



Airservices Australia  
Hobart Airport Targeted PFAS Investigation  
Sinclair Creek & Five Mile Beach

June 2018

# Executive summary

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.3 and the assumptions and qualifications contained throughout the Report.

GHD Pty Ltd (GHD) was engaged by Airservices Australia (Airservices) to undertake a targeted investigation of perfluoroalkyl and polyfluoroalkyl substances (PFAS) in water, sediments and biota in Sinclair Creek, which runs through the Hobart Airport property, and its' immediate downstream receiving environment, Five Mile Beach.

The purpose of this investigation was to expand on the preliminary investigation findings from 2017 that identified elevated PFAS in surface water in a number of locations along Sinclair Creek within the Airport boundary, and off-site at the mouth of the creek as it enters Five Mile Beach. This drainage system is considered to be a potential primary pathway for PFAS leaving the Airport site.

This investigation was designed to be a targeted sampling program, specifically looking at the associated potential human health risks (i.e. exposure via recreational users of the beach and consumption of fish). The scope of work included collection of surface water and sediment samples at intervals along the creek line, and at varying distances out into Five Mile Beach. Samples of biota (i.e. wild shellfish) were also collected, where identified. The scope of this investigation does not constitute a detailed site investigation or an investigation of possible sources of PFAS contamination.

The following key conclusions can be drawn from this investigation:

Limited biota was observed within the investigation area which may be caught for potential human consumption. The sample of wild oysters that was collected in Five Mile Beach did not contain PFAS concentrations above the laboratory's limit of reporting.

Concentrations of PFAS in surface water (and sediments) within Sinclair Creek were found to be highest west of the runway, decreasing east of the runway suggesting there is limited evidence of notable PFAS sources east of the runway contributing to impact in the creek. PFAS concentrations in water (and sediment) in Five Mile Beach were found to generally decrease with distance from the creek mouth.

In respect of the potential receptors (human health) that have been identified associated with Sinclair Creek and its discharge area on Five Mile Beach the following comments are made:

Risk to Airport workers conducting routine tasks and earthworks (and people on the adjacent private land) is considered low as the exposure pathway (to submerged sediments in the creek) is limited. The sediments do however show the potential to leach PFAS and therefore represent an ongoing secondary source of PFAS loading to the creek, and ultimately the downstream beach environment.

The potential risk to recreational and commercial fishers using the waters off Five Mile Beach (i.e. via consumption of finfish and shellfish) requires further investigation as PFAS concentrations in water entering the marine environment from Sinclair Creek exceed the nominated criteria for 'consumption of fish' (i.e. via bioaccumulation in the food chain). The exceedances do not necessarily represent an unacceptable risk to human health, but rather a trigger to conduct further investigation into PFAS in fish species in the broader Pitt Water area.

Risk to recreational users of the Five Mile Beach area adjacent to Sinclair Creek (i.e. via ingestion of water) is considered low. This is primarily attributed to evidence that concentrations decrease relatively rapidly with distance from the creek mouth and that the

area is subject to tidal inundation twice daily and effectively dilute concentrations during high tide conditions. It should be noted that the creek itself is considered to be a very low recreational value water body, such that the saltmarsh environment and shallow water do not represent an attractive location for swimming compared to the beach.

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# 1. Introduction

GHD Pty Ltd (GHD) was engaged by Airservices Australia (Airservices) to undertake an environmental investigation of an area that may have been affected by the historical use of aqueous film forming foam (AFFF) containing perfluoroalkyl and polyfluoroalkyl substances (PFAS) at the Hobart International Airport (the Airport). The investigation was centred on the water, sediments, and biota of Sinclair Creek, which runs through the Airport property, and its' immediate downstream receiving environment, Five Mile Beach. This report presents the findings of the targeted site investigation.

## 1.1 Background

AFFF has been used for fire-fighting purposes around Australia for several decades. Depending on the type of AFFF used, the principal PFAS constituents (as active or by-product ingredients) may have included a range of contaminants of potential concern including perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA) and fluorotelomers such as 6:2 fluorotelomer sulfonate (6:2FtS) and 8:2 fluorotelomer sulfonate (8:2FtS). The historical use of PFAS has resulted in contamination of soil, groundwater, sediments, surface water and infrastructure. While the risks to human health and the environment are still the subject of much research, PFAS compounds are highly persistent in the environment, can bio-accumulate, and may be harmful to animal and human health.

As the Airport site has a history of AFFF use, preliminary investigations have been undertaken to start to understand potential PFAS distribution. SEMF (2017)<sup>1</sup> identified elevated PFAS in surface water in a number of locations along Sinclair Creek within the Airport boundary and off-site at the mouth of the creek as it enters Five Mile Beach.

From this investigation, Sinclair Creek was identified as a potential primary pathway for PFAS leaving the Airport site, and Five Mile Beach as the subsequent receiving environment.

## 1.2 Purpose

The purpose of the present investigation was to expand on the SEMF (2017) findings, specifically investigating potential human health risk pathways through biota consumption (i.e. shellfish and finfish) and recreational exposure, with supporting sampling undertaken on sediments and water at the investigation sites to better understand contaminant characteristics along the primary pathway.

This investigation was designed to be a targeted sampling program, specifically looking at the potential primary pathway for PFAS leaving the airport (Sinclair Creek to Five Mile Beach). It does not represent a broader Details Site Investigation (DSI) of PFAS across the Airport, or an investigation of possible sources of contamination at the Site. The DSI program of works is to be developed subsequent to this investigation.

This targeted approach follows the guidance notes provided in HEPA (2018) *PFAS National Management Plan*<sup>2</sup>. It identifies that '*...priority should be given to early investigation of risks to sensitive off-site receptors*', and that '*this should include targeted sampling of key migration pathways and receptors...*', and '*...should be used to inform the subsequent more detailed investigation and risk assessment*'.

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<sup>1</sup> SEMF (2017) *Hobart Airport – Aviation Rescue Fire Fighting Services Preliminary Site Investigation*. Report for Airservices Australia dated 31 October 2017, Project: 2105.022

<sup>2</sup> HEPA (2018) *PFAS National Environmental Management Plan*, Heads of EPAs Australia and New Zealand (HEPA) and the Australian Government Department of the Environment and Energy (DoEE), January 2018

This report provides the results and analysis from the field sampling event, which was undertaken in accordance with the sampling analysis and quality plan (SAQP) developed for the investigation (Appendix G). The SAQP was provided to both the Tasmanian Government PFAS Interdepartmental Working Group (IWG) and Hobart International Airport for review and comment, prior to being executed.

### 1.3 Assumptions

*This report: has been prepared by GHD for Airservices Australia and may only be used and relied on by Airservices Australia for the purpose agreed between GHD and the Airservices Australia as set out in section 1.2 of this report.*

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

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

*The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.*

*The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described throughout this report. GHD disclaims liability arising from any of the assumptions being incorrect.*

*GHD has prepared this report on the basis of information provided by Airservices Australia and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.*

*The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.*

*Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.*

*Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.*

## 2. Investigation Sites

### 2.1 Sinclair Creek

Sinclair Creek commences as a narrow drainage line to the west of the Airport. The creek passes through several culverts within the Airport property before passing through a drainage system under the main runway, emerging to the east of the runway and continuing off site towards Five Mile Beach.

On the eastern side of the Airport the creek passes through Commonwealth land (the Airport) into a saltmarsh area (limited access area within a private freehold parcel) just prior to the creek's junction with Pittwater Road. The creek then passes through the freehold parcel and discharges into Five Mile Beach.

Sinclair Creek is mapped as Succulent saline hermland (ASS) under TASVEG 3.0 from the runway area on the eastern side of the Airport to Five Mile Beach. The creek is estuarine in nature, transitioning from tidal influenced marine waters from the Five Mile Beach mouth to freshwater from the airport direction. Flow in the creek is subject to discharge from the Taswater Wastewater Treatment Plant (on Airport land), as well as run-off flow from rain events, with the lower section subject to tidal influence from Five Mile Beach.

Geology of the creek and surrounds is classified as Undifferentiated Quaternary Sediments. A small area adjacent to where the creek crosses under Pittwater Road is listed as potential acid sulphate soils, with a high probability of occurrence (>70%) (the LIST).



Figure 2-1 Sinclair Creek

## 2.2 Five Mile Beach

Five Mile Beach is part of the broader Pitt Water area and commences south of Pittwater Bluff. It extends to the east along a spit towards the Pitt Water mouth, meeting Seven Mile Beach, which runs on the south facing side of the sandy spit. Offshore from Five Mile beach is Barren and Woody Islands, small rocky islands in the middle of Pitt Water.

Several major freshwater sources input into Pitt Water, including Coal River, Iron Creek, and Orielton Rivulet. Pitt Water has a narrow (~500 m) ocean inlet at Sandy Point at the end of Five Mile Beach; significant tidal currents flow through the entrance.

The marine environment out from Five Mile Beach is relatively shallow and low-energy. It is semi-enclosed to the north from the Tasman Highway causeway, which has a ~450 m bridge culvert section.

Owing to the shallow nature of the bay, large areas of intertidal soft sediments are present out from the beach. Sediments consist of relatively fine-grained silty sands at the western end of the beach, transitioning to areas of coarser sediments consistent with higher energy environments to the east.

Several shellfish farming leases are present off Five Mile Beach, just south of Woody Island where the main marine channel flows past. The leases range in distance from 2.7-5.9 kms from the mouth of Sinclair Creek

The shallow intertidal areas along Five Mile Beach are suspected to be targeted by recreational flounder fisherman. Other popular recreational uses of the Five Mile Beach area include swimming, boating, horse riding, and fishing.



Figure 2-2 Intertidal sand flats of Five Mile Beach

# 3. Methodology

## 3.1 Sample Sites

Sampling locations were strategically placed along Sinclair Creek taking into account different inputs along the length of the waterway, including a waste water treatment plant (WWTP) discharge location and several drainage line inputs.

For Five Mile Beach, sample locations were placed in arcing gradients around the mouth of Sinclair Creek, with reference sites situated 1 km to the east and north-west of the mouth. The sample pattern was selected to investigate potential contaminant gradients with increasing distance from the creek mouth.

A full list of sites and location descriptions are presented in Table 3-1, with sites shown graphically in Figure 1, Appendix A.

Table 3-1 Sample site descriptions

Site name	Location description
SC-1	Near original sample location "SW5" (refer SEMF 2017), upstream of runway
SC-2	Near original sample location "HIA 12-W" (refer SEMF 2017), upstream of runway
SC-3	Immediately downstream of runway on Sinclair Creek
SC-4	Downstream of first tributary north-east of runway on Sinclair Creek
SC-5	At Airport site boundary on Sinclair Creek
SC-6	At confluence of Five Mile Beach and Sinclair Creek
FMB-1, FMB-2, FMB-3	250 m arc from Sinclair Creek mouth
FMB-4, FMB-5, FMB-6	500 m arc from Sinclair Creek mouth
FMB-7	1 km north-west of Sinclair Creek mouth
FMB-8	1 km east of Sinclair Creek mouth

## 3.2 Water

### 3.2.1 Sampling method

*In-situ* physio-chemical water quality parameters were recorded at each sample location within Sinclair Creek, using a hand held water quality meter (YSI Quatro Pro Plus multimeter) calibrated to the manufacturers specifications. The following parameters were recorded:

- Dissolved oxygen (DO; mg/L)
- Temperature (oC)
- Electrical Conductivity (EC;  $\mu\text{S}/\text{cm}$ )
- pH (pH unit)

Surface water samples were collected by grab sampling with a dedicated sample bottle. Samples were placed in laboratory-supplied bottles appropriate for sampling PFAS and immediately stored in chilled insulated containers. All samples were transferred to the primary analytical laboratory: Australian Laboratory Services (ALS), and accompanied by chain of custody (CoC) documentation. Eurofins MGT were selected as the secondary analytical laboratory. Further details on sample preservation, handling and transport is provided below.

### 3.2.2 Sample Sites

Water quality samples were taken at all sites along Sinclair Creek and within the Five Mile Beach area (as per Table 3-1). To account for the potential influence of the Taswater Wastewater Treatment Plant discharge on water quality in the creek, samples were collected at select locations at two different times. The treatment plant is understood to discharge ~200,000 litres twice a day, for approximately 2-3 hours duration prior to high tide (total of ~400,000 litres/day). All water sample sites along the creek were collected at low-tide in order to obtain samples representative of the catchment during draining conditions. The three sample sites immediately down-stream of the treatment plant discharge point were repeated during treatment plant discharge conditions (i.e. just before high tide).

Water samples in Five Mile Beach were sampled during a rising low-tide, in order to obtain samples representative of the catchment during draining conditions, and not during tidal mixing/dilution conditions.

### 3.2.3 Analysis

Water was analysed for following parameters:

- PFAS – Full Suite Low Level (28 analytes)
- Field in-situ parameters (pH, conductivity, temperature, dissolved oxygen) (Sinclair Creek only)

A sampling parameter summary table is presented in Section 3.6.

## 3.3 Sediment

### 3.3.1 Sampling method

Sediment samples were collected using disposable sediment cores, which were plunged into the sediment to the required depth and then retrieved using a gloved hand to create a vacuum at the open end. Samples were then gravity extruded directly into pre-labelled sample laboratory supplied containers appropriate for sampling PFAS and immediately stored in chilled insulated containers. All samples were transferred to Australian Laboratory Services

(ALS) and accompanied by CoC documentation. A new set of disposable gloves were worn between each sample site by the samplers.

### 3.3.2 Sample Sites

Sediment samples were taken at all sites along Sinclair Creek and within the Five Mile Beach area (as per Table 3-1). At Sinclair Creek sites, depth intervals of 0-100 mm and 150-300 mm were taken. At Five Mile Beach sites, depth intervals were 0-100 mm.

### 3.3.3 Analysis

Sediment samples were analysed for the following parameters:

- PFAS – Full Suite (28 analytes)
- ASLP leach with PFAS Full Suite (28 analytes) (0-100 mm samples in Sinclair Creek and Five Mile Beach only)
- Total Organic Carbon
- Exchangeable Cations (Ca, Mg, Na, K) plus Cation Exchange Capacity (CEC)
- Particle Sizing to 75 µm (Sieve)

Sites FMB4 and FMB6 were analysed for PFAS full suite only.

A sampling parameter summary table is presented in Section 3.6.

## 3.4 Biota

### 3.4.1 Sampling method

Biota sampling was undertaken opportunistically around the investigation area. Where biota was able to be collected, whole samples were collected (i.e. whole shellfish) rather than attempting field dissection or compositing, with the intention that the analytical laboratory would undertake this aspect to avoid any field cross-contamination.

All fauna handling and sample collection was conducted in compliance with the GHD Animal Ethics Committee's (AEC) requirements for the sampling methods employed and species being targeted. The wellbeing of animals was the priority for all tasks.

A section of approximately 2500m along Five Mile Beach (centred on Sinclair Creek mouth) was surveyed for biota, in addition to Sinclair Creek by a GHD aquatic ecologist. As the beach environment was predominantly shallow soft sediments there was limited evidence of biota (human consumption) other than a single cluster of three wild oysters near sample location FMB-6 (sample ID 'FMB-Oysters'). The oysters (pacific oysters) appeared in good condition and were between 8-10 cm long. The oysters were collected whole in zip-lock plastic bags and placed into chilled eskies for further transport to the analytical laboratory for compositing prior to testing. While finfish were target species in this investigation, no notable populations were observed within the beach survey area at the time of the survey.

A survey of the investigation area of Sinclair Creek identified no evidence of biota (human consumption). Anecdotal information provided by Airport staff suggested eels have been identified further upstream in the creek system, but were not expected within the investigation area. No eels or other target biota were identified during the survey of Sinclair Creek.

### 3.4.2 Analysis

The biota samples were analysed for the following parameters:

- PFAS – Full Suite (28 analytes) plus Linear/Branched Speciation

## 3.5 Quality Assurance / Quality Control

### ***General Field work QA***

All fieldwork was conducted with reference to GHD's Standard Field Operating Procedures, ensuring that all samples were collected by a set of uniform and systematic methods, as required by GHD's QA system. Additional procedures specific to PFAS sampling were also adopted (i.e. minimising the potential to introduce potential PFAS from equipment, clothing etc.) and were detailed in the SAQP.

The water quality meter utilised for the investigation was calibrated by the rental supplier to ensure accuracy of measurements taken in the field.

Samples collected were preserved, handled and transported to maintain sample integrity in accordance with the procedures outlined below. Certificates of analysis for all analyses are provided in Appendix F.

Sample containers were supplied pre-prepared by the laboratory and were labelled with the container preservative and the analytes it is suitable for. All sampling was completed by staff wearing powder-free nitrile gloves. All staff took extra care to wear only natural sunscreens and wore cotton clothing. Samples were labelled with the following information:

- Project identification number
- Sample identification number
- Date and time of sampling
- Initials of sample collector

QA/QC samples were labelled differently so that samples were delivered 'blind' to the laboratory. The same information as for a normal sample was recorded. The sample identification system used indicates only the type of verification sample along with a unique number. The number corresponded to a predetermined location.

### ***Chain of custody forms***

Chain of Custody (CoC) procedures were used to track samples, discourage tampering and provide a sampling summary. The CoC form was filled out on completion of field sampling. An individual CoC was completed for each discrete batch of samples.

The following information was included on the CoC form:

- Project identification number
- Sample number
- Date and time of collection
- Type of sample
- Number and type of container (if required)
- Analysis required
- Signature of sampler

- Signature of receiver (laboratory)

Each batch of samples sent to ALS included a CoC form. When the batch was relinquished (by GHD) and received (by the laboratory or courier), the party involved signed the form and indicated the time and date. The original copy accompanied the samples to the laboratory in the sample container. The original was signed by the laboratory, scanned and sent to GHD for filing. The laboratory and GHD have retained a copy as a record of samples sent and analyses requested.

#### ***Sample handling and packing***

During fieldwork, samples were stored in a chilled container (esky with ice). At the end of work for each day, the CoC form was placed in a separate bag and sealed. The samples were then placed in a cooler containing ice. Samples were kept as close as possible to or below 4 °C. The CoC form was placed in the cooler with the samples and fresh ice, before being sealed with tape / security seals and couriered to ALS.

#### ***Sample storage and disposal***

Storage and disposal protocols are in accordance with National Association of Testing Authorities (NATA). The laboratory is responsible for ensuring samples are correctly stored and disposed of once submitted for analyses. The laboratory also ensured the correct sample containers (cleaned / washed / rinsed as required) were supplied for the analyses required as requested by GHD.

#### ***Sample receipt notification***

A sample receipt notification (SRN) was issued by the laboratory on the same day samples were received. The SRN was forwarded in digital (pdf) format, and highlighted any discrepancies between the chain of custody forms and the samples received, in addition to any breakages or inadequacies in sample preservation, preparation or containers. These are available upon request.

#### ***Sampling and analysis quality control***

The NEPM (NEPC 2013) recommended approach was adopted for QC sampling. The QC samples collected during the investigation are described as follows:

- Blind (intra-laboratory) duplicate: Blind duplicate samples are used to identify the variation in the analyte concentration between samples from the same sampling point.
- Split (inter-laboratory) duplicate: Split duplicate samples provide an indication of the repeatability of the results between laboratories.

A set of blind duplicate and split duplicate QC samples were collected at two sites.

### **3.6 Sampling Summary**

A summary of sediment and water quality analysis is presented in Table 3-2.

Table 3-2 Sampling summary

Site name	Location description	Sediment sample parameters					Water sample parameters	
		PFAS – Full Suite	PFAS – (ASLP leach testing	Total Organic Carbon	Cations/CEC	Particle Sizing	-PFAS – Full Suite Low Level	Field in-situ parameters
SC-1	Near original sample location "SW5", upstream of runway	2 (0-100mm; and 150-300mm)	1 (surface sample only)	2 (0-100mm; and 150-300mm)	2 (0-100mm; and 150-300mm)	2 (0-100mm; and 150-300mm)	1	1
SC-2	Near original sample location "HIA 12-W", upstream of runway	2 (0-100mm; and 150-300mm)	1 (surface sample only)	2 (0-100mm; and 150-300mm)	2 (0-100mm; and 150-300mm)	2 (0-100mm; and 150-300mm)	1	1
SC-3	Immediately downstream of runway on Sinclair Creek	2 (0-100mm; and 150-300mm)	1 (surface sample only)	2 (0-100mm; and 150-300mm)	2 (0-100mm; and 150-300mm)	2 (0-100mm; and 150-300mm)	2 (1 during WWTP flow; 1 when no WWTP flow)	2 (1 during WWTP flow; 1 when no WWTP flow)
SC-4	Downstream of first tributary north-east of runway on Sinclair Creek	2 (0-100mm; and 150-300mm)	1 (surface sample only)	2 (0-100mm; and 150-300mm)	2 (0-100mm; and 150-300mm)	2 (0-100mm; and 150-300mm)	2 (1 during WWTP flow; 1 when no WWTP flow)	2 (1 during WWTP flow; 1 when no WWTP flow)
SC-5	At Airport site boundary on Sinclair Creek	2 (0-100mm; and 150-300mm)	1 (surface sample only)	2 (0-100mm; and 150-300mm)	2 (0-100mm; and 150-300mm)	2 (0-100mm; and 150-300mm)	2 (1 during WWTP flow; 1 when no WWTP flow)	2 (1 during WWTP flow; 1 when no WWTP flow)
SC-6	At confluence of Five Mile Beach and Sinclair Creek	2 (0-100mm; and 150-300mm)	1 (surface sample only)	2 (0-100mm; and 150-300mm)	2 (0-100mm; and 150-300mm)	2 (0-100mm; and 150-300mm)	1	1
SC-A	Supplementary location within Sinclair Creek	2 (0-100mm; and 150-300mm)	1 (surface sample only)	2 (0-100mm; and 150-300mm)	2 (0-100mm; and 150-300mm)	2 (0-100mm; and 150-300mm)	1	1
SC-B	Supplementary location within Sinclair Creek	2 (0-100mm; and 150-300mm)	1 (surface sample only)	2 (0-100mm; and 150-300mm)	2 (0-100mm; and 150-300mm)	2 (0-100mm; and 150-300mm)	1	1
FMB-1	250 m arc from Sinclair Creek mouth	1	1	1	1	1	1	-

Site name	Location description	Sediment sample parameters						Water sample parameters	
		PFAS – Full Suite	PFAS – (ASLP leach testing	Total Organic Carbon	Cations/CEC	Particle Sizing	-PFAS – Full Suite Low Level	Field in-situ parameters	
FMB-2	250 m arc from Sinclair Creek mouth	1	1	1	1	1	1	-	
FMB-3	250 m arc from Sinclair Creek mouth	1	1	1	1	1	1	-	
FMB-4	500 m arc from Sinclair Creek mouth	1	-	-	-	-	1	-	
FMB-5	500 m arc from Sinclair Creek mouth	1	1	1	1	1	1	-	
FMB-6	500 m arc from Sinclair Creek mouth	1	-	-	-	-	1	-	
FMB-7	1 km north-west of Sinclair Creek mouth	1	1	1	1	1	1	-	
FMB-8	1 km east of Sinclair Creek mouth	1	1	1	1	1	1	-	
QA/QC		4	2	4	4	4	2	-	
<b>TOTAL</b>		28	16	26	26	26	21	11	

## 3.7 Assessment Criteria

### 3.7.1 Potential Receptors

The following potential receptors have been identified associated with Sinclair Creek and its discharge area on Five Mile Beach. These receptors are specific to assessment of potential human health risk and were identified in the preceding PSI preliminary conceptual site models (SEMF 2017):

- Airport workers and staff conducting routine tasks
- Airport workers undertaking earthworks.
- Recreational fishers Five Mile Beach area (i.e. biota via consumption of fish)
- Recreational users Five Mile Beach area (potential ingestion of water)

For the area of saltmarsh within the parcel of private land that Sinclair Creek passes through east of the Airport site, the exposure scenario for residents is not considered different to those identified above.

Assessment of ecological receptors (species protection) has not been included as part of this investigation as the objective of this program is to address potential human health risk (i.e. consumption of fish or recreational exposure scenarios). Investigation of the broader risks to potential ecological receptors within and surrounding the Airport will be addressed in the subsequent DSI program.

Likewise, assessment of potential impacts to groundwater and subsequent potential use of groundwater, and/or groundwater discharge to receiving environments will also be addressed in the subsequent DSI program.

### 3.7.2 Criteria (protection of human health)

PFAS contaminated site assessment in Australia is to be conducted in accordance with the guidance information provided in PFAS National Environmental Management Plan (HEPA 2018). Additionally, it should supplement the information provided in the *National Environment Protection (Assessment of Site Contamination) Measure 2009, as amended 2013* (the NEPM), which presents risk-based assessment criteria developed to protect human health (and the environment) in various environmental and land-use settings.

This investigation has been conducted in general accordance with both documents and the analytical results have therefore been compared with the following assessment criteria:

#### **Surface Water**

- Recreational water (i.e. via ingestion) - HEPA (2018) Health based guidance values
- Consumption of fish (i.e. via bioaccumulation in food chain) - GHD (2017), *PFAS Investigations, Derivation of PFAS soil and water criteria* (marine water), report for Airservices Australia, 17 May 2017

#### **Sediment**

There are no identified suitable criteria for PFAS in sediment (human health risk) at this time. While criteria have been developed for soil (i.e. via ingestion as a primary pathway) the exposure pathway is not considered applicable for submerged sediments within creek lines. Consideration of the associated potential risk is included in the conclusions section of this report.

## **Biota**

In the absence of shellfish criteria, finfish criteria have been conservatively applied to all biota in this investigation, as representing the most conservative criteria under the food category 'Fish and Seafood'.

- Finfish - Food Standards Australia New Zealand (FSANZ 2017) *Perfluorinated chemicals in food – Proposed trigger points for investigation, finfish dietary exposure*, Australian Government Department of Health

# 4. Results

## 4.1 Environmental Conditions

Sampling was undertaken over two days, with the main body of sampling completed on 11/04/2018, and a secondary site visit was undertaken on 13/04/2018.

Weather was overcast with low winds during both site visits and no rain was experienced.

On 11/04/2018, a low tide of 0.52 m was reached at 1055, with a high tide of 1.10 m reached at 1750. Sampling was undertaken between 0830 and 14:30, tidal influence in Sinclair Creek was avoided by sampling the Sinclair Creek sites in the morning.

On 13/04/2018, a low tide of 0.56 m was reached at 1203, with a high tide of 1.14 m reached at 1846. Sampling in Sinclair Creek on this day was completed at approximately 1000, avoiding any tidal saltwater incursion.

Physico-chemical characterization data of the surface waters at each sample location were collected and are presented in Table 4-1.

- Temperature and the oxidation-reduction potential increased moving downstream from SC1 until reaching the mouth of the creek where it joins up with Five Mile Beach when these parameter started dropping.
- The water moves from fresh to brackish moving downstream towards Five Mile Beach, with sampling locations SC3 and SC4 having the freshest water within Sinclair Creek,
- The pH of the creek water starts neutral and moved to mildly alkaline moving downstream toward Five Mile Beach.
- The dissolved oxygen levels generally increase downstream until reaching Five Mile Beach.

Table 4-1 Field water quality parameters

Site	Temperature (°C)	EC (µS/cm)	DO (mg/L)	pH (pH units)	ORP ±mV (SHE)
SC1	14.6	1160	0.84	7.27	65.4
SC2	14.5	1245	3.87	7.46	234.8
SC3	16.3	748	4.52	7.79	286.5
SC4	16.4	916	7.21	8.3	281.1

SC5	16.4	1387	17.35	8.11	277.3
SC6	15.2	25702	3.46	7.5	99.3

## 4.2 Data Quality Assessment

### 4.2.1 Data Quality Objectives

The Data Quality Objectives (DQOs) for the investigation were based on guidance presented in the NEPM schedules B1 and B3 (Guideline on Laboratory Analysis of Potentially Contaminated Soils). DQOs are aimed at ensuring that a satisfactory level of quality assurance and quality control (QA/QC) is adhered to during the field and laboratory procedures implemented to collect data. This ensures that the data is reliable and that any subsequent conclusions and recommendations can be made with confidence. A summary of the quality of data reported herein is presented in Sections 4.2.2 and 4.2.3 below.

### 4.2.2 Field program

The field data quality assessment table is presented as Table B1, Appendix B and Table C1, Appendix C. It presents calculated relative percent differences (RPDs) for the primary and secondary quality control samples that were collected during the field sampling program. In accordance with the NEPM, primary and blind duplicate (i.e. inter and intra-laboratory duplicates) QC samples were recovered at a rate of at least 5%, and two QC samples (comprising QA1 [water] and QA2 [soil]); recovered concurrent with primary samples SC\_6W and FMB\_8, respectively to confirm the repeatability of the analytical data.

RPDs between primary and intra-laboratory duplicate samples for water indicate acceptable precision in all analytical duplicate pairs (within the adopted criteria of 50% for organic, 30% for inorganic analytes). RPDs between the inter-laboratory duplicate samples showed exceedance values for a range of compounds with consistently higher concentrations in the secondary laboratory data. It has been identified that the laboratory have different methods of correction for recoveries. ALS does not correct where surrogates percentage recovery is low, in contrast Eurofins does correct for low recovery. Surrogate recoveries for both the primary sample and inter-laboratory duplicates (SC\_6W and QQA1, respectively) were low (~50-60%), and subsequently the Eurofins results were corrected 'up' to account for this. This is consistent with the higher concentrations shown between the two duplicates. Low recoveries are likely attributed to matrix interference. For the purposes of this investigation the highest concentrations from the primary laboratory will be conservatively applied, as there is some caution regarding the potential for over correction in response to poor surrogate recoveries.

RPDs between primary and intra-laboratory duplicate samples for soil indicate acceptable precision in all analytical duplicate pairs except PFOS. A low concentration was detected in the intra-laboratory duplicate (QA2) but not in the primary sample (FMB\_8). No PFOS concentration was detected above the laboratory's limit of reporting (LOR) in the inter-laboratory duplicate (QQA2). However, the higher LOR in the secondary lab could potentially mask the low concentration detected. It should be noted that the Eurofins LOR meets the general LOR for solids identified in the NEMP (HEPA 2018).

Notable variability between these same samples were also identified in total organic carbon (TOC) suggesting there is a relatively high degree of sample heterogeneity in the samples. The relative increase in TOC would present a potential increase in PFAS bonding capability, which appears to be the likely primary source of variability between duplicates from this location.

This is also displayed in variability within the associated PFOS ASLP leach data. For the purposes of this investigation the highest concentrations from the primary laboratory will be conservatively applied.

#### 4.2.3 Laboratory program

The NATA certified laboratories used for this assessment (ALS and Eurofins), implement internal QA/QC procedures during sample analysis, and provide a summary of checks of the adequacy of these in their analytical reports. GHD reviews the internal laboratory quality control data provided within the laboratory reports to confirm the data is acceptable for decision-making, before reporting the findings of site assessments. Copies of laboratory analytical reports, including their internal QC reports, are presented in Appendix F.

Review of the laboratory quality control reports indicates that internal quality control parameters met the laboratories QC requirements. No quality issues were identified with regard to the; repeatability of the results, sample holding times, method blanks, control samples, matrix spike and surrogate spike recoveries, and the frequency of the laboratories internal QC checks was acceptable, with the exception of a small number of matrix spike recoveries and laboratory control spike recoveries within ALS batch EM1806226. From those variations only one related to the key chemical of concern (PFOS) in sample [SC\_1S (0-100)] where the matrix spike recovery could not be determined due to elevated background levels.

#### 4.2.4 Summary Statement

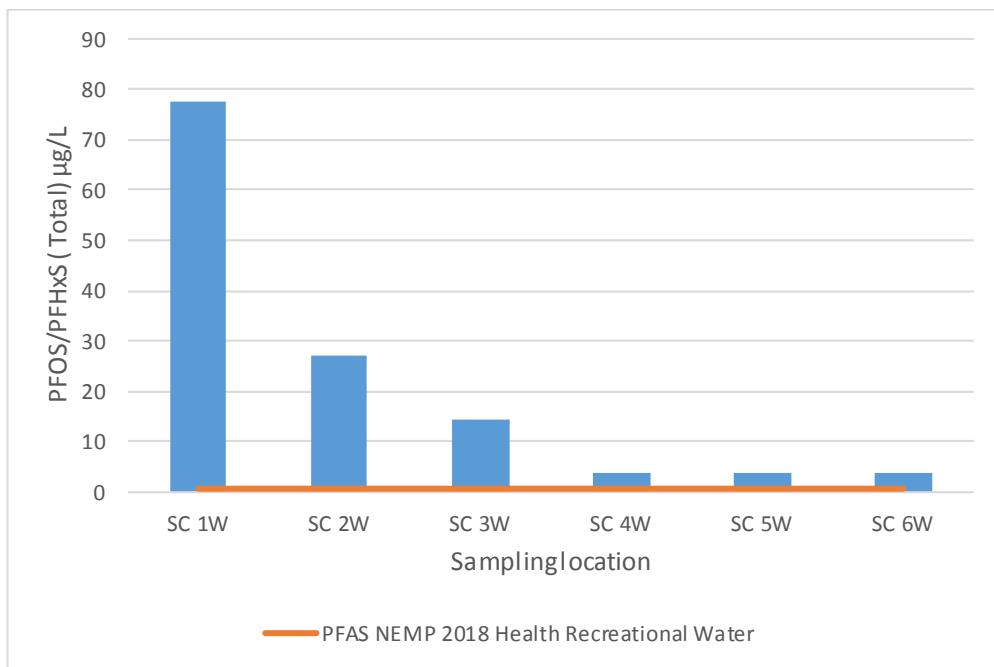
The QA/QC checks implemented both in the field and by the laboratory indicate that the data is of suitable quality to be used for decision-making regarding the composition of the material and potential risks that material poses to human health.

### 4.3 Water

Key contaminants of concern identified (PFAS compounds with highest concentrations) were PFOS and PFHxS. This is consistent with the preceding PSI's limited surface water investigations (SEMF 2017). Results from water quality analysis from Sinclair Creek and Five Mile Beach are tabulated in Appendix B, with PFOS/PFHxS total concentrations shown spatially in Figure 1, Appendix A. A summary of the results follows.

#### *Sinclair Creek*

- PFOS/PFHxS concentrations in water in Sinclair Creek ranged from 77.7 µg/L - 3.6 µg/L. All concentrations were above the health-based guidance value for 'Recreational Water' of 0.7 µg/L (HEPA 2018). It should be noted that the creek itself is considered to be a very low recreational value water body, such that the saltmarsh environment and shallow water do not represent an attractive location for swimming compared to the beach.
- PFOS/PFHxS concentration results are shown graphically in Figure 4-1. Concentrations were highest west of the runway (up-stream of runway), with a relatively rapid decreasing trend to the east towards Five Mile Beach.
- PFOA concentrations ranged from 0.055 µg/L to 0.594 µg/L, with the highest concentration found to the west of the runway. All values were below the health-based guidance value for 'Recreational Water' of 5.6 µg/L (HEPA 2018).
- PFOS/PFHxS concentrations recorded during the period of wastewater treatment plant discharge in the creek were lower in two of the three locations, but higher in one location compared to creek conditions prior to discharge.



**Figure 4-1 Sinclair Creek water PFOS/PFHxS (Total)**

#### **Five Mile Beach**

- Concentrations of PFOS/PFHxS at Five Mile Beach ranged from below the LOR ( $<0.002 \mu\text{g/L}$ ) to  $1.89 \mu\text{g/L}$ , with a general decreasing concentration gradient with distance from the creek mouth.
- Highest concentrations of PFOS/PFHxS were recorded from site FMB-2, which sits in the flow path of Sinclair Creek, as seen in Figure 1, Appendix A.
- FMB-2 was the only site to exceed the health-based guidance value for ‘Recreational Water’ of  $0.7 \mu\text{g/L}$  (HEPA 2018). All water concentrations  $>250 \text{ m}$  out in the bay were greater than one order of magnitude below recreational exposure criteria.
- No sites exceeded the health-based guidance value for PFOA in ‘Recreational Water’ of  $5.6 \mu\text{g/L}$  (HEPA 2018).
- Effectively all water samples in both Sinclair Creek and Five Mile Beach exceed the criteria for ‘consumption on fish’ (GHD 2017), given the criteria is below the LOR. Concentrations of PFOS were detected in all but one sample at concentrations above the LOR.

#### 4.4 Sediment

Results from sediment quality analysis from Sinclair Creek and Five Mile Beach are tabulated in Appendix C, with PFOS/PFHxS total concentrations shown spatially in Figure 2, Appendix A for both Sinclair Creek and Five Mile Beach. A summary of the results follows.

##### *Sinclair Creek*

- Concentrations of PFOS/PFHxS (total) in shallow sediments within the creek (0-100 mm depth interval) ranged from 0.0053 mg/kg to 0.103 mg/kg, with the highest west of the runway at site SC-1.
- Concentrations of PFOS/PFHxS (total) in deeper sediments within the creek (150-300 mm depth interval) ranged from below the LOR (<0.0002) to 0.0262 mg/kg, with the highest west of the runway at site SC-2.
- PFOS/PFHxS concentrations are shown graphically in Figure 2, Appendix A. Concentrations were highest west of the runway (i.e. SC1, SC2), with remaining sites relatively similar in concentration levels.

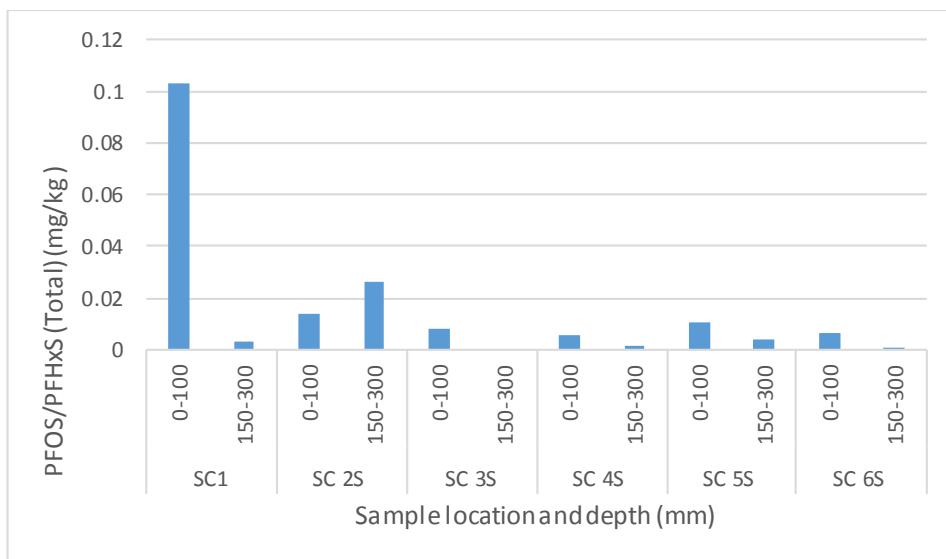


Figure 4-2 Sinclair Creek sediment PFOS/PFHxS (Total)

- PFOA was only detected at site SC-2 (maximum of 0.0004 mg/kg).
- ASLP leach samples, show PFOS/PFHxS ranged from 0.86 µg/L at site SC 3 (west of runway) to 0.3 µg/L at site SC 5. With the exception of site SC-3, remaining sites showed relatively similar results around the average value of 0.35 µg/L along the length of the creek.
- The majority of the leachable component of the PFAS compounds in each sample was PFOS and PFHxS, with trace amounts of PFOA in some samples.
- Particle size composition and its relationship to PFOS/PFHxS totals in Sinclair Creek is shown graphically in Figure 4-3. The only evidence of trends observed between composition and PFAS/PFHxS (total) concentration is the relative increase with greater fines content in sample location SC 2S. All samples were dominated by sands (>75 µm and <2 mm)

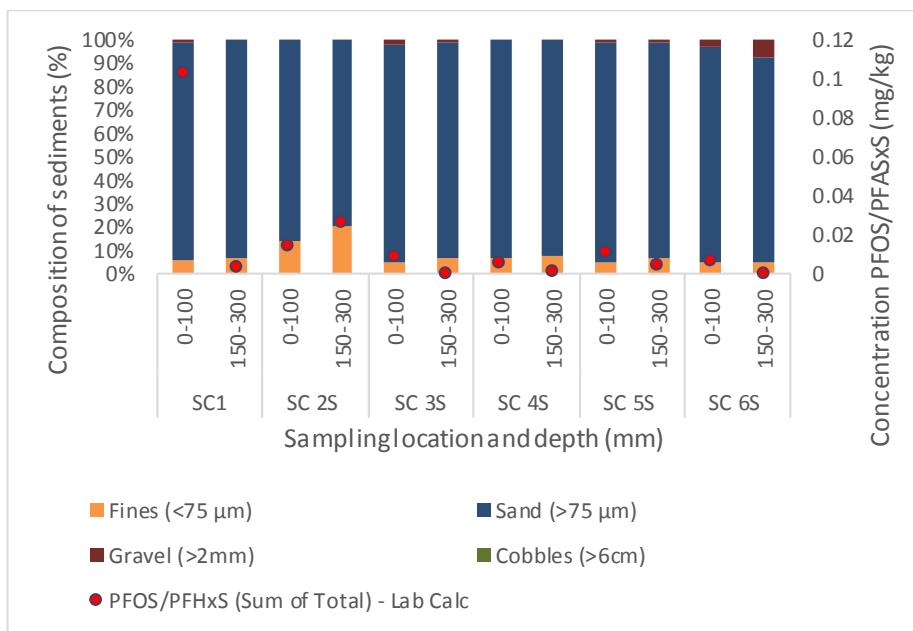


Figure 4-3 Particle size composition and its relationship to PFAS/PFHxS totals in Sinclair Creek

- Total organic carbon (TOC) and its relationship to PFAS/PFHxS totals in Sinclair Creek is shown graphically in Figure 4-4. With the exception of site SC 1 and SC 6, there does appear to be a detectable relationship between TOC and PFAS/PFHxS totals in Sinclair Creek such that increased TOC generally relates to a relative increase in PFOS/PFHxS concentrations at sample locations.

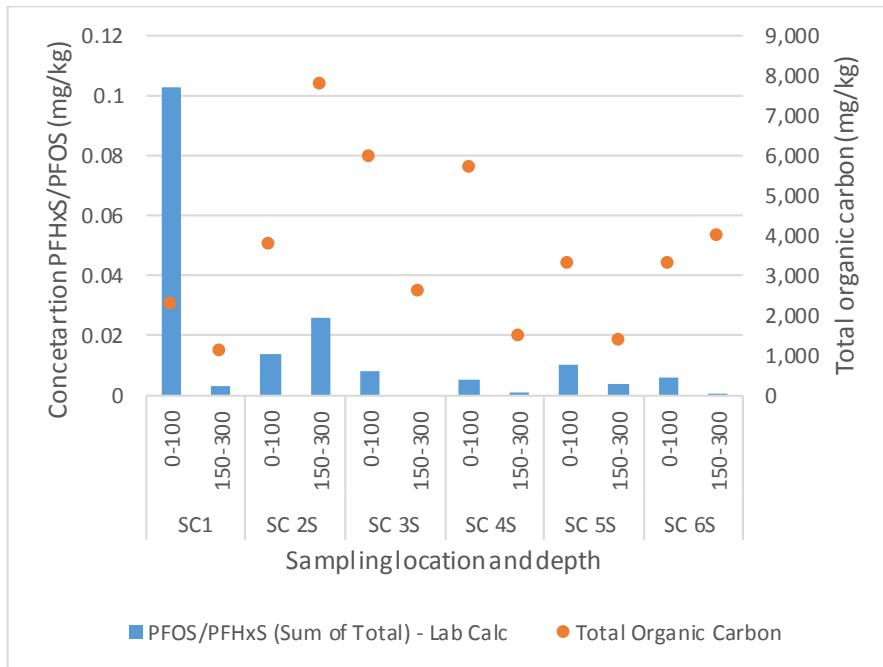


Figure 4-4 Total organic carbon (TOC) and its relationship to PFAS/PFHxS totals in Sinclair Creek

### Five Mile Beach

- Concentrations of PFOS/PFhXS (total) within Five Mile Beach ranged from below LOR (<0.0002 mg/kg) at several sites to 0.0034 mg/kg at site FMB-8.
- Spatially, as can be seen in Figure 2, Appendix A detections of PFAS were generally limited to sites within 250 m of the mouth of Sinclair Creek, with the exception of site FMB-5, which is in line with the flow of the main creek mouth channel, and FMB-8 potentially associated with sediment longshore drift.
- PFOA was not detected at any site.
- ASLP leach samples, show PFAS/PFhXS ranged from below LOR (<0.01 µg/L) to 0.19 µg/L. The majority of the leachable component of the PFAS/PFhXS total in each sample was from PFOS.
- Particle size composition and its relationship to PFAS/PFhXS totals in Five Mile Beach is shown graphically in Figure 4-5. No reliable trend is observed between composition and PFAS/PFhXS (total) concentration. All samples were dominated by sands (>75 µm and <2 mm).

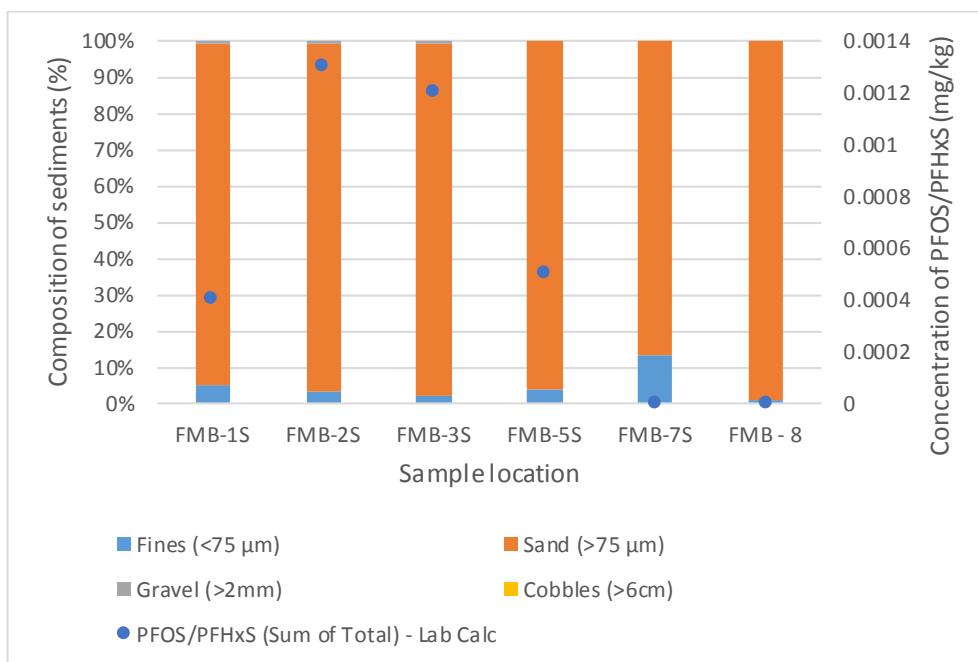


Figure 4-5 Particle size composition and its relationship to PFAS/PFhXS totals at Five Mile Beach

- Total organic carbon (TOC) and its relationship to PFAS/PFhXS totals at Five Mile Beach is shown graphically in Figure 4-6. There does not appear to be a relationship between TOC and PFAS/PFhXS totals at Five Mile Beach.

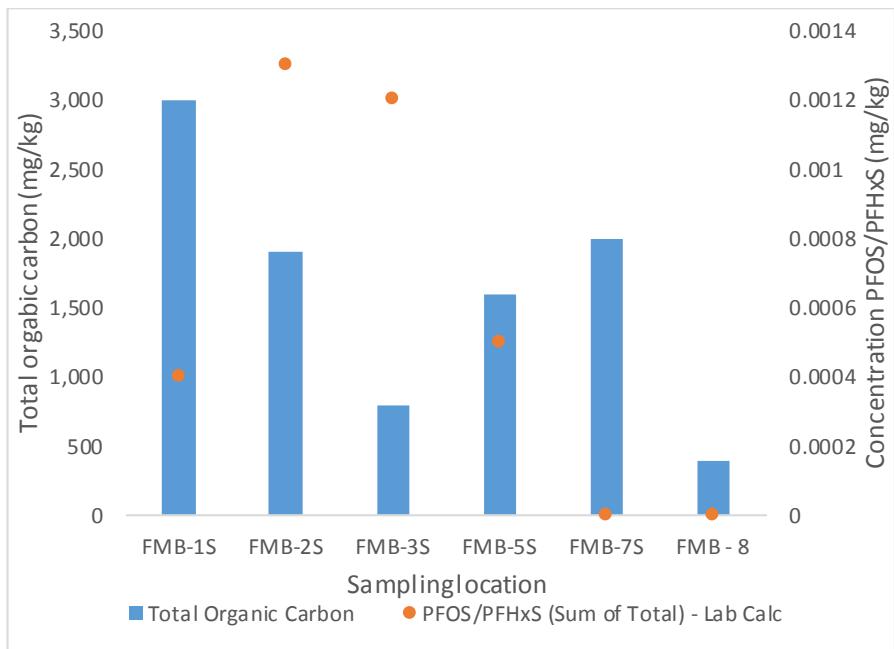


Figure 4-6 Total organic carbon (TOC) and its relationship to PFAS/PFHXs totals at Five Mile Beach

#### 4.5 Biota

Only a single sample of oysters were taken from Five Mile Beach. The results from the biota analysis from the oyster sample (composite of three oysters) from Five Mile Beach are tabulated in Appendix D.

No PFAS compounds were detected at concentrations above the laboratory's limit of reporting within the biota composite sample. Subsequently the associated trigger point criteria for human consumption (FSANZ 2017) was not exceeded.

## 5. Conclusions

Detectable PFAS concentrations have been identified in water and sediment within the investigation area. Key contaminants of concern (PFAS compounds with highest concentrations) within Sinclair Creek and also Five Mile Beach were PFOS and PFHxS. This is consistent with the findings from the PSI undertaken in 2017 (SEMF, 2017).

The objective of this targeted stage of investigation was to assess potential human health exposure pathways through biota consumption (i.e. shellfish and finfish) and recreational exposure in the vicinity of Sinclair Creek and Five Mile Beach, including sampling of sediments and water at the nominated investigation sites to better understand contaminant characteristics along the primary pathway from the airport site.

Assessment of ecological receptors (species protection) has not been included as part of this investigation as the objective of this program is to address potential human health risk. Investigation of the broader risks to potential ecological receptors within and surrounding the Airport will be addressed in the subsequent DSI program.

Based on the findings of these works, and subject to the limitations outlined in Section 1.3, the following key conclusions are made:

- Limited evidence of biota which may be caught for human consumption was identified during the course of these works. This is primarily associated with the environmental setting (small drainage creek subject to wastewater treatment plant discharge, draining to a shallow soft sediment beach). The sample of wild oysters that was collected within the investigation area did not contain PFAS concentrations above the laboratory's limit of reporting (albeit a single sample from a composite of three oysters). Based on the environmental setting, there is considered to be limited potential for seasonal variability in the presence of biota in the investigation area (suitable for human consumption).
- Concentrations of PFAS in surface water (and sediments) within Sinclair Creek are highest west of the runway, decreasing as the creek crosses eastwards beneath the runway section of the Airport. This suggest there is limited evidence of notable PFAS sources east of the runway contributing to PFAS impact in the creek.
- PFAS in surface water in Sinclair Creek is subject to a complex mixing/dilution environment in response to periodic (twice daily) waste water discharge from the treatment plant, and from marine water entering lower sections of the drainage system at high tide.
- PFAS concentrations in sediment within the creek are generally higher in the surface profile (i.e. 0-100 mm) than in the underlying profile (i.e. 150-300 mm) suggesting the bulk of contaminant loading in sediments is within the surface layers. The only exception is at one location (SC 2, west of the runway) where increased fines/total organic carbon content correlate to an increase in PFAS concentrations in the underlying profile.

- PFAS concentrations in water (and sediment) in Five Mile Beach appear to generally decrease with distance from the creek mouth. The highest concentrations were reported either within the continuation of the creek drainage channel at low-tide (central area), or along the beach to the east suggesting evidence of preferential water movement and sediment longshore drift in that direction.
- Further investigation of the potential source(s) of PFAS contamination entering Sinclair Creek will be addressed in a subsequent Detailed Site Investigation.

In respect of the potential receptors (human health) that have been identified associated with Sinclair Creek and its discharge area on Five Mile Beach in the preceding PSI preliminary conceptual site models (SEMF 2017), the following comments are made:

- Risk to Airport workers conducting routine tasks and earthworks (and people on the adjacent private land) is considered low as the exposure pathway (to submerged sediments in the creek) is limited. The sediments do however show the potential to leach PFAS and therefore represent an ongoing secondary source of PFAS loading to the creek, and ultimately the downstream beach environment.
- Risk to recreational (and commercial) fishers in Five Mile Beach (i.e. via consumption of finfish and shellfish) requires further investigation as PFAS concentrations in water entering the marine environment from Sinclair Creek exceed the criteria for ‘consumption of fish’ (i.e. via bioaccumulation in the food chain). While there is evidence that concentrations decrease relatively rapidly with distance from the creek mouth (i.e. due to dilution) and that wild oyster samples did not contain PFAS concentrations above the laboratory’s LOR, further investigation is still warranted to support these preliminary findings. The exceedances do not necessarily represent an unacceptable risk to human health, but rather a trigger to conduct further investigation into PFAS in fish species (finfish and shellfish) in Pitt Water, most likely to be targeted by recreational and commercial fisheries for human consumption. Risks to recreational fishers should be further investigated within the subsequent DSI program.
- Risk to recreational users of the Five Mile Beach area adjacent to Sinclair Creek (i.e. via ingestion of water) is considered low. This is primarily attributed to evidence that concentrations decrease relatively rapidly with distance from the creek mouth to levels below the criteria. Additionally, testing was conducted during low tide conditions and consequently the area will be subject to tidal inundation twice daily and effectively dilute concentrations during high tide conditions. It should be noted that the creek itself is considered to be a very low recreational value water body, such that the saltmarsh environment and shallow water do not represent an attractive location compared to the beach. In order to address the potential for seasonal variability of PFAS concentrations in surface water, further assessment should be included in the subsequent DSI program to support this conclusion.

## 6. References

GHD (2017), *PFAS Investigations, Derivation of PFAS soil and water criteria*, report for Airservices Australia, 17 May 2017HEPA (2018)

*PFAS National Environmental Management Plan*, Heads of EPAs Australia and New Zealand (HEPA) and the Australian Government Department of the Environment and Energy (DoEE), January 2018.

NEPC (2013) National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) National Environmental Protection Council (ASC NEPM)

SEMF (2017) *Hobart Airport – Aviation Rescue Fire Fighting Services Preliminary Site Investigation*. Report for Airservices Australia dated 31 October 2017, Project: 2105.022

# Appendices

## Appendix A – Figures



Paper Size A3  
0 50 100 200 300 400 500  
Metres

Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 55



#### Legend

- ▲ Sampling Point — Sinclair Creek ■ Airport-Commonwealth Land
- ▲ WWTP Outfall — Drainage lines
- - Drains

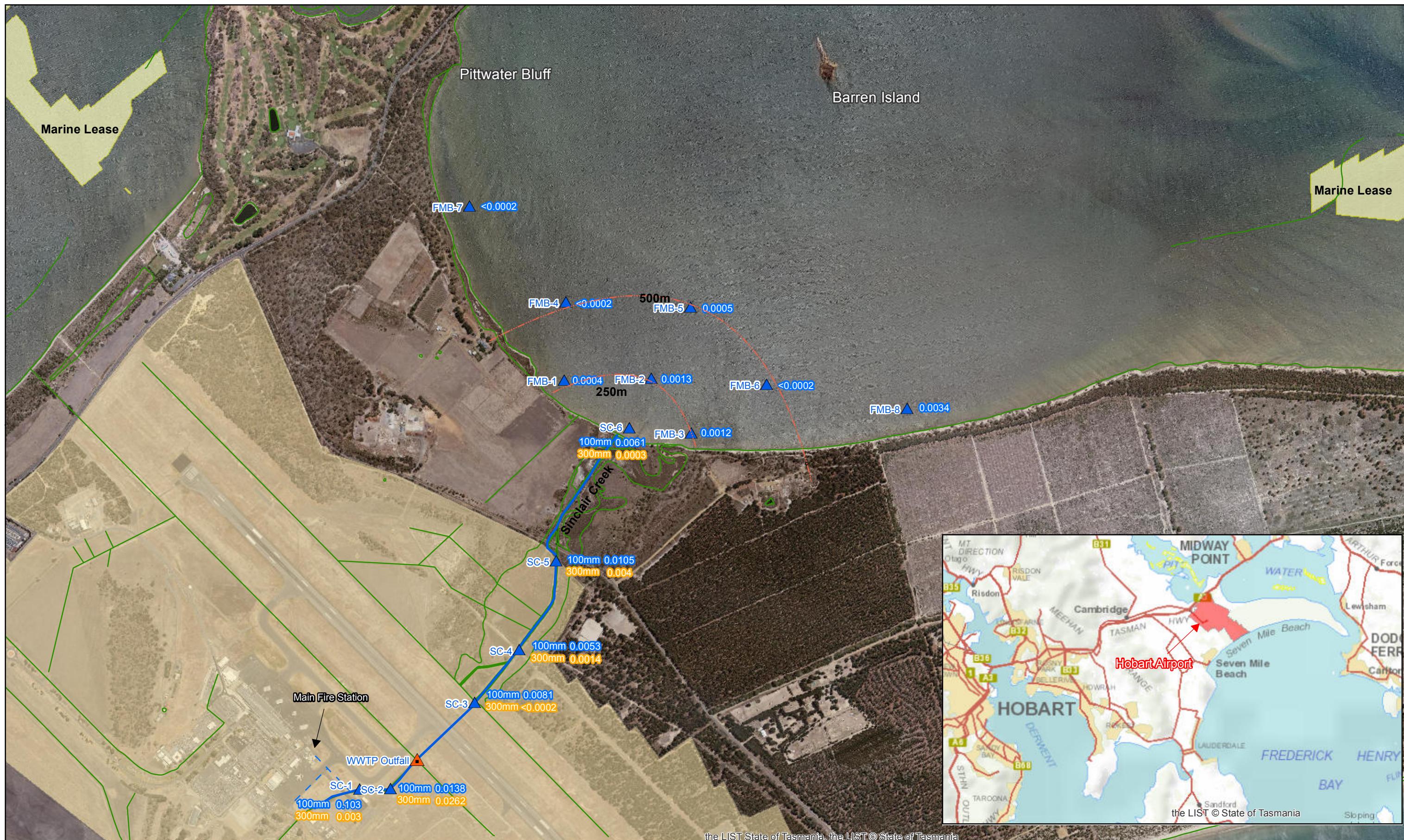


Airservices Australia

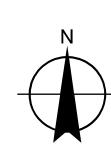
#### Water Sampling Locations indicating PFOS/PFHxS Concentrations (ug/L)

Job Number 32-18792  
Revision C  
Date 21 May 2018

Figure 1



Paper Size A3  
0 50 100 200 300 400 500  
Metres



Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 55

#### Legend

- Sampling Point
- WWTP Outfall
- Drain
- Sinclair Creek
- Airport-Commonwealth Land
- Drainage lines



Airservices Australia

#### Soil and Sediment Sampling Locations indicating PFOS/PFhXs Concentrations (mg/kg)

Job Number 32-18792  
Revision E  
Date 21 May 2018

Figure 2

## Appendix B – Water Quality Tables

Table B1: Field Data Quality Assessment - Water

	Location Code Date/Time		11/04/2018 13:00				
			SC 6W	QA 1	RPD	QQA1 (WATER)	RPD
	Field ID	Normal	Field_D	Interlab_D			
		water	water	water			
	Unit	EQL					
PFAS							
Perfluoro-n-hexadecanoic acid	µg/L	0.005	<0.005	<0.005	0		
PFOS/PFHxS (Sum of Total) - Lab	µg/L	0.001	3.74	3.78	1	7.2	63
N-Ethyl perfluorooctane	µg/L	0.002	<0.002	<0.002	0	<0.002	0
Perfluoroheptane sulfonic acid	µg/L	0.001	0.086	0.088	2	0.095	10
N-Methyl perfluorooctane	µg/L	0.002	<0.005	<0.005	0	<0.002	0
10:2 Fluorotelomer sulfonic acid	µg/L	0.001	<0.005	<0.005	0	<0.001	0
4:2 Fluorotelomer sulfonic acid	µg/L	0.001	<0.005	<0.005	0	<0.001	0
Perfluorobutane sulfonic acid	µg/L	0.001	0.053	0.047	12	0.085	46
N-Methyl perfluorooctane	µg/L	0.002	<0.002	<0.002	0	<0.002	0
Perfluorohexane sulfonic acid	µg/L	0.001	0.765	0.725	5	0.80	4
Perfluoropentanoic acid	µg/L	0.001	0.024	0.024	0	0.033	32
8:2 Fluorotelomer sulfonic acid	µg/L	0.001	<0.005	<0.005	0	<0.001	0
N-Ethyl perfluorooctane sulfonamide	µg/L	0.002	<0.005	<0.005	0	<0.002	0
N-Ethyl perfluorooctane	µg/L	0.002	<0.005	<0.005	0	<0.002	0
N-Methyl perfluorooctane sulfonamide	µg/L	0.002	<0.005	<0.005	0	<0.002	0
6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.005	<0.005	<0.005	0	<0.005	0
Perfluoroctanoic acid (PFOA)	µg/L	0.001	0.061	0.059	3	0.067	9
Perfluoropentane sulfonic acid	µg/L	0.001	0.056	0.050	11	0.27	131
Perfluorobutanoic acid	µg/L	0.005	<0.01	<0.01	0	0.028	95
Perfluorodecanoic acid	µg/L	0.001	<0.002	<0.002	0	0.004	67
Perfluorodecane sulfonic acid	µg/L	0.001	<0.002	<0.002	0	<0.001	0
Perfluorododecanoic acid	µg/L	0.001	<0.002	<0.002	0	<0.001	0
Perfluoroheptanoic acid	µg/L	0.001	0.020	0.019	5	0.026	26
Perfluorohexanoic acid (PFHxA)	µg/L	0.001	0.072	0.063	13	0.15	70
Perfluorononanoic acid	µg/L	0.001	0.004	0.004	0	0.007	55
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.001	2.98	3.06	3	6.4	73
Perfluorooctane sulfonamide (FOSA)	µg/L	0.002	<0.002	<0.002	0	<0.002	0
Perfluorotetradecanoic acid	µg/L	0.001	<0.005	<0.005	0	<0.001	0
Perfluorotridecanoic acid	µg/L	0.001	<0.002	<0.002	0	<0.001	0
Perfluoroundecanoic acid	µg/L	0.001	<0.002	<0.002	0	0.001	0

Table B2: PFAS in Surface Water

		Per- and Polyfluoroalkyl Substances (PFAS by LCMS)																												
		Perfluorooctane hexadecanoic acid µg/L	PFOA/PFHS (Sum of Total) - Lab Calc µg/L	N-Methyl perfluorocane sulfonamide/ethanol MetOSA µg/L	N-Ethyl perfluorocane sulfonamidaeic acid µg/L	Perfluorheptane sulfonic acid µg/L	10:2 Fluorotelomer sulfonic acid µg/L	4:2 Fluorotelomer sulfonic acid µg/L	Perfluorobutane sulfonic acid µg/L	N-Methyl perfluorocane sulfonamide acid (PFHxS) µg/L	Perfluorohexane sulfonic acid µg/L	N-Ethyl perfluorocane sulfonamide acid (PFHxA) µg/L	8:2 Fluorotelomer sulfonic acid µg/L	N-Ethyl perfluorocane sulfonamide acid (PFHxT) µg/L	6:2 Fluorotelomer Sulfonate (6:2 FTS) µg/L	Perfluorooctanoic acid (PFOA) µg/L	Perfluorooctane sulfonic acid µg/L	Perfluorobutanoic acid (PFBA) µg/L	Perfluorooctanoic acid (PFOS) µg/L	Perfluorodecanoic acid (PFDA) µg/L	Perfluorooctanoic acid (PFNA) µg/L	Perfluorooctane sulfonic acid (POS) µg/L	Perfluorooctane sulfonamide (FOSA) µg/L	Perfluorotetradeca- noic acid (PTFA) µg/L	Perfluoroundecanoic acid (PFTA) µg/L	PFAS (Sum of Total) µg/L				
EQL		0.005	0.002	0.005	0.002	0.002	0.005	0.005	0.002	0.002	0.002	0.005	0.002	0.005	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002			
HEPA (2018) PFAS NEMP Recreational Water			0.7													5.6														
GHD 2017 Consumption of Fish			0.001													0.0082														

Location Code	Date	Field ID	Per- and Polyfluoroalkyl Substances (PFAS by LCMS)																															
Sinclair Creek	11/04/2018	SC 1W	<0.005	77.7	<0.005	<0.002	1.83	<0.005	<0.005	1.18	<0.002	15.5	0.586	0.014	<0.005	<0.005	0.012	0.118	1.57	0.4	0.008	0.041	0.002	0.568	2.24	0.036	62.2	0.014	<0.005	<0.002	86.3	82.8		
	11/04/2018	SC 2W	<0.005	27.1	<0.005	<0.002	0.539	<0.005	<0.005	0.579	<0.002	6.97	0.223	0.006	<0.005	<0.005	<0.005	0.594	0.891	0.17	0.004	0.008	<0.002	0.226	0.858	0.012	20.1	0.005	<0.005	<0.002	31.2	29.7		
	11/04/2018	SC 3W	<0.005	14.3	<0.005	<0.002	0.436	<0.005	<0.005	0.248	<0.002	3.17	0.099	<0.005	<0.005	<0.005	<0.005	0.24	0.305	0.07	<0.002	0.006	0.096	0.37	0.006	11.1	0.003	<0.005	<0.002	16.1	15.4			
	11/04/2018	SC 3W PM^	<0.005	4.45	<0.005	<0.002	0.045	<0.005	<0.005	0.034	<0.002	0.39	0.02	<0.005	<0.005	<0.005	<0.005	0.036	0.032	<0.01	0.003	0.004	<0.002	0.014	0.045	0.007	4.06	<0.005	<0.005	<0.002	4.69	4.6		
	11/04/2018	SC 4W	<0.005	3.64	<0.005	<0.002	0.073	<0.005	<0.005	0.062	<0.002	0.899	0.029	<0.005	<0.005	<0.005	<0.005	0.055	0.068	0.03	<0.002	<0.002	<0.002	0.029	0.089	0.004	2.74	<0.002	<0.005	<0.002	4.08	3.93		
	11/04/2018	SC 4W PM^	<0.005	12.1	<0.005	<0.002	0.327	<0.005	<0.005	0.206	<0.002	2.58	0.084	<0.005	<0.005	<0.005	<0.005	0.187	0.236	0.04	<0.002	<0.002	<0.002	0.073	0.267	0.005	9.49	<0.002	<0.005	<0.002	13.5	12.9		
	11/04/2018	SC 5W	<0.005	3.98	<0.005	<0.002	0.088	<0.005	<0.005	0.061	<0.002	0.808	0.031	<0.005	<0.005	<0.005	<0.005	0.073	0.062	0.03	<0.002	<0.002	0.025	0.087	0.005	3.15	<0.002	<0.005	<0.002	4.42	4.26			
	11/04/2018	SC 5W PM^	<0.005	2.7	<0.005	<0.002	0.062	<0.005	<0.005	0.048	<0.002	0.605	0.025	<0.005	<0.005	<0.005	<0.005	0.056	0.048	<0.01	<0.002	<0.002	<0.002	0.016	0.065	0.003	2.1	<0.002	<0.005	<0.002	3.03	2.92		
	11/04/2018	SC 6W	<0.005	3.78	<0.005	<0.002	0.068	<0.005	<0.005	0.053	<0.002	0.765	0.024	<0.005	<0.005	<0.005	<0.005	0.061	0.056	<0.01	<0.002	<0.002	<0.002	0.02	0.072	0.004	3.06	<0.002	<0.005	<0.002	4.14	4.00		
	13/04/2018	SC AW	<0.025	8.88	<0.025	<0.010	0.155	<0.010	<0.010	0.136	<0.010	1.86	0.029	<0.010	<0.025	<0.025	<0.010	0.133	0.181	0.04	<0.010	<0.010	<0.010	0.029	0.236	0.01	7.02	<0.010	<0.025	<0.010	9.83	9.48		
	13/04/2018	SC BW	<0.025	8.27	<0.025	<0.010	0.167	<0.010	<0.010	0.17	<0.010	1.97	0.051	<0.010	<0.025	<0.025	<0.010	0.134	0.206	0.05	<0.010	<0.010	<0.010	0.034	0.276	<0.010	6.3	<0.010	<0.025	<0.010	9.36	8.98		
Five Mile Beach	11/04/2018	FMB -1W	<0.005	0.031	<0.005	<0.002	<0.002	<0.005	<0.005	<0.002	<0.002	0.006	<0.002	<0.005	<0.005	<0.005	<0.005	<0.002	<0.002	<0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.025	<0.005	<0.002	<0.002	0.031	0.031
	11/04/2018	FMB -2W	<0.005	1.69	<0.005	<0.002	0.052	<0.005	<0.005	0.05	<0.002	0.668	0.024	<0.005	<0.005	<0.005	<0.005	0.047	0.052	<0.01	<0.002	<0.002	<0.002	0.018	0.068	<0.002	1.22	<0.002	<0.005	<0.002	2.2	2.1		
	11/04/2018	FMB -3W	<0.005	0.413	<0.005																													

## Appendix C - Sediment Quality Tables

Table C1: Field Data Quality Assessment - Sediment

	Sample ID Date/Time Field ID Sample Type Matrix Type	FMB - 8					
		11/04/2018 15:00	11/04/2018 13:00	RPD	11/04/2018	RPD	
		FMB - 8	QA2		QQA2		
		Normal	Field_D		Interlab_D		
		soil	soil		soil		
	Unit	EQL					
Total Organic Carbon	mg/kg	200	400	2,300	<b>141</b>	2,000	<b>133</b>
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/L	0.002	<0.02	<0.02	0	<0.05	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.01	0
Perfluoroheptane sulfonic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
N-Methyl perfluorooctane sulfonamidoethanol MeFOSA	µg/L	0.002	<0.05	<0.05	0	<0.05	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005	0
10:2 Fluorotelomer sulfonic acid	µg/L	0.001	<0.05	<0.05	0	<0.01	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005	0
4:2 Fluorotelomer sulfonic acid	µg/L	0.001	<0.05	<0.05	0	<0.01	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005	0
Perfluorobutane sulfonic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.002	<0.02	<0.02	0	<0.05	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.01	0
Perfluorohexane sulfonic acid (PFHxS)	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluoropentanoic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
8:2 Fluorotelomer sulfonic acid	µg/L	0.001	<0.05	<0.05	0	<0.01	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005	0
N-Ethyl perfluorooctane sulfonamide	µg/L	0.002	<0.05	<0.05	0	<0.05	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005	0
N-Ethyl perfluorooctane sulfonamidoethanol	µg/L	0.002	<0.05	<0.05	0	<0.05	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005	0
N-Methyl perfluorooctane sulfonamide	µg/L	0.002	<0.05	<0.05	0	<0.05	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005	0
6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.005	<0.05	<0.05	0	<0.05	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.01	0
Perfluorooctanoic acid (PFOA)	µg/L	0.001	<0.01	<0.01	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluoropentane sulfonic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluorobutanoic acid	µg/L	0.005	<0.1	<0.1	0	<0.05	0
	mg/kg	0.001	<0.001	<0.001	0	<0.005	0
Perfluorodecanoic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluorodecane sulfonic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluorododecanoic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluoroheptanoic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluorohexanoic acid (PFHxA)	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluorononanoic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.001	<0.01	0.19	<b>180</b>	0.06	<b>143</b>
	mg/kg	0.0002	<0.0002	0.0034	<b>178</b>	<0.005	0
Perfluorooctane sulfonamide (FOSA)	µg/L	0.002	<0.02	<0.02	0	<0.05	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluorotetradecanoic acid	µg/L	0.001	<0.05	<0.05	0	<0.01	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005	0
Perfluorotridecanoic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluoroundecanoic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0

**Table C2: PFAS in Sediments**

Table C3: ASLP Leachable PFAS in Sediments

		Per- and Polyfluoroalkyl Substances (PFAS) by LCMS																																	
		PFOs/PFhxs (Sum of Total - Lab Calc)	PFOS/PFhxs (Sum of Total - Lab Calc)	N-Methyl perfluorooctane Sulfonamide (MeFOSA)	N-Ethyl perfluorooctane Sulfonic acid	Perfluoroheptane sulfonic acid	10:2 Fluorotelomer sulfonic acid	14:2 Fluorotelomer sulfonic acid	Perfluorobutane sulfonic acid	N-Methyl perfluorooctane Sulfonate (6:2:TS)	N-Ethyl perfluorooctane Sulfonate (6:2:TS)	Perfluorooctanoic acid (POA)	Perfluoropentane sulfonic acid	Perfluorobutanoic acid	Perfluorodecanoic acid	Perfluorohexanoic acid (PFHxA)	Perfluorooctane sulfonic acid (POOS)	Perfluorooctane (FOSA)	Perfluorotetradecanoic acid	Perfluoroundecanoic acid	PFAS (Sum of Total)/WA DER List)														
	mg/kg	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	µg/L	µg/L	µg/L
	EQL	0.0002	0.01	0.05	0.02	0.02	0.05	0.05	0.02	0.02	0.02	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Sinclair Creek	Date	Field ID																																	
		SC 1S (0-100)	0.103	0.37	<0.05	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	0.06	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	0.31	<0.02	<0.05	<0.02	<0.02	0.37	0.37		
		SC 2S (0-100)	0.0138	0.33	<0.05	0.03	<0.02	<0.05	<0.05	<0.02	<0.02	0.16	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	0.17	<0.02	<0.05	<0.02	<0.02	0.38	0.35			
		SC 3S (0-100)	0.0081	0.86	<0.05	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	0.05	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	0.81	<0.02	<0.05	<0.02	<0.02	0.86	0.86		
		SC 4S (0-100)	0.0053	0.42	<0.05	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	0.03	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	0.39	<0.02	<0.05	<0.02	<0.02	0.42	0.42		
		SC 5S (0-100)	0.0105	0.3	<0.05	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	0.3	<0.02	<0.05	<0.02	<0.02	0.3	0.3		
		SC 6S (0-100)	0.0061	0.32	<0.05	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	0.32	<0.02	<0.05	<0.02	<0.02	0.32	0.32		
		SC AS (0-100)	0.0185	0.37	<0.05	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	0.03	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	0.34	<0.02	<0.05	<0.02	<0.02	0.37	0.37			
		SC BS (0-100)	0.0163	0.34	<0.05	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	0.03	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	0.31	<0.02	<0.05	<0.02	<0.02	0.34	0.34		
		FMB-1S	0.0004	0.03	<0.05	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.05	<0.02	<0.02	0.03	0.03			
		FMB-2S	0.0013	0.03	<0.05	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.05	<0.02	<0.02	0.03	0.03			
		FMB-3S	0.0012	0.03	<0.05	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.05	<0.02	<0.02	0.04	0.04			
		FMB-5S	0.0005	0.02	<0.05	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.05	<0.02	<0.02	0.02	0.02			
		FMB-7S	<0.0002	<0.01	<0.05	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.02	<0.02	<0.01	<0.01			
		FMB - 8	<0.0002	0.19	<0.05	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	0.19	<0.02	<0.05	<0.02</td						

Table C4: Other Parameters in Sediments

	Exchangeable Cations on Alkaline Soils					Particle Size Analysis (Sieving)																		Total Organic Carbon mg/kg
	Exchangeable Calcium meq/100g	Exchangeable Magnesium meq/100g	Exchangeable Potassium meq/100g	Exchangeable Sodium meq/100g	CEC meq/100g	Fines (<75 µm) %	Sand (>75 µm) %	Gravel (>2mm) %	Cobbles (>6cm) %	+75µm %	+150µm %	+300µm %	+425µm %	+600µm %	+1180µm %	+2,360nm %	+4,750nm %	+9,500nm %	+19,000nm %	+37,500nm %	+75,000nm %			
EQL	0.2	0.2	0.2	0.2	0.2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	200

Location Code	Date	Field ID	1.5	0.8	0.2	<0.2	2.5	6	93	1	<1	94	61	10	4	3	1	<1	<1	<1	<1	<1	<1	<1	2,300
Sinclair Creek	11/04/2018	SC 1S (0-100)	1.5	0.8	0.2	<0.2	2.5	6	93	1	<1	94	61	10	4	3	1	<1	<1	<1	<1	<1	<1	<1	1,100
	11/04/2018	SC 1S (150-300)	1.4	0.6	<0.2	<0.2	2.2	7	93	<1	<1	93	55	9	2	1	<1	<1	<1	<1	<1	<1	<1	<1	3,800
	11/04/2018	SC 2S (0-100)	6.5	0.9	<0.2	<0.2	7.6	14	86	<1	<1	86	57	16	6	3	<1	<1	<1	<1	<1	<1	<1	<1	7,800
	11/04/2018	SC 2S (150-300)	10.3	1.3	0.2	0.3	12.2	20	80	<1	<1	80	56	14	4	1	<1	<1	<1	<1	<1	<1	<1	<1	6,000
	11/04/2018	SC 3S (0-100)	1.5	2.7	0.6	0.3	5.1	5	93	2	<1	95	83	26	9	5	2	2	1	<1	<1	<1	<1	<1	2,600
	11/04/2018	SC 3S (150-300)	1.1	2.1	0.6	0.2	4.1	7	92	1	<1	93	57	12	7	4	2	<1	<1	<1	<1	<1	<1	<1	5,700
	11/04/2018	SC 4S (0-100)	0.9	1.8	0.6	1	4.3	7	93	<1	<1	93	61	10	4	2	<1	<1	<1	<1	<1	<1	<1	<1	1,500
	11/04/2018	SC 4S (150-300)	0.6	1.3	0.4	0.5	2.8	8	92	<1	<1	92	49	11	4	2	<1	<1	<1	<1	<1	<1	<1	<1	3,300
	11/04/2018	SC 5S (0-100)	0.7	1.2	0.4	0.6	2.9	5	94	1	<1	95	75	17	6	3	1	<1	<1	<1	<1	<1	<1	<1	1,400
	11/04/2018	SC 5S (150-300)	0.8	1.4	0.4	0.5	3.1	7	92	1	<1	93	70	16	6	3	2	<1	<1	<1	<1	<1	<1	<1	3,300
	11/04/2018	SC 6S (0-100)	1.1	1.3	0.5	0.8	3.7	5	92	3	<1	95	72	30	12	6	4	2	2	1	<1	<1	<1	<1	4,000
	11/04/2018	SC 6S (150-300)	1.2	1.2	0.3	0.6	3.2	5	87	8	<1	95	73	28	17	14	10	7	4	<1	<1	<1	<1	<1	1,500
	13/04/2018	SC AS (0-100)	1.8*	1.1*	0.2*	<0.1*	3.1*	8	92	<1	<1	92	72	19	6	3	1	<1	<1	<1	<1	<1	<1	<1	1,000
	13/04/2018	SC AS (150-300)	1	1.1	0.3	0.3	2.7	5	95	<1	<1	95	77	21	6	3	<1	<1	<1	<1	<1	<1	<1	<1	1,700
	13/04/2018	SC BS (0-100)	13.8*	0.8*	0.1*	0.2*	14.9*	5	93	2	<1	95	62	16	7	4	3	2	2	<1	<1	<1	<1	<1	1,600
	13/04/2018	SC BS (150-300)	1.8	1.2	0.3	0.4	3.6	8	90	2	<1	92	71	16	7	4	3	2	<1	<1	<1	<1	<1	<1	2,300
Five Mile Beach	11/04/2018	FMB-1S	0.8	1.3	0.5	0.8	3.3	5	94	1	<1	95	54	9	4	2	1	1	<1	<1	<1	<1	<1	<1	3,000
	11/04/2018	FMB-2S	0.8	1	0.3	0.5	2.7	3	96	1	<1	97	82	12	4	2	1	<1	<1	<1	<1	<1	<1	<1	1,900
	11/04/2018	FMB-3S	0.9	0.9	0.3	0.4	2.6	2	97	1	<1	98	70	11	3	1	<1	<1	<1	<1	<1	<1	<1	<1	800
	11/04/2018	FMB-5S	0.8	1.3	0.4	0.6	3.1	4	96	<1	<1	96	63	10	3	2	<1	<1	<1	<1	<1	<1	<1	<1	1,600
	11/04/2018	FMB-7S	0.9	2.1	1	1	5	13	87	<1	<1	87	34	4	2	1	<1	<1	<1	<1	<1	<1	<1	<1	2,000
	11/04/2018	FMB - 8	0.6	0.5	<0.2	0.3	1.5	1	99	<1	<1	99	72	4	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2,300

\*Exchangeable Cations with pre-treatment

## Appendix D – Biota Tables

**Table D1: PFAS in Biota**

**Date/Time**      **Field ID**      **Matrix Type**

11/04/2018 13:00	FMB - Oysters	Biota	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.001	<0.001	<0.001	<0.001
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## Appendix E - QA/QC Tables

Table B1: Field Data Quality Assessment - Water

	Location Code Date/Time		11/04/2018 13:00				
			SC 6W	QA 1	RPD	QQA1 (WATER)	RPD
	Field ID	Normal	Field_D	Interlab_D			
		water	water	water			
	Unit	EQL					
PFAS							
Perfluoro-n-hexadecanoic acid	µg/L	0.005	<0.005	<0.005	0		
PFOS/PFHxS (Sum of Total) - Lab	µg/L	0.001	3.74	3.78	1	7.2	63
N-Ethyl perfluorooctane	µg/L	0.002	<0.002	<0.002	0	<0.002	0
Perfluoroheptane sulfonic acid	µg/L	0.001	0.086	0.088	2	0.095	10
N-Methyl perfluorooctane	µg/L	0.002	<0.005	<0.005	0	<0.002	0
10:2 Fluorotelomer sulfonic acid	µg/L	0.001	<0.005	<0.005	0	<0.001	0
4:2 Fluorotelomer sulfonic acid	µg/L	0.001	<0.005	<0.005	0	<0.001	0
Perfluorobutane sulfonic acid	µg/L	0.001	0.053	0.047	12	0.085	46
N-Methyl perfluorooctane	µg/L	0.002	<0.002	<0.002	0	<0.002	0
Perfluorohexane sulfonic acid	µg/L	0.001	0.765	0.725	5	0.80	4
Perfluoropentanoic acid	µg/L	0.001	0.024	0.024	0	0.033	32
8:2 Fluorotelomer sulfonic acid	µg/L	0.001	<0.005	<0.005	0	<0.001	0
N-Ethyl perfluorooctane sulfonamide	µg/L	0.002	<0.005	<0.005	0	<0.002	0
N-Ethyl perfluorooctane	µg/L	0.002	<0.005	<0.005	0	<0.002	0
N-Methyl perfluorooctane sulfonamide	µg/L	0.002	<0.005	<0.005	0	<0.002	0
6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.005	<0.005	<0.005	0	<0.005	0
Perfluoroctanoic acid (PFOA)	µg/L	0.001	0.061	0.059	3	0.067	9
Perfluoropentane sulfonic acid	µg/L	0.001	0.056	0.050	11	0.27	131
Perfluorobutanoic acid	µg/L	0.005	<0.01	<0.01	0	0.028	95
Perfluorodecanoic acid	µg/L	0.001	<0.002	<0.002	0	0.004	67
Perfluorodecane sulfonic acid	µg/L	0.001	<0.002	<0.002	0	<0.001	0
Perfluorododecanoic acid	µg/L	0.001	<0.002	<0.002	0	<0.001	0
Perfluoroheptanoic acid	µg/L	0.001	0.020	0.019	5	0.026	26
Perfluorohexanoic acid (PFHxA)	µg/L	0.001	0.072	0.063	13	0.15	70
Perfluorononanoic acid	µg/L	0.001	0.004	0.004	0	0.007	55
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.001	2.98	3.06	3	6.4	73
Perfluorooctane sulfonamide (FOSA)	µg/L	0.002	<0.002	<0.002	0	<0.002	0
Perfluorotetradecanoic acid	µg/L	0.001	<0.005	<0.005	0	<0.001	0
Perfluorotridecanoic acid	µg/L	0.001	<0.002	<0.002	0	<0.001	0
Perfluoroundecanoic acid	µg/L	0.001	<0.002	<0.002	0	0.001	0

Table C1: Field Data Quality Assessment - Sediment

	Sample ID Date/Time Field ID Sample Type Matrix Type	FMB - 8					
		11/04/2018 15:00	11/04/2018 13:00	RPD	11/04/2018	RPD	
		FMB - 8	QA2		QQA2		
		Normal	Field_D		Interlab_D		
		soil	soil		soil		
	Unit	EQL					
Total Organic Carbon	mg/kg	200	400	2,300	<b>141</b>	2,000	<b>133</b>
N-Ethyl perfluorooctane sulfonamidoacetic acid	µg/L	0.002	<0.02	<0.02	0	<0.05	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.01	0
Perfluoroheptane sulfonic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
N-Methyl perfluorooctane sulfonamidoethanol MeFOSA	µg/L	0.002	<0.05	<0.05	0	<0.05	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005	0
10:2 Fluorotelomer sulfonic acid	µg/L	0.001	<0.05	<0.05	0	<0.01	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005	0
4:2 Fluorotelomer sulfonic acid	µg/L	0.001	<0.05	<0.05	0	<0.01	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005	0
Perfluorobutane sulfonic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
N-Methyl perfluorooctane sulfonamidoacetic acid	µg/L	0.002	<0.02	<0.02	0	<0.05	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.01	0
Perfluorohexane sulfonic acid (PFHxS)	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluoropentanoic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
8:2 Fluorotelomer sulfonic acid	µg/L	0.001	<0.05	<0.05	0	<0.01	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005	0
N-Ethyl perfluorooctane sulfonamide	µg/L	0.002	<0.05	<0.05	0	<0.05	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005	0
N-Ethyl perfluorooctane sulfonamidoethanol	µg/L	0.002	<0.05	<0.05	0	<0.05	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005	0
N-Methyl perfluorooctane sulfonamide	µg/L	0.002	<0.05	<0.05	0	<0.05	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005	0
6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.005	<0.05	<0.05	0	<0.05	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.01	0
Perfluorooctanoic acid (PFOA)	µg/L	0.001	<0.01	<0.01	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluoropentane sulfonic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluorobutanoic acid	µg/L	0.005	<0.1	<0.1	0	<0.05	0
	mg/kg	0.001	<0.001	<0.001	0	<0.005	0
Perfluorodecanoic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluorodecane sulfonic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluorododecanoic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluoroheptanoic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluorohexanoic acid (PFHxA)	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluorononanoic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.001	<0.01	0.19	<b>180</b>	0.06	<b>143</b>
	mg/kg	0.0002	<0.0002	0.0034	<b>178</b>	<0.005	0
Perfluorooctane sulfonamide (FOSA)	µg/L	0.002	<0.02	<0.02	0	<0.05	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluorotetradecanoic acid	µg/L	0.001	<0.05	<0.05	0	<0.01	0
	mg/kg	0.0005	<0.0005	<0.0005	0	<0.005	0
Perfluorotridecanoic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0
Perfluoroundecanoic acid	µg/L	0.001	<0.02	<0.02	0	<0.01	0
	mg/kg	0.0002	<0.0002	<0.0002	0	<0.005	0

## Appendix F – Laboratory Certificates

## CERTIFICATE OF ANALYSIS

Work Order	<b>: EM1806226</b>	Page	<b>: 1 of 36</b>
Client	<b>: GHD PTY LTD</b>	Laboratory	<b>: Environmental Division Melbourne</b>
Contact	<b>: MR PETER TOPLISS</b>	Contact	<b>: Shirley LeCornu</b>
Address	<b>: 2 SALAMANCA SQUARE HOBART TAS, AUSTRALIA 7000</b>	Address	<b>: 4 Westall Rd Springvale VIC Australia 3171</b>
Telephone	<b>: +61 03 6332 5500</b>	Telephone	<b>: +61 3 8549 9630</b>
Project	<b>: 3218792</b>	Date Samples Received	<b>: 13-Apr-2018 10:00</b>
Order number	<b>: 3218792</b>	Date Analysis Commenced	<b>: 16-Apr-2018</b>
C-O-C number	<b>: ----</b>	Issue Date	<b>: 23-Apr-2018 19:39</b>
Sampler	<b>: DE</b>		
Site	<b>: Aiservices Sinclair Creek and Five Mile Beach</b>		
Quote number	<b>: EN/005/15 VICTORIA (Primary work only)</b>		
No. of samples received	<b>: 41</b>		
No. of samples analysed	<b>: 41</b>		

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.

### Signatures

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
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Franco Lentini		Sydney Organics, Smithfield, NSW
Greg Vogel	Lab Manager	Sydney Inorganics, Smithfield, NSW
Nathan Webb	Asbestos Identifier	Newcastle - Inorganics, Mayfield West, NSW



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

## 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: High LCS recovery deemed acceptable as all associated analyte results are less than LOR.
- EP231: Matrix Spike recovery bias low due to matrix interference
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity ( $H^+ + Al^{3+}$ ).
- EP231X (Biota): ALS NATA accreditation for PFAS in Biota covers all Perfluoroalkyl Sulfonic Acids, Perfluoroalkyl Carboxylic Acids and (n:2) Fluorotelomer Sulfonic Acids in fish (whole and muscle), plants and vegetable matrices, with the exception PFBA (fish only), EtFOSE, MeFOSE, EtFOSAA, MeFOSAA, EtFOSAA.

## *Analytical Results*

## Analytical Results

Sub-Matrix: ASLP LEACHATE (Matrix: WATER)			Client sample ID	SC 1S (0-100)	SC 2S (0-100)	SC 3S (0-100)	SC 4S (0-100)	SC 5S (0-100)
			Client sampling date / time	11-Apr-2018 13:00				
Compound	CAS Number	LOR	Unit	EM1806226-001	EM1806226-002	EM1806226-003	EM1806226-004	EM1806226-005
<b>EP231C: Perfluoroalkyl Sulfonamides - Continued</b>								
N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<b>0.03</b>	<0.02	<0.02	<0.02
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids</b>								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
<b>EP231P: PFAS Sums</b>								
Sum of PFAS	----	0.01	µg/L	<b>0.37</b>	<b>0.38</b>	<b>0.86</b>	<b>0.42</b>	<b>0.30</b>
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	<b>0.37</b>	<b>0.33</b>	<b>0.86</b>	<b>0.42</b>	<b>0.30</b>
Sum of PFAS (WA DER List)	----	0.01	µg/L	<b>0.37</b>	<b>0.35</b>	<b>0.86</b>	<b>0.42</b>	<b>0.30</b>
<b>EP231S: PFAS Surrogate</b>								
13C4-PFOS	----	0.02	%	<b>100</b>	<b>117</b>	<b>114</b>	<b>104</b>	<b>97.4</b>
13C8-PFOA	----	0.02	%	<b>81.8</b>	<b>110</b>	<b>116</b>	<b>106</b>	<b>76.0</b>

## Analytical Results

Sub-Matrix: ASLP LEACHATE (Matrix: WATER)			Client sample ID	SC 6S (0-100)	QA1	FMB-1S	FMB-2S	FMB-3S			
Compound	CAS Number	LOR	Unit	11-Apr-2018 13:00							
				EM1806226-006	EM1806226-019	EM1806226-023	EM1806226-024	EM1806226-025			
Result											
<b>EP231A: Perfluoroalkyl Sulfonic Acids</b>											
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02			
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02			
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02			
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02			
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.32	0.38	0.03	0.03	0.03			
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02			
<b>EP231B: Perfluoroalkyl Carboxylic Acids</b>											
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1			
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02			
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02			
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02			
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	<0.01	<0.01	0.01			
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02			
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02			
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02			
Perfluorododecanoic acid (PFDODA)	307-55-1	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02			
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02			
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05			
<b>EP231C: Perfluoroalkyl Sulfonamides</b>											
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02			
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05			
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05			

## Analytical Results

Sub-Matrix: ASLP LEACHATE (Matrix: WATER)		Client sample ID		SC 6S (0-100)	QA1	FMB-1S	FMB-2S	FMB-3S				
Compound	CAS Number	LOR	Unit	Client sampling date / time	11-Apr-2018 13:00							
					EM1806226-006	EM1806226-019	EM1806226-023	EM1806226-024	EM1806226-025			
Result												
<b>EP231C: Perfluoroalkyl Sulfonamides - Continued</b>												
N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			
N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			
N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02			
N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02			
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids</b>												
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			
<b>EP231P: PFAS Sums</b>												
Sum of PFAS	----	0.01	µg/L	0.32	0.38	0.03	0.03	0.03	0.04			
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	0.32	0.38	0.03	0.03	0.03	0.03			
Sum of PFAS (WA DER List)	----	0.01	µg/L	0.32	0.38	0.03	0.03	0.03	0.04			
<b>EP231S: PFAS Surrogate</b>												
13C4-PFOS	----	0.02	%	98.7	100	107	96.5	99.2				
13C8-PFOA	----	0.02	%	84.5	88.4	96.0	77.2	78.7				

## Analytical Results

Sub-Matrix: ASLP LEACHATE (Matrix: WATER)				Client sample ID	FMB-5S	FMB-7S	QA2	FMB - 8	---
Compound	CAS Number	LOR	Unit	Client sampling date / time	11-Apr-2018 13:00	11-Apr-2018 13:00	11-Apr-2018 13:00	[11-Apr-2018]	---
				Result		Result	Result	Result	---
<b>EP231A: Perfluoroalkyl Sulfonic Acids</b>									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	---
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	---
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	---
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	---
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.02	<0.01	0.19	<0.01	<0.01	---
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	---
<b>EP231B: Perfluoroalkyl Carboxylic Acids</b>									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	---
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	---
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	---
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	---
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01	---
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	---
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	---
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	---
Perfluorododecanoic acid (PFDaDA)	307-55-1	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	---
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	---
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	---
<b>EP231C: Perfluoroalkyl Sulfonamides</b>									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	---
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	---
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	---

## Analytical Results

Sub-Matrix: ASLP LEACHATE (Matrix: WATER)				Client sample ID	FMB-5S	FMB-7S	QA2	FMB - 8	---
				Client sampling date / time	11-Apr-2018 13:00	11-Apr-2018 13:00	11-Apr-2018 13:00	[11-Apr-2018]	---
Compound	CAS Number	LOR	Unit	EM1806226-027	EM1806226-029	EM1806226-037	EM1806226-039	-----	----
				Result	Result	Result	Result	-----	---
<b>EP231C: Perfluoroalkyl Sulfonamides - Continued</b>									
N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	---
N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	---
N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	---
N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	---
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids</b>									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	---
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	---
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	---
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	---
<b>EP231P: PFAS Sums</b>									
Sum of PFAS	----	0.01	µg/L	0.02	<0.01	0.19	<0.01	<0.01	---
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	0.02	<0.01	0.19	<0.01	<0.01	---
Sum of PFAS (WA DER List)	----	0.01	µg/L	0.02	<0.01	0.19	<0.01	<0.01	---
<b>EP231S: PFAS Surrogate</b>									
13C4-PFOS	----	0.02	%	112	113	107	106	106	---
13C8-PFOA	----	0.02	%	105	85.0	99.4	108	108	---

## Analytical Results

Client sample ID				FMB - Oysters	---	---	---	---	---
Compound	CAS Number	LOR	Unit	Client sampling date / time	11-Apr-2018 13:00	---	---	---	---
					EM1806226-038	-----	-----	-----	-----
<b>Biota Sample Pre-Preparation</b>									
Ø Sample Description	---	-	--	oysters	---	---	---	---	---
Ø Weight of Sample Prepared	---	0.1	g	17.8	---	---	---	---	---
<b>EP231_TOP_A: Perfluoroalkyl Sulfonic Acids</b>									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	1	µg/kg	<1	---	---	---	---	---
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	1	µg/kg	<1	---	---	---	---	---
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	1	µg/kg	<1	---	---	---	---	---
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	1	µg/kg	<1	---	---	---	---	---
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	1	µg/kg	<1	---	---	---	---	---
Perfluorodecane sulfonic acid (PFDS)	335-77-3	2	µg/kg	<2	---	---	---	---	---
<b>EP231_TOP_B: Perfluoroalkyl Carboxylic Acids</b>									
Perfluorobutanoic acid (PFBA)	375-22-4	5	µg/kg	<5	---	---	---	---	---
Perfluoropentanoic acid (PFPeA)	2706-90-3	2	µg/kg	<2	---	---	---	---	---
Perfluorohexanoic acid (PFHxA)	307-24-4	1	µg/kg	<1	---	---	---	---	---
Perfluoroheptanoic acid (PFHpA)	375-85-9	1	µg/kg	<1	---	---	---	---	---
Perfluorooctanoic acid (PFOA)	335-67-1	1	µg/kg	<1	---	---	---	---	---
Perfluorononanoic acid (PFNA)	375-95-1	1	µg/kg	<1	---	---	---	---	---
Perfluorodecanoic acid (PFDA)	335-76-2	1	µg/kg	<1	---	---	---	---	---
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	1	µg/kg	<1	---	---	---	---	---
Perfluorododecanoic acid (PFDoDA)	307-55-1	2	µg/kg	<2	---	---	---	---	---
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	2	µg/kg	<2	---	---	---	---	---
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	2	µg/kg	<2	---	---	---	---	---
<b>EP231_TOP_C: Perfluoroalkyl Sulfonamides</b>									
Perfluorooctane sulfonamide (FOSA)	754-91-6	5	µg/kg	<5	---	---	---	---	---

## Analytical Results

Sub-Matrix: BIOTA (Matrix: BIOTA)		Client sample ID		FMB - Oysters	---	---	---	---	---
		Client sampling date / time		11-Apr-2018 13:00	---	---	---	---	---
Compound	CAS Number	LOR	Unit	EM1806226-038	-----	-----	-----	-----	-----
				Result	---	---	---	---	---
<b>EP231_TOP_C: Perfluoroalkyl Sulfonamides - Continued</b>									
N-Methyl perfluoroctane sulfonamide (MeFOSA)	31506-32-8	5	µg/kg	<5	---	---	---	---	---
N-Ethyl perfluoroctane sulfonamide (EtFOSA)	4151-50-2	2	µg/kg	<2	---	---	---	---	---
N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	2	µg/kg	<2	---	---	---	---	---
N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	2	µg/kg	<2	---	---	---	---	---
N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	1	µg/kg	<1	---	---	---	---	---
N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	1	µg/kg	<1	---	---	---	---	---
<b>EP231_TOP_D: (n:2) Fluorotelomer Sulfonic Acids</b>									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	2	µg/kg	<2	---	---	---	---	---
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	2	µg/kg	<2	---	---	---	---	---
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	2	µg/kg	<2	---	---	---	---	---
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	2	µg/kg	<2	---	---	---	---	---
<b>EP231_TOP_P: PFAS Sums</b>									
Sum of PFAS	---	1	µg/kg	<1	---	---	---	---	---
Sum of PFHxS and PFOS	355-46-4/1763-23-1	1	µg/kg	<1	---	---	---	---	---
Sum of TOP C4 - C14 as Fluorine	---	1	µg/kg	<1	---	---	---	---	---
<b>EP231A: Perfluoroalkyl Sulfonic Acids</b>									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	1	µg/kg	<1	---	---	---	---	---
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	1	µg/kg	<1	---	---	---	---	---
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	1	µg/kg	<1	---	---	---	---	---

## Analytical Results

Sub-Matrix: BIOTA (Matrix: BIOTA)		Client sample ID		FMB - Oysters	---	---	---	---	---
		Client sampling date / time		11-Apr-2018 13:00	---	---	---	---	---
Compound	CAS Number	LOR	Unit	EM1806226-038	-----	-----	-----	-----	-----
				Result	---	---	---	---	---
<b>EP231A: Perfluoroalkyl Sulfonic Acids - Continued</b>									
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	1	µg/kg	<1	---	---	---	---	---
Perfluorooctane sulfonic acid (PFOS) - Linear	2795-39-3	1	µg/kg	<1	---	---	---	---	---
Perfluorooctane sulfonic acid (PFOS) - Branched	---	1	µg/kg	<1	---	---	---	---	---
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	1	µg/kg	<1	---	---	---	---	---
Perfluorodecane sulfonic acid (PFDS)	335-77-3	2	µg/kg	<2	---	---	---	---	---
<b>EP231B: Perfluoroalkyl Carboxylic Acids</b>									
Perfluorobutanoic acid (PFBA)	375-22-4	5	µg/kg	<5	---	---	---	---	---
Perfluoropentanoic acid (PFPeA)	2706-90-3	2	µg/kg	<2	---	---	---	---	---
Perfluorohexanoic acid (PFHxA)	307-24-4	1	µg/kg	<1	---	---	---	---	---
Perfluoroheptanoic acid (PFHpA)	375-85-9	1	µg/kg	<1	---	---	---	---	---
Perfluorooctanoic acid (PFOA)	335-67-1	1	µg/kg	<1	---	---	---	---	---
Perfluorononanoic acid (PFNA)	375-95-1	1	µg/kg	<1	---	---	---	---	---
Perfluorodecanoic acid (PFDA)	335-76-2	1	µg/kg	<1	---	---	---	---	---
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	1	µg/kg	<1	---	---	---	---	---
Perfluorododecanoic acid (PFDODA)	307-55-1	2	µg/kg	<2	---	---	---	---	---
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	2	µg/kg	<2	---	---	---	---	---
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	2	µg/kg	<2	---	---	---	---	---
<b>EP231C: Perfluoroalkyl Sulfonamides</b>									
Perfluorooctane sulfonamide (FOSA)	754-91-6	5	µg/kg	<5	---	---	---	---	---
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	5	µg/kg	<5	---	---	---	---	---
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	2	µg/kg	<2	---	---	---	---	---
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	2	µg/kg	<2	---	---	---	---	---

## Analytical Results

Sub-Matrix: BIOTA (Matrix: BIOTA)		Client sample ID		FMB - Oysters	---	---	---	---	---
		Client sampling date / time		11-Apr-2018 13:00	---	---	---	---	---
Compound	CAS Number	LOR	Unit	EM1806226-038	-----	-----	-----	-----	-----
				Result	---	---	---	---	---
<b>EP231C: Perfluoroalkyl Sulfonamides - Continued</b>									
N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSSE)	1691-99-2	2	µg/kg	<2	---	---	---	---	---
N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	1	µg/kg	<1	---	---	---	---	---
N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	1	µg/kg	<1	---	---	---	---	---
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids</b>									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	2	µg/kg	<2	---	---	---	---	---
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	2	µg/kg	<2	---	---	---	---	---
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	2	µg/kg	<2	---	---	---	---	---
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	2	µg/kg	<2	---	---	---	---	---
<b>EP231P: PFAS Sums</b>									
^ Sum of PFAS	---	1	µg/kg	<1	---	---	---	---	---
<b>EP231_TOP_S: PFAS Surrogate</b>									
13C4-PFOS	---	1	%	62.0	---	---	---	---	---
13C8-PFOA	---	1	%	77.5	---	---	---	---	---
<b>EP231S: PFAS Surrogate</b>									
13C4-PFOS	---	1	%	67.0	---	---	---	---	---
13C8-PFOA	---	1	%	89.5	---	---	---	---	---

## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	SC 1S (0-100)	SC 2S (0-100)	SC 3S (0-100)	SC 4S (0-100)	SC 5S (0-100)	
Compound	CAS Number	LOR	Unit	Client sampling date / time	11-Apr-2018 13:00				
					EM1806226-001	EM1806226-002	EM1806226-003	EM1806226-004	EM1806226-005
<b>EA055: Moisture Content (Dried @ 105-110°C)</b>									
Moisture Content	---	0.1	%	26.3	37.7	23.3	31.5	25.9	
<b>EA150: Particle Sizing</b>									
+75µm	---	1	%	94	86	95	93	95	
+150µm	---	1	%	61	57	83	61	75	
+300µm	---	1	%	10	16	26	10	17	
+425µm	---	1	%	4	6	9	4	6	
+600µm	---	1	%	3	3	5	2	3	
+1180µm	---	1	%	1	<1	2	<1	1	
+2.36mm	---	1	%	<1	<1	2	<1	<1	
+4.75mm	---	1	%	<1	<1	1	<1	<1	
+9.5mm	---	1	%	<1	<1	<1	<1	<1	
+19.0mm	---	1	%	<1	<1	<1	<1	<1	
+37.5mm	---	1	%	<1	<1	<1	<1	<1	
+75.0mm	---	1	%	<1	<1	<1	<1	<1	
<b>EA150: Soil Classification based on Particle Size</b>									
Fines (<75 µm)	---	1	%	6	14	5	7	5	
Sand (>75 µm)	---	1	%	93	86	93	93	94	
Gravel (>2mm)	---	1	%	1	<1	2	<1	1	
Cobbles (>6cm)	---	1	%	<1	<1	<1	<1	<1	
<b>ED006: Exchangeable Cations on Alkaline Soils</b>									
ø Exchangeable Calcium	---	0.2	meq/100g	1.5	6.5	----	0.9	0.7	
ø Exchangeable Magnesium	---	0.2	meq/100g	0.8	0.9	----	1.8	1.2	
ø Exchangeable Potassium	---	0.2	meq/100g	0.2	<0.2	----	0.6	0.4	
ø Exchangeable Sodium	---	0.2	meq/100g	<0.2	<0.2	----	1.0	0.6	
ø Cation Exchange Capacity	---	0.2	meq/100g	2.5	7.6	----	4.3	2.9	
<b>ED007: Exchangeable Cations</b>									
Exchangeable Calcium	---	0.1	meq/100g	---	---	1.5	----	----	
Exchangeable Magnesium	---	0.1	meq/100g	---	---	2.7	----	----	
Exchangeable Potassium	---	0.1	meq/100g	---	---	0.6	----	----	
Exchangeable Sodium	---	0.1	meq/100g	---	---	0.3	----	----	
Cation Exchange Capacity	---	0.1	meq/100g	---	---	5.1	----	----	
<b>EN60: ASLP Leaching Procedure</b>									
Initial pH	---	0.1	pH Unit	6.6	7.8	7.9	7.8	7.6	
After HCl pH	---	0.1	pH Unit	1.8	1.8	1.8	1.8	1.8	

## *Analytical Results*

## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Client sample ID		SC 1S (0-100)	SC 2S (0-100)	SC 3S (0-100)	SC 4S (0-100)	SC 5S (0-100)
		Client sampling date / time		11-Apr-2018 13:00				
Compound	CAS Number	LOR	Unit	EM1806226-001	EM1806226-002	EM1806226-003	EM1806226-004	EM1806226-005
				Result	Result	Result	Result	Result
<b>EP231C: Perfluoroalkyl Sulfonamides - Continued</b>								
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
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
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids</b>								
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
<b>EP231P: PFAS Sums</b>								
Sum of PFAS	----	0.0002	mg/kg	<b>0.104</b>	<b>0.0147</b>	<b>0.0081</b>	<b>0.0053</b>	<b>0.0107</b>
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	<b>0.103</b>	<b>0.0138</b>	<b>0.0081</b>	<b>0.0053</b>	<b>0.0105</b>
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	<b>0.103</b>	<b>0.0142</b>	<b>0.0081</b>	<b>0.0053</b>	<b>0.0105</b>
<b>EP231S: PFAS Surrogate</b>								
13C4-PFOS	----	0.0002	%	<b>89.0</b>	<b>74.0</b>	<b>73.5</b>	<b>74.5</b>	<b>73.0</b>
13C8-PFOA	----	0.0002	%	<b>78.0</b>	<b>72.0</b>	<b>71.0</b>	<b>72.5</b>	<b>60.5</b>

## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	SC 6S (0-100)	SC 1S (150-300)	SC 2S (150-300)	SC 3S (150-300)	SC 4S (150-300)
Compound	CAS Number	LOR	Unit	11-Apr-2018 13:00				
				EM1806226-006	EM1806226-007	EM1806226-008	EM1806226-009	EM1806226-010
<b>EA055: Moisture Content (Dried @ 105-110°C)</b>								
Moisture Content	---	0.1	%	25.0	21.9	33.1	23.4	21.5
<b>EA150: Particle Sizing</b>								
+75µm	---	1	%	95	93	80	93	92
+150µm	---	1	%	72	55	56	57	49
+300µm	---	1	%	30	9	14	12	11
+425µm	---	1	%	12	2	4	7	4
+600µm	---	1	%	6	1	1	4	2
+1180µm	---	1	%	4	<1	<1	2	<1
+2.36mm	---	1	%	2	<1	<1	<1	<1
+4.75mm	---	1	%	2	<1	<1	<1	<1
+9.5mm	---	1	%	1	<1	<1	<1	<1
+19.0mm	---	1	%	<1	<1	<1	<1	<1
+37.5mm	---	1	%	<1	<1	<1	<1	<1
+75.0mm	---	1	%	<1	<1	<1	<1	<1
<b>EA150: Soil Classification based on Particle Size</b>								
Fines (<75 µm)	---	1	%	5	7	20	7	8
Sand (>75 µm)	---	1	%	92	93	80	92	92
Gravel (>2mm)	---	1	%	3	<1	<1	1	<1
Cobbles (>6cm)	---	1	%	<1	<1	<1	<1	<1
<b>ED006: Exchangeable Cations on Alkaline Soils</b>								
ø Exchangeable Calcium	---	0.2	meq/100g	1.1	1.4	10.3	---	0.6
ø Exchangeable Magnesium	---	0.2	meq/100g	1.3	0.6	1.3	---	1.3
ø Exchangeable Potassium	---	0.2	meq/100g	0.5	<0.2	0.2	---	0.4
ø Exchangeable Sodium	---	0.2	meq/100g	0.8	<0.2	0.3	---	0.5
ø Cation Exchange Capacity	---	0.2	meq/100g	3.7	2.2	12.2	---	2.8
<b>ED007: Exchangeable Cations</b>								
Exchangeable Calcium	---	0.1	meq/100g	---	---	---	1.1	---
Exchangeable Magnesium	---	0.1	meq/100g	---	---	---	2.1	---
Exchangeable Potassium	---	0.1	meq/100g	---	---	---	0.6	---
Exchangeable Sodium	---	0.1	meq/100g	---	---	---	0.2	---
Cation Exchange Capacity	---	0.1	meq/100g	---	---	---	4.1	---
<b>EN60: ASLP Leaching Procedure</b>								
Initial pH	---	0.1	pH Unit	7.8	---	---	---	---
After HCl pH	---	0.1	pH Unit	1.8	---	---	---	---

## *Analytical Results*

## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Client sample ID		SC 6S (0-100)	SC 1S (150-300)	SC 2S (150-300)	SC 3S (150-300)	SC 4S (150-300)
		Client sampling date / time		11-Apr-2018 13:00				
Compound	CAS Number	LOR	Unit	EM1806226-006	EM1806226-007	EM1806226-008	EM1806226-009	EM1806226-010
<b>EP231C: Perfluoroalkyl Sulfonamides - Continued</b>								
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
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
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids</b>								
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
<b>EP231P: PFAS Sums</b>								
Sum of PFAS	----	0.0002	mg/kg	<b>0.0061</b>	<b>0.0030</b>	<b>0.0279</b>	<0.0002	<b>0.0014</b>
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	<b>0.0061</b>	<b>0.0030</b>	<b>0.0262</b>	<0.0002	<b>0.0014</b>
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	<b>0.0061</b>	<b>0.0030</b>	<b>0.0270</b>	<0.0002	<b>0.0014</b>
<b>EP231S: PFAS Surrogate</b>								
13C4-PFOS	----	0.0002	%	<b>82.5</b>	<b>73.0</b>	<b>77.5</b>	<b>66.0</b>	<b>69.5</b>
13C8-PFOA	----	0.0002	%	<b>62.0</b>	<b>76.5</b>	<b>80.5</b>	<b>60.5</b>	<b>66.5</b>

## *Analytical Results*

## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Client sample ID		SC 5S (150-300)	SC 6S (150-300)	QA1	FMB-1S	FMB-2S
		Client sampling date / time		11-Apr-2018 13:00				
Compound	CAS Number	LOR	Unit	EM1806226-011	EM1806226-012	EM1806226-019	EM1806226-023	EM1806226-024
<b>EP231A: Perfluoroalkyl Sulfonic Acids - Continued</b>								
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	<0.0002	<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	0.0037	0.0003	0.0045	0.0004	0.0013
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	0.0003	<0.0002	<0.0002	<0.0002	<0.0002
<b>EP231B: Perfluoroalkyl Carboxylic Acids</b>								
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	<0.0002
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 (PFDDoDA)	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
<b>EP231C: Perfluoroalkyl Sulfonamides</b>								
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
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Client sample ID		SC 5S (150-300)	SC 6S (150-300)	QA1	FMB-1S	FMB-2S
		Client sampling date / time		11-Apr-2018 13:00				
Compound	CAS Number	LOR	Unit	EM1806226-011	EM1806226-012	EM1806226-019	EM1806226-023	EM1806226-024
				Result	Result	Result	Result	Result
<b>EP231C: Perfluoroalkyl Sulfonamides - Continued</b>								
N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids</b>								
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
<b>EP231P: PFAS Sums</b>								
Sum of PFAS	----	0.0002	mg/kg	0.0043	0.0003	0.0045	0.0004	0.0013
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	0.0040	0.0003	0.0045	0.0004	0.0013
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	0.0040	0.0003	0.0045	0.0004	0.0013
<b>EP231S: PFAS Surrogate</b>								
13C4-PFOS	----	0.0002	%	66.5	67.0	62.5	62.5	64.5
13C8-PFOA	----	0.0002	%	71.0	66.5	64.0	74.0	62.5

## *Analytical Results*

## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Client sample ID		FMB-3S	FMB-4S	FMB-5S	FMB-6S	FMB-7S
Compound	CAS Number	LOR	Unit	11-Apr-2018 13:00				
				Result	Result	Result	Result	Result
<b>EP231A: Perfluoroalkyl Sulfonic Acids - Continued</b>								
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	<0.0002	<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	0.0012	<0.0002	0.0005	<0.0002	<0.0002
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
<b>EP231B: Perfluoroalkyl Carboxylic Acids</b>								
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	<0.0002
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 (PFDDoDA)	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
<b>EP231C: Perfluoroalkyl Sulfonamides</b>								
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
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Client sample ID		FMB-3S	FMB-4S	FMB-5S	FMB-6S	FMB-7S
		Client sampling date / time		11-Apr-2018 13:00				
Compound	CAS Number	LOR	Unit	EM1806226-025	EM1806226-026	EM1806226-027	EM1806226-028	EM1806226-029
				Result	Result	Result	Result	Result
<b>EP231C: Perfluoroalkyl Sulfonamides - Continued</b>								
N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids</b>								
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
<b>EP231P: PFAS Sums</b>								
Sum of PFAS	----	0.0002	mg/kg	0.0012	<0.0002	0.0005	<0.0002	<0.0002
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	0.0012	<0.0002	0.0005	<0.0002	<0.0002
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	0.0012	<0.0002	0.0005	<0.0002	<0.0002
<b>EP231S: PFAS Surrogate</b>								
13C4-PFOS	----	0.0002	%	62.0	65.5	69.5	67.5	61.5
13C8-PFOA	----	0.0002	%	62.0	64.5	66.0	71.0	63.0

## **Analytical Results**

## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Client sample ID		QA2	FMB - 8	---	---	---
		Client sampling date / time		11-Apr-2018 13:00	[11-Apr-2018]	---	---	---
Compound	CAS Number	LOR	Unit	EM1806226-037	EM1806226-039	-----	-----	-----
				Result	Result	---	---	---
<b>EP231A: Perfluoroalkyl Sulfonic Acids - Continued</b>								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	---	---	---
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	---	---	---
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	---	---	---
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	---	---	---
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0034	<0.0002	---	---	---
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	---	---	---
<b>EP231B: Perfluoroalkyl Carboxylic Acids</b>								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	---	---	---
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	---	---	---
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	---	---	---
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	---	---	---
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	---	---	---
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	---	---	---
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	---	---	---
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	---	---	---
Perfluorododecanoic acid (PFDDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	---	---	---
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	---	---	---
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	---	---	---
<b>EP231C: Perfluoroalkyl Sulfonamides</b>								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	---	---	---
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	---	---	---
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	---	---	---

## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Client sample ID		QA2	FMB - 8	---	---	---
		Client sampling date / time		11-Apr-2018 13:00	[11-Apr-2018]	---	---	---
Compound	CAS Number	LOR	Unit	EM1806226-037	EM1806226-039	-----	-----	-----
				Result	Result	---	---	---
<b>EP231C: Perfluoroalkyl Sulfonamides - Continued</b>								
N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	---	---	---
N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	---	---	---
N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	---	---	---
N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	---	---	---
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids</b>								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	---	---	---
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	---	---	---
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	---	---	---
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	---	---	---
<b>EP231P: PFAS Sums</b>								
Sum of PFAS	----	0.0002	mg/kg	<b>0.0034</b>	<0.0002	---	---	---
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	<b>0.0034</b>	<0.0002	---	---	---
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	<b>0.0034</b>	<0.0002	---	---	---
<b>EP231S: PFAS Surrogate</b>								
13C4-PFOS	----	0.0002	%	<b>80.0</b>	<b>74.0</b>	---	---	---
13C8-PFOA	----	0.0002	%	<b>80.5</b>	<b>78.5</b>	---	---	---

## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID		SC 1W	SC 2W	SC 3W	SC 4W	SC 5W
Compound	CAS Number	LOR	Unit	11-Apr-2018 13:00				
				Result	Result	Result	Result	Result
<b>EP231A: Perfluoroalkyl Sulfonic Acids</b>								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	1.18	0.579	0.248	0.062	0.061
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	1.57	0.891	0.305	0.068	0.062
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	15.5	6.97	3.17	0.899	0.808
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	1.83	0.539	0.436	0.073	0.088
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	62.2	20.1	11.1	2.74	3.15
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	0.041	0.008	0.006	<0.002	<0.002
<b>EP231B: Perfluoroalkyl Carboxylic Acids</b>								
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	0.40	0.17	0.07	0.03	0.03
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	0.586	0.223	0.099	0.029	0.031
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	2.24	0.858	0.370	0.089	0.087
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	0.568	0.226	0.096	0.029	0.025
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	0.118	0.594	0.240	0.055	0.073
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	0.036	0.012	0.006	0.004	0.005
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	0.008	0.004	<0.002	<0.002	<0.002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid (PFDsDA)	307-55-1	0.002	µg/L	0.002	<0.002	<0.002	<0.002	<0.002
Perfluorotridecanoic acid (PFTsDA)	72629-94-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorotetradecanoic acid (PFTsDA)	376-06-7	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
<b>EP231C: Perfluoroalkyl Sulfonamides</b>								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	0.014	0.005	0.003	<0.002	<0.002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005

## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID		SC 1W	SC 2W	SC 3W	SC 4W	SC 5W
		Client sampling date / time		11-Apr-2018 13:00				
Compound	CAS Number	LOR	Unit	EM1806226-013	EM1806226-014	EM1806226-015	EM1806226-016	EM1806226-017
				Result	Result	Result	Result	Result
<b>EP231C: Perfluoroalkyl Sulfonamides - Continued</b>								
N-Ethyl perfluoroctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids</b>								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	0.012	<0.005	<0.005	<0.005	<0.005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	0.014	0.006	<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	<0.005	<0.005
<b>EP231P: PFAS Sums</b>								
Sum of PFAS	----	0.002	µg/L	86.3	31.2	16.1	4.08	4.42
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	77.7	27.1	14.3	3.64	3.96
Sum of PFAS (WA DER List)	----	0.002	µg/L	82.8	29.7	15.4	3.93	4.26
<b>EP231S: PFAS Surrogate</b>								
13C4-PFOS	----	0.002	%	94.1	86.2	83.7	67.4	92.4
13C8-PFOA	----	0.002	%	96.6	91.2	93.9	73.1	94.5

## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID		SC 6W	SC 3W PM	SC 4W PM	SC 5W PM	FMB -1W
Compound	CAS Number	LOR	Unit	11-Apr-2018 13:00	11-Apr-2018 16:00	11-Apr-2018 16:00	11-Apr-2018 16:00	11-Apr-2018 13:00
				Result	Result	Result	Result	Result
<b>EP231A: Perfluoroalkyl Sulfonic Acids</b>								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	0.053	0.034	0.206	0.048	<0.002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	0.056	0.032	0.236	0.048	<0.002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	0.765	0.390	2.58	0.605	0.006
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	0.086	0.045	0.327	0.062	<0.002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	2.98	4.06	9.49	2.10	0.025
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	0.004	<0.002	<0.002	<0.002
<b>EP231B: Perfluoroalkyl Carboxylic Acids</b>								
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.01	0.04	<0.01	<0.01
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	0.024	0.020	0.084	0.025	<0.002
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	0.072	0.045	0.267	0.065	<0.002
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	0.020	0.014	0.073	0.016	<0.002
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	0.061	0.036	0.187	0.056	<0.002
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	0.004	0.007	0.005	0.003	<0.002
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	0.003	<0.002	<0.002	<0.002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid (PFDaDA)	307-55-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
<b>EP231C: Perfluoroalkyl Sulfonamides</b>								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005

## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID		SC 6W	SC 3W PM	SC 4W PM	SC 5W PM	FMB -1W
		Client sampling date / time		11-Apr-2018 13:00	11-Apr-2018 16:00	11-Apr-2018 16:00	11-Apr-2018 16:00	11-Apr-2018 13:00
Compound	CAS Number	LOR	Unit	EM1806226-018	EM1806226-020	EM1806226-021	EM1806226-022	EM1806226-030
				Result	Result	Result	Result	Result
<b>EP231C: Perfluoroalkyl Sulfonamides - Continued</b>								
N-Ethyl perfluoroctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids</b>								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	<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	<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	<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	<0.005	<0.005
<b>EP231P: PFAS Sums</b>								
Sum of PFAS	----	0.002	µg/L	4.12	4.69	13.5	3.03	0.031
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	3.74	4.45	12.1	2.70	0.031
Sum of PFAS (WA DER List)	----	0.002	µg/L	3.98	4.60	12.9	2.92	0.031
<b>EP231S: PFAS Surrogate</b>								
13C4-PFOS	----	0.002	%	66.6	90.3	75.6	73.3	61.5
13C8-PFOA	----	0.002	%	89.9	107	81.9	89.6	84.0

## Analytical Results

Client sample ID				FMB -2W	FMB -3W	FMB -4W	FMB -5W	FMB -6W
Compound	CAS Number	LOR	Unit	11-Apr-2018 13:00				
				Result	Result	Result	Result	Result
<b>EP231A: Perfluoroalkyl Sulfonic Acids</b>								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<b>0.050</b>	<b>0.006</b>	<0.002	<0.002	<0.002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<b>0.052</b>	<b>0.006</b>	<0.002	<0.002	<0.002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<b>0.668</b>	<b>0.101</b>	<0.002	<b>0.011</b>	<b>0.011</b>
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<b>0.052</b>	<b>0.009</b>	<0.002	<0.002	<0.002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<b>1.22</b>	<b>0.312</b>	<0.002	<b>0.014</b>	<b>0.015</b>
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
<b>EP231B: Perfluoroalkyl Carboxylic Acids</b>								
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<b>0.024</b>	<0.002	<0.002	<0.002	<0.002
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<b>0.068</b>	<b>0.008</b>	<0.002	<0.002	<0.002
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<b>0.018</b>	<0.002	<0.002	<0.002	<0.002
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<b>0.047</b>	<b>0.007</b>	<0.002	<0.002	<0.002
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorododecanoic acid (PFDDoDA)	307-55-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
<b>EP231C: Perfluoroalkyl Sulfonamides</b>								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005

## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID		FMB -2W	FMB -3W	FMB -4W	FMB -5W	FMB -6W
		Client sampling date / time		11-Apr-2018 13:00				
Compound	CAS Number	LOR	Unit	EM1806226-031	EM1806226-032	EM1806226-033	EM1806226-034	EM1806226-035
				Result	Result	Result	Result	Result
<b>EP231C: Perfluoroalkyl Sulfonamides - Continued</b>								
N-Ethyl perfluoroctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005
N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids</b>								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	<0.005	<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	<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	<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	<0.005	<0.005
<b>EP231P: PFAS Sums</b>								
Sum of PFAS	----	0.002	µg/L	2.20	0.449	<0.002	0.025	0.026
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	1.89	0.413	<0.002	0.025	0.026
Sum of PFAS (WA DER List)	----	0.002	µg/L	2.10	0.434	<0.002	0.025	0.026
<b>EP231S: PFAS Surrogate</b>								
13C4-PFOS	----	0.002	%	66.3	60.8	61.0	69.2	71.2
13C8-PFOA	----	0.002	%	92.3	72.1	76.0	82.1	93.9

## Analytical Results

Client sample ID				FMB -7W	FMB -8W	QA 1	---	---
Compound	CAS Number	LOR	Unit	11-Apr-2018 13:00	[11-Apr-2018]	[11-Apr-2018]	---	---
				Result	Result	Result	----	----
<b>EP231A: Perfluoroalkyl Sulfonic Acids</b>								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	<0.002	<b>0.047</b>	---	---
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	<0.002	<b>0.050</b>	---	---
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<b>0.002</b>	<b>0.019</b>	<b>0.725</b>	---	---
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	<0.002	<b>0.088</b>	---	---
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<b>0.014</b>	<b>0.023</b>	<b>3.06</b>	---	---
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002	<0.002	---	---
<b>EP231B: Perfluoroalkyl Carboxylic Acids</b>								
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	<b>0.024</b>	---	---
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	<0.002	<b>0.063</b>	---	---
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	<0.002	<b>0.019</b>	---	---
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	<0.002	<b>0.059</b>	---	---
Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	<0.002	<b>0.004</b>	---	---
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 (PFDDoDA)	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	---	---
Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.005	µg/L	<0.005	<0.005	<0.005	---	---
<b>EP231C: Perfluoroalkyl Sulfonamides</b>								
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	---	---

## Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID		FMB -7W	FMB -8W	QA 1	---	---
		Client sampling date / time		11-Apr-2018 13:00	[11-Apr-2018]	[11-Apr-2018]	---	---
Compound	CAS Number	LOR	Unit	EM1806226-036	EM1806226-040	EM1806226-041	-----	-----
				Result	Result	Result	---	---
<b>EP231C: Perfluoroalkyl Sulfonamides - Continued</b>								
N-Ethyl perfluoroctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	<0.005	---	---
N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<0.005	<0.005	---	---
N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	<0.005	---	---
N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	<0.002	---	---
N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	<0.002	<0.002	---	---
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids</b>								
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	---	---
<b>EP231P: PFAS Sums</b>								
Sum of PFAS	----	0.002	µg/L	<b>0.016</b>	<b>0.042</b>	<b>4.14</b>	---	---
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L	<b>0.016</b>	<b>0.042</b>	<b>3.78</b>	---	---
Sum of PFAS (WA DER List)	----	0.002	µg/L	<b>0.016</b>	<b>0.042</b>	<b>4.00</b>	---	---
<b>EP231S: PFAS Surrogate</b>								
13C4-PFOS	----	0.002	%	<b>63.9</b>	<b>68.7</b>	<b>66.0</b>	---	---
13C8-PFOA	----	0.002	%	<b>90.3</b>	<b>85.8</b>	<b>88.6</b>	---	---

## Surrogate Control Limits

### Sub-Matrix: ASLP LEACHATE

Compound	CAS Number	Recovery Limits (%)	
		Low	High
<b>EP231S: PFAS Surrogate</b>			
13C4-PFOS	---	60	130
13C8-PFOA	---	60	130

### Sub-Matrix: BIOTA

Compound	CAS Number	Recovery Limits (%)	
		Low	High
<b>EP231_TOP_S: PFAS Surrogate</b>			
13C4-PFOS	---	50	130
13C8-PFOA	---	50	130
<b>EP231S: PFAS Surrogate</b>			
13C4-PFOS	---	50	130
13C8-PFOA	---	50	130

### Sub-Matrix: SOIL

Compound	CAS Number	Recovery Limits (%)	
		Low	High
<b>EP231S: PFAS Surrogate</b>			
13C4-PFOS	---	60	130
13C8-PFOA	---	60	130

### Sub-Matrix: WATER

Compound	CAS Number	Recovery Limits (%)	
		Low	High
<b>EP231S: PFAS Surrogate</b>			
13C4-PFOS	---	60	120
13C8-PFOA	---	60	120

## QUALITY CONTROL REPORT

Work Order	<b>: EM1806226</b>	Page	<b>: 1 of 22</b>
Client	<b>: GHD PTY LTD</b>	Laboratory	<b>: Environmental Division Melbourne</b>
Contact	<b>: MR PETER TOPLISS</b>	Contact	<b>: Shirley LeCornu</b>
Address	<b>: 2 SALAMANCA SQUARE HOBART TAS, AUSTRALIA 7000</b>	Address	<b>: 4 Westall Rd Springvale VIC Australia 3171</b>
Telephone	<b>: +61 03 6332 5500</b>	Telephone	<b>: +61-3-8549 9630</b>
Project	<b>: 3218792</b>	Date Samples Received	<b>: 13-Apr-2018</b>
Order number	<b>: 3218792</b>	Date Analysis Commenced	<b>: 16-Apr-2018</b>
C-O-C number	<b>: ----</b>	Issue Date	<b>: 23-Apr-2018</b>
Sampler	<b>: DE</b>		
Site	<b>: Aiservices Sinclair Creek and Five Mile Beach</b>		
Quote number	<b>: EN/005/15 VICTORIA (Primary work only)</b>		
No. of samples received	<b>: 41</b>		
No. of samples analysed	<b>: 41</b>		



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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics, Smithfield, NSW
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Franco Lentini		Sydney Organics, Smithfield, NSW
Greg Vogel	Lab Manager	Sydney Inorganics, Smithfield, NSW
Nathan Webb	Asbestos Identifier	Newcastle - Inorganics, Mayfield West, NSW

## 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: BIOTA

		Laboratory Duplicate (DUP) Report							
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 1572408)</b>									
EM1806226-038	FMB - Oysters	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluoroctane sulfonic acid (PFOS)	1763-23-1	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	1	µg/kg	<2	<2	0.00	No Limit
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1572408)</b>									
EM1806226-038	FMB - Oysters	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	1	µg/kg	<2	<2	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluoroctanoic acid (PFOA)	335-67-1	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	1	µg/kg	<2	<2	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	1	µg/kg	<2	<2	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	2	µg/kg	<2	<2	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	5	µg/kg	<5	<5	0.00	No Limit
<b>EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 1572408)</b>									
EM1806226-038	FMB - Oysters	EP231X: Perfluoroctane sulfonamide (FOSA)	754-91-6	1	µg/kg	<5	<5	0.00	No Limit
		EP231X: N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	1	µg/kg	<1	<1	0.00	No Limit
		EP231X: N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	1	µg/kg	<1	<1	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 (%)
<b>ED007: Exchangeable Cations (QC Lot: 1570383) - continued</b>									
EM1806226-003	SC 3S (0-100)	ED007: Exchangeable Calcium	---	0.1	meq/100g	1.5	1.6	0.00	0% - 50%
		ED007: Exchangeable Magnesium	---	0.1	meq/100g	2.7	2.7	0.00	0% - 20%
		ED007: Exchangeable Potassium	---	0.1	meq/100g	0.6	0.6	0.00	No Limit
		ED007: Exchangeable Sodium	---	0.1	meq/100g	0.3	0.3	0.00	No Limit
		ED007: Cation Exchange Capacity	---	0.1	meq/100g	5.1	5.2	0.00	0% - 20%
<b>EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 1582774)</b>									
EM1805892-001	Anonymous	EP003: Total Organic Carbon	---	0.02	%	0.10	0.12	14.4	No Limit
EM1806226-001	SC 1S (0-100)	EP003: Total Organic Carbon	---	0.02	%	0.23	0.25	5.75	0% - 50%
<b>EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 1582775)</b>									
EM1806226-011	SC 5S (150-300)	EP003: Total Organic Carbon	---	0.02	%	0.14	0.14	0.00	No Limit
ES1810877-002	Anonymous	EP003: Total Organic Carbon	---	0.02	%	28.7	24.9	14.4	0% - 20%
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 1575133)</b>									
EM1806226-001	SC 1S (0-100)	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	0.0036	0.0044	18.2	0% - 20%
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	0.0003	0.0008	84.7	No Limit
		EP231X: Perfluoroctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0994	0.0988	0.582	0% - 20%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.0011	139	No Limit
EM1806226-011	SC 5S (150-300)	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	0.0004	60.9	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	0.0003	0.0003	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: Perfluoroctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0037	0.0034	9.52	0% - 50%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	0.0003	0.0002	0.00	No Limit
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 1575137)</b>									
EM1806226-037	QA2	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: Perfluoroctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0034	0.0032	5.82	0% - 50%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
ES1810982-022	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: Perfluoroctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1575133)</b>									
EM1806226-001	SC 1S (0-100)	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.0002	0.00	No Limit

**Sub-Matrix: SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1575133) - continued</b>									
EM1806226-001	SC 1S (0-100)	EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.0002	0.0005	69.2	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.0003	51.6	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	0.0013	146	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.0008	120	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
EM1806226-011	SC 5S (150-300)	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: Perfluoroctanoic 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
		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
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1575137)</b>									
EM1806226-037	QA2	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: Perfluoroctanoic 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
		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
ES1810982-022	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: Perfluoroctanoic 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

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 (%)
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1575137) - continued</b>									
ES1810982-022	Anonymous	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
<b>EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 1575133)</b>									
EM1806226-001	SC 1S (0-100)	EP231X: Perfluoroctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluoroctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluoroctane sulfonamide (EfFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EM1806226-011	SC 5S (150-300)	EP231X: Perfluoroctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluoroctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluoroctane sulfonamide (EfFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
<b>EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 1575137)</b>									
EM1806226-037	QA2	EP231X: Perfluoroctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluoroctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluoroctane sulfonamide (EfFOSA)	4151-50-2	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 (%)
<b>EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 1575137) - continued</b>									
EM1806226-037	QA2	EP231X: N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
ES1810982-022	Anonymous	EP231X: Perfluoroctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluoroctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluoroctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 1575133)</b>									
EM1806226-001	SC 1S (0-100)	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
EM1806226-011	SC 5S (150-300)	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
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 1575137)</b>									
EM1806226-037	QA2	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 (%)
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 1575137) - continued</b>									
EM1806226-037	QA2	EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
ES1810982-022	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 (%)
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 1578495)</b>									
EM1806226-034	FMB -5W	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	0.011	0.017	41.4	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: Perfluoroctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	0.014	0.013	7.41	No Limit
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002	0.00	No Limit
EM1806226-040	FMB -8W	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	0.019	0.019	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: Perfluoroctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	0.023	0.020	14.7	0% - 50%
		EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	<0.002	0.00	No Limit
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 1580025)</b>									
ES1810453-031	Anonymous	EP231X: Perfluoroctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	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 (%)
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 1580025) - continued</b>									
ES1810453-031	Anonymous	EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.05	<0.05	0.00	No Limit
EM1806226-027	FMB-5S	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.02	0.02	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
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1578495)</b>									
EM1806226-034	FMB -5W	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: Perfluoroctanoic 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
EM1806226-040	FMB -8W	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: Perfluoroctanoic 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
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1580025)</b>									
ES1810453-031	Anonymous	EP231X: Perfluoroctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	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 (%)
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1580025) - continued</b>									
ES1810453-031	Anonymous	EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.12	<0.12	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.2	<0.2	0.00	No Limit
EM1806226-027	FMB-5S	EP231X: Perfluoroctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluoropentanoic acid (PPPeA)	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
<b>EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 1578495)</b>									
EM1806226-034	FMB -5W	EP231X-LL: Perfluoroctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluoroctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Ethyl perfluoroctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
EM1806226-040	FMB -8W	EP231X-LL: Perfluoroctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	<0.002	0.00	No Limit
		EP231X-LL: N-Methyl perfluoroctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Ethyl perfluoroctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
		EP231X-LL: N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	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 (%)
<b>EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 1578495) - continued</b>									
EM1806226-040	FMB-8W	EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	<0.005	0.00	No Limit
<b>EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 1580025)</b>									
ES1810453-031	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.12	<0.12	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.12	<0.12	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.12	<0.12	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.12	<0.12	0.00	No Limit
EM1806226-027	FMB-5S	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
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 1578495)</b>									
EM1806226-034	FMB-5W	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
EM1806226-040	FMB-8W	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

**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 (%)
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 1578495) - continued</b>									
EM1806226-040	FMB-8W	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
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 1580025)</b>									
ES1810453-031	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
EM1806226-027	FMB-5S	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
<b>EP231P: PFAS Sums (QC Lot: 1580025)</b>									
ES1810453-031	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	<0.05	<0.05	0.00	No Limit
EM1806226-027	FMB-5S	EP231X: Sum of PFAS	----	0.01	µg/L	0.02	0.02	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: BIOTA

Method: Compound	CAS Number	LOR	Unit	Result	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
							LCS	Low
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 1572408)</b>								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	1	µg/kg	<1	5 µg/kg	52.8	50	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	1	µg/kg	<1	5 µg/kg	69.2	50	130
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	1	µg/kg	<1	5 µg/kg	63.2	50	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	1	µg/kg	<1	5 µg/kg	67.6	50	130
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	1	µg/kg	<1	5 µg/kg	68.0	50	130
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	1	µg/kg	<1	5 µg/kg	67.2	50	130
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1572408)</b>								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	5	µg/kg	<5	25 µg/kg	60.3	50	130
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	1	µg/kg	<1	5 µg/kg	60.0	50	130
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	1	µg/kg	<1	5 µg/kg	66.0	50	130
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	1	µg/kg	<1	5 µg/kg	61.6	50	130
EP231X: Perfluoroctanoic acid (PFOA)	335-67-1	1	µg/kg	<1	5 µg/kg	72.0	50	130
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	1	µg/kg	<1	5 µg/kg	60.4	50	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	1	µg/kg	<1	5 µg/kg	61.2	50	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	1	µg/kg	<1	5 µg/kg	64.4	50	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	1	µg/kg	<1	5 µg/kg	83.2	50	130
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	1	µg/kg	<1	5 µg/kg	72.0	50	130
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	2	µg/kg	<2	12.5 µg/kg	64.5	50	130
<b>EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 1572408)</b>								
EP231X: Perfluoroctane sulfonamide (FOSA)	754-91-6	1	µg/kg	<1	5 µg/kg	68.0	50	130
EP231X: N-Methyl perfluoroctane sulfonamide (MeFOSA)	31506-32-8	2	µg/kg	<2	12.5 µg/kg	66.6	50	130
EP231X: N-Ethyl perfluoroctane sulfonamide (EtFOSA)	4151-50-2	2	µg/kg	<2	12.5 µg/kg	66.2	50	130
EP231X: N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	2	µg/kg	<2	12.5 µg/kg	65.6	50	130
EP231X: N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	2	µg/kg	<2	12.5 µg/kg	77.8	50	130
EP231X: N-Methyl perfluoroctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	1	µg/kg	<1	5 µg/kg	84.0	50	130
EP231X: N-Ethyl perfluoroctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	1	µg/kg	<1	5 µg/kg	117	50	130
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 1572408)</b>								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	2	µg/kg	<2	5 µg/kg	69.6	50	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	2	µg/kg	<2	5 µg/kg	65.2	50	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	2	µg/kg	<2	5 µg/kg	64.4	50	130

**Sub-Matrix: BIOTA**

<b>Method: Compound</b>	<b>CAS Number</b>	<b>LOR</b>	<b>Unit</b>	<b>Result</b>	<b>Method Blank (MB) Report</b>	<b>Laboratory Control Spike (LCS) Report</b>		
					<b>Spike Concentration</b>	<b>Spike Recovery (%) LCS</b>	<b>Recovery Limits (%) Low High</b>	
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1572408) - continued</b>								
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	2	µg/kg	<2	5 µg/kg	113	50	130
<b>EP231P: PFAS Sums (QCLot: 1572408)</b>								
EP231X: Sum of PFAS	---	1	µg/kg	<1	---	---	---	---

**Sub-Matrix: SOIL**

<b>Method: Compound</b>	<b>CAS Number</b>	<b>LOR</b>	<b>Unit</b>	<b>Result</b>	<b>Method Blank (MB) Report</b>	<b>Laboratory Control Spike (LCS) Report</b>		
					<b>Spike Concentration</b>	<b>Spike Recovery (%) LCS</b>	<b>Recovery Limits (%) Low High</b>	
<b>ED006: Exchangeable Cations on Alkaline Soils (QCLot: 1583113)</b>								
ED006: Exchangeable Calcium	---	0.2	meq/100g	<0.2	33 meq/100g	85.1	80	120
ED006: Exchangeable Magnesium	---	0.2	meq/100g	<0.2	32 meq/100g	85.2	80	120
ED006: Exchangeable Potassium	---	0.2	meq/100g	<0.2	2.2 meq/100g	120	80	120
ED006: Exchangeable Sodium	---	0.2	meq/100g	<0.2	5.6 meq/100g	100.0	80	120
ED006: Cation Exchange Capacity	---	0.2	meq/100g	<0.2	---	---	---	---
<b>ED007: Exchangeable Cations (QCLot: 1570383)</b>								
ED007: Exchangeable Calcium	---	0.1	meq/100g	<0.1	3.45 meq/100g	97.7	80	120
ED007: Exchangeable Magnesium	---	0.1	meq/100g	<0.1	1.09 meq/100g	92.7	80	120
ED007: Exchangeable Potassium	---	0.1	meq/100g	<0.1	0.609 meq/100g	114	80	120
ED007: Exchangeable Sodium	---	0.1	meq/100g	<0.1	0.347 meq/100g	100	80	120
ED007: Cation Exchange Capacity	---	0.1	meq/100g	<0.1	---	---	---	---
<b>EN60: ASLP Leaching Procedure (QCLot: 1574987)</b>								
EN60a: Final pH	---	0.1	pH Unit	6.9	---	---	---	---
<b>EN60: ASLP Leaching Procedure (QCLot: 1574988)</b>								
EN60a: Final pH	---	0.1	pH Unit	6.9	---	---	---	---
<b>EP003: Total Organic Carbon (TOC) in Soil (QCLot: 1582774)</b>								
EP003: Total Organic Carbon	---	0.02	%	<0.02	0.44 %	98.6	70	130
<b>EP003: Total Organic Carbon (TOC) in Soil (QCLot: 1582775)</b>								
EP003: Total Organic Carbon	---	0.02	%	<0.02	0.44 %	96.5	70	130
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1575133)</b>								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	92.0	57	121
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	84.0	55	125
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	97.2	52	126
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	68.8	54	123
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	59.6	55	127
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	61.6	54	125
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1575137)</b>								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	74.0	57	121
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	80.4	55	125
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	76.0	52	126

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result		LCS	Low	High
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1575137) - continued</b>								
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	77.6	54	123
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	82.0	55	127
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	72.8	54	125
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1575133)</b>								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	57.5	52	128
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	72.8	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	60.8	57	128
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	61.2	60	134
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	65.6	63	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	73.2	55	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	74.4	62	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	66.0	53	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	61.2	49	129
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	104	59	129
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1575137)</b>								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	67.7	52	128
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	78.4	54	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	78.8	58	127
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	74.4	57	128
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	84.4	60	134
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	75.2	63	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	77.2	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	77.6	53	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	72.8	49	129
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	76.3	59	129
<b>EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1575133)</b>								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	64.0	52	132
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	70.8	65	126
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	81.6	64	126
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	63.3	63	124
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	65.7	58	125
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	71.2	61	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	87.6	55	130

Sub-Matrix: SOIL				<i>Method Blank (MB) Report</i>	<i>Laboratory Control Spike (LCS) Report</i>			
					<i>Spike Concentration</i>	<i>Spike Recovery (%)</i>	<i>Recovery Limits (%)</i>	
<i>Method: Compound</i>	<i>CAS Number</i>	<i>LOR</i>	<i>Unit</i>	<i>Result</i>	<i>LCS</i>	<i>Low</i>	<i>High</i>	
<b>EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1575137)</b>								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	74.8	52	132
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	74.4	65	126
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	73.2	64	126
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	70.2	63	124
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	62.3	58	125
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	80.4	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
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1575133)</b>								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	63.2	54	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	66.8	61	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	66.8	62	130
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	120	60	130
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1575137)</b>								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	100	54	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	83.6	61	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	81.6	62	130
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	117	60	130
Sub-Matrix: WATER				<i>Method Blank (MB) Report</i>	<i>Laboratory Control Spike (LCS) Report</i>			
					<i>Spike Concentration</i>	<i>Spike Recovery (%)</i>	<i>Recovery Limits (%)</i>	
<i>Method: Compound</i>	<i>CAS Number</i>	<i>LOR</i>	<i>Unit</i>	<i>Result</i>	<i>LCS</i>	<i>Low</i>	<i>High</i>	
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1578495)</b>								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.05 µg/L	77.4	50	130
EP231X-LL: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.002	µg/L	<0.002	0.05 µg/L	90.8	50	130
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.05 µg/L	77.4	50	130
EP231X-LL: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.002	µg/L	<0.002	0.05 µg/L	130	50	130
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.05 µg/L	92.8	50	130
EP231X-LL: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.002	µg/L	<0.002	0.05 µg/L	69.4	40	130
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1580025)</b>								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.5 µg/L	105	70	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.5 µg/L	96.2	70	130
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.5 µg/L	92.0	70	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.5 µg/L	84.2	70	130
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.5 µg/L	114	70	130
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.5 µg/L	96.0	70	130

**Sub-Matrix: WATER**

<b>Method: Compound</b>	<b>CAS Number</b>	<b>LOR</b>	<b>Unit</b>	<b>Result</b>	<b>Method Blank (MB) Report</b>	<b>Laboratory Control Spike (LCS) Report</b>		
					<b>Spike Concentration</b>	<b>Spike Recovery (%)</b>	<b>Recovery Limits (%)</b>	
					<b>LCS</b>	<b>Low</b>	<b>High</b>	
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1578495)</b>								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	0.25 µg/L	99.3	50	130
EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	0.05 µg/L	90.4	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	84.2	50	130
EP231X-LL: Perfluoroctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.05 µg/L	102	50	130
EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.002	µg/L	<0.002	0.05 µg/L	69.8	50	130
EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.002	µg/L	<0.002	0.05 µg/L	69.0	50	130
EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.002	µg/L	<0.002	0.05 µg/L	65.4	40	130
EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.002	µg/L	<0.002	0.05 µg/L	53.0	40	130
EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.002	µg/L	<0.002	0.05 µg/L	49.4	40	130
EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.005	µg/L	<0.005	0.125 µg/L	40.3	40	130
EP231X-LL: Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	---	µg/L	----	0.05 µg/L	71.6	50	130
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1580025)</b>								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	2.5 µg/L	105	70	130
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.5 µg/L	109	70	130
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.5 µg/L	97.8	70	130
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.5 µg/L	125	70	130
EP231X: Perfluoroctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.5 µg/L	105	70	130
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.5 µg/L	107	70	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.5 µg/L	124	70	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.5 µg/L	# 169	70	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.5 µg/L	88.4	70	130
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.5 µg/L	# 61.0	70	130
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	1.25 µg/L	113	70	150
<b>EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1578495)</b>								
EP231X-LL: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.002	µg/L	<0.002	0.05 µg/L	74.4	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.005	µg/L	<0.005	0.125 µg/L	43.7	40	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.005	µg/L	<0.005	0.125 µg/L	43.8	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.005	µg/L	<0.005	0.125 µg/L	50.4	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.005	µg/L	<0.005	0.125 µg/L	47.8	40	130
EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.002	µg/L	<0.002	0.05 µg/L	77.8	50	130
EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.002	µg/L	<0.002	0.05 µg/L	62.0	40	130
<b>EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1580025)</b>								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.5 µg/L	116	70	130

Sub-Matrix: WATER

Method: Compound	CAS Number	LOR	Unit	Result	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report		
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
					LCS	Low	High	
<b>EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1580025) - continued</b>								
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	1.25 µg/L	126	70	150
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	1.25 µg/L	94.9	70	150
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	1.25 µg/L	82.2	70	150
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	1.25 µg/L	122	70	150
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.5 µg/L	97.6	70	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.5 µg/L	103	70	130
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1578495)</b>								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	0.05 µg/L	117	50	130
EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	0.05 µg/L	95.2	50	130
EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	0.05 µg/L	93.8	50	130
EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	0.05 µg/L	79.0	50	130
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1580025)</b>								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.5 µg/L	116	70	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.5 µg/L	115	70	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.5 µg/L	105	70	130
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.5 µg/L	88.8	70	130

### 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	Spike Recovery (%)	Recovery Limits (%)	
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1575133)</b>							
EM1806226-001	SC 1S (0-100)	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	81.6	50	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	56.8	50	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	107	50	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	375-92-8	0.00125 mg/kg	116	50	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	# Not Determined	50	130
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	66.8	50	130
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1575137)</b>							
EM1806226-037	QA2	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	79.6	50	130

Sub-Matrix: SOIL

				Matrix Spike (MS) Report			
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike	Spike Recovery(%)	Recovery Limits (%)	
				Concentration	MS	Low	High
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1575137) - continued</b>							
EM1806226-037	QA2	EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	80.4	50	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	78.0	50	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	86.4	50	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	55.2	50	130
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	70.8	50	130
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1575133)</b>							
EM1806226-001	SC 1S (0-100)	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	49.8	30	130
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	87.2	50	130
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	74.8	50	130
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	80.0	50	130
		EP231X: Perfluoroctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	86.4	50	130
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	74.0	50	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	88.4	50	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	84.4	50	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	119	50	130
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	99.2	30	130
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	68.3	30	130
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1575137)</b>							
EM1806226-037	QA2	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	77.6	30	130
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	84.8	50	130
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	84.0	50	130
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	88.8	50	130
		EP231X: Perfluoroctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	81.2	50	130
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	90.8	50	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	80.8	50	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	87.6	50	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	74.0	50	130
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	75.2	30	130
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	72.1	30	130
<b>EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1575133)</b>							
EM1806226-001	SC 1S (0-100)	EP231X: Perfluoroctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	78.0	50	130
		EP231X: N-Methyl perfluoroctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	66.0	30	130
		EP231X: N-Ethyl perfluoroctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	76.8	30	130
		EP231X: N-Methyl perfluoroctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	50.3	30	130
		EP231X: N-Ethyl perfluoroctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	73.9	30	130



**Sub-Matrix: WATER**

				Matrix Spike (MS) Report			
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike	Spike Recovery(%)	Recovery Limits (%)	
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1580025) - continued				Concentration	MS	Low	High
ES180453-031	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.5 µg/L	104	50	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.5 µg/L	111	50	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.5 µg/L	63.2	50	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.5 µg/L	102	50	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.5 µg/L	115	50	130
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.5 µg/L	56.4	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1578495)							
EM1806226-035	FMB -6W	EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.25 µg/L	56.3	30	130
		EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.05 µg/L	52.2	50	130
		EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.05 µg/L	50.0	50	130
		EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.05 µg/L	63.4	50	130
		EP231X-LL: Perfluoroctanoic acid (PFOA)	335-67-1	0.05 µg/L	67.8	50	130
		EP231X-LL: Perfluorononanoic acid (PFNA)	375-95-1	0.05 µg/L	59.8	50	130
		EP231X-LL: Perfluorodecanoic acid (PFDA)	335-76-2	0.05 µg/L	50.0	50	130
		EP231X-LL: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.05 µg/L	55.2	30	130
		EP231X-LL: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.05 µg/L	56.2	30	130
		EP231X-LL: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.05 µg/L	46.4	30	130
		EP231X-LL: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.125 µg/L	# 27.4	30	130
		EP231X-LL: Perfluorohexadecanoic acid (PFHxDA)	67905-19-5	0.05 µg/L	34.0	30	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1580025)							
ES180453-031	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	2.5 µg/L	108	50	130
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.5 µg/L	97.4	50	130
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.5 µg/L	54.4	50	130
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.5 µg/L	113	50	130
		EP231X: Perfluoroctanoic acid (PFOA)	335-67-1	0.5 µg/L	121	50	130
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.5 µg/L	72.0	50	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.5 µg/L	101	50	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.5 µg/L	64.4	50	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.5 µg/L	92.2	50	130
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.5 µg/L	56.6	50	130
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	1.25 µg/L	115	50	150
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1578495)							
EM1806226-035	FMB -6W	EP231X-LL: Perfluoroctane sulfonamide (FOSA)	754-91-6	0.05 µg/L	# 23.2	30	130
		EP231X-LL: N-Methyl perfluoroctane sulfonamide (MeFOSA)	31506-32-8	0.125 µg/L	# 15.3	30	130
		EP231X-LL: N-Ethyl perfluoroctane sulfonamide (EtFOSA)	4151-50-2	0.125 µg/L	31.8	30	130

**Sub-Matrix: WATER**

				Matrix Spike (MS) Report			
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Spike	Spike Recovery(%)	Recovery Limits (%)	
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1578495) - continued				Concentration	MS	Low	High
EM1806226-035	FMB-6W	EP231X-LL: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.125 µg/L	32.6	30	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.125 µg/L	53.8	30	130
		EP231X-LL: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.05 µg/L	67.6	30	130
		EP231X-LL: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.05 µg/L	52.4	30	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1580025)							
ES1810453-031	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.5 µg/L	80.0	50	130
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	1.25 µg/L	120	50	150
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	1.25 µg/L	69.2	50	150
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	1.25 µg/L	110	50	150
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	1.25 µg/L	116	50	150
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.5 µg/L	95.4	50	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.5 µg/L	119	50	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1578495)							
EM1806226-035	FMB-6W	EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05 µg/L	67.6	50	130
		EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05 µg/L	52.6	50	130
		EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05 µg/L	57.6	50	130
		EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05 µg/L	58.8	50	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1580025)							
ES1810453-031	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.5 µg/L	124	50	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.5 µg/L	111	50	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.5 µg/L	98.8	50	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.5 µg/L	55.0	50	130

## QA/QC Compliance Assessment to assist with Quality Review

Work Order	: EM1806226	Page	: 1 of 14
Client	: GHD PTY LTD	Laboratory	: Environmental Division Melbourne
Contact	: MR PETER TOPLISS	Telephone	: +61-3-8549 9630
Project	: 3218792	Date Samples Received	: 13-Apr-2018
Site	: Aiservices Sinclair Creek and Five Mile Beach	Issue Date	: 23-Apr-2018
Sampler	: DE	No. of samples received	: 41
Order number	: 3218792	No. of samples analysed	: 41

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.

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### ***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.
- Laboratory Control outliers exist - please see following pages for full details.
- 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***

- Quality Control Sample Frequency Outliers exist - please see following pages for full details.

## 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
<b>Matrix Spike (MS) Recoveries</b>							
EP231A: Perfluoroalkyl Sulfonic Acids	EM1806226--001	SC 1S (0-100)	Perfluoroctane sulfonic acid (PFOS)	1763-23-1	Not Determined	----	MS recovery not determined, background level greater than or equal to 4x spike level.

Matrix: WATER

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
<b>Laboratory Control Spike (LCS) Recoveries</b>							
EP231B: Perfluoroalkyl Carboxylic Acids	QC-1580025-002	----	Perfluoroundecanoic acid (PFUnDA)	2058-94-8	169 %	70-130%	Recovery greater than upper control limit
EP231B: Perfluoroalkyl Carboxylic Acids	QC-1580025-002	----	Perfluorotridecanoic acid (PFTrDA)	72629-94-8	61.0 %	70-130%	Recovery less than lower control limit
<b>Matrix Spike (MS) Recoveries</b>							
EP231A: Perfluoroalkyl Sulfonic Acids	EM1806226-035	FMB -6W	Perfluorodecane sulfonic acid (PFDS)	335-77-3	28.2 %	30-130%	Recovery less than lower data quality objective
EP231B: Perfluoroalkyl Carboxylic Acids	EM1806226-035	FMB -6W	Perfluorotetradecanoic acid (PFTeDA)	376-06-7	27.4 %	30-130%	Recovery less than lower data quality objective
EP231C: Perfluoroalkyl Sulfonamides	EM1806226-035	FMB -6W	Perfluoroctane sulfonamide (FOSA)	754-91-6	23.2 %	30-130%	Recovery less than lower data quality objective
EP231C: Perfluoroalkyl Sulfonamides	EM1806226-035	FMB -6W	N-Methyl perfluoroctane sulfonamide (MeFOSA)	31506-32-8	15.3 %	30-130%	Recovery less than lower data quality objective

## Outliers : Frequency of Quality Control Samples

Matrix: BIOTA

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
	Method	QC	Regular	Actual	
<b>Matrix Spikes (MS)</b>					
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

## 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: BIOTA

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



**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
<b>EA055: Moisture Content (Dried @ 105-110°C)</b>								
HDPE Soil Jar (EA055) FMB-4S,	FMB-6S	11-Apr-2018	---	---	---	18-Apr-2018	25-Apr-2018	✓
Soil Glass Jar - Unpreserved (EA055) SC 1S (0-100), SC 3S (0-100), SC 5S (0-100), SC 1S (150-300), SC 3S (150-300), SC 5S (150-300), QA1, FMB-2S, FMB-5S, QA2,	SC 2S (0-100), SC 4S (0-100), SC 6S (0-100), SC 2S (150-300), SC 4S (150-300), SC 6S (150-300), FMB-1S, FMB-3S, FMB-7S, FMB - 8	11-Apr-2018	---	---	---	17-Apr-2018	25-Apr-2018	✓
<b>EA150: Particle Sizing</b>								
Snap Lock Bag (EA150) SC 1S (0-100), SC 3S (0-100), SC 5S (0-100), SC 1S (150-300), SC 3S (150-300), SC 5S (150-300), QA1, FMB-2S, FMB-5S, QA2,	SC 2S (0-100), SC 4S (0-100), SC 6S (0-100), SC 2S (150-300), SC 4S (150-300), SC 6S (150-300), FMB-1S, FMB-3S, FMB-7S, FMB - 8	11-Apr-2018	---	---	---	19-Apr-2018	08-Oct-2018	✓
<b>EA150: Soil Classification based on Particle Size</b>								
Snap Lock Bag (EA150) SC 1S (0-100), SC 3S (0-100), SC 5S (0-100), SC 1S (150-300), SC 3S (150-300), SC 5S (150-300), QA1, FMB-2S, FMB-5S, QA2,	SC 2S (0-100), SC 4S (0-100), SC 6S (0-100), SC 2S (150-300), SC 4S (150-300), SC 6S (150-300), FMB-1S, FMB-3S, FMB-7S, FMB - 8	11-Apr-2018	---	---	---	19-Apr-2018	08-Oct-2018	✓

**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
<b>ED006: Exchangeable Cations on Alkaline Soils</b>								
<b>Soil Glass Jar - Unpreserved (ED006)</b>	SC 1S (0-100), SC 4S (0-100), SC 6S (0-100), SC 2S (150-300), SC 5S (150-300), QA1, FMB-2S, FMB-5S, QA2,	SC 2S (0-100), SC 5S (0-100), SC 1S (150-300), SC 4S (150-300), SC 6S (150-300), FMB-1S, FMB-3S, FMB-7S, FMB - 8	11-Apr-2018	20-Apr-2018	09-May-2018	✓	20-Apr-2018	09-May-2018
<b>ED007: Exchangeable Cations</b>								
<b>Soil Glass Jar - Unpreserved (ED007)</b>	SC 3S (0-100),	SC 3S (150-300)	11-Apr-2018	16-Apr-2018	09-May-2018	✓	20-Apr-2018	09-May-2018
<b>EN60: ASLP Leaching Procedure</b>								
<b>Non-Volatile Leach: 180 day HT (e.g. metals ex.Hg) (EN60a)</b>	SC 1S (0-100), SC 3S (0-100), SC 5S (0-100), QA1, FMB-2S, FMB-5S, QA2,	SC 2S (0-100), SC 4S (0-100), SC 6S (0-100), FMB-1S, FMB-3S, FMB-7S, FMB - 8	11-Apr-2018	18-Apr-2018	08-Oct-2018	✓	----	----
<b>EP003: Total Organic Carbon (TOC) in Soil</b>								
<b>Pulp Bag (EP003)</b>	SC 1S (0-100), SC 3S (0-100), SC 5S (0-100), SC 1S (150-300), SC 3S (150-300), SC 5S (150-300), QA1, FMB-2S, FMB-5S, QA2,	SC 2S (0-100), SC 4S (0-100), SC 6S (0-100), SC 2S (150-300), SC 4S (150-300), SC 6S (150-300), FMB-1S, FMB-3S, FMB-7S, FMB - 8	11-Apr-2018	20-Apr-2018	09-May-2018	✓	20-Apr-2018	09-May-2018

**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	
<b>EP231A: Perfluoroalkyl Sulfonic Acids</b>									
HDPE Soil Jar (EP231X)	SC 1S (0-100), SC 3S (0-100), SC 5S (0-100), SC 1S (150-300), SC 3S (150-300), SC 5S (150-300), QA1, FMB-2S, FMB-4S, FMB-6S, QA2,	SC 2S (0-100), SC 4S (0-100), SC 6S (0-100), SC 2S (150-300), SC 4S (150-300), SC 6S (150-300), FMB-1S, FMB-3S, FMB-5S, FMB-7S, FMB - 8	11-Apr-2018	20-Apr-2018	08-Oct-2018	✓	22-Apr-2018	30-May-2018	✓
<b>EP231B: Perfluoroalkyl Carboxylic Acids</b>									
HDPE Soil Jar (EP231X)	SC 1S (0-100), SC 3S (0-100), SC 5S (0-100), SC 1S (150-300), SC 3S (150-300), SC 5S (150-300), QA1, FMB-2S, FMB-4S, FMB-6S, QA2,	SC 2S (0-100), SC 4S (0-100), SC 6S (0-100), SC 2S (150-300), SC 4S (150-300), SC 6S (150-300), FMB-1S, FMB-3S, FMB-5S, FMB-7S, FMB - 8	11-Apr-2018	20-Apr-2018	08-Oct-2018	✓	22-Apr-2018	30-May-2018	✓
<b>EP231C: Perfluoroalkyl Sulfonamides</b>									
HDPE Soil Jar (EP231X)	SC 1S (0-100), SC 3S (0-100), SC 5S (0-100), SC 1S (150-300), SC 3S (150-300), SC 5S (150-300), QA1, FMB-2S, FMB-4S, FMB-6S, QA2,	SC 2S (0-100), SC 4S (0-100), SC 6S (0-100), SC 2S (150-300), SC 4S (150-300), SC 6S (150-300), FMB-1S, FMB-3S, FMB-5S, FMB-7S, FMB - 8	11-Apr-2018	20-Apr-2018	08-Oct-2018	✓	22-Apr-2018	30-May-2018	✓



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
<b>EP231A: Perfluoroalkyl Sulfonic Acids</b>								
HDPE (no PTFE) (EP231X-LL)	SC 1W, SC 3W, SC 5W, SC 3W PM, SC 5W PM, FMB -2W, FMB -4W, FMB -6W, FMB -8W,	SC 2W, SC 4W, SC 6W, SC 4W PM, FMB -1W, FMB -3W, FMB -5W, FMB -7W, QA 1	11-Apr-2018	19-Apr-2018	08-Oct-2018	✓	20-Apr-2018	08-Oct-2018
HDPE (no PTFE) (EP231X)	SC 1S (0-100), SC 3S (0-100), SC 5S (0-100), QA1, FMB-2S, FMB-5S, QA2,	SC 2S (0-100), SC 4S (0-100), SC 6S (0-100), FMB-1S, FMB-3S, FMB-7S, FMB - 8	18-Apr-2018	----	----	----	19-Apr-2018	15-Oct-2018
<b>EP231B: Perfluoroalkyl Carboxylic Acids</b>								
HDPE (no PTFE) (EP231X-LL)	SC 1W, SC 3W, SC 5W, SC 3W PM, SC 5W PM, FMB -2W, FMB -4W, FMB -6W, FMB -8W,	SC 2W, SC 4W, SC 6W, SC 4W PM, FMB -1W, FMB -3W, FMB -5W, FMB -7W, QA 1	11-Apr-2018	19-Apr-2018	08-Oct-2018	✓	20-Apr-2018	08-Oct-2018
HDPE (no PTFE) (EP231X)	SC 1S (0-100), SC 3S (0-100), SC 5S (0-100), QA1, FMB-2S, FMB-5S, QA2,	SC 2S (0-100), SC 4S (0-100), SC 6S (0-100), FMB-1S, FMB-3S, FMB-7S, FMB - 8	18-Apr-2018	----	----	----	19-Apr-2018	15-Oct-2018

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
<b>EP231C: Perfluoroalkyl Sulfonamides</b>								
HDPE (no PTFE) (EP231X-LL)	SC 1W, SC 3W, SC 5W, SC 3W PM, SC 5W PM, FMB -2W, FMB -4W, FMB -6W, FMB -8W,	SC 2W, SC 4W, SC 6W, SC 4W PM, FMB -1W, FMB -3W, FMB -5W, FMB -7W, QA 1	11-Apr-2018	19-Apr-2018	08-Oct-2018	✓	20-Apr-2018	08-Oct-2018
HDPE (no PTFE) (EP231X)	SC 1S (0-100), SC 3S (0-100), SC 5S (0-100), QA1, FMB-2S, FMB-5S, QA2,	SC 2S (0-100), SC 4S (0-100), SC 6S (0-100), FMB-1S, FMB-3S, FMB-7S, FMB - 8	18-Apr-2018	----	----	----	19-Apr-2018	15-Oct-2018
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids</b>								
HDPE (no PTFE) (EP231X-LL)	SC 1W, SC 3W, SC 5W, SC 3W PM, SC 5W PM, FMB -2W, FMB -4W, FMB -6W, FMB -8W,	SC 2W, SC 4W, SC 6W, SC 4W PM, FMB -1W, FMB -3W, FMB -5W, FMB -7W, QA 1	11-Apr-2018	19-Apr-2018	08-Oct-2018	✓	20-Apr-2018	08-Oct-2018
HDPE (no PTFE) (EP231X)	SC 1S (0-100), SC 3S (0-100), SC 5S (0-100), QA1, FMB-2S, FMB-5S, QA2,	SC 2S (0-100), SC 4S (0-100), SC 6S (0-100), FMB-1S, FMB-3S, FMB-7S, FMB - 8	18-Apr-2018	----	----	----	19-Apr-2018	15-Oct-2018

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
<b>EP231P: PFAS Sums</b>								
HDPE (no PTFE) (EP231X-LL)	SC 1W, SC 3W, SC 5W, SC 3W PM, SC 5W PM, FMB -2W, FMB -4W, FMB -6W, FMB -8W,	SC 2W, SC 4W, SC 6W, SC 4W PM, FMB -1W, FMB -3W, FMB -5W, FMB -7W, QA 1	11-Apr-2018	19-Apr-2018	08-Oct-2018	✓	20-Apr-2018	08-Oct-2018
HDPE (no PTFE) (EP231X)	SC 1S (0-100), SC 3S (0-100), SC 5S (0-100), QA1, FMB-2S, FMB-5S, QA2,	SC 2S (0-100), SC 4S (0-100), SC 6S (0-100), FMB-1S, FMB-3S, FMB-7S, FMB - 8	18-Apr-2018	----	----	----	19-Apr-2018	15-Oct-2018

## 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: BIOTA

Quality Control Sample Type		Count		Rate (%)		Quality Control Specification	
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
<b>Laboratory Duplicates (DUP)</b>							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	100.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Laboratory Control Samples (LCS)</b>							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Method Blanks (MB)</b>							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	1	100.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Matrix Spikes (MS)</b>							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	0	1	0.00	5.00	✗	NEPM 2013 B3 & ALS QC Standard

### Matrix: SOIL

Quality Control Sample Type		Count		Rate (%)		Quality Control Specification	
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
<b>Laboratory Duplicates (DUP)</b>							
Exchangeable Cations	ED007	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	4	25	16.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	4	31	12.90	10.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Laboratory Control Samples (LCS)</b>							
Exchangeable Cations	ED007	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	25	8.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	31	6.45	5.00	✓	NEPM 2013 B3 & ALS QC Standard

### Method Blanks (MB)

ASLP for Non & Semivolatile Analytes	EN60a	2	14	14.29	9.09	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	25	8.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	31	6.45	5.00	✓	NEPM 2013 B3 & ALS QC Standard

### Matrix Spikes (MS)

Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	25	8.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
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### Matrix: WATER

Quality Control Sample Type		Count		Rate (%)		Quality Control Specification	
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
<b>Laboratory Duplicates (DUP)</b>							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	2	18	11.11	10.00	✓	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	
<b>Laboratory Duplicates (DUP) - Continued</b>							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Laboratory Control Samples (LCS)</b>							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Method Blanks (MB)</b>							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	15	6.67	5.00	✓	NEPM 2013 B3 & ALS QC Standard
<b>Matrix Spikes (MS)</b>							
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	18	5.56	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	15	6.67	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.

<b>Analytical Methods</b>	<b>Method</b>	<b>Matrix</b>	<b>Method Descriptions</b>
PFOS - Linear/Branched Speciation	EP231-PFOS-SP	BIOTA	n-house: Linear PFOS is determined by quantitation of the separate linear peak using linear PFOS. Branched PFOS is determined as the difference between total PFOS (determined using a mixed linear/branched standard) and linear PFOS.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	BIOTA	In-House. A sample extract is analysed 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
PFAS by LCMSMS after oxidation (TOP)	EP231X (TOP)	BIOTA	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.
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).
Particle Size Analysis (Sieving)	EA150	SOIL	In house: Referenced to AS1289.3.6.1 - 2009. Particle Size Analysis by Sieving
Exchangeable Cations on Alkaline Soils	* ED006	SOIL	In house: Referenced to Soil Survey Test Method C5. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with alcoholic ammonium chloride at pH 8.5. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil.
Exchangeable Cations	ED007	SOIL	In house: Referenced to Rayment & Lyons (2011) Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM (2013) Schedule B(3) (Method 301)
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO <sub>2</sub> ) is automatically measured by infra-red detector.

<i>Analytical Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In house: Direct injection analysis of fresh waters after dilution (1:1) with methanol. 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. 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	SOIL	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-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

<i>Preparation Methods</i>	<i>Method</i>	<i>Matrix</i>	<i>Method Descriptions</i>
Prep-Preparation for Biota Analysis	* Biota-PP	BIOTA	A sample is prepared from whole or particular tissues/organs, identified, homogenised and the total weight of prepared sample recorded.
Sample Preparation for PFAS in Biota	EP231-PR	BIOTA	In-house. A sample is mixed with water and a complexing reagent and twice extracted with MTBE. Sample cleanup is employed as required.
Exchangeable Cations Preparation Method (Alkaline Soils)	ED006PR	SOIL	In house: Referenced to Rayment and Lyons 2011 method 15C1.
Exchangeable Cations Preparation Method	ED007PR	SOIL	In house: Referenced to Rayment & Higginson (1992) method 15A1. A 1M NH4Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
ASLP for Non & Semivolatile Analytes	EN60a	SOIL	In house QWI-EN/60 referenced to AS4439.3 Preparation of Leachates
Sample Extraction for PFAS	EP231-PR	SOIL	In house
SPE preparation for LL and saline PFCs	EP231-SPE	SOIL	In house
Dry and Pulverise (up to 100g)	GEO30	SOIL	#
SPE preparation for LL and saline PFCs	EP231-SPE	WATER	In house

**CHAIN OF CUSTODY RECORD**

GHD Hobart  
2 Salamanca Square, Hobart 7000  
Telephone: 61 3 6210 0500 Facsimile: 61 3 6210 0501  
Email: hohamail@ghd.com.au



GHD Launceston  
102 Cameron Street, Launceston 7250  
Telephone: 61 3 6332 5555 Facsimile: 61 3 6332 5555  
Email: istmail@ghd.com.au

GHD Burnie  
10 Columnar Court, Burnie 7320  
Telephone: 61 3 6432 7900 Facsimile: 61 3 6432 7901  
Email: bwmail@ghd.com.au

Job Number	GHD Office	GHD Contact	Laboratory:	ALS Environmental
Project	Address:	Laboratory Contact:	Address:	2-4 Westall Rd, Springvale, Victoria
Requested Completion Date	Standard TAT	Purchase Order Number	Container	Shirelyle Cornu
Aliservices Sinclair Creek and Five Mile Beach	Daniel Elson	3218792		

Analyses Required		Type	Volume (ml)	Number of items	Preservative	Sample Matrix	A: Air	B: bag	C: Soil jar	D: glass bottle	E: plastic bottle	F: soil	G: glass	H: water	I: sludge	J: sediment	K: groundwater	L: water	M: soil	N: sample	O: composite sample	P: plastic wrap	Q: soil	R: glass	S: water	T: air	U: sample	V: soil	W: water	X: sludge	Y: sediment	Z: groundwater
1	SC 1S (0-100)	11/04/2018	13:00	S	J BG	3																										
2	SC 2S (0-100)	11/04/2018	13:00	S	J BG	3																										
3	SC 3S (0-100)	11/04/2018	13:00	S	J BG	3																										
4	SC 4S (0-100)	11/04/2018	13:00	S	J BG	3																										
5	SC 5S (0-100)	11/04/2018	13:00	S	J BG	3																										
6	SC 6S (0-100)	11/04/2018	13:00	S	J BG	3																										
7	SC 1S (150-300)	11/04/2018	13:00	S	J BG	3																										
8	SC 2S (150-300)	11/04/2018	13:00	S	J BG	3																										
9	SC 3S (150-300)	11/04/2018	13:00	S	J BG	3																										
10	SC 4S (150-300)	11/04/2018	13:00	S	J BG	3																										
11	SC 5S (150-300)	11/04/2018	13:00	S	J BG	3																										
12	SC 6S (150-300)	11/04/2018	13:00	S	J BG	3																										
13	SC 1W	11/04/2018	13:00	W	P	1																										
14	SC 2W	11/04/2018	13:00	W	P	1																										
15	SC 3W	11/04/2018	13:00	W	P	1																										
16	SC 4W	11/04/2018	13:00	W	P	1																										
17	SC 5W	11/04/2018	13:00	W	P	1																										
18	SC 6W	11/04/2018	13:00	W	P	1																										
19	QA1	11/04/2018	13:00	S/W	J BG P	4																										
20	SC 3W PM	11/04/2018	16:00	W	P	1																										
21	SC 4W PM	11/04/2018	16:00	W	P	1																										
22	SC 5W PM	11/04/2018	16:00	W	P	1																										

**PLEASE NOTE:**  
Sign white copy on receipt and release of samples. Samples are to be delivered to the laboratory address.  
On receipt of samples, the laboratory contact should sign the white copy and fax to GHD Contact.  
On completion of analyses please return white copy with results.  
Pink copy is returned to the sampler once the courier has signed for the samples.  
Email results to the email address of the relevant GHD Office and cc GHD Project Manager and GHD Contact with the GHD Job Number in the email subject line.  
Provide results in ESDAT compatible Format.

Page 1 of 2

Page 2 of 2

16/4

MP

EM1806226

Environmental Division

Melbourne

Work Order Reference

Telephone : + 61 3 6449 9600

Remarks:

10 c

**CHAIN OF CUSTODY RECORD**

**H-D Hobart**  
Salamanca Square, Hobart 7000  
Telephone: 61 3 6210 0600 Facsimile: 61 3 6210 0601  
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## CHAIN OF CUSTODY RECORD

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GHD Burnie  
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Telephone: 61 3 6432 7900 Facsimile: 61 3 6432 7901  
Email: bwtmail@ghd.com.au

Project  
Aiservices Sinclair Creek and Five Mile Beach

Job Number **3218792** | GHD Office **Hobart**  
GHD Project Manager **Peter Topliss**

Requested Completion Date  
Standard TAT

GHD Contact **Daniel Elson**

Purchase Order Number  
**3218792**

Sample ID	Date	Time	Preservative	Type	Analyses Required	Laboratory: Address: Container	Laboratory Contact: Shirely Le Cornu
SC 1S (0-100)	11/04/2018	13:00	S	J BG			
SC 2S (0-100)	11/04/2018	13:00	S	J BG			
SC 3S (0-100)	11/04/2018	13:00	S	J BG			
SC 4S (0-100)	11/04/2018	13:00	S	J BG			
SC 5S (0-100)	11/04/2018	13:00	S	J BG			
SC 6S (0-100)	11/04/2018	13:00	S	J BG			
SC 1S (150-300)	11/04/2018	13:00	S	J BG			
SC 2S (150-300)	11/04/2018	13:00	S	J BG			
SC 3S (150-300)	11/04/2018	13:00	S	J BG			
SC 4S (150-300)	11/04/2018	13:00	S	J BG			
SC 5S (150-300)	11/04/2018	13:00	S	J BG			
SC 6S (150-300)	11/04/2018	13:00	S	J BG			
SC 1W	11/04/2018	13:00	W	P			
SC 2W	11/04/2018	13:00	W	P			
SC 3W	11/04/2018	13:00	W	P			
SC 4W	11/04/2018	13:00	W	P			
SC 5W	11/04/2018	13:00	W	P			
SC 6W	11/04/2018	13:00	W	P			
QA1	11/04/2018	13:00	S/W	J B G P			
SC 3W PM	11/04/2018	16:00	W	P			
SC 4W PM	11/04/2018	16:00	W	P			
SC 5W PM	11/04/2018	16:00	W	P			

Sampled by:	Daniel Elson	Date/Time:	11/04/2018	Relinquished by:	Daniel Elson	Date/Time:	12/04/2018 / 6:00
Received by:		Date/Time:		Relinquished by:		Date/Time:	
Received by Courier:	<b>JACIE HUTCHINS</b>	Date/Time:		Relinquished by:		Date/Time:	<b>12/04/18 16:00</b>
Received by Lab:	<b>Bhawathi (ACS)</b>	Date/Time:	<b>13/04/18</b>	Relinquished by:		Date/Time:	
Remarks:							<b>10</b>

Page **1** of **2**

Page **1** of **2**

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Sign white copy on receipt and release of  
samples. Samples are to be delivered to the  
laboratory address.  
On receipt of samples, the laboratory contact  
should sign the white copy and fax to GHD  
Contact.  
On completion of analyses please return white  
copy with results.  
Pink copy is returned to the sampler once the  
courier has signed for the samples.  
Email results to the email address of the  
relevant GHD Office and cc GHD Project  
Manager and GHD Contact with the GHD Job  
Number in the email subject line.  
Provide results in ESDATA compatible format.

FREIGHT

Environmental Division  
Melbourne  
Work Order Reference  
**EM1806226**



Telephone : +61 3 6434 9600

## CHAIN OF CUSTODY RECORD

GHD Hobart  
2 Salamanca Square, Hobart 7000  
Telephone: 61 3 6210 0600 Facsimile: 61 3 6332 5555  
Email: hbmail@ghd.com.au



GHD Burnie  
10 Columnar Court, Burnie 7320  
Telephone: 61 3 6432 7900 Facsimile: 61 3 6432 7901  
Email: bwmail@ghd.com.au

Job Number

3218792

Hobart

Project

Aiservices Sinclair Creek and Five Mile Beach

GHD Project Manager

Peter Topliss

GHD Contact

Daniel Elson

Requested Completion Date

Standard TAT

Purchase Order Number

3218792

GHD Launceston

102 Cameron Street, Launceston 7250

Telephone: 61 3 632 5500 Facsimile: 61 3 6332 5555

Email: lsmail@ghd.com.au

Page:

2 of

2

**PLEASE NOTE:**  
Sign white copy on receipt and release of samples. Samples are to be delivered to the laboratory address.

On receipt of samples, the laboratory contact should sign the white copy and fax to GHD Contact.

On completion of analyses please return white copy with results.

Pink copy is returned to the sampler once the courier has signed for the samples.  
Email results to the email address of the relevant GHD Office and cc GHD Project Manager and GHD Contact with the GHD Job Number in the email subject line.  
Provide results in ESDAT compatible format.

Sample ID	Date	Time	Type	Analyses Required	ALS Environmental	
					Laboratory Address:	Laboratory Contact: Shirely Le Cornu
23 FMB-1S	11/04/2018	13:00	S	PFA5 - Full Suite (28 analytes) plus Linear/Branched Speciation (PN) (EP231X)	ASLP Leach EN60 + PFA5 Full Suite (EP231X)	Total Organic Carbon (EP003)
24 FMB-2S	11/04/2018	13:00	S	PFA5 - Full Suite (28 analytes) plus Linear/Branched Speciation (PN) (EP231X)	ASLP Leach EN60 + PFA5 Full Suite (EP231X)	Exchangeable Cations (ED007)
25 FMB-3S	11/04/2018	13:00	S	PFA5 - Full Suite (28 analytes) plus Linear/Branched Speciation (PN) (EP231X)	ASLP Leach EN60 + PFA5 Full Suite (EP231X)	
26 FMB-4S	11/04/2018	13:00	S	PFA5 - Full Suite (28 analytes) plus Linear/Branched Speciation (PN) (EP231X)	ASLP Leach EN60 + PFA5 Full Suite (EP231X)	
27 FMB-5S	11/04/2018	13:00	S	PFA5 - Full Suite (28 analytes) plus Linear/Branched Speciation (PN) (EP231X)	ASLP Leach EN60 + PFA5 Full Suite (EP231X)	
28 FMB-6S	11/04/2018	13:00	S	PFA5 - Full Suite (28 analytes) plus Linear/Branched Speciation (PN) (EP231X)	ASLP Leach EN60 + PFA5 Full Suite (EP231X)	
29 FMB-7S	11/04/2018	13:00	S	PFA5 - Full Suite (28 analytes) plus Linear/Branched Speciation (PN) (EP231X)	ASLP Leach EN60 + PFA5 Full Suite (EP231X)	
30 FMB-1W	11/04/2018	13:00	W	Polymer Matrix Sample	AS: Air; SL: Sludge; W: Water	
31 FMB-2W	11/04/2018	13:00	W	Polymer Matrix Sample	AS: Air; SL: Sludge; W: Water	
32 FMB-3W	11/04/2018	13:00	W	Polymer Matrix Sample	AS: Air; SL: Sludge; W: Water	
33 FMB-4W	11/04/2018	13:00	W	Polymer Matrix Sample	AS: Air; SL: Sludge; W: Water	
34 FMB-5W	11/04/2018	13:00	W	Polymer Matrix Sample	AS: Air; SL: Sludge; W: Water	
35 FMB-6W	11/04/2018	13:00	W	Polymer Matrix Sample	AS: Air; SL: Sludge; W: Water	
36 FMB-7W	11/04/2018	13:00	W	Polymer Matrix Sample	AS: Air; SL: Sludge; W: Water	
37 QA2	11/04/2018	13:00	S/W	Polymer Matrix Sample	AS: Air; SL: Sludge; W: Water	
38 FMB - Oysters	11/04/2018	13:00	B	Polymer Matrix Sample	AS: Air; SL: Sludge; W: Water	
39 FMB - 3			S	Polymer Matrix Sample	AS: Air; SL: Sludge; W: Water	
40 FMB - 2W			W	Polymer Matrix Sample	AS: Air; SL: Sludge; W: Water	
41 FIA 2			W	Polymer Matrix Sample	AS: Air; SL: Sludge; W: Water	

Sampled by:	Daniel Elson	Date/Time:	11/04/2018	Relinquished by:	Daniel Elson	Date/Time:	12/04/2018
Received by:		Date/Time:		Relinquished by:		Date/Time:	
Received by Courier:		Date/Time:		Relinquished by:		Date/Time:	
Received by Lab:		Date/Time:		Relinquished by:		Date/Time:	
Remarks:							

10

16.00

## **Shirley LeCornu**

---

**From:** Dan Elson <Daniel.Elson@ghd.com>  
**Sent:** Monday, 16 April 2018 2:42 PM  
**To:** Shirley LeCornu  
**Subject:** Missing sample id

Hi Shirley,

I suspect its FMB 8S and FMB 8W?

If so, could you analyse as per FMB 7S and FMB 7W respectively on the CoC?

Cheers  
Dan

**Dan Elson**  
**BSc**  
**Senior Environmental Scientist**

**GHD**

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T: +61 3 6210 0734 | M: 0411 296 901 | E: daniel.elson@ghd.com  
GHD 2 Salamanca Square Hobart TAS 7000 Australia | [www.ghd.com](http://www.ghd.com)

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# Certificate of Analysis

ALS Laboratory Group Pty Ltd  
5/585 Maitland Road  
Mayfield West, NSW 2304  
pH 02 4014 2500  
fax 02 4968 0349  
samples.newcastle@alsenviro.com

ALS Environmental  
Newcastle, NSW



**CLIENT:** Peter Topliss      **DATE REPORTED:** 20-Apr-2018

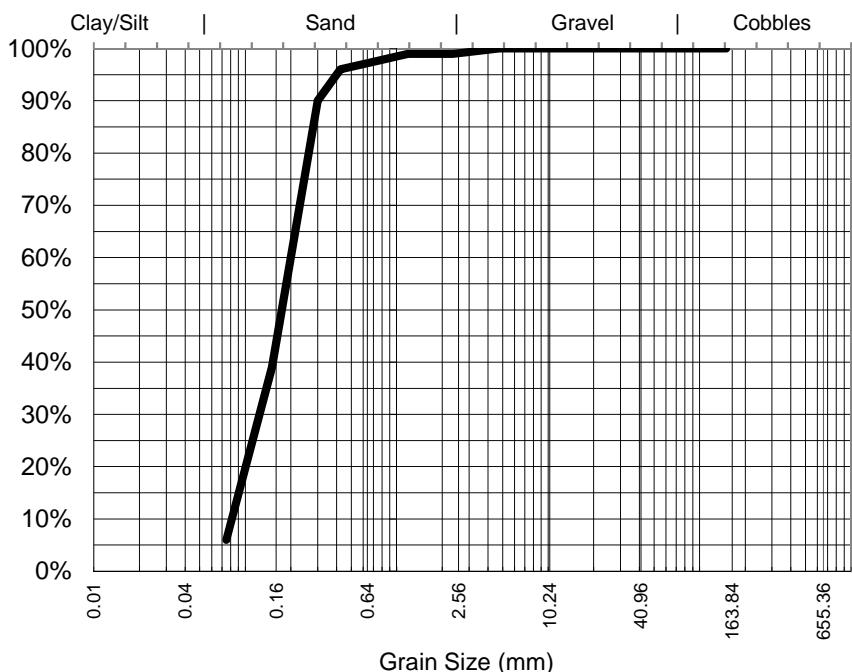
**COMPANY:** GHD Pty Ltd      **DATE RECEIVED:** 13-Apr-2018

**ADDRESS:** 2 Salamanca Square  
Hobart  
TAS, Australia 7000

**REPORT NO:** EM1806226-001 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** SC 1S (0-100)

## Particle Size Distribution



Particle Size (mm)	Percent Passing
4.75	100%
2.36	99%
1.18	99%
0.600	97%
0.425	96%
0.300	90%
0.150	39%
0.075	6%

Samples analysed as received.

Median Particle Size (mm)*	0.182
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, STONE, VEG

**Test Method:** AS1289.3.6.1

**NATA Accreditation: 825 Site: Newcastle**  
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**Nathan Webb**  
Laboratory Coordinator  
**Authorised Signatory**

# Certificate of Analysis

ALS Laboratory Group Pty Ltd  
5/585 Maitland Road  
Mayfield West, NSW 2304  
pH 02 4014 2500  
fax 02 4968 0349  
samples.newcastle@alsenviro.com

ALS Environmental  
Newcastle, NSW



**CLIENT:** Peter Topliss      **DATE REPORTED:** 20-Apr-2018

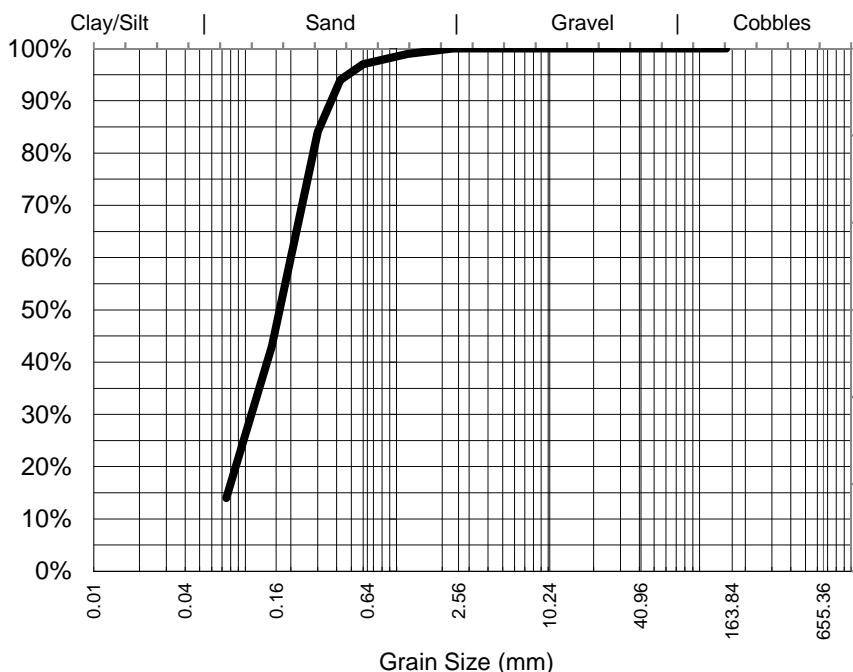
**COMPANY:** GHD Pty Ltd      **DATE RECEIVED:** 13-Apr-2018

**ADDRESS:** 2 Salamanca Square  
Hobart  
TAS, Australia 7000

**REPORT NO:** EM1806226-002 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** SC 2S (0-100)

## Particle Size Distribution



Particle Size (mm)	Percent Passing
2.36	100%
1.18	99%
0.600	97%
0.425	94%
0.300	84%
0.150	43%
0.075	14%

Samples analysed as received.

Median Particle Size (mm)*	0.176
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, VEG

**Test Method:** AS1289.3.6.1

**NATA Accreditation: 825 Site: Newcastle**  
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**Nathan Webb**  
Laboratory Coordinator  
**Authorised Signatory**

# Certificate of Analysis

ALS Laboratory Group Pty Ltd  
5/585 Maitland Road  
Mayfield West, NSW 2304  
pH 02 4014 2500  
fax 02 4968 0349  
samples.newcastle@alsenviro.com

ALS Environmental  
Newcastle, NSW



**CLIENT:** Peter Topliss      **DATE REPORTED:** 20-Apr-2018

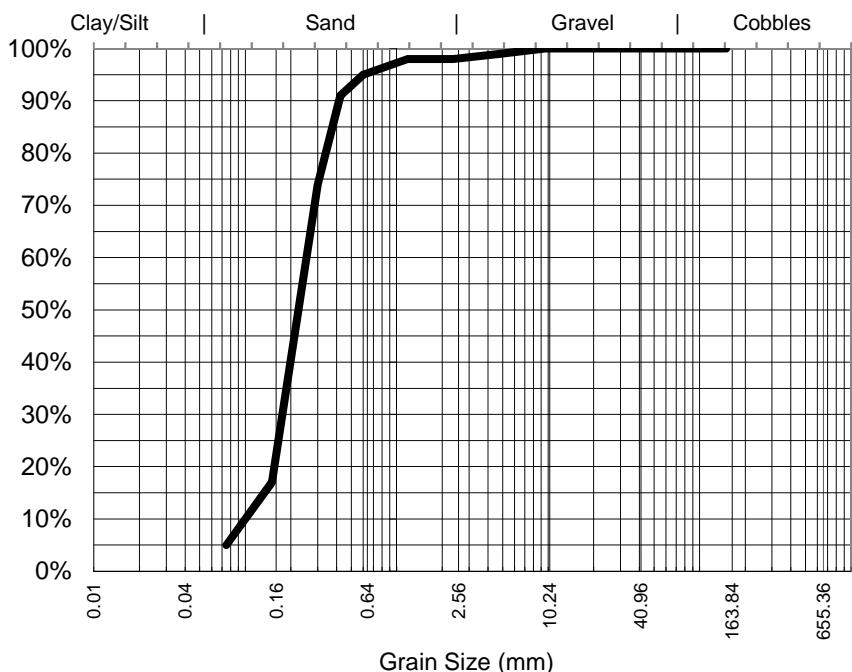
**COMPANY:** GHD Pty Ltd      **DATE RECEIVED:** 13-Apr-2018

**ADDRESS:** 2 Salamanca Square  
Hobart  
TAS, Australia 7000

**REPORT NO:** EM1806226-003 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** SC 3S (0-100)

## Particle Size Distribution



Particle Size (mm)	Percent Passing
9.50	100%
4.75	99%
2.36	98%
1.18	98%
0.600	95%
0.425	91%
0.300	74%
0.150	17%
0.075	5%

Samples analysed as received.

Median Particle Size (mm)*	0.237
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, STONE, VEG

**Test Method:** AS1289.3.6.1

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**Nathan Webb**  
Laboratory Coordinator  
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fax 02 4968 0349  
samples.newcastle@alsenviro.com

ALS Environmental  
Newcastle, NSW



**CLIENT:** Peter Topliss      **DATE REPORTED:** 20-Apr-2018

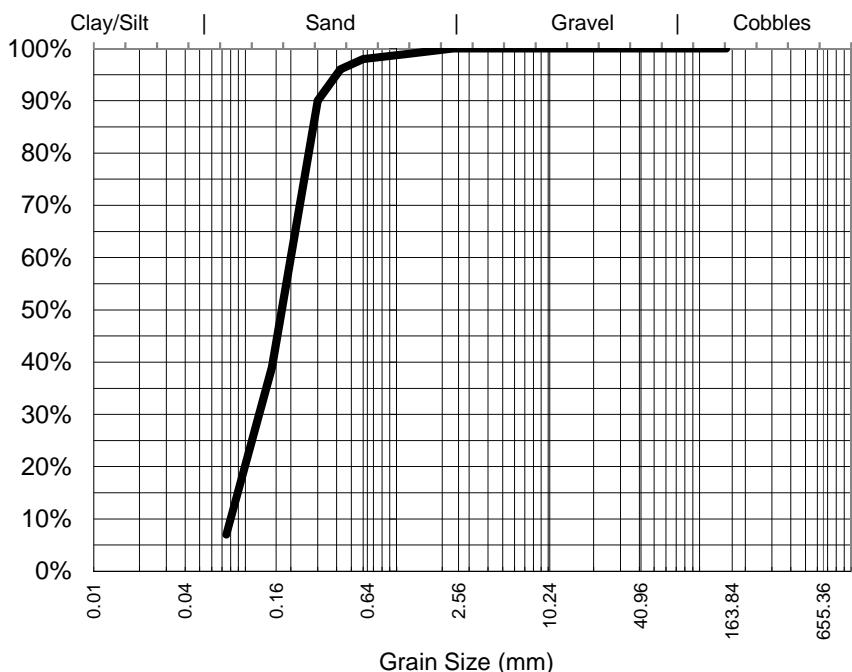
**COMPANY:** GHD Pty Ltd      **DATE RECEIVED:** 13-Apr-2018

**ADDRESS:** 2 Salamanca Square  
Hobart  
TAS, Australia 7000

**REPORT NO:** EM1806226-004 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** SC 4S (0-100)

## Particle Size Distribution



Particle Size (mm)	Percent Passing
2.36	100%
1.18	99%
0.600	98%
0.425	96%
0.300	90%
0.150	39%
0.075	7%

Samples analysed as received.

Median Particle Size (mm)*	0.182
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, VEG

**Test Method:** AS1289.3.6.1

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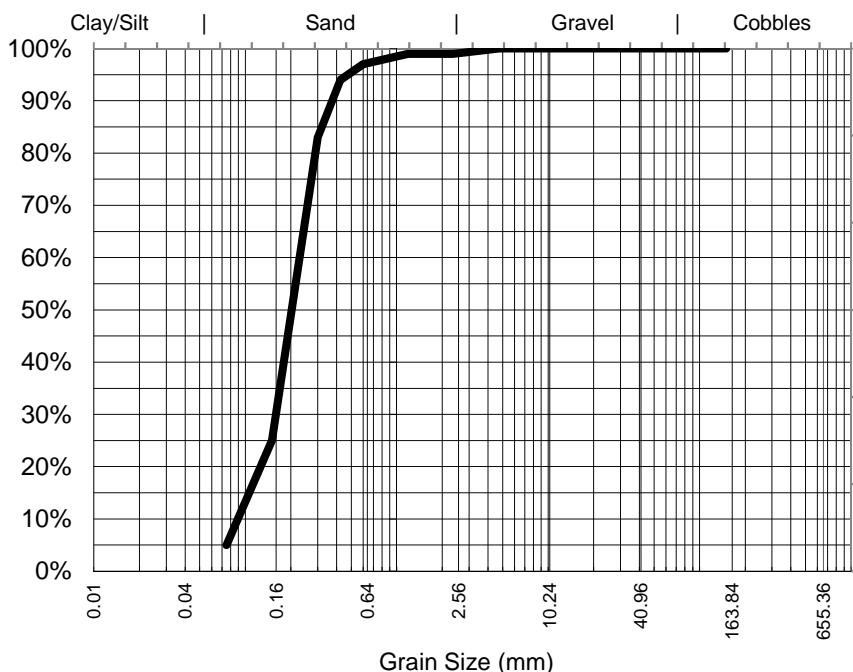
**COMPANY:** GHD Pty Ltd      **DATE RECEIVED:** 13-Apr-2018

**ADDRESS:** 2 Salamanca Square  
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**REPORT NO:** EM1806226-005 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** SC 5S (0-100)

## Particle Size Distribution



Particle Size (mm)	Percent Passing
4.75	100%
2.36	99%
1.18	99%
0.600	97%
0.425	94%
0.300	83%
0.150	25%
0.075	5%

Samples analysed as received.

Median Particle Size (mm)*	0.215
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, SHELL

**Test Method:** AS1289.3.6.1

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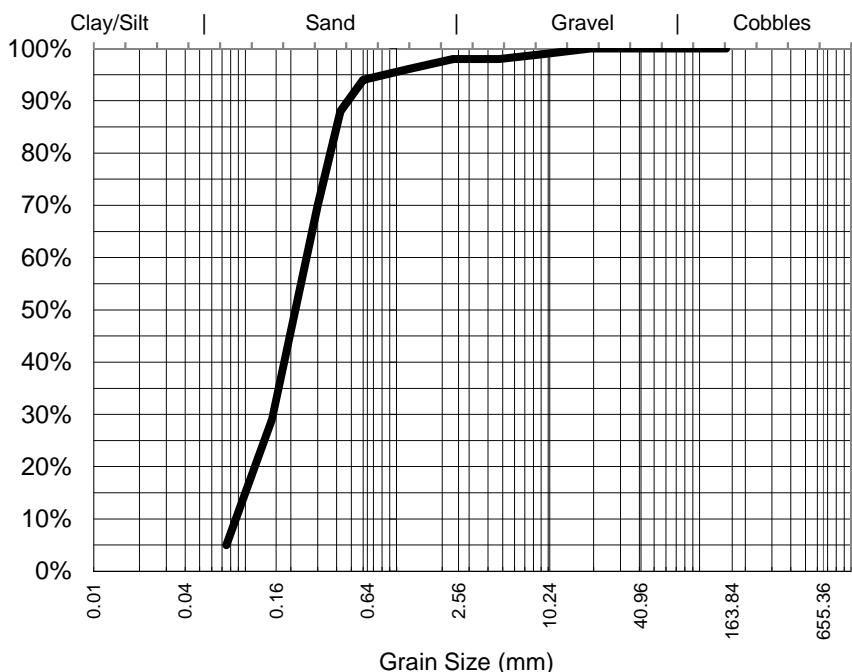
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**ADDRESS:** 2 Salamanca Square  
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TAS, Australia 7000

**REPORT NO:** EM1806226-006 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** SC 6S (0-100)

## Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	99%
4.75	98%
2.36	98%
1.18	96%
0.600	94%
0.425	88%
0.300	70%
0.150	29%
0.075	5%

Samples analysed as received.

Median Particle Size (mm)*	0.227
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, SHELL

**Test Method:** AS1289.3.6.1

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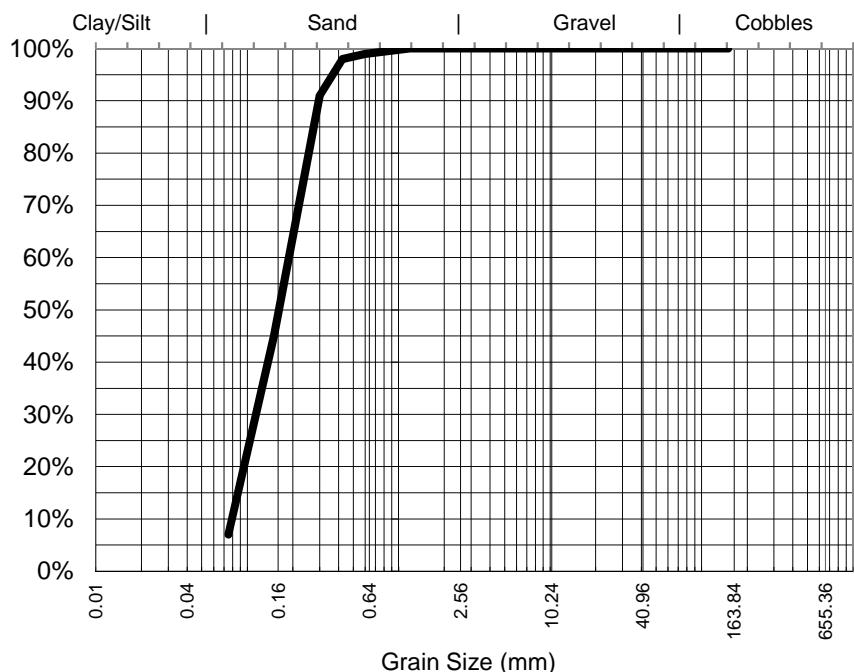
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**ADDRESS:** 2 Salamanca Square  
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**REPORT NO:** EM1806226-007 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** SC 1S (150-300)

## Particle Size Distribution



Particle Size (mm)	Percent Passing
1.18	100%
0.600	99%
0.425	98%
0.300	91%
0.150	45%
0.075	7%

Samples analysed as received.

Median Particle Size (mm)*	0.166
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, VEG

**Test Method:** AS1289.3.6.1

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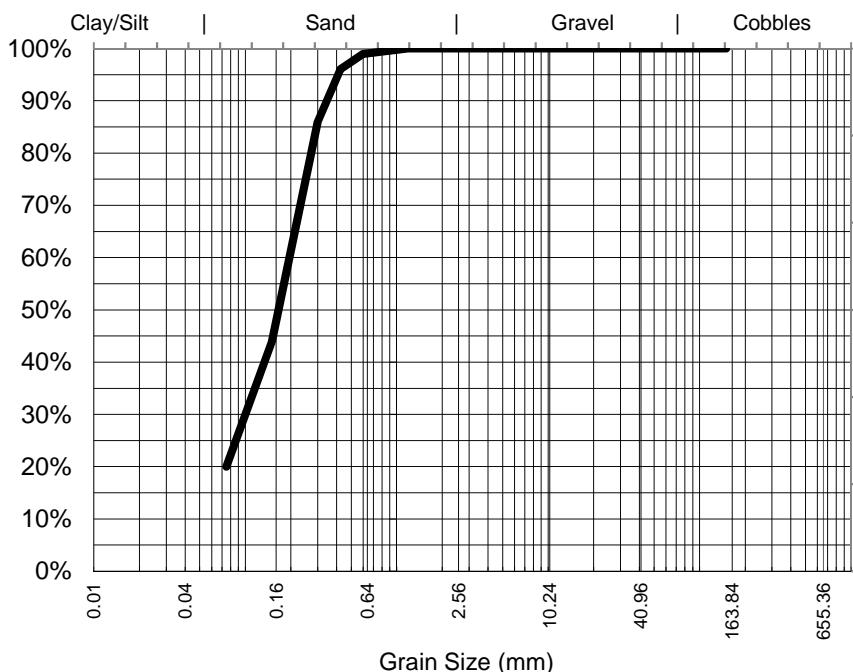
**ADDRESS:** 2 Salamanca Square  
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**REPORT NO:** EM1806226-008 / PSD

**PROJECT:** 3218792

**SAMPLE ID:** SC 2S (150-300)

## Particle Size Distribution



Particle Size (mm)	Percent Passing
1.18	100%
0.600	99%
0.425	96%
0.300	86%
0.150	44%
0.075	20%

Samples analysed as received.

Median Particle Size (mm)*	0.171
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, VEG

**Test Method:** AS1289.3.6.1

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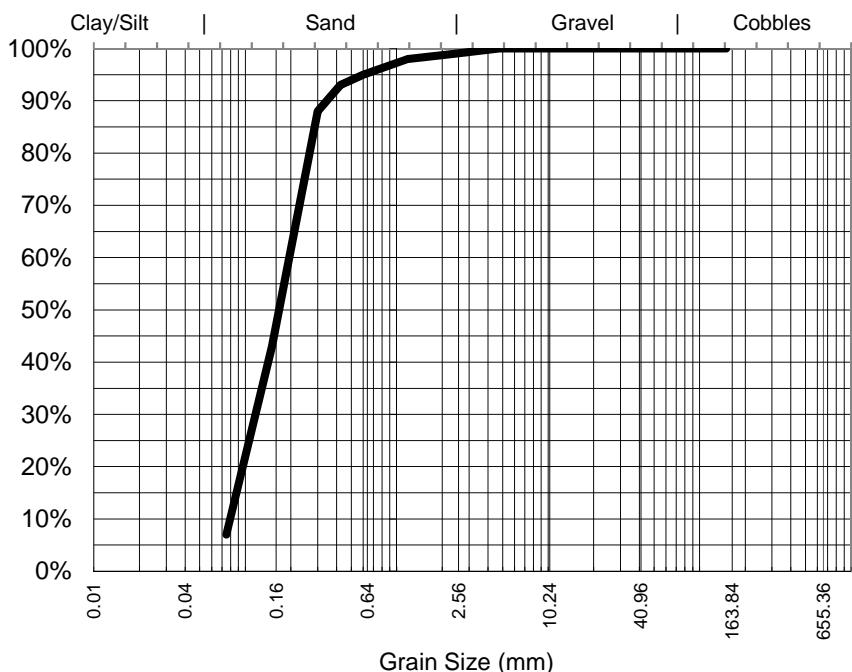
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**ADDRESS:** 2 Salamanca Square  
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**REPORT NO:** EM1806226-009 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** SC 3S (150-300)

## Particle Size Distribution



Particle Size (mm)	Percent Passing
4.75	100%
2.36	99%
1.18	98%
0.600	95%
0.425	93%
0.300	88%
0.150	43%
0.075	7%

Samples analysed as received.

Median Particle Size (mm)*	0.173
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, STONE, VEG

**Test Method:** AS1289.3.6.1

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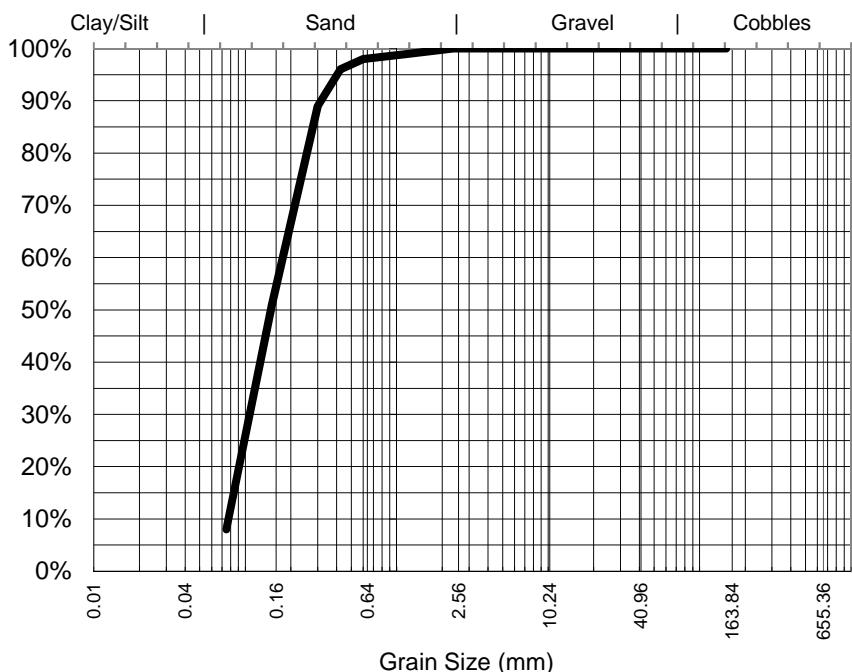
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**REPORT NO:** EM1806226-010 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** SC 4S (150-300)

## Particle Size Distribution



Particle Size (mm)	Percent Passing
2.36	100%
1.18	99%
0.600	98%
0.425	96%
0.300	89%
0.150	51%
0.075	8%

Samples analysed as received.

Median Particle Size (mm)*	0.148
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, VEG

**Test Method:** AS1289.3.6.1

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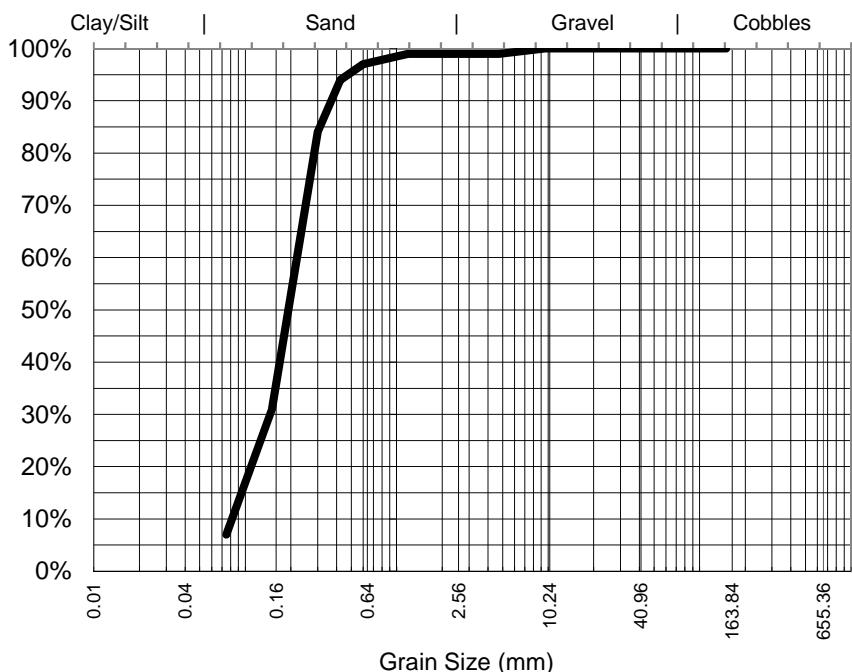
**ADDRESS:** 2 Salamanca Square  
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TAS, Australia 7000

**REPORT NO:** EM1806226-011 / PSD

**PROJECT:** 3218792

**SAMPLE ID:** SC 5S (150-300)

## Particle Size Distribution



Particle Size (mm)	Percent Passing
9.50	100%
4.75	99%
2.36	99%
1.18	99%
0.600	97%
0.425	94%
0.300	84%
0.150	31%
0.075	7%

Samples analysed as received.

Median Particle Size (mm)\* 0.204

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, SHELL

**Test Method:** AS1289.3.6.1

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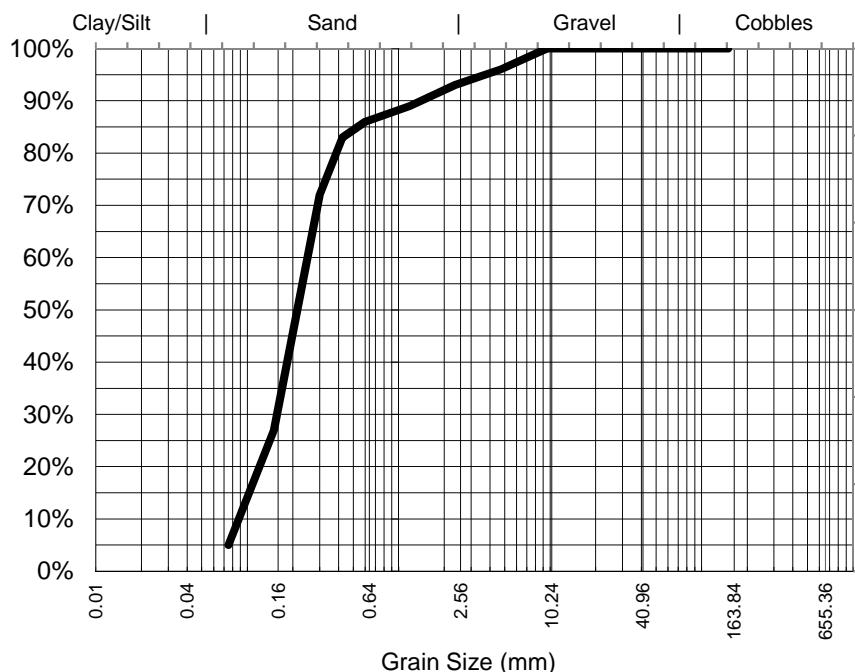
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**ADDRESS:** 2 Salamanca Square  
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TAS, Australia 7000

**REPORT NO:** EM1806226-012 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** SC 6S (150-300)

## Particle Size Distribution



Particle Size (mm)	Percent Passing
9.50	100%
4.75	96%
2.36	93%
1.18	89%
0.600	86%
0.425	83%
0.300	72%
0.150	27%
0.075	5%

Samples analysed as received.

Median Particle Size (mm)*	0.227
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, SHELL

**Test Method:** AS1289.3.6.1

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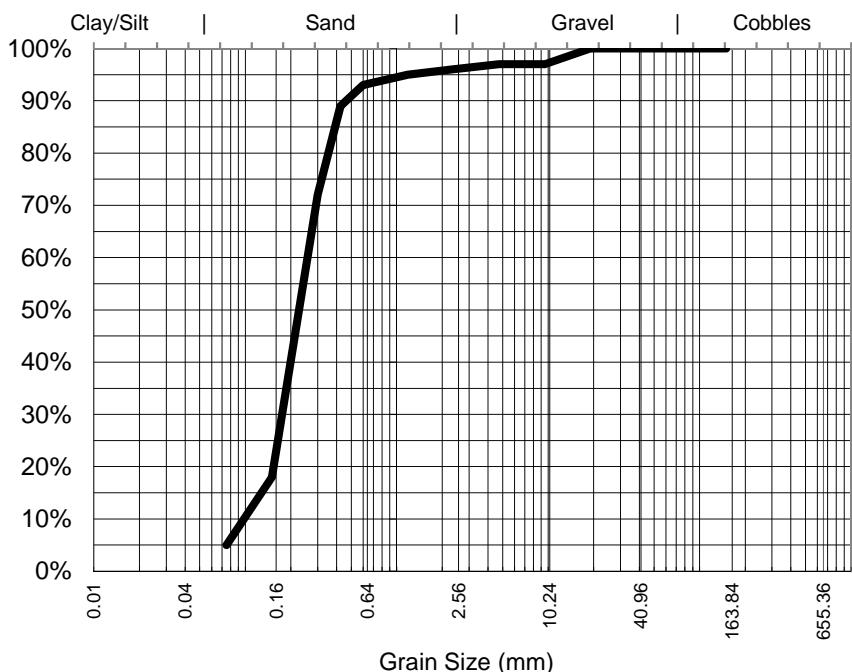
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**ADDRESS:** 2 Salamanca Square  
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**REPORT NO:** EM1806226-019 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** QA1

## Particle Size Distribution



Particle Size (mm)	Percent Passing
0.06	5%
0.16	20%
0.32	45%
0.64	90%
1.28	95%
2.56	97%
5.12	98%
10.24	99%
20.48	100%

Samples analysed as received.

Median Particle Size (mm)*	0.239
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, STONE, SHELL, VEG

**Test Method:** AS1289.3.6.1

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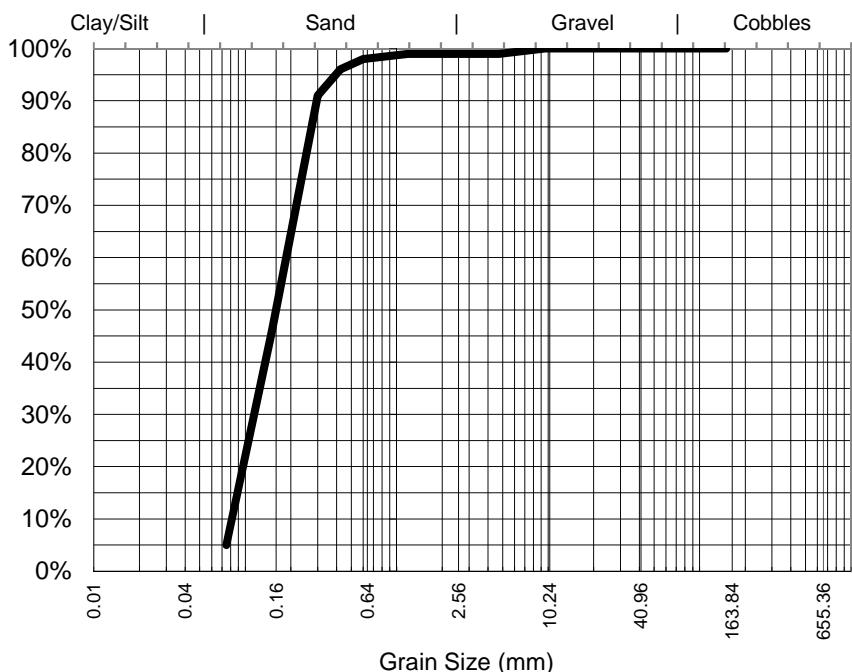
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**ADDRESS:** 2 Salamanca Square  
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**REPORT NO:** EM1806226-023 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** FMB-1S

## Particle Size Distribution



Particle Size (mm)	Percent Passing
9.50	100%
4.75	99%
2.36	99%
1.18	99%
0.600	98%
0.425	96%
0.300	91%
0.150	46%
0.075	5%

Samples analysed as received.

Median Particle Size (mm)\*      0.163

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, STONE, SHELL

**Test Method:** AS1289.3.6.1

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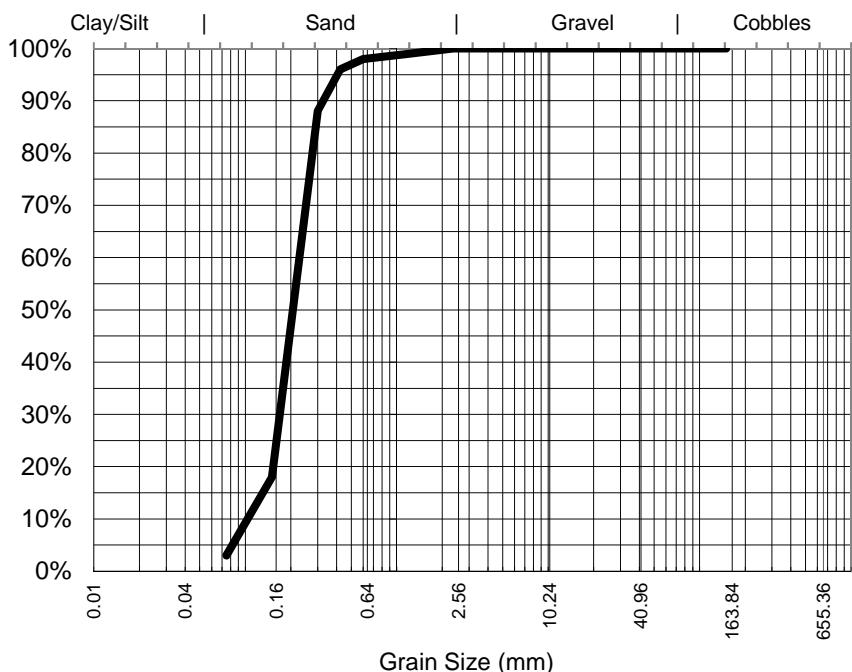
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**ADDRESS:** 2 Salamanca Square  
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TAS, Australia 7000

**REPORT NO:** EM1806226-024 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** FMB-2S

## Particle Size Distribution



Particle Size (mm)	Percent Passing
2.36	100%
1.18	99%
0.600	98%
0.425	96%
0.300	88%
0.150	18%
0.075	3%

Samples analysed as received.

Median Particle Size (mm)*	0.219
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, STONE, SHELL

**Test Method:** AS1289.3.6.1

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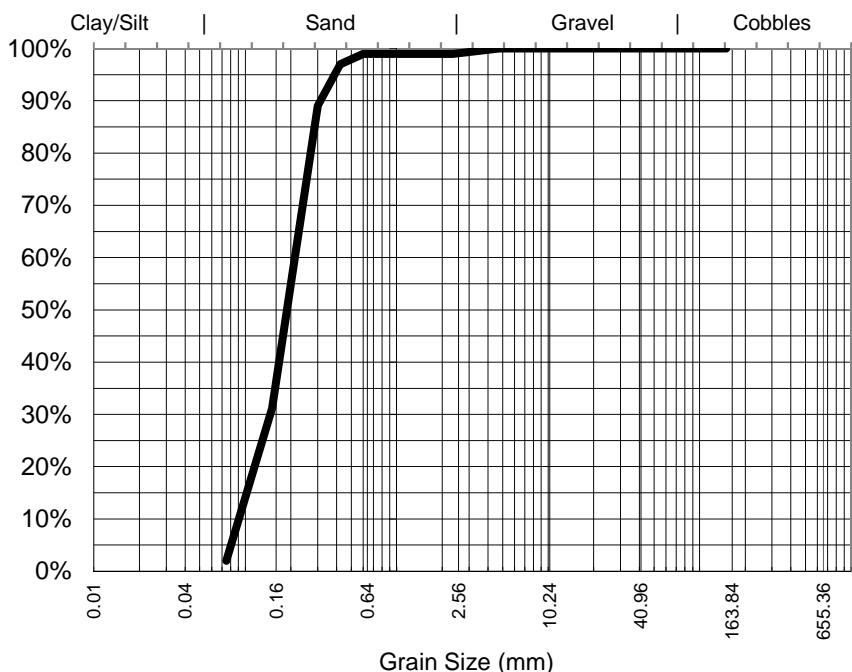
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**REPORT NO:** EM1806226-025 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** FMB-3S

## Particle Size Distribution



Particle Size (mm)	Percent Passing
0.01 - 0.16	0%
0.16 - 10.24	95%
10.24 - 40.96	100%
40.96 - 163.84	100%
163.84 - 655.36	0%
4.75	100%
2.36	99%
1.18	99%
0.600	99%
0.425	97%
0.300	89%
0.150	31%
0.075	2%

Samples analysed as received.

Median Particle Size (mm)*	0.199
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, STONE, SHELL

**Test Method:** AS1289.3.6.1

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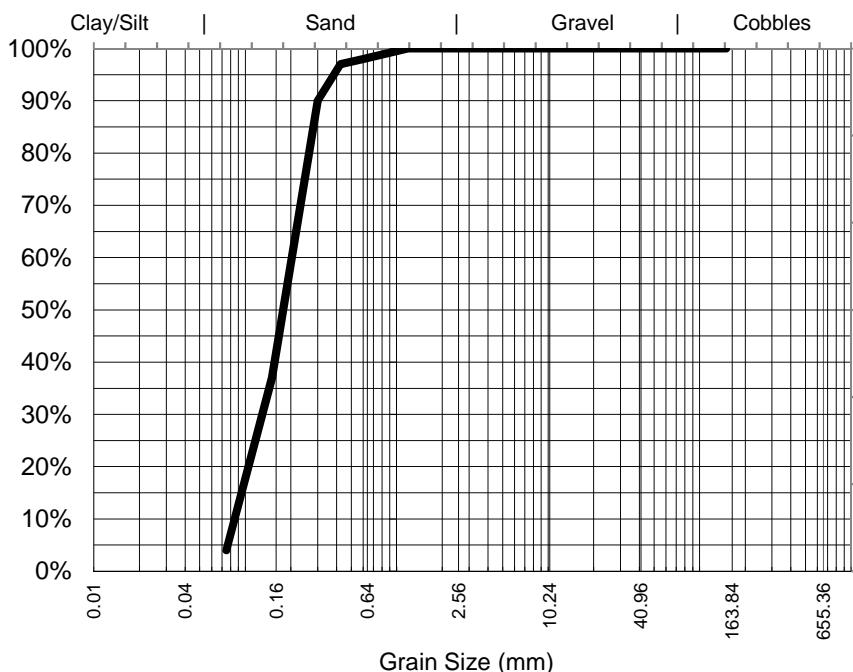
**COMPANY:** GHD Pty Ltd      **DATE RECEIVED:** 13-Apr-2018

**ADDRESS:** 2 Salamanca Square  
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TAS, Australia 7000

**REPORT NO:** EM1806226-027 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** FMB-5S

## Particle Size Distribution



Particle Size (mm)	Percent Passing
0.01 - 0.16	0%
0.16 - 0.64	95%
0.64 - 2.56	100%
2.56 - 10.24	100%
10.24 - 40.96	100%
40.96 - 163.84	100%
163.84 - 655.36	100%
0.18	100%
0.600	98%
0.425	97%
0.300	90%
0.150	37%
0.075	4%

Samples analysed as received.

Median Particle Size (mm)*	0.187
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, SHELL, VEG

**Test Method:** AS1289.3.6.1

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**REPORT NO:** EM1806226-029 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** FMB-7S

## Particle Size Distribution



Particle Size (mm)	Percent Passing
1.18	100%
0.600	99%
0.425	98%
0.300	96%
0.150	66%
0.075	13%

Samples analysed as received.

Median Particle Size (mm)*	0.127
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, SHELL

**Test Method:** AS1289.3.6.1

**NATA Accreditation: 825 Site: Newcastle**  
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Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.



Nathan Webb  
Laboratory Coordinator  
**Authorised Signatory**

# Certificate of Analysis

ALS Laboratory Group Pty Ltd  
5/585 Maitland Road  
Mayfield West, NSW 2304  
pH 02 4014 2500  
fax 02 4968 0349  
samples.newcastle@alsenviro.com

ALS Environmental  
Newcastle, NSW



**CLIENT:** Peter Topliss      **DATE REPORTED:** 20-Apr-2018

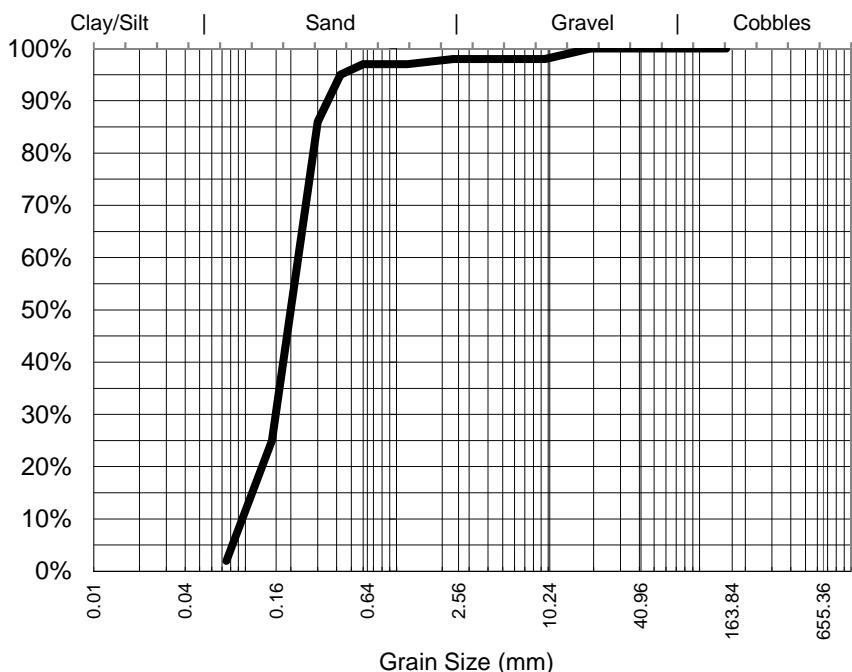
**COMPANY:** GHD Pty Ltd      **DATE RECEIVED:** 13-Apr-2018

**ADDRESS:** 2 Salamanca Square  
Hobart  
TAS, Australia 7000

**REPORT NO:** EM1806226-037 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** QA2

## Particle Size Distribution



Particle Size (mm)	Percent Passing
19.0	100%
9.50	98%
4.75	98%
2.36	98%
1.18	97%
0.600	97%
0.425	95%
0.300	86%
0.150	25%
0.075	2%

Samples analysed as received.

Median Particle Size (mm)\* 0.211

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, STONE, VEG

**Test Method:** AS1289.3.6.1

**NATA Accreditation: 825 Site: Newcastle**  
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**Nathan Webb**  
Laboratory Coordinator  
**Authorised Signatory**

# Certificate of Analysis

ALS Laboratory Group Pty Ltd  
5/585 Maitland Road  
Mayfield West, NSW 2304  
pH 02 4014 2500  
fax 02 4968 0349  
samples.newcastle@alsenviro.com

ALS Environmental  
Newcastle, NSW



**CLIENT:** Peter Topliss      **DATE REPORTED:** 20-Apr-2018

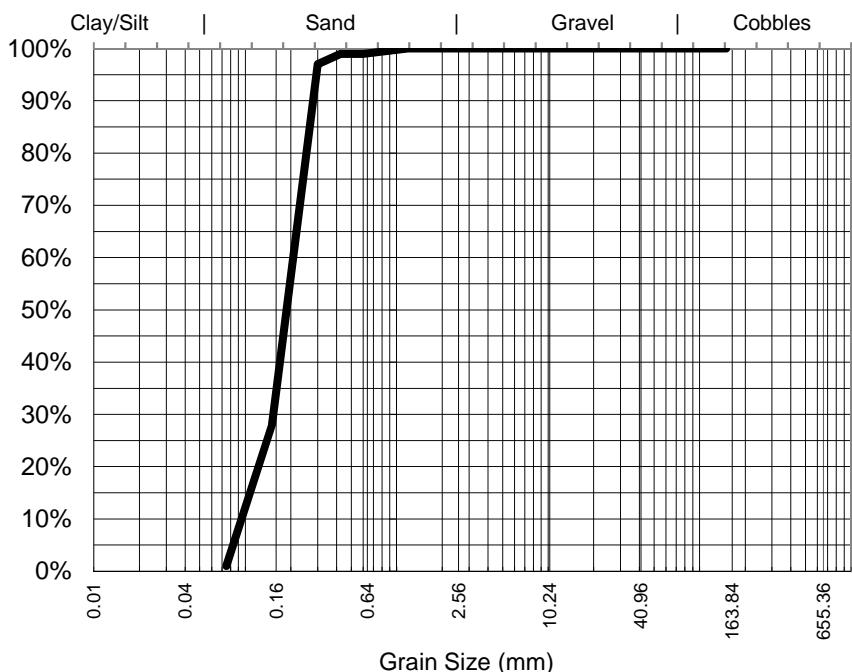
**COMPANY:** GHD Pty Ltd      **DATE RECEIVED:** 13-Apr-2018

**ADDRESS:** 2 Salamanca Square  
Hobart  
TAS, Australia 7000

**REPORT NO:** EM1806226-039 / PSD

**PROJECT:** 3218792      **SAMPLE ID:** FMB - 8

## Particle Size Distribution



Particle Size (mm)	Percent Passing
1.18	100%
0.600	99%
0.425	99%
0.300	97%
0.150	28%
0.075	1%

Samples analysed as received.

Median Particle Size (mm)*	0.198
----------------------------	-------

Median Particle Size is not covered under the current scope of ALS's NATA accreditation.

## Sample Comments:

**Analysed:** 18-Apr-18

**Loss on Pretreatment** NA

**Limit of Reporting:** 1%

**Sample Description:** FINES, SAND, VEG

**Test Method:** AS1289.3.6.1

**NATA Accreditation: 825 Site: Newcastle**  
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Nathan Webb  
Laboratory Coordinator  
**Authorised Signatory**

## CHAIN OF CUSTODY RECORD



GHD Hobart  
2 Salamanca Square, Hobart 7000  
Telephone: 61 3 6210 0600 Facsimile: 61 3 6210 0601  
Email: hbmail@ghd.com.au

GHD Burnie  
10 Columnar Court, Burnie 7320  
Telephone: 61 3 6432 7900 Facsimile: 61 3 6432 7901  
Email: bwmail@ghd.com.au

Job Number	3218792	GHD Office Hobart	Laboratory: Eurofins Mgt, Lane Cove West, New South Wales
Project	Aiservices Sinclair Creek and Five Mile Beach	Laboratory Contact:	
GHD Project Manager	GHD Contact	Container	Analyses Required
Peter Topliss	Daniel Elson	Type	
Requested Completion Date			
Standard TAT			

Sample ID	Date	Time	Composite Sample	Preservative	Sample Matrix	Sample SL: Judge W: Water	V: Vial G: Glass bottle	P: Plastic bottle	Number of items	Volume (ml)	PFAS - Full Suite Low Level (28 analytes)	ASLP Leach+PFAS Full Suite	PFAS Full Suite	Total Organic Carbon	Exchangeable Cations	Exchangelable Cations	
QQA1	11/04/2018	13:00		J BG	4												
QQA2	11/04/2018	13:00		J BG	3												

Sampled by:	Daniel Elson	Date/Time:	11/04/2018	Relinquished by:	Daniel Elson	Date/Time:	12/04/2018	Relinquished by:		Date/Time:	16:00
Received by:		Date/Time:		Relinquished by:		Date/Time:		Relinquished by:		Date/Time:	
Received by Courier:	JACK MUNCHINS	Date/Time:		Relinquished by:		Date/Time:		Relinquished by:		Date/Time:	
Received by Lab:	Bhattachari (ACS)	Date/Time:	13/4/18	Relinquished by:	Pranav Arora	Date/Time:	16/4/18 12:20	Relinquished by:		Date/Time:	
Remarks:											

43  
594228

Sulphate 1  
16/4/18 2:53pm

594228



## Certificate of Analysis



NATA Accredited  
Accreditation Number 1261  
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing  
The results of the tests, calibrations and/or  
measurements included in this document are traceable  
to Australian/national standards.

GHD Pty Ltd NT  
Level 5, 66 Smith Street  
Darwin  
NT 0800

Attention: Daniel Elson

Report 594228-L  
Project name AISERVICES SINCLAIR CREEK AND FIVE MILE BEACH  
Project ID 3218792  
Received Date Apr 16, 2018

Client Sample ID	LOR	Unit	QQA1 AUS Leachate M18-Ap18027	QQA2 AUS Leachate M18-Ap18028
<b>Sample Matrix</b>				
<b>Eurofins   mgt Sample No.</b>				
<b>Date Sampled</b>				
Test/Reference				
<b>Perfluoroalkyl carboxylic acids (PFCAs)</b>				
Perfluorobutanoic acid (PFBA) <sup>N11</sup>	0.05	ug/L	< 0.05	< 0.05
Perfluoropentanoic acid (PFPeA) <sup>N11</sup>	0.01	ug/L	< 0.01	< 0.01
Perfluorohexanoic acid (PFHxA) <sup>N11</sup>	0.01	ug/L	< 0.01	< 0.01
Perfluoroheptanoic acid (PFHpA) <sup>N11</sup>	0.01	ug/L	< 0.01	< 0.01
Perfluorooctanoic acid (PFOA) <sup>N11</sup>	0.01	ug/L	< 0.01	< 0.01
Perfluorononanoic acid (PFNA) <sup>N11</sup>	0.01	ug/L	< 0.01	< 0.01
Perfluorodecanoic acid (PFDA) <sup>N11</sup>	0.01	ug/L	< 0.01	< 0.01
Perfluoroundecanoic acid (PFUnDA) <sup>N11</sup>	0.01	ug/L	< 0.01	< 0.01
Perfluorododecanoic acid (PFDDoDA) <sup>N11</sup>	0.01	ug/L	< 0.01	< 0.01
Perfluorotridecanoic acid (PFTrDA) <sup>N15</sup>	0.01	ug/L	< 0.01	< 0.01
Perfluorotetradecanoic acid (PFTeDA) <sup>N11</sup>	0.01	ug/L	< 0.01	< 0.01
13C4-PFBA (surr.)	1	%	86	10
13C5-PFPeA (surr.)	1	%	103	52
13C5-PFHxA (surr.)	1	%	107	79
13C4-PFHpA (surr.)	1	%	106	94
13C8-PFOA (surr.)	1	%	93	88
13C5-PFNA (surr.)	1	%	92	92
13C6-PFDA (surr.)	1	%	73	75
13C2-PFUnDA (surr.)	1	%	55	56
13C2-PFDDoDA (surr.)	1	%	45	47
13C2-PFTeDA (surr.)	1	%	17	35
<b>Perfluoroalkane sulfonamido substances</b>				
Perfluorooctane sulfonamide (FOSA) <sup>N11</sup>	0.05	ug/L	< 0.05	< 0.05
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA) <sup>N11</sup>	0.05	ug/L	< 0.05	< 0.05
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA) <sup>N11</sup>	0.05	ug/L	< 0.05	< 0.05
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE) <sup>N11</sup>	0.05	ug/L	< 0.05	< 0.05
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE) <sup>N11</sup>	0.05	ug/L	< 0.05	< 0.05
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA) <sup>N11</sup>	0.05	ug/L	< 0.05	< 0.05
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA) <sup>N11</sup>	0.05	ug/L	< 0.05	< 0.05
13C8-FOSA (surr.)	1	%	64	71
D3-N-MeFOSA (surr.)	1	%	42	38
D5-N-EtFOSA (surr.)	1	%	40	35

Client Sample ID			QQA1 AUS Leachate M18-Ap18027	QQA2 AUS Leachate M18-Ap18028		
Sample Matrix	LOR	Unit	Apr 11, 2018			
Eurofins   mgt Sample No.			Apr 11, 2018			
Date Sampled			Apr 11, 2018			
Test/Reference						
<b>Perfluoroalkane sulfonamido substances</b>						
D7-N-MeFOSE (surr.)	1	%	31	22		
D9-N-EtFOSE (surr.)	1	%	29	23		
D5-N-EtFOSAA (surr.)	1	%	56	44		
D3-N-MeFOSAA (surr.)	1	%	50	52		
<b>Perfluoroalkane sulfonic acids (PFSAs)</b>						
Perfluorobutanesulfonic acid (PFBS) <sup>N11</sup>	0.01	ug/L	< 0.01	< 0.01		
Perfluoropentanesulfonic acid (PFPeS) <sup>N15</sup>	0.01	ug/L	< 0.01	< 0.01		
Perfluorohexameresulfonic acid (PFHxS) <sup>N11</sup>	0.01	ug/L	N <sup>09</sup> 0.02	< 0.01		
Perfluoroheptanesulfonic acid (PFHpS) <sup>N15</sup>	0.01	ug/L	< 0.01	< 0.01		
Perfluorooctanesulfonic acid (PFOS) <sup>N11</sup>	0.01	ug/L	N <sup>09</sup> 0.26	N <sup>09</sup> 0.06		
Perfluorodecanesulfonic acid (PFDS) <sup>N15</sup>	0.01	ug/L	< 0.01	< 0.01		
13C3-PFBS (surr.)	1	%	92	77		
18O2-PFHxS (surr.)	1	%	93	96		
13C8-PFOS (surr.)	1	%	91	106		
<b>n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)</b>						
1H.1H.2H.2H-perfluorohexameresulfonic acid (4:2 FTSA) <sup>N11</sup>	0.01	ug/L	< 0.01	< 0.01		
1H.1H.2H.2H-perfluoroctanesulfonic acid (6:2 FTSA) <sup>N11</sup>	0.05	ug/L	< 0.05	< 0.05		
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA) <sup>N11</sup>	0.01	ug/L	< 0.01	< 0.01		
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA) <sup>N15</sup>	0.01	ug/L	< 0.01	< 0.01		
13C2-4:2 FTSAs (surr.)	1	%	81	31		
13C2-6:2 FTSAs (surr.)	1	%	82	44		
13C2-8:2 FTSAs (surr.)	1	%	70	47		
<b>PFASs Summations</b>						
Sum (PFHxS + PFOS)*	0.01	ug/L	0.28	0.06		
Sum of US EPA PFAS (PFOS + PFOA)*	0.01	ug/L	0.26	0.06		
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.01	ug/L	0.28	0.06		
Sum of WA DER PFAS (n=10)*	0.05	ug/L	0.28	0.06		
Sum of PFASs (n=28)*	0.1	ug/L	0.28	< 0.1		
<b>AUS Leaching Procedure</b>						
Leachate Fluid <sup>C01</sup>		comment	4.0	4.0		
pH (initial)	0.1	pH Units	7.0	6.9		
pH (Leachate fluid)	0.1	pH Units	7.0	7.0		
pH (off)	0.1	pH Units	7.0	7.1		

## Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Per- and Polyfluorinated Alkyl Substances (PFASs)			
Perfluoroalkyl carboxylic acids (PFCAs)	Brisbane	Apr 20, 2018	14 Day
- Method: LTM-ORG-2100 Per- and Polyfluoro Alkyl Substances (PFAS)			
Perfluoroalkane sulfonamido substances	Brisbane	Apr 20, 2018	14 Day
- Method: LTM-ORG-2100 Per- and Polyfluoro Alkyl Substances (PFAS)			
Perfluoroalkane sulfonic acids (PFSAs)	Brisbane	Apr 20, 2018	14 Day
- Method: LTM-ORG-2100 Per- and Polyfluoro Alkyl Substances (PFAS)			
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)	Brisbane	Apr 20, 2018	14 Day
- Method: LTM-ORG-2100 Per- and Polyfluoro Alkyl Substances (PFAS)			
AUS Leaching Procedure	Brisbane	Apr 20, 2018	7 Days
- Method: LTM-GEN-7010 Leaching Procedure for Soils & Solid Wastes			

<b>Company Name:</b>	GHD Pty Ltd NT	<b>Order No.:</b>	3218792	<b>Received:</b>	Apr 16, 2018 2:53 PM
<b>Address:</b>	Level 5, 66 Smith Street Darwin NT 0800	<b>Report #:</b>	594228	<b>Due:</b>	Apr 23, 2018
<b>Project Name:</b>	AISERVICES SINCLAIR CREEK AND FIVE MILE BEACH	<b>Phone:</b>	08 8982 0100	<b>Priority:</b>	5 Day
<b>Project ID:</b>	3218792	<b>Fax:</b>	08 8981 1075	<b>Contact Name:</b>	Daniel Elson
<b>Eurofins   mgt Analytical Services Manager : Michael Cassidy</b>					

### Sample Detail

**Melbourne Laboratory - NATA Site # 1254 & 14271**

**Sydney Laboratory - NATA Site # 18217**

**Brisbane Laboratory - NATA Site # 20794**

**Perth Laboratory - NATA Site # 23736**

**External Laboratory**

No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID							
1	QQA1	Apr 11, 2018	1:00PM	Soil	M18-Ap18025	X	X		X	X	X	
2	QQA2	Apr 11, 2018	1:00PM	Soil	M18-Ap18026	X	X		X	X	X	
3	QQA1	Apr 11, 2018	1:00PM	AUS Leachate	M18-Ap18027			X			X	
4	QQA2	Apr 11, 2018	1:00PM	AUS Leachate	M18-Ap18028			X			X	
5	QQA1 (WATER)	Apr 11, 2018	1:00PM	Water	M18-Ap18029							X

**Test Counts**

2	2	2	2	2	4	1
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## Internal Quality Control Review and Glossary

### General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

### Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

**\*\*NOTE:** pH duplicates are reported as a range NOT as RPD

### Units

**mg/kg:** milligrams per kilogram

**mg/L:** milligrams per litre

**ug/L:** micrograms per litre

**ppm:** Parts per million

**ppb:** Parts per billion

**%:** Percentage

**org/100mL:** Organisms per 100 millilitres

**NTU:** Nephelometric Turbidity Units

**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

### Terms

<b>Dry</b>	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
<b>LOR</b>	Limit of Reporting.
<b>SPIKE</b>	Addition of the analyte to the sample and reported as percentage recovery.
<b>RPD</b>	Relative Percent Difference between two Duplicate pieces of analysis.
<b>LCS</b>	Laboratory Control Sample - reported as percent recovery.
<b>CRM</b>	Certified Reference Material - reported as percent recovery.
<b>Method Blank</b>	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
<b>Surr - Surrogate</b>	The addition of a like compound to the analyte target and reported as percentage recovery.
<b>Duplicate</b>	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
<b>USEPA</b>	United States Environmental Protection Agency
<b>APHA</b>	American Public Health Association
<b>TCLP</b>	Toxicity Characteristic Leaching Procedure
<b>COC</b>	Chain of Custody
<b>SRA</b>	Sample Receipt Advice
<b>QSM</b>	Quality Systems Manual ver 5.1 US Department of Defense
<b>CP</b>	Client Parent - QC was performed on samples pertaining to this report
<b>NCP</b>	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
<b>TEQ</b>	Toxic Equivalency Quotient

### QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

### QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

**Quality Control Results**

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code	
<b>Method Blank</b>								
<b>Perfluoroalkyl carboxylic acids (PFCAs)</b>								
Perfluorobutanoic acid (PFBA)	ug/L	< 0.05			0.05	Pass		
Perfluoropentanoic acid (PFPeA)	ug/L	< 0.01			0.01	Pass		
Perfluorohexanoic acid (PFHxA)	ug/L	< 0.01			0.01	Pass		
Perfluoroheptanoic acid (PFHpA)	ug/L	< 0.01			0.01	Pass		
Perfluorooctanoic acid (PFOA)	ug/L	< 0.01			0.01	Pass		
Perfluorononanoic acid (PFNA)	ug/L	< 0.01			0.01	Pass		
Perfluorodecanoic acid (PFDA)	ug/L	< 0.01			0.01	Pass		
Perfluoroundecanoic acid (PFUnDA)	ug/L	< 0.01			0.01	Pass		
Perfluorododecanoic acid (PFDoDA)	ug/L	< 0.01			0.01	Pass		
Perfluorotridecanoic acid (PFTrDA)	ug/L	< 0.01			0.01	Pass		
Perfluorotetradecanoic acid (PFTeDA)	ug/L	< 0.01			0.01	Pass		
<b>Method Blank</b>								
<b>Perfluoroalkane sulfonamido substances</b>								
Perfluorooctane sulfonamide (FOSA)	ug/L	< 0.05			0.05	Pass		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	ug/L	< 0.05			0.05	Pass		
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	ug/L	< 0.05			0.05	Pass		
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	ug/L	< 0.05			0.05	Pass		
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	ug/L	< 0.05			0.05	Pass		
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ug/L	< 0.05			0.05	Pass		
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ug/L	< 0.05			0.05	Pass		
<b>Method Blank</b>								
<b>Perfluoroalkane sulfonic acids (PFSAs)</b>								
Perfluorobutanesulfonic acid (PFBS)	ug/L	< 0.01			0.01	Pass		
Perfluoropentanesulfonic acid (PFPeS)	ug/L	< 0.01			0.01	Pass		
Perfluorohexanesulfonic acid (PFHxS)	ug/L	< 0.01			0.01	Pass		
Perfluoroheptanesulfonic acid (PFHpS)	ug/L	< 0.01			0.01	Pass		
Perfluorooctanesulfonic acid (PFOS)	ug/L	< 0.01			0.01	Pass		
Perfluorodecanesulfonic acid (PFDS)	ug/L	< 0.01			0.01	Pass		
<b>Method Blank</b>								
<b>n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)</b>								
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	ug/L	< 0.01			0.01	Pass		
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	ug/L	< 0.05			0.05	Pass		
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	ug/L	< 0.01			0.01	Pass		
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	ug/L	< 0.01			0.01	Pass		
Test	Lab Sample ID	QA Source	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
<b>Duplicate</b>								
<b>Perfluoroalkyl carboxylic acids (PFCAs)</b>								
Perfluorobutanoic acid (PFBA)	M18-Ap18028	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass
Perfluoropentanoic acid (PFPeA)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Perfluorohexanoic acid (PFHxA)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Perfluoroheptanoic acid (PFHpA)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Perfluorooctanoic acid (PFOA)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Perfluorononanoic acid (PFNA)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Perfluorodecanoic acid (PFDA)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Perfluoroundecanoic acid (PFUnDA)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Perfluorododecanoic acid (PFDoDA)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Perfluorotridecanoic acid (PFTrDA)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Perfluorotetradecanoic acid (PFTeDA)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass

Duplicate								
Perfluoroalkane sulfonamido substances				Result 1	Result 2	RPD		
Perfluoroctane sulfonamide (FOSA)	M18-Ap18028	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	M18-Ap18028	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	M18-Ap18028	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	M18-Ap18028	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	M18-Ap18028	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass
N-ethyl-perfluoroctanesulfonamidoacetic acid (N-EtFOSAA)	M18-Ap18028	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass
N-methyl-perfluoroctanesulfonamidoacetic acid (N-MeFOSAA)	M18-Ap18028	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass
Duplicate								
Perfluoroalkane sulfonic acids (PFSAs)				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Perfluoropentanesulfonic acid (PPPeS)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Perfluoroctanesulfonic acid (PFOS)	M18-Ap18028	CP	ug/L	0.06	0.06	3.0	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSA)				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
1H.1H.2H.2H-perfluoroctanesulfonic acid (6:2 FTSA)	M18-Ap18028	CP	ug/L	< 0.05	< 0.05	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	M18-Ap18028	CP	ug/L	< 0.01	< 0.01	<1	30%	Pass

## Comments

## Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

## **Qualifier Codes/Comments**

Code	Description
C01	Leachate Fluid Key: 1 - pH 5.0; 2 - pH 2.9; 3 - pH 9.2; 4 - Reagent (DI) water; 5 - Client sample, 6 - other
N09	Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.
N11	Isotope dilution is used for calibration of each native compound for which an exact labelled analogue is available (Isotope Dilution Quantitation). The isotopically labelled analogues allow identification and recovery correction of the concentration of the associated native PFAS compounds.
N15	Where the native PFAS compound does not have labelled analogue then the quantification is made using the Extracted Internal Standard Analyte with the closest retention time to the analyte and no recovery correction has been made (Internal Standard Quantitation).

### **Authorised By**



**Glenn Jackson**  
**National Operations Manager**

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

\* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

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## Certificate of Analysis



NATA Accredited  
Accreditation Number 1261  
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing  
The results of the tests, calibrations and/or  
measurements included in this document are traceable  
to Australian/national standards.

GHD Pty Ltd NT  
Level 5, 66 Smith Street  
Darwin  
NT 0800

Attention: Daniel Elson

Report 594228-S  
Project name AISERVICES SINCLAIR CREEK AND FIVE MILE BEACH  
Project ID 3218792  
Received Date Apr 16, 2018

Client Sample ID	LOR	Unit	QQA1 Soil M18-Ap18025	QQA2 Soil M18-Ap18026
<b>Sample Matrix</b>				
<b>Eurofins   mgt Sample No.</b>				
<b>Date Sampled</b>				
Test/Reference				
<b>Perfluoroalkyl carboxylic acids (PFCAs)</b>				
Perfluorobutanoic acid (PFBA) <sup>N11</sup>	5	ug/kg	< 5	< 5
Perfluoropentanoic acid (PFPeA) <sup>N11</sup>	5	ug/kg	< 5	< 5
Perfluorohexanoic acid (PFHxA) <sup>N11</sup>	5	ug/kg	< 5	< 5
Perfluoroheptanoic acid (PFHpA) <sup>N11</sup>	5	ug/kg	< 5	< 5
Perfluorooctanoic acid (PFOA) <sup>N11</sup>	5	ug/kg	< 5	< 5
Perfluorononanoic acid (PFNA) <sup>N11</sup>	5	ug/kg	< 5	< 5
Perfluorodecanoic acid (PFDA) <sup>N11</sup>	5	ug/kg	< 5	< 5
Perfluoroundecanoic acid (PFUnDA) <sup>N11</sup>	5	ug/kg	< 5	< 5
Perfluorododecanoic acid (PFDoDA) <sup>N11</sup>	5	ug/kg	< 5	< 5
Perfluorotridecanoic acid (PFTrDA) <sup>N15</sup>	5	ug/kg	< 5	< 5
Perfluorotetradecanoic acid (PFTeDA) <sup>N11</sup>	5	ug/kg	< 5	< 5
13C4-PFBA (surr.)	1	%	48	46
13C5-PFPeA (surr.)	1	%	58	46
13C5-PFHxA (surr.)	1	%	57	55
13C4-PFHpA (surr.)	1	%	55	51
13C8-PFOA (surr.)	1	%	52	48
13C5-PFNA (surr.)	1	%	55	50
13C6-PFDA (surr.)	1	%	82	76
13C2-PFUnDA (surr.)	1	%	101	93
13C2-PFDoDA (surr.)	1	%	102	105
13C2-PFTeDA (surr.)	1	%	93	95
<b>Perfluoroalkane sulfonamido substances</b>				
Perfluorooctane sulfonamide (FOSA) <sup>N11</sup>	5	ug/kg	< 5	< 5
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA) <sup>N11</sup>	5	ug/kg	< 5	< 5
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA) <sup>N11</sup>	5	ug/kg	< 5	< 5
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE) <sup>N11</sup>	5	ug/kg	< 5	< 5
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE) <sup>N11</sup>	5	ug/kg	< 5	< 5
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA) <sup>N11</sup>	10	ug/kg	< 10	< 10
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA) <sup>N11</sup>	10	ug/kg	< 10	< 10
13C8-FOSA (surr.)	1	%	84	82
D3-N-MeFOSA (surr.)	1	%	83	88
D5-N-EtFOSA (surr.)	1	%	74	74

Client Sample ID	LOR	Unit	QQA1 Soil M18-Ap18025 Apr 11, 2018	QQA2 Soil M18-Ap18026 Apr 11, 2018
<b>Sample Matrix</b>				
<b>Eurofins   mgt Sample No.</b>				
<b>Date Sampled</b>				
Test/Reference				
<b>Perfluoroalkane sulfonamido substances</b>				
D7-N-MeFOSE (surr.)	1	%	80	78
D9-N-EtFOSE (surr.)	1	%	81	80
D5-N-EtFOSAA (surr.)	1	%	82	80
D3-N-MeFOSAA (surr.)	1	%	91	87
<b>Perfluoroalkane sulfonic acids (PFSAs)</b>				
Perfluorobutanesulfonic acid (PFBS) <sup>N11</sup>	5	ug/kg	< 5	< 5
Perfluoropentanesulfonic acid (PFPeS) <sup>N15</sup>	5	ug/kg	< 5	< 5
Perfluorohexamersulfonic acid (PFHxS) <sup>N11</sup>	5	ug/kg	< 5	< 5
Perfluoroheptanesulfonic acid (PFHpS) <sup>N15</sup>	5	ug/kg	< 5	< 5
Perfluorooctanesulfonic acid (PFOS) <sup>N11</sup>	5	ug/kg	<sup>N09</sup> 12	< 5
Perfluorodecanesulfonic acid (PFDS) <sup>N15</sup>	5	ug/kg	< 5	< 5
13C3-PFBS (surr.)	1	%	73	74
18O2-PFHxS (surr.)	1	%	73	76
13C8-PFOS (surr.)	1	%	88	93
<b>n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)</b>				
1H.1H.2H.2H-perfluorohexamersulfonic acid (4:2 FTSA) <sup>N11</sup>	5	ug/kg	< 5	< 5
1H.1H.2H.2H-perfluoroctanesulfonic acid (6:2 FTSA) <sup>N11</sup>	10	ug/kg	< 10	< 10
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA) <sup>N11</sup>	5	ug/kg	< 5	< 5
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA) <sup>N15</sup>	5	ug/kg	< 5	< 5
13C2-4:2 FTSAs (surr.)	1	%	13	11
13C2-6:2 FTSAs (surr.)	1	%	13	11
13C2-8:2 FTSAs (surr.)	1	%	37	31
<b>PFASs Summations</b>				
Sum (PFHxS + PFOS)*	5	ug/kg	12	< 5
Sum of US EPA PFAS (PFOS + PFOA)*	5	ug/kg	12	< 5
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	5	ug/kg	12	< 5
Sum of WA DER PFAS (n=10)*	10	ug/kg	12	< 10
Sum of PFASs (n=28)*	50	ug/kg	< 50	< 50
Conductivity (1:5 aqueous extract at 25°C as rec.)	10	uS/cm	2300	1400
Total Organic Carbon	0.1	%	0.3	0.2
Magnesium (exchangeable)	0.1	meq/100g	1.4	0.7
Potassium (exchangeable)	0.1	meq/100g	0.2	0.1
Sodium (exchangeable)	0.1	meq/100g	0.5	0.2
% Moisture	1	%	23	23
<b>Particle Size by Sieve analysis*</b>				
<63 Micron	0.1	% w/w	0.2	0.1
>2000 Micron	0.1	% w/w	3.8	0.8
1000-2000 Micron	0.1	% w/w	1.0	0.7
125-250 Micron	0.1	% w/w	54	80
250-500 Micron	0.1	% w/w	30	15
500-1000 Micron	0.1	% w/w	4.6	1.8
63-125 Micron	0.1	% w/w	5.6	1.4
<b>Cation Exchange Capacity</b>				
Calcium (exchangeable)	0.1	meq/100g	13	5.5

## Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.  
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Per- and Polyfluorinated Alkyl Substances (PFASs)			
Perfluoroalkyl carboxylic acids (PFCAs)	Brisbane	Apr 20, 2018	180 Day
- Method: LTM-ORG-2100 Per- and Polyfluoro Alkyl Substances (PFAS)			
Perfluoroalkane sulfonamido substances	Brisbane	Apr 20, 2018	180 Day
- Method: LTM-ORG-2100 Per- and Polyfluoro Alkyl Substances (PFAS)			
Perfluoroalkane sulfonic acids (PFSAs)	Brisbane	Apr 20, 2018	180 Day
- Method: LTM-ORG-2100 Per- and Polyfluoro Alkyl Substances (PFAS)			
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)	Brisbane	Apr 20, 2018	180 Day
- Method: LTM-ORG-2100 Per- and Polyfluoro Alkyl Substances (PFAS)			
Conductivity (1:5 aqueous extract at 25°C as rec.)	Melbourne	Apr 18, 2018	7 Day
- Method: LTM-INO-4030 Conductivity			
Magnesium (exchangeable)	Melbourne	Apr 19, 2018	180 Days
- Method: LTM-MET-3060 Cation Exchange Capacity and ESP			
Potassium (exchangeable)	Melbourne	Apr 19, 2018	180 Days
- Method: LTM-MET-3060 Cation Exchange Capacity and ESP			
Sodium (exchangeable)	Melbourne	Apr 19, 2018	180 Days
- Method: LTM-MET-3060 Cation Exchange Capacity and ESP			
Cation Exchange Capacity	Melbourne	Apr 19, 2018	180 Days
- Method: LTM-MET-3060 - Cation Exchange Capacity (CEC) & Exchangeable Sodium Percentage (ESP)			
Total Organic Carbon	Melbourne	Apr 23, 2018	28 Day
- Method: APHA 5310B Total Organic Carbon			
Particle Size by Sieve analysis*	Melbourne	Apr 18, 2018	28 Day
- Method: AS1289.C6.1-1977 Determination of Particle Size by Sieving			
% Moisture	Melbourne	Apr 17, 2018	14 Day
- Method: LTM-GEN-7080 Moisture			

<b>Company Name:</b>	GHD Pty Ltd NT	<b>Order No.:</b>	3218792	<b>Received:</b>	Apr 16, 2018 2:53 PM
<b>Address:</b>	Level 5, 66 Smith Street Darwin NT 0800	<b>Report #:</b>	594228	<b>Due:</b>	Apr 23, 2018
<b>Project Name:</b>	AISERVICES SINCLAIR CREEK AND FIVE MILE BEACH	<b>Phone:</b>	08 8982 0100	<b>Priority:</b>	5 Day
<b>Project ID:</b>	3218792	<b>Fax:</b>	08 8981 1075	<b>Contact Name:</b>	Daniel Elson
<b>Eurofins   mgt Analytical Services Manager : Michael Cassidy</b>					

### Sample Detail

Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X		
Sydney Laboratory - NATA Site # 18217											
Brisbane Laboratory - NATA Site # 20794							X		X	X	
Perth Laboratory - NATA Site # 23736											
<b>External Laboratory</b>											
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID						
1	QQA1	Apr 11, 2018	1:00PM	Soil	M18-Ap18025	X	X	X	X	X	
2	QQA2	Apr 11, 2018	1:00PM	Soil	M18-Ap18026	X	X	X	X	X	
3	QQA1	Apr 11, 2018	1:00PM	AUS Leachate	M18-Ap18027			X		X	
4	QQA2	Apr 11, 2018	1:00PM	AUS Leachate	M18-Ap18028			X		X	
5	QQA1 (WATER)	Apr 11, 2018	1:00PM	Water	M18-Ap18029						X
<b>Test Counts</b>						2	2	2	2	2	1

## Internal Quality Control Review and Glossary

### General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

### Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

**\*\*NOTE:** pH duplicates are reported as a range NOT as RPD

### Units

**mg/kg:** milligrams per kilogram

**mg/L:** milligrams per litre

**ug/L:** micrograms per litre

**ppm:** Parts per million

**ppb:** Parts per billion

**%:** Percentage

**org/100mL:** Organisms per 100 millilitres

**NTU:** Nephelometric Turbidity Units

**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

### Terms

<b>Dry</b>	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
<b>LOR</b>	Limit of Reporting.
<b>SPIKE</b>	Addition of the analyte to the sample and reported as percentage recovery.
<b>RPD</b>	Relative Percent Difference between two Duplicate pieces of analysis.
<b>LCS</b>	Laboratory Control Sample - reported as percent recovery.
<b>CRM</b>	Certified Reference Material - reported as percent recovery.
<b>Method Blank</b>	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
<b>Surr - Surrogate</b>	The addition of a like compound to the analyte target and reported as percentage recovery.
<b>Duplicate</b>	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
<b>USEPA</b>	United States Environmental Protection Agency
<b>APHA</b>	American Public Health Association
<b>TCLP</b>	Toxicity Characteristic Leaching Procedure
<b>COC</b>	Chain of Custody
<b>SRA</b>	Sample Receipt Advice
<b>QSM</b>	Quality Systems Manual ver 5.1 US Department of Defense
<b>CP</b>	Client Parent - QC was performed on samples pertaining to this report
<b>NCP</b>	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
<b>TEQ</b>	Toxic Equivalency Quotient

### QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

### QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

**Quality Control Results**

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
<b>Method Blank</b>							
<b>Perfluoroalkyl carboxylic acids (PFCAs)</b>							
Perfluorobutanoic acid (PFBA)	ug/kg	< 5			5	Pass	
Perfluoropentanoic acid (PFPeA)	ug/kg	< 5			5	Pass	
Perfluorohexanoic acid (PFHxA)	ug/kg	< 5			5	Pass	
Perfluoroheptanoic acid (PFHpA)	ug/kg	< 5			5	Pass	
Perfluoroctanoic acid (PFOA)	ug/kg	< 5			5	Pass	
Perfluorononanoic acid (PFNA)	ug/kg	< 5			5	Pass	
Perfluorodecanoic acid (PFDA)	ug/kg	< 5			5	Pass	
Perfluoroundecanoic acid (PFUnDA)	ug/kg	< 5			5	Pass	
Perfluorododecanoic acid (PFDODA)	ug/kg	< 5			5	Pass	
Perfluorotridecanoic acid (PFTrDA)	ug/kg	< 5			5	Pass	
Perfluorotetradecanoic acid (PFTeDA)	ug/kg	< 5			5	Pass	
<b>Method Blank</b>							
<b>Perfluoroalkane sulfonamido substances</b>							
Perfluoroctane sulfonamide (FOSA)	ug/kg	< 5			5	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	ug/kg	< 5			5	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	ug/kg	< 5			5	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	ug/kg	< 5			5	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	ug/kg	< 5			5	Pass	
N-ethyl-perfluoroctanesulfonamidoacetic acid (N-EtFOSAA)	ug/kg	< 10			10	Pass	
N-methyl-perfluoroctanesulfonamidoacetic acid (N-MeFOSAA)	ug/kg	< 10			10	Pass	
<b>Method Blank</b>							
<b>Perfluoroalkane sulfonic acids (PFSAs)</b>							
Perfluorobutanesulfonic acid (PFBS)	ug/kg	< 5			5	Pass	
Perfluoropentanesulfonic acid (PFPeS)	ug/kg	< 5			5	Pass	
Perfluorohexanesulfonic acid (PFHxS)	ug/kg	< 5			5	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	ug/kg	< 5			5	Pass	
Perfluoroctanesulfonic acid (PFOS)	ug/kg	< 5			5	Pass	
Perfluorodecanesulfonic acid (PFDS)	ug/kg	< 5			5	Pass	
<b>Method Blank</b>							
<b>n:2 Fluorotelomer sulfonic acids (n:2 FTSA)</b>							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	ug/kg	< 5			5	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	ug/kg	< 10			10	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	ug/kg	< 5			5	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	ug/kg	< 5			5	Pass	
<b>Method Blank</b>							
Conductivity (1:5 aqueous extract at 25°C as rec.)	uS/cm	< 10			10	Pass	
Total Organic Carbon	%	< 0.1			0.1	Pass	
Magnesium (exchangeable)	meq/100g	< 0.1			0.1	Pass	
Potassium (exchangeable)	meq/100g	< 0.1			0.1	Pass	
Sodium (exchangeable)	meq/100g	< 0.1			0.1	Pass	
<b>Method Blank</b>							
<b>Cation Exchange Capacity</b>							
Calcium (exchangeable)	meq/100g	< 0.1			0.1	Pass	
<b>LCS - % Recovery</b>							
<b>Perfluoroalkyl carboxylic acids (PFCAs)</b>							
Perfluorobutanoic acid (PFBA)	%	102			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	%	114			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	%	97			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	%	100			50-150	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code	
Perfluorooctanoic acid (PFOA)	%	103			50-150	Pass		
Perfluorononanoic acid (PFNA)	%	102			50-150	Pass		
Perfluorodecanoic acid (PFDA)	%	101			50-150	Pass		
Perfluoroundecanoic acid (PFUnDA)	%	101			50-150	Pass		
Perfluorododecanoic acid (PFDoDA)	%	100			50-150	Pass		
Perfluorotridecanoic acid (PFTrDA)	%	84			50-150	Pass		
Perfluorotetradecanoic acid (PFTeDA)	%	99			50-150	Pass		
<b>LCS - % Recovery</b>								
<b>Perfluoroalkane sulfonamido substances</b>								
Perfluorooctane sulfonamide (FOSA)	%	95			50-150	Pass		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	%	111			50-150	Pass		
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	%	107			50-150	Pass		
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	%	101			50-150	Pass		
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	%	97			50-150	Pass		
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	%	102			50-150	Pass		
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	%	102			50-150	Pass		
<b>LCS - % Recovery</b>								
<b>Perfluoroalkane sulfonic acids (PFSAs)</b>								
Perfluorobutanesulfonic acid (PFBS)	%	98			50-150	Pass		
Perfluoropentanesulfonic acid (PPPeS)	%	111			50-150	Pass		
Perfluorohexanesulfonic acid (PFHxS)	%	98			50-150	Pass		
Perfluorohexamersulfonic acid (PFHpS)	%	100			50-150	Pass		
Perfluorooctanesulfonic acid (PFOS)	%	101			50-150	Pass		
Perfluorodecanesulfonic acid (PFDS)	%	72			50-150	Pass		
<b>LCS - % Recovery</b>								
<b>n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)</b>								
1H.1H.2H.2H-perfluorohexamersulfonic acid (4:2 FTSA)	%	100			50-150	Pass		
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	%	104			50-150	Pass		
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	%	94			50-150	Pass		
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	%	91			50-150	Pass		
<b>LCS - % Recovery</b>								
Total Organic Carbon	%	99			70-130	Pass		
Test	Lab Sample ID	QA Source	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
<b>Spike - % Recovery</b>								
<b>Perfluoroalkyl carboxylic acids (PFCAs)</b>				Result 1				
Perfluorobutanoic acid (PFBA)	B18-Ap18200	NCP	%	103			50-150	Pass
Perfluoropentanoic acid (PPPeA)	B18-Ap18200	NCP	%	103			50-150	Pass
Perfluorohexanoic acid (PFHxA)	B18-Ap18200	NCP	%	99			50-150	Pass
Perfluorohexamersulfonic acid (PFHpA)	B18-Ap18200	NCP	%	101			50-150	Pass
Perfluorooctanoic acid (PFOA)	B18-Ap18200	NCP	%	103			50-150	Pass
Perfluorononanoic acid (PFNA)	B18-Ap18200	NCP	%	105			50-150	Pass
Perfluorodecanoic acid (PFDA)	B18-Ap18200	NCP	%	104			50-150	Pass
Perfluoroundecanoic acid (PFUnDA)	B18-Ap18200	NCP	%	102			50-150	Pass
Perfluorododecanoic acid (PFDoDA)	B18-Ap18200	NCP	%	99			50-150	Pass
Perfluorotridecanoic acid (PFTrDA)	B18-Ap18200	NCP	%	79			50-150	Pass
Perfluorotetradecanoic acid (PFTeDA)	B18-Ap18200	NCP	%	103			50-150	Pass
<b>Spike - % Recovery</b>								
<b>Perfluoroalkane sulfonamido substances</b>				Result 1				
Perfluorooctane sulfonamide (FOSA)	B18-Ap18200	NCP	%	95			50-150	Pass

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	B18-Ap18200	NCP	%	104			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	B18-Ap18200	NCP	%	97			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	B18-Ap18200	NCP	%	94			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	B18-Ap18200	NCP	%	97			50-150	Pass	
N-ethyl-perfluoroctanesulfonamidoacetic acid (N-EtFOSAA)	B18-Ap18200	NCP	%	102			50-150	Pass	
N-methyl-perfluoroctanesulfonamidoacetic acid (N-MeFOSAA)	B18-Ap18200	NCP	%	102			50-150	Pass	
<b>Spike - % Recovery</b>									
<b>Perfluoroalkane sulfonic acids (PFSAs)</b>					Result 1				
Perfluorobutanesulfonic acid (PFBS)	B18-Ap18200	NCP	%	102			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)	B18-Ap18200	NCP	%	112			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	B18-Ap18200	NCP	%	99			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	B18-Ap18200	NCP	%	101			50-150	Pass	
Perfluoroctanesulfonic acid (PFOS)	B18-Ap18200	NCP	%	103			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	B18-Ap18200	NCP	%	70			50-150	Pass	
<b>Spike - % Recovery</b>									
<b>n:2 Fluorotelomer sulfonic acids (n:2 FTSA)</b>					Result 1				
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	B18-Ap18200	NCP	%	95			50-150	Pass	
1H.1H.2H.2H-perfluoroctanesulfonic acid (6:2 FTSA)	B18-Ap18200	NCP	%	112			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	B18-Ap18200	NCP	%	93			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	B18-Ap18200	NCP	%	82			50-150	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
<b>Duplicate</b>									
<b>Perfluoroalkyl carboxylic acids (PFCAs)</b>					Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoropentanoic acid (PFPeA)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorohexanoic acid (PFHxA)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoroheptanoic acid (PFHpA)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoroctanoic acid (PFOA)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorononanoic acid (PFNA)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorodecanoic acid (PFDA)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoroundecanoic acid (PFUnDA)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorododecanoic acid (PFDaDA)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorotridecanoic acid (PFTrDA)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorotetradecanoic acid (PFTeDA)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass	

Duplicate								
Perfluoroalkane sulfonamido substances				Result 1	Result 2	RPD		
Perfluoroctane sulfonamide (FOSA)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass
N-ethyl-perfluoroctanesulfonamidoacetic acid (N-EtFOSAA)	S18-Ap17100	NCP	ug/kg	< 10	< 10	<1	30%	Pass
N-methyl-perfluoroctanesulfonamidoacetic acid (N-MeFOSAA)	S18-Ap17100	NCP	ug/kg	< 10	< 10	<1	30%	Pass
Duplicate								
Perfluoroalkane sulfonic acids (PFSAs)				Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass
Perfluoropentanesulfonic acid (PFPeS)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass
Perfluorohexanesulfonic acid (PFHxS)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass
Perfluoroheptanesulfonic acid (PFHpS)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass
Perfluoroctanesulfonic acid (PFOS)	S18-Ap17100	NCP	ug/kg	5.3	5.5	4.0	30%	Pass
Perfluorodecanesulfonic acid (PFDS)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass
1H.1H.2H.2H-perfluoroctanesulfonic acid (6:2 FTSA)	S18-Ap17100	NCP	ug/kg	< 10	< 10	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	S18-Ap17100	NCP	ug/kg	< 5	< 5	<1	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
Conductivity (1:5 aqueous extract at 25°C as rec.)	S18-Ap16676	NCP	uS/cm	390	400	1.6	30%	Pass
Total Organic Carbon	S18-Ap16557	NCP	%	3.9	3.8	3.9	30%	Pass
% Moisture	M18-Ap17848	NCP	%	18	18	2.0	30%	Pass

## Comments

### Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

### Qualifier Codes/Comments

Code	Description
N09	Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.
N11	Isotope dilution is used for calibration of each native compound for which an exact labelled analogue is available (Isotope Dilution Quantitation). The isotopically labelled analogues allow identification and recovery correction of the concentration of the associated native PFAS compounds.
N15	Where the native PFAS compound does not have labelled analogue then the quantification is made using the Extracted Internal Standard Analyte with the closest retention time to the analyte and no recovery correction has been made (Internal Standard Quantitation).

### Authorised By

Michael Cassidy	Analytical Services Manager
Alex Petridis	Senior Analyst-Metal (VIC)
Jonathon Angell	Senior Analyst-Organic (QLD)
Michael Brancati	Senior Analyst-Inorganic (VIC)



**Glenn Jackson**

**National Operations Manager**

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

\* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

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## Certificate of Analysis



NATA Accredited  
Accreditation Number 1261  
Site Number 1254

Accredited for compliance with ISO/IEC 17025 – Testing  
The results of the tests, calibrations and/or  
measurements included in this document are traceable  
to Australian/national standards.

GHD Pty Ltd NT  
Level 5, 66 Smith Street  
Darwin  
NT 0800

Attention: Don Rockliff

Report 594228-W-V2  
Project name AISERVICES SINCLAIR CREEK AND FIVE MILE BEACH  
Project ID 3218792  
Received Date Apr 16, 2018

<b>Client Sample ID</b>			<b>QQA1 (WATER)</b>
<b>Sample Matrix</b>			<b>Water</b>
<b>Eurofins   mgt Sample No.</b>			<b>M18-Ap18029</b>
<b>Date Sampled</b>			<b>Apr 11, 2018</b>
Test/Reference	LOR	Unit	
<b>PFASs Summations</b>			
Sum (PFHxS + PFOS)*	0.001	ug/L	7.2
Sum of US EPA PFAS (PFOS + PFOA)*	0.001	ug/L	6.467
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	0.001	ug/L	7.267
Sum of WA DER PFAS (n=10)*	0.005	ug/L	7.589
Sum of PFASs (n=28)*	0.005	ug/L	7.966
<b>Perfluoroalkyl carboxylic acids (PFCAs) - Trace</b>			
Perfluorobutanoic acid (PFBA) <sup>N11</sup>	0.005	ug/L	0.028
Perfluoropentanoic acid (PFPeA) <sup>N11</sup>	0.001	ug/L	N0 <sup>9</sup> 0.033
Perfluorohexanoic acid (PFHxA) <sup>N11</sup>	0.001	ug/L	N0 <sup>9</sup> 0.15
Perfluoroheptanoic acid (PFHpA) <sup>N11</sup>	0.001	ug/L	N0 <sup>9</sup> 0.026
Perfluorooctanoic acid (PFOA) <sup>N11</sup>	0.001	ug/L	N0 <sup>9</sup> 0.067
Perfluorononanoic acid (PFNA) <sup>N11</sup>	0.001	ug/L	N0 <sup>9</sup> 0.007
Perfluorodecanoic acid (PFDA) <sup>N11</sup>	0.001	ug/L	N0 <sup>9</sup> 0.004
Perfluoroundecanoic acid (PFUnDA) <sup>N11</sup>	0.001	ug/L	0.001
Perfluorododecanoic acid (PFDDoDA) <sup>N11</sup>	0.001	ug/L	< 0.001
Perfluorotridecanoic acid (PFTrDA) <sup>N15</sup>	0.001	ug/L	< 0.001
Perfluorotetradecanoic acid (PFTeDA) <sup>N11</sup>	0.001	ug/L	< 0.001
13C4-PFBA (surr.)	1	%	23
13C5-PFPeA (surr.)	1	%	48
13C5-PFHxA (surr.)	1	%	50
13C4-PFHpA (surr.)	1	%	64
13C8-PFOA (surr.)	1	%	63
13C5-PFNA (surr.)	1	%	67
13C6-PFDA (surr.)	1	%	35
13C2-PFUnDA (surr.)	1	%	57
13C2-PFDDoDA (surr.)	1	%	56
13C2-PFTeDA (surr.)	1	%	36
<b>Perfluoroalkyl sulfonic acids (PFSAs)- Trace</b>			
Perfluorobutanesulfonic acid (PFBS) <sup>N11</sup>	0.001	ug/L	N0 <sup>9</sup> 0.085
Perfluoropentanesulfonic acid (PFPeS) <sup>N15</sup>	0.001	ug/L	N0 <sup>9</sup> 0.27
Perfluorohexanesulfonic acid (PFHxS) <sup>N11</sup>	0.001	ug/L	N0 <sup>9</sup> 0.80
Perfluoroheptanesulfonic acid (PFHpS) <sup>N15</sup>	0.001	ug/L	N0 <sup>9</sup> 0.095
Perfluorooctanesulfonic acid (PFOS) <sup>N11</sup>	0.001	ug/L	N0 <sup>9</sup> 6.4
Perfluorodecanesulfonic acid (PFDS) <sup>N15</sup>	0.001	ug/L	< 0.001
13C3-PFBS (surr.)	1	%	66

<b>Client Sample ID</b>			<b>QQA1 (WATER)</b>
<b>Sample Matrix</b>			<b>Water</b>
<b>Eurofins   mgt Sample No.</b>			<b>M18-Ap18029</b>
<b>Date Sampled</b>			<b>Apr 11, 2018</b>
Test/Reference	LOR	Unit	
<b>Perfluoroalkyl sulfonic acids (PFSAs)- Trace</b>			
18O2-PFHxS (surr.)	1	%	76
13C8-PFOS (surr.)	1	%	56
<b>Perfluoroalkyl sulfonamido substances- Trace</b>			
Perfluorooctane sulfonamide (FOSA) <sup>N11</sup>	0.002	ug/L	< 0.002
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA) <sup>N11</sup>	0.002	ug/L	< 0.002
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA) <sup>N11</sup>	0.002	ug/L	< 0.002
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE) <sup>N11</sup>	0.002	ug/L	< 0.002
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE) <sup>N11</sup>	0.002	ug/L	< 0.002
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA) <sup>N11</sup>	0.002	ug/L	< 0.002
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA) <sup>N11</sup>	0.002	ug/L	< 0.002
13C8-FOSA (surr.)	1	%	49
D3-N-MeFOSA (surr.)	1	%	34
D5-N-EtFOSA (surr.)	1	%	39
D7-N-MeFOSE (surr.)	1	%	26
D9-N-EtFOSE (surr.)	1	%	25
D5-N-EtFOSAA (surr.)	1	%	68
D3-N-MeFOSAA (surr.)	1	%	54
<b>n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace</b>			
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA) <sup>N11</sup>	0.001	ug/L	< 0.001
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA) <sup>N11</sup>	0.005	ug/L	< 0.005
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA) <sup>N11</sup>	0.001	ug/L	< 0.001
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA) <sup>N15</sup>	0.001	ug/L	< 0.001
13C2-4:2 FTSA (surr.)	1	%	81
13C2-6:2 FTSA (surr.)	1	%	74
13C2-8:2 FTSA (surr.)	1	%	58

## Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.

A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Per- and Polyfluoroalkyl Substances (PFASs) - Trace			
Perfluoroalkyl carboxylic acids (PFCAs) - Trace	Brisbane	Apr 23, 2018	14 Day
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluoroalkyl sulfonic acids (PFSAs)- Trace	Brisbane	Apr 23, 2018	14 Day
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluoroalkyl sulfonamido substances- Trace	Brisbane	Apr 23, 2018	14 Day
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace	Brisbane	Apr 23, 2018	14 Day
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			

<b>Company Name:</b>	GHD Pty Ltd NT	<b>Order No.:</b>	3218792	<b>Received:</b>	Apr 16, 2018 2:53 PM
<b>Address:</b>	Level 5, 66 Smith Street Darwin NT 0800	<b>Report #:</b>	594228	<b>Due:</b>	Apr 23, 2018
<b>Project Name:</b>	AISERVICES SINCLAIR CREEK AND FIVE MILE BEACH	<b>Phone:</b>	08 8982 0100	<b>Priority:</b>	5 Day
<b>Project ID:</b>	3218792	<b>Fax:</b>	08 8981 1075	<b>Contact Name:</b>	Daniel Elson
<b>Eurofins   mgt Analytical Services Manager : Michael Cassidy</b>					

### Sample Detail

**Melbourne Laboratory - NATA Site # 1254 & 14271**

**Sydney Laboratory - NATA Site # 18217**

**Brisbane Laboratory - NATA Site # 20794**

**Perth Laboratory - NATA Site # 23736**

**External Laboratory**

No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID							
1	QQA1	Apr 11, 2018	1:00PM	Soil	M18-Ap18025	X	X		X	X	X	
2	QQA2	Apr 11, 2018	1:00PM	Soil	M18-Ap18026	X	X		X	X	X	
3	QQA1	Apr 11, 2018	1:00PM	AUS Leachate	M18-Ap18027			X			X	
4	QQA2	Apr 11, 2018	1:00PM	AUS Leachate	M18-Ap18028			X			X	
5	QQA1 (WATER)	Apr 11, 2018	1:00PM	Water	M18-Ap18029							X
<b>Test Counts</b>						2	2	2	2	2	4	1

## Internal Quality Control Review and Glossary

### General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

### Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

**\*\*NOTE:** pH duplicates are reported as a range NOT as RPD

### Units

**mg/kg:** milligrams per kilogram

**mg/L:** milligrams per litre

**ug/L:** micrograms per litre

**ppm:** Parts per million

**ppb:** Parts per billion

**%:** Percentage

**org/100mL:** Organisms per 100 millilitres

**NTU:** Nephelometric Turbidity Units

**MPN/100mL:** Most Probable Number of organisms per 100 millilitres

### Terms

<b>Dry</b>	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
<b>LOR</b>	Limit of Reporting.
<b>SPIKE</b>	Addition of the analyte to the sample and reported as percentage recovery.
<b>RPD</b>	Relative Percent Difference between two Duplicate pieces of analysis.
<b>LCS</b>	Laboratory Control Sample - reported as percent recovery.
<b>CRM</b>	Certified Reference Material - reported as percent recovery.
<b>Method Blank</b>	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
<b>Surr - Surrogate</b>	The addition of a like compound to the analyte target and reported as percentage recovery.
<b>Duplicate</b>	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
<b>USEPA</b>	United States Environmental Protection Agency
<b>APHA</b>	American Public Health Association
<b>TCLP</b>	Toxicity Characteristic Leaching Procedure
<b>COC</b>	Chain of Custody
<b>SRA</b>	Sample Receipt Advice
<b>QSM</b>	Quality Systems Manual ver 5.1 US Department of Defense
<b>CP</b>	Client Parent - QC was performed on samples pertaining to this report
<b>NCP</b>	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
<b>TEQ</b>	Toxic Equivalency Quotient

### QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.1 where no positive PFAS results have been reported have been reviewed and no data was affected.

### QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

**Quality Control Results**

Test	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
<b>Method Blank</b>						
<b>Perfluoroalkyl carboxylic acids (PFCAs) - Trace</b>						
Perfluorobutanoic acid (PFBA)	ug/L	< 0.005		0.005	Pass	
Perfluoropentanoic acid (PFPeA)	ug/L	< 0.001		0.001	Pass	
Perfluorohexanoic acid (PFHxA)	ug/L	< 0.001		0.001	Pass	
Perfluoroheptanoic acid (PFHpA)	ug/L	< 0.001		0.001	Pass	
Perfluoroctanoic acid (PFOA)	ug/L	< 0.001		0.001	Pass	
Perfluorononanoic acid (PFNA)	ug/L	< 0.001		0.001	Pass	
Perfluorodecanoic acid (PFDA)	ug/L	< 0.001		0.001	Pass	
Perfluoroundecanoic acid (PFUnDA)	ug/L	< 0.001		0.001	Pass	
Perfluorododecanoic acid (PFDoDA)	ug/L	< 0.001		0.001	Pass	
Perfluorotridecanoic acid (PFTrDA)	ug/L	< 0.001		0.001	Pass	
Perfluorotetradecanoic acid (PFTeDA)	ug/L	< 0.001		0.001	Pass	
<b>Method Blank</b>						
<b>Perfluoroalkyl sulfonic acids (PFSAs)- Trace</b>						
Perfluorobutanesulfonic acid (PFBS)	ug/L	< 0.001		0.001	Pass	
Perfluoropentanesulfonic acid (PFPeS)	ug/L	< 0.001		0.001	Pass	
Perfluorohexanesulfonic acid (PFHxS)	ug/L	< 0.001		0.001	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	ug/L	< 0.001		0.001	Pass	
Perfluoroctanesulfonic acid (PFOS)	ug/L	< 0.001		0.001	Pass	
Perfluorodecanesulfonic acid (PFDS)	ug/L	< 0.001		0.001	Pass	
<b>Method Blank</b>						
<b>Perfluoroalkyl sulfonamido substances- Trace</b>						
Perfluoroctane sulfonamide (FOSA)	ug/L	< 0.002		0.002	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	ug/L	< 0.002		0.002	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	ug/L	< 0.002		0.002	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	ug/L	< 0.002		0.002	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	ug/L	< 0.002		0.002	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ug/L	< 0.002		0.002	Pass	
N-methyl-perfluoroctanesulfonamidoacetic acid (N-MeFOSAA)	ug/L	< 0.002		0.002	Pass	
<b>Method Blank</b>						
<b>n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace</b>						
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	ug/L	< 0.001		0.001	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	ug/L	< 0.005		0.005	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	ug/L	< 0.001		0.001	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	ug/L	< 0.001		0.001	Pass	
<b>LCS - % Recovery</b>						
<b>Perfluoroalkyl carboxylic acids (PFCAs) - Trace</b>						
Perfluorobutanoic acid (PFBA)	%	107		50-150	Pass	
Perfluoropentanoic acid (PFPeA)	%	94		50-150	Pass	
Perfluorohexanoic acid (PFHxA)	%	98		50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	%	99		50-150	Pass	
Perfluoroctanoic acid (PFOA)	%	98		50-150	Pass	
Perfluorononanoic acid (PFNA)	%	96		50-150	Pass	
Perfluorodecanoic acid (PFDA)	%	94		50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	%	95		50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	%	95		50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	%	91		50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	%	94		50-150	Pass	
<b>LCS - % Recovery</b>						
<b>Perfluoroalkyl sulfonic acids (PFSAs)- Trace</b>						

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code	
Perfluorobutanesulfonic acid (PFBS)	%	101			50-150	Pass		
Perfluoropentanesulfonic acid (PFPeS)	%	88			50-150	Pass		
Perfluorohexanesulfonic acid (PFHxS)	%	96			50-150	Pass		
Perfluoroheptanesulfonic acid (PFHpS)	%	104			50-150	Pass		
Perfluoroctanesulfonic acid (PFOS)	%	96			50-150	Pass		
Perfluorodecanesulfonic acid (PFDS)	%	79			50-150	Pass		
<b>LCS - % Recovery</b>								
<b>Perfluoroalkyl sulfonamido substances- Trace</b>								
Perfluoroctane sulfonamide (FOSA)	%	97			50-150	Pass		
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	%	96			50-150	Pass		
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	%	91			50-150	Pass		
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	%	102			50-150	Pass		
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	%	91			50-150	Pass		
N-ethyl-perfluoroctanesulfonamidoacetic acid (N-EtFOSAA)	%	98			50-150	Pass		
N-methyl-perfluoroctanesulfonamidoacetic acid (N-MeFOSAA)	%	95			50-150	Pass		
<b>LCS - % Recovery</b>								
<b>n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace</b>								
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	%	105			50-150	Pass		
1H.1H.2H.2H-perfluoroctanesulfonic acid (6:2 FTSA)	%	97			50-150	Pass		
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	%	86			50-150	Pass		
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	%	72			50-150	Pass		
Test	Lab Sample ID	QA Source	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
<b>Spike - % Recovery</b>								
<b>Perfluoroalkyl carboxylic acids (PFCAs) - Trace</b>								
Perfluorobutanoic acid (PFBA)	S18-Ap16564	NCP	%	102			50-150	Pass
Perfluoropentanoic acid (PFPeA)	S18-Ap16564	NCP	%	93			50-150	Pass
Perfluorohexanoic acid (PFHxA)	S18-Ap16564	NCP	%	102			50-150	Pass
Perfluoroheptanoic acid (PFHpA)	S18-Ap16564	NCP	%	101			50-150	Pass
Perfluoroctanoic acid (PFOA)	S18-Ap16564	NCP	%	99			50-150	Pass
Perfluorononanoic acid (PFNA)	S18-Ap16564	NCP	%	97			50-150	Pass
Perfluorodecanoic acid (PFDA)	S18-Ap16564	NCP	%	92			50-150	Pass
Perfluoroundecanoic acid (PFUnDA)	S18-Ap16564	NCP	%	89			50-150	Pass
Perfluorododecanoic acid (PFDoDA)	S18-Ap16564	NCP	%	91			50-150	Pass
Perfluorotridecanoic acid (PFTrDA)	S18-Ap16564	NCP	%	85			50-150	Pass
Perfluorotetradecanoic acid (PFTeDA)	S18-Ap16564	NCP	%	84			50-150	Pass
<b>Spike - % Recovery</b>								
<b>Perfluoroalkyl sulfonic acids (PFSAs)- Trace</b>								
Perfluorobutanesulfonic acid (PFBS)	S18-Ap16564	NCP	%	106			50-150	Pass
Perfluoropentanesulfonic acid (PFPeS)	S18-Ap16564	NCP	%	107			50-150	Pass
Perfluorohexanesulfonic acid (PFHxS)	A18-Ap16703	NCP	%	88			50-150	Pass
Perfluoroheptanesulfonic acid (PFHpS)	S18-Ap16564	NCP	%	101			50-150	Pass
Perfluoroctanesulfonic acid (PFOS)	A18-Ap16703	NCP	%	92			50-150	Pass
Perfluorodecanesulfonic acid (PFDS)	S18-Ap16564	NCP	%	58			50-150	Pass
<b>Spike - % Recovery</b>								
<b>Perfluoroalkyl sulfonamido substances- Trace</b>								
Perfluoroctane sulfonamide (FOSA)	S18-Ap16564	NCP	%	96			50-150	Pass

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	S18-Ap16564	NCP	%	85			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	S18-Ap16564	NCP	%	89			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	S18-Ap16564	NCP	%	87			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	S18-Ap16564	NCP	%	85			50-150	Pass	
N-ethyl-perfluoroctanesulfonamidoacetic acid (N-EtFOSAA)	S18-Ap16564	NCP	%	86			50-150	Pass	
N-methyl-perfluoroctanesulfonamidoacetic acid (N-MeFOSAA)	S18-Ap16564	NCP	%	89			50-150	Pass	
<b>Spike - % Recovery</b>									
<b>n:2 Fluorotelomer sulfonic acids (n:2 FTSA)- Trace</b>					Result 1				
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	S18-Ap16564	NCP	%	107			50-150	Pass	
1H.1H.2H.2H-perfluoroctanesulfonic acid (6:2 FTSA)	S18-Ap16564	NCP	%	96			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	S18-Ap16564	NCP	%	80			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	S18-Ap16564	NCP	%	66			50-150	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
<b>Duplicate</b>									
<b>Perfluoroalkyl carboxylic acids (PFCAs) - Trace</b>					Result 1	Result 2	RPD		
Perfluorobutanoic acid (PFBA)	S18-Ap16563	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass	
Perfluoropentanoic acid (PFPeA)	S18-Ap16563	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorohexanoic acid (PFHxA)	S18-Ap16563	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluoroheptanoic acid (PFHpA)	S18-Ap16563	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluoroctanoic acid (PFOA)	S18-Ap16563	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorononanoic acid (PFNA)	S18-Ap16563	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorodecanoic acid (PFDA)	S18-Ap16563	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluoroundecanoic acid (PFUnDA)	S18-Ap16563	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorododecanoic acid (PFDDoDA)	S18-Ap16563	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorotridecanoic acid (PFTrDA)	S18-Ap16563	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorotetradecanoic acid (PFTeDA)	S18-Ap16563	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
<b>Duplicate</b>									
<b>Perfluoroalkyl sulfonic acids (PFSAs)- Trace</b>					Result 1	Result 2	RPD		
Perfluorobutanesulfonic acid (PFBS)	S18-Ap16563	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluoropentanesulfonic acid (PFPeS)	S18-Ap16563	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorohexanesulfonic acid (PFHxS)	A18-Ap16702	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	S18-Ap16563	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluoroctanesulfonic acid (PFOS)	A18-Ap16702	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	
Perfluorodecanesulfonic acid (PFDS)	S18-Ap16563	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass	

Duplicate								
Perfluoroalkyl sulfonamido substances- Trace				Result 1	Result 2	RPD		
Perfluoroctane sulfonamide (FOSA)	S18-Ap16563	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	S18-Ap16563	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	S18-Ap16563	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	S18-Ap16563	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	S18-Ap16563	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass
N-ethyl-perfluoroctanesulfonamidoacetic acid (N-EtFOSAA)	S18-Ap16563	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass
N-methyl-perfluoroctanesulfonamidoacetic acid (N-MeFOSAA)	S18-Ap16563	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass
Duplicate								
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)- Trace				Result 1	Result 2	RPD		
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	S18-Ap16563	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass
1H.1H.2H.2H-perfluoroctanesulfonic acid (6:2 FTSA)	S18-Ap16563	NCP	ug/L	< 0.05	< 0.05	<1	30%	Pass
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	S18-Ap16563	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	S18-Ap16563	NCP	ug/L	< 0.01	< 0.01	<1	30%	Pass

## Comments

V2: PFAS Low Level

## Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

## Qualifier Codes/Comments

Code	Description
N09	Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.
N11	Isotope dilution is used for calibration of each native compound for which an exact labelled analogue is available (Isotope Dilution Quantitation). The isotopically labelled analogues allow identification and recovery correction of the concentration of the associated native PFAS compounds.
N15	Where the native PFAS compound does not have labelled analogue then the quantification is made using the Extracted Internal Standard Analyte with the closest retention time to the analyte and no recovery correction has been made (Internal Standard Quantitation).

## Authorised By

Michael Cassidy	Analytical Services Manager
Jonathon Angell	Senior Analyst-Organic (QLD)



**Glenn Jackson**

**National Operations Manager**

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

\* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please [click here](#).

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## Appendix G – Sampling and Analysis Plan



Airservices Australia  
Hobart Airport Targeted Biota Sampling  
Sampling Analysis and Quality Plan

April 2018

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# 1. Introduction

## 1.1 Overview

GHD Pty Ltd (GHD) were engaged by Air Services Australia (Air Services) to undertake an environmental investigation of an area that may have been affected by the historical use of aqueous film forming foam (AFFF) containing perfluoroalkyl and polyfluoroalkyl substances (PFAS) near the Hobart International Airport (the Airport). The investigation is centred on Sinclair Creek and its' downstream receiving environment, Five Mile Beach.

This report is the sampling analysis and quality plan (SAQP) for the investigation. It comprises a summary of the existing site information and a detailed program of on-site sediment, surface water and biota sampling and analysis.

The purpose of this SAQP is to outline the proposed sampling design and methodologies forming a reference document for both GHD staff and Air Services throughout the investigation.

## 1.2 Background

AFFF has been used for fire-fighting purposes around Australia for several decades. Depending on the type of AFFF used, the principal PFAS constituents (as active or by-product ingredients) may have included a range of contaminants of potential concern including perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA) and fluorotelomers such as 6:2 fluorotelomer sulfonate (6:2FtS) and 8:2 fluorotelomer sulfonate (8:2FtS). The historical use of PFAS has resulted in contamination of soil, groundwater, sediments, surface water and infrastructure. While the risks to human health and the environment are still the subject of much research, PFAS compounds are highly persistent in the environment, can bio-accumulate, and may be harmful to animal and human health.

The focus of this investigation is to undertake a comprehensive investigation of PFAS conditions at the investigation site, with a focus on human health risks.

## 1.3 Investigation Objectives and Rationale

The objectives of this investigation are start to respond to the key findings of a previous investigation:

- SEMF (2017) Hobart Airport – Aviation Rescue Fire Fighting Services Preliminary Site Investigation. Report for Airservices Australia dated 31 October 2017, Project: 2105.022

SEMF (2017) identified elevated PFAS in surface water in a number of locations along Sinclair Creek within the Airport boundary and off-site at the mouth of the creek as it enters Five Mile Beach.

In particular this SAQP is to provide initial assessment (as an interim priority) of the primary human health risk exposure scenarios (of PFAS) in the immediate investigation area (Sinclair Creek and Five Mile Beach). This is primarily associated with potential biota consumption (i.e. shellfish and finfish) and recreational exposure scenarios (i.e. ingestion).

The work is being conducted in the context that Sinclair Creek and Five Mile Beach are considered to be the primary pathway for PFAS leaving the site at this time. Potential pathways on site other than Sinclair Creek, and a broader range of potential receptors will be addressed in a subsequent broader body of work to be conducted after completion of this stage of works (i.e. a future Detailed Site Investigation).

The work is also being conducted in the context that at the time of reporting, Tasmanian Government Agencies were in the process of reviewing an appropriate investigation response to issues of potential PFAS impact from various sources in the broader Pitt Water area.

#### 1.4 Limitations

*This report: has been prepared by GHD for Airservices Australia and may only be used and relied on by Airservices Australia for the purpose agreed between GHD and the Airservices Australia as mentioned in Section 1.3 of this report.*

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

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## 2. Environmental Settings

### 2.1 Sinclair Creek

Sinclair Creek commences as a narrow drainage line to the west of the Airport. The creek passes through several culverts within the Airport property before passing through a drainage system under the main runway, emerging to the east of the runway and continuing off site towards Five Mile Beach.

On the eastern side of the Airport the creek passes through Commonwealth land (the Airport) into a single private freehold parcel just prior to the creek's junction with Pittwater Road. The creek then passes through the freehold parcel and discharges into Five Mile Beach.

Sinclair Creek is mapped as Succulent saline hermland (ASS) under TASVEG 3.0 from the runway area on the eastern side of the Airport to Five Mile Beach. The creek is estuarine in nature, transitioning from tidal influenced marine waters from the Five Mile Beach mouth to freshwater from the airport direction. Flow in the creek is subject to discharge from the Taswater Water Water Treatment Plant, as well as run-off flow from rain events, with the lower section subject to tidal influence from Five Mile Beach.

Geology of the creek and surrounds is classified as Undifferentiated Quaternary Sediments. A small area adjacent to where the creek crosses under Pittwater Road is listed as potential acid sulphate soils, with a high probability of occurrence (>70%) (the LIST).

### 2.2 Five Mile Beach

Five Mile Beach is adjacent to the Pitt Water area and commences south of Pittwater Bluff. It extends to the east along a spit towards the Pitt Water mouth, meeting Seven Mile Beach, which runs on the south facing side of the sandy spit. Offshore from Five Mile beach is Woody Island, a small rocky island in the middle of Pitt Water bay.

Several major freshwater sources input into Pitt Water, including Coal River, Iron Creek, and Orielton Rivulet. Pitt Water has a narrow (~500 m) ocean inlet at Sandy Point at the end of Five Mile Beach; significant tidal currents flow through the entrance.

The marine environment out from Five Mile Beach is relatively shallow and low-energy. It is semi-enclosed to the north from the Tasman Highway causeway, which has a ~450 m bridge culvert section.

Owing to the shallow nature of the bay, large areas of intertidal soft sediments are present out from the beach. Sediments consist of relatively fine-grained silty sands at the western end of the beach, transitioning to areas of coarser sediments consistent with higher energy environments to the east.

Several shellfish farming leases are present off Five Mile Beach, just south of Woody Island where the main marine channel flows past.

The shallow intertidal areas along Five Mile Beach are popular for flounder fishing. Other popular recreational uses of the Five Mile Beach area include swimming, boating, horse riding, and fishing.

## 3. Basis of Assessment

### 3.1 Assessment Framework

The investigation has been developed in consideration of the following:

- National Environmental Protection Council (NEPC) National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) (ASC NEPM; NEPC 1999) (NEPC, 2013)
- Environmental Health Standards Committee (enHealth) of the Australian Health Protection Principal Committee, Interim national guidance on human health reference values for per- and poly-fluoroalkyl substances for use in site investigations in Australia, June 2016 (enHealth, 2016)
- Draft Commonwealth Environmental Management Guidance on Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA). Department of the Environment and Energy October 2016
- HEPA NCWG (2018) PFAS National Environmental Management Plan, January 2018. Plan developed by the Heads of EPAs Australia and New Zealand (HEPA) National Chemicals Working Group (NCWG) in collaboration with the Australian Government Department of the Environment and Energy (DoEE).

### 3.2 Criteria

As this is primarily a human health investigation, the criteria to be applied for this assessment are:

- Food Standards Australia New Zealand (FSANZ) –Perfluorinated Chemicals in Food (2017).
- Australian Government Department of Health 2017 – Health based guidance values for PFAS for use in site investigations in Australia.

## 4. Sampling Plan

### 4.1 Sample Plan Overview

The sampling plan is to consider two zones of investigation 1) Sinclair Creek; and 2) Five Mile Beach. While the overall objectives of the investigation are the same for both zones, the environmental setting for each are quite different and have been separated below for further clarity.

To minimise the potential for cross contamination, the sampling program will commence in Five Mile Beach and progressively work in towards Sinclair Creek, and then finally up the creek itself.

It should be noted that this proposed plan does not account for seasonal variability in the creek and beach environments (i.e. due to varying seasonal rainfall recharge and its influence on potential PFAS loading in the environment). This may be addressed further in the subsequent stage(s) of investigation.

#### 4.1.1 Sinclair Creek

The majority of available information on PFAS in the creek is based on a single surface water sampling event along the length of the creek. The proposed plan includes the followings key details:

- Repeat surface water sampling along sections of the creek line to provide an initial indication of seasonal variability in PFAS concentrations;
- As per the Airservices brief, concentrate investigations on sections downstream of the runway (i.e. to the east);
- Due to the potential dilution effects of the wastewater treatment plant (WWTP) discharge point immediately upstream of the runway, determine any temporal trends in discharge flow (i.e. from WWTP operator) to inform the timing of creek sampling. Additionally, collect at least two surface water and sediment samples upstream of the WWTP discharge point for comparison with prior sampling data and to assess PFAS loading in sediments (i.e. near site HIA12-W from SEMF (2017));
- Select sample locations east of the runway that are just down-stream of tributaries to assist in identifying potential preferential PFAS surface water inputs other than Sinclair Creek itself. Sampling locations are also to account for any maintenance programs (i.e. creek clearance) that may have disturbed creek sediments;
- All creek sampling to be conducted at, or near to low tide conditions to attempt to obtain samples that are representative of surface water draining from the site, and not saline water flushing into the site;
- [REDACTED]
- [REDACTED]
- At each surface water sample location collect:
  - Field water quality parameters (EC, pH, TDS etc.),
  - Creek sediment sample (0-100mm depth interval, and a second at 150-300mm) to determine potential PFAS loading (as a secondary source).
  - PFAS analysis from surface sediment samples will also include ASLP leach testing in addition to totals analysis.
  - In addition to PFAS analysis, analyse sediments samples for cation exchange capacity, grain size and total organic carbon content.
- Assess the likely extent of tidal flushing and saline conditions along the creek line (i.e. via field EC data collection and observations) as a key influence in PFAS migration;
- Assess biota in Sinclair Creek that have potential for human consumption, including bait species, where present. While it is acknowledged there is a low likelihood of harvestable species along the creek line, the field team will be prepared to collect representative samples as required, based on field observations;
- [REDACTED]
- Parts of Sinclair Creek are identified as “Environmental Significant Area” and/or “containing vegetation of state-wide significance. Care will be taken by staff during access and sampling to minimise disturbance.

#### 4.1.2 Five Mile Beach

As PFAS enters the beach environment it is subject to a range of different chemical, physical and biological settings. The proposed plan includes the following key details:

- The focus of the investigation is on the potential PFAS loading in the marine sediments, where there is increased potential for PFAS to accumulate as it enters the marine environment. A radial pattern of sampling locations are proposed to investigate changes in concentrations with increasing distance from the creek;
- Additional sediment samples will be collected approximately 1 km from the creek mouth, near the high water line, to consider the potential for longshore drift of sediments, and increased recreation exposure risk (i.e. walkers).
- Water samples will be collected at the three outermost sediment sample location points for comparison with water quality data from the creek itself. Water samples will be collected prior to sediment samples to avoid suspended sediment influencing water samples.
- A broader survey area of approximately 1.5-2 km from the creek mouth will be used to locate and collect wild bivalve samples (i.e. oysters and mussels, and to a lesser extent scallops and cockles).
- Recreational users on Five Mile Beach are most likely represented by walkers on the beach, and then kayaking, windsurfing and swimmers with decreasing intensity. At this time, recreational use of Sinclair Creek itself is considered unlikely, but will be assessed during the field program. Water sampling identified above will be assessed against recreational exposure criteria to inform the associated potential risk to human health.
- At this time, it is anticipated that commercial shellfish leases (i.e. oysters) and other transient finfish species (i.e. whiting, garfish, squid etc.) within Pitt Water will be investigated by others, and are part of a broader investigation program.

## 4.2 Sampling Methodology

### 4.2.1 General

An environmental consultant from GHD will undertake the fieldwork and sampling program. Photographs and field data sheets will be prepared for each sampling location and will be included in the report. GHD will use a handheld GPS to record coordinates of sampling locations.

Each water, sediment and biota sample will be collected using a new set of disposable gloves and placed directly into laboratory provided Teflon-free sample jars and bottles, and then placed in chilled insulated containers for transport to the laboratory. A label will be attached to each sampling container showing job number, date, and sample location, depth and sampler initials. Sample details will be entered onto a chain of custody (CoC) form that will accompany the samples to the laboratory. A CoC form will be used for every batch of samples submitted to the laboratory and will include the scheduled analysis for each sample to be undertaken. Delivery of samples to the laboratory will need to comply with sample holding times.

When handling samples, no Teflon coated materials or aluminium foil will be used. All re-usable sampling equipment will be made from high-density polyethylene (HDPE) or stainless steel and decontaminated prior to use. During field sampling of PFAS, the sampling personnel will adhere to the following:

- Prior to sampling, the sampling personnel must wash their hands with soap and rinse thoroughly with tap water before donning a clean, new pair of disposable gloves
- No brand new field clothing to be worn
- No waterproof clothing (e.g. GoreTex, Teflon or Tyvek clothing) to be worn
- No fast food wrappers/containers or pre-wrapped foods or snacks

- No use of self-sticking notes or similar office products
- No reusable chemical or gel packs will be used to cool samples. Instead food-grade ice contained in polyethylene bags will be utilised
- Only natural sunscreens and insect repellents are to be worn
- During sampling, processing and storage, minimise the exposure of samples to light

#### 4.2.2 Sediment

##### **Sampling**

The majority of sediment samples will be collected in shallow water and hence there is no need to utilise any remote coring equipment. To minimise the chance of cross-contamination, all sediment samples will be taken by simply scooping the sample container into the surface substrate (top 100 mm of sediment) by hand. A new set of disposable gloves will be worn by the sampler between sites.

Once labelled, samples will be placed directly into chilled iceboxes for transport.

##### **Parameters**

Each sediment sample will be analysed for the following parameters:

- PFAS – Full Suite (28 analytes) (EP231X)
- PFAS – Full Suite (ASLP leach testing – surface sediment samples only within creek line)
- Total Organic Carbon (EP003)
- Exchangeable Cations (Ca, Mg, Na, K) plus Cation Exchange Capacity (CEC)
- Particle Sizing to 75µm (Sieve) EA150

##### **Sites**

Sediment sample sites are summarised in Table 1 and shown graphically in Figure 1.

**Table 1 Sediment sample sites**

Site name	Location description
SC-1S	Near original sample location “SW5”, upstream of runway
SC-2S	Near original sample location “HIA 12-W”, upstream of runway
SC-3S	Immediately downstream of runway on Sinclair Creek
SC-4S	Downstream of first tributary north-east of runway on Sinclair Creek
SC-5S	At Airport site boundary on Sinclair Creek
[REDACTED]	[REDACTED]
SC-6S	At confluence of Five Mile Beach and Sinclair Creek

Site name	Location description
FMB -1S, FMB -2S, FMB -3S	250 m arc from Sinclair Creek mouth
FMB -4S, FMB -5S, FMB -6S	500 m arc from Sinclair Creek mouth
FMB-7	1 km north-west of Sinclair Creek mouth
FMB-8	1 km east of Sinclair Creek mouth

#### 4.2.3 Water

##### *Sampling*

All water samples will be taken by submerging the sample container itself and removing the cap. Where bottles contain preservatives, a non-preserved bottle from the sample set will be used to fill these to avoid loss of preservative (non-PFAS analytes). Once labelled, samples will be placed directly into chilled iceboxes for transport.

A calibrated water quality meter will be used to assess in-situ physicochemical characteristics of the water being sampled. These will be recorded in field notes and presented with the laboratory results.

##### *Parameters*

Each water sample will be analysed for the following parameters:

- PFAS – Full Suite Low Level (28 analytes) (EP231X-LL)
- Field in-situ parameters (pH, conductivity, temperature, dissolved oxygen)

##### *Sites*

Water sample sites are summarised in Table 2 and shown graphically in Figure 1.

**Table 2 Water sample sites**

Site name	Location description
SC-1W	Near original sample location “SW5”, upstream of runway
SC-2W	Near original sample location “HIA 12-W”, upstream of runway
SC-3W	Immediately downstream of runway on Sinclair Creek
SC-4W	Downstream of first tributary north-east of runway on Sinclair Creek
SC-5W	At Airport site boundary on Sinclair Creek
[REDACTED]	[REDACTED]
SC-6W	At confluence of Five Mile Beach and Sinclair Creek

Site name	Location description
FMB -5W	500 m arc from Sinclair Creek mouth
FMB-7W	1 km north-west of Sinclair Creek mouth
FMB-8W	1 km east of Sinclair Creek mouth

#### 4.2.4 Biota

Where relevant, biota sampling will target commercial size fish. All biota sampling will include a record of general health and lengths of individuals. Sampling effort and methods employed at each site will be recorded with GPS locations and general environmental conditions. Analysis for each location will be conducted on a composite comprised of tissue from a number of animals (i.e. up to five). Compositing will be conducted by the laboratory, in a controlled environment. Analysis will be conducted on samples of edible portions (i.e. fish – fillet, skin on; molluscs – edible flesh).

##### *Fish*

Fish species will be collected using a standard baited pole and line technique within Sinclair Creek. Upon landing a fish, it will be immediately spiked as per GHD's animal ethics procedure.

Rather than field processing, all fish caught from each site will be sent to the laboratory for composite sample extraction. The number of fish contributing to each sample will be dependent on the number caught at each site.

##### *Oysters/Mussels*

Wild oysters and mussels will be targeted within the Five Mile Beach area. Oysters and mussels will be removed from their holdfasts by knife or by hand if possible.

Rather than field processing the entire shell will be submitted to the laboratory for analysis, with all shells sampled per site sent in a single sample lot. Shells from a single sample site will then be sub-sampled by the laboratory into a single composite sample for analysis.

##### *Parameters*

Each biota sample will be analysed for the following parameters:

- PFAS – Full Suite (28 analytes) plus Linear/Branched Speciation (PN) (EP231X)

##### *Sites*

Samples sites will opportunistically be selected within both Sinclair Creek and the Five Mile Beach area based on field observations. The final sample numbers and types may vary from those anticipated in this sampling plan, depending on access and abundance of biota at each location.

##### *Animal Ethics*

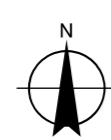
All fauna handling and sample collection will be conducted in compliance with the GHD Animal Ethics Committee's (AEC) requirements for the sampling methods employed and species being targeted. The wellbeing of animals will be the priority for all tasks.

Figure 1 Sampling locations



Paper Size A3  
0 50 100 200 300 400 500  
Metres

Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 55



#### Legend

- ▲ Sampling Point
- ▲ WWTP Outfall
- ▲ Main Fire Station Outfall
- Sinclair Creek
- Drainage lines
- Airport-Commonwealth
- Land

Air Services Australia



Indicative Sampling Locations:  
Sinclair Creek & Five Mile Beach Targeted Biota Sampling

Job Number 32-18792  
Revision C  
Date 05 Apr 2018

Figure 1

## 4.3 QA/QC

### ***Sample Labelling***

All sample containers will be labelled with the following information:

- Project identification number
- Sample identification number
- Date and time of sampling
- Initials of sample collector

### ***Chain of custody forms***

Chain of Custody (CoC) procedures are used to track samples, discourage tampering and provide a sampling summary. A CoC form will be filled out on completion of field sampling. An individual CoC will be completed for each discrete batch of samples.

The following information will be included on the CoC form:

- Project identification number
- Sample number
- Date and time of collection
- Type of sample
- Number and type of container (if required)
- Analysis required
- Signature of sampler
- Signature of receiver (laboratory)

Each batch of samples sent to ALS will include a CoC form. When the batch is relinquished (by GHD) and received (by the laboratory or courier), the party involved will sign the CoC form and indicate the time and date. The original copy will accompany the samples to the laboratory in the ice box. The original will be signed by the laboratory, scanned and sent back to GHD for filing. The laboratory and GHD will retain a copy as a record of samples sent and analyses requested.

### ***Sampling and analysis quality control***

The ASC NEPM (NEPC 2013) outlines a recommended approach to be adopted for QC sampling. The QC samples to be collected during the investigation are described as follows:

- Blind duplicate: Blind duplicate samples are used to identify the variation in the analyte concentration between samples from the same sampling point.
- Split duplicate: Split duplicate samples provide an indication of the repeatability of the results between laboratories.
- Trip blank: A sample of laboratory supplied deionised water is bottled and accompanies the other samples over the course of the fieldworks and submitted to the laboratory for analyses. Trip blanks provide an indication of contamination introduced during sample transport and handling, and also ensure that the testing laboratory is not reporting “false positives”.

Blind and split duplicate samples will be assessed by calculating the relative percentage difference (RPD) between the primary, blind and split samples.

A quantitative measure of the accuracy of the analytical results reported is made by calculating the RPDs between the primary, blind and split results in accordance with the procedure

described in AS 4482.1 – 2005 (Standards Australia 2005). GHD will adopt a nominal acceptance criterion of 50% RPD for field duplicates and splits for organics, and 30% RPD for field duplicates and splits for inorganics, however it is noted that this will not always be achieved, particularly in heterogeneous sediments, or at low analyte concentrations.

### **General Field work QA**

- All fieldwork will be conducted with reference to GHD's Standard Field Operating Procedures, which ensures all samples are collected by a set of uniform and systematic methods, as required by GHD's QA system.
- Decontamination procedures: Including the use of new disposable gloves for the collection of each sample, decontamination of any sampling equipment between each sampling location and the use of non-Teflon dedicated sampling containers provided by the primary laboratory.
- Calibration of field equipment: Field equipment (e.g. water quality meter) will be calibrated by the rental supplier to ensure accuracy of measurements taken in the field. If field measurements appear inconsistent GHD will either complete field calibration of the equipment or swap equipment with newly calibrated equipment from the supplier.

## **4.4 Laboratories**

The nominated laboratories, which are National Association of Testing Authorities (NATA) accredited for the specific analytical procedures are:

- Primary laboratory: Australian Laboratory Services (ALS) Environmental, Smithfield, New South Wales
- Secondary laboratory: Eurofins Mgt, Lane Cove West, New South Wales

The proposed laboratory PFAS detection limits are: Sediment: 0.0002-0.001 mg/kg; Water: 0.002-0.1 ug/L; and Biota: 1-5 ug/kg. [PFAS NEMP 2018 states: *In general, the limit of reporting (LOR) for PFAS is 0.01-0.05 ug/L for water, 5 ug/kg solids, and 0.5-5 ug/kg for biota*].

Laboratory methods to be used by the primary and secondary laboratories will be suitable for environmental contaminant analysis and are based on established internationally recognised procedures. Each of the laboratories is NATA accredited for the proposed analysis (except biota as no laboratories are NATA accredited at this time).

### **4.4.1 Laboratory quality control procedures**

The following laboratory QC procedures will be used during the investigation.

#### ***Laboratory duplicate samples***

Laboratory duplicate sample analysis is the analysis of a laboratory derived duplicate sample from the process batch, at a rate equivalent to one in 10 samples per analytical batch, or one sample per batch if less than 10 samples are analysed in a batch. A laboratory duplicate provides data on the analytical precision and reproducibility of the analytical results.

#### ***Method blank samples***

Method or blank sample analysis are the analyses of a sample that is as free as possible of the analyte(s) of interest, but has been prepared the same as the samples under investigation. The analysis is to ascertain if laboratory reagents, glassware and other laboratory consumables contribute to the observed concentration of analytes in the process batch. If below the maximum acceptable method blank (below practical quantification limit), the contribution is subtracted from

the gross analytical signal for each analysis before calculating the sample analyte concentration. The method blank should return analyte concentrations as ‘not detected’.

#### **Laboratory control samples**

Laboratory control spike analysis is the analysis of either a reference material or a control matrix fortified with analytes representative of the analyte class. The purpose of laboratory control spike samples is to monitor method precision and accuracy independent of the sample matrix. Typically, the percentage recovery of the laboratory control spike sample is compared to the dynamic recovery limits based on the statistical analysis of the processed laboratory control spike sample analysis. Recoveries should lie between 70% and 130%.

#### **Matrix spike samples**

Matrix spike sample analysis is the analysis of one or more replicate portions of samples from the batch, after fortifying the additional portion(s) with known quantities of the analyte(s) of interest. The percentage recovery of target analyte(s) from matrix spike samples is used to determine the bias of the method in the specific sample matrix. Recoveries should lie between 70% and 130%.

#### **Surrogate spike samples**

Surrogate spike samples are samples with known additions of known amounts of compounds, which are similar to the analytes of interests in terms of extractability, recovery through clean-up procedures and response to chromatographic or other measurement. Surrogate compounds may be alkylated or halogenated analogues or structural isomers of analytes of interest. The purpose of surrogate spikes, which are added immediately before the sample extraction step, is to provide a check for every analysis that no gross processing errors have occurred, which could have led to significant analyte loss or faulty calculation. Recoveries should lie between 50% and 150%.

#### **Internal standards**

Internal standards are known additions of known amounts of compounds which are not found in real samples, will not interfere with quantification of analytes of interest and may be separately and independently quantified. The purpose of internal standards in instrumental techniques is to provide independent signals, which serve to check the consistency of the analytical step. Internal standards are often used for organic compounds and some inorganic compounds.

### **4.5 Reporting**

At the conclusion of works, GHD will provide a detailed report for the site. The report will be reviewed by our Project Director (Peter Topliss) and technical advisors who have experience in PFAS investigations and assessment.

The report will include:

- Summary of scope of works, site identification, site history summary, site investigation information, methodology, data quality objectives, findings.
- Site observations and relevant field photographs.
- Details of the site-specific geological and surface water setting.
- Summary of the analytical results screened against the relevant criteria; as well as copies of the laboratory certificates and relevant QA/QC documentation.
- Figures detailing the site location, layout, exceedances and surface water flow directions.
- Conclusions and recommendations.

The report will be written in a manner consistent with relevant Tasmanian and National guidelines.

GHD will initially provide an electronic PDF copy of the draft reports for review to Airservices prior to its finalisation.

## 5. References

Australian Government Department of Health 2017 – Health based guidance values for PFAS for use in site investigations in Australia.

Draft Commonwealth Environmental Management Guidance on Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA). Department of the Environment and Energy October 2016

Environmental Health Standards Committee (enHealth) of the Australian Health Protection Principal Committee, Interim national guidance on human health reference values for per- and poly-fluoroalkyl substances for use in site investigations in Australia, June 2016 (enHealth, 2016)

Food Standards Australia New Zealand (FSANZ) 2017 – Perfluorinated Chemicals in Food (2017).

National Environmental Protection Council (NEPC) National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1) (ASC NEPM; NEPC 1999) (NEPC, 2013)

PFAS National Environmental Management Plan January 2018

SEMF (2017) Hobart Airport – Aviation Rescue Fire Fighting Services Preliminary Site Investigation. Report for Airservices Australia dated 31 October 2017, Project: 2105.022

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