monitoring and investigation has improved the understanding of these sources, and confirmed that surface water flows are the primary transport mechanism of PFAS away from the source areas. The management of the surface water flowing through the sites is a key management action across JBRF and HMAS Creswell.

The source areas, and the associated transport pathways can be grouped based on natural surface water catchments:

- Mary Creek Catchment – characterised by the southern portion of the RAN SSSS (AEC A), which is a primary source area, and the wetland down gradient of the RAN SSSS (AEC B), which is an ongoing secondary source area. PFAS impacted surface water and groundwater sourced from this area flows into Mary Creek and Mary Bay.
- Captains Lagoon Catchment – characterised by the northern portion of the RAN SSSS (AEC A), the former fire training area (AEC C) and the former hangar building (AEC D), which are primary source areas, and the HMAS Creswell Sewage Treatment Plant (STP [AEC G]) which is an ongoing secondary source area. PFAS impacted surface water and groundwater sourced from these areas flows into Captains Lagoon.
- Flat Rock Creek Catchment – characterised by the HMAS Creswell fire station (AEC F), the former golf course which is irrigated with treated effluent from the STP (AEC E), the smaller western portion of the former fire training area (AEC C). PFAS impacted surface water and groundwater from these areas flows into Flat Rock Creek, and Jervis Bay. The former hydrocarbon drum disposal area (AEC H) is also located in this catchment, but is no longer considered a PFAS source area.

PFAS has migrated away from source areas on the sites via the surface water, and to a lesser extent the groundwater, pathways described above. In doing so, it has spread throughout (and has been used to define) the Management Area. However, the concentrations of PFAS in the broader Management Area off-site are significantly lower than that recorded on the sites. The PFAS impacts within the broader Management Area are not directly connected to source areas, and are similar levels to those published for 'remote-ambient' land use environments in NEMP 3.0 (HEPA, 2025).

The surface water flowing through the following catchments is not impacted by any of the primary source areas, and the PFAS concentrations in these areas have not been determined to present an elevated risk associated with PFAS exposure:

- Telegraph Creek – the creek is not known to receive any surface water or groundwater flow from the sites, and the concentrations of PFAS in the surface water and sediment are less than or approximately equal to the laboratory limit of reporting (LOR).
- Summercloud Creek – the creek does not receive any significant surface water or groundwater flow from the sites, and the investigations and risk assessments have concluded there is a low risk of PFAS exposure in the area. The western portion of the Summercloud Creek catchment is included within the PFAS Management Area, and precautionary health advice has been issued by the Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts (DITRDCA) for the main Summercloud Creek line.
- Lake Windermere – The Lake Windermere catchment does not extend onto the sites, and is not connected with the shallow groundwater on the base. The very low concentrations of PFAS detected in Lake Windermere may be from groundwater migration via the deep bedrock groundwater or catchment-wide surface water runoff. Potential changes in the hydrogeological setting in the Lake Windermere catchment were noted in the 2023 Ongoing Monitoring Interpretative Report, and will be investigated as part of the future ongoing monitoring.
- Lake McKenzie – A small portion of the Lake McKenzie catchment intersects the south-western site boundary of JBRF. This catchment area includes the 'Clay Pools', an area of cultural significance to the Wreck Bay community. During the 2022 investigations (GHD, 2022b), an informal surface water drain was identified as a possible transport pathway towards the Clay Pools. Whilst it is understood that harvesting for ceremonial clay has transferred to another area, and the assessments did not identify an elevated risk of exposure, the identified drainage path presents a management opportunity.

Further information regarding PFAS source areas that have been identified through previous investigations is provided in the OMP (Defence, 2025b).

2.3.2 Receptors, risks and exposure management

2.3.2.1 Human health risk assessment

The potential pathways through which people could be exposed to PFAS from JBRF and HMAS Creswell were assessed in the Human Health Risk Assessment (HHRA (GHD, 2019b)). These exposure pathways included the drinking water, contact with soil, eating home produce, swimming, fishing, eating Lilly Pilly fruit, catching and eating seafood and cultural practices.

Cultural practices include the use of sediments and clays for ceremonial purposes by local residents of Wreck Bay. Use of sediments associated with the Clay Pools area was specifically considered in the HHRA, and potential PFAS exposure was determined to be low and acceptable. Cultural use of sediments is also known to occur at the end point of Summercloud Creek, however this area did not require detailed consideration in the HHRA because PFAS was not detected in the sediments and therefore is unlikely to represent an unacceptable risk. Sampling of sediments in both areas have been included in the OMP, and will continue to be assessed.

Potential exposure risks that were identified as elevated or unacceptable in the HHRA are summarised in Table 4 with corresponding precautionary advice from the ACT Chief Health Officer via the DITRDCA. Based on the OMP data collected to date, no changes to the risk profile have been identified.

Table 3 Summary of elevated risks identified in the human health risk assessment with precautionary advice

Risk Identification	Description	DITRDCA Precautionary Advice
Mary Creek Catchment		
Drinking water from Mary Creek	Frequent consumption of large quantities of surface water from Mary Creek may result in elevated exposure to PFAS. Frequent consumption is drinking more than 8 cups per week for an adult, and more than 6 cups per week for a child.	The ACT Chief Health Officer via DITRDCA has recommended that precautionary advice be provided to the community: – Mary Creek is closed to human use.
Swimming in Mary Creek	There is an elevated exposure risk to children who frequently swim in Mary Creek. Frequent swimming is swimming more than 4 days per week.	
Eating seafood from Mary Creek	There is an elevated exposure risk to adults and children eating seafood from Mary Creek. The assessment identified an elevated exposure risk even at low levels of consumption, such as one serve per week for adults and children.	
Captains Lagoon		
Eating seafood from Captains Lagoon	There is an elevated exposure risk to adults and children frequently eating seafood from Captains Lagoon. Frequent consumption is more than 15 serves per week for adults and children.	The ACT Chief Health Officer via DITRDCA has recommended that precautionary advice be provided to the community: Catching and eating seafood from Captains Lagoon should be avoided.
Flat Rock Creek		
Eating seafood from Flat Rock Creek	There is an elevated exposure risk to adults and children frequently eating seafood (oysters, shrimp and whelk) from Flat Rock Creek. Frequent consumption is more than 15 serves per week for adults and children.	The ACT Chief Health Officer via DITRDCA has recommended that precautionary advice be provided to the community: Catching and eating seafood from Flat Rock Creek should be avoided.

Drinking water supply

JBRF, HMAS Creswell and Wreck Bay Village are supplied with mains water from the Jervis Bay Water Treatment Plant operated by Shoalhaven Water on behalf of JBTA. The raw water is currently sourced from Lake Windermere. JBTA undertakes routine testing for PFAS and publishes the result in community bulletins online.

The water supply is suitable for drinking, cooking food, and watering home-grown produce, including fruit, vegetables, and chickens laying eggs.

Mammals

The eating of mammals (kangaroo and echidna) is understood to no longer occur in the Management Area, however the pathway is culturally significant to the Wreck Bay community and, as such, was included in the HHRA. The HHRA was based on PFAS concentrations in rabbits. The rabbits were collected on site near the source areas, during an approved cull. Rabbits have a smaller home range, and because they were living closer to the source areas, the animals sampled had higher PFAS concentrations than would be expected in the mammals traditionally collected. For mammal meat, the risk assessment did not identify an elevated exposure risk, however, for adults who eat mammal offal more than once every two weeks there is an elevated exposure risk.

Summercloud Creek and Marine Waters of Mary Bay, Summercloud Bay and Jervis Bay

The HHRA included the assessment of PFAS exposure pathways associated with the use of Summercloud Creek, and the catching and eating of seafood from the marine water (i.e. ocean waters) of Mary Bay, Summercloud Bay and Jervis Bay. The risk assessment did not identify an elevated exposure risk for all uses of Summercloud Creek, this includes drinking creek water, swimming, using clay (sediments) and catching and eating of seafood. There was no elevated exposure risk for catching and eating seafood from Mary Bay and Summercloud Bay, and there were no detections of PFAS in the seafood samples collected from Jervis Bay.

2.3.2.2 Ecological risk assessment

The potential exposure of plants and animals were assessed in the Ecological Risk Assessment (ERA, (GHD, 2020a)). PFAS exposure risks to the environment are low and acceptable across the majority of the Management Area off-site. PFAS concentrations in sediment and surface water on the sites, and in Mary Creek, Captains Lagoon and Flat Rock Creek represent a potential direct contact risk to plants and animals. Food chain PFAS exposures were identified as a potential risk to birds, reptiles and mammals feeding on aquatic organisms from these creeks. Food chain PFAS exposures were also identified as a potential risk to carnivorous birds (such as the Kookaburra and Pied Butcherbird) that may forage within the PFAS source areas of JBRF.

3. Data quality assessment

3.1 Data quality objectives

The DQOs for the monitoring outlined in the OMP (Defence, 2025b) are presented in Table 4. They have been prepared in line with the DQO process outlined in the ASC NEPM (Schedule B2) (NEPC, 2013).

Table 4 Data quality objectives

Process	Description
Step 1: State the problem	The sites have legacy PFAS contamination in a range of environmental media, at concentrations which may pose an unacceptable risk to some human health and ecological receptors, as identified by site specific human health and ecological risk assessments. Management measures (including remediation works) are therefore required to mitigate the identified potential risks. The 'problem', as it stands, is that PFAS concentrations may change over time, either due to the mitigation measures implemented or due to changes in the site circumstances. Additionally, site conditions may also change over time, such as via land use change, or changes in surface water drainage networks. Changes in PFAS concentrations, and in migration pathways and potential receptors may result in an overall change in the site risk profile over time. The objective of ongoing monitoring is therefore to assess potential changes in risk to human and ecological receptors from PFAS originating from the sites. Specifically, assessment of changes in PFAS concentrations compared to the baseline understanding applied in the site-specific risk assessments is required to assist in informing management measures at the sites, including supporting validation of remediation works so far as reasonably practicable.
Step 2: Identify the decision/goal of the study	This OMP is aimed at resolving the following principal study questions: 1. Has the nature, extent and magnitude of PFAS concentrations changed significantly compared to the site-specific risk assessments, to warrant refinement of any existing management measures? 2. Has the potential risk of exposure to PFAS changed significantly compared to the site-specific risk assessments to warrant a revision of the Human Health Risk Assessment (HHRA) (GHD, 2019b) and/or Ecological Risk Assessment (ERA) (GHD, 2020a)? 3. What are the changes in the nature, extent and magnitude of PFAS concentrations in the groundwater and surface water within the Management Area?
Step 3: Identify the information inputs	The following inputs are required to resolve the principal study questions outlined in Step 2, and confirm that the conclusions of the HHRA and ERA remain valid: – PFAS concentrations in groundwater, surface water and sediment from monitoring events, including previous monitoring events. – Field data (i.e. groundwater standing water levels, physio-chemical parameters, flow, colour and turbidity) on groundwater, surface water and field descriptions of sediment. – Weather conditions preceding sampling events, particularly rainfall events. – Site status, land and water use scenarios and whether these have changed. – Outcomes of statistical evaluation of the data, including analysis for surface water and groundwater concentrations over time (where there are sufficient data points, and where appropriate). – Outcomes of comparison of data sets to assessment criteria and assessment triggers (refer to Section 4.5).
Step 4: Define the boundaries of the study	The spatial boundary of the study is the lateral extent of the PFAS Management Area, as displayed in Figure 1 of Appendix A. The temporal boundary for the purposes of the study is the annual monitoring period data, which will be compared to historical data (where available). 'Baseline' site conditions are defined as the 2018 and 2019 results associated with the DSI (GHD, 2019a), noting that not all OMP monitoring locations existed at the time of the DSI.
Step 5: Develop the analytical approach/decision rules	The analytical and field data will be used to assess changes to the nature, extent and magnitude of PFAS in environmental media. The following approach will be used to address the three decision questions outlined in Step 2: – Monitoring locations will be categorised into the catchments they are located in, and as representative of either PFAS source zones (i.e. AECs), pathways or receptor environments. This is referred to as the 'SPR classification' and is provided for each monitoring location outlined in Appendix B.

Process	Description
	- Locations categorised as 'source' will not be assessed in detail as part of the OMR, as the intention of monitoring source areas is to benchmark source conditions should further 'pathway' and 'receptor' assessment be needed. - Water data associated with 'pathway' and 'receptor' locations will be assessed using statistical trend analysis (where appropriate). Additionally, data will be considered against adopted performance measures (comprised of screening criteria and assessment triggers) identified as relevant to the catchment area based conceptual site model. The process for assessment of potential receptor exposure pathways is outlined below. There are two different approaches depending on the current presence of administrative controls within a catchment area: - Where administrative measures are currently in place for a potential human receptor exposure pathway, or where potentially elevated ecological risks have previously been identified, water data will be assessed using trend analysis only, with performance measures considered to provide context to the magnitude of the results. - Where no administrative measures are in place for human health, or where no elevated risks to ecological health have previously been identified, an assessment of concentration trends and performance measures will be adopted. Where an individual location is identified as exceeding the performance measure, further assessment will be undertaken of that location as part of wider catchment area. - Assessment of potential receptor exposure pathways associated with ecological health will follow a similar approach to that described for human health. However, the application of administrative measures is not possible for ecological receptors. Therefore, catchments will be considered in terms of previously identified ecological risk or no previously identified ecological risks. - Trend assessment will not be undertaken for sediment data. The existing dataset is extensive and has shown little change over time. Sediment sampling in selected locations will be utilised as a conservative measure for assessment of potential risks to receptors. - Sediment data will only be compared to adopted performance measures (where applicable). Trend assessment for water data will be undertaken by comparing new data to the concentrations recorded during previous monitoring events to evaluate changes at individual locations and in population groups defined by surface water catchment area, and SPR classification. The following decision outcomes are anticipated from these approaches: - If concentrations of PFAS demonstrate discernible increasing trends, if concentrations exceed the performance measure, and/or no trend is determined but concentrations exceed the performance measures, trigger actions outlined in the OMP (Defence, 2025b) will be implemented. - If concentrations of PFAS demonstrate stable or declining trends, meet the OMP cessation trigger, and do not pose any unacceptable risks to identified receptors, then no further action is required other than to complete the monitoring until site management works are completed 'so far as reasonably practicable'.
Step 6: Specify performance or acceptance criteria	A robust data validation (QA/QC) program will be undertaken prior to data assessment in accordance with the requirements of the OMP to minimise the potential for significant decision errors. Data quality indicators (DQIs) will be applied to assess the usability of the data prior to making decisions, based on precision, accuracy, representativeness, comparability and completeness. The ASC NEPM (NEPC, 2013) and NEMP 3.0 (HEPA, 2025) detail the various metrics that will be used to assess data in terms of these DQIs. The adopted DQIs for this investigation are: - Field and analytical data are to be collected in general accordance with the NEMP 3.0 (HEPA, 2025) and the ASC NEPM (NEPC, 2013). - Field personnel should be trained and have sufficient experience to complete the fieldwork to an acceptable standard, as per the protocols outlined in the OMP / SAQP. - Robust field and laboratory quality assurance/quality control protocols are to be adopted, outlined in the SAQP in Section 3.2. - Use laboratories that are National Association of Testing Authorities (NATA) accredited for PFAS analysis and ensure laboratory limits of reporting (LORs) are suitable to meet the relevant adopted assessment levels outlined in Section 4.5.
Step 7: Develop the plan for obtaining data	The OMP (Defence, 2025b) provides the overarching structure for preparing a SAQP, including scope of work, broad sampling methodologies, monitoring locations and PFAS assessment levels. This SAQP has been developed to align with the requirements of the OMP (Defence, 2025b) and the principal study questions outlined in Step 2. As such, this SAQP is intended to provide the sampling methods that shall be used to obtain data of sufficient quality. An annual review of the OMP will be undertaken at the end of each year and at completion of the implementation period, to ensure that the OMP and subsequent SAQPs remain appropriate based on

Process	Description
	the outcomes of the previous annual report. Deviations from this OMP (if any) will be outlined and justified in the SAQP and annual report.

3.2 Assessment of data quality

The DQIs and their acceptance criteria are presented in Table 5.

Table 5 DQI acceptance criteria

Data quality indicator	Frequency	Data quality acceptance criteria
Precision – a quantitative measure of the variability (or reproducibility) of data		
Intra- and inter-laboratory duplicates	1 per 10 primary samples	The relative percentage differences (RPDs) are to be calculated for all primary and field duplicate pairs and will be considered acceptable based on the following RPD limits: – 200% for concentrations within 1 to 10 times the analyte LOR – 50% for concentrations within 10 to 30 times the analyte LOR – 30% for concentrations greater than 30 times the analyte LOR
Laboratory duplicates	As per laboratory NATA requirements	Laboratory duplicate sample RPDs are to be less than: – 20% for high level concentrations (i.e. greater than 20 times the analyte LOR). – 50% for medium level concentrations (i.e. between 10 and 20 times the analyte LOR).
Trip blank	1 per event	<LOR
Accuracy – a quantitative measure of the closeness of reported data to the true value		
Laboratory control samples	As per laboratory NATA requirements	<LOR
Matrix spikes	As per laboratory NATA requirements	70% - 130%
Method blanks	As per laboratory NATA requirements	<LOR
Rinsate blanks	1 per day (where re-usable sampling equipment is used)	<LOR
Representativeness – the confidence (expressed qualitatively) that data are representative of each media present on the site		
Sampling appropriate for media and analytes	All samples	Appropriate laboratory PFAS suite
Samples extracted and analysed within holding times	All samples	As per laboratory NATA requirements
LORs appropriate and consistent	All samples	All samples
Comparability – the confidence (expressed qualitatively) that data may be considered to be equivalent for each sampling and analytical event		
Experienced field staff	All samples	All samples

Data quality indicator	Frequency	Data quality acceptance criteria
Standard operating procedures for sample collection & handling	All samples	All samples
Appropriate analytical methods used for all analyses	All samples	All samples
Completeness – a measure of the amount of useable data (expressed as %) from a data collection activity		
Sample description and COCs completed and appropriate	All samples	All samples
Appropriate documentation	All samples	All samples
Satisfactory frequency and result for QA/QC samples	All QA/QC samples	As above
Acronyms: COC: Chain of Custody LOR: Limit of Reporting NATA: National Authorities Testing Australia QA/QC: Quality assurance / quality control		

4. Sampling rationale and methodology

4.1 The OMP

The revised OMP (Defence, 2025b) outlines the requirements for the monitoring works to be undertaken and provides the basis for the preparation of this SAQP. Monitoring is to be undertaken biannually (twice a year), with a summary of each event presented in Table 6. Specific sampling locations for each event are displayed on Figure 3, Figure 4A, Figure 4B, Figure 4C, Figure 4D and Figure 4E in Appendix A and are detailed in Appendix B.

Table 6 *Monitoring events summary*

Event	Media	Number of Locations
April	Surface water	54
	Sediment (except Clay Pools locations – 0021_SD066, 0021_SD067, 0021_SD068, 0021_SD069)	16
October	Groundwater	77 ¹
	Surface water	54
	Sediment	20
	Infrastructure Tanks	3

Table Notes:
 1. 0021_MW104 was removed from the scope of monitoring locations presented in the OMP (Defence, 2025b) as it was destroyed during remedial works. If replaced, it is to be included in future October sampling events.

4.2 Sample collection and handling

4.2.1 Groundwater sampling

The groundwater sampling methodology is presented in Table 7, which will be used for the October sampling event.

It is noted that the remedial performance monitoring activities (outlined in the GHD validation and performance monitoring SAQP (GHD, 2024b)) modified the collection of groundwater samples from hydrasleeves to low flow sampling given the difficulties using hydrasleeves during the Spring 2024 OMP event. The numerous shallow wells triggered the need for an alternative approach and we consider that low flow sampling over bailers is a more robust technique for consistent data quality for the whole base. For consistency purposes, and to align OMP sampling methodology between the historical LC and performance monitoring the sampling methodology is modified from hydrasleeves to low flow for all groundwater sampling activities.

Table 7 *Groundwater sampling methodology*

Item	Description
Technical guidelines	– AS/NZS 5667.1:1998 Water Quality – Sampling, Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples (Standards Australia, 1998a). – AS/NZS 5667.11:1998 Water Quality – Sampling, Part 11: Guidance on the Sampling of Groundwaters (Standards Australia, 1998c) – ASC NEPM (NEPC, 2013). – NEMP 3.0 (HEPA, 2025).
Field screening and gauging	The monitoring wells will be gauged prior to collection of groundwater samples using a decontaminated oil/water interface probe to measure standing water level (SWL). In addition, the base depth of the monitoring wells will be measured. Depth measurements will be referenced to the top of well casing as an established datum. Where possible, depth measurements will be recorded to the nearest millimetre.

Item	Description
Field chemistry and sampling	The wells will be purged and sampled using dedicated and disposable high-density polyethylene (HDPE) tubing coupled to a peristaltic pump system. If sampling locations are not able to be accessed with a peristaltic pump, disposable polyvinyl chloride (PVC) bailer and twine will be used to obtain a grab sample. Using this approach, only dedicated disposal equipment will come into contact with the sample, reducing the potential of for cross contamination between sampling locations. If wells are drawing down, or only a small volume of water is available, a sample will be collected prior to running the well dry. The well will then be purged dry, and allowed to recharge for the day of the sampling. If recharge has occurred a secondary grab sample will be collected and submitted preferentially to the first sample for analysis. Field parameters (pH, electrical conductivity [EC], oxygen reduction potential [ORP], dissolved oxygen [DO] and temperature) will be measured, recorded and stabilised prior to sample collection. In addition, observations of water quality such as the colour, turbidity level, and the presence/absence of odour or sheen will be recorded. Sample containers will be labelled with nomenclature as detailed in Section 4.4.1.
Decontamination	Prior to and following the collection of each groundwater sample, all non-disposable sampling equipment will undergo decontamination including: – Washing of equipment with phosphate/PFAS-free detergent (Liquinox) and/or – Rinsing of equipment with laboratory supplied PFAS-free water.
Quality assurance and quality control (QA/QC)	The following field QA/QC samples will be collected and analysed for PFAS (standard suite) as part of the groundwater sampling program: – One intra-laboratory duplicate per ten primary samples. – One inter-laboratory duplicate per ten primary samples. – One rinsate sample per day of sampling. – One trip blank per batch.

4.2.2 Surface water sampling

The surface water sampling methodology is presented in Table 8, which will be used for both sampling events.

Table 8 Surface water sampling methodology

Item	Description
Technical guidelines	– AS/NZS 5667.1:1998 Water Quality – Sampling, Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples (Standards Australia, 1998a). – AS/NZS 5667.6:1998 Water Quality – Sampling, Part 6: Guidance on the Sampling of rivers and streams (Standards Australia, 1998b). – ASC NEPM (NEPC, 2013). – NEMP 3.0 (HEPA, 2025).
Field chemistry and sampling	A surface water sample will be collected as a 'grab sample' mid-way through the water column or approximately 0.5 m below the surface at the individual surface water sampling locations. If the reachable water column is less than 0.5 m deep, the sample will be collected from at least half the water depth, and care should be taken to avoid surface films entering the sample. Each individual sample will be collected into a new laboratory-supplied, unpreserved sample container with new nitrile gloved hands. An extendable sampling pole may be used for easier sample collection. Field parameters (pH, EC, ORP, DO and temperature) will be measured and recorded for all surface water locations. In addition, observations of water quality such as the flow (flowing or not flowing), colour, turbidity level, and the presence/absence of odour or sheen will be recorded. Sample containers will be labelled with nomenclature as detailed in Section 4.4.1.
Quality assurance and quality control (QA/QC)	The following field QA/QC samples will be collected and analysed for PFAS (standard or trace suite depending on location, see Section 4.3.2) as part of the surface water sampling program: – One intra-laboratory duplicate per ten primary samples. – One inter-laboratory duplicate per ten primary samples. – One rinsate sample per day of sampling (where applicable). – One trip blank per batch.

4.2.3 Sediment sampling

The sediment sampling methodology is presented in Table 9, which will be used for both sampling events.

Table 9 *Sediment sampling methodology*

Item	Description
Technical guidelines	– AS/NZS 5667.12:1999 Water Quality – Sampling, Part 12: Guidance on sampling of bottom sediments. (Standards Australia, 1999). – ASC NEPM (NEPC, 2013). – NEMP 3.0 (HEPA, 2025).
Field chemistry and sampling	Sediment samples are to be representative of potentially deposited sediments and collected from a depth from within the water body using a hand trowel to a maximum depth of 0.3 m below the sediment surface. If this is not possible (due to embankment instability and/or high surface water depth), samples will be collected using a hand auger. A new laboratory supplied container will be used at each location for collection of samples and the sample containers will be labelled with the job number, sample identification and date collected. Description of each sampling location and the sample material will be recorded on the field notes. Sample containers will be labelled with nomenclature as detailed in Section 4.4.1.
Decontamination	If re-usable sampling equipment is used, then prior to and following the collection of each sediment sample the equipment must undergo decontamination including: – Washing of equipment with phosphate/PFAS-free detergent (Liquinox) and/or – Rinsing of equipment with laboratory supplied PFAS-free water.
Quality assurance and quality control (QA/QC)	The following field QA/QC samples will be collected and analysed for PFAS (standard suite) as part of the sediment water sampling program: – One intra-laboratory duplicate per ten primary samples. – One inter-laboratory duplicate per ten primary samples. – One rinsate sample per day of sampling (where applicable). – One trip blank per batch.

4.2.4 Infrastructure tank water sampling

The tank water sampling methodology is presented in Table 10, which will be used for the October sampling event.

Table 10 *Infrastructure tank sampling methodology*

Item	Description
Technical guidelines	– AS/NZS 5667:1998 Water Quality – Sampling, Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples (Standards Australia, 1998a). – ASC NEPM (NEPC, 2013). – NEMP 3.0 (HEPA, 2025).
Field chemistry and sampling	Tank grab samples will be collected using the sampling methodology provided below for each location: – OTH001 (Training Water Holding Tank [S415]): Fill sampling containers directly from tap. – OTH002 (Fire Main Water Tank [S416]): Fill sampling containers from the opening at the top of the tank with a sampling pole, accessed via a ladder. – OTH006 (DLSTRU [S481]): Use a peristaltic pump or disposable PVC bailers to collect sample. Field parameters (pH, EC, ORP, DO and temperature) will be measured and recorded for all sampling locations. In addition, observations of water quality such as the flow (if present), colour, turbidity level, and the presence/absence of odour or sheen will be recorded. Sample containers will be labelled with nomenclature as detailed in Section 4.4.1.
Quality assurance and quality control (QA/QC)	The following field QA/QC samples will be collected and analysed for PFAS (standard suite) as part of the sampling program: – One intra-laboratory duplicate per ten primary samples. – One inter-laboratory duplicate per ten primary samples.

Item	Description
	– One rinsate sample per day of sampling (where applicable). – One trip blank per batch.

4.2.5 Sample handling

Following the collection of each batch of samples, samples will be immediately stored in a cool, dark environment (esky) prior to being forwarded to the NATA accredited analytical laboratory within the specified holding times along with a standardised chain of custody (COC) form. Analyses will be undertaken on a standard turnaround time of five business days, and analytical results will be emailed to GHD as a compiled report from the laboratory (as Esdat files and PDF report).

4.3 Analytical suite and laboratory analysis methods

4.3.1 Laboratory NATA accreditation details

The NATA accredited laboratories selected for this monitoring program are as follows:

- Primary laboratory: Australian Life Science (ALS) Environmental, Smithfield, New South Wales (NATA Accreditation No. 825).
- Secondary laboratory: Eurofins, Girraween, New South Wales (NATA Accreditation No. 1261).

4.3.2 Analytical schedule

Surface water locations within the Lakes catchment (0021_SW032, 0021_SW034, 0021_SW037 and 0021_SW040) will be analysed at a trace level limit of reporting (<0.002-0.01 ug/L) to enable comparison to human health receptor guidelines. All other locations for this monitoring program will be analysed at a standard LOR as detailed in Table 11.

Table 11 Analytical schedule summary

Chemical Class	Analyte Code	Analyte Name	LOR			
			Groundwater and Surface Water (ug/L)		Sediment (mg/kg)	
			ALS	Eurofins	ALS	Eurofins
Perfluoroalkane sulfonic acids	PFBS	Perfluorobutane sulfonic acid	0.02	0.01	0.0002	0.005
	PFPeS	Perfluoropentane sulfonic acid	0.02	0.01	0.0002	0.005
	PFHxS	Perfluorohexane sulfonic acid	0.01	0.01	0.0002	0.005
	PFHpS	Perfluoroheptane sulfonic acid	0.02	0.01	0.0002	0.005
	PFOS	Perfluorooctane sulfonic acid	0.01	0.01	0.0002	0.005
	PFDS	Perfluorodecane sulfonic acid	0.02	0.01	0.0002	0.005
Perfluoroalkyl carboxylic acids	PFBA	Perfluorobutanoic acid	0.1	0.05	0.001	0.005
	PFPeA	Perfluoropentanoic acid	0.02	0.01	0.0002	0.005
	PFHxA	Perfluorohexanoic acid	0.02	0.01	0.0002	0.005
	PFHpA	Perfluoroheptanoic acid	0.02	0.01	0.0002	0.005
	PFOA	Perfluorooctanoic acid	0.01	0.01	0.0002	0.005
	PFNA	Perfluorononanoic acid	0.02	0.01	0.0002	0.005
	PFDA	Perfluorodecanoic acid	0.02	0.01	0.0002	0.005
	PFUnDA	Perfluoroundecanoic acid	0.02	0.01	0.0002	0.005
	PFDoDA	Perfluorododecanoic acid	0.02	0.01	0.0002	0.005

Chemical Class	Analyte Code	Analyte Name	LOR			
			Groundwater and Surface Water (ug/L)		Sediment (mg/kg)	
			ALS	Eurofins	ALS	Eurofins
Perfluoroalkyl sulfonamides	PFTTrDA	Perfluorotridecanoic acid	0.02	0.01	0.0002	0.005
	PFTTeDA	Perfluorotetradecanoic acid	0.05	0.01	0.0005	0.005
	FOSA	Perfluorooctane sulfonamide	0.02	0.05	0.0002	0.005
	MeFOSA	N-Methyl perfluorooctane sulfonamide	0.05	0.05	0.0005	0.005
	EtFOSA	N-Ethyl perfluorooctane sulfonamide	0.05	0.05	0.0005	0.005
	MeFOSE	N-Methyl perfluorooctane sulfonamidoethanol	0.05	0.05	0.0005	0.005
	EtFOSE	N-Ethyl perfluorooctane sulfonamidoethanol	0.05	0.05	0.0005	0.005
	MeFOSAA	N-Methyl perfluorooctane sulfonamidoacetic acid	0.02	0.05	0.0002	0.01
	EtFOSAA	N-Ethyl perfluorooctane sulfonamidoacetic acid	0.02	0.05	0.0002	0.01
(n:2) Fluorotelomer sulfonic acids	4:2 FTS	4:2 Fluorotelomer sulfonic acid	0.05	0.01	0.0005	0.005
	6:2 FTS	6:2 Fluorotelomer sulfonic acid	0.05	0.05	0.0005	0.01
	8:2 FTS	8:2 Fluorotelomer sulfonic acid	0.05	0.01	0.0005	0.005
	10:2 FTS	10:2 Fluorotelomer sulfonic acid	0.05	0.01	0.0005	0.005

4.3.3 Validation of analytical results

After completion of a monitoring event, analytical results will be reviewed and may need to be validated to confirm the original results if a QAQC discrepancy is considered possible. This would be achieved by requesting re-analysis of a sample by the laboratory or, if required, re-sampling and analysis. GHD would seek approval from Defence prior to mobilisation to the sites for re-sampling.

4.4 Data management

4.4.1 Sample nomenclature

All sample naming will be in accordance with the Defence Contamination Management Manual (DCMM) (Defence, 2018, Amended June 2021), specifically Annex L (Data Management). Sample IDs will follow the nomenclature below:

PPPP_XX000_YYMMDD

Where for this monitoring program:

- PPPP = Property ID = '0020' for HMAS Creswell and '0021' for JBRF.
- XX = Location type, e.g. 'MW' for monitoring well or 'SW' for surface water.
- 000 = Three-digit sample number = e.g. '027'.
- YYMMDD = Sample date by year, month then day, e.g. '251031'.

The above example would provide a sample ID (at HMAS Creswell) of '0020_SW027_251031.'

QA/QC samples will be labelled in accordance with DCMM Annex L, as per the following nomenclature:

- Intra-laboratory duplicate (blind): PPPP_QC1XX_YYMMDD.

- Inter-laboratory duplicate (split): PPPP_QC2XX_YYMMDD.
- Rinsate blank: PPPP_QC3XX_YYMMDD.
- Trip blank: PPPP_QC5XX_YYMMDD

4.4.2 Defence ESdat requirements

All field and analytical data collected as part of this monitoring program will be uploaded, stored and managed in the Defence Environmental Data Management System (EDMS) in accordance with DCMM Annex L using ESdat software. After completion of a monitoring event, field and analytical data will be uploaded into ESdat prior to submission of the factual report for the sampling event.

4.5 Adopted performance measures

The OMP (Defence, 2025b) defines performance measures to determine if PFAS concentrations associated with a potential exposure pathway and/or receptor environment represents an unacceptable risk to receptors such that further investigation or management is required. The performance measures are comprised of:

- Published screening criteria: The relevant guidelines and legislation reviewed at the time of this report to define the adopted screening criteria are outlined in Section 1.5.
- Assessment triggers: A project specific criterion applied to assess whether there have been possible adverse trends in risk. Quantitative triggers have been adopted as performance measures in the absence of screening criteria (for example, there is no published criteria for PFAS in sediments, or associated with infrastructure tanks).

The performance measures are specific to each surface water catchment based on the pathways and receptors identified in each catchment. Additionally, some catchments have existing management measures in place, which means that further assessment of potential risk for those exposure pathways is not required under the OMP. Therefore, for the catchment areas with management measures already in place, performance measures will only be adopted to provide qualitative context to the magnitude of the results obtained. As outlined in step 5 of the DQOs, the adopted performance measures will only be applied to locations categorised as representative of either 'pathway' or 'receptors' in the site CSM.

The summary of performance measures adopted per catchment as per the OMP (Defence, 2025b) is presented in Table 12.

Table 12 Summary of adopted performance measures

Media	Receptor	Criteria	Analyte						Applied to catchment?								
			PFAS (sum of total)	PFOS + PFHxS	PFHxS	PFOS	PFOA	PFBS	Mary Creek	Flatrock Creek	Captains Lagoon	Telegraph Creek	The Lakes	Clay Pools	Summercloud Creek	Bherwerre Barrier	RAN SSSS Infrastructure tanks
Groundwater and surface water	Ecology	NEMP (2025) – freshwater and marine water 95% species protection	-	-	-	0.13 ug/L	220 ug/L	-	C	C	C	✓	✓	✓	✓	✓	-
	Human health – direct contact and incidental ingestion	ADWG – health (2025) (NHMRC, 2011)	-	-	0.03 ug/L	0.008 ug/L	0.2 ug/L	1 ug/L	-	-	-	-	✓	-	-	-	-
		NEMP (2025) – Recreational	-	2 ug/L	2 ug/L	2 ug/L	10 ug/L	-	C	✓	✓	✓	✓	✓	✓	-	-
	Human health – consumption of biota	Detection >0.01 ug/L	>0.01 ug/L	-	-	-	-	-	-	-	-	✓	✓	✓	-	✓	-
	Human health – Defence personnel	Activity specific HHRA EPC for RAN SSSS	39.7 ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	✓
Sediment	Human health – ceremonial	Detection >0.0002 mg/kg	>0.0002 mg/kg	-	-	-	-	-	-	-	-	-	-	-	✓	-	-
		HHRA Exposure point concentration for clay pools	0.0014 mg/kg	-	-	-	-	-	-	-	-	-	-	✓	-	-	-

Table Notes:

✓ = performance measure to be applied for risk screening purposes,

C = performance measure to be used for qualitative, contextual purposes only,

- = performance measure not applicable

4.6 Quality assurance / quality control

4.6.1 Duplicate samples

Intra-laboratory (blind) and inter-laboratory (split) duplicates are to be collected and analysed for PFAS in accordance with the NEMP 3.0 (HEPA, 2025) at a minimum frequency of 1 in 10 primary samples.

4.6.2 Rinsate samples

Rinsate blank samples are to be collected at a rate of one per day of monitoring where re-usable sampling equipment has been used (e.g. interface probe, trowel). The rinsate blank sample is collected by pouring laboratory supplied deionised water over the decontaminated sampling equipment into the appropriate sampling container for PFAS analysis.

4.6.3 Trip blank samples

Trip blank samples will be used to estimate the amount of contamination introduced during the transport and storage of samples from the time of sampling to the time of analysis. Trip blanks are laboratory supplied and will be collected at a rate of 1 sample per fieldwork and analysed for PFAS at the standard LOR.

4.6.4 Calibration

Prior to use in the field, all field instruments (i.e. water quality meter, interface probe) are to be calibrated by the equipment supplier to optimise the accuracy of the measurements taken. The calibration certificate from the equipment supplier will be checked by the field team to confirm that the field instruments are in good working condition. All calibration certificates for equipment hired will be collected as part of the field documentation and presented as an attachment in the Sampling Event Report.

Field staff will also perform daily calibrations of the water quality meter for pH and EC.

4.7 Field documentation

4.7.1 Field notes

All sampling locations for each monitoring round will have an accompanying field record which is to include the information presented in Table 13.

Table 13 Summary of fieldwork documentation

Media	Information to be recorded
Groundwater	– Standing water level (pre-purge, and during purge), well depth and sample depth measurements. – Date, time and sampler. – Field parameters (pH, EC, ORP, DO and temperature). – Observations of colour, turbidity, presence/absence of odour or sheen. – Sample containers collected including intra- or inter-laboratory duplicates. – Field QA checks.
Surface water	– Date, time and sampler. – Field parameters (pH, EC, ORP, DO, temperature and turbidity). – Observations of colour, turbidity, presence/absence of odour or sheen. – Environmental observations such as weather, temperature, slope and erosion. – Hydrological observations such as flow (qualitative statement of 'flowing' or 'not flowing') and estimated width and depth of water body with photographs of each sample point. – Sample containers collected including intra- or inter-laboratory duplicates. – Other comments (health and safety, access issues, change in location, general observation, notes for future).

Media	Information to be recorded
Sediment samples	– Date, time and sampler. – Depth of sample from sediment surface level. – Observations of colour, soil type, moisture, presence/absence of odour or staining. – Environmental observations such as weather, slope and erosion. – Sample containers collected including intra- or inter-laboratory duplicates. – Other comments (health and safety, access issues, change in location, general observation, notes for future).

4.7.2 Sample labels

Sample containers will be labelled with the following identification:

- Project number.
- Sample identification (as per the nomenclature outlined in Section 4.4.1).
- Sampler name.
- Sample collection date.

4.7.3 Chain of custody (COC) forms

For each batch of samples prepared in the field, a COC form will be completed and sent with the samples to the laboratory. The COC form will include information such as the project number and name, sample identification and date, requested analyses and will be signed by the field staff representative. Upon receipt of samples at the laboratory, the COC will be signed by a laboratory staff member.

If additional samples are collected during monitoring based on field observations which are not from sampling locations included in this SAQP, GHD will seek approval from Defence for analysis of these samples.

5. Reporting

5.1 Sampling event report

After each monitoring event, observations, field and laboratory data will be documented in a Sampling Event Report prepared in accordance with the *PFAS Ongoing Monitoring Program Reporting Guidance* (Defence, 2024) and will include:

- Scope of works undertaken including constraints and assumptions.
- Deviations from SAQP/OMP and associated implications (if any).
- Sampling methodology.
- PFAS performance measures.
- Evaluation of quality assurance and quality control to assess the adequacy for interpretative use.
- Summary of the field observations including weather conditions, visual and olfactory indicators.
- Results and discussion of field parameters and analytical results, with comparison to historical conditions and performance measures, and consideration of results and other information against OMP triggers.
- Conclusions and recommendations for actions to be completed prior to next sampling event or for future consideration.
- Figures which present sampling locations, PFAS distribution and flow directions (groundwater and surface water).
- A tabulated summary of field parameters and analytical results with comparison to the performance measures.
- Inclusion of appendices for:
 - Field records of monitoring locations.
 - Laboratory analytical certificates and chain of custody forms.
 - Equipment calibration certificates.

5.2 Ongoing monitoring report

At the end of a specified period (typically annually but may vary) the whole data set (current and historic data) will be reviewed, and an Ongoing Monitoring Report (OMR) prepared.

The OMR will be prepared in accordance with the *PFAS Ongoing Monitoring Program Reporting Guidance* (Defence, 2024) and will include:

- Executive summary on key findings, triggers and implications for the community and other stakeholders.
- Objectives.
- Scope of works including any important deviations.
- Site location and description, management, monitoring and source areas and site setting.
- Sampling and analysis methodology.
- Evaluation of quality assurance and quality control across the monitoring period.
- Results including groundwater elevations and inferred groundwater flow direction, and a summary of field parameters and analytical results.
- Contextual and ancillary information that has occurred in the broader management area that may affect monitoring results, such as remediation projects, infrastructure projects and weather events.
- Figures which present sampling locations, PFAS distribution and flow directions (groundwater and surface water).
- A tabulated summary of field parameters and laboratory analytical results with comparison to the performance measures.

- Data interpretation as per the DQOs, including trends in concentration (where appropriate, as per the OMP (Defence, 2025b)), gradient and flow directions.
- Overall summary of the changes and extent of PFAS and whether monitoring has met the objectives of the OMP.
- Assessment of data against triggers detailed in the OMP and recommendations for responses.
- Inclusion of appendices for:
 - Previous OMP factual reports.
 - This SAQP.

6. References

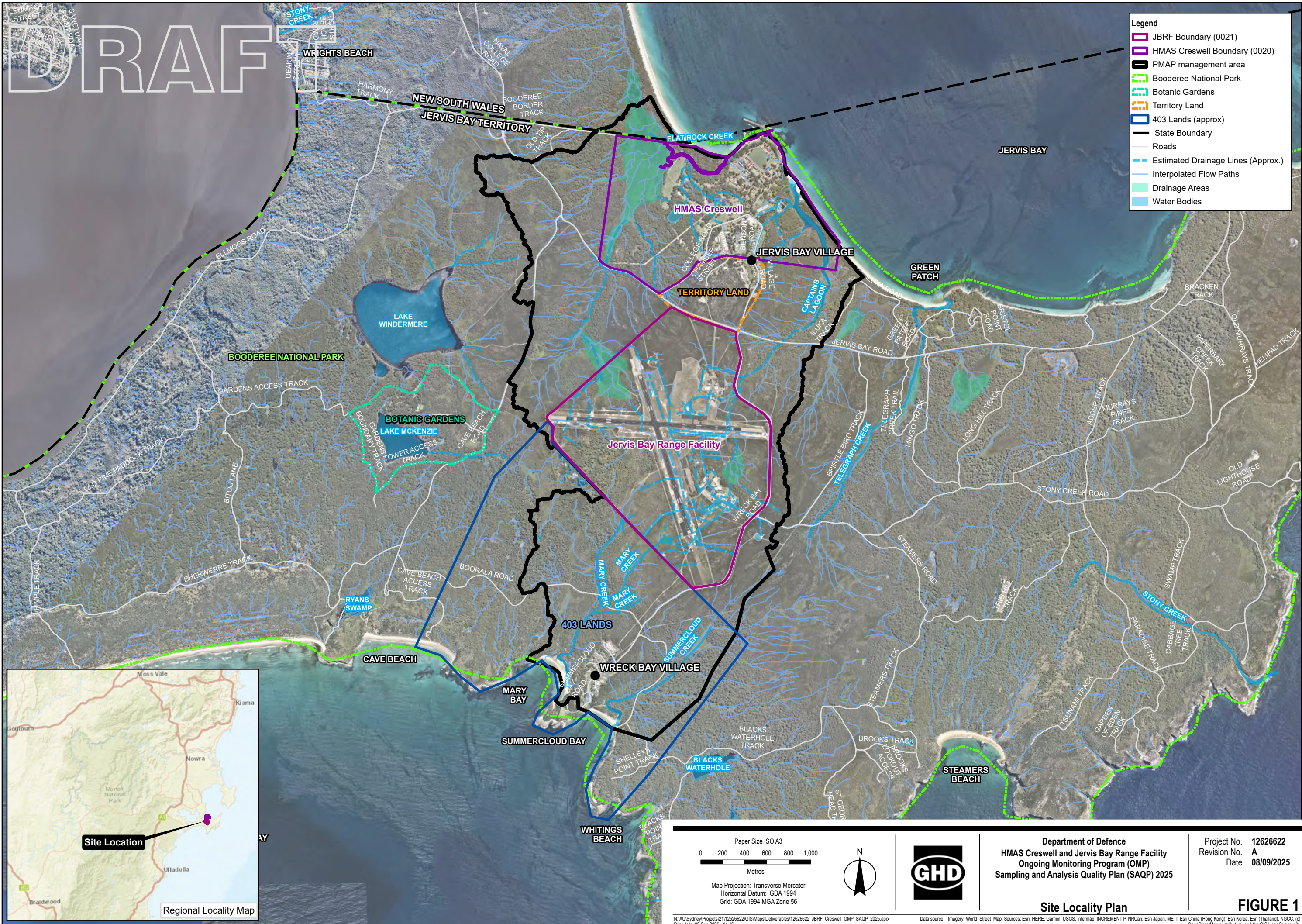
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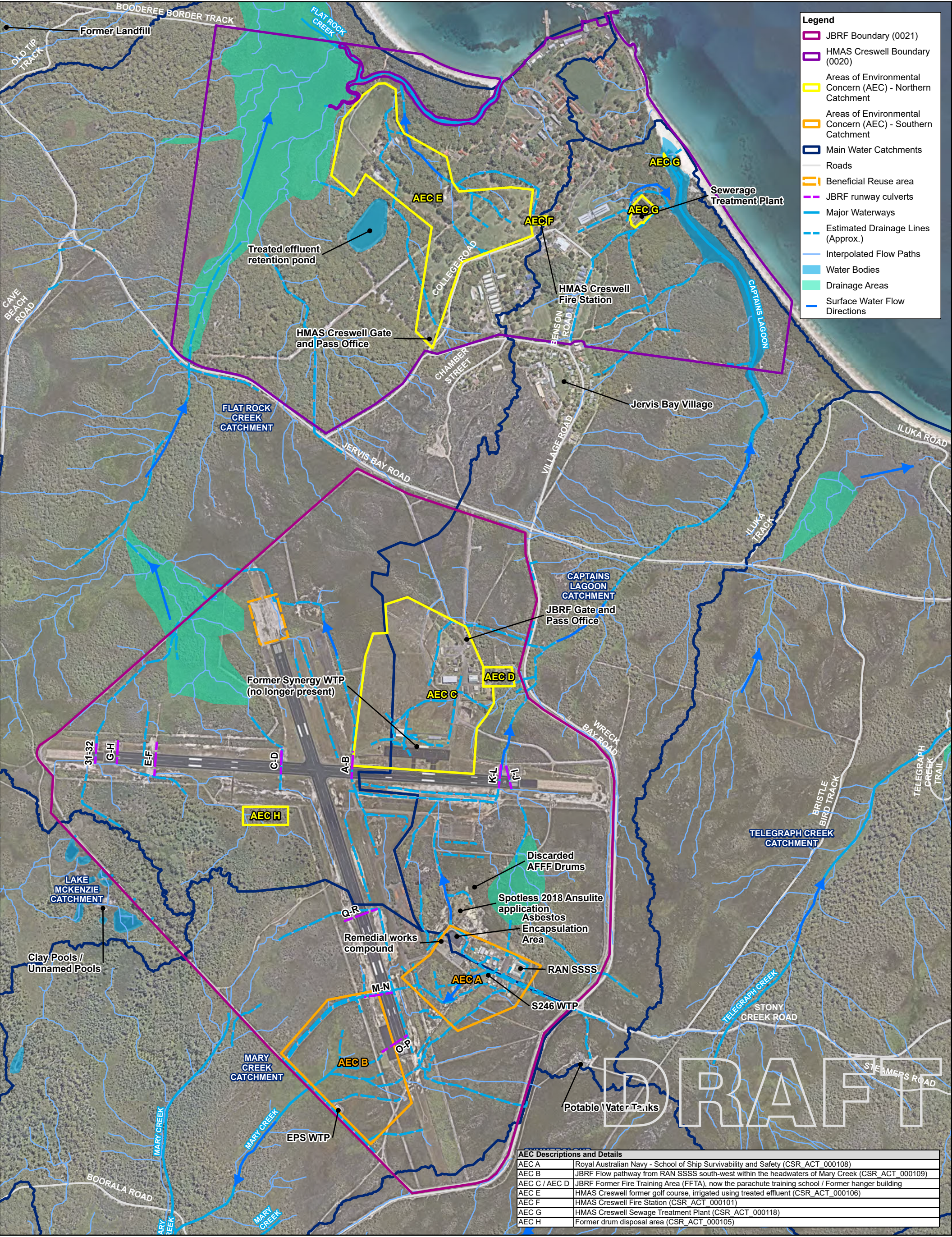
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Appendices

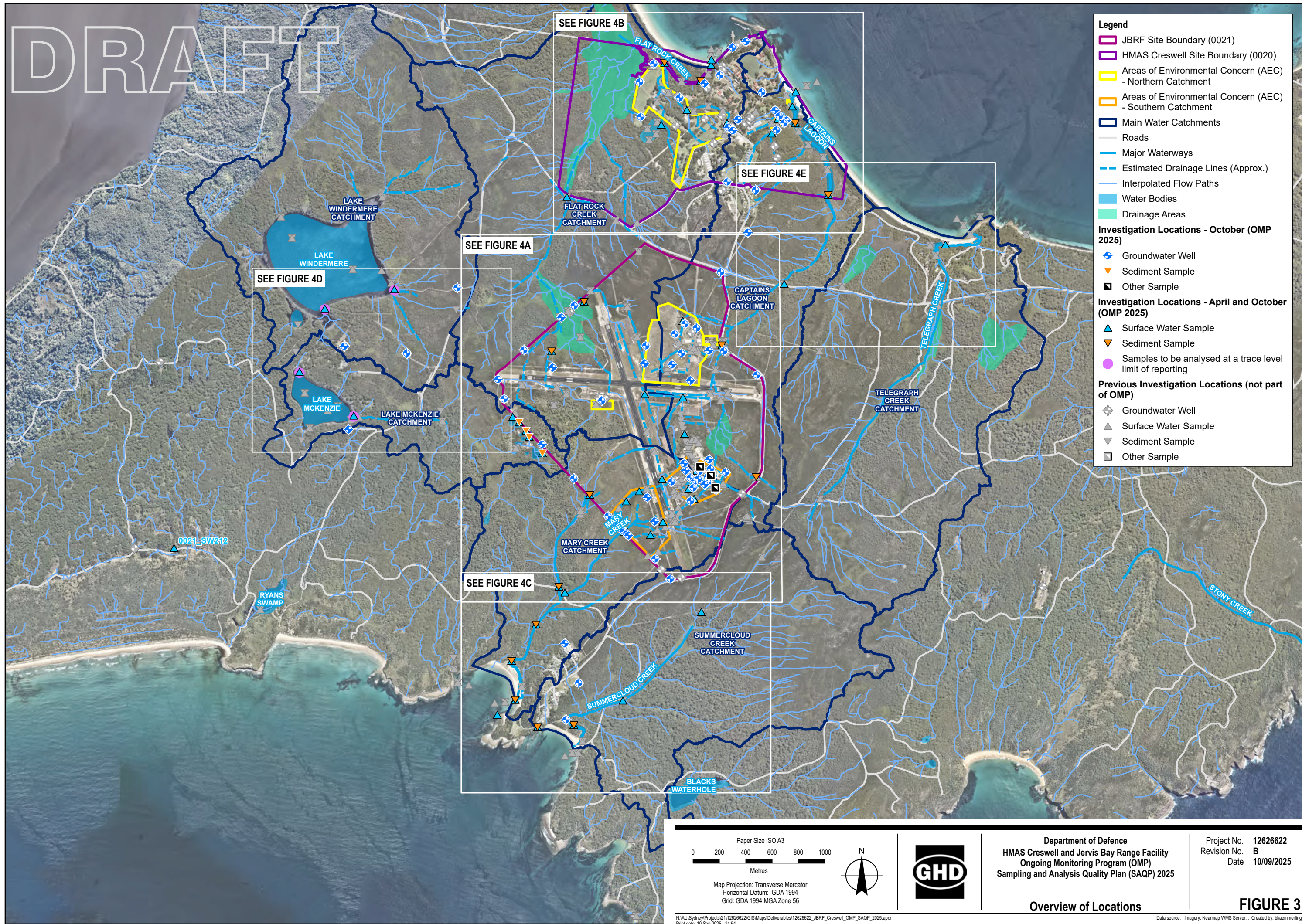
Appendix A

Figures

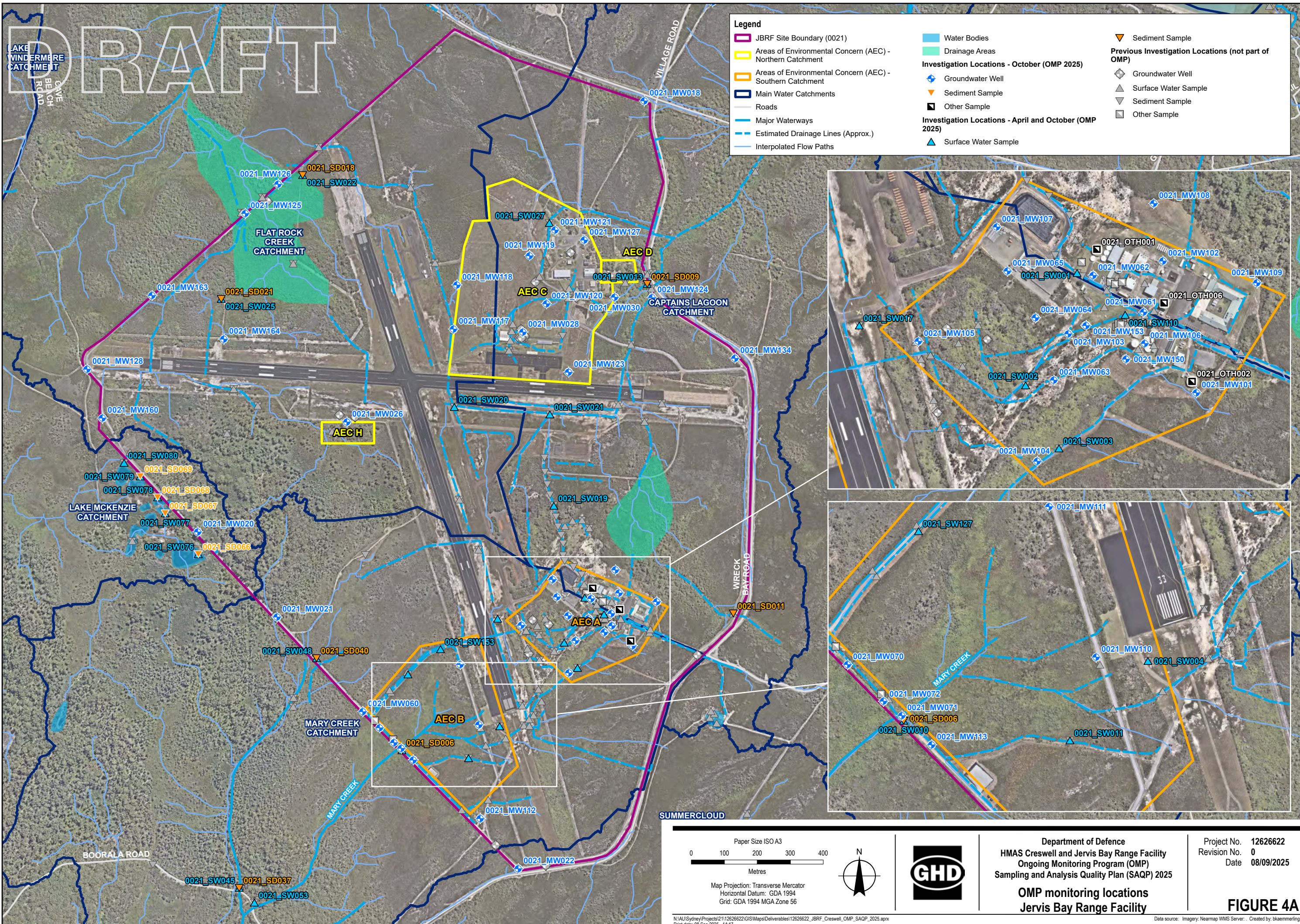


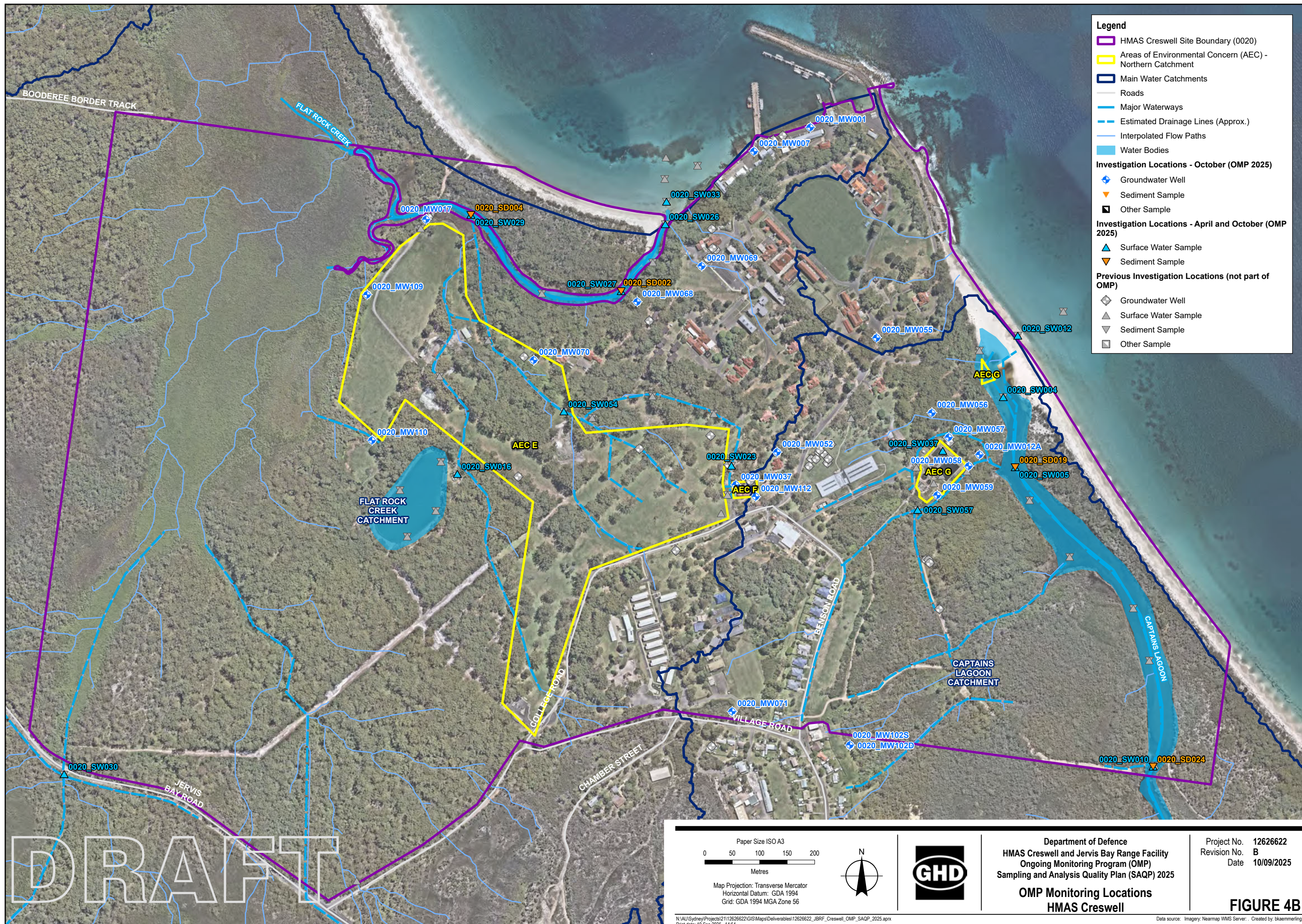


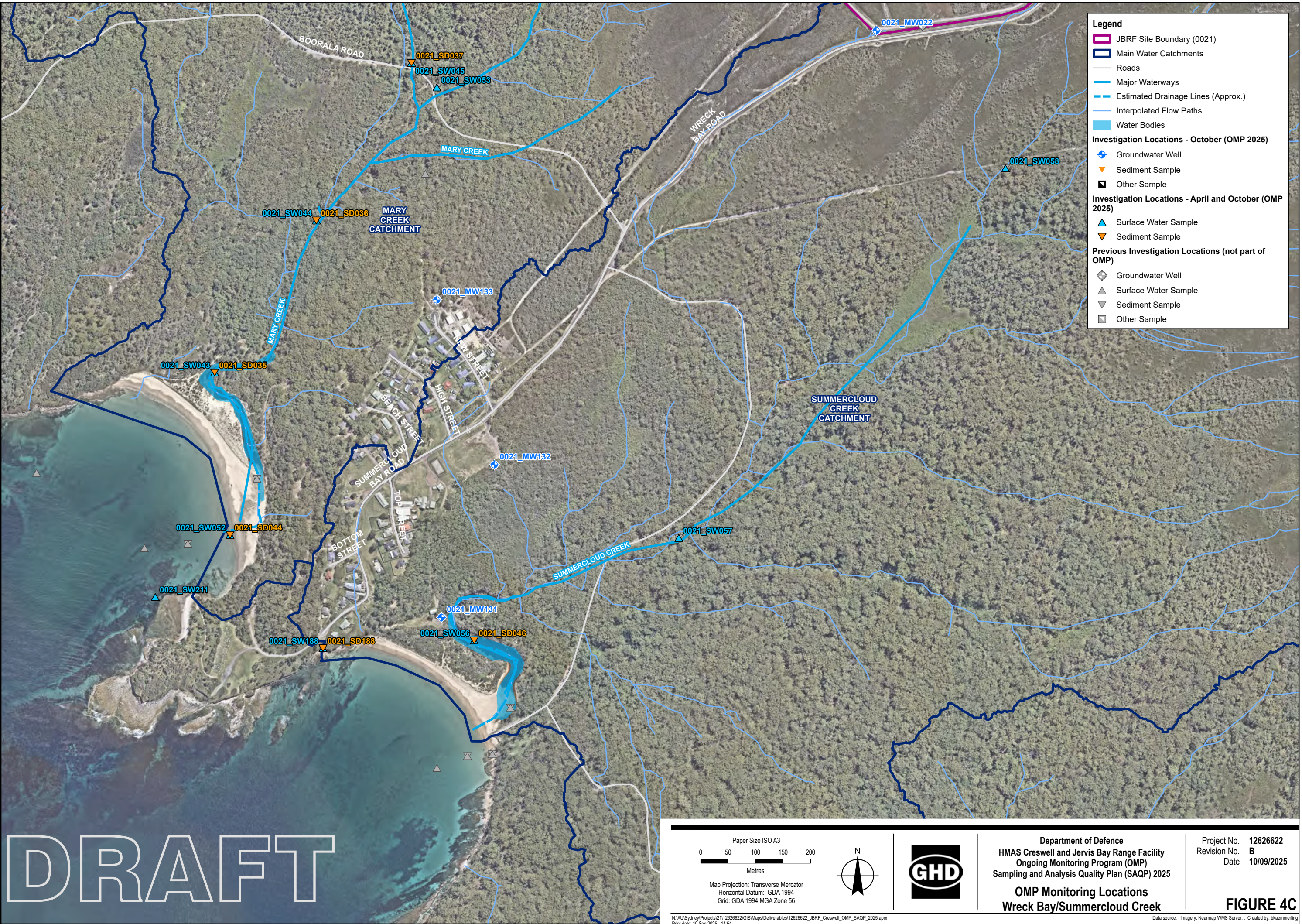
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Legend

- JBRF Site Boundary (0021)
- Main Water Catchments
- Roads
- Major Waterways
- Estimated Drainage Lines (Approx.)
- Interpolated Flow Paths
- Water Bodies

Investigation Locations - October (OMP 2025)

- Groundwater Well
- Sediment Sample
- Other Sample

Investigation Locations - April and October (OMP 2025)

- Surface Water Sample
- Sediment Sample

Previous Investigation Locations (not part of OMP)

- Groundwater Well
- Surface Water Sample
- Sediment Sample
- Other Sample

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Paper Size ISO A3

0 50 100 150 200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

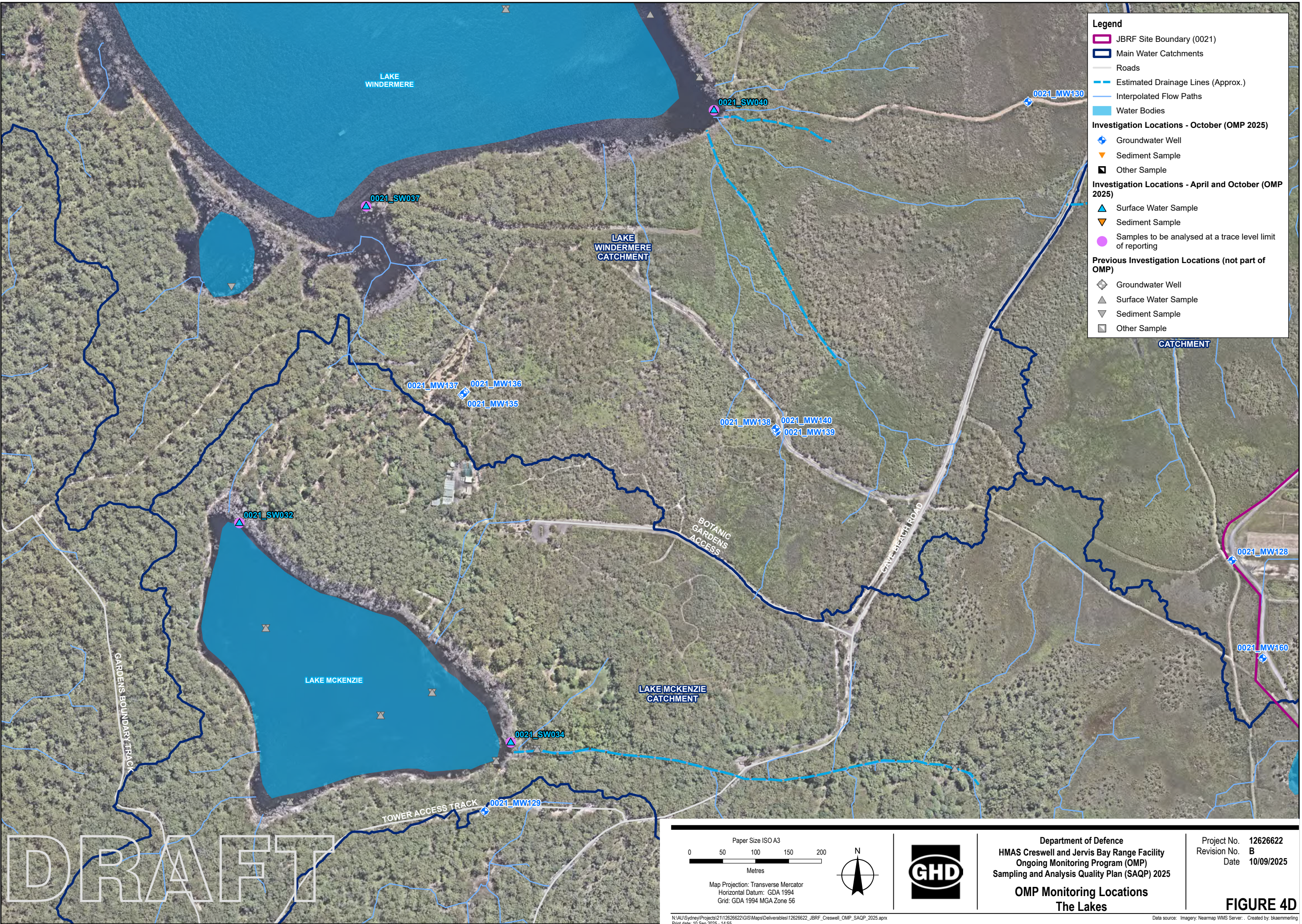
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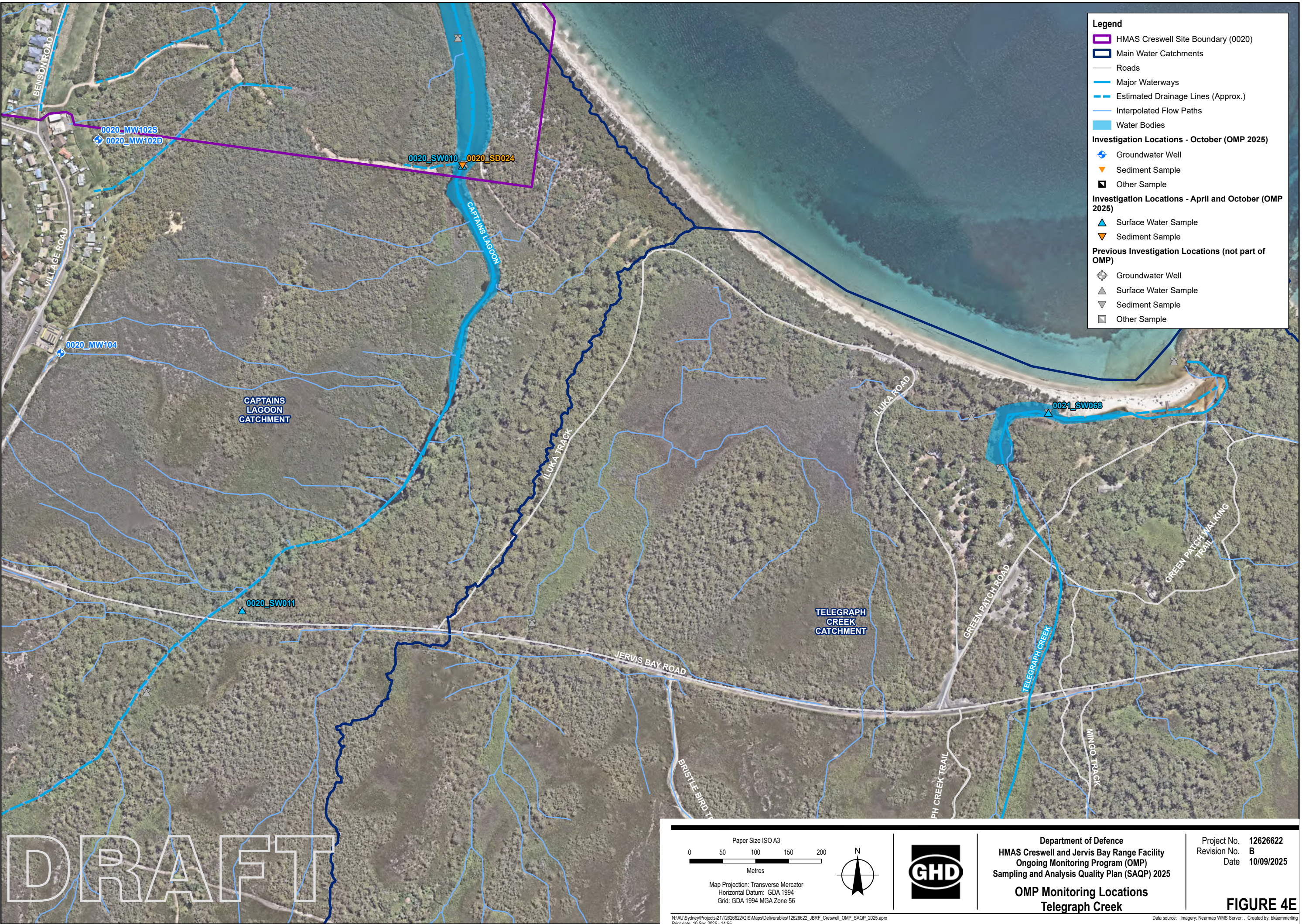
Department of Defence
HMAS Creswell and Jervis Bay Range Facility
Ongoing Monitoring Program (OMP)
Sampling and Analysis Quality Plan (SAQP) 2025

**OMP Monitoring Locations
Wreck Bay/Summercloud Creek**

Project No. 12626622
Revision No. B
Date 10/09/2025

FIGURE 4C





Appendix B

OMP sampling locations



Appendix B
OMP Sampling Locations

Sampling Event	Site	Location Code	Location Type	Catchment area	SPR classification	Groundwater Aquifer	x coord	y coord
October	0020	0020_MW001	MW	Flatrock Creek	Pathway	Upper aquifer	291055.973	6110951.983
October	0020	0020_MW007	MW	Flatrock Creek	Pathway	Upper aquifer	290953.549	6110908.313
October	0020	0020_MW012A	MW	Captains Lagoon	Pathway	Upper aquifer	291364.036	6110355.68
October	0020	0020_MW017	MW	Flatrock Creek	Pathway	Upper aquifer	290356.824	6110784.23
October	0020	0020_MW037	MW	Flatrock Creek	Source	Upper aquifer	290920.419	6110300.515
October	0020	0020_MW052	MW	Captains Lagoon	Source	Upper aquifer	290995.578	6110360.29
October	0020	0020_MW055	MW	Captains Lagoon	Pathway	Upper aquifer	291176.672	6110568.705
October	0020	0020_MW056	MW	Captains Lagoon	Pathway	Upper aquifer	291277.242	6110432.172
October	0020	0020_MW057	MW	Captains Lagoon	Pathway	Upper aquifer	291307.942	6110387.453
October	0020	0020_MW058	MW	Captains Lagoon	Pathway	Upper aquifer	291344.189	6110334.919
October	0020	0020_MW059	MW	Captains Lagoon	Pathway	Upper aquifer	291287.01	6110282.037
October	0020	0020_MW068	MW	Flatrock Creek	Pathway	Upper aquifer	290740.92	6110634.15
October	0020	0020_MW069	MW	Flatrock Creek	Pathway	Upper aquifer	290858.4	6110699.1
October	0020	0020_MW070	MW	Captains Lagoon	Pathway	Upper aquifer	290552.6	6110527.6
October	0020	0020_MW071	MW	Captains Lagoon	Pathway	Upper aquifer	290913.8	6109887.9
October	0020	0020_MW102D	MW	Captains Lagoon	Pathway	Upper aquifer	291128.354	6109825.853
October	0020	0020_MW102S	MW	Captains Lagoon	Pathway	Upper aquifer	291128.241	6109826.993
October	0020	0020_MW104	MW	Captains Lagoon	Pathway	Upper aquifer	291070.956	6109503.606
October	0020	0020_MW109	MW	Flatrock Creek	Pathway	Upper aquifer	290249.359	6110647.078
October	0020	0020_MW110	MW	Flatrock Creek	Pathway	Upper aquifer	290258.269	6110381.933
October	0020	0020_MW112	MW	Flatrock Creek	Source	Upper aquifer	290956.7	6110279.21
April & October	0020	0020_SW004	SW	Captains Lagoon	Receptor	N/A	291407.3	6110460.47
April & October	0020	0020_SW005	SW	Captains Lagoon	Receptor	N/A	291429.04	6110332.85
April & October	0020	0020_SW010	SW	Captains Lagoon	Receptor	N/A	291680.09	6109787.76
April & October	0020	0020_SW011	SW	Captains Lagoon	Pathway	N/A	291346.1	6109113.37
April & October	0020	0020_SW012	SW	Captains Lagoon	Receptor	N/A	291433.74	6110572.47
April & October	0020	0020_SW016	SW	Flatrock Creek	Source	N/A	290413.7	6110320.66
April & October	0020	0020_SW023	SW	Flatrock Creek	Pathway	N/A	290912.6	6110335.64
April & October	0020	0020_SW026	SW	Flatrock Creek	Receptor	N/A	290792.13	6110775.46
April & October	0020	0020_SW027	SW	Flatrock Creek	Receptor	N/A	290711.88	6110653.45
April & October	0020	0020_SW029	SW	Flatrock Creek	Receptor	N/A	290438.3	6110792.31
April & October	0020	0020_SW030	SW	Flatrock Creek	Pathway	N/A	289697.86	6109773.99
April & October	0020	0020_SW033	SW	Flatrock Creek	Receptor	N/A	290794.33	6110816.42
April & October	0020	0020_SW037	SW	Sewerage Treatment Plant	Tank	N/A	291297.2	6110362.77
April & October	0020	0020_SW054	SW	Flatrock Creek	Pathway	N/A	290607.55	6110434.4
April & October	0020	0020_SW057	SW	Captains Lagoon	Pathway	N/A	291251.46	6110255.21
April & October	0020	0020_SD002	SD	Flatrock Creek	Receptor	N/A	290711.88	6110653.45
April & October	0020	0020_SD004	SD	Flatrock Creek	Receptor	N/A	290438.3	6110792.31
April & October	0020	0020_SD019	SD	Captains Lagoon	Receptor	N/A	291429.04	6110332.85
April & October	0020	0020_SD024	SD	Captains Lagoon	Receptor	N/A	291680.09	6109787.76
October	0021	0021_MW018	MW	Captains Lagoon	Pathway	Upper aquifer	290864.247	6109202.482
October	0021	0021_MW020	MW	Clay Pools	Receptor	Upper aquifer	289511.025	6107896.296
October	0021	0021_MW021	MW	Mary Creek	Pathway	Upper aquifer	289751.053	6107637.677
October	0021	0021_MW022	MW	Summercloud Creek	Pathway	Upper aquifer	290482.222	6106874.883
October	0021	0021_MW026	MW	Flatrock Creek	Source	Upper aquifer	289962.765	6108229.124
October	0021	0021_MW028	MW	Captains Lagoon	Source	Upper aquifer	290496.309	6108501.849
October	0021	0021_MW030	MW	Captains Lagoon	Source	Upper aquifer	290774.537	6108607.883
October	0021	0021_MW060	MW	Mary Creek	Pathway	Upper aquifer	290010.902	6107351.267
October	0021	0021_MW061	MW	Mary Creek	Source	Upper aquifer	290764.59	6107648.95
October	0021	0021_MW062	MW	Captains Lagoon	Source	Upper aquifer	290703.31	6107693.79
October	0021	0021_MW063	MW	Mary Creek	Source	Upper aquifer	290655.768	6107566.497
October	0021	0021_MW064	MW	Mary Creek	Source	Upper aquifer	290633.558	6107642.063
October	0021	0021_MW065	MW	Mary Creek	Source	Upper aquifer	290599.451	6107698.659
October	0021	0021_MW070	MW	Mary Creek	Pathway	Upper aquifer	290062.002	6107301.998
October	0021	0021_MW071	MW	Mary Creek	Pathway	Upper aquifer	290127.795	6107240.119
October	0021	0021_MW072	MW	Mary Creek	Pathway	Upper aquifer	290105.45	6107257.561
October	0021	0021_MW101	MW	Mary Creek	Source	Upper aquifer	290828.47	6107551.279
October	0021	0021_MW102	MW	Captains Lagoon	Source	Upper aquifer	290787.901	6107710.981
October	0021	0021_MW103	MW	Mary Creek	Source	Upper aquifer	290673.21	6107622.859
October	0021	0021_MW105	MW	Mary Creek	Source	Upper aquifer	290491.579	6107613.423
October	0021	0021_MW106	MW	Mary Creek	Source	Upper aquifer	290766.014	6107611.265
October	0021	0021_MW107	MW	Mary Creek	Source	Upper aquifer	290586.379	6107752.175
October	0021	0021_MW108	MW	Captains Lagoon	Pathway	Upper aquifer	290776.799	6107780.714
October	0021	0021_MW109	MW	Captains Lagoon	Source	Upper aquifer	290902.001	6107684.325
October	0021	0021_MW110	MW	Mary Creek	Source	Upper aquifer	290363.29	6107310.97
October	0021	0021_MW111	MW	Mary Creek	Source	Upper aquifer	290306.44	6107493.88
October	0021	0021_MW112	MW	Mary Creek	Pathway	Upper aquifer	290367.053	6107026.943
October	0021	0021_MW113	MW	Mary Creek	Pathway	Upper aquifer	290163.822	6107204.885
October	0021	0021_MW117	MW	Flatrock Creek	Source	Upper aquifer	290286.037	6108510.839
October	0021	0021_MW118	MW	Flatrock Creek	Source	Upper aquifer	290296.314	6108644.899
October	0021	0021_MW119	MW	Captains Lagoon	Source	Upper aquifer	290516.502	6108733.952
October	0021	0021_MW120	MW	Captains Lagoon	Source	Upper aquifer	290567.691	6108588.091
October	0021	0021_MW121	MW	Captains Lagoon	Source	Upper aquifer	290593.764	6108811.096
October	0021	0021_MW123	MW	Captains Lagoon	Source	Upper aquifer	290634.696	6108380.753
October	0021	0021_MW124	MW	Captains Lagoon	Pathway	Upper aquifer	290887.738	6108606.804
October	0021	0021_MW125	MW	Flatrock Creek	Pathway	Upper aquifer	289654.8	6108861.45
October	0021	0021_MW126	MW	Flatrock Creek	Pathway	Upper aquifer	289754.28	6108950.77
October	0021	0021_MW127	MW	Captains Lagoon	Source	Upper aquifer	290682.48	6108780.58



Appendix B
OMP Sampling Locations

Sampling Event	Site	Location Code	Location Type	Catchment area	SPR classification	Groundwater Aquifer	x coord	y coord
October	0021	0021_MW128	MW	Flatrock Creek	Pathway	Upper aquifer	289175.06	6108389.365
October	0021	0021_MW129	MW	Lakes	Pathway	Lower aquifer	288041.834	6108008.845
October	0021	0021_MW130	MW	Lakes	Pathway	Lower aquifer	288865.496	6109084.007
October	0021	0021_MW131	MW	Summercloud Creek	Pathway	Upper aquifer	289690.892	6105807.677
October	0021	0021_MW132	MW	Summercloud Creek	Pathway	Upper aquifer	289787.261	6106085.186
October	0021	0021_MW133	MW	Mary Creek	Pathway	Upper aquifer	289682.533	6106385.742
October	0021	0021_MW134	MW	Captains Lagoon	Pathway	Upper aquifer	291139.191	6108422.681
October	0021	0021_MW135	MW	Lakes	Pathway	Lower aquifer	288008	6108639.52
October	0021	0021_MW136	MW	Lakes	Pathway	Lower aquifer	288012.42	6108644.53
October	0021	0021_MW137	MW	Lakes	Pathway	Upper aquifer	288009.67	6108641.47
October	0021	0021_MW138	MW	Lakes	Pathway	Lower aquifer	288483.69	6108586.1
October	0021	0021_MW139	MW	Lakes	Pathway	Lower aquifer	288484.48	6108583.61
October	0021	0021_MW140	MW	Lakes	Pathway	Upper aquifer	288483.13	6108588.77
October	0021	0021_MW150	MW	Mary Creek	Source	Upper aquifer	290743.4	6107591.73
October	0021	0021_MW153	MW	Mary Creek	Source	Upper aquifer	290694.93	6107632.96
October	0021	0021_MW160	MW	Flatrock Creek	Pathway	Upper aquifer	289221.681	6108240.792
October	0021	0021_MW163	MW	Flatrock Creek	Pathway	Upper aquifer	289372.054	6108612.776
October	0021	0021_MW164	MW	Flatrock Creek	Pathway	Upper aquifer	289589.895	6108480.526
April & October	0021	0021_SD006	SD	Mary Creek	Pathway	N/A	290129.98	6107234.12
April & October	0021	0021_SD009	SD	Captains Lagoon	Pathway	N/A	290873.11	6108648.01
April & October	0021	0021_SD011	SD	Captains Lagoon	Pathway	N/A	291134.2	6107649
April & October	0021	0021_SD018	SD	Flatrock Creek	Pathway	N/A	289828.77	6108977.95
April & October	0021	0021_SD021	SD	Flatrock Creek	Pathway	N/A	289581.99	6108602.42
April & October	0021	0021_SD035	SD	Mary Creek	Receptor	N/A	289278.25	6106253.36
April & October	0021	0021_SD036	SD	Mary Creek	Pathway	N/A	289463.14	6106529.97
April & October	0021	0021_SD037	SD	Mary Creek	Pathway	N/A	289636.38	6106816.62
April & October	0021	0021_SD040	SD	Mary Creek	Pathway	N/A	289870.79	6107513.25
April & October	0021	0021_SD044	SD	Mary Creek	Receptor	N/A	289306.16	6105957.95
April & October	0021	0021_SD046	SD	Summercloud Creek	Receptor	N/A	289750.41	6105765.93
October	0021	0021_SD066	SD	Clay Pools	Receptor	N/A	289512.61	6107828.64
October	0021	0021_SD067	SD	Clay Pools	Receptor	N/A	289412.16	6107952.6
October	0021	0021_SD068	SD	Clay Pools	Receptor	N/A	289388.88	6108000.81
October	0021	0021_SD069	SD	Clay Pools	Receptor	N/A	289336.46	6108064.48
April & October	0021	0021_SD188	SD	Summercloud Creek	Receptor	N/A	289475.29	6105751.77
April & October	0021	0021_SW001	SW	Captains Lagoon	Source	N/A	290683.95	6107696.48
April & October	0021	0021_SW002	SW	Mary Creek	Source	N/A	290621.53	6107560.2
April & October	0021	0021_SW003	SW	Mary Creek	Source	N/A	290662.01	6107483.79
April & October	0021	0021_SW004	SW	Mary Creek	Source	N/A	290426.13	6107306.54
April & October	0021	0021_SW010	SW	Mary Creek	Pathway	N/A	290129.98	6107234.12
April & October	0021	0021_SW011	SW	Mary Creek	Source	N/A	290331.58	6107210.14
April & October	0021	0021_SW013	SW	Captains Lagoon	Pathway	N/A	290873.11	6108648.01
April & October	0021	0021_SW017	SW	Mary Creek	Source	N/A	290419.84	6107632.75
April & October	0021	0021_SW019	SW	Captains Lagoon	Pathway	N/A	290590.23	6107975.27
April & October	0021	0021_SW020	SW	Flatrock Creek	Pathway	N/A	290288.47	6108274.91
April & October	0021	0021_SW021	SW	Captains Lagoon	Pathway	N/A	290578.19	6108252.42
April & October	0021	0021_SW022	SW	Flatrock Creek	Pathway	N/A	289828.77	6108977.95
April & October	0021	0021_SW025	SW	Flatrock Creek	Pathway	N/A	289581.99	6108602.42
April & October	0021	0021_SW027	SW	Captains Lagoon	Source	N/A	290576.62	6108832.99
April & October	0021	0021_SW032	SW	Lakes	Receptor	N/A	287669.77	6108446.98
April & October	0021	0021_SW034	SW	Lakes	Receptor	N/A	288081.2	6108114.26
April & October	0021	0021_SW037	SW	Lakes	Receptor	N/A	287861.99	6108927.06
April & October	0021	0021_SW040	SW	Lakes	Receptor	N/A	288389.42	6109072.68
April & October	0021	0021_SW043	SW	Mary Creek	Receptor	N/A	289278.25	6106253.36
April & October	0021	0021_SW044	SW	Mary Creek	Pathway	N/A	289463.14	6106529.97
April & October	0021	0021_SW045	SW	Mary Creek	Pathway	N/A	289636.38	6106816.62
April & October	0021	0021_SW048	SW	Mary Creek	Pathway	N/A	289870.79	6107513.25
April & October	0021	0021_SW052	SW	Mary Creek	Receptor	N/A	289306.16	6105957.95
April & October	0021	0021_SW053	SW	Mary Creek	Pathway	N/A	289682.45	6106772
April & October	0021	0021_SW056	SW	Summercloud Creek	Receptor	N/A	289750.41	6105765.93
April & October	0021	0021_SW057	SW	Summercloud Creek	Pathway	N/A	290122.79	6105952.4
April & October	0021	0021_SW058	SW	Summercloud Creek	Pathway	N/A	290717.13	6106624.81
April & October	0021	0021_SW068	SW	Telegraph Creek	Receptor	N/A	292568.59	6109413.15
April & October	0021	0021_SW076	SW	Clay Pools	Receptor	N/A	289512.61	6107828.64
April & October	0021	0021_SW077	SW	Clay Pools	Receptor	N/A	289412.16	6107952.6
April & October	0021	0021_SW078	SW	Clay Pools	Receptor	N/A	289388.88	6108000.81
April & October	0021	0021_SW079	SW	Clay Pools	Receptor	N/A	289336.46	6108064.48
April & October	0021	0021_SW080	SW	Clay Pools	Receptor	N/A	289287.51	6108105.39
April & October	0021	0021_SW110	SW	Mary Creek	Source	N/A	290742.283	6107645.754
April & October	0021	0021_SW127	SW	Mary Creek	Source	N/A	290148	6107464
April & October	0021	0021_SW153	SW	Mary Creek	Source	N/A	290246.73	6107540.37
April & October	0021	0021_SW188	SW	Summercloud Creek	Receptor	N/A	289475.29	6105751.77
April & October	0021	0021_SW211	SW	Mary Creek	Receptor	N/A	289170.18	6105844.76
April & October	0021	0021_SW212	SW	Bherwerre Barrier	Receptor	N/A	286718.41	6107109.79
October	0021	0021_OTH001	Tank	RAN SSSS	Tank	N/A	290708.1	6107725.08
October	0021	0021_OTH002	Tank	RAN SSSS	Tank	N/A	290823.46	6107565.01
October	0021	0021_OTH006	Tank	RAN SSSS	Tank	N/A	290789.59	6107660.1



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