Gingin Satellite Airfield - Comprehensive PFAS Investigation

Department of Defence

Detailed Site Investigation - Executive Summary

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PFAS 2017-18 Gingin
Executive Summary

The Department of Defence (Defence) commissioned Jacobs Group (Australia) Pty Ltd (Jacobs) to undertake a Comprehensive Investigation of Per- and Polyfluoroalkyl Substances (PFAS) conditions at Royal Australian Air Force (RAAF) Gingin Satellite Airfield (the Site) in Western Australia (WA) (the Project). The investigation follows the recommended general process for the assessment of site contamination outlined in Schedule A of the National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPM) (NEPC, 2013) and also considers the guidance provided in the PFAS National Environmental Management Plan (PFAS NEMP) (HEPA, 2018).

The first stage of the Project involved desktop studies and preliminary environmental sampling to develop a Preliminary Conceptual Site Model (CSM). The Preliminary CSM described potential PFAS sources, PFAS transport pathways and the potential for human and environmental exposure. The model was then used to develop a Sampling, Analysis and Quality Plan (SAQP) to guide a Detailed Site Investigation (DSI) involving sampling and laboratory analysis of soil, surface water, sediment, groundwater and biota on the Site and in the surrounding area. The DSI also included the collection of additional soil and water quality data as well as hydrogeological testing to help characterise conditions in the area.

The DSI was completed between January and April 2018. This report presents the work completed on the Project to date including the findings of the desktop study and preliminary sampling program, the Preliminary CSM and SAQP, the DSI scope of works, investigation findings, conclusions and recommendations for the next stages of the Project.

Background

Fire-fighting foam which contained PFAS as active ingredients was used at the Site from the 1960s. From 2004, Defence started to transition to a more environmentally safe product and also made changes to the way it uses fire-fighting foam to ensure that the risk of releasing this product into the environment is minimised.

PFAS are persistent chemicals that can bioaccumulate in humans and animals. Their high solubility and mobility in surface water and groundwater can mean that PFAS can travel long distances. Consumption of water and food grown using impacted water are thought to be the most important sources of human exposure to PFAS.

Sources of PFAS contamination

The DSI identified four key PFAS source areas on the Site – a former fuel storage area, the current fire house and adjacent vehicle refuelling area, the powerhouse building and a central area where firefighting equipment testing is understood to have occurred. Leachability testing of soil indicated the potential for discharge of PFAS to groundwater from these areas.

Extent of PFAS contamination

The Bassendean Sands are present across the Site and the surrounding area, with a maximum reported thickness in excess of 60 metres. This formation forms the major unconfined aquifer present in the area, and is referred to as the Gnangara Mound, or superficial aquifer. During the investigations completed at the Site, discontinuous lenses of less permeable silts and clayey sands were observed within the Bassendean Sands that may help attenuate the vertical migration of PFAS in the superficial aquifer. Below the superficial aquifer is the mostly confined Leederville aquifer, with a maximum thickness of more than 500 metres and comprising sandstone, siltstone and shale deposits.

Due to the sandy nature of surface soils prevalent across the Site, the potential for overland surface water flows is limited. Unlined drainage channels are present that run parallel to the runway and taxiway. While these drainage channels mostly flow towards the east of the Site, in reality surface water infiltration within these channels is likely to be substantial meaning that discharge of stormwater beyond the boundary of the Site is likely to be limited to only the most significant rainfall events. This is supported by the low concentrations of PFAS in soils along these channels away from identified primary PFAS source areas.
Groundwater sampling was completed at new and existing groundwater wells located across the Site. Towards the central source areas PFAS was reported in shallow groundwater wells within the superficial aquifer at concentrations above the adopted investigation criteria for drinking water and recreational water use. The highest concentrations were observed in wells located in the vicinity of the former fuel farm and powerhouse. Results from deeper groundwater wells (also within the superficial aquifer) in these source areas indicated a significant decrease in PFAS concentrations with increased depth, with all samples collected from the deep wells in these areas recording results below adopted investigation criteria and/or laboratory limit of reporting.

Towards the central area of the site two abstraction bores are present. One of these is installed at a depth of around 70 metres below ground level in the deeper Leederville aquifer. This bore is used to supply water to the Site for firefighting purposes. PFAS was not detected in samples collected from this bore. The second abstraction bore is installed at a shallow depth in the superficial aquifer. This bore is used for the Site water supply. This water is not currently used for drinking, but is used for laundry, irrigation, bathing and other non-potable uses. Samples were collected from the bore itself as well as a number of taps located across the Site. PFAS concentrations in these samples were above the drinking water health based guidance value with some samples (including those collected from the abstraction bore) also above the criteria for the recreational use of water.

In relation to the lateral (and vertical) migration of PFAS in groundwater away from identified source areas, significant dilution / dispersion of PFAS is apparent. There were a number of samples within the identified source areas that recorded concentrations above the health based investigation criteria for drinking water (0.07 µg/L) and recreational water use (0.7 µg/L) adopted from the PFAS NEMP (HEPA, 2018). However, samples collected from a network of inner perimeter wells down groundwater gradient to the west indicated a significant reduction in PFAS concentrations. Only two of these inner perimeter wells (located approximately equidistant between the Site boundary and main source areas) recorded concentrations above the adopted investigation criteria for drinking water. One downgradient well at the southern boundary of the Site recorded PFAS concentrations above the adopted investigation criteria for drinking water (but below the adopted investigation criteria for recreational water use). While it is considered that the reported PFAS concentrations at the Site boundary are likely to be diluted / dispersed to below drinking water criteria prior to discharge to any receptor, further assessment of the significance of PFAS at the Site boundary is recommended.

A single concentration above the adopted health based investigation criteria for drinking water was recorded up-gradient of the identified primary source areas. This new groundwater well was located close to the eastern boundary of the Site in a low-lying area near the confluence of the main unlined drainage channels. It is likely that this result can be attributed to the downward migration of PFAS from the stormwater drainage infrastructure. Groundwater flow direction at the Site is towards the west, and for this reason the risk to off-site groundwater users to the east is considered minimal.

In addition to on-site locations, samples were also collected off-site. These locations included the following:

- Private properties and broiler farms to the east of the Site that use groundwater for a range of domestic uses and for stock / poultry drinking water. PFAS was not detected in soil and groundwater samples collected from these properties.
- Ephemeral wetlands within the Yeal Swamp Nature Reserve as well as Lake Bambun, Lake Mungala and Lake Nambung. PFAS was not detected in sediment, surface water or biota (plant / vegetation) samples collected from these locations.
- Existing off-site groundwater monitoring wells located to the west of the Site, within the Underground Water Pollution Control Area (UWPCA). PFAS was not detected in groundwater samples collected from these wells that are installed in the Leederville and superficial aquifer.

The absence of PFAS in samples collected from off-site locations, including wells sampled downgradient within the UWPCA, combined with the outcome of on-site groundwater sampling indicates that PFAS impacts identified above the human health and ecological investigation criteria are currently confined to within the Site boundary.
Potential risks to human health and the environment

Concentrations of PFAS in the samples collected were compared to investigation criteria. These criteria were adopted from guideline values presented in the PFAS NEMP (HEPA, 2018). Where concentrations exceed these criteria, further assessment is required to understand whether there is an unacceptable risk to human health or the environment.

Potential risks to human health and the environment that will require further assessment include:

- PFAS concentrations in soil in the source areas do not present a human health risk to Site personnel. However, the concentrations exceed the commercial / industrial (indirect exposure) investigation criteria for ecological protection. On this basis, risks to terrestrial ecology on Site required further assessment.
- PFAS concentrations in the water supply to the Site (derived from the central on-site abstraction bore) exceed the human health criteria for drinking water and recreational water use. Further assessment of risks to human health associated with the use of this water will be needed.

Conclusions and recommendations

The DSI identified four primary sources of PFAS contamination at the Site. This contamination is migrating in groundwater away from these source areas in a west south-west direction. The extent of contamination in groundwater wells exceeding the investigation criteria for drinking water is largely limited to the shallow aquifer in the central area of the Site, in the vicinity of the former fuel farm, fire house, power house and firefighting equipment testing area. However, an abstraction bore is located in this area that is used to provide the Site water supply. Samples collected from this bore, as well as taps located across the Site contain concentrations of PFAS above the drinking water criteria. Some samples also reported concentrations above the criteria for the recreational use of water. While this water supply is not currently used for drinking, it is used for laundry, bathing, irrigation and other uses that may result in incidental ingestion by individuals that work at the Site.

Further away from the central area of the Site, significant dilution / dispersion of PFAS in groundwater is apparent, one exceedance of the investigation criteria was reported – one shallow well on the southern boundary of the Site. Additionally, detections for PFAS below investigation criteria were noted in three monitoring wells.

Samples were collected from existing off-site monitoring wells to the west of the Site. No PFAS was detected in these samples.

Based on the current understanding of PFAS concentrations in groundwater at the Site, the existing groundwater monitoring network is considered adequate to delineate the extent of the potential on and off-site plume at concentrations exceeding drinking water guidelines.

The recommendations for the next stages of the project can be summarised as follows:

1. A Human Health Risk Assessment (HHRA) is recommended in order to further assess risks identified during this DSI. The HHRA should focus specifically on the use of groundwater from abstraction bore 2 by Site personnel, and should additionally consider the risk to the Gnangara UWPCA from off-site migration of PFAS in groundwater. Additional sampling may be required to assess the risk to human health through the NEPM (NEPC, 2013) compliant HHRA process. [Recommended timing: immediate commencement of HHRA].

2. A PFAS Management Area Plan (PMAP) will be developed as part of this Project and will outline options for managing any unacceptable risks that may be identified as part of the HHRA in relation to the use of shallow groundwater at the Site. [Recommended timing: The PMAP forms part of the scope of this Project and will be completed within three months of this DSI being published and after the HHRA has been completed]. In addition, the PMAP should also include:
   - A requirement that a specific assessment of risks to construction and maintenance workers should be undertaken prior to commencement of any future works in identified PFAS source areas. This
assessment should also consider measures to ensure appropriate storage, handling and disposal of any PFAS impacted materials that may be encountered.

- An ongoing monitoring plan (OMP) in order to assess PFAS concentrations trends over time. The sampling will confirm the results of this DSI and assess variability inherent in laboratory methods, drilling methods, sampling processes or seasonal variability in groundwater conditions. Groundwater sampling conducted to date has been limited to summer (low rainfall) conditions. Given that detectable concentrations of PFAS have been recorded at the Site boundary (albeit below the investigation criteria) further sampling as part of an OMP is considered prudent.

- Relevant Site management requirements, such as, the restriction of growing fruit and vegetables on-site.

- Other maintenance requirements. For example, the integrity of the interceptor trap in the Wash Down Bay should be assessed and the trap cleared to minimise the risk of sediment in the trap acting as an ongoing source of PFAS to surface soils / groundwater.
Important note about your report

The sole purpose of this report is to present the Detailed Site Investigation undertaken by Jacobs for the Department of Defence (Defence) in connection with the Comprehensive Investigation of Per- and Polyfluoroalkyl Substances (PFAS) at Gingin Satellite Airfield, WA and surrounding areas.

This report was produced in accordance with and is limited to the scope of services set out in the agreement between Jacobs and Defence. That scope of services, as described in this report, was developed with Defence.

All reports and conclusions that deal with sub-surface conditions are based on interpretation and judgement and as a result have uncertainty attached to them. You should be aware that this report contains interpretations and conclusions which are uncertain, due to the nature of the investigations. No study can investigate every risk, and even a rigorous assessment and/or sampling programme may not detect all problem areas within a site.

This report is based on assumptions that the site conditions as revealed through sampling are indicative of conditions throughout the site. The findings are the result of standard assessment techniques used in accordance with normal practices and standards, and (to the best of our knowledge) they represent a reasonable interpretation of the current conditions on the site.

The passage of time, the possibility of migration, the manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by Defence and from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law. Opinions and judgements expressed in the report are based on Jacobs’ understanding and interpretation of current regulatory standards and should not be construed as legal opinions.

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