PFAS Detailed Site Investigation

Home Hill Fire Station, 83 Tenth Avenue, Home Hill, Queensland

Queensland Fire and Emergency Services

10 February 2020

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PFAS Detailed Site Investigation

Client: Queensland Fire and Emergency Services

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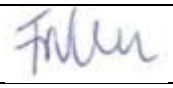
0	10-Feb-2020	Final	Frances Lee Project Director	

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Abbreviations

AFFF	Aqueous film forming foam
AHD	Australian height datum
ASC NEPM	Assessment of Site Contamination National Environment Protection Measure 1999 (as amended 2013)
ASRIS	Australian Soil Resources Information System
ASS	Acid sulfate soil
CLA	Contaminated Land Auditor
CLID	Contaminated land investigation document
CLR	Contaminated Land Register
COPC	Contaminants of potential concern
CSM	Conceptual site model
DES	Department of Environment and Science
DO	Dissolved oxygen
DQO	Data quality objectives
DQI	Data quality indicator
DSI	Detailed site investigation
EC	Electrical Conductivity
EMR	Environmental Management Register
EPP	Environmental Protection Policy
ESA	Environmentally Sensitive Areas
EV	Environmental Values
GDE	Groundwater Dependent Ecosystems
HEPA	Heads of Environmental Protection Agencies Australia and New Zealand
LOR	Limits of reporting
mbgl	Metres below ground level
mbtoc	Metres below top of casing
NATA	National Association of Testing Authorities
NDD	Non-destructive drilling
NEMP	National Environmental Management Plan
NEPC	National Environment Protection Council
NMI	National Measurement Institute
NRME	[Department of] Natural Resourcing, Mining and Energy
ORP	Oxidation reduction potential
PFAS	Per- and poly-fluoroalkyl substances
PFHxS	Perfluorohexanesulfonic acid
PFOA	Perfluorooctanoic acid

PFOS	Perfluorooctanesulfonic acid
PSI	Preliminary site investigation
QAS	Queensland Ambulance Services
QA/QC	Quality assurance / quality control
QFES	Queensland Fire and Emergency Services
SAQP	Sampling analysis and quality plan
SIR	Site investigation report
SOP	Standard operating procedure
SWL	Static water level
TDS	Total dissolved solids
TOPA	Total oxidisable precursor assay
USCS	Unified soil classification system
USEPA	United States Environmental Protection Agency

Glossary of Terms

Term	Definition
Aquifer	Geologic formation, group of formations, or part of a formation capable of transmitting and yielding economic or significant quantities of water.
Bore	A cylindrical drill hole sunk into the ground from which water is pumped for use or monitoring.
Borehole	A hole produced in the ground by drilling for the investigation and assessment of soil and rock profiles.
Discharge	A release of water from a particular source.
Drainage	Natural or artificial means for the interception and removal of surface or subsurface water.
Finished Foam	Finshed foam is formed following aeration of the foam concentrate.
Groundwater	Water located within an aquifer; that is, held in the rocks and soil beneath the earth's surface.
Groundwater monitoring well	A bore which has been specifically constructed to allow groundwater measurements to be taken and groundwater samples to be collected.
Groundwater recharge	A hydrologic process by which water enters the aquifer by moving downwards from surface water to groundwater.
Hydrogeology	The study of subsurface water in its geological context.
Hydrology	The study of rainfall and surface water runoff processes.
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment.
Pollutant / contaminant	Any matter that is not naturally present in the environment.
Primary Source	A primary source is a storage vessel or area where there is the potential for a contaminant to be directly released to ground (e.g. by leaks or spills or by direct release).
Runoff	The portion of water that drains away as surface flow.
Saturated zone	This portion of the subsurface below the groundwater table in which all pores in the soil and rock are completely filled with water.
Secondary Source	A secondary source is an area impacted by a primary source that has the potential for ongoing release of contaminants. For example contaminants adsorbed to soil could act as a source of contamination to groundwater.
Stormwater	Water that travels through drains following precipitation events.
Surface water	Water flowing or held in streams, rivers and other wetlands in the landscape.
Tributary	A river or stream flowing into a larger river or lake.
Unsaturated zone	The portion of the subsurface above the groundwater table. The soil and rock in this zone contains air as well as water in its pores.
Water table	The surface of saturation in an unconfined aquifer at which the pressure of the water is equal to that of the atmosphere.

Executive Summary

Background

AECOM Australia Pty Ltd (AECOM) was engaged by Queensland Fire and Emergency Services (QFES) to undertake an evaluation of the concentration and distribution of per- and poly- fluoroalkyl substances (PFAS) at Home Hill Fire Station, located at 83 Tenth Avenue, Home Hill, Queensland (the site). The location of the site is shown in **Figure 1** in **Appendix A**.

QFES is conducting the environmental investigation at Home Hill Fire Station using a staged approach. Stage 1 consisted of a preliminary site investigation (PSI) and sampling, analysis and quality plan (SAQP), which was completed in April 2019 (AECOM, 2019). Under Stage 2 of the project, a Queensland Contaminated Land Auditor (CLA) reviewed and endorsed the works completed in Stage 1. Following completion of Stages 1 and 2, QFES has engaged AECOM to undertake Stage 3 of the project, which is the delivery of the PFAS detailed site investigation (DSI) to implement the scope of work identified in the SAQP.

This report forms the Site Investigation Report (SIR) for the DSI and is consistent with the requirements of a Contaminated Land Investigation Document (CLID).

Key Findings of the PSI

The PSI (AECOM, 2019) was completed to understand the potential for PFAS contamination to be present at the fire station based on a review of the site and environmental setting and historical operations and practices. The PSI identified that firefighting training using aqueous film forming foam (AFFF) containing PFAS occurred at the fire station prior to 2003. Based on the findings of a site inspection and anecdotal information from site staff, firefighting training using AFFF took place in the open grassed area in the central area of the site. The volume of foam concentrate used was not specified but was noted to be limited. No infrastructure (e.g. tanks) is known to have stored foam on the site. The area used for firefighting training using foam was identified as the main potential PFAS source area with the Case 4 Pit identified as a secondary source area associated with potential storage and uncontrolled release of PFAS impacted water.

Objectives

The objectives of the works were to characterise potential PFAS impacts in soil and groundwater, including concentration and distribution, within and at the boundaries of the Home Hill Fire Station to assess the potential risks to human health and the environment and to update the PFAS conceptual site model (CSM) for the site.

Investigation Scope

The DSI was completed between July and September 2019. The DSI scope of work was completed in accordance with the SAQP (AECOM, 2019) and included the drilling of four soil bores on the site (drilled to approximately 10 metres below ground level, mbgl) that were converted to groundwater monitoring wells, advancement of four soil bores to between 0.1 and 0.5 mbgl, collection of soil and groundwater samples from the bores and sediment samples from the drainage lines. Surface water sampling was planned but could not be conducted as the drainage features were dry at the time of sampling. Laboratory analysis was undertaken for PFAS followed by preparation of this interpretative report.

Key Findings of the DSI

The key findings of the PFAS DSI are presented below.

- Groundwater elevations in August 2019 indicated a shallow aquifer is present beneath the site. Depth to groundwater was approximately 8.4 mbgl. Groundwater was inferred to locally flow towards the north/northeast. This is consistent with the expected regional groundwater flow direction, which is likely to be from south to north towards the Burdekin River, which is the main hydrological feature in the area.
- The primary PFAS compound present in the soil samples was perfluorooctanesulfonic acid (PFOS). The soil samples collected were from bores located adjacent to the main potential source area, the foam training area, and the area where the Case 4 Pit was located. The highest sum of

perfluorohexanesulfonic acid (PFHxS) and PFOS concentrations detected were in the shallow soil (0.5 mbgl) in a bore located to the east of the foam training area in the central portion of the site (HH_SS01). PFAS concentrations were at relatively higher concentrations in soil samples from bores adjacent to the foam training area indicating the area may have had a larger historical footprint. The soil samples analysed from bores in and around the foam training area indicated that soil PFAS (PFHxS and PFOS) concentrations decreased with increased depth, with relatively higher PFAS concentrations in the near-surface material. Elevated PFAS concentrations in soil were also detected in unsaturated and saturated zone samples collected from a soil bore (HH_BH03) located adjacent to the Case 4 Pit indicating a potential historical source of PFAS to soil in this area.

- None of the 18 soil samples analysed from eight soil bores exceeded the National Environmental Management Plan (NEMP) (HEPA, 2018) health guideline values for commercial land use. The concentration of PFOS in one soil sample from an unsealed area (HH_SS1 at 0.5 mbgl (0.223 mg/kg)) exceeded the NEMP (HEPA, 2018) ecological PFOS guideline value for a commercial land use. Landscaped/grassy areas, potentially accessible to ecological receptors are located in the central and eastern portion of the site. Analytical results for nine soil samples detected PFOS concentrations that exceeded the guideline value for ecological indirect exposure for residential land use. Due to the urbanised setting of the site, it is considered that the ecological receptors would be transient in nature, and comparison against the residential land use guideline is considered to be an appropriately conservative approach. The higher PFOS concentrations were detected in fill materials (to 0.8 mbgl) and in samples of natural soil located immediately below the base of the fill.
- The primary PFAS compounds detected in groundwater were PFHxS and PFOS. ∑(PFHxS+PFOS) concentrations exceeding the NEMP (HEPA, 2018) human health drinking water guideline value were reported in groundwater samples from all four monitoring wells. Two groundwater samples with relatively higher concentrations (5.1 µg/L and 3.7 µg/L ∑(PFHxS+PFOS) were located adjacent and cross-gradient to the Case 4 Pit (HH_MW03) and foam training area (HH_MW02), respectively. Groundwater concentrations in the other two monitoring wells, which were located hydraulically up- or cross-gradient of the foam training area, had relatively lower concentrations (up to 0.53 µg/L ∑(PFHxS+PFOS). This indicates the foam training area and the area of the Case 4 Pit are potentially source areas of PFAS to groundwater. The Case 4 Pit area and HH_MW03 are noted to be down-gradient of the adjacent SES facilities (a potential off-site source area) and cross-gradient to the foam training area.
- The lateral extent of the area of groundwater with elevated concentrations of PFHxS and PFOS is uncertain and has not been established in any direction. Based on the presence of a potentially permeable shallow sand aquifer and inferred local flow direction towards the north, there is the potential for PFAS in groundwater to extend off-site beyond the northern site boundary at concentrations in excess of human health and ecological guideline values. Residential and commercial properties and recreational land are present beyond the northern site boundary with the closest registered bore used for water supply present approximately 370 m northeast of the northern site boundary. There are 12 registered bores screened in the shallow aquifer (approximately 10 mbgl) that are used for water supply and which are located hydraulically down-gradient, within 1 km of the site. The closest surface water receptor is a canal located approximately 650 m north of the site, with the Burdekin River present approximately 3 km north of the site.
- The laboratory analytical technique for total oxidisable precursor assay (TOPA) is used to detect certain harder to analyse PFAS precursor compounds that may be present. The results of TOPA analysis on one soil and one groundwater sample did not indicate the presence of PFAS precursors. The results indicated a degraded PFAS product that is unlikely to significantly increase or alter through bio-transformation or oxidation processes.
- Based on information provided as part of the PSI, the source of the PFAS detected in soil and groundwater samples is considered likely to be related to the historical firefighting training practices at the fire station, or spills from storage containers, product transfer and other maintenance activities.

Based on these key findings, the PFAS CSM developed for the PSI has been updated. A number of possibly complete exposure pathways for PFAS sourced from the fire station to impact off-site human and ecological receptors have been identified. The significance of these potentially complete source-pathway-receptor linkages is uncertain and further investigation is required to understand the potential risks to off-site receptors.

1.0 Introduction

1.1 General

AECOM Australia Pty Ltd (AECOM) was engaged by Queensland Fire and Emergency Services (QFES) to undertake an evaluation of the concentration and distribution of per- and poly- fluoroalkyl substances (PFAS) at Home Hill Fire Station, located at 83 Tenth Avenue, Home Hill, Queensland (the site). The location of the site is shown in **Figure 1** in **Appendix A**.

Historical practices and operations at QFES facilities including Home Hill Fire Station may have involved using firefighting foam containing PFAS. PFAS are an emerging family of compounds that are highly soluble, persistent and bio-accumulative in the environment. Following release to ground, they can be readily mobilised from soil source zones, and migrate significant distances in surface water and groundwater.

1.2 Background

QFES is conducting the environmental investigation at Home Hill Fire Station using the following staged approach:

- Stage 1: Development of the preliminary site investigation (PSI) and sampling, analysis and quality plan (SAQP). This stage was completed in April 2019 (AECOM, 2019).
- Stage 2: Review and endorsement of the PSI and SAQP by a Queensland Contaminated Land Auditor (CLA). This stage was completed in April 2019.
- Stage 3: Implementation of the scope of works identified in the SAQP by conducting a detailed site investigation (DSI) and completion of a draft site investigation report (SIR).
- Stage 4: Review and endorsement of the SIR report by a CLA.
- Stage 5: Provide the final SIR to the regulator (DES) and subject to any further requirements, procure a suitable environmental consultant to design an investigation plan to measure and assess offsite impacts.
- Stage 6: Engage an appropriately qualified third party CLA to audit the suitability of any offsite investigation plan to meet the requirements of DES prior to implementation.

This report forms the SIR for the Stage 3 DSI and has been prepared to meet the requirements of a Contaminated Land Investigation Document (CLID).

1.3 Objectives

The objectives of the works were to characterise potential PFAS impacts in soil and groundwater, at Home Hill Fire Station, to assess the potential risks to human health and the environment and to update the PFAS conceptual site model (CSM) for the site.

The key outcomes / deliverables of the Stage 3 works were as follows:

- Undertaking soil and groundwater sampling at Home Hill Fire Station, in accordance with the SAQP.
- Preparation of a draft SIR detailing the implementation of the DSI, in accordance with Australian guidance for investigation of sites potentially impacted by PFAS including the National Environmental Protection Council (NEPC), National Environmental Protection (Assessment of Site Contamination) Measure (NEPM) (1999, as amended 2013) (NEPC, 2013) and the PFAS National Environmental Management Plan (Heads of Environmental Protection Agencies (HEPA), 2018).

  The stage 4 deliverable will be a final SIR that incorporates any comments/ corrections from the QFES review and inclusion of all the requirements of the audit by the CLA.

1.4 Scope of Works

The scope of work undertaken to meet the objectives of the PFAS DSI were as follows:

- Completion of fieldwork in accordance with the CLA-endorsed SAQP (AECOM, 2019) which included the following activities:
    - Drilling of four soil bores (HH_BH01 to HH_BH04) to approximately 10 metres below ground level (mbgl), which were converted to groundwater monitoring wells (HH_MW01 to HH_MW04). Collection of soil samples at approximately 1.0 m intervals. Development of groundwater monitoring wells.
    - Collection of soil samples from shallow soil bores (HH_SS1 to HH_SS2) to 0.5 mbgl advanced in the grassed areas at the foam training area and the Case 4 Pit.
    - Collection of groundwater samples from the four new groundwater monitoring wells.
    - Collection of two sediment samples (HH_SED01 and HH_SED02) from the on-site drainage lines.
    - Surveying of the top of the casing at each monitoring well to MGA94 coordinates and Australian Height Datum (AHD).
    - Laboratory analysis of soil and groundwater for PFAS, with groundwater analysed for trace level concentrations.
- Preparation of an SIR (this report), which includes an update of the PFAS CSM.

Changes to the scope of works compared to the SAQP were as follows:

- Co-located surface water and sediment samples were to be collected from perimeter locations on-site where surface water flows may potentially occur, however, as water was not present at the time of sampling, only sediment samples were collected.
- The SAQP identified a shallow soil bore positioned on the lot (Lot 7 on H616103) occupied by State Emergency Services in the southern portion of the property. As this lot is outside the site boundary for the investigation, in replacement, two near surface soil samples were collected from the foam training area (HH_SS3 and HH_SS4).

1.5 PFAS Analysis

Aqueous film forming foam (AFFF) manufactured over the last 50 years are estimated to contain between 200 and 600 possible PFAS compounds of varying signatures / composition (NEMP, HEPA, 2018[1]). However, at present, Australian commercial analytical laboratories, using National Association of Testing Authority (NATA) accredited methods, are currently able to analyse for around 28 PFAS (see **Table 1**). This analytical limitation is not considered significantly influential as the current PFAS laboratory analytical schedule includes the compounds that have guidelines available. These compounds were also the primary ingredients of AFFF and are more likely to be encountered where AFFF was used, stored and/or discharged.

[1] Noting that the Draft NEMP Version 2.0 is currently out for public comment until June 2019 with expected publication in early 2020.

Table 1 Compounds Analysed in the PFAS Suite

PFAS Group	Compound	Abbreviation	CAS No.
Perfluoroalkyl Sulfonic Acids	Perfluoro butane sulfonic acid	PFBS	375-73-5
	Perfluoropentane sulfonic acid	PFPeS	2706-91-4
	Perfluorohexane sulfonic acid	PFHxS	355-46-4
	Perfluoroheptane sulfonic acid	PFHpS	375-92-8
	Perfluorooctane sulfonic acid	PFOS	1763-23-1
	Perfluorodecane sulfonic acid	PFDS	335-77-3
Perfluoroalkyl Carboxylic Acids	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUnDA	2058-94-8
	Perfluorododecanoic acid	PFDoDA	307-55-1
	Perfluorotridecanoic acid	PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTeDA	376-06-7
Perfluoroalkyl Sulfonamides	Perfluorooctane sulphonamide	FOSA	754-91-6
	N-Methyl perfluorooctane sulfonamide	MeFOSA	31506-32-8
	N-Ethyl perfluorooctane sulfonamide	EtFOSA	4151-50-2
	N-Methyl perfluorooctane sulfonamidoethanol	MeFOSE	2448-09-7
	N-Ethyl perfluorooctane sulfonamidoethanol	EtFOSE	1691-99-2
	N-Methyl perfluorooctane sulfonamidoacetic acid	MeFOSAA	2355-31-9
	N-Ethyl perfluorooctane sulfonamidoacetic acid	EtFOSAA	2991-50-6
Fluorotelomer Sulfonic Acids	4:2 Fluorotelomer sulfonic acid	4:2 FTS	757124-72-4
	6:2 Fluorotelomer sulfonic acid	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonic acid	8:2 FTS	39108-34-4
	10:2 Fluorotelomer sulfonic acid	10:2 FTS	120226-60-0

1.6 Relevant Regulation and Guidance

This PFAS DSI has been developed considering the following legislation and guidance.

- *DES, Queensland Auditor Handbook for Contaminated Land, Module 6: Content requirements for contaminated land investigation documents, certifications and audit reports (2018)*
- *Environmental Protection Act, 1994*
- HEPA (2018) *PFAS National Environmental Management Plan (NEMP)*
- NEPC (1999) *National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013) (ASC NEPM 2013)*
  - *Schedule A- Recommended general process for assessment of site contamination*
  - *Schedule B1 Guideline on Investigation Levels for Soil and Groundwater*
  - *Schedule B2 Guideline on Site Characterisation*
  - *Schedule B3 Guideline on Laboratory Analysis of Potentially Contaminated Soils*
- Standards Australia (AS4482.1-2005) *Guide to the sampling and investigation of potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds*
- Standards Australia (AS 4482.2-1999) *Guide to the sampling and investigation of potentially contaminated soil, Part 2: Volatile Substances.*

A summary of guideline values adopted for this investigation is presented in **Section 5.0**.

2.0 Site Setting

2.1 Site Identification

Home Hill Fire Station is located in central Home Hill and is accessed via Tenth Avenue or Eleventh Avenue. Site identification details as identified in the PSI (AECOM, 2019) are shown in **Table 2**.

Table 2 Home Hill Fire Station Site Identification

Item	Details
Site Address	83 Tenth Avenue, Home Hill, 4806
Registered Site Owner	Lot 6 / H616666 and Lot 8 / SP123356 are owned by The State of Queensland. (Represented by Department of Community Safety, now Public Safety Business Agency)*.
Registered Address of Site Owner	Public Safety Business Agency, L13 Makerston House, 30 Makerston Street, Brisbane, Queensland, 4000
Site Occupier	QFES
Local Government Area	Burdekin Shire Council
Zoning	Public Purpose
Future Zoning	No change
Lot and Plan	Lot 6 / H616666 and Lot 8 / SP123356 The site is shared with Queensland Ambulance Service (QAS).
Tenure	Freehold
Latitude / Longitude	-19.66099 / 147.41598
Site Area	1,811m^2
Current / Future Site Use	Current and future site use is as a fire station (i.e. commercial/industrial land use).
Environmental Management Register (EMR) / Contaminated Land Register (CLR)	A search of the DES EMR and CLR for the two lots (Lot 6 / H616666 and Lot 8 / SP123356) conducted as part of the PSI (AECOM, 2019) indicated that the site is not included on either the EMR or CLR.
Environmentally relevant activities or notifiable activities	The PSI did not identify any environmentally relevant activities or notifiable activities at the site.

* The adjacent lot, Lot 7 on H616103, is occupied by State Emergency Service (SES) and is partially fenced from the other two lots (a fence is present marking the boundary along the southern boundary of the western portion of the site). Burdekin Shire Council is the registered Trustee for this lot.

2.2 Site Layout and Features

The site layout is detailed on **Figure 2**, **Appendix A**. The site is rectangular with its long axis orientated northeast to southwest. The site is not permanently staffed and is shared with QAS. There are two main buildings located on site; the old fire station building (pre-2002) in the eastern portion of the site and the current fire station building in the western portion of the site, which consists of the Engine Room and offices. A storage shed used by QAS is present in the western central portion of the site. There is a storage area for wrecked cars / awning and slab to the east of the offices.

The fire station is crewed by approximately eight auxiliary firefighters with all training activities conducted on the open grassed area in the central portion of the site (refer to **Figure 2**, **Appendix A**). A concrete in-ground water tank (Case 4 Pit), with dimensions of 900 mm diameter x 2400 mm deep

and a capacity of 1530 L, is located adjacent to the western side of the old fire station building. The pit was used for pump testing and water drafting training. Sampling and analysis of the water in the Case 4 Pit occurred in 2016 and indicated the presence of trace PFAS concentrations, see **Section 2.4**. The Case 4 Pit was covered by a steel plate to prevent water ingress and has since been decommissioned (sometime between 2016 and 2018) and backfilled with sand. Water drafting training is now undertaken in a semi-permanent water tank located adjacent to the Engine Room.

Stormwater drainage includes two subsurface drains in the western portion of the site, one of the drainage lines runs from the open area east of the Engine Room, towards the south and then southwest, along the southern site boundary to Tenth Avenue. There is a drainage pit adjacent to the northern site boundary in the western portion of the site, with a stormwater drain running westwards to Tenth Avenue. A depression is present along the southern boundary where surface water flows may potentially occur. There are no stormwater drainage lines in the central and eastern portions of the site. A surface depression is located in the grassed area used for foam training in the centre of the site.

A number of underground services are present at the site including sewer lines, electrical and communications lines, hydrant water lines and town water connections to buildings (refer to **Figure 2**, **Appendix A**). The material used to infill around these services is likely to consist of bedding sands which have the potential to act as preferential pathways for contaminant migration in the unsaturated zone, in areas where clay is the dominant soil. Backfill around the Case 4 Pit also has the potential to act as a preferential pathway. No information was identified in the PSI (AECOM, 2019) on the potential emplacement of fill at the fire station.

Vegetation is present on approximately 60% of the site, with the remainder sealed with concrete.

The adjacent SES lot (Lot 7 on H616103) is present to the south of the eastern portion of the site and contains a building and a storage shed, which were constructed between 1970 and 1975.

2.3 Surrounding Land Use

The site is within an urban area surrounded by commercial and residential properties. Eleventh Avenue is located adjacent to the northeastern site boundary with Tenth Avenue present adjacent to the southwestern site boundary. Details of surrounding land uses are provided in **Table 3** below.

Table 3 Home Hill Fire Station Surrounding Land Use

Direction	Land Use
Southwest	Tenth Avenue bounds the site to the southwest. A Memorial Park and bowls club is present on the western side of Tenth Avenue with commercial properties further beyond. Beyond Tenth Avenue to the south-southwest is a residential property and Burdekin Memorial Hall with further commercial and residential properties beyond.
Southeast	Adjacent to the site to the southeast are SES storage shed / buildings which are located within the cadastral property boundary and beyond the immediate site boundary. Beyond the SES land are buildings associated with the Home Hill Health Centre, beyond which are residential properties.
Northeast	Adjacent to the site to the northeast is Eleventh Avenue, beyond which are residential properties (approximately 20-30 m).
Northwest	Adjacent to the site to the northwest is RSL Park and a residential property and then Tenth Street. Beyond Tenth Street to the northwest are mainly residential properties with some commercial properties. A service station (Michelle's Caravan Park and Service Station) is located approximately 400 m to the northwest.

2.4 Previous Environmental Investigation

A PFAS PSI was completed in March 2019 (AECOM, 2019). The key findings of this investigation are summarised below.

- Based on aerial photographs, the site was developed in the mid to late 1960s with the current fire station building built in the late 1990s/early 2000s. Prior to development in the 1960s, the site was unoccupied, and the land use is not known. The site is surrounded by commercial and residential properties and recreational land.
- There were a number of buildings present on the site between the 1960s and 1990s before the current fire station building was constructed. The redevelopment of the site may have involved excavation and relocation of soil beneath the site, which has the potential to create preferential pathways for contaminant migration.
- Based on the interview information, firefighting foams containing PFAS have been present at the site with AFFF (3M Lightwater) used prior to 2003. Since this time, Solberg foam has been used, which is PFAS-free[2].
- The inventory of foam concentrate in February 2019 was 160 L Solberg foam. Foam concentrate is stored in 20 L containers in the ancillary shed to the Engine Room. No infrastructure (e.g. tanks) is known to have stored foam. The volume of foam stored at the site was reported to have always been low (volume not specified) with drums collected from a larger station (not identified) on an as-needed basis.
- Firefighting training using foam has occurred on the grassed area in the centre of the site. The volume of foam used has not been specified but was noted to be low due to the cost of the foam concentrate. All foams are reportedly used prior to the use by date. No inadvertent releases of foam concentrate were identified.
- PFAS was identified in two water samples collected in 2016 (QFES, 2016) from the Case 4 Pit with a concentration of 0.097 µg/L ∑(PFHxS+PFOS) detected. Two samples of tap water were also analysed and PFAS was not detected.
- A high-level review of the area within 4 km of the site identified the potential for off-site sources of PFAS including a sugar mill located approximately 2 km northwest of the site and an industrial unit, located approximately 200 m to the northeast of the site. The adjacent SES property, Lot 7 on H616103, is also considered a potential source.

[2] Reported by the manufacturer at https://www.solbergfoam.com/Foam-Concentrates/RE-HEALING-Foam.aspx

3.0 Environmental Setting

3.1 Climate

A summary of the monthly climate statistics is presented in **Table 4** below based on information available on the Australian Government Bureau of Meteorology website for the nearest weather station (Ayr DPI Research Station) for the period 1951 to 2019. Home Hill has a tropical climate, characteristic of distinct wet and dry seasons. The wet season occurs between December and April. Mean annual rainfall is 944.7 mm.

Table 4 Summary of Monthly Climate at Ayr DPI Research Station – 1951 to 2019

Month	Mean maximum temperature (ºC)	Mean minimum temperature (ºC)	Mean rainfall (mm)
January	31.8	22.8	216.4
February	31.6	22.8	235.3
March	30.9	21.6	155.0
April	29.6	19.0	46.8
May	27.7	16.2	40.2
June	25.5	13.0	24.0
July	25.2	11.8	15.2
August	26.3	12.7	15.3
September	28.2	15.1	9.8
October	29.9	18.1	26.7
November	31.2	20.6	45.0
December	32.1	22.1	99.8

3.2 Site Topography

Contour mapping from Queensland Globe online interactive mapping indicates the site is relatively flat, between 10 and 20 m above sea level.

During the site inspection in the PSI, a depression was noted to be present along the southern site boundary, where surface water flows may potentially occur. There was no equivalent along the northern site boundary. Subsurface stormwater drains are present in the western portion of the site and these drain to the west towards Tenth Avenue. A surface depression is located in the grassed area at the centre of the site at the location of the foam training area.

3.3 Soil Type and Acid Sulfate Soils (ASS)

Mapping from the Australian Soil Resources Information System (ASRIS) indicated the site is underlain by Anthroposols which are soils which have been modified or constructed by humans.

Mapping from ASRIS indicates that there is an extremely low probability of occurrence of ASS.

3.4 Geology

Geological mapping (Queensland Globe) indicates that the majority of the site is underlain by Quaternary flood plain alluvium, comprising clay, silt, sand and gravel.

The bore card for the closest registered bore to the site (RN186025, located 220 m to the south) indicates the geology beneath the site comprises topsoil, underlain by red silts and coarse brown sands.

3.5 Hydrology

The site is located within the flood plain of the Burdekin River. The closest water feature to the site is a drain, located approximately 225 m to the south of the site, which runs to the southeast then east. Another drain is situated approximately 650 m north of the site, which flows in an easterly direction and appears to discharge into a reservoir located approximately 4 km northeast of the site. A pond is present approximately 850 m to the southwest with an associated drainage line that runs to the northwest from the pond.

The Burdekin River is approximately 3 km north of the site and is the major hydrological feature in the area. This river flows from west to east discharging into the Coral Sea. The mouth of the Burdekin River is approximately 10 km to the east of the site.

Burdekin Regional Council online interactive mapping indicates the site and adjacent land is not within the Storm Tide Evacuation Zone.

3.6 Hydrogeology

The Groundwater Resources of Queensland 1:2,500,000 mapping indicates the aquifer beneath the site to comprise unconsolidated sediments, with a yield of >15 L/s and salinity of 500 to 1500 mg/L. The groundwater is noted to be suitable for most purposes and marginal for human consumption, and low tolerant crops. Based on the proximity of the surface water features (Burdekin River) to the site, the inferred groundwater flow direction beneath the site is to the north/northeast towards the Burdekin River.

A search of the Department of Natural Resources, Mines and Energy (NRME) registered groundwater bore database was completed in October 2019 and identified 23 bores within 1 km of the site. The registered bore locations are shown on **Figure 1**, **Appendix A**. Five of these bores are identified as abandoned[3], two are used for monitoring purposes[4] and 16 are used for water supply as identified in **Table 5** below. It is noted that 12 of these bores are located to the north and potentially hydraulically down-gradient of the site and all of the bores are screened in the shallow aquifer with SWL ranging between 5.3 and 10.6 mbgl.

[3] RN12000540, RN12000541, RN12000542, RN12000018, RN12000019
[4] RN12000114, RN166700

Table 5 Registered groundwater bores within 1 km of Home Hill Fire Station

Bore ID	Distance and Direction	Screen Depth	Additional Comments / Use if Known
RN186025	220 m south	19 to 20.1 mbgl	Water supply, SWL 9.7 mbgl
RN175675	370 m northeast	18.8 to 20.0 mbgl	Water supply, SWL 9.5 mbgl
RN175547	390 m northeast	18.9 to 20.12 mbgl	Water supply, SWL 9.5 mbgl
RN175674	420 m northeast	18.8 to 20.0 mbgl	Water supply, SWL 10.3 mbgl
EN175546	460 m northeast	18.8 to 20.12 mbgl	Water supply, SWL 9.5 mbgl
RN153225	490 m north	15.15 to 16.15 mbgl	Water supply, SWL 6.5 mbgl
RN175676	500 m southeast	19.0 to 20.2 mbgl	Water supply, SWL 9.3 mbgl
RN96585	600 m south	13.4 to 14.0 mbgl	Water supply, SWL not listed
RN102089	570 m north	17.2 to 17.8 mbgl	Water supply, SWL 10.2 mbgl
RN125935	620 m north	16.9 to 18.5 mbgl	Water supply, SWL 10.1 mbgl
RN102765	650 m northeast	17.0 to 18.0 mbgl	Water supply, SWL 10.2 mbgl
RN140881	750 m northeast	13.3 to 18.3 mbgl	Water supply, SWL 5.3 mbgl
RN125929	850 m west	15.3 to 16.8 mbgl	Water supply, SWL 10.5 mbgl
RN175972	870 m northwest	12.6 to 13.6 mbgl	Water supply, SWL10.6 mbgl
RN125096	830 m northwest	16.0 to 17.5 mbgl	Water supply, SWL 10.9 mbgl
RN102145	960 m north	12.0 to 18.0 mbgl	Water supply, SWL not listed

3.7 Environmental Values

Environmental values (EVs) and water quality objectives are not yet defined for the Haughton Basin area under EPP Water and are under development. As per DES guidance, in areas where no water quality objectives are scheduled, the Queensland water quality guidelines apply as default objectives. The surface water environmental values considered therefore include: aquatic ecosystems, irrigation, farm supply / use, stockwater, aquaculture, human consumer, primary recreation, secondary recreation, visual recreation, drinking water, industrial use, cultural and spiritual values.

3.8 Groundwater Dependent Ecosystems and Environmentally Sensitive Areas

A search of the Groundwater Dependent Ecosystems (GDE) database[5] indicated the following aquatic ecosystems are present within 4 km of the site: Wetland at Burdekin River – moderate potential GDE. No subterranean and terrestrial GDEs were identified.

A search of the Environmentally Sensitive Areas (ESAs) database[6] indicated the site is within a Category C river improvement area. Areas to the north of the site along the Burdekin River are classed as Category B endangered regional ecosystems (biodiversity status).

[5] http://www.bom.gov.au/water/groundwater/gde/map.shtml
[6] https://environment.des.qld.gov.au/licences-permits/maps_of_environmentally_sensitive_areas.php

4.0 Fieldwork- DSI

4.1 Overview

Fieldwork was completed between July and August 2019 in accordance with the SAQP dated April 2019 (AECOM, 2019). Details of the tasks completed are shown in **Table 6**.

Table 6 Summary of Fieldwork

Activity	Dates
Service clearance survey at proposed soil bore locations.	22 July 2019
Drilling of four soil bores (HH_BH01 to HH_BH04), collection of soil samples, conversion to groundwater monitoring wells (HH_MW01 to HH_MW04), well development	24 – 25 July 2019
Advancement of four shallow soil bores (HH_SS1 to HH_SS4) and collection of soil samples	24 - 25 July 2019
Gauging and collection of groundwater samples from the four newly installed wells (HH_MW01 to HH_MW04). Collection of two sediment samples (HH_SED01 and HH_SED02)	06 August 2019
Surveying of the groundwater wells	06 August 2019

Co-located surface water and sediment samples were to be collected from the on-site drainage lines, however, as water was not present at the time of sampling, only sediment samples were collected.

4.2 Sampling Rationale

An overview of the rationale for sampling locations is presented in **Table 7**. The sampling locations are shown on **Figure 2**, **Appendix A**. The coordinates of sampling positions are shown in **Table T1**, **Appendix B**. Photographs taken during the fieldworks are shown in **Appendix C**.

Table 7 Sampling Rationale

Location ID	Location/Rationale
HH_BH01 / HH_MW01	To investigate soil and groundwater quality in the central western portion of the site potentially hydraulically cross-gradient of the foam training area.
HH_BH02 / HH_MW02	To investigate soil and groundwater quality in the central portion of the site within the foam training area and the surface depression.
HH_BH03 / HH_MW03	To investigate soil and groundwater quality in the eastern portion of the site adjacent to, and southwest of, the Case 4 Pit.
HH_BH04 / HH_MW04	To investigate soil and groundwater quality in the central portion of the site, to the south, and potentially hydraulically up-gradient of the area used for foam training.
HH_SS1	To investigate the potential for PFAS in shallow soil in an unsealed area in the central northern portion of the site adjacent to the foam training area.
HH_SS2 to HH_SS4	To investigate the potential for PFAS in shallow soil in an unsealed area in the northern central portion of the site where foam training occurred.
HH_SED01, HH_SED02	To investigate the potential for PFAS in sediment in drainage lines along the southern (SED01) and northern (SED02) site boundaries.

Due to the ubiquity of PFAS used in a variety of everyday products and the potential for cross contamination during sampling activities, the recommended mitigation practices identified in the NEMP (HEPA, 2018) and Western Australia's Department of Environmental Regulation (2017) were implemented during the sampling program as stipulated in the SAQP (AECOM, 2019). Further details on the quality assurance / quality control (QA/QC) practices employed are provided in **Appendix G**.

4.2.1 Soil Investigation

Sampling methodologies and details relating to laboratory analysis of samples are described in the SAQP (AECOM, 2019). The soil investigation methodology is described in **Table 8**.

Table 8 Soil Investigation Methodology

Activity/Item	Details
Service location	AECOM obtained on-site utility plans and Dial-Before-You-Dig plans before the start of the works. A contractor (Copp and Co Civil & Plant Hire Pty Ltd) conducted service location and cleared proposed bore locations for services. Concrete coring was conducted at one location (HH_BH04). All soil bores were advanced by non-destructive digging (vacuum extraction using a water lance) to 1.5 mbgl to confirm the absence / presence of underground utilities.
Drilling method and target depth	Soil bores (for conversion to groundwater monitoring wells) were advanced by a contractor (Proactive Drilling Services Pty Ltd) with a Geoprobe drilling rig using solid stem augers to the target depth (approximately 10 mbgl). HH_SS1 and HH_SS3 were advanced using a hand auger to the target depth of 0.5 mbgl. HH_SS2 and HH_SS4 were surface samples only (approximately 0.1 mbgl) collected with a hand auger.
Soil logging	Soil logging was in accordance with the unified soil classification system (USCS) and AS1726-2016. The soil profile(s) encountered are provided in bore logs in **Appendix D**.
Soil sampling	During drilling, samples were obtained at the depths specified in the SAQP. To reduce the likelihood of cross contamination, soil samples were collected using new nitrile gloves and placed into laboratory prepared PFAS sample containers. Sample jars were filled to the top and securely sealed. The field QA/QC samples comprised intra-laboratory duplicate samples, inter-laboratory duplicate samples and rinsate blank samples.
Soil sample preservation	During collection in the field, soil samples were placed in eskies kept cool with bagged ice prior to air transport to the laboratory. Samples were submitted with chain of custody documentation to a laboratory NATA accredited for the analysis performed.
Decontamination procedures	The decontamination procedures were performed before initial use of re-useable equipment and after each subsequent use. All reusable sampling equipment was decontaminated between each sample by scrubbing in a solution of Liquinox[7] and potable water before being rinsed in PFAS-free distilled water. For each day of sampling, following decontamination procedures, a rinsate blank was completed by running laboratory prepared rinsate water over the reusable sampling equipment for collection directly into laboratory prepared sampling containers for analysis. At each sample location, a new set of disposable nitrile gloves was used to directly collect soil samples from the re-useable sampling equipment for placement into the laboratory prepared sampling containers.
Disposal of waste	Waste soil generated during the drilling was disposed of into 205 L drums for temporarily storage in an area nominated by QFES.

[7] Further information on PFAS-free status of Liquinox is provided at http://technotes.alconox.com/industry/laboratory/manual-lab-cleaning/pfoa-pfos-pfas-alconox-cleaners/

4.2.2 Groundwater Investigation

The groundwater investigation methodology is described in **Table 9**.

Table 9 Groundwater Investigation Methodology

Activity	Details
Monitoring well installation	Monitoring well construction comprised a 50 mm diameter uPVC screen and casing with screw fittings, installed in an approximately 150 mm diameter bore. All four wells were installed to approximately 10 mbgl. Screen length varied between wells dependent on water strike. Screened sections were installed in a gravel filter pack to 0.5 m above the top of the screen and isolated with a 1 m thick bentonite seal. Each well was fitted with a flush mounted gatic and secured into position with concrete. A water tight enviro-cap was installed on the top of each well casing to prevent accidental blockage of the well.
Well development	Wells were developed following installation using a foot pump. The wells were purged until the extracted water was 'clearing' and field parameters were stabilised. Monitoring well construction details can be found in **Table T1, Appendix B**.
Well gauging	Monitoring wells were gauged using an oil/water interface probe. The results of groundwater level gauging are presented in **Table T2, Appendix B**. The field sheets and calibration certificates are provided in **Appendix E**.
Field Parameters	Groundwater physicochemical properties were measured in the field prior to sample collection using a calibrated YSI water quality meter. Groundwater pH, temperature, electrical conductivity, redox potential and dissolved oxygen concentrations were measured. Groundwater physicochemical parameters are presented in **Table T3, Appendix B**. Water quality meter calibration certificates are presented in **Appendix E**.
Groundwater sampling	The groundwater sampling procedure is described in detail in the SAQP (AECOM, 2019). Groundwater samples were collected from each monitoring well using a low flow peristaltic pump in accordance with Australian Standard AS5667.11 (1998) and the AECOM Standard Operating Procedure (SOP). Samples were obtained following stabilisation of field parameters and standing water level. The field QA/QC samples comprised intra-laboratory duplicate samples, inter-laboratory duplicate samples, and rinsate blank samples.
Sample preservation	During collection in the field, samples were placed into the appropriate laboratory-supplied containers and placed in an esky, which was kept cool with bagged ice before being delivered to the laboratory. Samples were submitted with chain of custody documentation to a laboratory NATA accredited for the analysis requested.
Decon-tamination procedures	The oil/water interface probe and peristaltic pump were decontaminated by scrubbing in a solution of Liquinox[8] and potable water before rinsing with PFAS-free distilled water between each groundwater well. A rinsate sample was collected from either the interface probe or peristaltic pump each day of sampling. Dedicated tubing was used for during the monitoring of each well to minimise the potential for cross-contamination and appropriate silicone and HDPE tubing was used which is PFAS-free. A new pair of nitrile gloves were used for each well sampled.
Disposal of waste	Purged groundwater was disposed of into a 205 L waste drum, which was temporarily stored in an area nominated by QFES.
Surveying	Surveying of newly installed groundwater wells was completed by Veris Australia Pty Ltd. The surveying report is presented in **Appendix F**.

[8] Further information on PFAS-free status of Liquinox is provided at http://technotes.alconox.com/industry/laboratory/manual-lab-cleaning/pfoa-pfos-pfas-alconox-cleaners/

4.2.3 Sediment Investigation

The sediment sampling methodology is summarised in **Table 10**.

Table 10 Sediment Investigation Methodology

Activity	Details
Sediment sampling	On-site sediment samples were collected using a gloved hand placing samples directly into laboratory sample jars. At each location the sample jar was filled to the top to ensure no headspace and the cap was immediately applied.
Sample preservation	Samples were placed into the appropriate laboratory-supplied containers and placed in an esky, which was kept cool with bagged ice. Samples were submitted with chain-of-custody documentation to a laboratory NATA accredited for the analysis performed.
Decontamination	A new pair of disposable nitrile gloves was used to collect each sediment sample to avoid the potential for cross contamination.

4.3 Laboratory Analysis and Quality Assurance / Quality Control

A summary of samples analysed for this DSI is shown in **Table 11**. The laboratory analyses were conducted by Australian Laboratory Services (ALS) (primary laboratory) and National Measurement Institute (NMI) (secondary laboratory).

Table 11 Summary of Laboratory Analyses

Sample Media	Number of primary samples analysed for PFAS	No of duplicate samples	No of triplicate samples	No of rinsate samples
Soil	18	2	2	3
Groundwater	4	1	1	1
Sediment	2	1	1	1

4.3.1 Data Quality Objectives and Analytical Data Validation

The *National Environment Protection (Assessment of Site Contamination) Measure (*as amended 2013) (ASC NEPM) Schedule B2 Guideline on-Site Characterisation specifies that the nature and quality of the data produced in an investigation should be determined by the data quality objectives (DQO). As referenced by the ASC NEPM, the DQO process is detailed in the United States Environmental Protection Agency (US EPA, 2006) *Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4 : EPA/240/B-06/001),* February 2006. The DQOs were specified within the SAQP and are presented in **Appendix G**. AECOM has undertaken a review of the laboratory analytical results for quality control purposes; the results of the data validation process are presented in **Appendix G** and the laboratory quality control reports are included in **Appendix H**. In summary, while some non-conformances have been identified, these are considered of minor importance and it is concluded that the dataset presented in this report is suitable for use.

5.0 Assessment Criteria

Section 3.7 identified that EVs and water quality objectives are not yet defined for the Haughton Basin area under EPP Water and are under development. As per DES guidance, in areas where no water quality objectives are scheduled, the Queensland water quality guidelines apply as default objectives.

The guidelines values relevant for the site that have been adopted for this investigation are identified in **Table 12**. The guideline values are considered to provide a suitable level of protection for all EVs identified (refer to **Section 3.7**).

Table 12 Adopted investigation levels for PFAS

Media	Environmental Value	PFAS	Guideline Value
Soil	Human health- industrial / commercial landuse	∑(PFHxS+PFOS)	20 mg/kg[A]
		PFOA	50 mg/kg[A]
	Ecosystems- interim soil – ecological indirect exposure (residential)	PFOS	0.01 mg/kg[A]
	Ecosystems- interim soil – ecological indirect exposure (commercial)		0.140 mg/kg[A]
Groundwater	Human health- drinking water	∑(PFHxS+PFOS)	0.07 µg/L[A]
		PFOA	0.56 µg/L[A]
Groundwater discharging to surface water / surface water	Aquatic ecosystem protection (99% species protection)	PFOS	0.00023 µg/L[A]
			0.051 µg/L[B]
		PFOA	19 µg/L[A]
	Human health- recreational contact with waters	∑(PFHxS+PFOS)	2.0 µg/L[C]
		PFOA	10 µg/L[C]
Sediment	No Criteria	-	-

Notes:

A - NEMP (HEPA, 2018)

B-It is noted, that the NEMP (HEPA, 2018) 99% species protection guideline value for PFOS (0.00023 µg/L) is below the laboratory limit of reporting (LOR) and that the CSIRO has undertaken work to further review the draft freshwater criteria presented in the HEPA (2018) NEMP. The revised draft guideline values for PFOS were presented in Batley et al., 2018, Application of revised methodologies for default guideline value derivations: PFOS in freshwater at the Society of Environmental Toxicology and Chemistry (SETAC) North America scientific conference in November 2018. AECOM understands, through discussions with CSIRO, that these values are currently being further revised to consider more recent ecotoxicity testing results and the updated statistical interpretation methodology recommended in ANZG (2018). In the interim, both the draft freshwater criteria from the HEPA (2018) NEMP and the draft revised criteria proposed by Batley et al (2018) will be used to evaluate the data.

C- Australian Government National Health and Medical Research Council (2019), Guidance on Per and Polyfluoroalkyl substances in Recreational Water. Values are for recreational activities in natural waters only and not applicable for water extracted to fill swimming pools.

6.0 Results

6.1 Soil Conditions

The bore logs for the four deep soil bores (HH_BH01 to HH_BH04) and four shallow soil bores (HH_SS1 to HH_SS4) drilled in July 2019 are shown in **Appendix D**. Soil bores HH_BH01 to HH_BH04 were drilled to 10 mbgl, HH_SS1 and HH_SS3 were hand augured to 0.5 mbgl and HH_SS2 and HH_SS4 were hand auger samples collected from approximately 0.1 mbgl.

Soil conditions consisted of silty sand fill material up to 0.8 mbgl (reworked anthroposols) underlain by sand with gravel inclusions and silty/sandy clay lenses. The soil profile is considered indicative of a shallow horizon of anthroposols underlain by natural Quaternary flood plain alluvium.

There was no visual or olfactory indication of contamination in the soil samples during the drilling.

6.2 Hydrogeology

6.2.1 Observations during Drilling

Groundwater was encountered within the natural sand horizon in the deep soil bores HH_BH01 to HH_BH04. Groundwater was encountered at 8.4 mbgl in all four monitoring wells as shown on the bore logs in **Appendix D** and in **Table T1**, **Appendix B**.

6.2.2 Groundwater Elevations and Groundwater Flow Direction

The four groundwater monitoring wells sampled during this investigation were gauged before groundwater samples were collected. The standing water levels (SWLs in metres below top of casing [mbtoc]) were between 8.00 and 8.37 mbtoc. The groundwater elevations were between 4.08 and 4.10 m AHD. The SWLs and groundwater elevations are presented in **Table T2**, **Appendix B**.

The inferred groundwater contours and local groundwater flow direction at the fire station are shown on **Figure 3**, **Appendix A**. Based on the available data, groundwater is inferred to locally flow towards the north/northeast however it is noted that the lateral groundwater (i.e. east – west) dataset is limited.

6.2.3 Water Quality Parameters

Table T3, **Appendix B** presents the field water quality parameter results collected during the groundwater monitoring event. The raw data were recorded on the field sheets presented in **Appendix E**. Water quality results are presented in **Table 13**.

Table 13 Groundwater Quality Parameter Results

Parameter	Units	MW01	MW02	MW03	MW04
		6/08/2019	6/08/2019	6/08/2019	6/08/2019
pH		6.39	6.50	6.39	6.46
Temperature	°C	27.7	27.8	27.7	28.3
Electrical Conductivity	µS/cm	467.5	677.0	536.0	610.0
Total Dissolved Solids	mg/L	303.9	440.1	348.4	396.5
Dissolved Oxygen	mg/L	5.2	4.96	3.46	4.36
Oxidation Reduction Potential	mV	343.9	348.9	357.1	353.4

The results indicate that the groundwater is slightly acidic, fresh, moderately oxygenated with mildly reducing conditions.

6.2.4 Groundwater Field Observations

There was no visual or olfactory indication of contamination in the monitoring wells during the groundwater monitoring, including no identification of non-aqueous phase liquids, foaming or odours.

6.3 Analytical Results

6.3.1 Soil

The soil analytical results are presented in **Table T4**, **Appendix B** and on **Figure 4**, **Appendix A**. The laboratory analytical reports are presented in **Appendix H**. PFAS was detected in all 18 soil samples analysed.

There were no exceedances of the human health guideline values for commercial land use in the soil samples analysed. A summary of the results in comparison against the adopted human health guideline values is presented in **Table 14**.

Table 14 Summary of PFAS Soil Analytical Results and Assessment with Human Health Guideline Values

Com-pound	No. of samples analysed	No. of samples >LOR*	Max. concentration (mg/kg)	Human health guideline value (mg/kg)	No. of samples exceeding human health guideline value
∑(PFHxS +PFOS)	18	18	0.223	20	0
PFOS	18	18	0.223	No guideline value	
PFOA	18	8	0.0009	50	0
Sum of PFAS	18	18	0.227	No guideline value	

*LOR = limit of reporting

A summary of the results in comparison against the adopted ecological guideline values is presented in **Table 15**.

There was one exceedance of the ecological guideline value for PFOS for indirect exposure for commercial land use. The exceedance was reported at HH_SS1_0.5 (0.223 mg/kg). The samples were collected to the northeast of the foam training area.

A comparison of PFAS concentrations to the residential land use ecological guidelines for indirect exposure was also performed, as the central and western portion of the site contains open ground/grassed areas where secondary consumers such as insectivorous birds and mammals may forage. This is a conservative approach, as it is considered that the wildlife would be transient in nature due to the urbanised setting of the site. There were nine exceedances of the ecological guideline value for PFOS for indirect exposure for residential land-use (not including duplicate and triplicate results). A summary of the results in comparison against the ecological criteria is presented in **Table 15**.

Table 15 Summary of PFAS Soil Analytical Results and Assessment with Ecological Guideline Values

Com-pound	No. of samples analysed	No. of sam-ples >LOR*	Max. concen-tration (mg/kg)	Ecological guideline value commercial / residential (mg/kg)	No. of samples exceeding of commercial guideline value	No. of samples exceeding of residential guideline value
∑(PFHxS +PFOS)	18	18	0.223	No guideline value	No guideline value	No guideline value
PFOS	18	18	0.223	0.14 / 0.01	1	9
PFOA	18	8	0.0009	No guideline value	No guideline value	No guideline value
Sum of PFAS	18	18	0.227	No guideline value	No guideline value	No guideline value

6.3.2 Groundwater

The groundwater analytical results for samples collected from monitoring wells are presented in **Appendix B.** The laboratory analytical reports are presented in **Appendix H**. A summary of the assessment of the results with human health guideline values is presented in **Table 16** below.

Table 16 Assessment of Groundwater Results with Human Health Guideline Values

Compound	No. of samples analysed	No. of samples >LOR	Maximum con-centration (µg/L)	Adopted drinking water / recreational water guideline value	No. of samples exceeding drinking water guideline value	No. of samples exceeding recreational water guideline value
∑(PFHxS+PFOS)	4	4	5.10	0.07 / 2.0	4	2
PFOA	4	4	0.048	0.56 / 10.0	0	0
Sum of PFAS	4	4	5.46	No guideline		

The groundwater analytical results for ∑(PFHxS+PFOS) and PFOA concentrations are presented on **Figure 5**, **Appendix A**. Groundwater samples from all four monitoring wells exceeded the human health guideline values for drinking water for ∑(PFHxS+PFOS), with the maximum concentration (5.1 µg/L) detected in HH_MW03, located adjacent to the Case 4 Pit. Two of the groundwater samples (HH_MW02 and HH_MW03) also exceeded the recreational water guideline value.

The concentrations of PFOA in the four groundwater samples did not exceed the human health guideline value for drinking water.

The concentrations of PFOS in all four groundwater samples exceeded the ecological guideline values for 99% species protection for fresh water in all four samples. There were no exceedances of the adopted ecological guideline values for PFOA.

6.3.3 TOPA

One soil sample and one groundwater sample were also analysed for TOPA to understand the potential presence of PFAS precursors. The results are summarised in **Table 17**.

Table 17 Summary of TOPA Analysis (Soil and Groundwater)

Sample	Units	Sum of 28 PFAS (standard analysis)	Sum of 28 PFAS (TOPA)	Sum of TOP C4-C14 Carboxylates and C4-C8 Sulfonates	% of Sum of 28 TOPA to 28 PFAS standard analysis
HH_SS1_0.5_190724	mg/kg	0.227	0.159	0.16	-30%
HH_MW03_190806	µg/L	5.46	2.57	2.57	0%

Comparison of the results for the soil sample indicates the sum of 28 PFAS by TOPA was 30% lower than the sum of 28 PFAS by standard analysis. This may indicate depletion of oxidant by compounds other than PFAS. The result is indicative of a degraded PFAS product.

Comparison of the results for the groundwater sample indicates the sum of 28 PFAS by TOPA was equal to the sum of 28 PFAS by standard analysis, suggesting no depletion of oxidant by compounds other than PFAS during the TOPA reaction. The result is indicative of a degraded PFAS product that is unlikely to significantly increase through biotransformation or oxidation processes.

6.3.4 Sediment

The sediment analytical results for samples collected from two on-site drainage lines are presented in **Table T6, Appendix B** and on **Figure 6, Appendix A**. The laboratory analytical reports are presented in **Appendix H**. A summary of the results is presented in **Table 18** below.

Table 18 Summary of Sediment Results

Compound	No. of samples analysed	No. of samples >LOR	Maximum concentration (mg/kg)
∑(PFHxS+PFOS)	2	2	0.0026
PFOS	2	2	0.0026
PFOA	2	1	0.0002
Sum of PFAS	2	4	0.0026

No suitable criteria are available for assessing human and ecological risk from sediment. The moisture contents of SED01 and SED02 samples were less than 11%. A comparison of soil guideline values for human health or ecological guidelines values (NEMP, 2018) for commercial landuse for PFHxS and PFOS and PFOA indicated there are no exceedances of the guideline values.

7.0 Discussion

7.1 Geological and Hydrogeological Conditions

7.1.1 Soil Conditions

Based on the soil conditions recorded in the bore logs, the subsurface lithology beneath the site generally comprises of a shallow layer of fill (up to 0.8 mbgl) consisting of re-worked anthroposols, underlain by natural sands with silty/sandy clays to the maximum depth of the investigation (10.0 mbgl).

7.1.2 Hydrogeology

Measured groundwater elevations indicate the presence of a shallow aquifer, with groundwater encountered at 8.4 mbgl across the site. Based on the limited groundwater elevation data (four locations), the inferred contours indicate local groundwater flow is to the north/northeast. This is consistent with the expected regional groundwater flow direction which is likely to be to the north / northeast towards the Burdekin River located approximately 3 km north of the site. Sand is the dominant soil type within the unsaturated and saturated zone.

The foam training area is located in an unsealed area. It is likely that the majority of training exercises completed using AFFF would have resulted in the application of foam directly to the soil surface with subsequent direct infiltration to the subsurface. PFAS infiltration may have occurred vertically through the subsurface fill and silty/sandy clays before moving through the sandy unsaturated zone to the underlying groundwater (saturated zone).

The presence of underground services, particularly the sewer line running south-north through the former foam training area and the Case 4 Pit may create preferential pathways through coarse backfill materials in areas where clay is the main soil type present. However, it is noted that sand is the main soil type generally present so the potential for preferential pathways is likely to be limited.

7.2 Soil Analytical Results

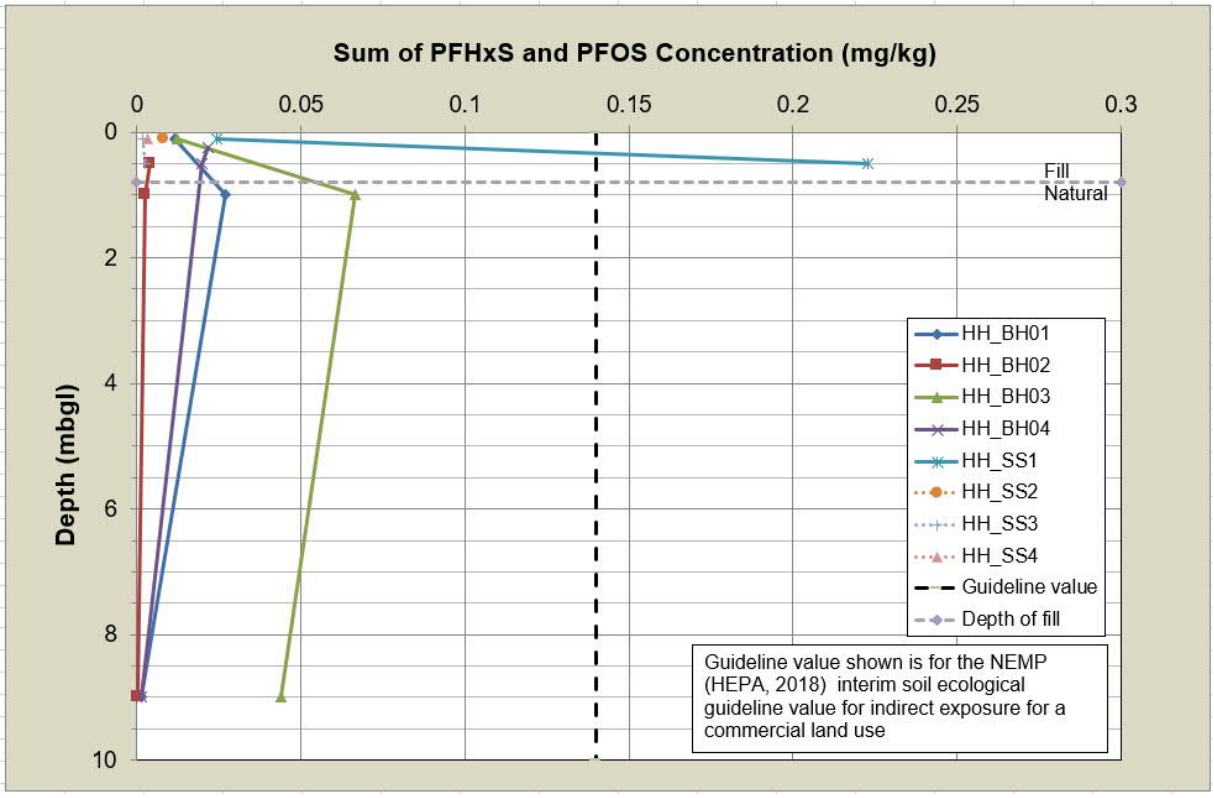
The investigation results indicate PFAS (∑PFHxS+PFOS) concentrations were higher in soil samples from the three soil bores located adjacent to (east, west and north) the area identified as the foam training area in the PSI (AECOM, 2019) compared to the four soil bores from within the foam training area. The soil sample with the highest PFAS concentration was at 0.5 mbgl at soil bore HH_SS1, located to the east of the former foam training area (∑(PFHxS+PFOS) was 0.223 mg/kg). This was the deepest soil sample collected from this soil bore. A soil sample from HH_BH01 (1.0 mbgl) located to the west of the foam training area had 0.027 mg/kg ∑(PFHxS+PFOS), while the sample from HH_BH04 (0.25 mbgl), located to the south of the foam training area had 0.022 mg/kg ∑(PFHxS+PFOS). This may indicate the use of AFFF was over larger footprint than was identified in the PSI.

PFAS (∑PFHxS+PFOS) concentrations in deeper soil samples from the saturated zone in soil bores within and around the foam training area (HH_BH01, HH_BH02 and HH_BH04) were one to two orders of magnitude lower compared to shallow soils (< 1.0 mbgl) indicating attenuation with depth through the unsaturated soil profile. This is shown graphically in **Chart 1**.

PFAS (∑PFHxS+PFOS) concentrations reported within soil samples from HH_BH03, located adjacent to the Case 4 Pit area (which was used for firefighting training) are similar at different depths (0.012 mg/kg at 0.1 mbgl, 0.067 mg/kg at 1.0 mbgl and 0.044 mg/kg at 9.0 mbgl) indicating this area to be a potential source of PFAS. The results also indicate the potential for backfill materials around the Case 4 Pit to create a preferential vertical pathway for the migration of PFAS to groundwater.

The maximum ∑(PFHxS+PFOS) concentration reported in soil samples is two orders of magnitude lower than the NEMP (HEPA, 2018) guideline value for human health for a commercial land use. The results suggest the potential presence of areas with locally elevated PFAS concentrations and this uneven distribution may reflect historical practices of foam application in the foam training area.

Chart 1 Concentration of ∑(PFHxS+PFOS) with depth in soil bores at Home Hill Fire Station



7.3 Groundwater Analytical Results

PFAS was detected in all four monitoring wells (HH_MW01 and HH_MW04) with the highest groundwater PFAS concentrations detected at two source areas identified in the PSI (AECOM, 2019):

- adjacent to the Case 4 Pit (HH_MW03 had 5.1 µg/L ∑(PFHxS+PFOS) located in the east of the site (refer **Figure 5**, **Appendix A**) and
- within the foam training area (HH_MW02 had 3.7 µg/L ∑(PFHxS+PFOS).

Groundwater PFAS concentration in the two monitoring wells that were hydraulically up- and cross-gradient of the former foam training area (HH_MW04 and HH_MW01, respectively) were relatively lower with up to 0.5 µg/L ∑(PFHxS+PFOS) detected in HH_MW04. ∑(PFHxS+PFOS) concentrations in groundwater samples from the four wells exceeded the NEMP (HEPA, 2018) guideline value for human health (drinking water) while the concentrations at HH_MW02 and HH_MW03 also exceeded the NHMRC human health recreational water guideline value.

As the inferred contours indicate groundwater as sampled at MW02 and MW03 is locally flowing towards the north/northeast within a sand aquifer that is likely to be relatively permeable, there is the potential for PFAS contaminants to migrate off-site at concentrations that exceed human health and ecological guideline values. Due to the limited number of monitoring wells, the extent of PFAS in groundwater has not been established in any direction.

Shorter chain compounds (i.e. compounds with six or fewer perfluorinated carbons) have higher mobility in groundwater relative to longer chain compounds. Due to the main source area (foam training area) being located close to the down-gradient (northwestern) boundary, no monitoring wells were positioned down-gradient of this area and therefore there is limited information on the potential mobility of shorter chain compounds. Groundwater samples from monitoring well HH_MW03 positioned close to Case 4 Pit where training activities occurred is noted to have the highest concentrations of some shorter chain compounds including PFHxS (0.70 µg/L), PFPeS (0.068 µg/L) and PFHxA (0.07 µg/L). Shorter chain compounds are considered to have a higher potential to migrate in groundwater beyond the down-gradient site boundary.

7.4 Comparison of PFAS composition in soil and groundwater samples

Table 19 presents a comparison of the compounds detected in soil and groundwater samples.

Table 19 PFAS Composition in Soil and Groundwater Samples

PFAS	Carbon Chain Length	Average soil ratios for different soil depth intervals			Average groundwater ratio (n=4)
		0.1-0.5 mbgl (n = 11)	1.0 mbgl (n = 3)	9.0 mbgl (n = 4)	
PFBA	4	0%	0%	0%	0%
PFBS	4	0%	0%	0%	2.1%
PFPeS	5	0%	0%	0%	2.3%
PFPeA	5	1.0%	2.4%	0%	0.7%
PFHxS	6	1.3%	0.5%	24.8%	33.8%
PFHxA	6	0.7%	0.2%	0%	1.8%
6:2 FTS	6	0%	0%	0%	0.1%
PFHpS	7	0.4%	0%	0.4%	0.7%
PFHpA	7	1.9%	0%	0%	1.4%
PFOS	8	67.6%	94.4%	74.4%	55.7%
PFOA	8	1.8%	0%	0.4%	1.3%
PFNA	8	3.2%	2.5%	0%	0.1%
FOSA	8	0.3%	0%	0%	0%
8:2 FTS	8	0.4%	0%	0%	0%
PFDS	10	1.3%	0%	0%	0%
PFDcA	10	7.4%	0%	0%	0%
10:2 FTS	10	6.0%	0%	0%	0%
PFUnDA	11	5.8%	0%	0%	0%
PFDoDA	12	0.8%	0%	0%	0%
PFTrDA	12	0.1%	0%	0%	0%

Note: The average composition has been calculated using all primary soil and groundwater samples.

7.4.1 Soil Profile

Table 19 shows that the PFAS present in soil samples ranged from short (six perfluorinated carbons) to long chain (twelve perfluorinated carbons). Comparison of the compounds detected indicates a larger range of compounds were detected in the shallower depth interval (0.1 to 0.5 mbgl) compared to the deeper depth intervals. For example, no compounds with more than eight perfluorinated carbons were detected in the samples from deeper than 1.0 mbgl. For all depth intervals, the main compound present is PFOS (average composition was between 68% and 94%). This may be due to the slightly acidic to near neutral (pH ranging 5.66 to 6.49) and fresh conditions (total dissolved solids ranging 69.9 to 866 mg/L) of the groundwater, which may inhibit the sorption of PFOS onto organic matter, thus increasing mobility (CRC CARE, 2018).

The samples from 9.0 mbgl mainly consisted of two compounds, PFOS (74%) and PFHxS (25%). The ratio of PFHxS was noted to increase from 1% at the 0.1 to 0.5 mbgl depth interval to 25% at the 9.0 mbgl depth interval. As the samples from 9.0 mbgl are from the saturated zone (SWL was between 8.0 and 8.4 mbgl), the presence of PFHxS and PFOS is likely to relate to adsorption onto clay particles of these compounds from groundwater. PFHxS and PFOS are noted to be the main compounds present in groundwater.

7.4.2 Groundwater Profile

The groundwater samples had a smaller range of chain lengths compared to the soil samples, between four and eight perfluorinated carbons. The smaller number of chain lengths present in groundwater may be due to the longer chain PFAS having a greater potential to sorb to soil particles compared to shorter chain PFAS, or due to longer chain PFAS having lower solubilities than shorter chain compounds.

The composition of PFAS in groundwater is dominated by PFOS (average 56%) and PFHxS (average of 34%), with seven other compounds present at 1% or higher.

7.4.3 Summary

Based on **Table 19** approximately 99% of the mass of PFAS in the soil (based on the sum of 28 PFAS analysed) is comprised of longer chain with more than six perfluorinated carbons. Approximately 96% of the mass of PFAS in groundwater is comprised of longer chain length with more than six perfluorinated carbons.

7.5 Sediment Analytical Results

∑(PFHxS+PFOS) concentrations in the sediment samples from drains located along the northern and southern site boundaries were 0.0004 and 0.0026 mg/kg at HH_SED01 and HH_SED02, respectively, indicating concentrations relatively close to the limit of reporting. The concentrations indicate sediment in the drains at the locations sampled is unlikely to represent a source of PFAS to surface water. PFOS (with eight perfluorinated carbons) was the only compound detected in HH_SED01, while a larger range of compounds, between five and twelve perfluorinated carbons, were detected in HH_SED02.

8.0 Conceptual Site Model - PFAS

8.1 Introduction

8.1.1 Purpose

The purpose of the CSM is to provide an understanding of the nature and extent of contamination impacts and the migration mechanisms, and the exposure pathways by which identified receptors may be exposed to contamination from the Investigation areas. The CSM also serves as a framework to assess risks to human health and ecological receptors and assists in identifying uncertainties and data gaps. A preliminary CSM was developed as part of the PSI (AECOM, 2019). The CSM has been updated based on the findings of this PFAS DSI.

8.1.2 Definition of source-pathway-receptor linkages

In accordance with national guidance on assessment of contamination (NEPM, 2013), potential risks to receptors are evaluated based on three components:

- **Source**: A potentially hazardous substance that has been released into the environment
- **Receptors**: A person, ecosystem or ecological member potentially at risk of experiencing an adverse response following exposure to the source or derivatives of the source
- **Pathway**: A mechanism by which receptors can become exposed to the source or derivatives of the source.

If all three components are present at an exposure scenario, the source-pathway-receptor linkage is considered complete and a receptor is exposed to risk. However, if one of these three is missing there is no direct risk to receptors.

8.1.3 Definition of exposure pathways

In order for a human receptor to be exposed to a chemical contaminant derived from the site, a complete exposure pathway must exist. An exposure pathway describes the course a chemical or physical agent takes from the source to the exposed individual and generally includes the following elements (USEPA, 1989):

- A source and mechanism of chemical release
- A retention or transport medium (or media where chemicals are transferred between media)
- A point of potential human contact with the contaminated media
- An exposure route (e.g. ingestion, inhalation) at the point of exposure.

8.2 Contaminants of Potential Concern

The main contaminants of concern are those with guideline values in the NEMP (HEPA, 2018), PFHxS, PFOS and PFOA.

8.3 Sources

The main source areas of PFAS contamination at the site are summarised below.

8.3.1 Primary Sources

The following activities on the site are considered to have resulted in PFAS impacts to soil, and groundwater:

- Former firefighting training activities using AFFF containing PFAS at the foam training area (see **Figure 2, Appendix A**)
- Leaks and spills of AFFF containing PFAS from storage areas, and during product transfer and maintenance.

8.3.2 Secondary Sources

The following secondary sources were identified could potentially lead to PFAS impacts:

- Surface soil where AFFF containing PFAS was historically discharged to surface
- Unsaturated zone soil beneath potential source zones
- Concrete infrastructure that has been in contact with AFFF
- Water with trace concentrations of PFAS stored in the Case 4 Pit
- Sediment within earthen stormwater perimeter drainage lines.

8.3.3 Off-Site

The following off-site landuses have the potential to affect groundwater quality beneath the site:

- The adjacent SES land, immediately to the south in the eastern portion of the site
- An industrial unit, located approximately 200 m to the northeast of the site
- Wilmar Sugar Inkerman Mill located approximately 2 km northwest of the site.

8.4 Migration Mechanisms

The mechanisms which may have contributed to the migration of PFAS across and from the site include:

- Historical discharge of AFFF containing PFAS to ground surface or leakage from storage infrastructure
- Spilling of AFFF containing PFAS to ground surface during filling and decanting operations
- Sorption of PFAS to soil in areas where AFFF was historically used, particularly in unsealed areas such as the grassed former foam training area
- Localised dispersion of firefighting foams with wind during historical application
- Surface water run-off containing PFAS flowing into surface water and off-site migration within the drainage system
- Leaching of PFAS from soil and infiltration to groundwater in areas where AFFF was historically used
- Leaching of PFAS from concrete pavements and infiltration to surface water or groundwater
- Lateral and vertical migration of PFAS in groundwater under the influence of groundwater flow and PFAS dispersion
- Migration within backfill to underground services which may act as preferential pathways for PFAS in the unsaturated zone
- Use of groundwater offsite for industrial activities, recreational activities, irrigation for parks and gardens and domestic activities
- Sorption of PFAS to soil below the groundwater table during migration with groundwater. Sorption to soil slows down the migration of PFAS, but sorbed PFAS may continue to diffuse back into groundwater and act as a secondary source, if conditions are suitable
- Excavation of soil containing PFAS and relocation to other areas on site
- Transport of sediment along stormwater drains.

8.5 Receptors and Exposure Pathways

The following potential human and ecological receptors have been identified:

- Personnel who work at the fire station (current and future QFES employees). This includes intrusive (i.e. involved in soil excavation) maintenance workers who may conduct infrequent maintenance activities at the site and come into contact with impacted soil and/or stormwater and/or groundwater
- Visitors to the site who stay for a short period and are not frequently present at the site who may come into contact with impacted soil and/or stormwater
- Persons exposed to groundwater extracted from off-Site bores for industrial activities, recreational activities, irrigation for parks and gardens and domestic activities
- Recreational users of nearby surface water bodies
- The terrestrial ecosystem (flora and fauna) both on- and off-site
- The aquatic ecosystems of nearby waterways.

The following potential exposure pathways have been identified for human receptors:

- Dermal contact and/or incidental ingestion of PFAS impacted soil, including dust inhalation
- Persons drinking PFAS impacted groundwater
- Dermal contact and/or incidental ingestion of PFAS impacted groundwater, surface water and sediment (in drains).

The following potential exposure pathways have been identified for ecological receptors:

- Ecological receptors in direct contact with PFAS impacted soil, sediment and surface water.

8.6 Assessment of Exposure Pathways

An assessment of the exposure pathways for the site is presented in **Table 20**. A figure showing the key features of the CSM is presented as **Figure 7**, **Appendix A**.

Table 20 Home Hill Fire Station CSM – PFAS

Primary Source	Secondary Sources	Transport Mechanism	Exposure Pathways	Receptor	Likelihood of complete linkage	Comments
On-Site areas where firefighting foams have been discharged or spilt to the environment. Off-Site areas where firefighting foams have been discharged or spilt to the environment	PFAS in soil	Excavation of soil during construction / maintenance activities	Human health: incidental ingestion of soil, direct contact with soil (dermal contact and dust inhalation)	Intrusive maintenance / landscaping workers	Unlikely	Considered unlikely due to use of occupational health and safety controls and non-exceedance of health guideline values for PFAS in soil for a commercial land use. No anticipated change to future land use.
			Ecological: ingestion of plants and terrestrial biota by higher order ecological receptors	Terrestrial ecosystem	Possible	Considered possible due to exceedance of the indirect ecological guideline value for commercial/industrial land use and residential land use criteria. Near surface soils are considered accessible to ecological receptors.
		General QFES activities	Human health: incidental ingestion of soil, direct contact with soil (dermal contact and dust inhalation)	Site workers and visitors	Unlikely	Considered unlikely due to non-exceedance of health guideline values for PFAS in soil for commercial land use. No anticipated change to future land use.
	PFAS in concrete lined pits and drains	Leaching of PFAS within concrete structures to soil, groundwater and surface water.	Human health - Incidental ingestion or contact with soil, groundwater or surface water.	Surface soil, groundwater, and surface water	Possible	Considered possible as PFAS concentrations in soil and groundwater may be partly sourced from concrete impregnated with PFAS.
			Ecological – uptake and bioaccumulation.			

Primary Source	Secondary Sources	Transport Mechanism	Exposure Pathways	Receptor	Likelihood of complete linkage	Comments
	PFAS in groundwater	Groundwater transport in aquifer followed by extraction and use for domestic, recreational, industrial uses and irrigation (parks)	Human health: direct ingestion or incidental ingestion or direct contact with groundwater (off-Site)	Off-Site groundwater users	Possible	Considered possible because groundwater beneath the site is fresh and potable, the shallow sand aquifer is likely to be permeable, the presence of registered bores hydraulically down gradient of the site (to the north), which are used for water supply and are screened in the shallow aquifer. Additional unregistered bores may also be present in the surrounding area.
			Uptake and bioaccumulation in terrestrial biota	Flora and fauna	Possible	
		Groundwater transport in aquifer followed by extraction for stock watering	Livestock: direct ingestion or incidental ingestion or direct contact with groundwater (off-site)	Livestock	Unlikely	Considered unlikely as the fire station is located in an urban areas and groundwater in the vicinity of the site is unlikely to be used for stock watering purposes.
	PFAS in surface water	Surface water transport via overland flow into on- and off-site drains that discharge into channels and potentially the Burdekin River	Human health: direct or incidental ingestion or direct contact with off-site surface water (i.e. surface water, drainage overland flow water).	Recreational users	Possible	Considered possible as PFAS in shallow soil / concrete at the site has the potential to leach into runoff which may enter stormwater channels. This would be mitigated by the distance of the site from surface water features. The nearest feature is a canal (650 m to the north) and Burdekin River (3 km to the north). As no water was present during the sampling event, the investigation was not able to sample surface water.
			Ecological: direct exposure as well as ingestion of biota by higher order ecological receptors	Aquatic ecosystem	Possible	

Primary Source	Secondary Sources	Transport Mechanism	Exposure Pathways	Receptor	Likelihood of complete linkage	Comments
	Accumulation of PFAS in creek sediment	Dispersion via surface water	Human health: incidental ingestion or direct contact with sediment (off-site). Direct ingestion of aquatic biota	Recreational users	Unlikely	Considered unlikely as sediment samples collected from drainage lines on-site have relatively low PFAS concentrations that are close to the LOR.
			Ecological: direct exposure, as well as ingestion of biota by higher order ecological receptors	Aquatic ecosystem	Unlikely	

9.0 Conclusions

The key findings of the PFAS DSI are presented below.

- Groundwater elevations in August 2019 indicated a shallow aquifer is present beneath the site. Depth to groundwater was approximately 8.4 mbgl. Groundwater was inferred to locally flow towards the north/northeast. This is consistent with the expected regional groundwater flow direction, which is likely to be from south to north towards the Burdekin River, which is the main hydrological feature in the area.
- The primary PFAS compound present in the soil samples was perfluorooctanesulfonic acid (PFOS). The soil samples collected were from bores located adjacent to the main potential source area, the foam training area and the area where the Case 4 Pit was located. The highest sum of perfluorohexanesulfonic acid (PFHxS) and PFOS concentrations detected were in the shallow soil (0.5 mbgl) in a bore located to the east of the foam training area in the central portion of the site (HH_SS01). PFAS concentrations were at relatively higher concentrations in soil samples from bores adjacent to the foam training area indicating the area may have had a larger historical footprint. The soil samples analysed from bores in and around the foam training area indicated that soil PFAS (PFHxS and PFOS) concentrations decreased with increased depth, with relatively higher PFAS concentrations in the near-surface material. Elevated PFAS concentrations in soil were also detected in unsaturated and saturated zone samples collected from a soil bore (HH_BH03) located adjacent to the Case 4 Pit indicating a potential historical source of PFAS to soil in this area.
- None of the 18 soil samples analysed from eight soil bores exceeded the NEMP (HEPA, 2018) health guideline values for commercial land use. The concentration of PFOS in one soil sample from an unsealed area (HH_SS1 at 0.5 mbgl (0.223 mg/kg)) exceeded the NEMP (HEPA, 2018) ecological PFOS guideline value for a commercial land use. Landscaped/grassy areas, potentially accessible to ecological receptors are located in the central and eastern portion of the site. Analytical results for nine soil samples detected PFOS concentrations that exceeded the guideline value for ecological indirect exposure for residential land use. Due to the urbanised setting of the site, it is considered that the ecological receptors would be transient in nature, and comparison against the residential land use guideline is considered to be an appropriately conservative approach. The higher PFOS concentrations were detected in fill materials (to 0.8 mbgl) and in samples of natural soil located immediately below the base of the fill.
- The primary PFAS compounds detected in groundwater were PFHxS and PFOS. ∑(PFHxS+PFOS) concentrations exceeding the NEMP (HEPA, 2018) human health drinking water guideline value were reported in groundwater samples from all four monitoring wells. Two groundwater samples with relatively higher concentrations (5.1 µg/L and 3.7 µg/L ∑(PFHxS+PFOS) were located adjacent and cross-gradient to the Case 4 Pit (HH_MW03) and foam training area (HH_MW02), respectively. Groundwater concentrations in the other two monitoring wells, which were located hydraulically up- or cross-gradient of the foam training area, had relatively lower concentrations (up to 0.53 µg/L ∑(PFHxS+PFOS). This indicates the foam training area and the area of the Case 4 Pit are potentially source areas of PFAS to groundwater. The Case 4 Pit area and HH_MW03 are noted to be down-gradient of the adjacent SES facilities (a potential off-site source area) and cross-gradient to the foam training area.
- The lateral extent of the area of groundwater with elevated concentrations of PFHxS and PFOS is uncertain and has not been established in any direction. Based on the presence of a potentially permeable shallow sand aquifer and inferred local flow direction towards the north, there is the potential for PFAS in groundwater to extend off-site beyond the northern site boundary at concentrations in excess of human health and ecological guideline values. Residential and commercial properties and recreational land are present beyond the northern site boundary with the closest registered bore used for water supply present approximately 370 m northeast of the northern site boundary. There are 12 registered bores screened in the shallow aquifer (approximately 10 mbgl) that are used for water supply and which are located hydraulically down-gradient, within 1 km of the site. The closest surface water receptor is a canal located

approximately 650 m north of the site, with the Burdekin River present approximately 3 km north of the site.

- The laboratory analytical technique for TOPA is used to detect certain harder to analyse PFAS precursor compounds that may be present. The results of TOPA analysis on one soil and one groundwater sample did not indicate the presence of PFAS precursors. The results indicated a degraded PFAS product that is unlikely to significantly increase or alter through bio-transformation or oxidation processes.
- Based on information provided as part of the PSI, the source of the PFAS detected in soil and groundwater samples is considered likely to be related to the historical firefighting training practices at the fire station, or spills from storage containers, product transfer and other maintenance activities.

Based on these key findings, the PFAS CSM developed for the PSI has been updated. A number of possibly complete exposure pathways for PFAS sourced from the fire station to impact off-site human and ecological receptors have been identified. The significance of these potentially complete source-pathway-receptor linkages is uncertain and further investigation is required to understand the potential risks to off-site receptors.

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11.0 Limitations

AECOM Australia Pty Ltd has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Queensland Fire and Emergency Services and only those third parties who have been authorised in writing by AECOM to rely on the report.

The report is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report.

The report is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 23 May 2019.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

The methodology adopted and sources of information used by AECOM are outlined in the report.

Where this report indicates that information has been provided to AECOM by third parties, AECOM has made no independent verification of this information unless required as part of the agreed scope of work. AECOM assumes no liability for any inaccuracies in or omissions to that information.

This report was prepared between 19 August 2019 and 19 November2019. The information in this report is considered to be accurate at the date of issue and is in accordance with conditions at the Site and surrounding areas at the dates sampled. Opinions and recommendations presented herein apply to the Site and surrounding areas existing at the time of our investigation and cannot necessarily apply to changes to Site and surrounding areas of which AECOM is not aware and has not had the opportunity to evaluate. This document and the information contained herein should only be regarded as validly representing the Site and surrounding area conditions at the time of the investigation unless otherwise explicitly stated in a preceding section of this report. AECOM disclaims responsibility for any changes that may have occurred after this time.

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List of Appendices

Appendix A

Figures

Appendix A Figures

AECOM

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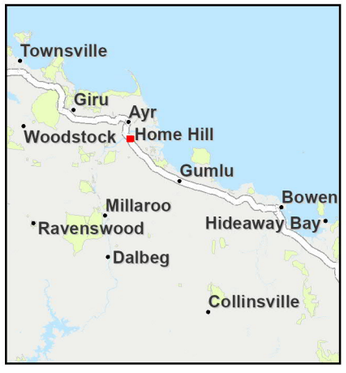
Meters

Legend

- Registered Groundwater Bores
- Drainage lines
- 1km Site Radius
- Site Boundary
- Cadastre
- Lakes



Queensland Fire and Emergency Services (QFES)

FIGURE 1
Site Location

PFAS Detailed Site Investigation at
Home Hill Fire Station

Source: State of Queensland, 2019.
World Imagery: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CHES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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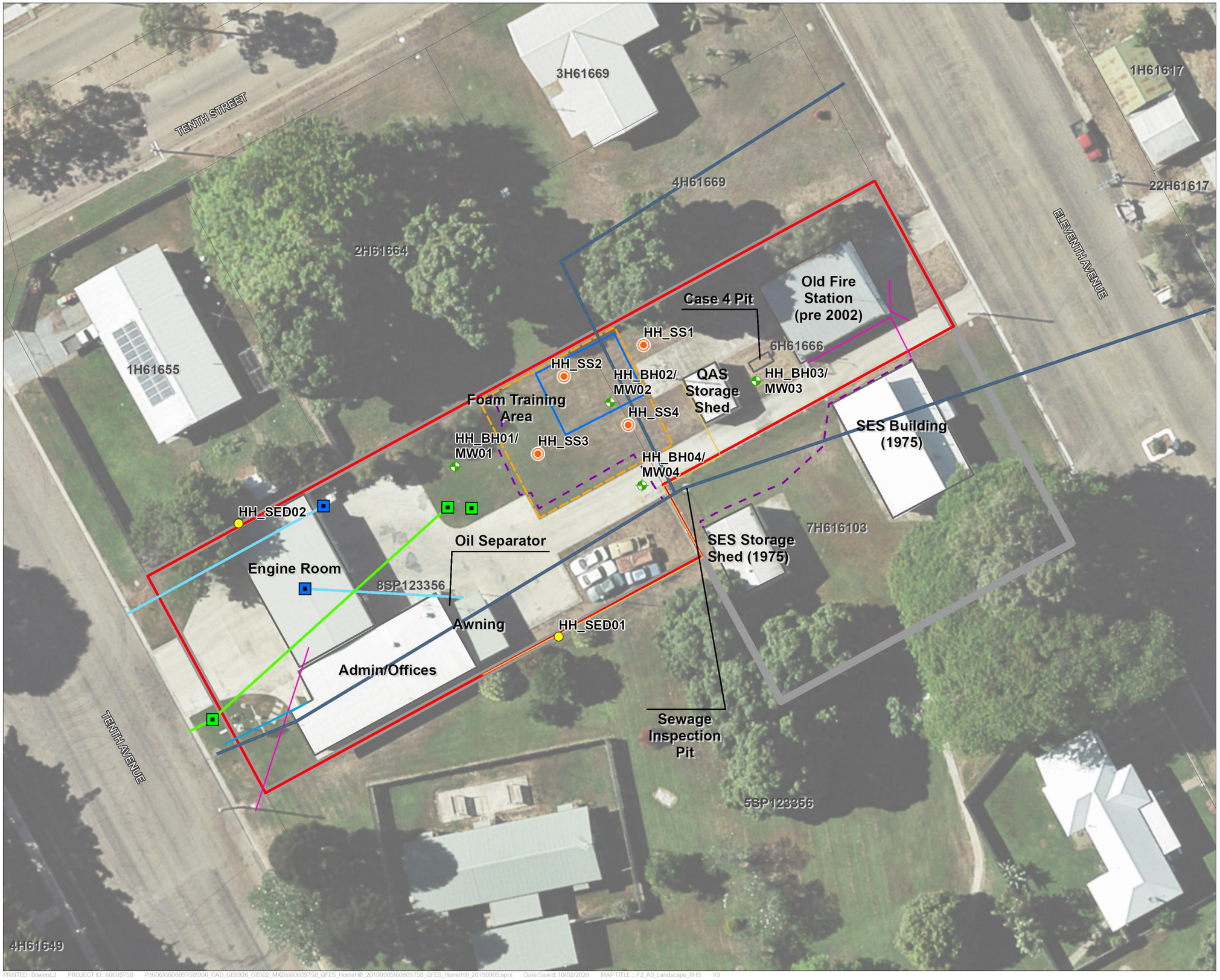


AECOM

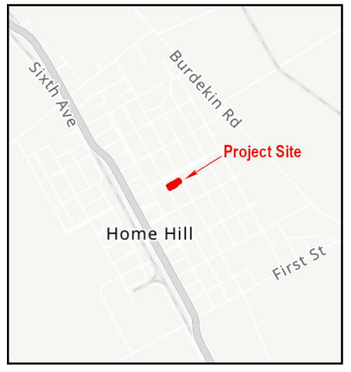
N

0 5 10 15

Meters

Legend

- Monitoring Well Sample Location
- Sediment Sample Location
- Surface Soil Sample Location
- Drainage Pit
- Hydrant
- Drainage Line
- Comms Line
- Electrical Line
- Fence
- Hydrant Water Mains
- Sewer
- Water Line
- Approximate area used for foam training exercises
- Natural Depression
- Site Boundary
- Property Boundary
- Cadastre



Queensland Fire and Emergency Services (QFES)

FIGURE 2
Site Layout and Sampling Locations

PFAS Detailed Site Investigation at Home Hill Fire Station

Source: State of Queensland, 2019, AECOM 2019 World Imagery: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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AECOM

N

0 5 10 15

Meters

Legend

- Monitoring Well Sample Location
- Sediment Sample Location
- Surface Soil Sample Location
- Drainage Pit
- Hydrant
- Inferred groundwater contours (mAHD)*
- Drainage Line
- Comms Line
- Electrical Line
- Fence
- Hydrant Water Mains
- Sewer
- Water Line
- Approximate area used for foam training exercises
- Natural Depression
- Site Boundary
- Property Boundary
- Cadastre
- Inferred Groundwater flow direction

* Groundwater elevations shown on map are in mAHD

Queensland Fire and Emergency Services (QFES)

FIGURE 3
Inferred Groundwater Contours: 6 August 2019

PFAS Detailed Site Investigation at Home Hill Fire Station

Source: State of Queensland, 2019. AECOM 2019 World Imagery: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Analyte	Unit	HH_SS2_190724
		0.1 m
PFOS	mg/kg	0.0076
PFHxS	mg/kg	0.0005
PFOA	mg/kg	0.0004

Analyte	Unit	HH_BH02_190724		
		0.5 m	1.0 m	9.0 m
PFOS	mg/kg	0.0039	0.0023	0.0002
PFHxS	mg/kg	<0.0002	<0.0002	<0.0002
PFOA	mg/kg	<0.0002	<0.0002	<0.0002

Analyte	Unit	HH_SS1_190724	
		0.1 m	0.5 m
PFOS	mg/kg	0.023	0.223
PFHxS	mg/kg	0.0013	0.0004
PFOA	mg/kg	0.0009	0.0002

Analyte	Unit	HH_BH03_190725		
		0.1 m	1.0 m	9.0 m
PFOS	mg/kg	0.0115	0.0665	0.033
PFHxS	mg/kg	0.0008	0.0002	0.0109
PFOA	mg/kg	0.0002	<0.0002	0.0008

Analyte	Unit	HH_SS3_190724	
		0.1 m	0.5 m
PFOS	mg/kg	0.0016	0.0025
PFHxS	mg/kg	<0.0002	<0.0002
PFOA	mg/kg	0.0009	0.0007

Analyte	Unit	HH_SS4_190724
		0.1 m
PFOS	mg/kg	0.0033
PFHxS	mg/kg	<0.0002
PFOA	mg/kg	0.0002

Analyte	Unit	HH_BH01_190724		
		0.1 m	1.0 m	9.0 m
PFOS	mg/kg	0.0112	0.0268	0.0009
PFHxS	mg/kg	0.0003	0.0003	0.0003
PFOA	mg/kg	<0.0002	<0.0002	<0.0002

Analyte	Unit	HH_BH04_190725		
		0.25 m	0.5 m	9.0 m
PFOS	mg/kg	0.0217	0.0193	0.0006
PFHxS	mg/kg	<0.0002	0.0005	0.0006
PFOA	mg/kg	<0.0002	<0.0002	<0.0002

TENTH STREET
TENTH AVENUE
4H61669
22H61617
2H61664
6H61666
7H616103
8SP123356
5SP123356
4H61649
Old Fire Station (pre 2002)
Case 4 Pit
HH_SS1
HH_SS2
HH_BH02/ MW02
QAS Storage Shed
HH_BH03/ MW03
Foam Training Area
HH_SS4
HH_BH01/ MW01
HH_SS3
HH_BH04/ MW04
SES Building (1975)
HH_SED02
Oil Separator
Engine Room
SES Storage Shed (1975)
Awning
HH_SED01
Admin/Offices
Sewage Inspection Pit

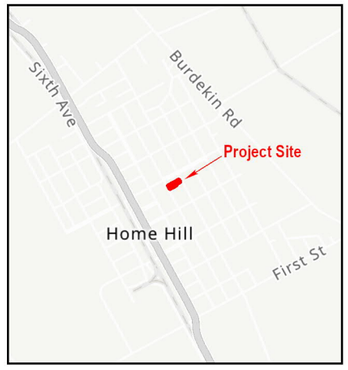
Exceedance of NEMP (HEPA, 2018) guidance value for human health for commercial / industrial landuse.
Exceedance of NEMP (HEPA, 2018) guideline value for ecological indirect exposure for residential landuse.

AECOM

N

0 5 10 15
Meters

Legend
- Monitoring Well Sample Location
- Sediment Sample Location
- Surface Soil Sample Location
- Drainage Pit
- Hydrant
- Drainage Line
- Comms Line
- Electrical Line
- Fence
- Hydrant Water Mains
- Sewer
- Water Line
- Approximate area used for foam training exercises
- Natural Depression
- Site Boundary
- Property Boundary
- Cadastre



Queensland Fire and Emergency Services (QFES)

FIGURE 4
Soil PFAS Analytical Results

PFAS Detailed Site Investigation at
Home Hill Fire Station

Source: State of Queensland, 2019, AECOM 2019
World Imagery: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Analyte	Unit	HH_MW02	HH_QC106	HH_QC206
		6/08/2019	6/08/2019	6/08/2019
PFOS	µg/L	*3.25*	*3.29*	*3.50*
PFHxS	µg/L	0.16	0.15	0.18
PFHxS+PFOS	µg/L	**3.41**	**3.44**	**3.68**
PFOA	µg/L	0.017	0.013	0.008

Analyte	Unit	HH_MW03
		6/08/2019
PFOS	µg/L	*4.40*
PFHxS	µg/L	0.70
PFHxS+PFOS	µg/L	**5.10**
PFOA	µg/L	0.048

Analyte	Unit	HH_MW01
		6/08/2019
PFOS	µg/L	*0.056*
PFHxS	µg/L	0.090
PFHxS+PFOS	µg/L	0.146
PFOA	µg/L	<0.01

Analyte	Unit	HH_MW04
		6/08/2019
PFOS	µg/L	*0.10*
PFHxS	µg/L	0.43
PFHxS+PFOS	µg/L	0.53
PFOA	µg/L	0.028

TENTH STREET
TENTH AVENUE
ELEVENTH AVENUE
1H61617
22H61617
4H61669
2H61664
1H61655
6H61666
5SP123356
7H616103
4H61649
8SP123356
Case 4 Pit
Old Fire Station (pre 2002)
HH_SS1
HH_SS2
HH_BH02/ MW02
HH_BH03/ MW03
QAS Storage Shed
Foam Training Area
HH_SS4
HH_BH01/ MW01
HH_SS3
HH_BH04/ MW04
SES Building (1975)
HH_SED02
Oil Separator
Engine Room
SES Storage Shed (1975)
Awning
HH_SED01
Admin/Offices
Sewage Inspection Pit

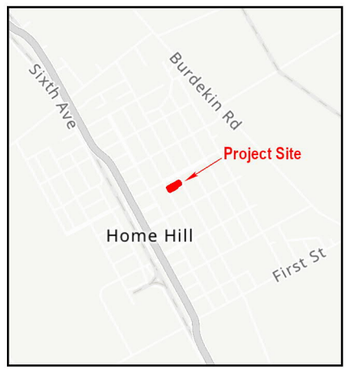
	Exceedance of NEMP (HEPA, 2018) guidance value for human health (drinking water)
Value	Exceedance of NHMRC (2019) guidance value for human health (recreational water)
	Exceedance of NEMP (HEPA, 2018) guideline value for protection of aquatic ecosystem (99%)
Value	Exceedance of Battley et al (2018) draft guideline value for protection of aquatic ecosystem (99%)

AECOM

N

0 5 10 15
Meters

Legend
- Monitoring Well Sample Location
- Sediment Sample Location
- Surface Soil Sample Location
- Drainage Pit
- Hydrant
- Drainage Line
- Comms Line
- Electrical Line
- Fence
- Hydrant Water Mains
- Sewer
- Water Line
- Approximate area used for foam training exercises
- Natural Depression
- Site Boundary
- Property Boundary
- Cadastre



Queensland Fire and Emergency Services (QFES)

FIGURE 5
Groundwater PFAS Analytical Results
PFAS Detailed Site Investigation at Home Hill Fire Station

Source: State of Queensland, 2019. AECOM 2019 World Imagery: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Analyte	Unit	HH_SED02
		6/08/2019
PFOS	mg/kg	0.0004
PFHxS	mg/kg	0.0004
PFOA	mg/kg	0.0002

Analyte	Unit	HH_SED01
		6/08/2019
PFOS	mg/kg	0.0021
PFHxS	mg/kg	<0.0002
PFOA	mg/kg	<0.0002

3H61669
1H61617
4H61669
22H61617
2H61664
ELEVENTH AVENUE
1H61655
Case 4 Pit
Old Fire Station (pre 2002)
6H61666
HH_SS1
HH_SS2
HH_BH02/ MW02
QAS Storage Shed
HH_BH03/ MW03
Foam Training Area
HH_SS4
SES Building (1975)
HH_BH01/ MW01
HH_SS3
HH_BH04/ MW04
HH_SED02
7H616103
Oil Separator
SES Storage Shed (1975)
Engine Room
8SP123356
Awning
HH_SED01
Admin/Offices
TENTH AVENUE
Sewage Inspection Pit
5SP123356
4H61649

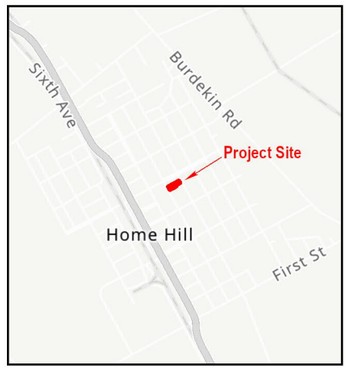
AECOM

N

0 5 10 15
Meters

Legend

- Monitoring Well Sample Location
- Sediment Sample Location
- Surface Soil Sample Location
- Drainage Pit
- Hydrant
- Drainage Line
- Comms Line
- Electrical Line
- Fence
- Hydrant Water Mains
- Sewer
- Water Line
- Approximate area used for foam training exercises
- Natural Depression
- Site Boundary
- Property Boundary
- Cadastre



Queensland Fire and Emergency Services (QFES)

FIGURE 6
Sediment PFAS Analytical Results

PFAS Detailed Site Investigation at
Home Hill Fire Station

Source: State of Queensland, 2019, AECOM 2019 World Imagery: ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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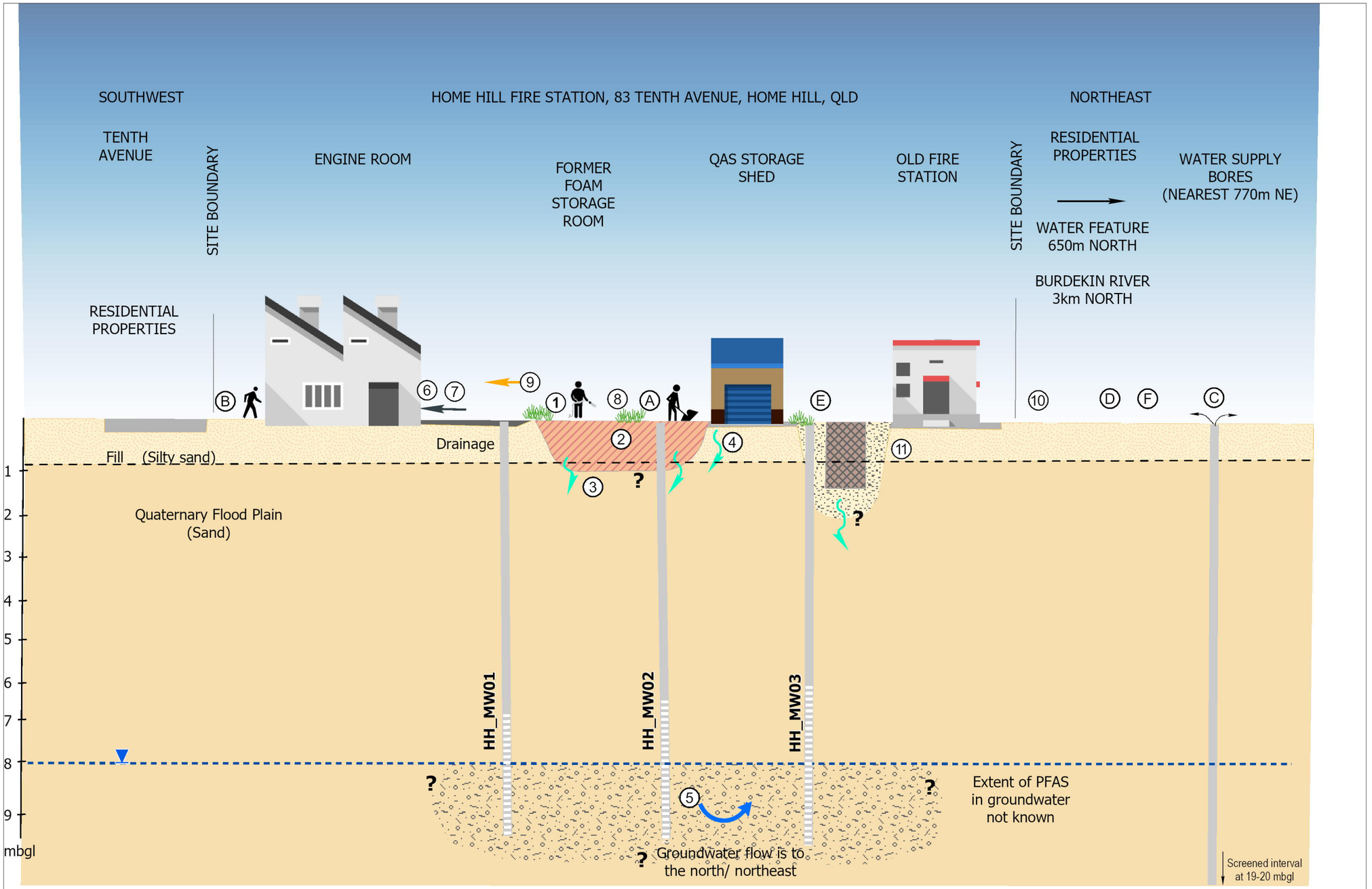
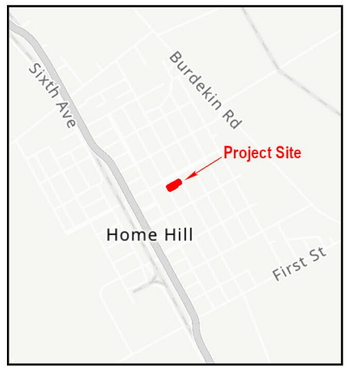
AECOM

NOT TO SCALE



Legend

- PFAS in groundwater
- PFAS in soil
- Concrete
- Case 4 Pit
- Backfill
- Inferred groundwater flow direction
- Infiltration / Leaching
- Migration in stormwater drains
- Wind dispersion of foam
- Inferred groundwater depth
- Groundwater table



Queensland Fire and Emergency Services (QFES)

FIGURE 7
PFAS Conceptual Site Model

PFAS Detailed Site Investigation at Home Hill Fire Station

Source: State of Queensland, 2019. World Imagery - ESRI, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

TRANSPORT PATHWAYS

1. Historical discharge of AFFF to ground / leaks or spills of AFFF
2. Sorption of PFAS to soil
3. Infiltrating water leaching PFAS from soil to groundwater
4. Leaching of PFAS from concrete to groundwater or surface water
5. Groundwater transport followed by abstraction / discharge
6. Surface water runoff to surface water and off-site migration in the drainage system
7. Sediment transport along stormwater drains
8. Excavation of soil and relocation on site
9. Localised dispersion of foam with wind during historical application
10. Use of groundwater off-site for irrigation of parks and gardens
11. Use of tap water on-site for domestic or irrigation purposes

RECEPTORS

- A. Intrusive construction workers
- B. QFES personnel
- C. Off-site groundwater users
- D. Off-site surface water recreational users
- E. Terrestrial ecosystems
- F. Aquatic ecosystems

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Appendix B

Tables

Appendix B Tables

Location ID	Date of Installation	Easting	Northing	Top of Casing Elevation (mAHD)	Cover	TOC Elevation (m AHD)	Drilled Depth (m)	Top of screen (mbgs)	Water Strike (mbgs)	Lithology of screened section
BH01/MW01	24/07/2019	543616.680	7825995.215	12.471	Gatic	12.523	10.0	7.0	8.4	SAND
BH02/MW02	24/07/2019	543635.536	7826003.024	12.114	Gatic	12.195	10.0	7.0	8.4	SAND
BH03/MW03	25/07/2019	543653.240	7826005.662	12.086	Gatic	12.176	10.0	7.0	8.4	SAND
BH04/MW04	25/07/2019	543639.395	7825992.910	12.325	Gatic	12.4	10.0	6.0	8.4	SAND

Notes
'm' is metres
'mAHD' is metres above Australian height datum
'mbgs' is metres below ground surface
TOC' is top of casing

Well ID	Easting	Northing	Top of Casing Elevation (mAHD)	Gauging Date	Total Depth (mbtoc)	Depth to Water (mbtoc)	Corrected Groundwater Elevation (mAHD)
HH_MW01	543616.7	7825995.2	12.471	6/08/2019	10.0	8.372	4.099
HH_MW02	543635.5	7826003.0	12.114	6/08/2019	10.0	8.032	4.082
HH_MW03	543653.2	7826005.7	12.086	6/08/2019	10.1	7.997	4.089
HH_MW04	543639.4	7825992.9	12.325	6/08/2019	9.0	8.221	4.104

Notes
'mAHD' is metres above Australian height datum
'mbtoc' is metres below top of casing

Well ID	Date	pH	Temperature (°C)	Electrical Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Dissolved Oxygen (mg/L)	Field Oxidation Reduction Potential (mV)	Oxidation Reduction Potential (mV)*
MW01	6/08/2019	6.39	27.7	467.5	303.9	5.2	138.9	343.9
MW02	6/08/2019	6.50	27.8	677.0	440.1	4.96	143.9	348.9
MW03	6/08/2019	6.39	27.7	536.0	348.4	3.46	152.1	357.1
MW04	6/08/2019	6.46	28.3	610.0	396.5	4.36	148.4	353.4

Notes
'°C' is degrees Celsius
'µS/cm' is microsiemens per centimetre
'mg/L' is milligrams per litre
'mV' is millivolt
* A correction factor (+205) has been applied to the water quality meter reading to correct to the value that would be obtained by a hydrogen reference electrode.

	Sum (PFHxS + PFOS)	PFOS	PFHxS	PFHxA	PFOA	PFBS	PFPeS	PFHpS	PFDS	PFBA	PFPeA	PFHpA	PFNA	PFDcA	PFUnA	PFDoA	PFTrDA	PFTeDA	4:2 FTS	6:2 FTS	8:2 FTS	10:2 FTS	MeFOSAA	EtFOSAA	FOSA	N-Et-FOSA	N-Me-FOSA	N-Et-FOSE	N-MeFOSE	Sum of PFAS	Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0002	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005	0.0002	0.0002
NEMP (HEPA, 2018) Human Health Industrial/Commercial	20				50																										
NEMP (HEPA 2018) Interim Soil Ecological Residential		0.01																													
NEMP (HEPA, 2018) Interim Soil Ecological Commercial		**0.14**																													

Sample ID	Date	Lab Report	Type																													
PFAS by Standard Analysis																																
HH_SS1_0.1_190724	24/07/2019	EB1919840	Normal	0.0243	0.023	0.0013	0.0007	0.0009	0.0002	<0.0002	<0.0002	0.0013	<0.001	0.0007	0.0012	0.0011	0.0026	0.0028	0.0005	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0009	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0372	-
HH_SS1_0.5_190724	24/07/2019	EB1919840	Normal	0.223	**0.223**	0.0004	0.0004	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	0.0005	0.0004	0.0016	0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.227	-
HH_QC101_190724	24/07/2019	EB1919840	Duplicate	0.186	**0.186**	0.0003	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	0.0004	0.0003	0.0016	0.0004	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.189	-
HH_QC201_190724	24/07/2019	RN1242618	Triplicate	0.220	**0.22**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.002	<0.001	0.0022	<0.001	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.005	<0.005	0.222	-
HH_SS2_0.1_190724	24/07/2019	EB1919840	Normal	0.0081	0.0076	0.0005	0.0003	0.0004	<0.0002	<0.0002	<0.0002	0.0047	<0.001	0.0003	0.0004	0.0004	0.0006	0.0008	0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0162	-
HH_SS3_0.1_190724	24/07/2019	EB1919840	Normal	0.0016	0.0016	<0.0002	0.0003	0.0009	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	0.0002	0.0009	0.0012	0.0048	0.0037	0.0006	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0029	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0171	-
HH_SS3_0.5_190724	24/07/2019	EB1919840	Normal	0.0025	0.0025	<0.0002	0.0006	0.0007	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	0.0005	0.0011	0.0011	0.0033	0.0023	0.0006	0.0002	<0.0005	<0.0005	<0.0005	0.0007	0.0061	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0197	-
HH_SS4_0.1_190724	24/07/2019	EB1919840	Normal	0.0033	0.0033	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	0.0003	0.0006	0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0049	-
HH_BH01_0.1_190724	24/07/2019	EB1919840	Normal	0.0115	0.0112	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	0.0003	0.0003	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0121	-
HH_QC100_190724	24/07/2019	EB1919840	Duplicate	0.0067	0.0067	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0069	-
HH_QC200_190724	24/07/2019	RN1242618	Triplicate	0.013	0.013	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.005	<0.005	0.013	-
HH_BH01_1.0_190724	24/07/2019	EB1919840	Normal	0.0271	0.0268	0.0003	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0273	-
HH_BH01_9.0_190724	24/07/2019	EB1919840	Normal	0.0012	0.0009	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0012	-
HH_BH02_0.5_190724	24/07/2019	EB1919840	Normal	0.0039	0.0039	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	0.0002	0.0002	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0046	-
HH_BH02_1.0_190724	24/07/2019	EB1919840	Normal	0.0023	0.0023	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	0.0002	<0.0002	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0027	-
HH_BH02_9.0_190725	25/07/2019	EB1919840	Normal	0.0002	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0002	-
HH_BH03_0.1_190725	25/07/2019	EB1919840	Normal	0.0123	0.0115	0.0008	<0.0002	0.0002	<0.0002	<0.0002	<0.0002	0.0015	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	0.0004	<0.0005	<0.0005	<0.0005	<0.0005	0.0144	-
HH_BH03_1.0_190725	25/07/2019	EB1919840	Normal	0.0667	0.0665	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0667	-
HH_BH03_9.0_190725	25/07/2019	EB1919840	Normal	0.0439	0.033	0.0109	<0.0002	0.0008	<0.0002	<0.0002	0.0008	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0455	-
HH_BH04_0.25_190725	25/07/2019	EB1919840	Normal	0.0217	0.0217	<0.0002	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0219	-
HH_BH04_0.5_190725	25/07/2019	EB1919840	Normal	0.0198	0.0193	0.0005	<0.0002	<0.0002	<0.0002	<0.0002	0.0006	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0204	-
HH_BH04_9.0_190725	25/07/2019	EB1919840	Normal	0.0012	0.0006	0.0006	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0012	-
PFAS by TOPA Analysis																																
HH_SS1_0.5_190724	24/07/2019	EB1921187-AC	Normal	0.148	**0.148**	0.0004	0.0016	0.0008	<0.0002	<0.0002	<0.0002	<0.0002	0.00	0.0029	0.001	0.0016	0.0006	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.159	0.16

Notes

Total Oxidisable Precursor Assay (TOPA)
'mg/kg' is milligrams per kilogram
'<' is less than limit of reporting
'-' not analysed

		Sum (PFHxS + PFOS)	PFOS	PFHxS	PFHxA	PFOA	PFBS	PFPeS	PFHpS	PFDS	PFBA	PFPeA	PFHpA	PFNA	PFDcA	PFUnA	PFDoA	PFTrDA	PFTeDA	4:2 FTS	6:2 FTS	8:2 FTS	10:2 FTS	MeFOSAA	EtFOSAA	FOSA	N-Et-FOSA	N-Me-FOSA	N-Et-FOSE	N-MeFOSE	Sum of PFAS	Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates
	Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
	LOR	0.0003	0.0003	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.001	0.001	0.001	0.001	0.0005	0.0005	0.0005	0.001	0.001	0.001	0.001	0.0003	0.01
NEMP (HEPA, 2018) Human Health Drinking Water		0.07				0.56																										
NHMRC (2019) Human Health Recreational Water		**2.0**				**10.0**																										
NEMP (HEPA, 2018) Ecological Freshwater 99% Species Protection			0.00023			19.0																										
Battley et al (2018) Ecological Freshwater 99% Species Protection			*0.051*																													
Sample ID	**Date**	**Lab Report**	**Type**																													
PFAS by Standard Analysis																																
HH_MW01_190806	6/08/2019	EB1921176	Normal	0.15	*0.06*	0.090	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.025	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.025	<0.025	<0.025	<0.025	0.146	
HH_MW02_190806	6/08/2019	EB1921176	Normal	**3.41**	3.25	0.161	0.029	0.017	0.049	0.024	<0.01	<0.01	<0.05	0.015	0.021	<0.01	<0.01	<0.01	<0.01	<0.01	<0.025	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.025	<0.025	<0.025	<0.025	3.570	
HH_QC106_190806	6/08/2019	EB1921176	Duplicate	**3.44**	*3.29*	0.149	0.029	0.013	0.047	0.024	<0.01	<0.01	<0.05	0.015	0.021	<0.01	<0.01	<0.01	<0.01	<0.01	<0.025	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.025	<0.025	<0.025	<0.025	3.590	
HH_QC206_190806	6/08/2019	RN1244319	Triplicate	**3.68**	*3.50*	0.180	0.032	0.0075	0.041	0.024	0.0062	<0.001	0.0099	0.019	0.019	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	1.500	<0.001	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.005	<0.005	8.927	
HH_MW03_190806	6/08/2019	EB1921176	Normal	**5.10**	*4.40*	0.699	0.072	0.048	0.047	0.068	0.026	<0.01	<0.05	0.034	0.046	<0.01	<0.01	<0.01	<0.01	<0.01	<0.025	<0.01	0.019	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.025	<0.025	<0.025	<0.025	5.460	
HH_MW04_190806	6/08/2019	EB1921176	Normal	0.53	*0.10*	0.431	0.04	0.028	0.046	0.055	0.019	<0.002	<0.01	0.014	0.032	0.003	<0.002	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.002	<0.005	<0.005	<0.005	<0.005	<0.005	0.768	
PFAS by TOPA Analysis																																
HH_MW03_190806	6/08/2019	EB1922105	Normal	1.56	*0.75*	0.810	0.540	0.060	0.050	0.080	0.030	<0.02	<0.1	0.170	0.080	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	2.570	2.570

Notes
TOPA is Total Oxidisable Precursor Assay
'µg/L' micrograms per litre
'<' less than the limit of reporting
'-' not analysed

	Sum (PFHxS + PFOS)	PFOS	PFHxS	PFHxA	PFOA	PFBS	PFPeS	PFHpS	PFDS	PFBA	PFPeA	PFHpA	PFNA	PFDcA	PFUnA	PFDoA	PFTrDA	PFTeDA	4:2 FTS	6:2 FTS	8:2 FTS	10:2 FTS	MeFOSAA	EtFOSAA	FOSA	N-Et-FOSA	N-Me-FOSA	N-Et-FOSE	N-MeFOSE	Sum of PFAS
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0002	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005	0.0002
HH_SED01_190806	0.0021	0.0021	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0021
HH_QC107_190806	0.0014	0.0014	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.0014
HH_QC207_190806	0.0026	0.0026	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.002	<0.002	<0.005	<0.005	0.0026
HH_SED02_190806	0.0004	0.0004	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.001	0.0003	0.0002	0.0005	0.0006	0.0006	0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	0.003

Sample ID	Date	Lab Report	Type
HH_SED01_190806	6/08/2019	EB1921176	Normal
HH_QC107_190806	6/08/2019	EB1921176	Duplicate
HH_QC207_190806	6/08/2019	RN1244319	Triplicate
HH_SED02_190806	6/08/2019	EB1921176	Normal

Notes
'mg/kg' is milligrams per kilogram
'<' less than the limit of reporting
'-' not analysed

Appendix C

Photographs

PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Home Hill Fire Station	83 Tenth Avenue, Home Hill, Queensland	60609758

Plate No.	Date:
1	13/02/2019

Direction Photo Taken:
N/A

Description:
20L Class B foam drums stored in the workshop / storage shed adjoining the engine room.

PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Home Hill Fire Station	83 Tenth Avenue, Home Hill, Queensland	60609758

Plate No.	Date:
2	13/02/2019

Direction Photo Taken:
North

Description:
Concrete hardstand area outside workshop / storage, used for vehicle wash-down. AST in the background is used for drafting training.

PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Home Hill Fire Station	83 Tenth Avenue, Home Hill, Queensland	60609758

Plate No.	Date:
3	13/02/2019

Direction Photo Taken: Southeast

Description: Location of decommissioned Case 4 Pit formerly used for drafting training.

PHOTOGRAPHIC LOG

Site Name:	Site Location:	Project No:
Home Hill Fire Station	83 Tenth Avenue, Home Hill, Queensland	60609758

Plate No.	Date:
4	13/02/2019

Direction Photo Taken: Northeast

Description: View along the length of the site towards Eleventh Avenue. The grassed area on the left hand side of the photograph is used for foam training. Some surface staining on the concrete hardstand is visible in the foreground.

PHOTOGRAPHIC LOG

Site Name: Home Hill Fire Station	**Site Location:** 83 Tenth Avenue, Home Hill, Queensland	**Project No:** 60609758

Plate No.	**Date:**
5	06/08/2019

Direction Photo Taken: North

Description: Location of SED01 along earthern drain along the southern site boundary.

PHOTOGRAPHIC LOG

Site Name: Home Hill Fire Station	**Site Location:** 83 Tenth Avenue, Home Hill, Queensland	**Project No:** 60609758

Plate No.	**Date:**
6	06/08/2019

Direction Photo Taken: N/A

Description: Location of sampling point SED02, which was collected from an earthen drain.

Appendix D

Bore Logs

MONITORING WELL LOG HH_BH01/HH_MW01

ENSR Australia Pty Ltd
Level 5, 828 Pacific Highway
Gordon NSW 2073

PROJECT NUMBER 60609758
PROJECT NAME QFES PFAS DSIs - Home Hill
LOCATION 83 Tenth Avenue, Home Hill, 4806
DRILLING METHOD Hand Auger, Push tube and SSA
SAMPLING METHOD Grab & Push Tube
SURFACE ELEVATION 12.471 m AHD
WELL HEAD/TOC
LOGGED BY C. McCosker
COMMENTS

DATE 24/7/2019
BLANK 0.0 - 7.0 m bgs
SCREEN 7.0 - 10.0 m bgs.
GRAVEL PACK 6.5 - 10.0 m bgs.
SANITARY SEAL/BENTONITE 4.5 - 6.5 m bgs.
NORTHING 7825995.2
EASTING 543616.7

PID (ppm)	Penetrometer (Kg/cm2)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0.0			HH_BH01_0.1_190724				FILL: Silty CLAY loam, grey, dry, soft, no plasticity.	
0.0			HH_BH01_0.5_190724					
								0.80
0.0			HH_BH01_1.0_190724		1.0		Silty SAND, dark brown, dry, medium dense, fine grained.	
								1.35
0.0			HH_BH01_1.5_190724				SAND, light brown-orange, dry, medium dense, medium grained.	
0.0			HH_BH01_2.0_190724		2.0			
0.0			HH_BH01_3.0_190724		3.0			
								3.60
0.0			HH_BH01_3.8_190724				Silty CLAY, brown, slightly moist, firm, low plasticity.	3.90
0.0			HH_BH01_4.0_190724		4.0		Clayey SAND, brown, dry, medium dense, medium grained.	
								4.60
0.0			HH_BH01_5.0_190724		5.0		SAND, light brown-orange, dry, medium dense, medium-coarse grained.	
0.0			HH_BH01_6.0_190724		6.0			
0.0			HH_BH01_7.0_190724		7.0		Coarse grained @ 6.80m bgs.	
0.0			HH_BH01_8.0_190724		8.0			
							Wet @ 8.40m bgs.	
0.0			HH_BH01_9.0_190724		9.0		Moist, trace of fine-medium sub-rounded gravels @ 9.00m bgs.	
								10.00
0.0			HH_BH01_10.0_190724		10.0		End of hole at target depth. Total Depth: 10.00 m	

WELL DIAGRAM: Grout; Casing; Bentonite; Filter Sands; Screen

BORELOGS_HH.GPJ 16/12/19

MONITORING WELL LOG HH_BH02/HH_MW02

ENSR Australia Pty Ltd
Level 5, 828 Pacific Highway
Gordon NSW 2073

PROJECT NUMBER 60609758
PROJECT NAME QFES PFAS DSIs - Home Hill
LOCATION 83 Tenth Avenue, Home Hill, 4806
DRILLING METHOD Hand Auger, Push tube and SSA
SAMPLING METHOD Grab & Push Tube
SURFACE ELEVATION 12.114 m AHD
WELL HEAD/TOC
LOGGED BY C. McCosker
COMMENTS

DATE 24/7/2019
BLANK 0.0 - 7.0 m bgs
SCREEN 7.0 - 10.0 m bgs.
GRAVEL PACK 6.5 - 10.0 m bgs.
SANITARY SEAL/BENTONITE 4.5 - 6.5 m bgs.
NORTHING 7826003
EASTING 543635.5

PID (ppm)	Penetrometer (Kg/cm2)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0.0			HH_BH02_0.1_190725				FILL: Silty SAND loam, dark brown, dry, loose, fine grained.	
								0.40
0.0			HH_BH02_0.5_190725	✳			SAND, light brown-orange, dry, medium dense, fine grained.	
								0.80
0.0			HH_BH02_1.0_190725	✳	1.0		SAND, orange, very slightly moist, loose, medium grained.	
0.0			HH_BH02_1.5_190725					
0.0			HH_BH02_2.0_190725		2.0			
0.0			HH_BH02_3.0_190725		3.0			
								3.10
							Silty CLAY, brown, dry, stiff, low plasticity.	
0.0			HH_BH02_4.0_190725		4.0			
								4.60
							SAND, light brown-orange, dry, loose, medium-coarse grained.	
0.0			HH_BH02_5.0_190725		5.0			
0.0			HH_BH02_6.0_190725		6.0			
0.0			HH_BH02_7.0_190725		7.0		Coarse grained, trace of fine grained sub-rounded gravels @ 6.80m bgs.	
							No gravels @ 7.50m bgs.	
0.0			HH_BH02_8.0_190725		8.0		Slightly moist @ 8.00m bgs.	▼
							Wet @ 8.40m bgs.	▽
0.0			HH_BH02_9.0_190725	✳	9.0			
0.0			HH_BH02_10.0_190725		10.0			10.00
							End of hole at target depth. Total Depth: 10.00 m	

WELL DIAGRAM: Grout; Casing; Bentonite; Filter Sands; Screen

BORELOGS_HH.GPJ 16/12/19

MONITORING WELL LOG HH_BH03/HH_MW03

ENSR Australia Pty Ltd
Level 5, 828 Pacific Highway
Gordon NSW 2073

PROJECT NUMBER 60609758
PROJECT NAME QFES PFAS DSIs - Home Hill
LOCATION 83 Tenth Avenue, Home Hill, 4806
DRILLING METHOD Hand Auger, Push tube and SSA
SAMPLING METHOD Grab & Push Tube
SURFACE ELEVATION 12.086 m AHD
WELL HEAD/TOC
LOGGED BY C. McCosker
COMMENTS

DATE 25/7/2019
BLANK 0.0 - 7.0 m bgs
SCREEN 7.0 - 10.0 m bgs.
GRAVEL PACK 6.5 - 10.0 m bgs.
SANITARY SEAL/BENTONITE 4.5 - 6.5 m bgs.
NORTHING 7826005.7
EASTING 543653.2

PID (ppm)	Penetrometer (Kg/cm2)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0.0			HH_BH03_0.1_190725				FILL: Silty SAND loam, dark brown, dry, loose, fine grained.	0.35
0.0			HH_BH03_0.5_190725				DISTURBED NATURAL: Silty SAND, brown, dry, medium dense, medium grained.	0.70
0.0			HH_BH03_1.0_190725		1.0		SAND, light brown-orange, dry, medium dense, medium grained. Medium-coarse grained @ 1.20m bgs.	
0.0			HH_BH03_1.5_190725					
0.0			HH_BH03_2.0_190725		2.0		Slightly moist @ 2.20m bgs.	
0.0			HH_BH03_3.0_190725		3.0		Sandy CLAY, brown, grey mottle, dry, firm, no plasticity, fine-medium grained sand. Stiff, low plasticity @ 3.60m bgs.	2.90
0.0			HH_BH03_4.0_190725		4.0		Coarse grained sand @ 4.30m bgs.	
0.0			HH_BH03_5.0_190725		5.0		SAND, light brown-orange, dry, loose, medium grained.	4.80
0.0			HH_BH03_6.0_190725		6.0		Medium-coarse grained @ 5.90m bgs.	
0.0			HH_BH03_7.0_190725		7.0		Coarse grained @ 6.80m bgs. Slightly moist, trace of fine sub-rounded gravels @ 7.00m bgs.	
0.0			HH_BH03_8.0_190725		8.0		With fine sub-rounded gravels @ 8.00m bgs. Wet @ 8.40m bgs.	
0.0			HH_BH03_9.0_190725		9.0		Trace of fine-medium sub-rounded gravels @ 9.10m bgs.	
0.0			HH_BH03_10.0_190725		10.0		End of hole at target depth. Total Depth: 10.00 m	10.00

WELL DIAGRAM: Grout; Casing; Bentonite; Filter Sands; Screen

BORELOGS_HH.GPJ 16/12/19

MONITORING WELL LOG HH_BH04/HH_MW04

ENSR Australia Pty Ltd
Level 5, 828 Pacific Highway
Gordon NSW 2073

PROJECT NUMBER 60609758
PROJECT NAME QFES PFAS DSIs - Home Hill
LOCATION 83 Tenth Avenue, Home Hill, 4806
DRILLING METHOD Hand Auger, Push tube and SSA
SAMPLING METHOD Grab & Push Tube
SURFACE ELEVATION 12.325 m AHD
WELL HEAD/TOC
LOGGED BY C. McCosker
COMMENTS

DATE 25/7/2019
BLANK 0.0 - 6.0 m bgs
SCREEN 6.0 - 9.0 m bgs.
GRAVEL PACK 5.5 - 9.0 m bgs.
SANITARY SEAL/BENTONITE 3.5 - 5.5 m bgs.
NORTHING 7825992.9
EASTING 543639.4

PID (ppm)	Penetrometer (Kg/cm2)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGL)	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
							CONCRETE	0.20
0.0			HH_BH04_0.25_190725	*			DISTURBED NATURAL: Silty SAND, light brown-orange, dry, medium dense, medium grained.	0.40
0.0			HH_BH04_0.5_190725	*				
							FILL: Silty SAND, black, dry, loose, fine-medium grained, trace of waste fill including glass and plastic.	0.80
0.0			HH_BH04_1.0_190725		1.0			
0.0			HH_BH04_1.5_190725				SAND, orange, dry, loose, medium grained. With coarse sub-rounded gravels and cobbles @ 1.30m bgs.	
0.0			HH_BH04_2.0_190725		2.0			
								2.90
0.0			HH_BH04_3.0_190725		3.0		Sandy CLAY, brown, dry, firm, no plasticity. Slightly moist @ 3.40m bgs. Dry, stiff, low plasticity @ 3.70m bgs.	
0.0			HH_BH04_4.0_190725		4.0		Very slightly moist @ 4.30m bgs.	
								4.60
0.0			HH_BH04_5.0_190725		5.0		SAND, light brown-orange, dry, medium dense, medium grained. With brown, grey mottled clay pockets @ 5.40m bgs.	
0.0			HH_BH04_6.0_190725		6.0		No clay pockets, medium-coarse grained @ 5.90m bgs.	
0.0			HH_BH04_7.0_190725		7.0		Trace of fine grained sub-angular gravels @ 6.80m bgs. Trace of fine-coarse grained sub-rounded gravels @ 7.00m bgs.	
0.0			HH_BH04_8.0_190725		8.0		Coarse grained @ 7.90m bgs. Wet @ 8.40m bgs.	
0.0			HH_BH04_9.0_190725	*	9.0			
0.0			HH_BH04_10.0_190725					10.00
							End of hole at target depth. Collapse to 9.00m bgs, well installed at this depth.	

WELL DIAGRAM: Grout; Casing; Bentonite; Filter Sands; Screen

Total Depth: 9.00 m

BORELOGS_HH.GPJ 16/12/19

AECOM Australia Pty Ltd
Level 8, 540 Wickham Street
Fortitude Valley, QLD 4006

BOREHOLE LOG HH_SS1

PROJECT NUMBER 60609758 **DATE** 24/07/2019
PROJECT NAME QFES PFAS DSIs - Home Hill
LOCATION 83 Tenth Avenue, Home Hill, 4806
DRILLING METHOD Hand Auger
SAMPLING METHOD Grab

LOGGED BY C. McCosker
COMMENTS

PID (ppm)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGS)	GRAPHIC LOG	USCS CLASS	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0.0		HH_SS1_0.1_190724	✳			SW-SM	FILL: Silty SAND loam, dark brown, dry, loose, fine grained.	
0.0		HH_SS1_0.5_190724	✳			SW-SM	Silty SAND, light brown-orange, loose, fine-medium grained.	0.40
							End of hole at target depth. Total Depth: 0.50 m	0.50

BORELOGS_HH.GPJ 16/12/19

AECOM Australia Pty Ltd
Level 8, 540 Wickham Street
Fortitude Valley, QLD 4006

BOREHOLE LOG HH_SS3

PROJECT NUMBER 60609758 **DATE** 24/07/2019
PROJECT NAME QFES PFAS DSIs - Home Hill
LOCATION 83 Tenth Avenue, Home Hill, 4806
DRILLING METHOD Hand Auger
SAMPLING METHOD Grab

LOGGED BY C. McCosker
COMMENTS

PID (ppm)	RECOVERY	SAMPLE NUMBER	ANALYSED	DEPTH (m BGS)	GRAPHIC LOG	USCS CLASS	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0.0		HH_SS3_0.1_190724				SW-SM	FILL: Silty SAND, brown, dry, loose, fine grained, trace of medium grained angular gravels.	
							No gravels.	
0.0		HH_SS3_0.5_190724						0.50
							End of hole at target depth. Total Depth: 0.50 m	

BORELOGS_HH.GPJ 16/12/19

Appendix E

Fieldsheets and Calibration Certificates

ANZ

FQM - Groundwater Sampling and Purging Record

Q4AN(EV)-405-FM1

						Bore ID:	MW01
Project Name:	QFES GW Monitoring	**Project Number:**	60609758	**PM Name:**	James Peachey	**Sample Date:**	6/8/19
Client:	QFES	**Project Location:**	Home Hill	**Fieldwork Staff:**	NK	**Well Development or Well Sampling Event? (circle)**	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level:	Bore Radius (mm): 100	Chem Kit Serial No.: 19C101112	☑ Decontaminated	☑ Low Flow Pump rate: 3/4	Hydrasleeve Size:	**Monitoring sequence followed (number in order):**
Depth to GW (m-pvc): 8.372	Screen Interval (m): –	Chem Kit Model: YSI pro plus	☐ Dedicated	Intake depth: 9.5	Hydrasleeve Type:	
Bore Depth (m-pvc): 10.003	Casing Radius (mm): 50	**Corrected Redox:** Y / N	☐ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc): –	Cover Type (gatic/stick up):	(The correction to apply is probe dependent)	☐ Other (specify)	☑ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m): –	Bore Locked (YES/NO):	**Parameter method:** ☐ Downhole		☐ Other (specify)	Sampling Start Time:	Hydrasleeve out
	Key Type (if applicable): –	☐ Retrieved				Parameters
Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:		Total purged volume (L):		

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
12:17	–	8.372	–	–	–	–	–	–	
12:20	0.5	"	Peri	5.45	468.8	6.43	138.7	27.7	Clear - no odour, no sheen; pale yellow/brown.
12:23	1.5	"	"	5.18	466.5	6.41	137.9	27.7	"
12:26	2.25	"	"	5.05	466.4	6.40	138.3	27.7	"
12:29	3.0	"	"	5.20	467.5	6.39	138.9	27.7	"
	—	Sampled		@ 1230	@	3L.			
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information	Field Commets
Field Filtered:	**Unfiltered:**		x 40 mL Vial (HCl)		x 60 mL Ferrous		x 60 mL metals (HNO_3)	//	Bore volume calculation, bore condition, fate of tubing, redox correction etc.
//	//		x 40 mL Vial (H_2SO_4)		x 100 mL Amber	1	x 250 mL Plastic		//

Approval and Distribution

Fieldwork Staff Signature	**Date**	**Checker Name and Signature**	**Date**
Project Manager Signature	**Date**	**Distribution:** Project Central File	

ANZ

FQM - Groundwater Sampling and Purging Record

Q4AN(EV)-405-FM1

						Bore ID:	MW02
Project Name:	QFES GW Monitoring	**Project Number:**	60609758	**PM Name:**	James Peachey	**Sample Date:**	6/8/19
Client:	QFES	**Project Location:**	Home Hill	**Fieldwork Staff:**	NK	**Well Development or Well Sampling Event? (circle)**	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 6/8/19 ~1330	Bore Radius (mm): 200?	Chem Kit Serial No.: 19C101112	☑ Decontaminated	☑ **Low Flow** Pump rate: 3/4	Hydrasleeve Size:	**Monitoring sequence followed (number in order):**
Depth to GW (m-pvc): 8.032 1249	Screen Interval (m): To bottom	Chem Kit Model: YSI ProPlus	☐ Dedicated	Intake depth: 9.5m	Hydrasleeve Type:	
Bore Depth (m-pvc): 10.018	Casing Radius (mm): 50	**Corrected Redox:** Y / (N)	☐ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc): —	Cover Type (gatic/stick up):	(The correction to apply is probe dependent)	☐ Other (specify)	☑ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m): —	Bore Locked (YES/NO):	**Parameter method:** ☐ Downhole		☐ Other (specify)	Sampling Start Time:	Hydrasleeve out
	Key Type (if applicable): —	☐ Retrieved				Parameters
Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:		Total purged volume (L):		

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
12:52	0	8.038	Peri	—	—	—	—	—	
12:55	0.5	8.038	Peri (3/4)	5.01	680	6.50	145.4	27.9	Clear, no odour, no sheen, pale yellow/brown.
12:58	1.25	"	"	5.22	680	6.50	144.5	28.0	"
13:01	2.0	"	"	4.72	679	6.50	144.5	27.8	"
13:04	2.5	"	"	4.96	677	6.50	143.9	27.8	"
	—		Sampled @	2.5L	@	1305			
Acceptable Parameter Range:			± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C		± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information	Field Commets
Field Filtered:	**Unfiltered:**		x 40 mL Vial (HCl)		x 60 mL Ferrous		x 60 mL metals (HNO_3)	HH-QC106_190806	Bore volume calculation, bore condition, fate of tubing, redox correction etc.
			x 40 mL Vial (H_2SO_4)		x 100 mL Amber	3	x 250 mL Plastic	HH-QC206_190806	

Approval and Distribution

Fieldwork Staff Signature	Date	Checker Name and Signature	Date
Project Manager Signature	**Date**	**Distribution:** Project Central File	

ANZ

FQM - Groundwater Sampling and Purging Record

Q4AN(EV)-405-FM1

turn

Project Name:	QFES GW Monitoring	**Project Number:**	60609758	**PM Name:**	James Peachey	**Bore ID:**	MW03
Client:	QFES	**Project Location:**	Home Hill	**Fieldwork Staff:**	NK	**Sample Date:**	6/8/19
						Well Development or Well Sampling Event? (circle)	

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 6/8/19 ~1340	Bore Radius (mm): 200mm?	Chem Kit Serial No.: 19C101112	☑ Decontaminated	☑ **Low Flow** Pump rate: 3/4.	Hydrasleeve Size:	**Monitoring sequence followed (number in order):**
Depth to GW (m-pvc): 7.997	Screen Interval (m): Bottom	Chem Kit Model: YSI ProPlus	☐ Dedicated	Intake depth: 9.5m	Hydrasleeve Type:	
Bore Depth (m-pvc): 10.092	Casing Radius (mm): 50mm	**Corrected Redox:** Y / (N)	☐ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc): –	Cover Type (gatic/stick up):	(The correction to apply is probe dependent)	☐ Other (specify)	☑ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m): –	Bore Locked (YES/NO):	**Parameter method:** ☐ Downhole		☐ Other (specify)	Sampling Start Time:	Hydrasleeve out
	Key Type (if applicable): –	☐ Retrieved				Parameters
Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:		Total purged volume (L):		

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
13:49	0	7.997	~~Stg~~ Peri	–	–	–	–	–	
			(3/4 turn)						
13:52	0.5	8.004	"	3.76	535	6.39	152.9	27.8	No odour/sheen, clear, pale yellow brown,
13:55	1.5	8.004	"	3.61	534	6.37	153.2	27.8	" some fine sand.
13:58	2.25	"	"	3.57	536	6.38	152.9	27.8	"
14:01	3.0	"	"	3.32	536	6.38	152.3	27.7	"
14:04	3.50	"	"	3.46	536	6.39	152.1	27.7	"
		Sampled @ 1405		@ 3.5L.					
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information	Field Commets
Field Filtered:	**Unfiltered:**		x 40 mL Vial (HCl)		x 60 mL Ferrous		x 60 mL metals (HNO_3)	//	Bore volume calculation, bore condition, fate of tubing, redox correction etc.
//	//		x 40 mL Vial (H_2SO_4)		x 100 mL Amber	1	x 250 mL Plastic		//

Approval and Distribution

Fieldwork Staff Signature	**Date**	**Checker Name and Signature**	**Date**
Project Manager Signature	**Date**	**Distribution:** Project Central File	

ANZ

FQM - Groundwater Sampling and Purging Record

Q4AN(EV)-405-FM1

Turned.

Project Name:	QFES GW Monitoring	**Project Number:**	60609758	**PM Name:**	James Peachey	**Bore ID:**	MW04
Client:	QFES	**Project Location:**	Home Hill	**Fieldwork Staff:**	NK	**Sample Date:**	6/8/19

Well Development or Well Sampling Event? (circle)

General Bore Information		Parameter Info.	Decontamination	Sampling Method	Hydrasleeve info.	
Date of GW Level: 6/8/19 1400	Bore Radius (mm): 200mm?	Chem Kit Serial No.: 19C101112	☐ Decontaminated	☑ Low Flow Pump rate: 3/4	Hydrasleeve Size:	Monitoring sequence followed (number in order):
Depth to GW (m-pvc): 8.221	Screen Interval (m): Bottom	Chem Kit Model: YSI ProPlus	☐ Dedicated	Intake depth: 8.5	Hydrasleeve Type:	
9.013 Bore Depth (m-pvc): ~~9.013~~	Casing Radius (mm): 50	**Corrected Redox:** Y / N	☐ Disposable	☐ Bailer ☐ Hydrasleeve	Sampling Depth (m-pvc):	Gauging
Depth to Product (m-pvc): –	Cover Type (gatic/stick up):	(The correction to apply is probe dependent)	☐ Other (specify)	☑ Peristaltic Pump ☐ Waterra	Hydrasleeve Install time:	Hydrasleeve in
Product Thickness (m): –	Bore Locked (YES/NO):	**Parameter method:** ☐ Downhole		☐ Other (specify)	Sampling Start Time:	Hydrasleeve out
	Key Type (if applicable): –	☐ Retrieved				Parameters

Calculated bore volume (L):	Includes/ excludes bore annulus (circle)	# purge volumes removed:	Total purged volume (L):

Water Quality Parameters

Time	Cumulative Vol. Removed (L)	SWL (m-pvc)	Pump Rate	DO (ppm or mg/L)	E.C. (mS/cm or µS/cm)	pH	Redox (mV)	Temp °C	Odour, Colour, Turbidity
14:28	0	8.224	Peri (1/2)	–	–	–	–	–	clear, no odour/sheen
14:31	0.5	"	turn	4.20	608	6.44	151.0	28.5	
14:34	0.75	"	"	4.16	611	6.44	149.9	28.5	
14:~~40~~	1.25	"	~~"~~ "	4.91	613	6.44	148.8	28.5	went to 5min increments as volume ~~0.75~~ 0.1L/min.
14:45 ~~14:40~~	1.75	"	"	4.22 /	609 /	6.44 /	147.7 /	28.6 /	"
14:50	2.25	"	"	4.36 /	610 /	6.46 /	148.4 /	28.3 /	cloud cover, became overcast (°C ↑)
			Sampled @ 1450		@ 2.25L.				
Acceptable Parameter Range:				± 10%	± 3%	± 0.05	± 10 mV	± 0.2 °C	± 10% turbidity (if using a turbidity meter)

Analytes Sampled for:		Bottles Collected						QA/QC Information	Field Commets
Field Filtered:	Unfiltered:		x 40 mL Vial (HCl)		x 60 mL Ferrous		x 60 mL metals (HNO_3)	//	Bore volume calculation, bore condition, fate of tubing, redox correction etc.
/	//		x 40 mL Vial (H_2SO_4)		x 100 mL Amber	1	x 250 mL Plastic		//

Approval and Distribution

Fieldwork Staff Signature _____ Date _____ Checker Name and Signature _____ Date _____

Project Manager Signature _____ Date _____ **Distribution:** Project Central File

Oil / Water Interface Meter

Instrument Interface Meter (30M)
Serial No. 224606

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

This is to certify that the above instrument has been cleaned and tested.

Calibrated by: Nikhil Mruthyunjayappa

Calibration date: 15/07/2019

Next calibration due: 13/09/2019

Gas Detection Air Sampling & Monitoring Environmental & Water Quality Monitoring

airmet

Air-Met Scientific Pty Ltd

ABN 73 006 849 949

Ph 1300 137 067

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 11K100831

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Capacity	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
	Seal	✓	
Connectors	Condition	✓	
Sensor	1. pH	✓	
	2. mV	✓	
	3. EC/Temp.	✓	
	4. D.O	✓	
Alarms	Beeper	✓	
	Settings	✓	
Software	Version	✓	
Data logger	Operation	✓	
Download	Operation	✓	
Other tests:			

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 7.00		pH 7.00	NIST	320613	pH 7.00
2. pH 4.00		pH 4.00	NIST	320612	pH 4.00
3. mV		240mV	NIST	325420/325421	240mV
4. EC		2.76mS	NIST	304153	2.76mS
6. D.O		0 ppm	NIST	5928	0 ppm
7. Temp		22.6oC	NIST	MultiTherm 09000528	22.6oC

Calibrated by: Nikhil Mruthyunjayappa

Calibration date: 15-Jul-19

Next calibration due: 11-Jan-20

PID Calibration Certificate

Instrument PhoCheck Tiger
Serial No. T-114169

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
	Recharge OK?	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
Pump	Operation	✓	
	Filter	✓	
	Flow	✓	
	Valves, Diaphragm	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	PID	✓	10.6 ev
Alarms	Beeper	✓	
	Settings	✓	
Software	Version	✓	
Data logger	Operation	✓	
Download	Operation	✓	
Other tests:			

Low	High	TWA	STEL
50ppm	100ppm		

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Diffusion mode Aspirated mode

Sensor	Serial no	Calibration gas and concentration	Certified	Gas bottle No		Instrument Reading
PID Lamp		93ppm Isobutylene	NIST	BR100		93.0ppm

Calibrated by: Nikhil Mruthyunjayappa

Calibration date: 15/07/2019

Next calibration due: 14/08/2019

Gas Calibration Certificate

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Instrument MX4
Serial No. 13054CJ-002
Sensors CO, H2S, O2, LEL

Item	Test	Pass	Comments			
Battery	Charge Condition	✓				
	Fuses	✓				
	Capacity	✓				
	Recharge OK?	✓				
Switch/keypad	Operation	✓				
Display	Intensity	✓				
	Operation (segments)	✓				
Grill Filter	Condition	✓				
	Seal	✓				
PCB	Condition	✓				
Connectors	Condition	✓				
			Low	**High**	**TWA**	**STEL**
Sensor	Oxygen	✓	19.50%	23.50%	N/A	N/A
	Pentane	✓	5% LEL	10% LEL	N/A	N/A
	CO	✓	30 ppm	60 ppm	30ppm	60ppm
	H2S	✓	10 ppm	15 ppm	10ppm	15ppm
Alarms	Beeper	✓				
	Settings	✓				
Software	Version					
Datalogger	Operation					
Download	Operation					
Other tests:						

Certificate of Calibration

This is to certify that the above instrument has been calibrated to the following specifications:

Diffusion mode Aspirated mode

Sensor	Serial no	Calibration gas and concentration	Certified	Gas bottle No	Instrument Reading
O2		Fresh Air		Fresh Air	20.90%
LEL		25% LEL Pentane	NIST	BR133	25% LEL Pentane
CO		100ppm	NIST	BR133	100ppm
H2S		25ppm	NIST	BR133	25ppm

Calibrated by: **Braeden Curtis**

Calibration date: **16/07/19**

Next calibration due: **15/01/2020 0:00**

AECOM

ANZ

FQM - Water Quality Meter Calibration Record

Q4AN(EV)-410-FM1

Project Name:	~~Bowen Basin GME~~ QFES Surat	**Project Number:**	~~60603041, 2.1~~ 60609758
Project Location:	Airlie Beach	**Client:**	~~Arrow Energy~~ QFES
PM Name:	~~Rob Bartlett / Josh Radford~~ James P	**Fieldwork Staff Name:**	

This calibration record is intended to prompt fieldwork staff to calibrate water quality meter (WQM) daily before the start of fieldworks.

INSTRUMENT DETAILS

Supplier:	Aimet
Make and Model:	YGI Pro plus.
Serial Number:	

CALIBRATION

CALIBRATE WITH CALIBRATION SOLUTIONS

Date and Time:	10:00 8/8/19				
Parameter	Acidity		Conductivity	Dissolved Oxygen	
Units	pH	pH	µS/cm	ppm	ppm
Calibration Standard Concentration:	4.0	7.0			
Calibration Reading:	4.0	7.01			
Calibration Temperature:	24.9	24.6			

ONGOING CHECKS

BUMP TEST WITH CALIBRATION SOLUTION

Date and Time:	10:00 8/8/19				
Parameter	Acidity		Conductivity	Dissolved Oxygen	ORP
Units	pH	pH	µS/cm	ppm	ppm
Calibration Standard Concentration:	4.0	7.0	2707	Zero	232.4
Bump Test Reading:	3.93	7.09	2693	0.03	232.3
Bump Test Temperature:	24.8	24.4	24.0	24.7	25°C

COMMENTS

Detail any equipment faults, minor maintenance performed, change of batteries or technical support provided.

Approval and Distribution

☐ Each individual instrument has been inspected and calibrated daily and bump tested as required by fieldwork staff.

Fieldwork Staff Signature **Date**

Distribution: Project Central File

Appendix F

Surveying Report

Our Ref: 400571
Surveyed - Veris
Date of Survey 6/8/19
Site Address: 83 tenth Avenue Home Hill

Origin of Coordinates

Projection	MGA Zone 55
Coordinate Datum	GDA94
Height Datum	AHD

Coordinate Origin PM 143379 E 542 347.470m, N 7 826 338.449m, Z 12.128m

Point ID	Easting (m)	Northing(m)	Elevation (m)
MW01 Natural Surface Level	543616.862	7825995.313	12.523
MW01 CASING	543616.680	7825995.215	12.471
MW02 CASING	543635.536	7826003.024	12.114
MW02 Natural Surface Level	543635.738	7826003.076	12.195
MW03 CASING	543653.240	7826005.662	12.086
MW03 Natural Surface Level	543652.994	7826005.545	12.176
MW04 Natural Surface Level	543639.524	7825992.950	12.400
MW04 CASING	543639.395	7825992.910	12.325

Appendix G

Analytical Data Validation

Appendix G - Analytical Data Validation

G1.0 Introduction

The amended NEPM, Schedule B [2]) Guideline on Site Characterisation (2013) specifies that the nature and quality of the data produced in an investigation should be determined by the data quality objectives (DQOs). As referenced by the NEPM, the DQO process is detailed in the United States Environmental Protection Agency (US EPA) *Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4 : EPA/240/B-06/001), February 2006.*

The US EPA defines the process as *'a strategic planning approach based on the Scientific Method that is used to prepare for a data collection activity. It provides a systematic procedure for defining the criteria that a data collection design should satisfy, including when to collect samples, where to collect samples, the tolerable level of decision errors for the study, and how many samples to collect'.*

The process of establishing appropriate DQOs is defined by the US EPA (2006) according to the following seven steps:

The seven steps in defining DQOs

Step	Data Quality Objective Step
1	***State the problem*** – Define the problem that necessitates the study; identify the planning team, examine budget, schedule.
2	***Identify the goal of the study –*** State how environmental data will be used in meeting objectives and solving the problem, identify study questions, define alternative outcomes.
3	***Identify information inputs*** – Identify data & information needed to answer study questions.
4	***Define the boundaries of the study*** – Specify the target population & characteristics of interest, define spatial & temporal limits, scale of inference.
5	***Develop the analytic approach*** – Define the parameter of interest, specify the type of inference, and develop the logic for drawing conclusions from findings.
6	***Specify performance or acceptance criteria*** – Develop performance criteria for new data being collected or acceptable criteria for existing data being considered for use.
7	***Develop the plan for obtaining data*** – Select the resource-effective sampling and analysis plan that meets the performance criteria.

The approach adopted relative to the seven steps presented above is discussed below.

G1.1 Step 1 – State the Problem

A report prepared by QFES in November 2016 (QFES, 2016) indicated that PFAS was detected in water held within the Case 4 Pit at the fire station.

The findings of a review of the historical use of firefighting foams containing PFAS at the site have been documented in the PSI report (AECOM, 2019) and it was identified that there was the potential for PFAS to have been released to ground. The extent of the potential presence of PFAS in the different environmental media (soil, groundwater, surface water and sediment) was not known and characterisation of potential source areas, boundary locations and downstream (for surface water) and down-gradient (for groundwater) was required to inform the potential presence of complete source-pathway-receptor linkages at the site.

G1.2 Identify the Goal of the Study

The overarching purpose of the works is to characterise the potential for PFAS impacts, including concentration and distribution in environmental media (soil, groundwater, surface water and sediment), within and at the boundary of the site.

G1.3 Identify Information Inputs

To allow assessment of the data against the study goal listed in step 2 above, the following inputs have been considered:

- Anecdotal information on historical operations provided from interviews with personnel familiar with the fire stations
- Observations made during the site inspections completed in January and February 2019
- The data review information (site and environmental setting) presented in the PSI report (AECOM, 2019) including:
    - Quantitative site characterisation data including visual observations, laboratory analytical data from field samples (samples of water from the Case 4 pit, comparison of analytical data with screening criteria appropriate for the land use
    - Hydrogeological and hydrological data for each of the six sites including inferred groundwater and surface water flow direction
    - The potential for preferential pathways e.g. stormwater drains.
- Tier 1 health and ecological investigation and screening levels of each protected beneficial use applicable within the boundary of the study area
- Soil, groundwater and sediment analytical results collected between July and August 2019 as presented in this DSI report.

G1.4 Define the Boundaries of the Study

The lateral extent of the study area defined for decision making is the physical area of the fire station (Lot on Plan boundaries) is outlined in figures in **Appendix A**. The vertical extent of the investigation is the depth to the shallow aquifer system beneath each site. This is considered to be less than 20 mbgl.

The temporal boundary of the study is the current conditions at the time of the fieldwork in July – August 2019.

G1.5 Develop the Analytical Approach

The decision rules can be defined as:

- If the laboratory quality assurance/quality control data are within the acceptable ranges, the data should be considered suitable for use.
- If the PFAS concentrations are reported above the laboratory LOR or risk-based screening levels in one or more samples, then it should be considered whether further assessment is required.

The decision on the acceptance of the analytical data should be made on the basis of the Data Quality Indicators (DQIs) as follows:

- **Precision:** A quantitative measure of the variability (or reproducibility) of data.
- **Accuracy**: A quantitative measure of the closeness of reported data to the “true” value.
- **Representativeness**: The confidence (expressed qualitatively) that data are representative of each media present at each fire station.
- **Completeness**: A measure of the amount of useable data from a data collection activity.
- **Comparability**: The confidence (expressed qualitatively) that data may be considered to be equivalent for each sampling and analytical event.

G1.5.1 Precision

Suitable criteria and/or performance indicators for assessment of precision include:

- Performance of intra-laboratory duplicate sample sets through calculation of relative percentage differences (RPDs).
- Performance of inter-laboratory duplicate sample sets through calculation of RPDs.
- The RPDs should be assessed as acceptable if less than or equal to 30% as per the NEPM Schedule B3. Where the results shows greater than 30% difference a review of the cause should be conducted (NEPC, 2013). It is noted that RPDs that exceed this range may be considered acceptable where:
  - results are less than 10 times the LOR (no limit)
  - results are less than 20 times the LOR and the RPD is less than 50%
  - heterogeneous materials are encountered.

G1.5.2 Accuracy (Bias)

The closeness of the reported data to the “true” value is assessed through review of performance of:

- Method blanks, which are analysed for the analytes targeted in the primary samples
- Matrix spikes and surrogate recoveries
- Laboratory control samples.

G1.5.3 Representativeness

To ensure the data produced by the laboratory is representative of conditions encountered in the field, the following steps are taken by the laboratory and subsequently reviewed by the Consultant:

- Blank samples should be run in parallel with field samples to confirm there are no unacceptable instances of laboratory cross contamination.
- Review of RPD values for field and laboratory duplicates to provide an indication that the samples are generally homogeneous, with no unacceptable instances of significant sample matrix heterogeneities.
- The appropriateness of collection methodologies, handling, storage and preservation techniques should be assessed to ensure/confirm there was minimal opportunity for sample interference or degradation (i.e. volatile loss during transport due to incorrect preservation / transport methods).

G1.5.4 Completeness

In validating the degree of completeness of the analytical data sets acquired during the program the following is considered:

- Whether standard operating procedures (SOPs) for sampling protocols have been adhered to.
- Copies of all chain of custody (CoC) documentation are reviewed and presented.

It can therefore be considered whether the proportion of “useable data” generated in the data collection activities is sufficient for the purposes of assessing the problem as stated in Step 1 above.

G1.5.5 Comparability

Given that assessment data can comprise several data sets from separate sampling episodes, issues of comparability between data sets are reduced through adherence to SOPs and regulator endorsed or made guidelines and standards on each data gathering activity.

In addition, the data should be collected by experienced field staff familiar with PFAS contamination investigations and NATA accredited laboratories should be employed in all laboratory programs for soil, sediment and water analysis.

G1.6 Specify Performance or Acceptance Criteria

Specific limits for this project are in accordance with the appropriate guidance made or endorsed by state and national regulations, appropriate indicators of data quality, and standard procedures for field sampling and handling.

This step also examines the certainty of conclusive statements based on the available new site data collected. This should include the following points to quantify tolerable limits:

- A decision can be made based on a certainty assumption of 95% confidence in any given data set. A limit on the decision error should be 5% that a conclusive statement may be a false positive or false negative.
- A decision error in the context of the decision rule presented above would lead to either underestimation or overestimation of the risk level associated with a particular sampling area.

Sampling errors may occur when the sampling program does not adequately detect the variability of a contaminant from point to point across the site. To address this, the SAQP outlines minimum numbers of samples proposed to be collected from each media.

- As such, there may be limitations in the data if aspects of the SAQP cannot be implemented. Some examples of this scenario include but are not limited to:
    - Proposed surface water sample locations may be dry at the time of sampling; and
    - Proposed samples are not collected due to access being restricted to a given location.
- Limitations in ability to acquire useful and representative information from the data collected. The data are proposed to be collected from multiple locations and sample media. Some examples of this scenario include:
    - Measurement errors can occur during sample collection, handling, preparation, analysis and data reduction. To address this the following measures are proposed:
        - Collection of sufficient sample mass to facilitate analysis reported to standard laboratory detections limits. Collection of insufficient sample mass may result in raised detection limits.
        - Field staff to follow a standard procedure when collecting samples, including decontamination of tools, removal of adhered soil to avoid false positives in results, and use of appropriate sample containers and preservation methods.
        - Laboratories to follow a standard procedure when preparing samples for analysis and undertaking analysis.
- Laboratories to report quality assurance/ quality control data for comparison with the DQIs established for the project.

G1.7 Optimise the Design for Obtaining Data

The methodology is designed to meet the objectives described in **Section 1.3** of the main body of the report and to achieve the nominated DQOs. Optimisation of the data collection process should be achieved by:

- Working closely with the analytical laboratories and sampling equipment suppliers to ensure that appropriate procedures and processes are developed and implemented prior to and during the fieldwork, to ensure that sample handling, and transport to and processing by the analytical laboratories is as smooth as possible; and
- Conducting sampling according to the environmental consultant's SOPs for the type of sampling being conducted.

The scope of works should be carried out to a level of accuracy and confidence presented in the NEPM (NEPC, 2013).

G2.0 Assessment of Data Quality

The quality of the data collected as part of the investigations was assessed on a range of factors including:

- Documentation and data completeness
- Data quality – comparability, representativeness, and precision and accuracy for sampling. Assessment criteria for data quality indicators for samples are listed below in the table below.

Acceptance Criteria for Data Quality Indicators in Laboratory Analysis

Data Quality Indicator	Acceptance Criteria
Rinsate Blanks	Less than the laboratory LOR
Intra laboratory field duplicates (1) (3)	RPD less than ± 30-50% (where results > 10 x LOR) (2)
Laboratory Duplicates (1) (2) (3)	RPDs in conformance with criteria in the laboratory QC report.
Matrix Spikes (3) (4)	Recoveries between 70-130% of the theoretical recovery or as nominated in the laboratory's QC report
Method Blanks	Less than the laboratory LOR
Laboratory Control Samples (5)	Recoveries between laboratory-specified range for each particular analyte / analytical suite.
Surrogate Spikes	Recoveries for surrogates are test dependent and are based on USEPA Method SW846. Control limits are dynamic and vary for individual tests but are within the criteria described in USEPA Method SW846.

Notes:

1. Potential exceptions to this criterion may occur where sample variation or heterogeneity, rather than poor laboratory performance, is accountable for the poor reproducibility, or where the results are close to the LOR. This typical RPD range is obtained from AS 4482.1-2005 Guide to the investigation and sampling of sites with potentially contaminated soil.
2. If the results are close to the LOR, then higher results will be accepted.
3. Criteria for sample duplicate and matrix spike results assume no sample heterogeneity. If samples are found to be heterogeneous with respect to a particular analyte the above criteria does not apply.
4. Assumes that samples are homogeneous and the background analyte level is less than 20% of the spike level (refer to USEPA Method 8000B). Note that there is no requirement for matrix spikes to pass as certain matrices may preclude recovery of spiked compounds. In this case, data will be accepted if LCS data meets the acceptance criteria.

   5.80% of the compounds tested must fall within the control limits. Control limits are dynamic and vary for individual tests as per USEPA Method 8000B.

5. Decision errors may include collecting samples that are not representative of the contamination status of the material and/or analytical errors.

G3.0 Field QA/QC Data Assessment

G3.1 General

All work completed as part of the project was conducted in accordance with standard AECOM environmental sampling protocols. The essential elements of the QA/QC program are presented in the table below.

Essential Elements of the Field QA/QC Program

Action	Description
Use of Experienced Personnel	Fieldwork was undertaken by trained AECOM engineers/scientists with previous experience in contaminated site assessment, field sampling techniques and health and safety issues.
Record Keeping	Full records of all field activities including sample collection and photo log are maintained on standard field activity sheets.
Sample Collection	New nitrile gloves were worn during soil, groundwater and sediment sampling, and were replaced between each sample collection.
Sample Labelling	A unique sample number was used for each sample to specify the sample origin (soil bore/monitoring well number and date), preservation standards and analytical requirements.
Chain of Custody	Chain of Custody procedures are required for all sample transfers. Custody sheets list sample numbers; date of collection and analyses required and are signed by each individual transferring and accepting custody.
Sample Storage	The collected samples were transferred to laboratory supplied sampling containers with appropriate preservation as required and then placed in cool storage prior to transfer to NATA accredited laboratories (ALS and NMI).
Decontamination	All non-dedicated field equipment used in the sampling process was decontaminated using de-ionised water prior to mobilisation and between sampling locations to reduce the risks of cross contamination.

In addition to the primary samples, quality control field duplicate samples were collected to assess aspects of field protocols and laboratory performance and to classify the validity of the laboratory data. Field duplicates were collected in general accordance with AS 4482.1-2005 *Guide to the investigation and sampling of sites with potentially contaminated soil* (Standards Australia 2005).

G3.2 Handling and Sample Preservation

The laboratories reported that all samples were received in appropriately pre-treated and preserved containers. Samples were received preserved and chilled at the laboratory. The sample temperature readings recorded on the Sample Receipt Notification (SRN) ranged from 1.2°C to 6.1°C with ice present.

G3.3 Frequency of Field Quality Control Samples

Field duplicate samples (intra-laboratory duplicates) and field triplicate samples (inter-laboratory duplicates) were collected and labelled so that they could not be linked to their respective primary samples.

Field duplicate and triplicate samples were collected as 1 duplicate and triplicate sample per 10 primary samples (10%) prepared in the field by equally splitting the primary field samples. A summary of the actual duplicate and triplicate analysis frequency undertaken during this investigation is presented in the table below. The table shows that a sufficient number of field QC samples were collected.

Summary of Duplicate and Triplicate Samples

Media	No of Primary Samples	No of Duplicate Samples	% Duplicate Samples	No of Triplicate Samples	% Triplicate Samples
Soil samples	18	2	11%	2	11%
Water samples	4	1	25%	1	25%
Sediment samples	2	1	50%	1	50%

Relative Percentage Difference (RPD) Calculations

A RPD analysis of primary and duplicate/triplicate samples is used to measure the representativeness and/or precision of duplicate samples. The RPD is calculated from the absolute difference between results of the duplicate pair divided by the mean value of the duplicate pair.

RPD (%) = 100 x (D1-D2) / ((D1+D2) / 2)

Where: D1 = primary sample analysis, D2 = duplicate sample analysis

AS 4482.1-2005 states that the typical RPD which can be expected from acceptable field duplicates is < ± 30- 50% of the mean concentration of the analyte, where the results are greater than ten times the limit of reporting (LOR).

The acceptable ranges adopted are:

- 81% for laboratory duplicates between 0-10 x LOR.
- 50% for laboratory duplicates between 10-30 x LOR.
- 30% for laboratory duplicates greater than 30 x LOR.
- All other RPD calculations were either not calculable, due to the primary or duplicate sample reporting concentrations of COPC less than the LOR or within the expected range of 0- 30% for all other analytes reported.

Evaluation of the Soil Dataset

An evaluation of the soil dataset is presented in **Table G1**. There was one RPD non-conformance identified. This was for sample HH_QC100_190724, which was a duplicate (intra-laboratory duplicate) of HH_BH01_0.1_190724 with the RPD for PFOS (50%) exceeding the adopted limit (30%). The duplicate sample had a lower PFOS concentration compared to the primary sample. The concentration of PFOS in the triplicate sample was similar to the primary sample (RPD was 15%). The reason for the difference is considered to be heterogeneity in the soil. As the higher concentrations detected in the primary sample have been used in the assessment, the RPD non-conformance is not considered to impact report interpretation.

Evaluation of the Sediment Dataset

An evaluation of the soil dataset is presented in **Table G2**. No RPD non-conformances were identified in the dataset.

Evaluation of the Groundwater Dataset

An evaluation of the groundwater dataset is presented in **Table G3**. There was one RPD non-conformances identified in the dataset. This was for the primary-triplicate sample set for HH_MW02 (HH_QC206_190806) with 6:2 FTS detected at a concentration of 1.5 µg/L in the triplicate sample, while this compound was reported at a concentration of <0.01 µg/L in the primary sample (and also the duplicate sample), resulting in a RPD of 197%. This result is anomalous and the reason for the large detection in the triplicate sample (relative to the other results) is not known. The use of different laboratory methods may be a factor in the discrepancy between primary and secondary laboratories. This compound was not detected in any of the other samples. There are no guideline screening levels for 6:2 FTS so the detection of this compound does not impact the risk assessment aspects of the report.

G3.4 Rinsate Blank Samples

To assess the effectiveness of sampling procedures, four rinsate blank samples were collected on days when sampling equipment was used. Rinsate blanks were collected from sampling equipment which was decontaminated and re-used by passing laboratory supplied deionised water over the sampling equipment following decontamination procedures. The rinsate samples were analysed for PFAS.

The analytical results for PFAS compounds recorded for the rinsate blank samples are presented in **Table G4**. All results for the rinsate samples were below the LOR indicating decontamination procedures were adequate. The data are deemed acceptable for interpretative use and not considered to impact on data interpretation for this investigation.

G4.0 Laboratory QA/QC

The analytical data was received from the laboratories as the following laboratory batches:

ALS – EB1919840, EB1921176, EB1921187, EB1922105.

NMI – RN1242618, RN1244319.

G4.1 Extraction and Analysis Holding Time

All samples were received and analysed within the specified holding times with the exception of moisture content within HH_SS1_0.5 (TOPA) (EB1921187) however it is noted that moisture content was analysed within the holding time for the standard analysis and that this exceedance was due to the rebatching of this sample for TOPA analysis.

G4.2 Laboratory QA/QC

The laboratories used in the investigation (ALS for primary and duplicate samples and NMI for triplicate samples) are NATA accredited for the analyses performed. Quality assurance procedures adopted by both primary and secondary analytical laboratories included analysis of blanks, duplicates, laboratory control samples, matrix spikes and surrogate spikes.

For this investigation, 32 primary and field quality control samples were analysed across six laboratory batches. The additional two laboratory batches identified in **Section G4.0** (EB1921187 and EB1922105) contained samples rebatched for TOPA analysis.

G4.2.1 Laboratory/Method Blanks

The quality control term Method/Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC type is to monitor potential laboratory contamination.

All the laboratory blanks were within the DQO limits for this investigation. Method blank concentrations were not detected above the LOR for any of the analytes.

G4.2.2 Laboratory Control Sample (LCS)

The quality control term Laboratory Control Sample (LCS) refers to a known, interference free matrix spiked with target analytes or certified reference material. The purpose of this QC type is to monitor method precision and accuracy independent of sample matrix. Accepted frequency of LCS samples is 1 in 20.

LCS recovery non-conformances were reported for one of the six laboratory reports, EB1921176. The non-conformances were for EtFOSA, MEFOSE, EtFOSE, ETFOSAA, 6:2 FTS and 10:2 FTS where recovery was less than the lower data quality objective.

As advised by ALS a batch is accepted if at least 80% of the analytes return conforming LCS recoveries. As this criteria has been met for these two batches and as the analytes that reported non-conformances are not key analytes, these non-conformances are not considered to affect the data analysis and interpretation for this investigation. It is additionally noted that none of these analytes were detected in the primary sample so there is no impact on the data interpretation.

G4.2.3 Laboratory Duplicates

The quality control term laboratory duplicate refers to an intra-laboratory split sample randomly selected from the sample batch. Laboratory duplicates provide information on method precision and sample heterogeneity. RPDs are used to assess precision. Frequency of laboratory duplicate samples 1 in 10.

All the laboratory duplicates were within the DQO limits for this investigation.

G4.2.4 Matrix Spikes

The quality control term Matrix Spike (MS) refers to an intra-laboratory split sample spiked with a representative set of target analytes. The purpose of this QC type is to monitor potential matrix effects on analyte recoveries. The samples undergo the same extraction and analysis

procedures and the results are used to assess the method precision and bias. Spike recoveries are reported as a percent recovery. Frequency of MS samples is 1 in 20.

A summary of batches with MS recovery non-conformances are presented in the table below.

Summary of Matrix Spike Recovery non-conformances

Analyte	Batches	Comments
PFOS	EB1919839-050 (Anonymous)	MS recovery not determined due to the higher background level greater than or equal to 4x spike level.
PFOS	EB1919840-060 (HH_QC100_190724)	MS recovery not determined due to the higher background level greater than or equal to 4x spike level.
PFTeDA, MeFOSE	EB1919840-060 (HH_QC100_190724)	Recovery was less than the lower data quality objective.
PFOS, PFBA, PFNA, PFDA, PFUnDA, PFDoDA, PFTrDA, PFTeDA, MeFOSA, EtFOSA, MeFOSE, EtFOSE EtFOSAA, 6:2 FTS, 10:2 FTS	EB1921176-006 (HH_SED02_190806)	Recovery was less than the lower data quality objective.
PFOS	EB1921176-002 (HH_MW02_190806)	MS recovery not determined due to the higher background level greater than or equal to 4x spike level.
PFUnDA, 6:2 FTS, 10:2 FTS	EB1921138-003 (Anonymous)	Recovery was greater than the lower data quality objective.
EtFOSAA	EB1921138-003 (Anonymous)	Recovery was less than the lower data quality objective.

The data demonstrate that matrix interference has occurred in some of the samples, in particular, the sediment sample HH_SED02 where matrix spikes non-conformances are recorded for 15 analytes, which may indicate suppressed recovery of these analytes in the sample.

The recovery of matrix spikes above and below the data quality objectives are considered to be due to heterogeneity of the samples. The non-determining of the MS recovery is potentially due to the matrix of the particular sample rather than the spike recovery. Overall the data are not considered to affect the quality of the data for interpretative use.

G4.2.5 Surrogate Spikes

The quality control term surrogate spike (SS) refers to a compound added to a sample aliquot in known amounts before extraction and analysis. The compound should be similar in composition and behaviour to the target analyte but not naturally occurring in the sample. A surrogate is used to monitor the method performance for analysis of organic compounds. Spike recoveries are reported as a percent recovery.

A summary of batches with surrogate spike recovery non-conformances are presented in the table below.

Summary of Surrogate Spike Recovery non-conformances

Analyte	Batches	Comments
13C4-PFOS	EB1921176 - soil (HH_QC107)	Recovery less than lower data quality objective.

Surrogate spike recovery non-conformance is potentially due to the matrix of the particular samples rather than the surrogate recovery and as such does not affect the quality of the data for interpretative use.

G4.2.6 Frequency of Laboratory QC samples

The laboratory reported a sufficient frequency of quality control samples to assess whether the results have been reported to an acceptable accuracy and precision for all the batches. No non-conformances were identified for any of the QC samples.

G5.0 Conclusions

While non-conformances with the laboratory QA/QC have been identified, these non-conformances are not considered to adversely impact the purpose of the investigation with respect to comparison against the adopted assessment criteria. It is concluded that, for the purposes of this investigation, the data are suitable for interpretation and acceptable for use in this assessment.

Table G1 Soil Duplicate and Triplicate Analytical Results
PFAS DSI
QFES - Home Hill Fire Station

AECOM Imagine it. Delivered.

	Lab Report Number	EB1919840	EB1919840		EB1919840	RN1242618		EB1919840	EB1919840		EB1919840	RN1242618	
	Field ID	HH_BH01_0.1_190724	HH_QC100_190724	RPD	HH_BH01_0.1_190724	HH-QC200-190724	RPD	HH_SS1_0.5_190724	HH_QC101_190724	RPD	HH_SS1_0.5_190724	HH-QC201-190724	RPD
	Sampled Date	24/07/2019	24/07/2019		24/07/2019	24/07/2019		24/07/2019	24/07/2019		24/07/2019	24/07/2019	
Compound	Units	LOR											
PFBS	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFPeS	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFHxS	mg/kg	0.0002 : 0.001 (Interlab)	0.0003	<0.0002	40	0.0003	<0.001	0	0.0004	0.0003	29	0.0004	<0.001	0
PFHpS	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFOS	mg/kg	0.0002 : 0.002 (Interlab)	**0.0112**	**0.0067**	50	0.0112	0.013	15	0.223	0.186	18	0.223	0.22	1
PFDS	mg/kg	0.0002	<0.0002	<0.0002	0	<0.0002	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFBA	mg/kg	0.001	<0.001	<0.001	0	<0.001	<0.002	0	<0.001	<0.001	0	<0.001	<0.002	0
PFPeA	mg/kg	0.0002 : 0.002 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.002	0	0.0005	0.0004	22	0.0005	<0.002	0
PFHxA	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0	0.0004	0.0003	29	0.0004	<0.001	0
PFHpA	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0	0.0004	0.0003	29	0.0004	<0.001	0
PFOA	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0	0.0002	<0.0002	0	0.0002	<0.001	0
PFNA	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0	0.0016	0.0016	0	0.0016	0.0022	32
PFDA	mg/kg	0.0002 : 0.001 (Interlab)	0.0003	<0.0002	40	0.0003	<0.001	0	0.0005	0.0004	22	0.0005	<0.001	0
PFUnDA	mg/kg	0.0002 : 0.002 (Interlab)	0.0003	0.0002	40	0.0003	<0.002	0	<0.0002	<0.0002	0	<0.0002	<0.002	0
PFDoDA	mg/kg	0.0002 : 0.002 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.002	0	<0.0002	<0.0002	0	<0.0002	<0.002	0
PFTrDA	mg/kg	0.0002 : 0.002 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.002	0	<0.0002	<0.0002	0	<0.0002	<0.002	0
PFTeDA	mg/kg	0.0005 : 0.002 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.002	0	<0.0005	<0.0005	0	<0.0005	<0.002	0
4:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.001	0	<0.0005	<0.0005	0	<0.0005	<0.001	0
6:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.001	0	<0.0005	<0.0005	0	<0.0005	<0.001	0
8:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.001	0	<0.0005	<0.0005	0	<0.0005	<0.001	0
10:2 FTS	mg/kg	0.0005 : 0.002 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.002	0	<0.0005	<0.0005	0	<0.0005	<0.002	0
MeFOSAA	mg/kg	0.0002 : 0.002 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.002	0	<0.0002	<0.0002	0	<0.0002	<0.002	0
EtFOSAA	mg/kg	0.0002 : 0.002 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.002	0	<0.0002	<0.0002	0	<0.0002	<0.002	0
FOSA	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0	<0.0002	<0.0002	0	<0.0002	<0.001	0
EtFOSA	mg/kg	0.0005 : 0.002 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.002	0	<0.0005	<0.0005	0	<0.0005	<0.002	0
MeFOSA	mg/kg	0.0005 : 0.002 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.002	0	<0.0005	<0.0005	0	<0.0005	<0.002	0
EtFOSE	mg/kg	0.0005 : 0.005 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.005	0	<0.0005	<0.0005	0	<0.0005	<0.005	0
MeFOSE	mg/kg	0.0005 : 0.005 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.005	0	<0.0005	<0.0005	0	<0.0005	<0.005	0

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 81 (1-10 x EQL); 50 (10-30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

Table G2 Sediment Duplicate and Triplicate Analytical Results
PFAS DSI
QFES - Home Hill Fire Station

AECOM Imagine it. Delivered.

Lab Report Number			EB1921176	EB1921176		EB1921176	RN1244319	
Field ID			HH_SED01_190806	HH_QC107_190806	**RPD**	HH_SED01_190806	HH_QC207_190806	**RPD**
Sampled Date			6/08/2019	6/08/2019		6/08/2019	6/08/2019	
Compound	**Units**	**LOR**						
PFBS	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFPeS	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFHxS	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFHpS	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFOS	mg/kg	0.0002 : 0.002 (Interlab)	0.0021	0.0014	40	0.0021	0.0026	21
PFDS	mg/kg	0.0002	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFBA	mg/kg	0.001	<0.001	<0.001	0	<0.001	<0.002	0
PFPeA	mg/kg	0.0002 : 0.002 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.002	0
PFHxA	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFHpA	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFOA	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFNA	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFDA	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0
PFUnDA	mg/kg	0.0002 : 0.002 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.002	0
PFDoDA	mg/kg	0.0002 : 0.002 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.002	0
PFTrDA	mg/kg	0.0002 : 0.002 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.002	0
PFTeDA	mg/kg	0.0005 : 0.002 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.002	0
4:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.001	0
6:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.001	0
8:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.001	0
10:2 FTS	mg/kg	0.0005 : 0.002 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.002	0
MeFOSAA	mg/kg	0.0002 : 0.002 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.002	0
EtFOSAA	mg/kg	0.0002 : 0.002 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.002	0
FOSA	mg/kg	0.0002 : 0.001 (Interlab)	<0.0002	<0.0002	0	<0.0002	<0.001	0
EtFOSA	mg/kg	0.0005 : 0.002 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.002	0
MeFOSA	mg/kg	0.0005 : 0.002 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.002	0
EtFOSE	mg/kg	0.0005 : 0.005 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.005	0
MeFOSE	mg/kg	0.0005 : 0.005 (Interlab)	<0.0005	<0.0005	0	<0.0005	<0.005	0

*RPDs have only been considered where a concentration is greater than 1 times the EQL.

**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 81 (1-10 x EQL); 50 (10-30 x EQL); 30 (> 30 x EQL))

***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

Lab Report Number	EB1921176	EB1921176		EB1921176	RN1244319	
Field ID	HH_MW02_190806	HH_QC106_190806	RPD	HH_MW02_190806	HH_QC206_190806	RPD
Sampled Date	6/08/2019	6/08/2019		6/08/2019	6/08/2019	
Compound	**Units**	**LOR**						
PFBS	mg/kg	0.0002 : 0.001 (Interlab)	0.049	0.047	4	0.049	0.041	18
PFPeS	mg/kg	0.0002 : 0.001 (Interlab)	0.024	0.024	0	0.024	0.024	0
PFHxS	mg/kg	0.0002 : 0.001 (Interlab)	0.161	0.149	8	0.161	0.18	11
PFHpS	mg/kg	0.0002 : 0.001 (Interlab)	<0.01	<0.01	0	<0.01	0.0062	0
PFOS	mg/kg	0.0002 : 0.002 (Interlab)	3.25	3.29	1	3.25	3.50	7
PFDS	mg/kg	0.0002	<0.01	<0.01	0	<0.01	<0.001	0
PFBA	mg/kg	0.001	<0.05	<0.05	0	<0.05	0.0099	0
PFPeA	mg/kg	0.0002 : 0.002 (Interlab)	0.015	0.015	0	0.015	0.019	24
PFHxA	mg/kg	0.0002 : 0.001 (Interlab)	0.029	0.029	0	0.029	0.032	10
PFHpA	mg/kg	0.0002 : 0.001 (Interlab)	0.021	0.021	0	0.021	0.019	10
PFOA	mg/kg	0.0002 : 0.001 (Interlab)	0.017	0.013	27	0.017	0.0075	78
PFNA	mg/kg	0.0002 : 0.001 (Interlab)	<0.01	<0.01	0	<0.01	<0.001	0
PFDA	mg/kg	0.0002 : 0.001 (Interlab)	<0.01	<0.01	0	<0.01	<0.001	0
PFUnDA	mg/kg	0.0002 : 0.002 (Interlab)	<0.01	<0.01	0	<0.01	<0.001	0
PFDoDA	mg/kg	0.0002 : 0.002 (Interlab)	<0.01	<0.01	0	<0.01	<0.001	0
PFTrDA	mg/kg	0.0002 : 0.002 (Interlab)	<0.01	<0.01	0	<0.01	<0.002	0
PFTeDA	mg/kg	0.0005 : 0.002 (Interlab)	<0.025	<0.025	0	<0.025	<0.002	0
4:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	<0.01	<0.01	0	<0.01	<0.001	0
6:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	<0.01	<0.01	0	**<0.01**	**1.50**	**197**
8:2 FTS	mg/kg	0.0005 : 0.001 (Interlab)	<0.01	<0.01	0	<0.01	<0.001	0
10:2 FTS	mg/kg	0.0005 : 0.002 (Interlab)	<0.01	<0.01	0	<0.01	<0.001	0
MeFOSAA	mg/kg	0.0002 : 0.002 (Interlab)	<0.01	<0.01	0	<0.01	<0.002	0
EtFOSAA	mg/kg	0.0002 : 0.002 (Interlab)	<0.01	<0.01	0	<0.01	<0.002	0
FOSA	mg/kg	0.0002 : 0.001 (Interlab)	<0.01	<0.01	0	<0.01	<0.001	0
EtFOSA	mg/kg	0.0005 : 0.002 (Interlab)	<0.025	<0.025	0	<0.025	<0.002	0
MeFOSA	mg/kg	0.0005 : 0.002 (Interlab)	<0.025	<0.025	0	<0.025	<0.002	0
EtFOSE	mg/kg	0.0005 : 0.005 (Interlab)	<0.025	<0.025	0	<0.025	<0.005	0
MeFOSE	mg/kg	0.0005 : 0.005 (Interlab)	<0.025	<0.025	0	<0.025	<0.005	0

*RPDs have only been considered where a concentration is greater than 1 times the EQL.
**High RPDs are in bold (Acceptable RPDs for each EQL multiplier range are: 81 (1-10 x EQL); 50 (10-30 x EQL); 30 (> 30 x EQL))
***Interlab Duplicates are matched on a per compound basis as methods vary between laboratories. Any methods in the row header relate to those used in the primary laboratory

Table G4 Rinsate Analytical Results
PFAS DSI
QFES - Home Hill
Fire Station

Lab Report Number	EB1919840	EB1919840	EB1919840	EB1921176
Field ID	HH_QC300_190724	HH_QC301_190724	HH_QC302_190725	HH_QC303_190806
Sampled Date	24/07/2019	24/07/2019	25/07/2019	6/08/2019

Compound	**Units**	**LOR**				
PFBS	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
PFPeS	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
PFHxS	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
PFHpS	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
PFOS	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
PFDS	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
PFBA	mg/kg	0.01	<0.01	<0.01	<0.01	<0.01
PFPeA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
PFHxA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
PFHpA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
PFOA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
PFNA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
PFDA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
PFUnDA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
PFDoDA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
PFTrDA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
PFTeDA	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005
4:2 FTS	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005
6:2 FTS	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005
8:2 FTS	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005
10:2 FTS	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005
MeFOSAA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
EtFOSAA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
FOSA	mg/kg	0.002	<0.002	<0.002	<0.002	<0.002
EtFOSA	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005
MeFOSA	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005
EtFOSE	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005
MeFOSE	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005

Appendix H

Analytical Laboratory Reports

ALSCompass SAMPLING Intelligence

Environmental Division
Brisbane
Work Order Reference
EB1919840

Telephone : +61-7-3243 7222

Custody Document for Submissions via ALS Compass App

Project: 606909758 20 → HH **Client:** AECOM Pty Ltd **Project Manager:** James Peachey
Phone: (0425 206 362

ALS Compass COC Reference: 2656 **# Samples:** **Sampler:** Camden McCosker
Phone: (0499 990 214

Turnaround Requirements: Standard 5 Day Urgent

Special Instructions:
2 Eskies

Please report with –YYMMDD end of Sample ID

Custody:

Relinquished by:	Received by:	Relinquished by:	Received by:
Camden	KSchafer	KSchafer	M. Birch
Date / Time:	Date / Time: 31-7-19 0945	Date / Time: 31-7-19 1600	Date / Time: 1/8/19 9.40

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order	: **EB1919840**		
Amendment	: **1**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: CAMDEN McCOSKER	Contact	: Carsten Emrich
Address	: Brisbane	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: camden.mccosker@aecom.com	E-mail	: carsten.emrich@alsglobal.com
Telephone	: ----	Telephone	: +61 7 3552 8616
Facsimile	: ----	Facsimile	: +61-7-3243 7218
Project	: 60609758_HH	Page	: 1 of 4
Order number	: 60609758 2.0	Quote number	: EB2019AECOMAU0002 (BN/112/19)
C-O-C number	: 2656	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: CAMDEN McCOSKER		

Dates

Date Samples Received	: 01-Aug-2019 09:40	Issue Date	: 12-Aug-2019
Client Requested Due Date	: 08-Aug-2019	Scheduled Reporting Date	: **08-Aug-2019**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 2	Temperature	: 0.9°C; 4.3°C - Ice present
Receipt Detail	: MEDIUM ESKY	No. of samples received / analysed	: 68 / 23

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- ***01/08/2019*: SRN has been resent to acknowledge samples have been fowarded to NMI as requested on the Chain of Custody. This will incur a freight fowarding fee. For any further information regarding these adjustments please contact client services at ALSEnviro.Brisbane@alsglobal.com.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Analysis will be conducted by ALS Environmental, Brisbane, NATA accreditation no. 825, Site No. 818 (Micro site no. 18958).
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) SOIL No analysis requested	SOIL - EA055-103 Moisture Content	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)
EB1919840-001	24-Jul-2019 14:35	HH_BH01_0.1_190724		✓	✓
EB1919840-002	24-Jul-2019 14:35	HH_BH01_0.5_190724	✓		
EB1919840-003	24-Jul-2019 14:36	HH_BH01_1.0_190724		✓	✓
EB1919840-004	24-Jul-2019 14:36	HH_BH01_1.5_190724	✓		
EB1919840-005	24-Jul-2019 15:38	HH_BH01_2.0_190724	✓		
EB1919840-006	24-Jul-2019 15:39	HH_BH01_3.0_190724	✓		
EB1919840-007	24-Jul-2019 15:39	HH_BH01_4.0_190724	✓		
EB1919840-008	24-Jul-2019 15:40	HH_BH01_3.8_190724	✓		
EB1919840-009	24-Jul-2019 15:40	HH_BH01_5.0_190724	✓		
EB1919840-010	24-Jul-2019 15:43	HH_BH01_6.0_190724	✓		
EB1919840-011	24-Jul-2019 15:46	HH_BH01_7.0_190724	✓		
EB1919840-012	24-Jul-2019 15:46	HH_BH01_8.0_190724	✓		
EB1919840-013	24-Jul-2019 15:47	HH_BH01_9.0_190724		✓	✓
EB1919840-014	24-Jul-2019 15:47	HH_BH01_10.0_190724	✓		
EB1919840-015	24-Jul-2019 15:48	HH_SS1_0.1_190724		✓	✓
EB1919840-016	24-Jul-2019 15:50	HH_SS1_0.5_190724		✓	✓
EB1919840-017	24-Jul-2019 15:50	HH_SS2_0.1_190724		✓	✓
EB1919840-018	24-Jul-2019 16:00	HH_SS4_0.1_190724		✓	✓
EB1919840-019	24-Jul-2019 16:11	HH_SS3_0.1_190724		✓	✓
EB1919840-020	24-Jul-2019 16:12	HH_SS3_0.5_190724		✓	✓
EB1919840-021	24-Jul-2019 16:42	HH_BH02_0.1_190724	✓		
EB1919840-022	24-Jul-2019 16:44	HH_BH02_0.5_190724		✓	✓
EB1919840-023	24-Jul-2019 16:44	HH_BH02_1.0_190724		✓	✓
EB1919840-024	24-Jul-2019 16:45	HH_BH02_1.5_190724	✓		
EB1919840-025	25-Jul-2019 08:40	HH_BH02_2.0_190725	✓		
EB1919840-026	25-Jul-2019 08:41	HH_BH02_3.0_190725	✓		
EB1919840-027	25-Jul-2019 08:41	HH_BH02_4.0_190725	✓		
EB1919840-028	25-Jul-2019 08:42	HH_BH02_5.0_190725	✓		
EB1919840-029	25-Jul-2019 08:42	HH_BH04_6.0_190725	✓		
EB1919840-030	25-Jul-2019 08:43	HH_BH02_7.0_190725	✓		
EB1919840-031	25-Jul-2019 08:53	HH_BH02_8.0_190725	✓		
EB1919840-032	25-Jul-2019 08:54	HH_BH02_9.0_190725		✓	✓
EB1919840-033	25-Jul-2019 08:54	HH_BH02_10.0_190725	✓		
EB1919840-034	25-Jul-2019 09:29	HH_BH03_0.1_190725		✓	✓
EB1919840-035	25-Jul-2019 09:30	HH_BH03_0.5_190725	✓		

			(On Hold) SOIL No analysis requested	SOIL - EA055-103 Moisture Content	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)
EB1919840-036	25-Jul-2019 09:30	HH_BH03_1.0_190725		✓	✓
EB1919840-037	25-Jul-2019 09:30	HH_BH03_1.5_190725	✓		
EB1919840-038	25-Jul-2019 10:42	HH_BH03_2.0_190725	✓		
EB1919840-039	25-Jul-2019 10:43	HH_BH03_3.0_190725	✓		
EB1919840-040	25-Jul-2019 10:43	HH_BH03_4.0_190725	✓		
EB1919840-041	25-Jul-2019 10:44	HH_BH03_5.0_190725	✓		
EB1919840-042	25-Jul-2019 10:44	HH_BH03_6.0_190725	✓		
EB1919840-043	25-Jul-2019 10:44	HH_BH03_7.0_190725	✓		
EB1919840-044	25-Jul-2019 10:45	HH_BH03_8.0_190725	✓		
EB1919840-045	25-Jul-2019 11:05	HH_BH03_9.0_190725		✓	✓
EB1919840-046	25-Jul-2019 11:05	HH_BH03_10.0_190725	✓		
EB1919840-047	25-Jul-2019 11:47	HH_BH04_0.25_190725		✓	✓
EB1919840-048	25-Jul-2019 11:48	HH_BH04_0.5_190725		✓	✓
EB1919840-049	25-Jul-2019 11:48	HH_BH04_1.0_190725	✓		
EB1919840-050	25-Jul-2019 11:49	HH_BH04_1.5_190725	✓		
EB1919840-051	25-Jul-2019 13:10	HH_BH04_2.0_190725	✓		
EB1919840-052	25-Jul-2019 13:11	HH_BH04_3.0_190725	✓		
EB1919840-053	25-Jul-2019 13:11	HH_BH04_4.0_190725	✓		
EB1919840-054	25-Jul-2019 13:14	HH_BH04_5.0_190725	✓		
EB1919840-055	25-Jul-2019 13:14	HH_BH04_6.0-1_190725	✓		
EB1919840-056	25-Jul-2019 13:15	HH_BH04_7.0_190725	✓		
EB1919840-057	25-Jul-2019 13:16	HH_BH04_8.0_190725	✓		
EB1919840-058	25-Jul-2019 13:37	HH_BH04_9.0_190725		✓	✓
EB1919840-059	25-Jul-2019 13:38	HH_BH04_10.0_190725	✓		
EB1919840-060	24-Jul-2019 14:37	HH_QC100_190724		✓	✓
EB1919840-063	24-Jul-2019 15:51	HH_QC101_190724		✓	✓
EB1919840-064	24-Jul-2019 16:45	HH_QC102_190724	✓		
EB1919840-065	25-Jul-2019 08:57	HH_QC103_190725	✓		
EB1919840-067	25-Jul-2019 11:06	HH_QC104_190725	✓		
EB1919840-068	25-Jul-2019 11:47	HH_QC105_190725	✓		

Matrix: **WATER**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	WATER - EP231X-LL (EB) PFAS - Full Suite Low Level (28 analytes)
EB1919840-061	24-Jul-2019 14:47	HH_QC300_190724	✓
EB1919840-062	24-Jul-2019 15:37	HH_QC301_190724	✓
EB1919840-066	25-Jul-2019 09:27	HH_QC302_190725	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS PAYABLE

- A4 - AU Tax Invoice (INV)	Email	AP_CustomerService.ANZ@aecom.com

CAMDEN McCOSKER

- *AU Certificate of Analysis - NATA (COA)	Email	camden.mccosker@aecom.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	camden.mccosker@aecom.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	camden.mccosker@aecom.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	camden.mccosker@aecom.com
- A4 - AU Tax Invoice (INV)	Email	camden.mccosker@aecom.com
- Chain of Custody (CoC) (COC)	Email	camden.mccosker@aecom.com
- EDI Format - ESDAT (ESDAT)	Email	camden.mccosker@aecom.com
- EDI Format - XTab (XTAB)	Email	camden.mccosker@aecom.com

JAMES PEACHEY

- *AU Certificate of Analysis - NATA (COA)	Email	james.peachey@aecom.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	james.peachey@aecom.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	james.peachey@aecom.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	james.peachey@aecom.com
- A4 - AU Tax Invoice (INV)	Email	james.peachey@aecom.com
- Chain of Custody (CoC) (COC)	Email	james.peachey@aecom.com
- EDI Format - ESDAT (ESDAT)	Email	james.peachey@aecom.com
- EDI Format - XTab (XTAB)	Email	james.peachey@aecom.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1919840**	Page	: 1 of 13
Amendment	: **1**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: CAMDEN McCOSKER	Contact	: Carsten Emrich
Address	: Brisbane	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8616
Project	: 60609758_HH	Date Samples Received	: 01-Aug-2019 09:40
Order number	: 60609758 2.0	Date Analysis Commenced	: 01-Aug-2019
C-O-C number	: 2656	Issue Date	: 12-Aug-2019 11:12
Sampler	: CAMDEN McCOSKER		
Site	: ----		
Quote number	: BN/112/19		
No. of samples received	: 68		
No. of samples analysed	: 23		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Minh Wills	2IC Organic Chemist	Brisbane Organics, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP231X: Sample 'HH_QC100_190724' shows poor matrix spike recovery due to matrix interference. Confirmed by re-extraction and re-analysis.
- Amendment (12/08/19): This report has been amended following minor ID formatting corrections. The date has been added to the end of the sample ID. All analysis results are as per the previous report

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	HH_BH01_0.1_190724	HH_BH01_1.0_190724	HH_BH01_9.0_190724	HH_SS1_0.1_190724	HH_SS1_0.5_190724
				Client sampling date / time	24-Jul-2019 14:35	24-Jul-2019 14:36	24-Jul-2019 15:47	24-Jul-2019 15:48	24-Jul-2019 15:50
Compound	CAS Number	LOR	Unit		EB1919840-001	EB1919840-003	EB1919840-013	EB1919840-015	EB1919840-016
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		**6.1**	**7.6**	**3.6**	**7.8**	**6.4**
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0002**	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		**0.0003**	**0.0003**	**0.0003**	**0.0013**	**0.0004**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		**0.0112**	**0.0268**	**0.0009**	**0.0230**	**0.223**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0013**	<0.0002
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		<0.001	<0.001	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0007**	**0.0005**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		<0.0002	**0.0002**	<0.0002	**0.0007**	**0.0004**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0012**	**0.0004**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0009**	**0.0002**
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0011**	**0.0016**
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		**0.0003**	<0.0002	<0.0002	**0.0026**	**0.0005**
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		**0.0003**	<0.0002	<0.0002	**0.0028**	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0005**	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	HH_BH01_0.1_190724	HH_BH01_1.0_190724	HH_BH01_9.0_190724	HH_SS1_0.1_190724	HH_SS1_0.5_190724
				Client sampling date / time	24-Jul-2019 14:35	24-Jul-2019 14:36	24-Jul-2019 15:47	24-Jul-2019 15:48	24-Jul-2019 15:50
Compound	CAS Number	LOR	Unit		EB1919840-001	EB1919840-003	EB1919840-013	EB1919840-015	EB1919840-016
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	**0.0009**	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0121**	**0.0273**	**0.0012**	**0.0372**	**0.227**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0115**	**0.0271**	**0.0012**	**0.0243**	**0.223**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0115**	**0.0273**	**0.0012**	**0.0280**	**0.225**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**79.0**	**90.0**	**94.0**	**86.5**	**83.0**
13C8-PFOA	----	0.0002	%		**97.0**	**94.5**	**96.5**	**95.0**	**95.5**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	HH_SS2_0.1_190724	HH_SS4_0.1_190724	HH_SS3_0.1_190724	HH_SS3_0.5_190724	HH_BH02_0.5_190724
			Client sampling date / time	24-Jul-2019 15:50	24-Jul-2019 16:00	24-Jul-2019 16:11	24-Jul-2019 16:12	24-Jul-2019 16:44
Compound	CAS Number	LOR	Unit	EB1919840-017	EB1919840-018	EB1919840-019	EB1919840-020	EB1919840-022
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**11.0**	**2.8**	**3.5**	**2.7**	**3.6**
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	**0.0005**	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	**0.0076**	**0.0033**	**0.0016**	**0.0025**	**0.0039**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	**0.0047**	<0.0002	<0.0002	<0.0002	<0.0002
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	**0.0003**	<0.0002	**0.0002**	**0.0005**	**0.0002**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	**0.0003**	<0.0002	**0.0003**	**0.0006**	<0.0002
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	**0.0004**	<0.0002	**0.0009**	**0.0011**	**0.0002**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	**0.0004**	**0.0002**	**0.0009**	**0.0007**	<0.0002
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	**0.0004**	**0.0003**	**0.0012**	**0.0011**	**0.0003**
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	**0.0006**	**0.0006**	**0.0048**	**0.0033**	<0.0002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	**0.0008**	**0.0005**	**0.0037**	**0.0023**	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	**0.0002**	<0.0002	**0.0006**	**0.0006**	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	**0.0002**	<0.0002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	HH_SS2_0.1_190724	HH_SS4_0.1_190724	HH_SS3_0.1_190724	HH_SS3_0.5_190724	HH_BH02_0.5_190724
				Client sampling date / time	24-Jul-2019 15:50	24-Jul-2019 16:00	24-Jul-2019 16:11	24-Jul-2019 16:12	24-Jul-2019 16:44
Compound	CAS Number	LOR	Unit		EB1919840-017	EB1919840-018	EB1919840-019	EB1919840-020	EB1919840-022
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	**0.0007**	<0.0005
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	<0.0005	**0.0029**	**0.0061**	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0162**	**0.0049**	**0.0171**	**0.0197**	**0.0046**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0081**	**0.0033**	**0.0016**	**0.0025**	**0.0039**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0095**	**0.0035**	**0.0039**	**0.0061**	**0.0043**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**82.5**	**71.5**	**74.0**	**71.0**	**85.5**
13C8-PFOA	----	0.0002	%		**92.5**	**92.5**	**92.5**	**84.5**	**95.5**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	HH_BH02_1.0_190724	HH_BH02_9.0_190725	HH_BH03_0.1_190725	HH_BH03_1.0_190725	HH_BH03_9.0_190725
				Client sampling date / time	24-Jul-2019 16:44	25-Jul-2019 08:54	25-Jul-2019 09:29	25-Jul-2019 09:30	25-Jul-2019 11:05
Compound	CAS Number	LOR	Unit		EB1919840-023	EB1919840-032	EB1919840-034	EB1919840-036	EB1919840-045
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		**4.2**	**4.1**	**6.0**	**5.4**	**4.3**
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		<0.0002	<0.0002	**0.0008**	**0.0002**	**0.0109**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	**0.0008**
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		**0.0023**	**0.0002**	**0.0115**	**0.0665**	**0.0330**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<0.0002	<0.0002	**0.0015**	<0.0002	<0.0002
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		<0.001	<0.001	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		**0.0002**	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		<0.0002	<0.0002	**0.0002**	<0.0002	**0.0008**
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		**0.0002**	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg		<0.0002	<0.0002	**0.0004**	<0.0002	<0.0002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	HH_BH02_1.0_190724	HH_BH02_9.0_190725	HH_BH03_0.1_190725	HH_BH03_1.0_190725	HH_BH03_9.0_190725
				Client sampling date / time	24-Jul-2019 16:44	25-Jul-2019 08:54	25-Jul-2019 09:29	25-Jul-2019 09:30	25-Jul-2019 11:05
Compound	CAS Number	LOR	Unit		EB1919840-023	EB1919840-032	EB1919840-034	EB1919840-036	EB1919840-045
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0027**	**0.0002**	**0.0144**	**0.0667**	**0.0455**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0023**	**0.0002**	**0.0123**	**0.0667**	**0.0439**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0025**	**0.0002**	**0.0125**	**0.0667**	**0.0447**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**89.5**	**87.5**	**86.5**	**87.0**	**94.5**
13C8-PFOA	----	0.0002	%		**96.0**	**97.0**	**93.0**	**94.0**	**103**

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	HH_BH04_0.25_190725	HH_BH04_0.5_190725	HH_BH04_9.0_190725	HH_QC100_190724	HH_QC101_190724
				Client sampling date / time	25-Jul-2019 11:47	25-Jul-2019 11:48	25-Jul-2019 13:37	24-Jul-2019 14:37	24-Jul-2019 15:51
					EB1919840-047	EB1919840-048	EB1919840-058	EB1919840-060	EB1919840-063
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		**7.7**	**8.2**	**5.3**	**6.4**	**6.8**
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		<0.0002	**0.0005**	**0.0006**	<0.0002	**0.0003**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		<0.0002	**0.0006**	<0.0002	<0.0002	<0.0002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		**0.0217**	**0.0193**	**0.0006**	**0.0067**	**0.186**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		<0.001	<0.001	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	**0.0004**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		**0.0002**	<0.0002	<0.0002	<0.0002	**0.0003**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	**0.0003**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	**0.0016**
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	**0.0004**
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0002**	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	HH_BH04_0.25_190725	HH_BH04_0.5_190725	HH_BH04_9.0_190725	HH_QC100_190724	HH_QC101_190724
				Client sampling date / time	25-Jul-2019 11:47	25-Jul-2019 11:48	25-Jul-2019 13:37	24-Jul-2019 14:37	24-Jul-2019 15:51
Compound	CAS Number	LOR	Unit		EB1919840-047	EB1919840-048	EB1919840-058	EB1919840-060	EB1919840-063
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0219**	**0.0204**	**0.0012**	**0.0069**	**0.189**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0217**	**0.0198**	**0.0012**	**0.0067**	**0.186**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0219**	**0.0198**	**0.0012**	**0.0067**	**0.187**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**89.5**	**92.0**	**104**	**71.0**	**73.5**
13C8-PFOA	----	0.0002	%		**94.0**	**97.5**	**104**	**78.5**	**77.5**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	HH_QC300_190724	HH_QC301_190724	HH_QC302_190725	----	----
				Client sampling date / time	24-Jul-2019 14:47	24-Jul-2019 15:37	25-Jul-2019 09:27	----	----
Compound	CAS Number	LOR	Unit		EB1919840-061	EB1919840-062	EB1919840-066	--------	--------
					Result	Result	Result	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L		<0.002	<0.002	<0.002	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L		<0.01	<0.01	<0.01	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L		<0.005	<0.005	<0.005	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L		<0.002	<0.002	<0.002	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L		<0.005	<0.005	<0.005	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L		<0.005	<0.005	<0.005	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	HH_QC300_190724	HH_QC301_190724	HH_QC302_190725	----	----
				Client sampling date / time	24-Jul-2019 14:47	24-Jul-2019 15:37	25-Jul-2019 09:27	----	----
Compound	CAS Number	LOR	Unit		EB1919840-061	EB1919840-062	EB1919840-066	--------	--------
					Result	Result	Result	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L		<0.005	<0.005	<0.005	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L		<0.005	<0.005	<0.005	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L		<0.002	<0.002	<0.002	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L		<0.002	<0.002	<0.002	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L		<0.005	<0.005	<0.005	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L		<0.005	<0.005	<0.005	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L		<0.005	<0.005	<0.005	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L		<0.005	<0.005	<0.005	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L		<0.002	<0.002	<0.002	----	----
Sum of PFAS (WA DER List)	----	0.002	µg/L		<0.002	<0.002	<0.002	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.002	%		**86.6**	**80.0**	**79.7**	----	----
13C8-PFOA	----	0.002	%		**97.5**	**102**	**99.4**	----	----

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231S: PFAS Surrogate			
13C4-PFOS	----	70	130
13C8-PFOA	----	70	130

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231S: PFAS Surrogate			
13C4-PFOS	----	70	130
13C8-PFOA	----	70	130

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EB1919840**	Page	: 1 of 16
Amendment	: **1**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: CAMDEN McCOSKER	Contact	: Carsten Emrich
Address	: Brisbane	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: +61 7 3552 8616
Project	: 60609758_HH	Date Samples Received	: 01-Aug-2019
Order number	: 60609758 2.0	Date Analysis Commenced	: 01-Aug-2019
C-O-C number	: 2656	Issue Date	: 12-Aug-2019
Sampler	: CAMDEN McCOSKER		
Site	: ----		
Quote number	: BN/112/19		
No. of samples received	: 68		
No. of samples analysed	: 23		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Minh Wills	2IC Organic Chemist	Brisbane Organics, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2501989)									
EB1919839-001	Anonymous	EA055: Moisture Content	----	0.1	%	13.8	14.1	2.41	0% - 20%
EB1919839-027	Anonymous	EA055: Moisture Content	----	0.1	%	5.7	5.5	4.13	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2501990)									
EB1919840-013	HH_BH01_9.0_190724	EA055: Moisture Content	----	0.1	%	3.6	3.6	0.00	0% - 20%
EB1919840-034	HH_BH03_0.1_190725	EA055: Moisture Content	----	0.1	%	6.0	5.9	2.36	0% - 20%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2501993)									
EB1919839-046	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	0.0013	0.0014	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0413	0.0451	8.75	0% - 20%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EB1919840-019	HH_SS3_0.1_190724	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0016	0.0015	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2501997)									
EB1919840-063	HH_QC101_190724	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	0.0003	0.0004	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.186	0.207	10.8	0% - 20%

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2501997) - continued									
EB1919840-063	HH_QC101_190724	EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EB1919842-019	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	0.0013	0.0015	14.8	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0144	0.0151	5.40	0% - 20%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2501993)									
EB1919839-046	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	0.0006	0.0006	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EB1919840-019	HH_SS3_0.1_190724	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.0003	0.0003	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0009	0.0008	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0009	0.0008	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	0.0012	0.0011	9.84	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	0.0048	0.0044	8.26	0% - 20%
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	0.0037	0.0035	5.04	0% - 50%
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	0.0006	0.0006	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2501997)									
EB1919840-063	HH_QC101_190724	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0004	0.0005	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.0003	0.0003	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0003	0.0003	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	0.0016	0.0017	6.91	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	0.0004	0.0004	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2501997) - continued									
EB1919840-063	HH_QC101_190724	EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EB1919842-019	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	0.0004	0.0004	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2501993)									
EB1919839-046	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EB1919840-019	HH_SS3_0.1_190724	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2501997)									

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2501997) - continued									
EB1919840-063	HH_QC101_190724	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EB1919842-019	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2501993)									
EB1919839-046	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EB1919840-019	HH_SS3_0.1_190724	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2501993) - continued									
EB1919840-019	HH_SS3_0.1_190724	EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	0.0029	0.0027	7.53	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2501997)									
EB1919840-063	HH_QC101_190724	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EB1919842-019	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2501826)									
EB1919838-042	Anonymous	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002	0.00	No Limit
EB1919842-038	Anonymous	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2501826) - continued									
EB1919842-038	Anonymous	EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2501826)									
EB1919838-042	Anonymous	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.01	0.00	No Limit
EB1919842-038	Anonymous	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.01	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2501826)									
EB1919838-042	Anonymous	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2501826) - continued									
EB1919838-042	Anonymous	EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
EB1919842-038	Anonymous	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2501826)									
EB1919838-042	Anonymous	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	<0.005	0.00	No Limit
EB1919842-038	Anonymous	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	<0.005	0.00	No Limit
EP231P: PFAS Sums (QC Lot: 2501826)									
EB1919838-042	Anonymous	EP231X-LL: Sum of PFAS	----	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Sum of PFAS (WA DER List)	----	0.002	µg/L	<0.002	<0.002	0.00	No Limit
EB1919842-038	Anonymous	EP231X-LL: Sum of PFAS	----	0.002	µg/L	<0.002	<0.002	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231P: PFAS Sums (QC Lot: 2501826) - continued									
EB1919842-038	Anonymous	EP231X-LL: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: Sum of PFAS (WA DER List)	----	0.002	µg/L	<0.002	<0.002	0.00	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2501993)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.0011 mg/kg	96.8	57	121
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00117 mg/kg	99.1	55	125
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00118 mg/kg	99.2	52	126
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00119 mg/kg	92.8	54	123
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00116 mg/kg	87.9	55	127
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.0012 mg/kg	100	54	125
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2501997)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.0011 mg/kg	79.1	57	121
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00117 mg/kg	81.2	55	125
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00118 mg/kg	79.7	52	126
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00119 mg/kg	75.2	54	123
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00116 mg/kg	70.7	55	127
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.0012 mg/kg	103	54	125
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2501993)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	67.0	52	128
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	85.2	54	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	91.2	58	127
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	88.0	57	128
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	91.6	60	134
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	81.2	63	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	83.6	55	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	87.2	62	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	84.8	53	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	72.4	49	129
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	81.4	59	129
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2501997)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	59.4	52	128
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	80.4	54	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	79.6	58	127
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	76.4	57	128
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	74.4	60	134
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	72.0	63	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	72.0	55	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	71.2	62	130

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2501997) - continued								
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	69.2	53	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	72.0	49	129
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	68.4	59	129
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2501993)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	85.6	52	132
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	86.5	65	126
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	84.1	64	126
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	70.4	63	124
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	80.9	58	125
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	86.0	61	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	82.4	55	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2501997)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	68.8	52	132
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	68.8	65	126
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	93.8	64	126
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	68.4	63	124
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	89.9	58	125
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	72.0	61	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	76.4	55	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2501993)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00116 mg/kg	95.7	54	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00118 mg/kg	92.8	61	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00119 mg/kg	100	62	130
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.0012 mg/kg	118	60	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2501997)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00116 mg/kg	88.4	54	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00118 mg/kg	77.1	61	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00119 mg/kg	77.3	62	130
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.0012 mg/kg	102	60	130

Sub-Matrix: **WATER**

Method Blank (MB) Report	Laboratory Control Spike (LCS) Report: Spike	Spike Recovery (%)	Recovery Limits (%)

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2501826)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.0442 µg/L	91.2	50	130
EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	0.0469 µg/L	79.7	50	130
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.0473 µg/L	82.9	50	130
EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	0.0476 µg/L	82.1	50	130
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.0464 µg/L	58.2	50	130
EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	0.0482 µg/L	61.8	40	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2501826)								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	0.25 µg/L	76.3	50	130
EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	0.05 µg/L	81.0	50	130
EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	0.05 µg/L	87.0	50	130
EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	0.05 µg/L	84.6	50	130
EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.05 µg/L	82.2	50	130
EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	0.05 µg/L	74.6	50	130
EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	0.05 µg/L	70.0	50	130
EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	0.05 µg/L	60.6	40	130
EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	0.05 µg/L	60.6	40	130
EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	0.05 µg/L	68.4	40	130
EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	0.125 µg/L	74.6	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2501826)								
EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	0.05 µg/L	76.2	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	0.125 µg/L	68.6	40	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	0.125 µg/L	61.5	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	0.125 µg/L	51.8	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	0.125 µg/L	62.4	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	0.05 µg/L	62.6	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	0.05 µg/L	57.0	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2501826)								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	0.0467 µg/L	91.6	50	130
EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	0.0474 µg/L	85.2	50	130
EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	0.0479 µg/L	72.2	50	130
EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	0.0482 µg/L	54.1	50	130
EP231P: PFAS Sums (QCLot: 2501826)								
EP231X-LL: Sum of PFAS	----	0.002	µg/L	<0.002	----	----	----	----

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231P: PFAS Sums (QCLot: 2501826) - continued								
EP231X-LL: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Sum of PFAS (WA DER List)	----	0.002	µg/L	<0.002	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2501993)							
EB1919839-050	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	83.6	57	121
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	88.8	55	125
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	95.2	52	126
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	91.2	54	123
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	# Not Determined	55	127
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	92.8	54	125
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2501997)							
EB1919840-060	HH_QC100_190724	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	65.6	57	121
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	71.2	55	125
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	73.6	52	126
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	60.4	54	123
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	# Not Determined	55	127
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	64.8	54	125
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2501993)							
EB1919839-050	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	72.3	52	128
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	103	54	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	103	58	127
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	97.6	57	128
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	100	60	134
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	86.8	63	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	96.8	55	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	91.2	62	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	87.2	53	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	73.6	49	129
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	80.9	59	129

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2501997)							
EB1919840-060	HH_QC100_190724	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	57.9	52	128
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	81.2	54	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	79.6	58	127
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	84.8	57	128
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	73.2	60	134
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	66.0	63	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	72.0	55	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	64.4	62	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	56.8	53	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	53.2	49	129
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	# 51.9	59	129
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2501993)							
EB1919839-050	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	107	52	132
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	87.8	65	126
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	85.7	64	126
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	76.9	63	124
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	86.5	58	125
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	88.0	61	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	86.0	55	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2501997)							
EB1919840-060	HH_QC100_190724	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	70.8	52	132
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	79.3	65	126
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	80.0	64	126
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	# 50.8	63	124
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	65.7	58	125
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	74.0	61	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	63.2	55	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2501993)							
EB1919839-050	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	90.4	54	130

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2501993) - continued							
EB1919839-050	Anonymous	EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	92.8	61	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	94.0	62	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	94.8	60	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2501997)							
EB1919840-060	HH_QC100_190724	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	72.8	54	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	69.2	61	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	77.2	62	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	86.4	60	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2501826)							
EB1919838-043	Anonymous	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.05 µg/L	73.8	50	130
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.05 µg/L	73.0	50	130
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.05 µg/L	76.4	50	130
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.05 µg/L	75.0	50	130
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.05 µg/L	68.6	50	130
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.05 µg/L	57.6	40	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2501826)							
EB1919838-043	Anonymous	EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.25 µg/L	71.8	50	130
		EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.05 µg/L	75.4	50	130
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.05 µg/L	81.6	50	130
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.05 µg/L	79.8	50	130
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.05 µg/L	78.2	50	130
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.05 µg/L	71.0	50	130
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.05 µg/L	66.4	50	130
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.05 µg/L	53.6	40	130
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.05 µg/L	55.0	40	130
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.05 µg/L	74.8	40	130
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.125 µg/L	61.8	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2501826)							
EB1919838-043	Anonymous	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.05 µg/L	63.6	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.125 µg/L	59.9	40	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.125 µg/L	52.2	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.125 µg/L	51.0	50	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2501826) - continued							
EB1919838-043	Anonymous	EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.125 µg/L	57.1	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.05 µg/L	52.8	50	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.05 µg/L	51.0	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2501826)							
EB1919838-043	Anonymous	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05 µg/L	81.4	50	130
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05 µg/L	78.0	50	130
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05 µg/L	69.0	50	130
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05 µg/L	52.4	50	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB1919840**	Page	: 1 of 8
Amendment	: **1**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: CAMDEN McCOSKER	Telephone	: +61 7 3552 8616
Project	: 60609758_HH	Date Samples Received	: 01-Aug-2019
Site	: ----	Issue Date	: 12-Aug-2019
Sampler	: CAMDEN McCOSKER	No. of samples received	: 68
Order number	: 60609758 2.0	No. of samples analysed	: 23

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	EB1919839--050	Anonymous	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231A: Perfluoroalkyl Sulfonic Acids	EB1919840--060	HH_QC100_190724	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	EB1919840--060	HH_QC100_190724	**Perfluorotetradecanoic acid (PFTeDA)**	376-06-7	51.9 %	59-129%	**Recovery less than lower data quality objective**
EP231C: Perfluoroalkyl Sulfonamides	EB1919840--060	HH_QC100_190724	**N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)**	24448-09-7	50.8 %	63-124%	**Recovery less than lower data quality objective**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
HDPE Soil Jar (EA055) HH_BH01_0.1_190724, HH_BH01_1.0_190724, HH_BH01_9.0_190724, HH_SS1_0.1_190724, HH_SS1_0.5_190724, HH_SS2_0.1_190724, HH_SS4_0.1_190724, HH_SS3_0.1_190724, HH_SS3_0.5_190724, HH_BH02_0.5_190724, HH_BH02_1.0_190724, HH_QC100_190724, HH_QC101_190724	**24-Jul-2019**	**----**	----	----	**01-Aug-2019**	07-Aug-2019	✓
HDPE Soil Jar (EA055) HH_BH02_9.0_190725, HH_BH03_0.1_190725, HH_BH03_1.0_190725, HH_BH03_9.0_190725, HH_BH04_0.25_190725, HH_BH04_0.5_190725, HH_BH04_9.0_190725	**25-Jul-2019**	**----**	----	----	**01-Aug-2019**	08-Aug-2019	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X) HH_BH01_0.1_190724, HH_BH01_1.0_190724, HH_BH01_9.0_190724, HH_SS1_0.1_190724, HH_SS1_0.5_190724, HH_SS2_0.1_190724, HH_SS4_0.1_190724, HH_SS3_0.1_190724, HH_SS3_0.5_190724, HH_BH02_0.5_190724, HH_BH02_1.0_190724	**24-Jul-2019**	**02-Aug-2019**	20-Jan-2020	✓	**05-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) HH_QC100_190724, HH_QC101_190724	**24-Jul-2019**	**03-Aug-2019**	20-Jan-2020	✓	**05-Aug-2019**	12-Sep-2019	✓
HDPE Soil Jar (EP231X) HH_BH02_9.0_190725, HH_BH03_0.1_190725, HH_BH03_1.0_190725, HH_BH03_9.0_190725, HH_BH04_0.25_190725, HH_BH04_0.5_190725	**25-Jul-2019**	**02-Aug-2019**	21-Jan-2020	✓	**05-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) HH_BH04_9.0_190725	**25-Jul-2019**	**03-Aug-2019**	21-Jan-2020	✓	**05-Aug-2019**	12-Sep-2019	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X) HH_BH01_0.1_190724, HH_BH01_1.0_190724, HH_BH01_9.0_190724, HH_SS1_0.1_190724, HH_SS1_0.5_190724, HH_SS2_0.1_190724, HH_SS4_0.1_190724, HH_SS3_0.1_190724, HH_SS3_0.5_190724, HH_BH02_0.5_190724, HH_BH02_1.0_190724	**24-Jul-2019**	**02-Aug-2019**	20-Jan-2020	✓	**05-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) HH_QC100_190724, HH_QC101_190724	**24-Jul-2019**	**03-Aug-2019**	20-Jan-2020	✓	**05-Aug-2019**	12-Sep-2019	✓
HDPE Soil Jar (EP231X) HH_BH02_9.0_190725, HH_BH03_0.1_190725, HH_BH03_1.0_190725, HH_BH03_9.0_190725, HH_BH04_0.25_190725, HH_BH04_0.5_190725	**25-Jul-2019**	**02-Aug-2019**	21-Jan-2020	✓	**05-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) HH_BH04_9.0_190725	**25-Jul-2019**	**03-Aug-2019**	21-Jan-2020	✓	**05-Aug-2019**	12-Sep-2019	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X) HH_BH01_0.1_190724, HH_BH01_1.0_190724, HH_BH01_9.0_190724, HH_SS1_0.1_190724, HH_SS1_0.5_190724, HH_SS2_0.1_190724, HH_SS4_0.1_190724, HH_SS3_0.1_190724, HH_SS3_0.5_190724, HH_BH02_0.5_190724, HH_BH02_1.0_190724	**24-Jul-2019**	**02-Aug-2019**	20-Jan-2020	✓	**05-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) HH_QC100_190724, HH_QC101_190724	**24-Jul-2019**	**03-Aug-2019**	20-Jan-2020	✓	**05-Aug-2019**	12-Sep-2019	✓
HDPE Soil Jar (EP231X) HH_BH02_9.0_190725, HH_BH03_0.1_190725, HH_BH03_1.0_190725, HH_BH03_9.0_190725, HH_BH04_0.25_190725, HH_BH04_0.5_190725	**25-Jul-2019**	**02-Aug-2019**	21-Jan-2020	✓	**05-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) HH_BH04_9.0_190725	**25-Jul-2019**	**03-Aug-2019**	21-Jan-2020	✓	**05-Aug-2019**	12-Sep-2019	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X) HH_BH01_0.1_190724, HH_BH01_1.0_190724, HH_BH01_9.0_190724, HH_SS1_0.1_190724, HH_SS1_0.5_190724, HH_SS2_0.1_190724, HH_SS4_0.1_190724, HH_SS3_0.1_190724, HH_SS3_0.5_190724, HH_BH02_0.5_190724, HH_BH02_1.0_190724	**24-Jul-2019**	**02-Aug-2019**	20-Jan-2020	✓	**05-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) HH_QC100_190724, HH_QC101_190724	**24-Jul-2019**	**03-Aug-2019**	20-Jan-2020	✓	**05-Aug-2019**	12-Sep-2019	✓
HDPE Soil Jar (EP231X) HH_BH02_9.0_190725, HH_BH03_0.1_190725, HH_BH03_1.0_190725, HH_BH03_9.0_190725, HH_BH04_0.25_190725, HH_BH04_0.5_190725	**25-Jul-2019**	**02-Aug-2019**	21-Jan-2020	✓	**05-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) HH_BH04_9.0_190725	**25-Jul-2019**	**03-Aug-2019**	21-Jan-2020	✓	**05-Aug-2019**	12-Sep-2019	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X) HH_BH01_0.1_190724, HH_BH01_1.0_190724, HH_BH01_9.0_190724, HH_SS1_0.1_190724, HH_SS1_0.5_190724, HH_SS2_0.1_190724, HH_SS4_0.1_190724, HH_SS3_0.1_190724, HH_SS3_0.5_190724, HH_BH02_0.5_190724, HH_BH02_1.0_190724	**24-Jul-2019**	**02-Aug-2019**	20-Jan-2020	✓	**05-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) HH_QC100_190724, HH_QC101_190724	**24-Jul-2019**	**03-Aug-2019**	20-Jan-2020	✓	**05-Aug-2019**	12-Sep-2019	✓
HDPE Soil Jar (EP231X) HH_BH02_9.0_190725, HH_BH03_0.1_190725, HH_BH03_1.0_190725, HH_BH03_9.0_190725, HH_BH04_0.25_190725, HH_BH04_0.5_190725	**25-Jul-2019**	**02-Aug-2019**	21-Jan-2020	✓	**05-Aug-2019**	11-Sep-2019	✓
HDPE Soil Jar (EP231X) HH_BH04_9.0_190725	**25-Jul-2019**	**03-Aug-2019**	21-Jan-2020	✓	**05-Aug-2019**	12-Sep-2019	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) HH_QC300_190724, HH_QC301_190724	**24-Jul-2019**	**01-Aug-2019**	20-Jan-2020	✓	**01-Aug-2019**	20-Jan-2020	✓
HDPE (no PTFE) (EP231X-LL) HH_QC302_190725	**25-Jul-2019**	**01-Aug-2019**	21-Jan-2020	✓	**01-Aug-2019**	21-Jan-2020	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X-LL) HH_QC300_190724, HH_QC301_190724	**24-Jul-2019**	**01-Aug-2019**	20-Jan-2020	✓	**01-Aug-2019**	20-Jan-2020	✓
HDPE (no PTFE) (EP231X-LL) HH_QC302_190725	**25-Jul-2019**	**01-Aug-2019**	21-Jan-2020	✓	**01-Aug-2019**	21-Jan-2020	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X-LL) HH_QC300_190724, HH_QC301_190724	**24-Jul-2019**	**01-Aug-2019**	20-Jan-2020	✓	**01-Aug-2019**	20-Jan-2020	✓
HDPE (no PTFE) (EP231X-LL) HH_QC302_190725	**25-Jul-2019**	**01-Aug-2019**	21-Jan-2020	✓	**01-Aug-2019**	21-Jan-2020	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) HH_QC300_190724, HH_QC301_190724	**24-Jul-2019**	**01-Aug-2019**	20-Jan-2020	✓	**01-Aug-2019**	20-Jan-2020	✓
HDPE (no PTFE) (EP231X-LL) HH_QC302_190725	**25-Jul-2019**	**01-Aug-2019**	21-Jan-2020	✓	**01-Aug-2019**	21-Jan-2020	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X-LL)							
HH_QC300_190724, HH_QC301_190724	**24-Jul-2019**	**01-Aug-2019**	20-Jan-2020	✓	**01-Aug-2019**	20-Jan-2020	✓
HDPE (no PTFE) (EP231X-LL)							
HH_QC302_190725	**25-Jul-2019**	**01-Aug-2019**	21-Jan-2020	✓	**01-Aug-2019**	21-Jan-2020	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	4	38	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	4	39	**10.26**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	39	**5.13**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	39	**5.13**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	39	**5.13**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-House. A portion of soil is extracted with MTBE. The extract is taken to dryness, made up in mobile phase. Analysis is by LC/MSMS, ESI Negative Mode using MRM. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	WATER	In-house: Analysis of fresh and saline waters by solid phase extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1

Preparation Methods	Method	Matrix	Method Descriptions
Sample Extraction for PFAS	EP231-PR	SOIL	In house
SPE preparation for LL and saline PFCs	EP231-SPE	WATER	In house

CHAIN OF CUSTODY

ALS Environmental

ALS Laboratory: please tick →

☐ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com
☐BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
☐MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
☐NEWCASTLE 5/585 Maitland Rd Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com
☐NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com
☐PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT: AECOM Pty Ltd	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☑ Standard TAT (List due date): 5 Day ☐ Non Standard or urgent TAT (List due date):
OFFICE: Brisbane		
PROJECT: 60609758 2.0	ALS QUOTE NO.: BN/112/19	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7
ORDER NUMBER:	AECOM6/190802/2	
PROJECT MANAGER: James Peachey	CONTACT PH: 0426 206 362	Due 09/09/08/19
SAMPLER: Camden McCosker	SAMPLER MOBILE: 0499 990 214	
COC emailed to ALS? (YES / NO)	EDD FORMAT (or default):	
Email Reports to (will default to PM if no other addresses are listed):		
Email Invoice to (will default to PM if no other addresses are listed):		

FOR LABORATORY USE ONLY (Circle)			
Custody Seal Intact?	Yes	No	N/A
Free ice / frozen ice bricks present upon receipt?	Yes	No	N/A
Random Sample Temperature on Receipt:		°C	
Other comment:			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Camden			
DATE/TIME: 31/7/19 0940	DATE/TIME:	DATE/TIME: 1/8/19	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: Please forward to NMI with this COC

ALS USE	SAMPLE DETAILS MATRIX: SOLID (S) WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED Including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).							Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EP231X (PFAS 28)		EP231X-ST (PFAS 28 super trace)	EP231X-LL (low level)			HOLD	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
	HH-QC200-190724	24/7/19	S	IP	1	✓				N19/019402			Forward to NMI
	HH-QC201-190724	"	"	"	1	✓				N19/019403			"
	HH-QC202-190724	"	"	IP	1					N19/019404		✓	"
	HH-QC203-190725	25/7/19	"	"	1					N19/019405		✓	"
	HH-QC204-190725	"	"	"	1					N19/019406		✓	"
	HH-QC205-190725	"	"	"	1					N19/019407		✓	"
				TOTAL									

RECEIVED
02 AUG 2019
BY: Am 13:08

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

Australian Government
Department of Industry, Innovation and Science

National Measurement Institute

SAMPLE RECEIPT NOTIFICATION

CUSTOMER DETAILS

Attention: JAMES PEACHEY

Customer: AECOM AUSTRALIA PTY LTD

Address: LEVEL 8
FORTITUDE VALLEY QLD 4006

Email: james.peachey@aecom.com

Telephone:

Fax:

LABORATORY DETAILS

Lab: National Measurement Institute

Contact: Susanne Neuman

Address: 105 Delhi Road, North Ryde, NSW
NSW 2113

Email: Susanne.Neuman@measurement.gov.au

Telephone: 02 9449 0181

Fax:

SAMPLE DETAILS

NMI Job Name: **AECO06/190802/2**

Total No. of Samples: **6**

LRNs	Customer Sample ID	Lab Sample Description
N19/019402	HH-QC200-190724	SOIL
N19/019403	HH-QC201-190724	SOIL
N19/019404	HH-QC202-190724	SOIL
N19/019405	HH-QC203-190725	SOIL
N19/019406	HH-QC204-190725	SOIL
N19/019407	HH-QC205-190725	SOIL

SAMPLE RECEIVED CONDITION

Date samples received:	2-AUG-2019
Sample received in good order:	Yes
NMI Quotation no. provided:	
Client purchase order number:	60609758_2_0
Temperature of samples:	Chilled
Comments:	Sample N19/019404-07 on hold
Estimated report date:	9-AUG-2019
Mode of Delivery:	Courier

Additional Terms and Conditions

Incomplete / unclear information about samples or required testing will delay the start of the analysis work

If you require your Purchase Order (PO) number to be included on our invoice, please provide the number during sample submission and before the completion of work to avoid unnecessary delays and/or additional processing/handling fees.

The lodgement of an order or receipt of samples for NMI services referenced in this Sample Receipt Notification constitutes an acceptence of the current version of NMI Terms and Conditions or other applicable Terms referenced in the NMI Quotation. NMI Terms and Conditions are available on the web at http://www.measurement.gov.au/Services/EnvironmentalTesting/Pages/Terms-and-Conditions.aspx

REPORT OF ANALYSIS

Report No. RN1242618

Client	: AECOM AUSTRALIA PTY LTD	**Job No.**	: AECO06/190802/2
	LEVEL 8	**Quote No.**	: QT-02018
	540 WICKHAM STREET	**Order No.**	: 60609758_2_0
		Date Received	: 02-AUG-2019
Attention	: JAMES PEACHEY	**Sampled By**	: CLIENT
Project Name	: 60609758 2.0		
Your Client Services Manager	: Richard Coghlan	**Phone**	: 02 9449 0161

Lab Reg No.	Sample Ref	Sample Description
N19/019402	HH-QC200-190724	SOIL
N19/019403	HH-QC201-190724	SOIL

Lab Reg No.		N19/019402	N19/019403			
Date Sampled		24-JUL-2019	24-JUL-2019			
	Units					Method
PFAS (per-and poly-fluoroalkyl substances)						
PFBA (375-22-4)	mg/kg	<0.002	<0.002			NR70
PFPeA (2706-90-3)	mg/kg	<0.002	<0.002			NR70
PFHxA (307-24-4)	mg/kg	<0.001	<0.001			NR70
PFHpA (375-85-9)	mg/kg	<0.001	<0.001			NR70
PFOA (335-67-1)	mg/kg	<0.001	<0.001			NR70
PFNA (375-95-1)	mg/kg	<0.001	0.0022			NR70
PFDA (335-76-2)	mg/kg	<0.001	<0.001			NR70
PFUdA (2058-94-8)	mg/kg	<0.002	<0.002			NR70
PFDoA (307-55-1)	mg/kg	<0.002	<0.002			NR70
PFTrDA (72629-94-8)	mg/kg	<0.002	<0.002			NR70
PFTeDA (376-06-7)	mg/kg	<0.002	<0.002			NR70
PFHxDA (67905-19-5)	mg/kg	<0.002	<0.002			NR70
PFODA (16517-11-6)	mg/kg	<0.005	<0.005			NR70
FOUEA (70887-84-2)	mg/kg	<0.001	<0.001			NR70
PFBS (375-73-5)	mg/kg	<0.001	<0.001			NR70
PFPeS (2706-91-4)	mg/kg	<0.001	<0.001			NR70
PFHxS (355-46-4)	mg/kg	<0.001	<0.001			NR70
PFHpS (375-92-8)	mg/kg	<0.001	<0.001			NR70
PFOS (1763-23-1)	mg/kg	0.013	0.22			NR70
PFNS (68259-12-1)	mg/kg	<0.001	<0.001			NR70
PFDS (335-77-3)	mg/kg	<0.001	<0.001			NR70
PFOSA (754-91-6)	mg/kg	<0.001	<0.001			NR70
N-MeFOSA (31506-32-8)	mg/kg	<0.002	<0.002			NR70
N-EtFOSA (4151-50-2)	mg/kg	<0.002	<0.002			NR70
N-MeFOSAA (2355-31-9)	mg/kg	<0.002	<0.002			NR70
N-EtFOSAA(2991-50-6)	mg/kg	<0.002	<0.002			NR70
N-MeFOSE (24448-09-7)	mg/kg	<0.005	<0.005			NR70
N-EtFOSE (1691-99-2)	mg/kg	<0.005	<0.005			NR70

REPORT OF ANALYSIS

Lab Reg No.		N19/019402	N19/019403			
Date Sampled		24-JUL-2019	24-JUL-2019			
	Units					Method
PFAS (per-and poly-fluoroalkyl substances)						
4:2 FTS (757124-72-4)	mg/kg	<0.001	<0.001			NR70
6:2 FTS (27619-97-2)	mg/kg	<0.001	<0.001			NR70
8:2 FTS (39108-34-4)	mg/kg	<0.001	<0.001			NR70
10:2 FTS (120226-60-0)	mg/kg	<0.002	<0.002			NR70
8:2 diPAP (678-41-1)	mg/kg	<0.002	<0.002			NR70
PFBA (Surrogate Recovery)	%	122	113			NR70
PFPeA (Surrogate Recovery)	%	116	124			NR70
PFHxA (Surrogate Recovery)	%	109	123			NR70
PFHpA (Surrogate Recovery)	%	106	119			NR70
PFOA (Surrogate Recovery)	%	123	125			NR70
PFNA (Surrogate Recovery)	%	114	108			NR70
PFDA (Surrogate Recovery)	%	123	124			NR70
PFUdA (Surrogate Recovery)	%	114	120			NR70
PFDoA (Surrogate Recovery)	%	118	129			NR70
PFTeDA (Surrogate Recovery)	%	135	118			NR70
PFHxDA (Surrogate Recovery)	%	161	167			NR70
FOUEA (Surrogate Recovery)	%	59	32			NR70
PFBS (Surrogate Recovery)	%	113	120			NR70
PFHxS (Surrogate Recovery)	%	113	113			NR70
PFOS (Surrogate Recovery)	%	128	122			NR70
PFOSA (Surrogate Recovery)	%	114	116			NR70
N-MeFOSA (Surrogate Recovery)	%	128	135			NR70
N-EtFOSA (Surrogate Recovery)	%	122	127			NR70
N-MeFOSAA (Surrogate Recovery)	%	110	113			NR70
N-EtFOSAA (Surrogate Recovery)	%	111	98			NR70
N-MeFOSE (Surrogate Recovery)	%	89	148			NR70
N-EtFOSE (Surrogate Recovery)	%	126	146			NR70
4:2 FTS (Surrogate Recovery)	%	86	83			NR70
6:2 FTS (Surrogate Recovery)	%	85	86			NR70
8:2 FTS (Surrogate Recovery)	%	88	93			NR70
8:2 diPAP (Surrogate Recovery)	%	62	52			NR70
Dates						
Date extracted		6-AUG-2019	6-AUG-2019			
Date analysed		12-AUG-2019	12-AUG-2019			

N19/019402
To N19/019403

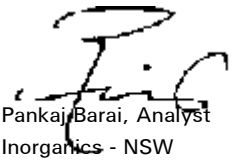
REPORT OF ANALYSIS

PFOS is quantified using a combined branched and linear standard,
linear and branched isomers are totalled for reporting.
All results corrected for labelled surrogate recoveries.
Selected PFAS surrogate recoveries are biased due to matrix effects.

Danny Slee, Section Manager
Organic - NSW
Accreditation No. 198

13-AUG-2019

Lab Reg No.		**N19/019402**	**N19/019403**			
Date Sampled		**24-JUL-2019**	**24-JUL-2019**			
	Units					**Method**
Trace Elements						
Total Solids	%	92.7	93.4			NT2_49



Pankaj Barai, Analyst
Inorganics - NSW
Accreditation No. 198

13-AUG-2019

All results are expressed on a dry weight basis.

NATA
ACCREDITED FOR
TECHNICAL
COMPETENCE

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This report shall not be reproduced except in full.
Results relate only to the sample(s) tested.

REPORT OF ANALYSIS

This Report supersedes reports: *RN1242286* *RN1242606*

Measurement Uncertainty is available upon request.
Chemical Accreditation 198: 105 Delhi Road, North Ryde, NSW, 2113

Australian Government

National Measurement Institute

QUALITY ASSURANCE REPORT

Client: AECOM AUSTRALIA PTY LTD

NMI QA Report No: AECO06/190802/2 **Sample Matrix:** Solid

Analyte	Method	LOR	Blank	Sample Duplicates			Recoveries	
				Sample	Duplicate	RPD	LCS	Matrix Spike
		mg/kg	mg/kg	mg/kg	mg/kg	%	%	%
PFBA (375-22-4)	NR70	0.002	<0.002	NA	NA	NA	114	NA
PFPeA (2706-90-3)	NR70	0.002	<0.002	NA	NA	NA	103	NA
PFHxA (307-24-4)	NR70	0.001	<0.001	NA	NA	NA	108	NA
PFHpA (375-85-9)	NR70	0.001	<0.001	NA	NA	NA	104	NA
PFOA (335-67-1)	NR70	0.001	<0.001	NA	NA	NA	103	NA
PFNA (375-95-1)	NR70	0.001	<0.001	NA	NA	NA	115	NA
PFDA (335-76-2)	NR70	0.001	<0.001	NA	NA	NA	108	NA
PFUdA (2058-94-8)	NR70	0.002	<0.002	NA	NA	NA	108	NA
PFDoA (307-55-1)	NR70	0.002	<0.002	NA	NA	NA	104	NA
PFTrDA (72629-94-8)	NR70	0.002	<0.002	NA	NA	NA	100	NA
PFTeDA (376-06-7)	NR70	0.002	<0.002	NA	NA	NA	118	NA
PFHxDA (67905-19-5)	NR70	0.002	<0.002	NA	NA	NA	91	NA
PFODA (16517-11-6)	NR70	0.005	<0.005	NA	NA	NA	99	NA
FOUEA (70887-84-2)	NR70	0.001	<0.001	NA	NA	NA	104	NA
PFBS (375-73-5)	NR70	0.001	<0.001	NA	NA	NA	95	NA
PFPeS (2706-91-4)	NR70	0.001	<0.001	NA	NA	NA	96	NA
PFHxS (355-46-4)	NR70	0.001	<0.001	NA	NA	NA	102	NA
PFHpS (375-92-8)	NR70	0.001	<0.001	NA	NA	NA	110	NA
PFOS (1763-23-1)	NR70	0.002	<0.002	NA	NA	NA	107	NA
PFNS (68259-12-1)	NR70	0.001	<0.001	NA	NA	NA	108	NA
PFDS (335-77-3)	NR70	0.001	<0.001	NA	NA	NA	106	NA
PFOSA (754-91-6)	NR70	0.001	<0.001	NA	NA	NA	106	NA
N-MeFOSA (31506-32-8)	NR70	0.002	<0.002	NA	NA	NA	96	NA
N-EtFOSA (4151-50-2)	NR70	0.002	<0.002	NA	NA	NA	98	NA
N-MeFOSAA (2355-31-9)	NR70	0.002	<0.002	NA	NA	NA	100	NA
N-EtFOSAA(2991-50-6)	NR70	0.002	<0.002	NA	NA	NA	101	NA
N-MeFOSE (24448-09-7)	NR70	0.005	<0.005	NA	NA	NA	89	NA
N-EtFOSE (1691-99-2)	NR70	0.005	<0.005	NA	NA	NA	128	NA
4:2 FTS (757124-72-4)	NR70	0.001	<0.001	NA	NA	NA	103	NA
6:2 FTS (27619-97-2)	NR70	0.001	<0.001	NA	NA	NA	108	NA
8:2 FTS (39108-34-4)	NR70	0.001	<0.001	NA	NA	NA	101	NA
10:2 FTS (120226-60-0)	NR70	0.002	<0.002	NA	NA	NA	89	NA
8:2 diPAP (678-41-1)	NR70	0.002	<0.002	NA	NA	NA	107	NA

Results expressed in percentage (%) or mg/kg wherever appropriate.
Acceptable Spike recovery is 50-150%.
Maximum acceptable RPDs on spikes and duplicates is 40%.
'NA ' = Not Applicable.
RPD= Relative Percentage Difference.

Signed:

Danny Slee
Organics Manager, NMI-North Ryde

Date: **13/08/2019**

ANZ

FQM - Generic Chain of Custody Form

Environmental Division
Brisbane
Work Order Reference
EB1921176

Telephone : + 61-7-3243 7222

CONSULTANT: AECOM	ADDRESS / OFFICE:	SAMPLER: NK	
PROJECT MANAGER (PM): James Peachey	SITE: QFES Home Hill	MOBILE: 0499989474	PHONE:
PROJECT NUMBER & TASK CODE: 60609758	P.O. NO.: 60609758 2.0	EMAIL REPORT TO: james.peachey@aecom.com; janelle.passler@aecom.com;	
RESULTS REQUIRED (Date):	QUOTE NO.: BN/112/19	ANALYSIS REQUIRED including SUITES (note - suite codes must be listed to attract su	

FOR LABORATORY USE ONLY
COOLER SEAL (circle appropriate)
Intact: Yes No N/A
SAMPLE TEMPERATURE
CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:
Hold onto samples for further TOPA Selection

ALS ID	SAMPLE ID	MATRIX	DATE	Time	Type / Code	Total bottles	EP231X-LL: PFAS Low Level	EP231X-LL (TOPA): PFAS TOPA Low Level	EP231X-ST: PFAS Full Suite Super Trace	EP231X: PFAS Full Suite	HOLD	
1.	HH_MW01_190806	W	6/08/19	1230	P	1	X					
2.	HH_MW02_190806	W	6/08/19	1305	P	1	X					
3	HH_MW03_190806	W	6/08/19	1405	P	1	X					
4.	HH_MW04_190806	W	6/08/19	1450	P	1	X					
5.	HH_SED01_190806	S	6/08/19	1530	J	1				X		
6	HH_SED02_190806	S	6/08/19	1545	J	1				X		
7.	HH_QC106_190806	W	6/08/19		P	1	X					
8.	HH_QC107_190806	S	6/08/19		J	1				X		
	HH_QC206_190806	W	6/08/19		P	1	X					Forward to NMI
	HH_QC207_190806	S	6/08/19		J	1				X		Forward to NMI
9.	HH_QC303_190806	W	6/08/19		P	1	x					

RELINQUISHED BY		RECEIVED BY		RECEIVED BY		METHOD OF SHIPMENT
Name: N. Sutton	Date: 9/8/19	Name: N. SUTTON	Date: 9/8/19	Name: WM	Date: 13/8/19	Con' Note No:
Of:	Time: 1500	Of: ALS MACKAY	Time: 3:00	Of: ALS QLD	Time: 9:30AM	Transport Co:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag. **Soil Container Codes:** Jar = Unpreserved glass jar

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AECOM

ANZ

FQM - Generic Chain of Custody Form

Q4AN(EV)-007-FM1

CONSULTANT: AECOM	ADDRESS / OFFICE:	SAMPLER: NK	**Destination Laboratory**
PROJECT MANAGER (PM): James Peachey	SITE: QFES Ayr	MOBILE: 0499989474 PHONE:	Brisbane
PROJECT NUMBER & TASK CODE: 60609758	P.O. NO.: 60609758 2.0	EMAIL REPORT TO: james.peachey@aecom.com; janelle.passier@aecom.com;	
RESULTS REQUIRED (Date):	QUOTE NO.: BN/112/19	**ANALYSIS REQUIRED including SUITES** (note - suite codes must be listed to attract suite prices)	

FOR LABORATORY USE ONLY

COOLER SEAL (circle appropriate)

Intact: Yes No N/A

SAMPLE TEMPERATURE

CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

Hold onto samples for further TOPA Selection

SAMPLE INFORMATION (note: S = Soil, W=Water)				CONTAINER INFORMATION		EP231X-LL: PFAS Low Level	EP231X-LL (TOPA): PFAS TOPA Low Level	EP231X-ST: PFAS Full Suite Super Trace	EP231X: PFAS Full Suite	HOLD
		MATRIX	DATE	Type / Code	Total bottles					

Notes: e.g. Highly contaminated samples e.g. "High PAHs expected". Extra volume for QC or trace LORs etc.

RELINQUISHED BY:		RECEIVED BY		RECEIVED BY		METHOD OF SHIPMENT
Name: N. Kuo	Date: 9/8/19	Name: N. SUTTON	Date: 9/8/19	Name:	Date:	Con' Note No:
Of:	Time: 1500	Of: ALS MACKAY	Time: 3:00	Of:	Time:	Transport Co:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic

V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic;

F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

Soil Container Codes: Jar = Unpreserved glass jar

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FQM - Generic Chain of Custody Form

AECOM

Q4AN(EV)-007-FM1

CONSULTANT: AECOM	ADDRESS / OFFICE:	SAMPLER: NK	**Destination Laboratory**
PROJECT MANAGER (PM): **James Peachey**	SITE: **QFES Airlie Beach**	MOBILE: 0499989474 PHONE:	Brisbane
PROJECT NUMBER & TASK CODE: **60609758**	P.O. NO.: 60609758 2.0	EMAIL REPORT TO: james.peachey@aecom.com; janelle.passier@aecom.com;	
RESULTS REQUIRED (Date):	QUOTE NO.: BN/112/19	**ANALYSIS REQUIRED including SUITES** (note - suite codes must be listed to attract suite prices)	

FOR LABORATORY USE ONLY	COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:	SAMPLE INFORMATION (note: S = Soil, W=Water)	CONTAINER INFORMATION	PFAS Low Level	PFAS TOPA Low Level	PFAS Full Suite Super Trace	PFAS Full Suite	Notes: e.g. Highly contaminated samples e.g. "High PAHs expected". Extra volume for QC or trace LORs etc.
COOLER SEAL (circle appropriate)	**Hold onto samples for further TOPA Selection**							
Intact: Yes No N/A								
SAMPLE TEMPERATURE								
CHILLED: Yes No								

RELINQUISHED BY:		RECEIVED BY		RECEIVED BY		METHOD OF SHIPMENT
Name: N. Kelso	Date: 9/8/19	Name: N. SUTTON	Date: 9/8/19	Name:	Date:	Con' Note No:
Of:	Time: 1500	Of: ALS MACKAY	Time: 3:00	Of:	Time:	Transport Co:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic;
F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag. **Soil Container Codes**: Jar = Unpreserved glass jar

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AECOM

ANZ

FQM - Generic Chain of Custody Form

Q4AN(EV)-007-FM1

CONSULTANT: AECOM	ADDRESS / OFFICE:	SAMPLER: NK	**Destination Laboratory**
PROJECT MANAGER (PM): **James Peachey**	SITE: **QFES Proserpine**	MOBILE: 0499989474 PHONE:	Brisbane
PROJECT NUMBER & TASK CODE: **60609758**	P.O. NO.: 60609758 2.0	EMAIL REPORT TO: james.peachey@aecom.com; janelle.passier@aecom.com;	
RESULTS REQUIRED (Date):	QUOTE NO.: BN/112/19	**ANALYSIS REQUIRED including SUITES** (note - suite codes must be listed to attract suite prices)	

FOR LABORATORY USE ONLY

COOLER SEAL (circle appropriate)

Intact: Yes No N/A

SAMPLE TEMPERATURE

CHILLED: Yes No

COMMENTS / SPECIAL HANDLING / STORAGE OR DISPOSAL:

Hold onto samples for further TOPA Selection

SAMPLE INFORMATION (note: S = Soil, W=Water)					CONTAINER INFORMATION		231X-LL: PFAS Low Level	31X-LL (TOPA): PFAS TOPA Low Level		231X-ST: PFAS Full Suite Super Trace		P231X: PFAS Full Suite							Notes: e.g. Highly contaminated samples e.g. "High PAHs expected". Extra volume for QC or trace LORs etc.

RELINQUISHED BY:		RECEIVED BY		RECEIVED BY		METHOD OF SHIPMENT
Name: N. Vann	Date: 9/8/19	Name: N.SUTTON	Date: 9/8/19	Name:	Date:	Con' Note No:
Of:	Time: 15:00	Of: ALS MACKAY	Time: 3:00	Of:	Time:	Transport Co:

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic

V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic;

F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag. **Soil Container Codes:** Jar = Unpreserved glass jar

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SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EB1921176**

Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAMES PEACHEY	Contact	: Carsten Emrich
Address	: Brisbane	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: james.peachey@aecom.com	E-mail	: carsten.emrich@alsglobal.com
Telephone	: +61 07 3553 2000	Telephone	: +61 7 3552 8616
Facsimile	: +61 07 3553 2050	Facsimile	: +61-7-3243 7218
Project	: 60609758	Page	: 1 of 4
Order number	: 60609758 2.0	Quote number	: EB2019AECOMAU0002 (BN/112/19)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: QFES		
Sampler	: NK		

Dates

Date Samples Received	: 13-Aug-2019 09:30	Issue Date	: 13-Aug-2019
Client Requested Due Date	: 22-Aug-2019	Scheduled Reporting Date	: **22-Aug-2019**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 2	Temperature	: 1.4, 1.2°C - Ice present
Receipt Detail	: MEDIUM ESKIES	No. of samples received / analysed	: 39 / 37

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please be advised that samples "HH_QC206_190806", "HH_QC207_190806",**

  will be forwarded to NMI for analysis. Please note that this will incur a freight forwarding fee.
-

- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- **Super Trace PFAS analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).**
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Analysis will be conducted by ALS Environmental, Brisbane, NATA accreditation no. 825, Site No. 818 (Micro site no. 18958).
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA055-103 Moisture Content	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)
EB1921176-005	06-Aug-2019 15:30	HH_SED01_190806	✓	✓
EB1921176-006	06-Aug-2019 15:45	HH_SED02_190806	✓	✓
EB1921176-008	06-Aug-2019 00:00	HH_QC107_190806	✓	✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) WATER No analysis requested	WATER - EP231X-LL (EB) PFAS - Full Suite Low Level (28 analytes)	WATER - EP231X-ST PFAS - Super Trace Waters Long Suite (28
EB1921176-001	06-Aug-2019 12:30	HH_MW01_190806		✓	
EB1921176-002	06-Aug-2019 13:05	HH_MW02_190806		✓	
EB1921176-003	06-Aug-2019 14:05	HH_MW03_190806		✓	
EB1921176-004	06-Aug-2019 14:50	HH_MW04_190806		✓	
EB1921176-007	[06-Aug-2019]	HH_QC106_190806		✓	
EB1921176-009	06-Aug-2019 00:00	HH_QC303_190806		✓	

	(On Hold) WATER No analysis requested	WATER - EP231X-LL (EB) PFAS - Full Suite Low Level (28 analytes)	WATER - EP231X-ST PFAS - Super Trace Waters Long Suite (28

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

ACCOUNTS PAYABLE

- A4 - AU Tax Invoice (INV)	Email	AP_CustomerService.ANZ@aecom.com

JAMES PEACHEY

- *AU Certificate of Analysis - NATA (COA)	Email	james.peachey@aecom.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	james.peachey@aecom.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	james.peachey@aecom.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	james.peachey@aecom.com
- A4 - AU Tax Invoice (INV)	Email	james.peachey@aecom.com
- Chain of Custody (CoC) (COC)	Email	james.peachey@aecom.com
- EDI Format - ESDAT (ESDAT)	Email	james.peachey@aecom.com

JANELLE PASSIER

- *AU Certificate of Analysis - NATA (COA)	Email	janelle.passier@aecom.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	janelle.passier@aecom.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	janelle.passier@aecom.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	janelle.passier@aecom.com
- A4 - AU Tax Invoice (INV)	Email	janelle.passier@aecom.com
- Chain of Custody (CoC) (COC)	Email	janelle.passier@aecom.com
- EDI Format - ESDAT (ESDAT)	Email	janelle.passier@aecom.com

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1921176-AJ**	Page	: 1 of 9
Amendment	: **3**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAMES PEACHEY	Contact	: Carsten Emrich
Address	: Brisbane	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3553 2000	Telephone	: +61 7 3552 8616
Project	: 60609758	Date Samples Received	: 13-Aug-2019 09:30
Order number	: 60609758 2.0	Date Analysis Commenced	: 15-Aug-2019
C-O-C number	: ----	Issue Date	: 04-Sep-2019 13:58
Sampler	: NK		
Site	: QFES		
Quote number	: BN/112/19		
No. of samples received	: 9		
No. of samples analysed	: 9		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EP231X-LL: Samples were diluted due to matrix interference. LOR adjusted accordingly.
- **Super Trace PFAS analysis will be conducted by ALS Environmental, Sydney, NATA accreditation no. 825, Site No. 10911 (Micro site no. 14913).**
- Amendment (04/09/2019): This report has been amended and re-released to allow the reporting of additional analytical data.
- Amendment (29/8/19): This report has been amended to allow the splitting of the work order into 5 separate reports. All analysis results are as per the previous report.
- Amendment (30/8/19): This report has been amended to allow the the work order to be split into 4 separate reports. All analysis results are as per the previous report.
- EP231X-ST: Sample EB1921176_015 required dilution prior to extraction due to matrix interferences (high sediment content). LOR values have been adjusted accordingly.
- EP231X-LL & EP231X: Matrix spike shows results out of control limit due to primary sample matrix interference. Confirmed by re-extraction and re-analysis.
- EP231X: Particular samples show poor surrogate recovery due to matrix interference. Confirmed by re-extraction and re-analysis.
- EP231X: Duplicate shows results out of control limit due to sample heterogeneity. Confirmed by re-extraction and re-analysis.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	HH_SED01_190806	HH_SED02_190806	HH_QC107_190806	----	----
				Client sampling date / time	06-Aug-2019 15:30	06-Aug-2019 15:45	06-Aug-2019 00:00	----	----
Compound	CAS Number	LOR	Unit		EB1921176-005	EB1921176-006	EB1921176-008	--------	--------
					Result	Result	Result	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		**8.5**	**10.9**	**8.2**	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		**0.0021**	**0.0004**	**0.0014**	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		<0.001	<0.001	<0.001	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		<0.0002	**0.0003**	<0.0002	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		<0.0002	**0.0002**	<0.0002	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		<0.0002	**0.0002**	<0.0002	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		<0.0002	**0.0005**	<0.0002	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		<0.0002	**0.0006**	<0.0002	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		<0.0002	**0.0006**	<0.0002	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	**0.0002**	<0.0002	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	HH_SED01_190806	HH_SED02_190806	HH_QC107_190806	----	----
				Client sampling date / time	06-Aug-2019 15:30	06-Aug-2019 15:45	06-Aug-2019 00:00	----	----
Compound	CAS Number	LOR	Unit		EB1921176-005	EB1921176-006	EB1921176-008	--------	--------
					Result	Result	Result	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0021**	**0.0030**	**0.0014**	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0021**	**0.0004**	**0.0014**	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0021**	**0.0011**	**0.0014**	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**93.5**	**91.5**	**67.5**	----	----
13C8-PFOA	----	0.0002	%		**102**	**90.0**	**79.0**	----	----

Analytical Results

Sub-Matrix: **WATER**
(Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	HH_MW01_190806	HH_MW02_190806	HH_MW03_190806	HH_MW04_190806	HH_QC106_190806
				Client sampling date / time	06-Aug-2019 12:30	06-Aug-2019 13:05	06-Aug-2019 14:05	06-Aug-2019 14:50	[06-Aug-2019]
					EB1921176-001	EB1921176-002	EB1921176-003	EB1921176-004	EB1921176-007
					Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L		<0.010	**0.049**	**0.047**	**0.046**	**0.047**
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L		<0.010	**0.024**	**0.068**	**0.055**	**0.024**
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L		**0.090**	**0.161**	**0.699**	**0.431**	**0.149**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L		<0.010	<0.010	**0.026**	**0.019**	<0.010
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L		**0.056**	**3.25**	**4.40**	**0.100**	**3.29**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L		<0.010	<0.010	<0.010	<0.002	<0.010
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L		<0.05	<0.05	<0.05	<0.01	<0.05
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L		<0.010	**0.015**	**0.034**	**0.014**	**0.015**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L		<0.010	**0.029**	**0.072**	**0.040**	**0.029**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L		<0.010	**0.021**	**0.046**	**0.032**	**0.021**
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L		<0.010	**0.017**	**0.048**	**0.028**	**0.013**
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L		<0.010	<0.010	<0.010	**0.003**	<0.010
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L		<0.010	<0.010	<0.010	<0.002	<0.010
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L		<0.010	<0.010	<0.010	<0.002	<0.010
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L		<0.010	<0.010	<0.010	<0.002	<0.010
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L		<0.010	<0.010	<0.010	<0.002	<0.010
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L		<0.025	<0.025	<0.025	<0.005	<0.025
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L		<0.010	<0.010	<0.010	<0.002	<0.010
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L		<0.025	<0.025	<0.025	<0.005	<0.025
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L		<0.025	<0.025	<0.025	<0.005	<0.025

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	HH_MW01_190806	HH_MW02_190806	HH_MW03_190806	HH_MW04_190806	HH_QC106_190806
				Client sampling date / time	06-Aug-2019 12:30	06-Aug-2019 13:05	06-Aug-2019 14:05	06-Aug-2019 14:50	[06-Aug-2019]
Compound	CAS Number	LOR	Unit		EB1921176-001	EB1921176-002	EB1921176-003	EB1921176-004	EB1921176-007
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L		<0.025	<0.025	<0.025	<0.005	<0.025
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L		<0.025	<0.025	<0.025	<0.005	<0.025
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L		<0.010	<0.010	<0.010	<0.002	<0.010
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L		<0.010	<0.010	<0.010	<0.002	<0.010
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L		<0.010	<0.010	<0.010	<0.005	<0.010
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L		<0.010	<0.010	**0.019**	<0.005	<0.010
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L		<0.010	<0.010	<0.010	<0.005	<0.010
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L		<0.010	<0.010	<0.010	<0.005	<0.010
EP231P: PFAS Sums									
Sum of PFAS	----	0.002	µg/L		**0.146**	**3.57**	**5.46**	**0.768**	**3.59**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L		**0.146**	**3.41**	**5.10**	**0.531**	**3.44**
Sum of PFAS (WA DER List)	----	0.002	µg/L		**0.146**	**3.54**	**5.36**	**0.691**	**3.56**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.002	%		**126**	**126**	**126**	**83.5**	**117**
13C8-PFOA	----	0.002	%		**116**	**128**	**125**	**92.8**	**122**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	HH_QC303_190806	----	----	----	----
				Client sampling date / time	06-Aug-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1921176-009	--------	--------	--------	--------
					Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L		<0.002	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L		<0.002	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L		<0.002	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L		<0.002	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L		<0.002	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L		<0.002	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L		<0.01	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L		<0.002	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L		<0.002	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L		<0.002	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L		<0.002	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L		<0.002	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L		<0.002	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L		<0.002	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L		<0.002	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L		<0.002	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L		<0.005	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L		<0.002	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L		<0.005	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L		<0.005	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	HH_QC303_190806	----	----	----	----
				Client sampling date / time	06-Aug-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1921176-009	--------	--------	--------	--------
					Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L		<0.005	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L		<0.005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L		<0.002	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L		<0.002	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L		<0.005	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L		<0.005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L		<0.005	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L		<0.005	----	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.002	µg/L		<0.002	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L		<0.002	----	----	----	----
Sum of PFAS (WA DER List)	----	0.002	µg/L		<0.002	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.002	%		**82.0**	----	----	----	----
13C8-PFOA	----	0.002	%		**89.7**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231S: PFAS Surrogate			
13C4-PFOS	----	70	130
13C8-PFOA	----	70	130

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231S: PFAS Surrogate			
13C4-PFOS	----	70	130
13C8-PFOA	----	70	130

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EB1921176-AJ**	Page	: 1 of 11
Amendment	: **3**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAMES PEACHEY	Contact	: Carsten Emrich
Address	: Brisbane	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3553 2000	Telephone	: +61 7 3552 8616
Project	: 60609758	Date Samples Received	: 13-Aug-2019
Order number	: 60609758 2.0	Date Analysis Commenced	: 15-Aug-2019
C-O-C number	: ----	Issue Date	: 04-Sep-2019
Sampler	: NK		
Site	: QFES Home Hill		
Quote number	: BN/112/19		
No. of samples received	: 9		
No. of samples analysed	: 9		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2524697)									
EB1921176-005	HH_SED01_190806	EA055: Moisture Content	----	0.1	%	8.5	8.3	2.98	0% - 20%
EB1921176-030	Anonymous	EA055: Moisture Content	----	0.1	%	16.8	16.9	0.695	0% - 20%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2524688)									
EB1921176-005	HH_SED01_190806	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0021	0.0015	35.7	0% - 50%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EB1921176-030	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0013	# 0.0022	54.0	0% - 50%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	0.0004	0.0007	46.9	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2524688)									
EB1921176-005	HH_SED01_190806	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2524688) - continued									
EB1921176-005	HH_SED01_190806	EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EB1921176-030	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	0.0006	0.0009	45.5	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	0.0008	0.0015	53.7	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2524688)									
EB1921176-005	HH_SED01_190806	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EB1921176-030	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2524688)									
EB1921176-005	HH_SED01_190806	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EB1921176-030	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2524698)									
EB1921176-001	HH_MW01_190806	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.010	0.010	0.00	No Limit
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	0.090	0.083	8.09	No Limit
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	0.056	0.031	57.5	No Limit
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.010	<0.010	0.00	No Limit
EB1921176-020	Anonymous	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	4.22	4.05	4.11	0% - 20%
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	0.250	0.300	18.2	No Limit
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	59.9	# 47.1	23.9	0% - 20%
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.100	<0.100	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2524698)									
EB1921176-001	HH_MW01_190806	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.025	<0.025	0.00	No Limit
		EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.05	<0.05	0.00	No Limit
EB1921176-020	Anonymous	EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	0.260	0.260	0.00	No Limit
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	0.380	0.340	11.1	No Limit
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	0.610	0.550	10.3	No Limit
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	0.930	0.880	5.52	No Limit
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	0.110	0.130	16.7	No Limit
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.250	<0.250	0.00	No Limit
		EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.50	<0.50	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2524698)									
EB1921176-001	HH_MW01_190806	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.025	<0.025	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.025	<0.025	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.025	<0.025	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.025	<0.025	0.00	No Limit
EB1921176-020	Anonymous	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.100	<0.100	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 2524698) - continued									
EB1921176-020	Anonymous	EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.250	<0.250	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.250	<0.250	0.00	No Limit
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.250	<0.250	0.00	No Limit
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.250	<0.250	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2524698)									
EB1921176-001	HH_MW01_190806	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.010	<0.010	0.00	No Limit
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.010	<0.010	0.00	No Limit
EB1921176-020	Anonymous	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	1.35	1.37	1.47	0% - 50%
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.100	<0.100	0.00	No Limit
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.100	<0.100	0.00	No Limit
EP231P: PFAS Sums (QC Lot: 2524698)									
EB1921176-001	HH_MW01_190806	EP231X-LL: Sum of PFAS	----	0.002	µg/L	0.146	0.124	16.3	0% - 50%
		EP231X-LL: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	0.146	0.114	24.6	0% - 50%
		EP231X-LL: Sum of PFAS (WA DER List)	----	0.002	µg/L	0.146	0.114	24.6	0% - 50%
EB1921176-020	Anonymous	EP231X-LL: Sum of PFAS	----	0.002	µg/L	68.0	# 55.0	21.2	0% - 20%
		EP231X-LL: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	64.1	# 51.2	22.5	0% - 20%
		EP231X-LL: Sum of PFAS (WA DER List)	----	0.002	µg/L	67.6	# 54.6	21.4	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2524688)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.0011 mg/kg	93.2	57	121
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00117 mg/kg	92.7	55	125
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00118 mg/kg	78.0	52	126
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00119 mg/kg	92.8	54	123
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00116 mg/kg	77.6	55	127
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.0012 mg/kg	90.0	54	125
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2524688)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	# 37.5	52	128
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	73.6	54	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	92.0	58	127
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	77.6	57	128
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	78.8	60	134
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	78.8	63	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	58.4	55	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	77.2	62	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	73.2	53	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	60.0	49	129
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	59.3	59	129
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2524688)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	78.4	52	132
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	# 54.5	65	126
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	# 45.4	64	126
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	# 35.2	63	124
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	# 48.1	58	125
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	67.6	61	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	62.4	55	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2524688)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00116 mg/kg	79.3	54	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00118 mg/kg	74.2	61	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00119 mg/kg	85.3	62	130

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2524688) - continued								
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.0012 mg/kg	100	60	130

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2524698)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.0442 µg/L	93.7	50	130
EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	0.0469 µg/L	99.1	50	130
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.0473 µg/L	85.2	50	130
EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	0.0476 µg/L	93.5	50	130
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.0464 µg/L	77.6	50	130
EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	0.0482 µg/L	64.1	40	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2524698)								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	0.25 µg/L	85.6	50	130
EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	0.05 µg/L	86.2	50	130
EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	0.05 µg/L	91.2	50	130
EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	0.05 µg/L	90.6	50	130
EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.05 µg/L	88.0	50	130
EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	0.05 µg/L	75.6	50	130
EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	0.05 µg/L	64.4	50	130
EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	0.05 µg/L	69.6	40	130
EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	0.05 µg/L	67.8	40	130
EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	0.05 µg/L	61.8	40	130
EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	0.125 µg/L	79.3	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2524698)								
EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	0.05 µg/L	81.8	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	0.125 µg/L	88.2	40	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	0.125 µg/L	57.3	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	0.125 µg/L	57.3	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	0.125 µg/L	60.6	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	0.05 µg/L	53.4	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	0.05 µg/L	51.2	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2524698)								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	0.0467 µg/L	89.9	50	130

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2524698) - continued								
EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	0.0474 µg/L	96.0	50	130
EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	0.0479 µg/L	72.0	50	130
EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	0.0482 µg/L	56.6	50	130
EP231P: PFAS Sums (QCLot: 2524698)								
EP231X-LL: Sum of PFAS	----	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.002	µg/L	<0.002	----	----	----	----
EP231X-LL: Sum of PFAS (WA DER List)	----	0.002	µg/L	<0.002	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2524688)							
EB1921176-006	HH_SED02_190806	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	66.8	57	121
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	70.0	55	125
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	54.4	52	126
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	70.0	54	123
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	# 37.3	55	127
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	54.0	54	125
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2524688)							
EB1921176-006	HH_SED02_190806	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	# 26.1	52	128
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	57.3	54	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	74.5	58	127
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	60.9	57	128
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	64.5	60	134
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	# 62.2	63	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	# 37.0	55	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	# 51.8	62	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	# 51.3	53	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	# 41.6	49	129
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	# 49.2	59	129
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2524688)							
EB1921176-006	HH_SED02_190806	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	65.6	52	132

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2524688) - continued							
EB1921176-006	HH_SED02_190806	EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	# 49.2	65	126
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	# 48.6	64	126
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	# 33.0	63	124
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	# 39.7	58	125
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	61.6	61	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	# 51.2	55	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2524688)							
EB1921176-006	HH_SED02_190806	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	63.2	54	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	# 57.6	61	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	65.2	62	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	# 46.8	60	130

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 2524698)							
EB1921176-002	HH_MW02_190806	EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.05 µg/L	114	50	130
		EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.05 µg/L	108	50	130
		EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.05 µg/L	82.4	50	130
		EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.05 µg/L	123	50	130
		EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.05 µg/L	# Not Determined	50	130
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.05 µg/L	107	40	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2524698)							
EB1921176-002	HH_MW02_190806	EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.25 µg/L	103	50	130
		EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.05 µg/L	110	50	130
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.05 µg/L	107	50	130
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.05 µg/L	108	50	130
		EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.05 µg/L	106	50	130
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.05 µg/L	103	50	130
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.05 µg/L	87.0	50	130
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.05 µg/L	125	40	130
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.05 µg/L	110	40	130
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.05 µg/L	97.8	40	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 2524698) - continued							
EB1921176-002	HH_MW02_190806	EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.125 µg/L	106	40	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 2524698)							
EB1921176-002	HH_MW02_190806	EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.05 µg/L	123	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.125 µg/L	129	40	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.125 µg/L	112	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.125 µg/L	96.1	50	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.125 µg/L	114	40	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.05 µg/L	112	50	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.05 µg/L	81.4	40	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2524698)							
EB1921176-002	HH_MW02_190806	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05 µg/L	117	50	130
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05 µg/L	116	50	130
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05 µg/L	119	50	130
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05 µg/L	114	50	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB1921176**	Page	: 1 of 13
Amendment	: **3**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAMES PEACHEY	Telephone	: +61 7 3552 8616
Project	: 60609758	Date Samples Received	: 13-Aug-2019
Site	: QFES Home Hill	Issue Date	: 04-Sep-2019
Sampler	: NK	No. of samples received	: 39
Order number	: 60609758 2.0	No. of samples analysed	: 39

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **Duplicate outliers exist - please see following pages for full details.**
- **Laboratory Control outliers exist - please see following pages for full details.**
- **Matrix Spike outliers exist - please see following pages for full details.**
- **Surrogate recovery outliers exist for all regular sample matrices - please see following pages for full details.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EP231A: Perfluoroalkyl Sulfonic Acids			**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	54.0 %	0% - 50%	**RPD exceeds LOR based limits**
Laboratory Control Spike (LCS) Recoveries							
EP231B: Perfluoroalkyl Carboxylic Acids	QC-2524688-002	----	**Perfluorobutanoic acid (PFBA)**	375-22-4	37.5 %	52-128%	**Recovery less than lower control limit**
EP231C: Perfluoroalkyl Sulfonamides	QC-2524688-002	----	**N-Methyl perfluorooctane sulfonamide (MeFOSA)**	31506-32-8	54.5 %	65-126%	**Recovery less than lower control limit**
EP231C: Perfluoroalkyl Sulfonamides	QC-2524688-002	----	**N-Ethyl perfluorooctane sulfonamide (EtFOSA)**	4151-50-2	45.4 %	64-126%	**Recovery less than lower control limit**
EP231C: Perfluoroalkyl Sulfonamides	QC-2524688-002	----	**N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)**	24448-09-7	35.2 %	63-124%	**Recovery less than lower control limit**
EP231C: Perfluoroalkyl Sulfonamides	QC-2524688-002	----	**N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)**	1691-99-2	48.1 %	58-125%	**Recovery less than lower control limit**
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	EB1921176--006	HH_SED02_190806	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	37.3 %	55-127%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids	EB1921176--006	HH_SED02_190806	**Perfluorobutanoic acid (PFBA)**	375-22-4	26.1 %	52-128%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids	EB1921176--006	HH_SED02_190806	**Perfluorononanoic acid (PFNA)**	375-95-1	62.2 %	63-130%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids	EB1921176--006	HH_SED02_190806	**Perfluorodecanoic acid (PFDA)**	335-76-2	37.0 %	55-130%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids	EB1921176--006	HH_SED02_190806	**Perfluoroundecanoic acid (PFUnDA)**	2058-94-8	51.8 %	62-130%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids	EB1921176--006	HH_SED02_190806	**Perfluorododecanoic acid (PFDoDA)**	307-55-1	51.3 %	53-134%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids	EB1921176--006	HH_SED02_190806	**Perfluorotridecanoic acid (PFTrDA)**	72629-94-8	41.6 %	49-129%	**Recovery less than lower data quality objective**
EP231B: Perfluoroalkyl Carboxylic Acids	EB1921176--006	HH_SED02_190806	**Perfluorotetradecanoic acid (PFTeDA)**	376-06-7	49.2 %	59-129%	**Recovery less than lower data quality objective**
EP231C: Perfluoroalkyl Sulfonamides	EB1921176--006	HH_SED02_190806	**N-Methyl perfluorooctane sulfonamide (MeFOSA)**	31506-32-8	49.2 %	65-126%	**Recovery less than lower data quality objective**

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries - Continued							
EP231C: Perfluoroalkyl Sulfonamides	EB1921176--006	HH_SED02_190806	**N-Ethyl perfluorooctane sulfonamide (EtFOSA)**	4151-50-2	48.6 %	64-126%	**Recovery less than lower data quality objective**
EP231C: Perfluoroalkyl Sulfonamides	EB1921176--006	HH_SED02_190806	**N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)**	24448-09-7	33.0 %	63-124%	**Recovery less than lower data quality objective**
EP231C: Perfluoroalkyl Sulfonamides	EB1921176--006	HH_SED02_190806	**N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)**	1691-99-2	39.7 %	58-125%	**Recovery less than lower data quality objective**
EP231C: Perfluoroalkyl Sulfonamides	EB1921176--006	HH_SED02_190806	**N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)**	2991-50-6	51.2 %	55-130%	**Recovery less than lower data quality objective**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EB1921176--006	HH_SED02_190806	**6:2 Fluorotelomer sulfonic acid (6:2 FTS)**	27619-97-2	57.6 %	61-130%	**Recovery less than lower data quality objective**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EB1921176--006	HH_SED02_190806	**10:2 Fluorotelomer sulfonic acid (10:2 FTS)**	120226-60-0	46.8 %	60-130%	**Recovery less than lower data quality objective**

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EP231A: Perfluoroalkyl Sulfonic Acids			**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	23.9 %	0% - 20%	**RPD exceeds LOR based limits**
EP231P: PFAS Sums			**Sum of PFAS**	----	21.2 %	0% - 20%	**RPD exceeds LOR based limits**
EP231P: PFAS Sums			**Sum of PFHxS and PFOS**	355-46-4/1763-23-1	22.5 %	0% - 20%	**RPD exceeds LOR based limits**
EP231P: PFAS Sums			**Sum of PFAS (WA DER List)**	----	21.4 %	0% - 20%	**RPD exceeds LOR based limits**
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	EB1921176--002	HH_MW02_190806	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	EB1921138--003	Anonymous	**Perfluoroundecanoic acid (PFUnDA)**	2058-94-8	156 %	40-130%	**Recovery greater than upper data quality objective**
EP231C: Perfluoroalkyl Sulfonamides	EB1921138--003	Anonymous	**N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)**	2991-50-6	35.2 %	40-130%	**Recovery less than lower data quality objective**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EB1921138--003	Anonymous	**6:2 Fluorotelomer sulfonic acid (6:2 FTS)**	27619-97-2	135 %	50-130%	**Recovery greater than upper data quality objective**

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries - Continued							
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EB1921138--003	Anonymous	**10:2 Fluorotelomer sulfonic acid (10:2 FTS)**	120226-60-0	136 %	50-130%	**Recovery greater than upper data quality objective**

Regular Sample Surrogates

Sub-Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP231S: PFAS Surrogate	EB1921176-008	HH_QC107_190806	**13C4-PFOS**	----	67.5 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate			**13C4-PFOS**	----	69.5 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate			**13C4-PFOS**	----	21.5 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate			**13C4-PFOS**	----	12.5 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate			**13C4-PFOS**	----	30.5 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate			**13C4-PFOS**	----	40.5 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate			**13C8-PFOA**	----	21.5 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate			**13C8-PFOA**	----	14.0 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate			**13C8-PFOA**	----	35.5 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate			**13C8-PFOA**	----	49.0 %	70-130 %	**Recovery less than lower data quality objective**

Sub-Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP231S: PFAS Surrogate			**13C4-PFOS**	----	35.9 %	70-130 %	**Recovery less than lower data quality objective**
EP231S: PFAS Surrogate			**13C8-PFOA**	----	45.5 %	70-130 %	**Recovery less than lower data quality objective**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)								
HDPE Soil Jar (EA055)								
HH_SED01_190806, HH_QC107_190806, 6	HH_SED02_190806,	**06-Aug-2019**	**----**	----	----	**15-Aug-2019**	20-Aug-2019	✓
HDPE Soil Jar (EA055)		**08-Aug-2019**	**----**	----	----	**15-Aug-2019**	22-Aug-2019	✓
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE Soil Jar (EP231X)								
HH_SED01_190806, HH_QC107_190806,	HH_SED02_190806,	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓
HDPE Soil Jar (EP231X)		**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE Soil Jar (EP231X)								
HH_SED01_190806, HH_QC107_190806,	HH_SED02_190806,	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓
HDPE Soil Jar (EP231X)		**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X) HH_SED01_190806, HH_SED02_190806, HH_QC107_190806,	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓
HDPE Soil Jar (EP231X)	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X) HH_SED01_190806, HH_SED02_190806, HH_QC107_190806,	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓
HDPE Soil Jar (EP231X)	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X) HH_SED01_190806, HH_SED02_190806, HH_QC107_190806,	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓
HDPE Soil Jar (EP231X)	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**19-Aug-2019**	24-Sep-2019	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) HH_MW01_190806, HH_MW02_190806, HH_MW03_190806, HH_MW04_190806, HH_QC106_190806, HH_QC303_190806,	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**15-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**19-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**15-Aug-2019**	03-Feb-2020	✓	**15-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**16-Aug-2019**	03-Feb-2020	✓	**16-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**08-Aug-2019**	**02-Sep-2019**	04-Feb-2020	✓	**02-Sep-2019**	04-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**15-Aug-2019**	04-Feb-2020	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X-LL) HH_MW01_190806, HH_MW02_190806, HH_MW03_190806, HH_MW04_190806, HH_QC106_190806, HH_QC303_190806,	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**15-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**19-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**15-Aug-2019**	03-Feb-2020	✓	**15-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**16-Aug-2019**	03-Feb-2020	✓	**16-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**08-Aug-2019**	**02-Sep-2019**	04-Feb-2020	✓	**02-Sep-2019**	04-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**15-Aug-2019**	04-Feb-2020	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X-LL) HH_MW01_190806, HH_MW02_190806, HH_MW03_190806, HH_MW04_190806, HH_QC106_190806, HH_QC303_190806,	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**15-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**19-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**15-Aug-2019**	03-Feb-2020	✓	**15-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**16-Aug-2019**	03-Feb-2020	✓	**16-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**08-Aug-2019**	**02-Sep-2019**	04-Feb-2020	✓	**02-Sep-2019**	04-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**15-Aug-2019**	04-Feb-2020	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) HH_MW01_190806, HH_MW02_190806, HH_MW03_190806, HH_MW04_190806, HH_QC106_190806, HH_QC303_190806,	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**15-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**19-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**15-Aug-2019**	03-Feb-2020	✓	**15-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**16-Aug-2019**	03-Feb-2020	✓	**16-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**08-Aug-2019**	**02-Sep-2019**	04-Feb-2020	✓	**02-Sep-2019**	04-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**15-Aug-2019**	04-Feb-2020	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X-LL) HH_MW01_190806, HH_MW02_190806, HH_MW03_190806, HH_MW04_190806, HH_QC106_190806, HH_QC303_190806,	**06-Aug-2019**	**15-Aug-2019**	02-Feb-2020	✓	**15-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**19-Aug-2019**	02-Feb-2020	✓	**19-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-ST)	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**15-Aug-2019**	03-Feb-2020	✓	**15-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**07-Aug-2019**	**16-Aug-2019**	03-Feb-2020	✓	**16-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**08-Aug-2019**	**02-Sep-2019**	04-Feb-2020	✓	**02-Sep-2019**	04-Feb-2020	✓
HDPE (no PTFE) (EP231X-LL)	**08-Aug-2019**	**15-Aug-2019**	04-Feb-2020	✓	**15-Aug-2019**	04-Feb-2020	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	12	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	4	26	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-ST	2	5	**40.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	3	26	**11.54**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-ST	2	5	**40.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	3	26	**11.54**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-ST	2	5	**40.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	2	26	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-ST	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-House. A portion of soil is extracted with MTBE. The extract is taken to dryness, made up in mobile phase. Analysis is by LC/MSMS, ESI Negative Mode using MRM. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	WATER	In-house: Analysis of fresh and saline waters by solid phase extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-ST	WATER	In-house: Analysis of fresh and saline waters by solid phase extraction and LC-Electrospray-MS-MS, Negative Mode using MRM. This method is targeted to pristine environmental and drinking waters reporting at sub-parts per trillion. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. The DQO for internal standard response is 50-150% of that established at initial calibration. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. This method complies with the quality control definitions as stated in QSM 5.1. Data is reviewed in line with the DQOs as stated in QSM5.1

Preparation Methods	Method	Matrix	Method Descriptions
Sample Extraction for PFAS	EP231-PR	SOIL	In house
SPE preparation for LL and saline PFCs	EP231-SPE	WATER	In house

REPORT OF ANALYSIS

Report No. RN1244319

Client	: AECOM AUSTRALIA PTY LTD	**Job No.**	: AECO06/190816/3
	LEVEL 8	**Quote No.**	: QT-02018
	540 WICKHAM STREET	**Order No.**	: 60609759_2_0
		Date Received	: 16-AUG-2019
Attention	: JAMES PEACHEY	**Sampled By**	: CLIENT
Project Name	: 60609758_2_0		
Your Client Services Manager	: Richard Coghlan	**Phone**	: 02 9449 0161

Lab Reg No.	Sample Ref	Sample Description
N19/020818	HH_QC207_190806	SOIL 6/08/19

Lab Reg No.		N19/020818		
Date Sampled		06-AUG-2019		
	Units			Method
PFAS (per-and poly-fluoroalkyl substances)				
PFBA (375-22-4)	mg/kg	<0.002		NR70
PFPeA (2706-90-3)	mg/kg	<0.002		NR70
PFHxA (307-24-4)	mg/kg	<0.001		NR70
PFHpA (375-85-9)	mg/kg	<0.001		NR70
PFOA (335-67-1)	mg/kg	<0.001		NR70
PFNA (375-95-1)	mg/kg	<0.001		NR70
PFDA (335-76-2)	mg/kg	<0.001		NR70
PFUdA (2058-94-8)	mg/kg	<0.002		NR70
PFDoA (307-55-1)	mg/kg	<0.002		NR70
PFTrDA (72629-94-8)	mg/kg	<0.002		NR70
PFTeDA (376-06-7)	mg/kg	<0.002		NR70
PFHxDA (67905-19-5)	mg/kg	<0.002		NR70
PFODA (16517-11-6)	mg/kg	<0.005		NR70
FOUEA (70887-84-2)	mg/kg	<0.001		NR70
PFBS (375-73-5)	mg/kg	<0.001		NR70
PFPeS (2706-91-4)	mg/kg	<0.001		NR70
PFHxS (355-46-4)	mg/kg	<0.001		NR70
PFHpS (375-92-8)	mg/kg	<0.001		NR70
PFOS (1763-23-1)	mg/kg	0.0026		NR70
PFNS (68259-12-1)	mg/kg	<0.001		NR70
PFDS (335-77-3)	mg/kg	<0.001		NR70
PFOSA (754-91-6)	mg/kg	<0.001		NR70
N-MeFOSA (31506-32-8)	mg/kg	<0.002		NR70
N-EtFOSA (4151-50-2)	mg/kg	<0.002		NR70
N-MeFOSAA (2355-31-9)	mg/kg	<0.002		NR70
N-EtFOSAA(2991-50-6)	mg/kg	<0.002		NR70
N-MeFOSE (24448-09-7)	mg/kg	<0.005		NR70

REPORT OF ANALYSIS

Lab Reg No.		N19/020818			
Date Sampled		06-AUG-2019			
	Units				Method
PFAS (per-and poly-fluoroalkyl substances)					
N-EtFOSE (1691-99-2)	mg/kg	<0.005			NR70
4:2 FTS (757124-72-4)	mg/kg	<0.001			NR70
6:2 FTS (27619-97-2)	mg/kg	<0.001			NR70
8:2 FTS (39108-34-4)	mg/kg	<0.001			NR70
10:2 FTS (120226-60-0)	mg/kg	<0.002			NR70
8:2 diPAP (678-41-1)	mg/kg	<0.002			NR70
PFBA (Surrogate Recovery)	%	124			NR70
PFPeA (Surrogate Recovery)	%	120			NR70
PFHxA (Surrogate Recovery)	%	116			NR70
PFHpA (Surrogate Recovery)	%	122			NR70
PFOA (Surrogate Recovery)	%	123			NR70
PFNA (Surrogate Recovery)	%	123			NR70
PFDA (Surrogate Recovery)	%	127			NR70
PFUdA (Surrogate Recovery)	%	130			NR70
PFDoA (Surrogate Recovery)	%	126			NR70
PFTeDA (Surrogate Recovery)	%	127			NR70
PFHxDA (Surrogate Recovery)	%	131			NR70
FOUEA (Surrogate Recovery)	%	78			NR70
PFBS (Surrogate Recovery)	%	116			NR70
PFHxS (Surrogate Recovery)	%	120			NR70
PFOS (Surrogate Recovery)	%	124			NR70
PFOSA (Surrogate Recovery)	%	122			NR70
N-MeFOSA (Surrogate Recovery)	%	105			NR70
N-EtFOSA (Surrogate Recovery)	%	113			NR70
N-MeFOSAA (Surrogate Recovery)	%	119			NR70
N-EtFOSAA (Surrogate Recovery)	%	136			NR70
N-MeFOSE (Surrogate Recovery)	%	107			NR70
N-EtFOSE (Surrogate Recovery)	%	136			NR70
4:2 FTS (Surrogate Recovery)	%	88			NR70
6:2 FTS (Surrogate Recovery)	%	103			NR70
8:2 FTS (Surrogate Recovery)	%	101			NR70
8:2 diPAP (Surrogate Recovery)	%	59			NR70
Dates					
Date extracted		19-AUG-2019			
Date analysed		21-AUG-2019			

N19/020818
to

REPORT OF ANALYSIS

N19/020822:

PFOS is quantified using a combined branched and linear standard,
linear and branched isomers are totalled for reporting.
All results corrected for labelled surrogate recoveries.
Selected PFAS surrogate recoveries are biased due to matrix effects.
FOUEA Surrogate Recovery was not reported.
LORs raised for selected analytes due to low surrogate recoveries.

Danny Slee, Section Manager
Organic - NSW
Accreditation No. 198

28-AUG-2019

Lab Reg No.		N19/020818		
Date Sampled		06-AUG-201		
	Units			Method
Trace Elements				
Total Solids	%	92.5		NT2_49

Pankaj Barai, Analyst
Inorganics - NSW
Accreditation No. 198

28-AUG-2019

All results are expressed on a dry weight basis.

REPORT OF ANALYSIS

Client	: AECOM AUSTRALIA PTY LTD	**Job No.**	: AECO06/190816/3
	LEVEL 8	**Quote No.**	: QT-02018
	540 WICKHAM STREET	**Order No.**	: 60609759_2_0
		Date Received	: 16-AUG-2019
Attention	: JAMES PEACHEY	**Sampled By**	: CLIENT
Project Name	: 60609758_2_0		
Your Client Services Manager	: Richard Coghlan	**Phone**	: 02 9449 0161

Lab Reg No.	Sample Ref	Sample Description
N19/020817	HH_QC206_190806	WATER 6/08/19

Lab Reg No.		Units	N19/020817		Method
Date Sampled			06-AUG-2019		
PFAS (per-and poly-fluoroalkyl substances)					
PFBA (375-22-4)		ug/L	0.0099		NR70
PFPeA (2706-90-3)		ug/L	0.019		NR70
PFHxA (307-24-4)		ug/L	0.032		NR70
PFHpA (375-85-9)		ug/L	0.019		NR70
PFOA (335-67-1)		ug/L	0.0075		NR70
PFNA (375-95-1)		ug/L	<0.001		NR70
PFDA (335-76-2)		ug/L	<0.001		NR70
PFUdA (2058-94-8)		ug/L	<0.001		NR70
PFDoA (307-55-1)		ug/L	<0.001		NR70
PFTrDA (72629-94-8)		ug/L	<0.002		NR70
PFTeDA (376-06-7)		ug/L	<0.002		NR70
PFHxDA (67905-19-5)		ug/L	<0.002		NR70
PFODA (16517-11-6)		ug/L	<0.005		NR70
FOUEA (70887-84-2)		ug/L	<0.001		NR70
PFBS (375-73-5)		ug/L	0.041		NR70
PFPeS (2706-91-4)		ug/L	0.024		NR70
PFHxS (355-46-4)		ug/L	0.18		NR70
PFHpS (375-92-8)		ug/L	0.0062		NR70
PFOS (1763-23-1)		ug/L	3.5		NR70
PFNS (68259-12-1)		ug/L	<0.001		NR70
PFDS (335-77-3)		ug/L	<0.001		NR70
PFOSA (754-91-6)		ug/L	<0.001		NR70
N-MeFOSA (31506-32-8)		ug/L	<0.002		NR70
N-EtFOSA (4151-50-2)		ug/L	<0.002		NR70
N-MeFOSAA (2355-31-9)		ug/L	<0.002		NR70
N-EtFOSAA(2991-50-6)		ug/L	<0.002		NR70

REPORT OF ANALYSIS

Lab Reg No.			N19/020817	
Date Sampled			06-AUG-2019	
		Units		Method
PFAS (per-and poly-fluoroalkyl substances)				
N-MeFOSE (24448-09-7)		ug/L	<0.005	NR70
N-EtFOSE (1691-99-2)		ug/L	<0.005	NR70
4:2 FTS (757124-72-4)		ug/L	<0.001	NR70
6:2 FTS (27619-97-2)		ug/L	1.5	NR70
8:2 FTS (39108-34-4)		ug/L	<0.001	NR70
10:2 FTS (120226-60-0)		ug/L	<0.001	NR70
8:2 diPAP (678-41-1)		ug/L	<0.002	NR70
PFBA (Surrogate Recovery)		%	116	NR70
PFPeA (Surrogate Recovery)		%	107	NR70
PFHxA (Surrogate Recovery)		%	104	NR70
PFHpA (Surrogate Recovery)		%	108	NR70
PFOA (Surrogate Recovery)		%	106	NR70
PFNA (Surrogate Recovery)		%	71	NR70
PFDA (Surrogate Recovery)		%	106	NR70
PFUdA (Surrogate Recovery)		%	87	NR70
PFDoA (Surrogate Recovery)		%	74	NR70
PFTeDA (Surrogate Recovery)		%	90	NR70
PFHxDA (Surrogate Recovery)		%	132	NR70
FOUEA (Surrogate Recovery)		%	71	NR70
PFBS (Surrogate Recovery)		%	104	NR70
PFHxS (Surrogate Recovery)		%	102	NR70
PFOS (Surrogate Recovery)		%	97	NR70
PFOSA (Surrogate Recovery)		%	90	NR70
N-MeFOSA (Surrogate Recovery)		%	75	NR70
N-EtFOSA (Surrogate Recovery)		%	56	NR70
N-MeFOSAA (Surrogate Recovery)		%	72	NR70
N-EtFOSAA (Surrogate Recovery)		%	93	NR70
N-MeFOSE (Surrogate Recovery)		%	133	NR70
N-EtFOSE (Surrogate Recovery)		%	65	NR70
4:2 FTS (Surrogate Recovery)		%	68	NR70
6:2 FTS (Surrogate Recovery)		%	81	NR70
8:2 FTS (Surrogate Recovery)		%	86	NR70
8:2 diPAP (Surrogate Recovery)		%	66	NR70
Dates				
Date extracted			23-AUG-2019	
Date analysed			23-AUG-2019	

REPORT OF ANALYSIS

Lab Reg No.			N19/020817	
Date Sampled			06-AUG-2019	
		Units		Method

Danny Slee, Section Manager
Organic - NSW
Accreditation No. 198

28-AUG-2019

ACCREDITED FOR TECHNICAL COMPETENCE

Accredited for compliance with ISO/IEC 17025 - Testing.
This report shall not be reproduced except in full.
Results relate only to the sample(s) tested.

This Report supersedes reports: *RN1244317*

Measurement Uncertainty is available upon request.

Australian Government

National Measurement Institute

QUALITY ASSURANCE REPORT

Client: AECOM Australia Pty Ltd

NMI QA Report No: AECO06/190816/3 **Sample Matrix:** Liquid

Analyte	Method	LOR	Blank	Sample Duplicates			Recoveries	
				Sample	Duplicate	RPD	LCS	Matrix Spike
		ug/L	ug/L	ug/L	ug/L	%	%	%
PFBA (375-22-4)	NR70	0.005	<0.005	NA	NA	NA	130	NA
PFPeA (2706-90-3)	NR70	0.002	<0.002	NA	NA	NA	97	NA
PFHxA (307-24-4)	NR70	0.001	<0.001	NA	NA	NA	96	NA
PFHpA (375-85-9)	NR70	0.001	<0.001	NA	NA	NA	94	NA
PFOA (335-67-1)	NR70	0.001	<0.001	NA	NA	NA	100	NA
PFNA (375-95-1)	NR70	0.001	<0.001	NA	NA	NA	104	NA
PFDA (335-76-2)	NR70	0.001	<0.001	NA	NA	NA	108	NA
PFUdA (2058-94-8)	NR70	0.001	<0.001	NA	NA	NA	83	NA
PFDoA (307-55-1)	NR70	0.001	<0.001	NA	NA	NA	80	NA
PFTrDA (72629-94-8)	NR70	0.002	<0.002	NA	NA	NA	90	NA
PFTeDA (376-06-7)	NR70	0.002	<0.002	NA	NA	NA	106	NA
PFHxDA (67905-19-5)	NR70	0.002	<0.002	NA	NA	NA	86	NA
PFODA (16517-11-6)	NR70	0.005	<0.005	NA	NA	NA	85	NA
FOUEA (70887-84-2)	NR70	0.001	<0.001	NA	NA	NA	90	NA
PFBS (375-73-5)	NR70	0.001	<0.001	NA	NA	NA	100	NA
PFPeS (2706-91-4)	NR70	0.001	<0.001	NA	NA	NA	99	NA
PFHxS (355-46-4)	NR70	0.001	<0.001	NA	NA	NA	104	NA
PFHpS (375-92-8)	NR70	0.001	<0.001	NA	NA	NA	101	NA
PFOS (1763-23-1)	NR70	0.002	<0.002	NA	NA	NA	99	NA
PFNS (68259-12-1)	NR70	0.001	<0.001	NA	NA	NA	98	NA
PFDS (335-77-3)	NR70	0.001	<0.001	NA	NA	NA	97	NA
PFOSA (754-91-6)	NR70	0.001	<0.001	NA	NA	NA	96	NA
N-MeFOSA (31506-32-8)	NR70	0.002	<0.002	NA	NA	NA	93	NA
N-EtFOSA (4151-50-2)	NR70	0.002	<0.002	NA	NA	NA	108	NA
N-MeFOSAA (2355-31-9)	NR70	0.002	<0.002	NA	NA	NA	91	NA
N-EtFOSAA(2991-50-6)	NR70	0.002	<0.002	NA	NA	NA	98	NA
N-MeFOSE (24448-09-7)	NR70	0.005	<0.005	NA	NA	NA	109	NA
N-EtFOSE (1691-99-2)	NR70	0.005	<0.005	NA	NA	NA	91	NA
4:2 FTS (757124-72-4)	NR70	0.001	<0.001	NA	NA	NA	98	NA
6:2 FTS (27619-97-2)	NR70	0.001	<0.001	NA	NA	NA	97	NA
8:2 FTS (39108-34-4)	NR70	0.001	<0.001	NA	NA	NA	106	NA
10:2 FTS (120226-60-0)	NR70	0.001	<0.001	NA	NA	NA	112	NA
8:2 diPAP (678-41-1)	NR70	0.002	<0.002	NA	NA	NA	103	NA

Results expressed in percentage (%) or ug/L wherever appropriate.
Acceptable Spike recovery is 50-150%.
Maximum acceptable RPDs on spikes and duplicates is 40%.
'NA ' = Not Applicable.
RPD= Relative Percentage Difference.

Signed:

Danny Slee
Organics Manager, NMI-North Ryde

Date: **28/08/2019**

Australian Government

National Measurement Institute

QUALITY ASSURANCE REPORT

Client: AECOM Australia Pty Ltd

NMI QA Report No: AECO06/190813/3 **Sample Matrix:** Solid

Analyte	Method	LOR	Blank	Sample Duplicates			Recoveries	
				Sample	Duplicate	RPD	LCS	Matrix Spike
		mg/kg	mg/kg	mg/kg	mg/kg	%	%	%
PFBA (375-22-4)	NR70	0.002	<0.002	NA	NA	NA	110	NA
PFPeA (2706-90-3)	NR70	0.002	<0.002	NA	NA	NA	97	NA
PFHxA (307-24-4)	NR70	0.001	<0.001	NA	NA	NA	101	NA
PFHpA (375-85-9)	NR70	0.001	<0.001	NA	NA	NA	94	NA
PFOA (335-67-1)	NR70	0.001	<0.001	NA	NA	NA	99	NA
PFNA (375-95-1)	NR70	0.001	<0.001	NA	NA	NA	86	NA
PFDA (335-76-2)	NR70	0.001	<0.001	NA	NA	NA	99	NA
PFUdA (2058-94-8)	NR70	0.002	<0.002	NA	NA	NA	100	NA
PFDoA (307-55-1)	NR70	0.002	<0.002	NA	NA	NA	106	NA
PFTrDA (72629-94-8)	NR70	0.002	<0.002	NA	NA	NA	100	NA
PFTeDA (376-06-7)	NR70	0.002	<0.002	NA	NA	NA	104	NA
PFHxDA (67905-19-5)	NR70	0.002	<0.002	NA	NA	NA	89	NA
PFODA (16517-11-6)	NR70	0.005	<0.005	NA	NA	NA	86	NA
FOUEA (70887-84-2)	NR70	0.001	<0.001	NA	NA	NA	99	NA
PFBS (375-73-5)	NR70	0.001	<0.001	NA	NA	NA	97	NA
PFPeS (2706-91-4)	NR70	0.001	<0.001	NA	NA	NA	97	NA
PFHxS (355-46-4)	NR70	0.001	<0.001	NA	NA	NA	96	NA
PFHpS (375-92-8)	NR70	0.001	<0.001	NA	NA	NA	92	NA
PFOS (1763-23-1)	NR70	0.002	<0.002	NA	NA	NA	110	NA
PFNS (68259-12-1)	NR70	0.001	<0.001	NA	NA	NA	94	NA
PFDS (335-77-3)	NR70	0.001	<0.001	NA	NA	NA	97	NA
PFOSA (754-91-6)	NR70	0.001	<0.001	NA	NA	NA	99	NA
N-MeFOSA (31506-32-8)	NR70	0.002	<0.002	NA	NA	NA	101	NA
N-EtFOSA (4151-50-2)	NR70	0.002	<0.002	NA	NA	NA	90	NA
N-MeFOSAA (2355-31-9)	NR70	0.002	<0.002	NA	NA	NA	102	NA
N-EtFOSAA(2991-50-6)	NR70	0.002	<0.002	NA	NA	NA	91	NA
N-MeFOSE (24448-09-7)	NR70	0.005	<0.005	NA	NA	NA	87	NA
N-EtFOSE (1691-99-2)	NR70	0.005	<0.005	NA	NA	NA	79	NA
4:2 FTS (757124-72-4)	NR70	0.001	<0.001	NA	NA	NA	91	NA
6:2 FTS (27619-97-2)	NR70	0.001	<0.001	NA	NA	NA	86	NA
8:2 FTS (39108-34-4)	NR70	0.001	<0.001	NA	NA	NA	100	NA
10:2 FTS (120226-60-0)	NR70	0.002	<0.002	NA	NA	NA	94	NA
8:2 diPAP (678-41-1)	NR70	0.002	<0.002	NA	NA	NA	93	NA

Results expressed in percentage (%) or mg/kg wherever appropriate.
Acceptable Spike recovery is 50-150%.
Maximum acceptable RPDs on spikes and duplicates is 40%.
'NA ' = Not Applicable.
RPD= Relative Percentage Difference.

Signed:

Danny Slee
Organics Manager, NMI-North Ryde

Date: **26/08/2019**

From: Peachey, James <james.peachey@aecom.com>
Sent: Tuesday, 13 August 2019 3:34 PM
To: Carsten Emrich <Carsten.Emrich@alsglobal.com>
Subject: [EXTERNAL] - Additional analysis

Hi Carsten

Please could you arrange for the following samples to be analysed for TOPA (EP231X-TOP):

EB1919840-016 HH_SS1_0.5

Regards

James Peachey
Associate Director - Environment
D +61 7 3553 3909 M +61 426 206 362
james.peachey@aecom.com

AECOM
Level 8, 540 Wickham Street, Fortitude Valley, QLD 4006
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aecom.com

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Environmental Division
Brisbane
Work Order Reference
EB1921187

Telephone : +61-7-3243 7222

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1921187-AC**	Page	: 1 of 5
Amendment	: **1**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAMES PEACHEY	Contact	: Carsten Emrich
Address	: Brisbane	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3553 2000	Telephone	: +61 7 3552 8616
Project	: 60609758 _HH	Date Samples Received	: 13-Aug-2019 15:34
Order number	: 60609758	Date Analysis Commenced	: 16-Aug-2019
C-O-C number	: ----	Issue Date	: 27-Aug-2019 13:02
Sampler	: CAMDEN McCOSKER		
Site	: ----		
Quote number	: BN/112/19		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

-
- Amendment (27/8/19): This report has been amended to split samples into individual work orders. All analysis results are as per the previous report

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	HH_SS1_0.5_190724	----	----	----	----
				Client sampling date / time	24-Jul-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1921187-003	--------	--------	--------	--------
					Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		**6.2**	----	----	----	----
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		**0.0004**	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		**0.148**	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<0.0002	----	----	----	----
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		**0.002**	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		**0.0029**	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		**0.0016**	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		**0.0010**	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		**0.0008**	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		**0.0016**	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		**0.0006**	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		<0.0002	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0005	----	----	----	----
EP231_TOP_C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg		<0.0002	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	HH_SS1_0.5_190724	----	----	----	----
				Client sampling date / time	24-Jul-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1921187-003	--------	--------	--------	--------
					Result	----	----	----	----
EP231_TOP_C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg		<0.0005	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg		<0.0002	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	----	----	----	----
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg		<0.0005	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		<0.0005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	----	----	----	----
EP231_TOP_P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.159**	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.148**	----	----	----	----
Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.0002	mg/kg		**0.159**	----	----	----	----
Sum of TOP C4 - C14 as Fluorine	----	0.0002	mg/kg		**0.103**	----	----	----	----
EP231_TOP_S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**89.0**	----	----	----	----
13C8-PFOA	----	0.0002	%		**88.5**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **SOIL**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP231_TOP_S: PFAS Surrogate			
13C4-PFOS	----	60	130
13C8-PFOA	----	60	130

QUALITY CONTROL REPORT

Work Order	: **EB1921187-AC**	Page	: 1 of 5
Amendment	: **1**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAMES PEACHEY	Contact	: Carsten Emrich
Address	: Brisbane	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3553 2000	Telephone	: +61 7 3552 8616
Project	: 60609758 _HH	Date Samples Received	: 13-Aug-2019
Order number	: 60609758	Date Analysis Commenced	: 16-Aug-2019
C-O-C number	: ----	Issue Date	: 27-Aug-2019
Sampler	: CAMDEN McCOSKER		
Site	: ----		
Quote number	: BN/112/19		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2527602)									
EB1921187-001	Anonymous	EA055: Moisture Content	----	0.1	%	14.6	14.5	0.706	0% - 20%
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2527289)									
EB1921187-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	0.0093	0.0102	9.42	0% - 20%
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	0.0064	0.0072	10.7	0% - 20%
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	0.101	0.106	4.32	0% - 20%
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	0.0162	0.0148	9.04	0% - 20%
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	1.83	2.05	11.3	0% - 20%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2527289)									
EB1921187-001	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0883	0.105	17.4	0% - 20%
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.109	0.119	8.85	0% - 20%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0241	0.0253	5.06	0% - 20%
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0357	0.0361	1.08	0% - 20%
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	0.183	0.164	11.3	0% - 20%
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	0.0344	# 0.0258	28.6	0% - 20%
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	0.0246	# 0.0186	27.7	0% - 20%
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	0.0012	0.0013	9.02	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	0.028	0.030	4.66	0% - 20%
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QC Lot: 2527289)									
EB1921187-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QC Lot: 2527289) - continued									
EB1921187-001	Anonymous	EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2527289)									
EB1921187-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EP231_TOP_P: PFAS Sums (QC Lot: 2527289)									
EB1921187-001	Anonymous	EP231X: Sum of PFAS	----	0.0002	mg/kg	2.49	2.71	8.53	0% - 20%
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	1.93	2.16	11.0	0% - 20%
		EP231X: Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.0002	mg/kg	2.49	2.71	8.53	0% - 20%
		EP231X: Sum of TOP C4 - C14 as Fluorine	----	0.0002	mg/kg	1.62	1.76	8.36	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids (QCLot: 2527289)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00236 mg/kg	71.6	50	150
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00232 mg/kg	64.2	50	150
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	----	----	----	----
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QCLot: 2527289)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	----	----	----	----
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.0025 mg/kg	72.2	50	150
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	----	----	----	----
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QCLot: 2527289)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	----	----	----	----
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	----	----	----	----
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	----	----	----	----
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	----	----	----	----
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	----	----	----	----
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	----	----	----	----
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2527289)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	----	----	----	----
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00018 mg/kg	0.00	0	200
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	----	----	----	----

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2527289) - continued								
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB1921187**	Page	: 1 of 6
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAMES PEACHEY	Telephone	: +61 7 3552 8616
Project	: 60609758 _HH	Date Samples Received	: 13-Aug-2019
Site	: ----	Issue Date	: 21-Aug-2019
Sampler	: CAMDEN McCOSKER	No. of samples received	: 4
Order number	: 60609758	No. of samples analysed	: 4

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **Duplicate outliers exist - please see following pages for full details.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids			**Perfluorodecanoic acid (PFDA)**	335-76-2	28.6 %	0% - 20%	**RPD exceeds LOR based limits**
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids			**Perfluoroundecanoic acid (PFUnDA)**	2058-94-8	27.7 %	0% - 20%	**RPD exceeds LOR based limits**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA055: Moisture Content (Dried @ 105-110°C)						
HDPE Soil Jar	----	----	----	16-Aug-2019	15-Aug-2019	**1**
HDPE Soil Jar HH_SS1_0.5_190724	----	----	----	16-Aug-2019	07-Aug-2019	**9**
HDPE Soil Jar	----	----	----	16-Aug-2019	10-Aug-2019	**6**
HDPE Soil Jar	----	----	----	16-Aug-2019	12-Aug-2019	**4**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
HDPE Soil Jar (EA055)	**01-Aug-2019**	**----**	----	----	**16-Aug-2019**	15-Aug-2019	×
HDPE Soil Jar (EA055) HH_SS1_0.5_190724	**24-Jul-2019**	**----**	----	----	**16-Aug-2019**	07-Aug-2019	×
HDPE Soil Jar (EA055)	**27-Jul-2019**	**----**	----	----	**16-Aug-2019**	10-Aug-2019	×
HDPE Soil Jar (EA055)	**29-Jul-2019**	**----**	----	----	**16-Aug-2019**	12-Aug-2019	×

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X (TOP))	**01-Aug-2019**	**16-Aug-2019**	29-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP)) HH_SS1_0.5_190724	**24-Jul-2019**	**16-Aug-2019**	21-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**27-Jul-2019**	**16-Aug-2019**	24-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**29-Jul-2019**	**16-Aug-2019**	26-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X (TOP))	**01-Aug-2019**	**16-Aug-2019**	29-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP)) HH_SS1_0.5_190724	**24-Jul-2019**	**16-Aug-2019**	21-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**27-Jul-2019**	**16-Aug-2019**	24-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**29-Jul-2019**	**16-Aug-2019**	26-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
EP231_TOP_C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X (TOP))	**01-Aug-2019**	**16-Aug-2019**	29-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP)) HH_SS1_0.5_190724	**24-Jul-2019**	**16-Aug-2019**	21-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**27-Jul-2019**	**16-Aug-2019**	24-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**29-Jul-2019**	**16-Aug-2019**	26-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X (TOP))	**01-Aug-2019**	**16-Aug-2019**	29-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP)) HH_SS1_0.5_190724	**24-Jul-2019**	**16-Aug-2019**	21-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**27-Jul-2019**	**16-Aug-2019**	24-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**29-Jul-2019**	**16-Aug-2019**	26-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231_TOP_P: PFAS Sums							
HDPE Soil Jar (EP231X (TOP))	**01-Aug-2019**	**16-Aug-2019**	29-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP)) HH_SS1_0.5_190724	**24-Jul-2019**	**16-Aug-2019**	21-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**27-Jul-2019**	**16-Aug-2019**	24-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓
HDPE Soil Jar (EP231X (TOP))	**29-Jul-2019**	**16-Aug-2019**	26-Jan-2020	✓	**17-Aug-2019**	25-Sep-2019	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	SOIL	In house, following oxidation per Houtz,Erika F.; Sedlak,David L. (2012): Oxidative Conversion as a Means of Detecting Precursors to Perfluoroalkyl Acids in Urban Runoff. In Environmental Science & Technology 46 (17), pp. 9342¿9349.: A portion of the oxidised sample is mixed with methanol (1:1) prior to analysis by LC-Electrospray-MS-MS,Negative Mode using MRM. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers.

Preparation Methods	Method	Matrix	Method Descriptions
Sample Extraction for PFAS	EP231-PR	SOIL	In house

From: Peachey, James <james.peachey@aecom.com>
Sent: Friday, 23 August 2019 5:47 AM
To: Carsten Emrich <Carsten.Emrich@alsglobal.com>
Cc: ALSEnviro Brisbane <ALSEnviro.Brisbane@alsglobal.com>
Subject: [EXTERNAL] - Rebatch EB1921176 and ES1925572

Hi Carsten

Please could you rebatch the following samples for TOPA (EP231X-TOP):

EB1921176
-003 (HH_MW03_190806)

Regards

James Peachey
Associate Director - Environment
D +61 7 3553 3909 M +61 426 206 362
james.peachey@aecom.com

AECOM
Level 8, 540 Wickham Street, Fortitude Valley, QLD 4006
PO Box 1307 Fortitude Valley QLD 4006
T +61 7 3553 2000 F +61 7 3553 2050
aecom.com

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Environmental Division
Brisbane
Work Order Reference
EB1922105

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1922105**	Page	: 1 of 5
Amendment	: **1**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAMES PEACHEY	Contact	: Carsten Emrich
Address	: Brisbane	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3553 2000	Telephone	: +61 7 3552 8616
Project	: 60609758	Date Samples Received	: 23-Aug-2019 05:47
Order number	: 60609758 2.0	Date Analysis Commenced	: 27-Aug-2019
C-O-C number	: ----	Issue Date	: 12-Sep-2019 17:46
Sampler	: NK		
Site	: QFES Home Hill		
Quote number	: BN/112/19		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Amendment (12/9/19): This report has been amended as a result of misinterpretation of sample identification numbers (IDs). All analysis results are as per the previous report

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	HH_MW03_190806	----
				Client sampling date / time	06-Aug-2019 00:00	----
Compound	CAS Number	LOR	Unit	EB1922105-001	--------	
				Result	----	
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids						
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	**0.05**	----	
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	**0.08**	----	
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	**0.81**	----	
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	**0.03**	----	
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	**0.75**	----	
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	----	
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids						
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	----	
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	**0.17**	----	
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	**0.54**	----	
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	**0.08**	----	
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	**0.06**	----	
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	----	
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	----	
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	----	
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	----	
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	----	
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	----	
EP231_TOP_C: Perfluoroalkyl Sulfonamides						
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	----	
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	----	
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	----	

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	HH_MW03_190806	----
				Client sampling date / time	06-Aug-2019 00:00	----
Compound	CAS Number	LOR	Unit	EB1922105-001	--------	
				Result	----	
EP231_TOP_C: Perfluoroalkyl Sulfonamides - Continued						
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	----	
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	----	
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	----	
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	----	
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids						
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	----	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	----	
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	----	
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	----	
EP231_TOP_P: PFAS Sums						
Sum of PFAS	----	0.01	µg/L	**2.57**	----	
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	**1.56**	----	
Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.01	µg/L	**2.57**	----	
^ **Sum of TOP C4 - C14 as Fluorine**	----	0.01	µg/L	**1.64**	----	
EP231_TOP_S: PFAS Surrogate						
13C4-PFOS	----	0.02	%	**97.0**	----	
13C8-PFOA	----	0.02	%	**128**	----	

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP231_TOP_S: PFAS Surrogate			
13C4-PFOS	----	60	130
13C8-PFOA	----	60	130

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EB1922105**	Page	: 1 of 6
Amendment	: **1**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAMES PEACHEY	Contact	: Carsten Emrich
Address	: Brisbane	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3553 2000	Telephone	: +61 7 3552 8616
Project	: 60609758	Date Samples Received	: 23-Aug-2019
Order number	: 60609758 2.0	Date Analysis Commenced	: 27-Aug-2019
C-O-C number	: ----	Issue Date	: 12-Sep-2019
Sampler	: NK		
Site	: QFES Home Hill		
Quote number	: BN/112/19		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Diana Mesa	2IC Organic Chemist	Brisbane Organics, Stafford, QLD

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids (QC Lot: 2544054)									
EB1922105-001	HH_MW03_190806	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.75	0.75	0.00	0% - 20%
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	0.05	0.04	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	0.08	0.07	15.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	0.81	0.76	7.14	0% - 20%
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	0.03	0.03	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
EB1922179-007	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2544054)									
EB1922105-001	HH_MW03_190806	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	0.06	0.05	0.00	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.17	0.10	53.7	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.54	0.47	13.5	0% - 20%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	0.08	0.05	36.2	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
EB1922179-007	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QC Lot: 2544054) - continued									
EB1922179-007	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QC Lot: 2544054)									
EB1922105-001	HH_MW03_190806	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EB1922179-007	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2544054)									
EB1922105-001	HH_MW03_190806	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 2544054) - continued									
EB1922105-001	HH_MW03_190806	EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EB1922179-007	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EP231_TOP_P: PFAS Sums (QC Lot: 2544054)									
EB1922105-001	HH_MW03_190806	EP231X: Sum of PFAS	----	0.01	µg/L	2.57	2.32	10.2	0% - 20%
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	1.56	1.51	3.26	0% - 20%
		EP231X: Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.01	µg/L	2.57	2.32	10.2	0% - 20%
		EP231X: Sum of TOP C4 - C14 as Fluorine	----	0.01	µg/L	1.64	1.48	10.3	0% - 20%
EB1922179-007	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Sum of TOP C4 - C14 as Fluorine	----	0.01	µg/L	<0.01	<0.01	0.00	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids (QCLot: 2544054)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.946 µg/L	87.4	50	150
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.928 µg/L	64.1	50	150
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	----	----	----	----
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids (QCLot: 2544054)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	----	----	----	----
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	1 µg/L	99.7	50	150
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	----	----	----	----
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	----	----	----	----
EP231_TOP_C: Perfluoroalkyl Sulfonamides (QCLot: 2544054)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	----	----	----	----
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	----	----	----	----
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	----	----	----	----
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	----	----	----	----
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	----	----	----	----
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	----	----	----	----
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	----	----	----	----
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2544054)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	----	----	----	----
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.0948 µg/L	-1.05	0	200
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	----	----	----	----

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 2544054) - continued								
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	----	----	----	----
EP231_TOP_P: PFAS Sums (QCLot: 2544054)								
EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	----	----	----	----
EP231X: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.01	µg/L	<0.01	----	----	----	----
EP231X: Sum of TOP C4 - C14 Carboxylates and C4 - C8 Sulfonates	----	0.01	µg/L	<0.01	----	----	----	----
EP231X: Sum of TOP C4 - C14 as Fluorine	----	0.01	µg/L	<0.01	----	----	----	----

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB1922105**	Page	: 1 of 5
Amendment	: **1**		
Client	: **AECOM Australia Pty Ltd**	Laboratory	: Environmental Division Brisbane
Contact	: MR JAMES PEACHEY	Telephone	: +61 7 3552 8616
Project	: 60609758	Date Samples Received	: 23-Aug-2019
Site	: QFES Home Hill	Issue Date	: 12-Sep-2019
Sampler	: NK	No. of samples received	: 4
Order number	: 60609758 2.0	No. of samples analysed	: 4

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231_TOP_A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X (TOP)) HH_MW03_190806,	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP))	**07-Aug-2019**	**27-Aug-2019**	03-Feb-2020	✓	**27-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP))	**08-Aug-2019**	**27-Aug-2019**	04-Feb-2020	✓	**27-Aug-2019**	04-Feb-2020	✓
EP231_TOP_B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X (TOP)) HH_MW03_190806,	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP))	**07-Aug-2019**	**27-Aug-2019**	03-Feb-2020	✓	**27-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP))	**08-Aug-2019**	**27-Aug-2019**	04-Feb-2020	✓	**27-Aug-2019**	04-Feb-2020	✓
EP231_TOP_C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X (TOP)) HH_MW03_190806,	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP))	**07-Aug-2019**	**27-Aug-2019**	03-Feb-2020	✓	**27-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP))	**08-Aug-2019**	**27-Aug-2019**	04-Feb-2020	✓	**27-Aug-2019**	04-Feb-2020	✓
EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X (TOP)) HH_MW03_190806,	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP))	**07-Aug-2019**	**27-Aug-2019**	03-Feb-2020	✓	**27-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP))	**08-Aug-2019**	**27-Aug-2019**	04-Feb-2020	✓	**27-Aug-2019**	04-Feb-2020	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231_TOP_P: PFAS Sums							
HDPE (no PTFE) (EP231X (TOP)) HH_MW03_190806,	**06-Aug-2019**	**27-Aug-2019**	02-Feb-2020	✓	**27-Aug-2019**	02-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP))	**07-Aug-2019**	**27-Aug-2019**	03-Feb-2020	✓	**27-Aug-2019**	03-Feb-2020	✓
HDPE (no PTFE) (EP231X (TOP))	**08-Aug-2019**	**27-Aug-2019**	04-Feb-2020	✓	**27-Aug-2019**	04-Feb-2020	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	2	18	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	WATER	In house, following oxidation per Houtz,Erika F.; Sedlak,David L. (2012): Oxidative Conversion as a Means of Detecting Precursors to Perfluoroalkyl Acids in Urban Runoff. In Environmental Science & Technology 46 (17),pp. 9342¿9349.: A portion of the oxidised sample is mixed with methanol (1:1) prior to analysis by LC-Electrospray-MS-MS,Negative Mode using MRM. Where commercially available, isotopically labelled analogues of the target analytes are used as internal standards for quantification. Where a labelled analogue is not commercially available, the internal standard with similar chemistry and the closest retention time to the target is used for quantification. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers.

Preparation Methods	Method	Matrix	Method Descriptions
Total Oxidisable Precursor Digest for PFAS	* ORG70-W	WATER	In-House with oxidation per Houtz, Erika F.; Sedlak, David L. (2012): Oxidative Conversion as a Means of Detecting Precursors to Perfluoroalkyl Acids in Urban Runoff. In Environmental Science & Technology 46 (17), pp. 9342¿9349: A 5 mL sample is digested with persulfate under alkaline conditions, neutralised and prepared for analysis per EP231.