Vopak Terminals Australia Pty Ltd

Environmental Audit Report

Vopak Terminal Darwin
780 and 800 Berrimah Road
East Arm Darwin NT

27 July 2022

62148 / 143,007 (Rev 0)

JBS&G

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Abbreviations

Term	Definition
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
bgl	Below ground level
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
CLM	Contaminated Land Management
COC	Chain of Custody
CoPCs	Contaminants of Potential Concern
CSM	Conceptual Site Model
DAT	Darwin Acid Terminal
DGV	Default guideline value
DHWQOs	Darwin Harbour Water Quality Objectives
DIFT	Darwin Industry Fuel Terminal
DO	Dissolved oxygen
DQIs	Data Quality Indicators
DQO	Data Quality Objectives
DSI	Detailed Site Investigation
EC	Electrical conductivity
Eh	Redox potential
EIL	Ecological Investigation Level
EMS	Environmental Management Systems
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ESL	Ecological Screening Level
GRR	Global Resource Recovery
GV	Guideline Value
HHERA	Human Health and Ecological Risk Assessment
HIL	Health Investigation Level
HSL	Health Screening Level
JBS&G	JBS&G Australia Pty Ltd
LA ULP	Low aromatic unleaded fuel
LOR	Limit of Reporting
LWTF	Liquid Waste Treatment Facility
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NT	Northern Territory
OEMP	Operational Environmental Management Plan
OUD	Open Unlined Drain
PAH	Polycyclic Aromatic Hydrocarbon
PARCC	Precision, accuracy, representativeness, comparability and completeness
PFAS	Per- and poly-fluoroalkyl substances
PFHxS	Perfluorohexane sulfonate
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonate
PULP	Premium unleaded fuel
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percentage Difference
SAQP	Sampling Analysis and Quality Plan
SWL	Standing Water Level
TPH	Total Petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbons
ULP	Unleaded fuel
VTD	Vopak Terminal Darwin
WMPC	Waste Management and Pollution Control

1. Introduction

1.1 Introduction

Andrew Lau (the auditor) of JBS&G Australia Pty Ltd (JBS&G) was engaged by Vopak Terminals Australia Pty Ltd (Vopak, the client) to carry out an environmental audit program in relation to the Vopak facility located at 780 and 800 Berrimah Road, East Arm Darwin NT ('the site') (**Figure 1**). The site is legally identified as Portions 5719 and 5783 Hundred of Bagot occupying an area of approximately 13.3 hectares.

The Vopak Terminal Darwin (VTD) facility receives bulk liquids offloaded from tanker ships at East Arm Wharf via pipeline and stored in aboveground tanks prior to transfer to road tankers.

The south eastern portion of the site at 800 Berrimah Road has been sub-leased to Smorgon Fuels Pty Ltd trading as Global Resource Recovery (GRR) and is operated as a liquid waste treatment facility (LWTF).

1.2 Background

On Saturday 26th September 2020, a leakage of an underground pipeline forming part of the site fire suppression system occurred resulting in Ansulite® 3x 3 AR-AFFF (Alcohol Resistant Aqueous Film Forming Foam) solution coming into contact with the environment. Ansulite® is known to contain per- and poly-fluoroalkyl substances (PFAS) and PFAS precursors. PFAS have the potential to be bioaccumulative, persistent and toxic. PFAS readily leaches from soil to groundwater and can move long distances.

Repair of the leak has been undertaken and is considered by the Northern Territory Environment Protection Authority (NT EPA) to have addressed the primary source of PFAS contamination. However, other sources of PFAS, including from contaminated infrastructure (concrete and drains), and residual soil or sediment contamination, was considered to potentially remain at the site.

Groundwater monitoring undertaken at the site in October 2020 (EcOz 2020c) identified the following:

- high concentrations of fluorotelomer sulfonic acid, a PFAS precursor, in monitoring bores near the firewater storage tank and in the vicinity of the leakage;
- high concentrations of perfluoroalkyl carboxylic acids were identified in monitoring bores near the firewater storage tank and in the vicinity of the leakage;
- concentrations of heavy metals including copper, lead and zinc were identified above the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger values for dissolved metals in groundwater;
- concentrations of ammonia were identified exceeding the Darwin Harbour Water Quality Objectives (DHWQOs) for the Darwin Harbour region;
- low concentrations of total petroleum hydrocarbons (TPH) in groundwater at the site;
- the incident of 26/9/20 was the primary source of PFAS contamination at the site;
- secondary sources of PFAS contamination include:
    - contaminated stormwater within the bunded area of tanks 101 and 102
    - firewater storage tank area.

The site is located within the Darwin Harbour Site of Conservation Significance and within Darwin Harbour Region which is a Declared Beneficial Use area. Given the nature of Vopak activities,

hydrocarbon contamination from potential fuel leaks and spills present an ongoing risk to the environment.

On 25 October 2021, the NT EPA issued a Section 48 Notice[1] in accordance with the *Waste Management and Pollution Control Act 1998* (the Act) for an environmental audit program to be carried out on the site by an environmental auditor accredited under the New South Wales or Victorian auditor accreditation schemes.

Andrew Lau is a site auditor accredited by both the NSW EPA under the *Contaminated Land Management Act 1997* (CLM Act 1997) (Accreditation Number 0503) and EPA VIC under the *Environment Protection Act 2017* (EP Act 2017) (Appointment ID EXT001246). The audit was completed with the assistance of Christine Louie, a JBS&G senior consultant trained and experienced in contaminated land assessment and auditing, and Exemplar Global certified Environmental Management Systems (EMS) auditor (including site contamination assessment and regulatory compliance scopes). Matthew Parkinson, a JBS&G principal consultant, provided risk assessment expert support to the auditor.

1.3 Environmental Audit Program Objectives

The objectives of the works were to undertake an environmental audit program in accordance with the requirements of the Section 48 Notice (NT EPA 2021) to '*evaluate the types, amount, distribution and mobility of petroleum hydrocarbons, per- and poly-fluoroalkyl substances (PFAS) and other contaminants of concern (copper, lead, zinc and ammonia) present in the environment at the premises that have the potential to cause environmental harm*'.

The environmental audit program has been undertaken with consideration to the provisions of the *Waste Management and Pollution Control Act 1998* (WMPC Act 1998) and subsequent amendments.

1.4 Environmental Audit Program Scope and Methodology

In accordance with the Section 48 Notice (NT EPA 2021), the scope of the environmental audit program was to include the following:

- Review of systems, plans, procedures, monitoring programs, data, records, reports and other information considered relevant to the scope of the audit;
- Inspection of activities, processes, plant and equipment at the premises;
- Collection and/or modelling of data relevant to the scope of the audit;
- Assessment of the risk of environmental harm from activities conducted at the premises by or for Vopak including the actions taken in response to the incident;
- Identification of measures to reduce risks posed to the environment to an acceptable level;
- Provision of a timetable for implementation of recommendations.

In accordance with the Section 48 Notice (NT EPA 2021), the auditor prepared a scope of works for the environmental audit program which was submitted to the NT EPA on 20 December 2021 by Vopak.

The scope and methodology for the environmental audit program undertaken is outlined in **Table 1.1**.

[1] *Notice to Carry Out Environmental Audit Program Issued to Vopak Terminal Darwin Pty Ltd ACN 107 742 174*, dated 25 October 2021. Northern Territory Environmental Protection Authority (NT EPA 2021).

Table 1.1: Environmental Audit Program Scope and Methodology

Scope Item	Description
Premises	Vopak Terminal - 780 and 800 Berrimah Road, East Arm, Darwin NT (Portions 5719 and 5783 Hundred of Bagot)
Contaminants of Concern	• PFAS • petroleum hydrocarbons • copper • lead • zinc • ammonia • other contaminants identified during audit program
Media	Soil, groundwater, sediment and surface/stormwater
Assessment of extent of impact of identified contamination	• Desktop review of available information. Information reviewed included: o Documentation in relation to the incident of 26/9/20 – incident response reports, follow up actions, investigation reports and waste disposal records. SMEC Australia Pty Ltd was engaged as the environmental consultant to undertake site investigations in relation to the fire fighting foam leak. Additional site investigations were undertaken in April 2022 post wet season. Human health and ecological risk assessment including development of adjusted guidelines values for PFAS compounds where guideline values do not currently exist in Australia was undertaken. o Operations manuals including fire suppression system, stormwater system o Emergency Procedures Plan o Operations Environmental Management Plan o Environmental monitoring reports – groundwater, stormwater and sediment o Historical environmental assessment reports o Environmental audit reports o Site drawings and maps • Site visit and walkover to assess the site setting and inspect Vopak operations including relevant plant and equipment associated with the fire fighting foam solution leak and other contaminants of concern identified for the site. • Face to face interviews with relevant VTD and GRR employees including operations personnel that undertook activities in relation to the incident.
Beneficial Uses Assessment	Beneficial uses in relation to human health and ecological exposure to contamination from the site were identified and assessed.
Environmental Audit Program Timeframe	Due to the impacts of the wet season in the Darwin region on the groundwater monitoring investigations and delays in reporting by the environmental consultant (SMEC), a revised schedule for submission of the Environmental Audit Report by 27 July 2022 was approved by the NT EPA.

1.5 Documents Reviewed

The following documents were reviewed as part of this environmental audit:

- *Vopak Terminals Darwin Biodisele (sic) Baseline Inspection and Monitoring Report Vopak Terminals Darwin Pty Ltd*. Version 1.2, 14 August 2017. EcOz Pty Ltd (EcOz 2017).
- *2017-2020 Audit, Operations Environmental Management Plan, Vopak Terminal Darwin*. Rev 1, 192124-17, 12 August 2020. EcOz Pty Ltd (EcOz 2020a).
- *Firefighting foam leak – soil and water analysis results*. EcOz Pty Ltd (EcOz 2020b).
- *Emergency Procedures Plan Darwin (MHF)*. OPS09_1D, December 2020. Vopak Terminal Darwin Pty Ltd (Vopak 2020).
- *Groundwater Quality Monitoring Early Wet Season, October 2020, Vopak Darwin Terminal*. EcOz Pty Ltd (EcOz 2020c).

- *Vopak Darwin (East Arm) Terminal Incident & Environmental Advice*. 29 January 2021. JBS&G Australia Pty Ltd (JBS&G 2021).
- *Stormwater Pit Monitoring, February 2021, Vopak Terminal Darwin*. Rev 1, 198492, 15/02/2021. EcOz Pty Ltd (EcOz 2021a).
- *Operations Environmental Management Plan, Vopak Terminal, Darwin, February 2021*. Rev 1, 198187-16, 23 March 2021. Vopak Terminal Darwin Pty Ltd (Vopak 2021).
- *Stormwater Pit Monitoring, March 2021, Vopak Terminal Darwin*. Rev 1, 198492, 24/03/2021. EcOz Pty Ltd (EcOz 2021b).
- *Groundwater Quality Monitoring, Late Wet Season, April 2021, Vopak Terminal Darwin*. Rev 1, 201413, 10 May 2021. EcOz Pty Ltd (EcOz 2021c).
- Letter addressed to Vopak Terminal Darwin: *Variation – Site Investigations, Foam Leak Area, Vopak Darwin Terminal*. 3008099 V01, 25 June 2021. SMEC Australia Pty Ltd (SMEC 2021).
- *Global Resource Recovery – Monthly Groundwater Monitoring Event (January 2022)*. 24 January 2022. Greencap Pty Ltd (Greencap 2022a).
- *Global Resource Recovery – Monthly Groundwater Monitoring Event (February 2022)*. 23 February 2022. Greencap Pty Ltd (Greencap 2022b).
- *Vopak Darwin Terminal – Site Investigations. Sampling, Analysis and Quality Plan*. Revision 1, 31/03/2022. SMEC Australia Pty Ltd (SMEC 2022a).
- Excel Workbook: Vopak Terminals Darwin – Sediment Sampling Database, *Vopak Sediment Database (ID 190016)* for 1 July 2008 – 12 April 2022.
- *Global Resource Recovery – Monthly Groundwater Monitoring Event (April 2022)*. 29 April 2022. Greencap Pty Ltd (Greencap 2022c).
- Excel Workbook: Vopak Terminals Darwin – Environmental Monitoring Bores, *Vopak Groundwater Database (ID 195652)* for 23 Aug 2005 – 5 May 2022.
- Excel Workbook: Vopak Terminals Darwin, *Vopak Stormwater Database (ID 196690)* for 5 Nov 2007 – 5 May 2022.
- *Vopak Terminal Environmental Monitoring December 2021 – April 2022*. Revision 0, 3 June 2022. GHD Pty Ltd (GHD 2022).
- *Environmental Management Plan.* Revision 1.3, Document No: GRR-DRW-PRO-210, 4 July 2022. Global Resource Recovery (GRR 2022).
- *Vopak Darwin Terminal Site Investigations*. Revision 3, 13/07/2022. SMEC Australia Pty Limited (SMEC 2022b).
- *Human Health and Ecological Risk Assessment: Vopak Bulk Fuel Terminal, NT*. Revision C, 18 July 2022. Environmental Risk Sciences Pty Ltd (EnRiskS 2022).
- *Incident Investigation Report, Vopak Darwin Underground Firefighting Foam Pipeline Pinhole, Incident Date: 26th September 2020*. Rev 1, 16/07/2022. Vopak Terminal Darwin Pty Ltd (Vopak 2022).

The following additional documents were also considered during the environmental audit program:

- *Ansulite® 3x3 Low-viscosity AR-AFFF Concentrate Data/Specifications*. Ansul Incorporated (Ansul 2017).
- *Ansulite A334-LV 3%x3% AR-AFFF Low Viscosity Concentrate Data Sheet*. Tyco Fire Products LP/Ansul (Ansul 2016).

- Letter: *PFOA/PFOS/PFOSF/PFHxS Content of Johnson Controls/Tyco Foam Products*, 31 May 2018. Tyco Fire Protection Products (Tyco 2018).
- Letter: *Perfluorohexane Sulfonic Acid (PFHxS)*, 30 January 2019. Tyco Fire Protection Products (Tyco 2019).
- *Ultrasonic Thickness Inspection Report. Vopak Foam Line – Repair Patch*, Report No. DO 311-20 UTM-01, 23/10/2020. DITS Pty Ltd (DITS 2020a).
- *Magnetic Particle Inspection Report. Vopak Foam Line – Repair Patch*, Report No. DO 311-20 MT-01, 26/10/2020. DITS Pty Ltd (DITS 2020b).
- *Purchase Order P4300412. Global Resource Recovery (GRR) Removal of foam from line incident PFAS GRR quote ref #: GD6529*, 18/2/2021. Vopak Terminal Darwin Pty Ltd (Vopak 2021).
- *Ansulite 3x3 FP F604A Safety Data Sheet*, Version 6, 27 January 2022. Ansul (Ansul 2022).
- *Environment Protection Licence EPL229 – 02*. Commencement date: 29/06/2022. Northern Territory Environment Protection Authority (NT EPA 2022).

1.6 Guidance Documents

In undertaking this Environmental Audit Program, the environmental auditor has given consideration to the following:

- *Waste Management and Pollution Control Act 1998*
- *Water Act 1992*
- Guidelines made or approved by the NSW EPA (s105 *Contaminated Land Management Act 1997*)
- *Guideline for Reporting on Environmental Monitoring.* Version 1.0, May 2016. Northern Territory Environment Protection Authority (NT EPA 2016)
- *Northern Territory Contaminated Land Guideline.* Version 1.0, June 2017. Northern Territory Environmental Protection Authority (NT EPA 2017)
- *PFAS National Environmental Management Plan*. Version 2.0. Heads of EPAs Australia and New Zealand (HEPA 2020).

1.7 Site Inspection and Interviews

The VTD and GRR sites were inspected and interviews conducted with operations personnel as outlined in **Table 1.2**.

Table 1.2: Summary of Site Inspections and Interviews

Date	Attendance	Purpose
26 April 2022	Paul Birch (VTD Terminal Manager) Scott Kernahan (VTD SHECQ Co-ordinator) Christine Louie (JBS&G's Auditor Assistant)	Site inspection VTD – foam solution leak excavation and fire pump house. Site interviews VTD
27 April 2022	Paul Birch (VTD Terminal Manager) Scott Kernahan (VTD SHECQ Co-ordinator) Sam Ramsay (VTD Operator) Peter Green (Maintenance Supervisor) Christine Louie (JBS&G's Auditor Assistant)	Site inspection VTD – site walkover Site interviews VTD
	Mick Rogers (GRR Operations Manager) Scott Kernahan (VTD SHECQ Co-ordinator) Christine Louie (JBS&G's Auditor Assistant)	Site inspection GRR – site walkover Site interview GRR

Details of the site inspection and interviews are provided in **Section 4**.

2. Site Description

2.1 Site Identification

The details for the site have been summarised in **Table 2.1** and described in further detail in the following sections. The site location and layout are shown in **Figures 1** and **2** presented in **Appendix A**.

Table 2.1: Summary Site Details

Street Address:	780 Berrimah Road East Arm NT 0828	800 Berrimah Road East Arm NT 0828
Property Description:	Section 5719 Hundred of Bagot	Section 5783 Hundred of Bagot
Title:	CUFT Volume 808 Folio 341	CUFT Volume 808 Folio 378
Survey Plan	S2003/201	S2005/171A
Local Government Area:	City of Darwin	City of Darwin
Property Size:	8.7 ha	4.58 ha
Zoning:	Development (DV)	Development (DV)
Owner	Northern Territory Government Land Development Corporation	Northern Territory Government Land Development Corporation

2.2 Site Condition

The site is located within a cleared area near the Darwin Harbour Estuary. The land on which the site is located encompasses an area formerly known as Quarantine Island and low lying land comprising of mangrove vegetation and soft mangrove muds that has been reclaimed and cut/filled.

No vegetation exists on the VTD site. The GRR LWTF comprises of an administration/laboratory building, operational buildings, bunded concrete or asphalt hardstand and a car park. There are some small garden beds but no remnant vegetation or landscape features of significance. The surrounding area is estuarine comprising mudflats, tidal creeks and mangroves.

The GRR LWTF occupies 1.5 hectares in the south east portion of the site. The production facility was initially constructed and commissioned as a biodiesel production facility but has not been operated for this purpose. The facility has been upgraded and repurposed for the treatment of a variety of industrial liquid wastes. The remainder of the site comprises the VTD bulk liquid fuel storage and transfer facility.

2.3 Site Operations

Site operations details are presented in EcOz 2021a and summarised in this section.

The VTD facility operates 24 hours a day, 365 days a year. Bulk liquids are delivered to East Arm Wharf via tanker ships and transported to the site via pipeline.

Bulk storage at the site comprises of three zones:

- Darwin Industry Fuel Terminal (DIFT);
- Darwin Acid Terminal (DAT);
- 6-series tank farm (previously the DBT).

The GRR LWTF comprises of the former biodiesel plant converted for the processing of waste oil and oily water, and the former glycerine recovery plant converted for the recovery of ethylene glycol.

2.3.1 Darwin Industry Fuel Terminal

The DIFT zone comprises 12 tanks containing premium unleaded fuel (PULP), unleaded fuel (ULP), Jet A1, diesel, Avgas and low aromatic unleaded fuel (LA ULP or LAF) with a total combined operating volume of 120,500 m^3. The aboveground tanks are located within three bunded areas.

Stormwater drainage from within the bunded tank areas, trafficable areas and other hardstand areas across the site flows through the oil/water separator and main DIFT stormwater pit prior to discharging to Darwin Harbour.

The fire water tank and associated pump house and pipework for delivery of firefighting foam across the VTD and GRR sites is contained within the DIFT zone.

2.3.2 Darwin Acid Terminal

The DAT zone comprises of one tank of capacity 10,870 m^3 for storage of sulfuric acid. The tank is located within a bunded area.

2.3.3 6-series Tank Farm

The 10 storage tanks contained in the 6-series tank farm were originally installed to provide storage for the now redundant Biodiesel Processing Plant. Tanks TK6101 through TK6108, with a combined capacity of 25,750 m^3, are used to provide additional petroleum diesel storage. Tanks TK6201 through TK 6203 are decommissioned.

The fire water tank and pumping system also services the 6-series tank farm.

Stormwater drainage within the 6-series tank farm bunds is captured in a stormwater pit and sampled prior to discharging to Darwin Harbour.

2.3.4 Liquid Waste Treatment Facility

The GRR site operations are described in GRR 2022 and summarised in this section.

The liquid waste treatment facility (LWTF) comprises of the following processes:

- waste oil and oily water processing plant - includes storage tanks, heated tanks, separators, tricanters and centrifuges;
- ethylene glycol recovery plant - includes storage tanks, water removal, distillation and polishing equipment;
- industrial wastewater treatment – located in a concrete bunded area and includes storage tanks, batch treatment tanks, reverse osmosis and filter presses;
- repackaging, consolidating and storing for transfer to third party licensed facilities – wastes not treatable at the LWTF including cyanides, chromic acid, concentrated acids and alkalis, some solvents, chlorinated hydrocarbons, pesticides, PFOS and grease are stored in segregated containers for transport to third party EPA licensed waste treatment or recycling facilities; and
- sludge treatment – includes sludge pits and separation tanks for waste streams requiring dewatering.

The LWTF has the capability for separating low concentration PFAS wash waters through the media filters and reverse osmosis facility.

The premises operates under Environment Protection Licence EPL 229-02 for the treatment, storage and recycling of a range of industrial liquid waste including treatment of wastewater and recycling of ethylene glycol.

2.4 Topography

The site and surrounding area are located on a reclaimed area relatively flat peninsula style formation within the broader Darwin Port.

The site is situated at approximately 5 to 8 m Australian Height Datum (AHD).

2.5 Soils and Geology

The site is underlain by siltstone, shale, sandstone (quartz arenite, sublitharenite), quartz pebble conglomerate, and metamorphosed to lower greeschist facies (Burrell Creek Formation) (Department of Mines and Energy 1:100,000 scale geology map of Darwin). Surrounding areas comprise of intertidal marine alluvium.

The soil profile encountered during the recent site investigations at the VTD site (SMEC 2022b) comprised the following:

- Roadbase or pavers (0 to 0.08 m below ground level (bgl)) – medium to coarse gravel or concrete pavers;
- Fill (0.08 to 1.4 m bgl) – gravelly silt or silty gravelly sand transitioning to sandy silty gravel, cobbly gravel, gravelly cobbles or cobbles/boulders. (increasing in size with depth);
- Weathered rock (approximately 0.5 – 1.2 bgl onwards) – siltstone.
- Estuarine (1.7 m bgl – 2.9 m bgl) – sandy clay encountered only at one location (EMB20) along the western boundary.

2.6 Hydrology

The whole site is sealed and run-off drains to stormwater pits and directed to the stormwater treatment system if required. Water of an acceptable quality is released to the Open Unlined Drain (OUD). A few unsealed areas exist at the site around the central OUD and along the rear unlined drain which forms an easement owned by LDC.

2.6.1 Stormwater Management

A segregated drainage system is used at the VTD and GRR sites to keep potentially contaminated water from entering the stormwater system (Vopak 2021).

VTD Site

Within the VTD site, bulk liquid storage tanks are contained within bunded areas. A summary of the bunded areas is provided in **Table 2.2**.

Table 2.2: VTD Site Bunded Areas

Bund Area	Tanks	Chemicals Stored	Treatment / Discharge
1	TK0101 TK0102 TK0103 TK0104 TK0105 TK0106	PULP ULP LAULP AvGas	Treatment in stormwater treatment system then drains to DIFT stormwater pit.
2	TK0201 TK0202 TK0203	Jet-A1	Treatment in stormwater treatment system then drains to DIFT stormwater pit.
3	TK0301 TK0302 TK0303	Diesel	Treatment in stormwater treatment system then drains to DIFT stormwater pit.
61	TK6101 TK6102 TK6103 TK6104 TK6105 TK6106 TK6107 TK6108	Diesel Oily water	Treatment in stormwater treatment system then drains to stormwater pits for inspection by a trained operator for signs of visible pollution, and testing of pH and EC prior to release to the OUD and discharge to Darwin Harbour. Water unsuitable for discharge is either recycled through the stormwater treatment system disposed of to a licensed water facility.

Bund Area	Tanks	Chemicals Stored	Treatment / Discharge
62	TK6201 TK6202 TK6203	Decommissioned	
63	TK6301	Sulfuric acid	Drains to stormwater pits for inspection by a trained operator for signs of visible pollution, and testing of pH and EC prior to release to the OUD and discharge to Darwin Harbour. Water unsuitable for discharge is either recycled through the stormwater treatment system disposed of to a licensed water facility.

The OUD was sealed with concrete in 2015.

Management of stormwater collected outside of the bunded areas is summarised in **Table 2.3**.

Table 2.3: VTD Stormwater Management – Outside of Bunded Areas

Tank / Pit	Collection Area	Treatment / Discharge
Oil water collection tank (TK2801)	Truck loading bays	Pumped out as required and waste water disposed of to a licensed waste facility.
Slops tanks (TK0501 and TK0502)	Water from oily-water pit Hydrocarbons removed in oily water separator Tank dewatering drain Jet-A1 flush tank	Pumped out as required and waste water disposed of to a licensed waste facility.
Final Stormwater Pit	Road tanker traffic areas Car park Roofed areas	Gravity fed to final stormwater pit.

The site layout and drainage schematic are provided in **Figure 2**.

High risk petrochemical loading areas are washed down and drains flushed prior to the first wet season rains. Collected wash water is disposed of by a licensed contractor.

GRR Site

Site runoff is capture, segregated and managed as follows (GRR 2022):

- Low risk areas – runoff from roads, roofs and non-production areas are piped directly to a baffled stormwater holding pit which includes an oil skimming system and oil water separation system.
- High risk areas – runoff from tank farms and production areas are bunded and piped to a blind collection pit adjacent to the main stormwater pit. Bunded operational and storage areas are kept isolated from the stormwater system. Water collected within the bunds is assessed as per the requirements of the EPL and released to the stormwater system and subsequent discharge to the OUD or directed to liquid waste storage tanks for processing through the wastewater treatment system.
- Roofed operational areas (filter press area, wastewater treatment plant, truck receival area and sludge receival/truck wash area) – collected rainfall is tested and treated in the wastewater treatment plan before discharge to sewer.

Testing is undertaken of the water in the final chamber of the stormwater discharge pit. Water is retained on-site for treatment through the wastewater treatment plan if quality does not meet the EPL discharge requirements.

2.7 Hydrogeology

Groundwater exists as a shallow unconfined aquifer that is linked to the Darwin Harbour estuary. Groundwater, particularly in the north-western portion, is influenced by tidal flows and seawater intrusion. Groundwater recharge is via direct infiltration of surface water run-off. During the dry

season, groundwater level is between 3 and 7 m below ground level. During the wet season, the groundwater table rises close to ground level.

2.8 Climate

There are two distinct climatic seasons in the Top End of the NT:

- Dry season – occurs from May to September. Temperatures range from the high twenties to the low thirties and humidity is low. Rain is uncommon due to the dry south-easterly airstreams passing over the Top End.
- Wet season – comprises of a transition period referred to as the 'build-up' occurring from October to December when humidity is greatly increased and temperatures range from the low to mid thirties with high humidity. The 'monsoon' peaks in January and February with cloudy conditions and frequent rains which can produce flooding. Temperatures during the monsoon period are around the high twenties with very humid conditions.

2.9 Surrounding Environment

The site surrounding land uses are as follows:

- North – rail spur for the Darwin – Alice Springs railway to the north-west. Land to the north east is currently being developed for a US Jet fuel storage facility;
- East – Berrimah Road;
- South – Northern Cement Works;
- West - rail spur for the Darwin – Alice Springs railway.

2.10 Audit Findings

The information provided by EcOz 2021a and SMEC 2022b in regard to the site condition and surrounding environment has been checked against and generally meets the requirements of EPA 2020a. The information provided was also consistent with the observations made during the audit site inspection. Site identification and site area details have been confirmed by the auditor with publicly available records.

Overall, the information provided by EcOz 2021a and SMEC 2022b, supplemented by observations made during the site inspection and information provided by Vopak in relation to the site condition and the surrounding environment, is considered adequate for the purposes of the environmental audit program.

3. Site Inspection and Interviews

3.1 Site Inspection

A walkover and inspection of the VTD facility was undertaken on 26 and 27 April 2022. The GRR facility was visited on 27 April 2022. As detailed in **Table 1.2**, the site inspections were undertaken by the environmental auditor assistant (Christine Louie) accompanied by VTD and/or GRR personnel.

Table 3.1 summarises observations made by the auditor assistant and anecdotal information gained from the inspection of the VTD and GRR facilities.

Table 3.1: Summary of Site Inspection Observations

Site Area	Anecdotal Information	Audit Observations
VTD Facility		
Adjacent sites	The adjacent site to the north east was under construction for use as a Jet fuel storage facility at the time of the site inspection.	Vegetation management and weed spraying was being undertaken along the boundary at the adjacent site to the west. A freight cargo train with container carriages and cars was parked along the railway line to the west. Tourist coach buses and taxis were observed using the roadway to the west.
VTD Forecourt		The forecourt hardstand from the entry extending across to the acid gantry is comprised of pavers. There is no observable slope. Stormwater drains are located along the extents of the forecourt.
AFFF solution pipeline leak excavation	The excavation was reported to have been dug using hand tools following the discovery of the foam solution leak due to the presence of underground services. The excavation was reported to have been temporarily covered with tarp pending further site investigation and/or remediation. Further to the recent soil sampling in the excavation, the excavation is proposed to be backfilled in the near future until such time that further works will be undertaken.	The excavation was open with the base exposed. Timber shoring had been placed along the walls of the excavation. The foam solution pipeline and two adjacent pipelines were exposed. The foam solution line was covered in a blue coloured wrapping material. Surface water was observed to have collected at the base of the excavation. A fold-up ladder providing access into the excavation was placed at the southern end. A timber pallet was located at the northern end of the excavation. The excavation was fenced off.
Fire Water Pump House	The firefighting system is shared with the GRR facility. Underground pipelines are reported to supply firefighting foam to the GRR Facility.	The pump house contains the foam storage tank and pumps for the foam firefighting system. The firefighting water storage tank is located adjacent to the pump house to the south. Surface markings to the rear of the pump house showing the locations of the underground foam supply pipelines were observed. Two storage containers located adjacent to the pump house were used to store portable bunds and hoses.
Western boundary	Runoff from the site into the swale has been reported not to occur. Amos and Glyphix herbicides were reported to have been used around the pipeline rack after the wet season.	A vegetated swale is located along the western fenceline. The swale continues along the railway line upstream and downstream. Coarse screens are located along the fencelines at the entry and exit to the VTD facility. The western portion of the site between the DIFT tanks and the swale is sealed gravel /asphalt hardstand. Some staining of the hardstand was observed to the west of tank TK0303.

Site Area	Anecdotal Information	Audit Observations
VTD Facility		
OUD	The OUD is affected by tides in Darwin Harbour. King tides that occur 2 to 3 times per year have been reported to result in the stormwater level in the OUD being backed up near the roadway.	The OUD contained a shallow layer of water. A slight oil sheen was observed in the OUD water. Various small diameter pipes drain into the OUD. The OUD accepts stormwater from the VTD and GRR facilities. Orange staining of the OUD lining was observed near the acid storage tank and the outlet from the DIFT portion of the VTD facility.
DAT Gantry	The loading gantry has not been used for 12 to 16 months.	IBCs containing foam slops collected from the firefighting system deluge testing; drums of soil/water from the recent site investigations; hoses and small amounts of chemicals on portable bunds were stored in the gantry area.
Emergency Response Hut	The hut was previously used as the drivers hut for the DAT Gantry.	Emergency response equipment and PPE was stored in the air-conditioned hut.
Stormwater Pit	Stormwater is sampled prior to discharge to the OUD. The stormwater pit is required to be pumped out daily during the wet season.	The final stormwater separator pit was in a tidy state. Slight staining of the outlet screens and water level mark within the pit were observed. A layer of water (no sheen or turbidity) was present in the pit.
Facility Hardstand		Hardstand is a mixture of asphalt, concrete and pavers beyond the entry forecourt. Some patches of staining were observed in the forecourt in the DIFT area. Dried dark soil/sediment was observed around the firefighting hydrants near the DAT site.
GRR Facility		
General site	Repairs were being organised for the asphalt hardstand at the time of the inspection.	Timber pallets, IBC and drums of waste liquids were stored around the facility. Drums and pallets were stacked neatly and out of the way of access roadways. Asphalt hardstand was broken and had lifted up in various areas along the eastern portion of the site.
Stormwater Pit	Stormwater is treated in a coalescing separator prior to discharge.	Areas around the top of the pit and the pit were stained orange. Staining was also observed around the stormwater drain adjacent to the stormwater pit. Water in the first section of the pit was opaque. An orange/brown layer was present at the water surface in the second and screened section of the pit.

3.2 Site Interviews

Interviews were undertaken with operations personnel from VTD and GRR.

As detailed in **Table 1.2**, site interviews were undertaken by the environmental auditor assistant (Christine Louie) with VTD and GRR personnel.

Table 3.2 summarises the main considerations gained from the interviews.

Table 3.2: Summary of Site Interviews

Site Area	Anecdotal Information
Foam leak excavation	The excavation had not been reinstated while awaiting further investigation and/or remediation works to be undertaken. The excavation is reported to have been covered with a tarp which was removed for the recent soil and groundwater sampling in the vicinity. As no further soil and water investigations have been proposed, the excavation will be filled until such time when further works or investigation are required.
Site Maintenance - VTD	Preventative and corrective maintenance undertaken on-site. Preventative maintenance is scheduled based on regulatory requirements and manufacturer recommendations.

Site Area	Anecdotal Information
Training - VTD	Training needs analysis is conducted every two years for all personnel. Safety critical modules are required to be completed prior to personnel working in operational areas on-site. A training matrix is maintained of training completed, expired etc.

3.3 Audit Findings

Based on the observations made during the site inspections and interviews with operations personnel, the auditor provides the following opinions:

- While VTD has reported that the AFFF pipeline leak excavation was covered with tarpauline pending further investigation or remediation works, the excavation remained open two weeks post the additional site investigations (SMEC 2022b). The auditor considers the open excavation to be a secondary source of contamination with potential for migration of contaminants via stormwater and/or groundwater while it remains open. Any stormwater collected at the base of the excavation would require testing and management as appropriate.
- Observed minor areas of staining on hardstand, in the stormwater pit and in the OUD are indicative of petroleum hydrocarbon historical spills or leakages.

4. AR-AFFF Solution Leak

The leakage of Ansulite® AR-AFFF solution from an underground pipeline in the area adjacent to the additive tank and truck loading areas was reported to have occurred on 26 September 2020. The location of the leak is shown in **Figure 2**.

Details of the identification of the leak and subsequent actions undertaken by VTD operations to manage the incident are presented in an incident report dated 16/7/2022 (VTD 2022) and EcOz 2020b. A summary of the key information in relation to the AR-AFFF solution leak is provided in **Section 4.1** following.

4.1 Timeline of Actions Undertaken

An outline of the AR-AFFF solution pipeline leak and activities undertaken in response to the incident, as reported in VTD 2022 and EcOz 2020b and supplemented via information gained during the site interviews with operations personnel, and subsequent related activities is provided in **Table 4.1**.

Table 4.1: AR-AFFF Solution Leak - Actions Undertaken (as reported by Vopak and/or documented in VTD 2022 or EcOz 2020b)

Date	Activity
Sat 26 September 2020	• Leak of AR-AFFF solution from underground pipe in the vicinity of additive tanks and truck loading area detected around 1852 hours following automatic starting and resetting of firefighting foam pumps. Discharge valve in fire pump house closed. Some solution was observed running into two nearby drains and soaker snakes placed in front of drains to divert runoff away. • Site operations closed from 2001 hours onwards. • NT EPA notified of incident. • Foam solution pipe isolated at points nearest to leak. • Runoff in drains pumped out into IBCs.
Sun 27 September 2020	• Entire fire water and foam system shut down at 0600 hours as section of pipe where leak occurred was still pressurised. • Pavers around leak removed. Excavation around pipeline undertaken by hand until pinhole identified. A temporary clamp was placed around the leak in pipeline. • The contents of the IBCs and slurry in the excavation were removed by hydrovac trucks. The paved area was pressure cleaned with the cleaning water collected by a licensed waste contractor. • Runoff captured in the stormwater pit was pumped to the bund of TK101/TK102.
Mon 28 September 2020	• Soil samples were collected from the excavation and ground surface around the leak for laboratory analysis (EcOz 2020b). • Ultrasonic thickness testing completed along exposed pipeline section. With the exception of the pinhole section, pipeline thickness was reported as confirmed to meet specification minimum wall thickness. • Pipeline section was cleaned and a new clamp was fitted. • Following de-isolation of the repaired pipeline, normal operation of the VTD was commenced at 1615 hours.
Tue 29 September 2020	• Stormwater transferred to the TK101/TK102 bund was sampled for laboratory analysis (EcOz 2020b).
19 October 2020	• Runoff generated during two stormwater events since the leak had also been pumped into the TK101/TK102 bund. Stormwater stored in the bund was sampled again following the rainfall events (EcOz 2020b).
January 2021	• Sampling of collected stormwater transferred from the TK101/TK102 bund into tanks TK6106 and TK6107 (JBS&G 2020).
February 2021	• The water stored in TK6106 and TK6107 is disposed of off-site to Global Resource Recovery liquid waste facility in Laverton VIC.
November 2021	• Appointment of environmental auditor to undertake Environmental Audit Program in response to NT EPA Section 48 Notice.
17 December 2021	• Submission to NT EPA of Environmental Audit Program Scope of Works prepared by the environmental auditor.

Date	Activity
April 2022	• Completion of soil and groundwater investigations (SMEC 2022b) to collect additional data to address requirements of Section 48 Notice.
June 2022	• Human health and ecological assessment (HHERA) undertaken in relation to presence of PFAS at the site (EnRiskS 2022).
27 July 2022	• Submission of Environmental Audit Report to NT EPA.

Findings on the AFFF solution leak were documented in VTD 2022 as follows:

- The underground firefighting foam pipeline was commissioned in 2005/6 and there is no evidence of any asset integrity inspections or pressure testing having been undertaken since commissioning;
- No signs of corrosion or damage to the protective sleeve were observed in the exposed section of pipeline;
- The root cause of the pinhole was not determined.

The key recommendations of the incident report (VTD 2022) were as follows:

- Review firefighting pipeline systems inspection and testing regime;
- Undertake protection of exposed section of pipeline prior to covering up excavation pit;
- Independent review and verification of asset integrity inspection reports to be completed by Terminal Manager or Engineering Manager;
- Maintain emergency stocks of rapid response clamping system;
- Train terminal staff in emergency isolation process of the firefighting system to ensure potential impacts of any future events are minimised;
- Check fitness for purpose of longitudinal weld/joint in each section of pipeline prior to installation;
- Assess the need to have firefighting foam system charged 24/7 and undertake changes to allow firefighting foam system to remain ready for service without being under pressure;
- One page lessons learnt to be shared;
- Develop a methodology (preferably non-destructive in nature) to perform asset integrity inspections. Inspections to be scheduled using a risk based approach.

Vopak has advised that budget has been allocated for preliminary engineering and design works in relation to the firefighting pipeline system.

The results of the soil and stormwater sampling (EcOz 2020b) are discussed in **Section 8**.

4.2 Audit Findings

Based on the information provided in relation to the AFFF solution pipeline leak, the auditor provides the following opinions:

- The early identification of the leak via visual observations as part of routine operations contributed to limiting the amount of AFFF solution released to the environment. However, due to apparent gaps in operational knowledge of the overall firefighting system, pressurisation of the pipeline resulted in the leak continuing until the entire system was shut down.
- Appropriate measures were undertaken to ensure that AFFF contaminated surface runoff captured in the stormwater pit was contained and prevented from being discharged into Darwin Harbour. The stormwater pit contents were disposed of off-site to appropriately licensed waste facilities.

- Surface runoff captured in the stormwater pit was initially transferred into the TK101/TK102 bund where it remained for a period of months prior to being transferred into an empty diesel tank. It is unclear whether a tank was available for storage of the storm/surface water during that interim period. The auditor notes that the occurrence of two rain events and pressure cleaning of the pavers increased the volume of water contained within the bund. PFAS compounds are water soluble and mobile, and the retention of PFAS contaminated water within the bund is considered likely to have impacted the walls and base of the concrete bunded area. Pressure cleaning of the paved area/removed pavers is considered likely to have contributed to the migration of contaminants including PFAS into stormwater.
- The AFFF solution pipeline incident occurred in September 2020 and while an incident report has been prepared, it is understood that with the exception of the ultrasonic testing and repair of the pipeline, the recommendations are understood not to be complete as at the time of this audit.

5. Conceptual Site Model

The *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)* (NEPC 2013) identified a Conceptual Site Model (CSM) is a representation of site related information regarding contamination sources, receptors, and exposure pathways between those sources and receptors.

NEPC 2013 identifies the essential elements of a CSM as including:

- known and potential sources of contamination and contaminants of concern including the mechanism(s) of contamination;
- potentially affected media (soil, sediment, groundwater, surface water, indoor and ambient air);
- human and ecological receptors;
- potential and complete exposure pathways; and
- any potential preferential pathways for vapour migration (if potential for vapours identified).

5.1 Sources of Contamination

Potential sources of contamination identified for the site by SMEC 2022b include the following:

- storage of bulk fuel, acid products, additives and lubricants and degreasers (VTD site);
- storage and use of fire fighting foam concentrate;
- storage of wastewaters (GRR site);
- potential leakage from on-site and off-site sewerage systems;
- historical filling of the site;

The main contaminants of potential concern identified for the site include:

- Total recoverable hydrocarbons (TRH);
- Benzene, toluene, ethylbenzene and xylenes (BTEX);
- Polycyclic aromatic hydrocarbons (PAHs);
- Heavy metals (arsenic, cadmium, chromium, copper, lead, nickel, zinc and mercury);
- Nutrients (nitrogen and phosphorus)
- Per- and polyfluoroalkyl substances (PFAS).

5.2 Potentially Affected Media

Potentially affected media include soil, groundwater, surface water and sediment.

5.3 Beneficial Uses & Receptors

Potential human receptors of contamination include:

- Site workers/maintenance workers on-site and nearby to the site; and
- Consumers of seafood (fish, shellfish or other biota) from receiving wetland/harbour environment.

Potential ecological receptors of contamination include:

- Off-site ecosystems (aquatic and terrestrial organisms) of adjacent wetlands or Darwin Harbour; and

- Consumers of aquatic organisms (birds and mammals).

The NT Government has developed water quality objectives for *Darwin Harbour through the Darwin Harbour Water Quality Protection Plan* (Department of Land Resource Management 2014).

The beneficial uses declared for Darwin Harbour under the *Water Act* are:

- aquacultural;
- environmental; and
- cultural.

5.4 Potential Transport Mechanisms

Potential transport mechanisms for migration of contaminants identified by SMEC 2022b include:

- Leaching from soil into the groundwater system and migration off-site;
- Migration from site via groundwater, surface water/stormwater or sediment (transport via surface water/stormwater) to adjacent receiving environment;
- Leaching from sediment into surface water and migration off-site to receiving environment;
- Migration from site via airborne dust; and
- Migration from site soil or groundwater via air vapour.

5.5 Potential Exposure Pathways

Potential exposure pathways for receptors identified by SMEC 2022b include:

- Dermal contact with soil, sediment, surface water or groundwater;
- Ingestion of soil, sediment, surface water or groundwater;
- Inhalation of dust or vapours; and
- Uptake by plants or ingestion by aquatic or terrestrial organisms.

5.6 Audit Findings

SMEC 2022b identified potential contamination issues based on the site history and previous site investigations. The list of potential contaminants and associated potentially contaminated media are considered to have been suitably comprehensive noting the use of the site as a fuel terminal and LWTF and historical filling of the site, and encompasses the substances identified in the Section 48 Notice, namely petroleum hydrocarbons, PFAS, copper, lead, zinc and ammonia, that have the potential to cause environmental harm at the site. Taking into consideration the investigations previously undertaken at the site, the environmental auditor considers that the list of CoPCs was adequate to assess the nature and extent of contamination at the site.

SMEC 2022b considered human and ecological receptors, and potential exposure pathways. The environmental auditor considers that potential source-pathway-receptor linkages have generally been adequately addressed.

The auditor notes that the CSM prepared by SMEC 2022b was sufficiently detailed and generally meets the requirements of the NEPC 2013.

Overall, the auditor considers that the identified potential contamination issues and potentially contaminated media were appropriate for the purposes of assessing the contamination status of the site.

6. Sampling Analytical and Quality Program

To address the requirements of the Section 48 Notice for evaluation of the types, amount, distribution and mobility of identified contaminants of concern at the site and potential to cause harm to the environment, soil and groundwater investigations were undertaken by SMEC 2020b to address data gaps and supplement the groundwater, stormwater and sediment monitoring data gathered as part of regular environmental monitoring (GHD 2022).

6.1 Data Usability Assessment

An assessment of quality assurance and quality control (QA/QC) has been undertaken by GHD 2022 and SMEC 2022b. Review of QA/QC against data quality indicators (DQIs) was undertaken by GHD 2022 and SMEC 2022b.

The auditor has undertaken a review of the field and laboratory QA/QC undertaken by the consultants, which has been summarised in **Table 5.1** against the PARCC parameters (precision, accuracy, representativeness, comparability and completeness).

The data quality indicators have generally considered the parameters of precision, accuracy, representativeness, comparability and completeness. Specific elements as undertaken to assess each of these measures and adopted within the extent of investigation works completed has included:

- Intra-laboratory duplicates (blind);
- Inter-laboratory duplicates (spilt);
- Field rinsate / equipment blanks (including equipment decontamination);
- Trip blanks;
- Trip spikes;
- Sampling data including sample location, sample depth, borelogs, sampling personnel, sampling methodology, field parameters, well construction and/or sample preservation;
- Analysis within holding times;
- Completion of chain of custody documentation (i.e. field relinquishment advice, sample receipt advice);
- Use of NATA accredited laboratories; and
- Completion of laboratory QA/QC (inclusive of method blanks, laboratory control samples, matrix spikes, laboratory duplicates, surrogate added to organic analytes and method descriptions).

The inclusion of each of these elements has been assessed for the works completed on the site and are summarised in **Table 6.1**.

Table 6.1: Data Usability Assessment – DQI Compliance

DQI	GHD 2022	SMEC 2022b
Intra-Laboratory Duplicates	Yes	Partial
Inter-Laboratory Duplicates	No	Yes
Trip Blank	No	Yes
Rinsate Blank	No	Partial
Trip Spike	No	Yes
Chain of Custody	Yes	Yes
Samples logs / borelogs / sampling forms	Yes	Yes
Assessment of Holding Times	Partial	Partial

DQI	GHD 2022	SMEC 2022b
NATA Accredited Laboratory	Yes	Yes
Laboratory QA/QC	Yes	Partial

The DQIs were generally adequately met. An assessment of compliance with the main elements of the DQIs is as follows:

- Soil samples were collected from 10 boreholes installed in three accessible directions stepping out from the AFFF solution pipeline leak excavation at distances of 2 m, 5 m and 15 m. Soil samples were also collected from the nine boreholes installed as part of groundwater monitoring well installation across the site. The number and location of soil sampling bores installed around the excavation are considered appropriate to delineate impacts of the AFFF pipeline leakage and provide general coverage across the site to address data gaps.
- Soil bores were installed to a depth of approximately 3 metres below ground level (m bgl) just below the top of the water table. Samples were collected at two depths within soil and weathered rock. The sampling depths are considered appropriate to assess the vertical extent of contamination.
- Groundwater monitoring wells were installed in three locations around the excavation; two wells targeted previously detected high concentrations of PFAS on-site; two wells targeted downgradient conditions along the western boundary; and one well was installed in the centre of the site downgradient of previously detected PFAS impact. The number and location of monitoring wells are considered sufficient to address data gaps within the existing groundwater monitoring network.
- Groundwater wells were developed following installation and samples collected three to four days after installation instead of at least seven days following installation. While the reduced period between installation and sampling is considered to be a non-compliance, wells were purged prior to sampling and representative samples collected. The use of bailers similar to the sampling methodology used for existing monitoring wells for comparability purposes is considered appropriate and the samples collected are considered to be suitably representative.
- Groundwater, stormwater and sediment samples were collected as part of the regular environmental monitoring for the site. Sampling locations for the pre-wet, mid-wet and post-wet seasons were completed at locations sampled in previous monitoring rounds. The samples collected are considered appropriate for the purposes of the environmental audit program.
- The relative percent differences (RPDs) for primary/duplicate sample pairs exceeded the acceptance limits for three stormwater sample pairs and two groundwater sample pairs (GHD 2022). The exceedances were reported to be due to low concentrations of analytes resulting in large differences in RPDs and are not a reflection of inconsistencies in laboratory analysis or field methodology.
- Holding times were exceeded for BOD and TRH (sediment) analysis (GHD 2022). As the majority of BOD results were below the LOR, GHD 2022 reported that the quality of the dataset was not compromised. The exceedance of TRH analysis in sediment by 13 days was not considered (GHD 2022) to affect the dataset.
- Analysis of PFAS was not undertaken on the intra-laboratory duplicate during the groundwater sampling for the newly installed wells (SMEC 2022b). The relative percent differences for sample pairs for all other analytes were within the DQIs and the non-compliance is not considered to affect the dataset.

- Relative percent differences (RPDs) were outside the acceptance limits for two sample pairs for heavy metals analysis in soil and one sample pair for heavy metals analysis in groundwater. SMEC 2022b reported that RPD exceedances were disregarded where sample concentrations were less than 10 times the LOR.
- Samples (GHD 2022 and SMEC 2022b) were received at the Darwin laboratory at temperatures above 6°C and recorded at a maximum temperature of 25°C for a number of batches. As the field temperatures for the samples were recorded in excess of 30°C and ice was reported to have been placed in the ice chests with the samples during fieldwork and prior to dispatch to both the Darwin and Sydney laboratories, the discrepancy is not considered to have affected the reliability of the dataset.
- Holding times were exceeded for analysis of moisture content in batch ES2212731 by one day; analysis of TPH/TRH and BTEXN in the trip blank or trip spike in batch ES2213150 by four days; and analysis of TPH/TRH, BTEXN and PAHs in batch ES2213154. Comment was not provided by SMEC 2022b on the non-compliances. The auditor considers that as petroleum hydrocarbons have generally not been detected above the LOR or at low concentrations, the non-compliances are not considered to have impacted the reliability of the dataset (SMEC 2022b).
- The expected QC frequencies were not met for laboratory duplicate and matrix spike for analysis of TRH, PFAS, PAHS/phenols for three batches (SMEC 2022b). These batches relate to the inter-laboratory duplicate analyses and are not considered to affect the useability of the data for precision assessment.
- Laboratory matrix spike recoveries exceeded the acceptance criteria for 6:2 FTS and 8:2 FTS analysis and ammonia analysis in two batches - acceptable recovery was obtained for laboratory control spikes indicating sample matrix interference. Matrix spike recoveries were not determined for anonymous samples in one batch for PFOS, 6:2 FTS and 8:2 FTS analyses which are not considered to be representative of sampled material. The useability of the dataset (SMEC 2022b) is not considered to be affected by the non-compliances.
- Laboratory duplicate recovery recorded RPDs outside the adopted control limits for arsenic in the anonymous sample in one batch which is not considered to be representative of the sampled material. The useability of the dataset (SMEC 2022b) is not considered to be affected by the non-compliance.
- Concentrations of TRH analytes were detected above the detection limit in one rinsate sample due to TRH-free rinsate water not being available at the time of sample collection. Concentrations of all other analytes were not detected above the LOR. As TRH was not detected in the TRH-free rinsate sample analysed in a separate batch, the non-compliance is not considered to affect the useability of the dataset (SMEC 2022b).

6.2 Audit Findings

The quality assurance/quality control measures employed by GHD 2022 and SMEC 2022b were checked and found, overall, to adequately comply with the requirements outlined of NEPC 2013. The laboratory QA/QC results have been reviewed and the results indicate that the analytical laboratories were achieving adequate levels of precision and accuracy. As such, the sampling, analytical and quality protocols undertaken by GHD 2022 and SMEC 2022b were considered to be adequately reliable for the purpose of assessing the contamination status of the site and the data is therefore considered reliable and useful for the purpose of this environmental audit program.

7. Environmental Quality Objectives

7.1 Introduction

Development and operation of the site for the purposes of a fuel terminal was granted by the NT Department of Infrastructure, Planning and Environment in 2003 with subsequent approvals for amendments to lot boundaries and site layout. Under Development Permit No. DP03/0455, operation of the VTD site is required to be undertaken in accordance with the Operational Environmental Management Plan (OEMP) (Vopak 2021) approved by the Office of Environment and Heritage (now EPA).

Operation of the sub-leased GRR LWTF site is regulated by the NT EPA under EPL 229-02.

The Environmental Audit Program has been undertaken with consideration of the objectives of the protection of human health and ecology.

Data collected for the site has been assessed against criteria sourced from the NEPC[2], CRC CARE[3] and HEPA[4]. The Darwin Harbour Water Quality Objectives (NT Gov 2010) have been developed based on ANZECC & ARMCANZ 2000.

A human health and ecological risk assessment (HHERA) (EnRiskS 2022) was undertaken to assess the risks posed by PFAS impacts at the site. Screening assessment was undertaken for PFAS compounds where guideline values are not available and interim water quality guidelines have been developed. A summary of the screening assessment detailed in the HHERA is provided in **Section 7.6**.

7.2 Soil

Assessment of soil contamination has been undertaken against the following criteria:

- Health Investigation Levels (HIL) D – commercial/industrial, includes premises such as shops, offices, factories and industrial sites;
- Health Screening Levels (HSLs) for vapour intrusion - HSL D for commercial/industrial land use for 0 m to < 1 m and 1 m to < 2 m for sand;
- Health Screening Levels for direct contact HSL D for commercial/industrial land use and intrusive maintenance worker; and
- Health based guidance values for perfluorooctane sulfonate (PFOS)/perfluorohexane sulfonate (PFHxS) and perfluorooctanoic acid (PFOA) - HIL D for industrial/commercial land use.

Based on the operational nature of the site facilities, ecological soil assessment criteria have not been considered.

The commercial/industrial land use scenario is considered appropriate for ongoing fuel terminal land uses.

For PFAS compounds where health based guideline values are not available, the following have been used for screening purposes:

- Guideline values for PFOS have been applied to sulfonates (including PFBS and PFPeS) and fluorotelomers (including 4:2 FTS, 6:2 FTS, 8:2 FTS and 10:2 FTS); and

[2] *National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended 2013, National Environment Protection Council (NEPC 2013).

[3] *Technical report no. 10 - Health screening levels for petroleum hydrocarbons in soil and groundwater*. September 2011, E. Friebel and P. Nadebaum. Co-operative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE 2011).

[4] *PFAS National Environmental Management Plan*. Version 2.0-, January 2020. Heads of EPAs Australia and New Zealand. (HEPA 2020).

- Guideline values for PFOA have been applied to carboxylic acids (including PFBA, PFPeA, PFHxA, PFHpA, PFNA, PFDA, PFUnDA and PFTrDA).

7.3 Sediment

Assessment of sediment contamination has been undertaken against the following criteria:

- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG 2018) – sediment quality default guideline values (DGVs) and upper guidelines values (GV-high).

7.4 Groundwater

Assessment of groundwater contamination has been undertaken against the following criteria:

- Health Screening Levels for vapour intrusion - HSL D for commercial/industrial land use for 2 m to < 4 m for sand;
- Health based guidance values for PFOS/PFHxS and PFOA – recreational water quality;
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG 2018) – 95% species protection levels for slightly to moderately disturbed marine water systems. For potentially bioaccumulative toxicants (cadmium, mercury and nickel), the 99% species protection levels have been used.
- Ecological guidance values for PFOS and PFOA - interim marine values for 95% (slightly to moderately disturbed systems) and 99% (high conservation value systems) protection of species;
- Water Quality Objectives for Darwin Harbour Region[5] for the upper estuary.

For PFAS compounds where health based guidelines values are not available, the following have been used for screening purposes:

- Guideline values for PFOS have been applied to sulfonates (including PFBS and PFPeS) and fluorotelomers (including 4:2 FTS, 6:2 FTS, 8:2 FTS and 10:2 FTS); and
- Guideline values for PFOA have been applied to carboxylic acids (including PFBA, PFPeA, PFHxA, PFHpA, PFNA, PFDA, PFUnDA and PFTrDA).

7.5 Stormwater

Assessment of stormwater contamination has been undertaken against the following criteria:

- Health based guidance values for PFOS/PFHxS and PFOA – recreational water quality
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG 2018) – 95% species protection levels for slightly to moderately disturbed marine water systems.
- Water Quality Objectives for Darwin Harbour Region for the upper estuary.
- Ecological guidance values for PFOS and PFOA - interim marine values for 95% (slightly to moderately disturbed systems)

For PFAS compounds where health based guidelines values are not available, the following have been used for screening purposes:

- Guideline values for PFOS have been applied to sulfonates (including PFBS and PFPeS) and fluorotelomers (including 4:2 FTS, 6:2 FTS, 8:2 FTS and 10:2 FTS); and

[5] *Water Quality Objectives for the Darwin Harbour Region – Background Document*. February 2010. Department of Natural Resources, Environment, The Arts and Sport, Northern Territory Government (NT Gov 2010).

- Guideline values for PFOA have been applied to carboxylic acids (including PFBA, PFPeA, PFHxA, PFHpA, PFNA, PFDA, PFUnDA and PFTrDA).

7.6 PFAS

The HHERA (EnRiskS 2022) undertook screening assessment of PFAS and based on the much lower toxicity of the PFAS compounds 6:2 FTS, 8:2 FTS and PFHxA compared to PFOS, the recreational water quality guideline (for groundwater and storm water) was adjusted as follows:

- 6:2 FTS and 8:2 FTS – 500 µg/L; and
- PFHxA – 10,000 µg/L.

Refined assessment was undertaken of the screening process for protection of ecological health and an interim water quality guideline of 210 µg/L for 95% species protection was generated for 6:2 FTS and 8:2 FTS, and is applicable to all of the fluorotelomers in storm water and groundwater.

The assessment of the significance of levels of contamination measured on the site was assessed by the completion of the site specific human health and ecological risk assessment (HHERA, EnRiskS 2022). **Table 7.1** following has provided an assessment of the risk assessment as specific to the HHERA. This has been assessed by consideration of each of the required parts of a risk assessment as outlined in Appendix E of *Guidelines for the NSW Site Auditor Scheme (3rd Edition)*, 2017, NSW EPA.

Table 7.1: Assessment of HHERA

Risk Assessment Component	Auditor Assessment
Hazard Identification	The HHERA has presented an initial screening assessment of all data as nominated with scope of the risk assessment. This has comprised a summary of the maximum level of each constituent reported and a comparison to screening criteria as protective of human and ecological exposures within a commercial / industrial site. Screening criteria have ben taken from levels published / endorsed by regulators within Australia. The assessment has been specific to each of the media which have been previously assessed. Constituents which have exceeded the criteria, inclusive of FTS forms of PFAS and PFOS, have been selected for further risk assessment. The screening criteria adopted have been confirmed as appropriately conservative and the maximum concentrations have been correctly identified. Justification was provided for omission of some carboxylic constituents from further risk assessment, which approached the screening criteria.
Toxicological Information	A detailed toxicity review has been provided for the FTS constituents, while published /. Regulator available sources have been relied upon for PFOS with additional commentary of recent technical body positions in respect of ecological risk. The alternate PFOS ecological criteria presented is supported by the Site Auditor's own knowledge of the current state of PFOS ecological criteria development in Australia and is appropriate for this assessment. The review of toxicological data for FTS forms of PFAS is considered to be comprehensive and appropriate for the assessment. Detailed explanation has been given to the interpretation of the available toxicity data to use for assessment of FTS risk on the site.
Exposure Assessment	A conservative approach to exposure assessment has been adopted, with typical guidance as presented in the development of the Regulator criteria generally adopted and considered with the assessment's interpretation of toxicological data. All potential human and ecological exposure populations on and in proximity of the site have been considered. The exposure assessment has been supplemented with a detailed review of ambient sources of PFAS in the environment. The criteria for FTS did not consider the potential for bioaccumulation. An ecological protection level of 95% was instead adopted, as generally appropriate for an urban catchment. Sufficient justification was provided to the risk assessment as to why bioaccumulation did not warrant consideration for FTS forms and the Site Auditor agrees with the use of a 95% protection level.
Risk Characterisation	Risk characterisation has been undertaken by a presentation of alternate / site specific health and ecological based criteria for POFOS and FTS forms of PFAS and comparison to site data. The level of risk has been demonstrated as likely to be low.

Risk Assessment Component	Auditor Assessment
	The risk assessment does note a requirement for further monitoring so as to properly characterise levels of FTS forms of PFAS through all seasonal conditions on the site. The results of this additional monitoring will not influence the site specific risk based criteria as presented in the risk assessment, but may affect the assessment of the level of risk. A generic assessment of uncertainties has been included in the risk assessment – which is generally sufficient when considered with the specific discussion of uncertainties and potential limitations within the remainder of the risk assessment.
Equations	All calculations undertaken in the risk assessment, which generally related to the derivation of the site specific FTS based criteria, are explained in the risk assessment. The calculations have been checked and confirmed as accurate.
Data Evaluation	The data evaluation within the risk assessment has been restricted to the data as made available by the primary consultant. The limitations of the assessment have been identified and reported within the risk assessment. Further specific discussion has been provided of potential limitations of the available dataset to have identified maximum levels of some constituents and guidance is further provided as to the requirements of additional / future monitoring.
Assessment	The risk assessment has derived robust and site specific criteria for the assessment of PFOS and FTS forms of PFAS on and in proximity of the site. The effectiveness of the risk assessment is limited by the available dataset of levels of FTS and PFOS, and the representativeness of the dataset for the range of meteorological conditions that may occur at the site. The risk assessment has provided recommendations for collection of an expanded monitoring dataset that should be adopted in the ongoing characterisation of the site.

7.7 Audit Findings

The criteria adopted to assess risks posed to human health and the environment from identified contamination at the site are considered to be generally appropriate.

The absence of ecological criteria for soils is considered appropriate given the nature of the site as operational industrial facilities with hardstand generally across the whole of the site.

Ecological criteria adopted for the protection of marine water systems and Darwin Harbour are considered to be appropriate.

Where guideline values are not available for PFAS compounds, the adjusted and refined assessment criteria adopted are considered to be appropriately conservative.

Overall, the auditor considers that the soil, sediment, groundwater and stormwater criteria adopted are appropriate for assessing the identified contaminants of concern at the site, and nature and extent of contamination that may be present at the site.

8. Assessment of Environmental Impacts

8.1 Environmental Monitoring

Regular environmental monitoring of groundwater, stormwater and sediments for the VTD and GRR sites is undertaken as part of site operations in accordance with the requirements of the VTD OEMP (Vopak 2021) and EPL 220-02 applicable to the GRR site. Environmental monitoring conducted regularly at the site is summarised in **Table 8.1**.

Table 8.1: Environmental Monitoring Program – VTD and GRR (Vopak 2021 and EPL 220-02)

Media	Location	Frequency	Parameters
Groundwater	VTD EMB 1 EMB2 EMB3 EMB4 EMB5 EMB6 EMB7 EMB8 EMB11 EMB12 EMB15 EMB16	Biannually - at the end of the dry season and the end of the wet season each year.	Field parameters • pH • dissolved oxygen • electrical conductivity • turbidity • temperature • oxidation-reduction potential • total dissolved solids • salinity Laboratory Analysis • Heavy metals – arsenic, cadmium, chromium, copper, nickel, lead, zinc, mercury • Total petroleum/recoverable hydrocarbons • Benzene, toluene, ethylbenzene, m, p & o-xylenes, naphthalene • Polycyclic aromatic hydrocarbons • PFAS (28 analytes)

Media	Location	Frequency	Parameters
	GRR[a] EMB7 EMB12 EMB13 EMB14 EMB15	Monthly - gauging and measurement of field parameters Quarterly – laboratory analysis (EMB13 and EMB14 only) Annual – laboratory analysis	Field parameters • pH • dissolved oxygen • electrical conductivity • temperature • oxidation-reduction potential Laboratory Analysis • Metals – antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, nickel, lead, manganese, selenium, vanadium, zinc, mercury • Total recoverable hydrocarbons • Benzene, toluene, ethylbenzene, m, p & o-xylenes, naphthalene • Polycyclic aromatic hydrocarbons • Major ions – calcium, magnesium, sodium, potassium, carbonate, bicarbonate, chloride, sulphate • Nutrients – total phosphorus, total nitrogen, oxides of nitrogen, ammonium • PFAS • Organic alcohols – monoethylene glycol, triethylene glycol • Polychlorinated biphenyls • Total cyanide • phenols

Media	Location	Frequency	Parameters
Surface water / stormwater	VTD • DIFT1 – upper end of largest stormwater pit • DIFT2 – lower end of the stormwater pit • DAT 2 - stormwater pit receiving water captured within the acid tank bund • 6-series – stormwater pit receiving water captured within the bund for the 6-series tank farm	Three times during the wet season: • Oct/Nov (immediately following the first wet season rains); • Jan/Feb (mid wet season); • April/May (end of wet season).	Field parameters • pH • dissolved oxygen • electrical conductivity • turbidity • temperature • total dissolved solids • salinity Laboratory Analysis • Metals – antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, nickel, lead, manganese, selenium, vanadium, zinc, mercury • Total petroleum/recoverable hydrocarbons • Benzene, toluene, ethylbenzene, m, p & o-xylenes, naphthalene • Oil and grease • Nutrients – ammonia, nitrite, nitrate, nitriate+nitrate, total Kjeldahl nitrogen, total nitrogen, total phosphorus • PFAS (28 analytes) • Total suspended solids • Biochemical oxygen demand
	GRR • Stormwater discharge pit – final chamber	As required. Daily during months of storm water – measurement of field parameters Monthly during months of storm water – laboratory analysis	Field parameters • pH • dissolved oxygen • electrical conductivity • temperature Laboratory Analysis • Heavy metals – arsenic, cadmium, chromium, copper, nickel, lead, zinc, mercury • Total recoverable hydrocarbons • Benzene, toluene, ethylbenzene, m, p & o-xylenes, naphthalene • Polycyclic aromatic hydrocarbons • Nutrients – total phosphorus, total nitrogen, oxides of nitrogen, ammonium • PFAS • Organic alcohols – monoethylene glycol, triethylene glycol • Polychlorinated biphenyls • Total cyanide • phenols • Total suspended solids • Total dissolved solids

Media	Location	Frequency	Parameters
Sediment	• Four locations along the shallow unlined drain located on the north-western boundary of the VTD site which receives runoff from the tarmac north-west of the main tank farm. Water in the drain flows south-west and discharges to into the OUD. • Three locations along the shallow unlined drain located on the south-western boundary of the VTD site which receives runoff from the tarmac west of the acid tank. Water in the drain flows north-west and discharges to into the OUD. • One location at the end of the OUD prior to the crossing under the railway line. • Two locations at the outlet of the OUD	Biennially - once every two years at the end of the wet season (April/May). Photos of mangroves, mudflats and saltmarshes are also taken (photo point monitoring) complementary to the sediment sampling at the point where the OUD discharges to Darwin Harbour (location 12) to detect any adverse changes to habitats over time.	• Heavy metals – arsenic, cadmium, chromium, copper, nickel, lead, zinc, mercury • Total petroleum/recoverable hydrocarbons • Benzene, toluene, ethylbenzene, m, p & o-xylenes, naphthalene

Notes:

[a] EPL 229-02 also requires monitoring of groundwater monitoring wells EMB7, EMB12 and EMB15 which are located on the VTD site.

Site assessment investigation works were undertaken following the AR-AFFF solution pipeline leak as outlined in **Table 4.1** (VTD 2022 and EcOz 2020b) and summarised as follows:

- initial sampling of soil in excavation around the AR-AAFFF pipeline leak;
- initial sampling of stormwater transferred from stormwater pit into TK101/TK102 bund and resampling of bund waters following rainfall events;
- sampling of stormwater following transfer into empty storage tank; and
- installation of six soil bores stepping out from the excavation and nine groundwater monitoring wells across the VTD site to address data gaps. Sampling and analysis of soil and groundwater.

A summary of the findings of the recent environmental monitoring undertaken to date and the additional site investigations undertaken to address the requirements of the Section 48 Notice are provided in the following sections. Copies of GHD 2022 and SMEC 2022b (including EnRiskS 2022) are included as **Appendix A** and **Appendix B** respectively.

Sampling locations are shown in **Figure 2**.

8.2 Soil

Sampling of soil was undertaken from the excavation around the pipeline leak (EcOz 2020b) following temporary clamping of the pipe and of surface soil from underneath removed pavers. Concentrations of anionic surfactants were detected above the LOR in all of the base samples and one surface soil sample. Concentrations of glycols and PFAS (mainly 6:2 FTS which was detected in all samples) were detected above the limit of reporting in all of the soil samples. Concentrations of PFOS (0.0197 to 0.0423 mg/kg) were detected above the ecological indirect exposure guideline value

(0.01 mg/kg) in all the base samples. Concentrations of TPH/TRH, BTEXN, PAHs and VOCs were not detected above the LOR.

Additional soil sampling was undertaken from soil bores installed stepping out in accessible directions (north, south and east) of the pipe leak excavation and from soil bores installed for new groundwater monitoring wells (SMEC 2022b). Concentrations of PFAS were detected above the LOR in all soil samples analysed with the exception of one sample. Concentrations of PFAS (including PFOS and PFOA related compounds) were not detected above the adopted assessment criteria for industrial land use. The distribution of PFAS across the site has been assessed as the sum of PFAS concentrations with the highest concentration (0.52 mg/kg) detected in surface soil near the location of the reported historical foam solution release (EMB17 0.05-0.15), higher than concentrations detected in soil samples collected from the pipeline leak excavation. Generally, the concentrations of sum of PFAS did not show a clear pattern in distribution across the site compared to locations within the vicinity of the pipeline leak.

Assessment of leachability of PFAS from soils into groundwater and/or surface water during rain events was undertaken using the Australian Standard Leaching Procedure (ASLP) (SMEC 2022b). The results indicated that PFOS and 6:2 FTS are highly leachable. As the ASLP test provides a significant overestimate of leachability during a single rain event, assessment of potential for human health and ecological effects from PFAS are addressed further in the following discussion on groundwater and stormwater.

Concentrations of heavy metals (arsenic, chromium, copper, lead, nickel and zinc) detected were below the adopted site criteria in soil samples analysed. Concentrations of TPH/TRH, BTEX and PAHs were not detected above the LOR in the soil samples analysed (SMEC 2022b).

8.3 Groundwater

A baseline study was undertaken on the GRR site prior to sub-lease of the former biodiesel facility to GRR (EcOz 2017). Groundwater sampling was undertaken for the two monitoring wells located within the GRR site. Concentrations of PFOA (0.45 µg/L and 0.36 µg/L) and PFHxA (1.42 µg/L and 0.45 µg/L) were detected in both monitoring wells EMB13 and EMB14 respectively, below the 95% species protection ecological screening criteria (220 µg/L). Concentrations of 6:2 FTS and 8:2 FTS were detected in the monitoring well closest to the VTD site (EMB13) at concentrations (14.8 µg/L and 1.75 µg/L) above the 95% species protection ecological screening criteria (0.13 µg/L) but below the interim water quality guideline developed (210 µg/L).

Analysis results for PFAS monitoring for the GRR site undertaken in March 2022 (GRR 2022) detected concentrations of PFOA (2.2 µg/L and 0.08 µg/L for EMB13 and EMB14 respectively) below the 95% species protection ecological screening criteria (220 µg/L). Concentrations of 6:2 FTS and 8:2 FTS were detected in the monitoring well closest to the VTD site (EMB13) at concentrations (16 µg/L and 0.7 µg/L) above the 95% species protection ecological screening criteria (0.13 µg/L) but below the adopted refined interim water quality guideline (210 µg/L). Concentrations of all heavy metals, ammonia and TRH were detected below the 95% species protection ecological screening criteria.

Groundwater was sampled in December 2021 and April 2022 as the most recent pre-wet and post-wet season sampling rounds at the VTD site (GHD 2022). During the most recent groundwater sampling undertaken in April 2022, nine new monitoring wells were installed to provide groundwater data for areas of the site where there were data gaps (SMEC 2022b).

The field parameter results for the groundwater monitoring events (GHD 2022 and SMEC 2022b) are summarised as follows:

- standing water levels: 3.920 m AHD (EMB20) to 5.741 m AHD (EMB14) during the post-wet season monitoring with a general groundwater flow direction to the west;

- pH: 4.26 (EMB15) to 7.84 (EMB2) pre-wet season and 3.54 (EMB21) to 8.29 (EMB1) post-wet season;
- electrical conductivity: 172 µS/cm (EMB7) to 66,241 µS/cm (EMB16) pre-wet season and 82 µS/cm (EMB6) to 57,715 µS/cm (EMB16);
- temperature: 32.1°C (EMB7) to 37.3°C (EMB15) pre-wet season and 32.2°C (EMB18) to 38.7°C (EMB5) post-wet season;
- dissolved oxygen: 23.3% (EMB6) to 65.2% (EMB8) pre-wet season and 14.6% (EMB23) to 84.8% (EMB5) post-wet season;
- redox potential: -80.7 mV (EMB3) to 387.1 mV (EMB15) pre-wet season and -80.8 mV (EMB6) to 1,526 mV (EMB5).

pH was recorded below the WQO lower limit (pH 6) for six monitoring wells pre-wet season and nine monitoring wells (one existing and eight new wells) post-wet season. Electrical conductivity concentrations vary widely across the site with values indicative of saltwater naturally mixing with groundwater along the coastline.

The analytical results for the groundwater monitoring events (GHD 2022 and SMEC 2022b), for contaminants other than PFAS, are summarised as follows:

- concentrations of ammonia were detected above the WQO (20 µg/L) in all monitoring wells with the exception of EMB 15 with a maximum concentration of 3,450 µg/L (EMB6) pre-wet season and EMB8, EMB21 and EMB24 with a maximum concentration of 6,850 µg/L (EMB20) post-wet season;
- concentrations of copper were detected above the adopted assessment criteria (1.3 µg/L) in EMB2 (3 µg/L), EMB4 (4 µg/L), EMB5 (3 µg/L), EMB7 (3 µg/L), EMB8 (8 µg/L), EMB12 (4 µg/L), EMB15 (16 µg/L) and EMB16 (147 µg/L) pre-wet season and EMB5 (2 µg/L), EMB12 (6 µg/L), EMB15 (17 µg/L), EMB16 (74 µg/L) and EMB21 (5µg/L) post-wet season;
- concentrations of zinc were detected above the adopted assessment criteria (8 µg/L) in EMB1 (15 µg/L), EMB2 (129 µg/L), EMB4 (135 µg/L), EMB5 (22 µg/L), EMB7 (3 µg/L), EMB (8 µg/L), EMB12 (61 µg/L) and EMB15 (49 µg/L) pre-wet season and EMB1 (30 µg/L), EMB2 (138 µg/L), EMB4 (18 µg/L), EMB5 (12 µg/L), EMB7 (20 µg/L), EMB8 (12 µg/L), EMB12 (6 µg/L), EMB15 (20 µg/L), EMB19 (12 µg/L) and EMB22 (22 µg/L) post-wet season;
- concentrations of lead were detected below the adopted assessment criteria (4.4 µg/L) in all monitoring wells with the exception of EMB8 (8 µg/L) and EMB15 (7 µg/L) pre-wet season;
- concentrations of TRH/TPH were detected above the LOR in all existing monitoring wells, with the exception of monitor EMB6, at a maximum concentration of TRH >C_{10}-C_{40} of 620 µg/L (EMB8) pre-wet season and only in monitoring wells EMB6 (TRH >C_{10}-C_{40} 170 µg/L), EMB1 (TRH C_{10}-C_{14} 60 µg/L) and EMB4 (TRH C_{10}-C_{14} 60 µg/L) post-wet season. Concentrations of TPH/TRH were not detected above the LOR in groundwater sampled from the newly installed wells; and
- concentrations of BTEXN and PAHs were not detected above the LOR in both the pre-wet season and post-wet season.

The concentrations of ammonia, copper, zinc and lead detected vary between monitoring rounds but remain within the historical range for the site. Specific sources of ammonia, copper, zinc and lead within the VTD site are not known with the exception of lead in Avgas which would be expected to be co-present with higher concentrations of petroleum hydrocarbons. Concentrations of copper and zinc have regularly been detected above the 95% species protection ecological screening criteria

in groundwater monitoring undertaken to date at the site. The detected concentrations of metals are considered to be reflective of background conditions for industrial site areas. The presence of ammonia in groundwater is considered to be associated with the organic-rich estuarine sediments underlying the site.

Groundwater monitoring for the VTD site has included analysis of PFAS for 12 wells since the AFFF solution pipeline leak with monitoring undertaken in October 2020, April 2021, December 2021 and April 2022.

Screening assessment was undertaken by grouping the monitoring wells based on location as follows (EnRiskS 2022):

- Upgradient wells away from areas of known leaks (EMB3, EMB6, EMB8, EMB18);
- Vicinity of AFFF solution pipeline leak incident (EMB5, EMB23, EMB24, EMB25);
- Vicinity of reported historic leak in south east of site (EMB7, EMB17);
- Western boundary (EMB1, EMB2, EMB11, EMB20, EMB21, EMB22);
- Southern boundary (EMB15, EMB16); and
- Vicinity of stormwater drain (EMB4, EMB12, EMB19).

Review of the PFAS results for the monitoring well groups indicated the following:

- Concentrations of PFAS have been detected in the upgradient wells;
- Very low concentrations of PFAS have been detected along the southern boundary (EMB15) and no PFAS has been detected in the southwestern corner of the site (EMB16);
- The highest concentrations of PFAS have been detected in the south-eastern portion of the site where the historic leak was reported to have occurred;
- High concentrations of PFAS have also been detected in the vicinity of the AFFF solution pipeline leak and stormwater drain;
- 6:2 FTS (maximum 140 µ/L AFFF south east corner of site), 8:2 FTS (maximum 12.7 µg/L AFFF solution pipeline leak) and PFHxA (maximum 22.2 µg/L AFFF solution pipeline leak) are the only PFAS compounds detected at concentrations exceeding the human health (recreational) screening guidelines (2 µg/L) for PFOS and PFOA (10 µg/L). However, concentrations of PFAS compounds detected do not exceed the adjusted guideline values adopted for 6:2 FTS and 8:2 FTS (500 µg/L) and PFHxA (10,000 µg/L).
- 6:2 FTS and 8:2 FTS are the key chemicals present at concentrations along the western boundary (considered most relevant for assessment of potential risks to ecosystems) exceeding the ecological screening criteria. Concentrations of 6:2 FTS (maximum 4.45 µg/L) and 8:2 FTS (maximum 0.17 µg/L) were detected above the 95% (0.00023 µg/L) and 99% (0.13 µg/L) species protection screening criteria respectively. However, concentrations of these PFAS compounds detected across the site do not exceed the interim water quality guideline developed (210 µg/L).
- Concentrations of PFAS are generally higher at the end of the dry season compared to the end of the wet season.

8.4 Stormwater

Sampling was undertaken of the surface water/stormwater captured in the stormwater pit and transferred into the TK101/TK102 bund following the AFFF solution pipeline leak (EcOz 2020b). Physical water quality parameters were recorded within the Darwin Harbour WQOs. Concentrations of heavy metals (copper and zinc) and nutrients (ammonia, NOx and total nitrogen) were detected

above the Darwin Harbour WQOs but within the range of historic monitoring results for the VTD site. Concentrations of glycol (diethylene glycol monobutyl ether) and PFAS (mainly fluorotelomer sulfonic acids 6:2 FTS and 8:2 FTS, and carboxylic acids) were detected above the LOR in the surface water/stormwater samples. Concentrations of PFAS detected in the second round of sampling post storm events were found to have reduced by approximately 55%. Low concentrations of petroleum hydrocarbons (TRH C_{10}-C_{16} 1,700 µg/L) were detected in the stormwater sampled.

Stormwater was sampled in December 2021, February 2022 and May 2022 as the most recent pre-wet, mid-wet and post-wet season sampling rounds at the VTD site. The results of the monitoring (GHD 2022) are summarised as follows:

- DIFT1 – concentrations of zinc (maximum 47 µg/L), copper (2 µg/L), ammonia (maximum 270 µg/L), NOx (maximum 140 µg/L), total nitrogen (maximum 500 µg/L) and total suspended solids (23 mg/L) have been detected exceeding the adopted site criteria. pH (8.6) was recorded above the WQO in the pre-wet season monitoring round;
- DIFT2 – concentrations of zinc (maximum 83 µg/L), toluene (331 µg/L), ammonia (maximum 130 µg/L), NOx (maximum 570 µg/L) and total nitrogen (maximum 1,100 µg/L) were detected exceeding the adopted site criteria;
- DAT2 – concentrations of copper (12 µg/L), zinc (53 µg/L), ammonia (maximum 50 µg/L), NOx (maximum 350 µg/L), total nitrogen (maximum 1,000 µg/L) and total phosphorus (maximum 410 µg/L) were detected exceeding the adopted site criteria. pH (9.87) was recorded above the WQO in the pre-wet season monitoring round;
- Series 6 – concentrations of copper (6 µg/L), zinc (73 µg/L), ammonia (maximum 360 µg/L), NOx (maximum 470 µg/L) and total nitrogen (800 µg/L) were detected exceeding the adopted site criteria. pH (maximum 8.91) was recorded above the WQO.
- Concentrations of TRH (F1 fraction 210 µg/L and F2 fraction 110 µg/L), benzene (50 µg/L), ethylbenzene (8 µg/L), m&p-xylenes (50 µg/L), o-xylenes (65 µg/L) and naphthalene (7 µg/L) were detected above the LOR in stormwater sampled in DIFT2 during the mid-wet season sampling. Toluene (331 µg/L) was detected above the adopted site criteria (180 µg/L).

Concentrations of zinc have been consistently detected above the adopted site criteria in stormwater sampled from DIFT1 and DIFT2. Concentrations of both copper and zinc have been detected above the adopted site criteria in stormwater collected from all sampling locations at the VTD site. Concentrations of nutrients (ammonia, NOx and total nitrogen) have been consistently detected above the WQOs in stormwater collected from all sampling locations. The concentrations of metals and ammonia detected in stormwater were found to be generally lower than the concentrations detected in groundwater in the environment, over the recent monitoring periods (SMEC 2022b).

Surface water sampling undertaken monthly in the stormwater pit during the wet season at the GRR site has detected concentrations of nutrients (total phosphorus, total nitrogen and ammonium), metals (arsenic, chromium, cobalt, manganese, mercury, nickel and zinc) above the EPL trigger values.

Analysis for PFAS has only been undertaken since the AFFF solution pipeline leak with monitoring undertaken in December 2020, February 2021, March 2021, December 2021, February 2022 and May 2022. Review of the PFAS results for the four stormwater sampling locations (EnRiskS 2022) indicated the following:

- Limited low concentrations of PFAS (including individual PFAS compounds) below the adopted human health (recreation) screening criteria have been detected in the stormwater sampled from the DAT2 and 6-series sampling locations;

- Concentrations of PFAS have been detected in stormwater mainly as 6:2 FTS, 8:2 FTS, PFHxA and PFPeA which are not bioaccumulative.
- Concentrations of 6:2 FTS (maximum 49.2 µg/L DIFT2) and 8:2 FTS (maximum 8.9 µg/L DIFT2) have been detected exceeding the human health (recreation) screening criteria (2 µg/L for PFOS related compounds) in stormwater sampled from the DIFT1 and DIFT2 sampling locations with concentrations found to be variable over sampling events. However, the concentrations detected do not exceed the adjusted guideline values adopted for 6:2 FTS and 8:2 FTS (500 µg/L).
- Concentrations of PFOS (maximum 0.03 µg/L DIFT1) have been detected exceeding the 99% species protection ecological screening criteria (0.00023 µg/L) but below the 95% species protection ecological screening criteria.
- Concentrations of 6:2 FTS (maximum 49.2 µg/L DIFT2), 8:2 FTS (maximum 8.9 µg/L DIFT2) and 10:2 FTS (maximum 0.22 µg/L DIFT2) have been detected exceeding the 95% species protection ecological screening criteria (0.13 µg/L). However, concentrations of these PFAS compounds detected across the site do not exceed the interim water quality guideline developed (210 µg/L).
- Concentrations of PFAS vary across the sampling events and are impacted by the nature of rain events.

Surface water sampling undertaken monthly in the stormwater pit during the wet season at the GRR site detected concentrations of PFOS (0.16 µg/L and 0.55 µg/L in November 2021 and December 2021 respectively) above the EPL trigger value of 0.13 µg/L.

8.5 Sediment

Sediment sampling is undertaken biennially and the last monitoring round was undertaken in May 2022 (GHD 2022) coinciding with the post-wet season stormwater sampling program. The results of the monitoring are summarised as follows:

- Concentrations of arsenic, chromium, copper, lead, nickel, zinc and mercury have been detected above the LOR in sediment samples. Concentrations of arsenic were detected above the DGV in all samples with the exception of the northern most sample location with concentrations detected above the GV-high value at two sample locations. Concentrations of chromium or zinc were detected above the DGV in the sample from one location.

  The concentrations of arsenic detected in the sediment samples during the 2022 sampling were reported to be within the range of historic sampling results. Arsenic is commonly associated with acid sulfate soils which are typical of the estuarine environment of the site (GHD 2022).

- TRH >C_{16}-C_{34} and TRH >C_{34}-$_{40}$ fractions were detected above the LOR at low concentrations (maximum of 114 mg/kg at sampling location 5) in all sediment samples with the exception of one location in the drain leading to Darwin Harbour.

8.6 PFAS – Summary of Extent of Impact

Based on an assessment of the results of the investigations undertaken at the site, the following conclusions are made in relation to PFAS impact at the site (SMEC 2022b):

- The key PFAS compounds detected are 6:2 FTS and 8:2 FTS which are not bioaccumulative;
- Concentrations of PFAS detected in soil sampled across the site, including in the vicinity of the AFFF solution pipeline leak and the reported historic foam solution release along the

boundary in the south-east of the site, did not exceed the adopted assessment or screening criteria for industrial land use;

- PFAS was detected in soil and groundwater across the site including at locations not within the vicinity of any identified sources which may be attributed to ambient concentrations or upgradient sources. The distribution of PFAS across the site is reflective of reported historical releases of firefighting foam solution and the 2020 AFFF solution pipeline leak;
- Concentrations of PFAS compounds detected in groundwater sampled across the site did not exceed the adjusted human health (recreational) screening guidelines or developed interim water quality guideline.
- Concentrations of PFAS compounds detected in stormwater sampled at the site did not exceed the adjusted human health (recreational) screening guideline or developed interim water quality guideline.
- The current PFAS concentrations detected in soil, groundwater and stormwater at the site do not present unacceptable risks to human health or the environment.
- Based on the broader distribution of PFAS in soil and groundwater at the site, and the unlikely risks posed to human health and the environment, remediation of the 2020 foam solution leak area is not considered to be warranted.

8.7 Other Contaminants – Summary of Extent of Impact

Based on an assessment of the results of the investigations undertaken at the site, the following conclusions are made in relation to the presence of other contaminants at the site (GHD 2022 and SMEC 2022b):

- Concentrations of TPH/TRH, BTEX and PAHs have not been detected above the LOR in soil. Concentrations of heavy metals in soil have been detected at concentrations below the LOR and/or the adopted site criteria.
- Concentrations of copper, lead, zinc and ammonia detected above the adopted assessment criteria in groundwater continue to remain within the historical range for the site and do not exhibit an upward trend. Concentrations are considered to be within the historic background ranges and are not considered to pose risks to the environment.
- Concentrations of TPH/TRH in groundwater have generally not been detected above the LOR or at low concentrations (maximum TPH C_{10}-C_{36} 1,520 µg/L EMB2 pre-wet season 2009). Concentrations of BTEX and PAHs have not been detected above the LOR in groundwater.
- With the exception of a small number of toluene and xylenes detections above the adopted site criteria, concentrations of petroleum hydrocarbons have not been detected above the LOR or been detected at low concentrations in stormwater at the VTD site. The presence of low level petroleum hydrocarbons is indicative of the nature of a fuel handling facility and not considered to pose unacceptable risk to the environment.
- Concentrations of copper, zinc and ammonia detected above the adopted site criteria in stormwater at the VTD site continue to remain within the historical range for the site and are lower than concentrations observed in groundwater.
- Concentrations of copper, lead, zinc and TRH detected in sediment samples are variable across sampling events but recent sampling results are similar in magnitude to previous sampling results and do not show an increasing trend. Sediment quality is not considered to pose unacceptable risk to the environment.

Based on the soil, groundwater, stormwater and sediment investigations conducted, the following recommendations were made (SMEC 2022b):

- Additional monitoring of PFAS in groundwater, stormwater and sediment is recommended to provide appropriate data to support the conclusions that levels of key PFAS compounds (6:2 FTS and 8:2 FTS) present at the site are in compliance with the criteria developed in the HHERA (EnRiskS 2022). Monitoring should include:
    - Groundwater – twice per year – early wet season and late wet season, from a network of at least 14 bores;
    - Stormwater pit – three times per year – early, mid and late wet season, from at least four locations. Inclusion of additional monitoring points such as the location where stormwater exists the Vopak site via the open drain is recommended;
    - Sediment in drains – once every two years at eth end of the wet season, from 12 locations.
- Check the quality of discharges from the LWTF;
- Monitoring should continue with exceedances triggering review of potential causes and corrective actions undertaken if associated with operational processes or housekeeping;
- Implementation of best practice measures in relation to chemical use (including PFAS containing foam) to mitigate potential impacts to the environment.

8.8 Audit Findings

The sampling and analysis works undertaken as part of the regular environmental monitoring program (GHD 2022) and to provide additional soil and groundwater information for the site (SMEC 2022b) are considered appropriate and reliable for the purposes of the environmental audit program.

It is noted that the highest area of PFAS impact detected in soil and groundwater across the VTD site (away from the 2020 AFFF solution pipeline leak area) is likely related to historical firefighting foam solution releases however areas of the site exist where the source of PFAS impact has not been identified. PFAS, heavy metals and nutrients impacts have also been identified in groundwater and stormwater within the GRR site which is managed under EPL-229.

The site investigation results reported by GHD 2022 and SMEC 2022b are considered to have been generally obtained in a manner which enables conclusions to be drawn regarding the types, amount, distribution and mobility of contaminants.

9. Audit Summary Opinion

9.1 Conclusions

On the basis of the findings of the environmental audit program, and subject to the limitations in **Section 10**, summary opinions are provided below on the '*types, amount, distribution and mobility of petroleum hydrocarbons, per- and poly-fluoroalkyl substances (PFAS), and other contaminants of concern (copper, lead, zinc and ammonia) present in the environment at the premises that have the potential to cause environmental harm*'.

Petroleum Hydrocarbons

- Concentrations of TPH/TRH, BTEX and PAHs have not been detected above the LOR in soil across the site.
- Concentrations of TPH/TRH have generally not been detected above the LOR or been detected at low concentrations in groundwater across the site. Concentrations of BTEX and PAHs have not been detected above the LOR in groundwater.
- Concentrations of TPH/TRH have generally not been detected above the LOR or been detected at low concentrations in stormwater. Concentrations of BTEX were generally not detected above the LOR or were detected at low concentrations below the adopted site criteria with a small number of exceptions for concentrations of toluene and xylenes detected above the adopted site criteria. The presence of low level petroleum hydrocarbons is considered consistent with the nature of a fuel handling facility;
- Concentrations of TPH/TRH have generally not been detected above the LOR or been detected at low concentrations in sediment samples. Concentrations of BTEX have not been detected above the LOR;
- Petroleum hydrocarbons compounds including TRH, BTEX and PAHs have not been detected in soil across the site. With the exception of occasional detections of toluene and xylenes above the site criteria detected in stormwater, the limited detections and/or low concentrations of TRH reported in surface water, groundwater and sediments indicate that there is limited, if any, migration of these contaminants from the site into the receiving environment while the current operational controls remain in place.
- Therefore, concentrations of petroleum hydrocarbons identified in groundwater, stormwater and sediments at the site are not considered to pose risks to human health or the environment.

PFAS

- Concentrations of PFAS were detected in soils across the site at levels consistent with typical background levels in urban areas. However, the concentrations of PFAS in soil, including areas where historical firefighting foam solution releases have been reported, were not reported above the adopted site criteria or screening criteria for industrial land use.
- Concentrations of PFAS reported in groundwater and stormwater at the site are below the adjusted human health (recreational) screening guideline or developed interim ecological water quality guideline values.
- The key PFAS compounds identified at the site are 6:2 FTS and 8:2 FTS which are not bioaccumulative.
- The distribution of PFAS in soil and groundwater across the site is broadly consistent with the reported PFAS related leaks/incidents. The reported concentrations of PFAS in

groundwater at the downgradient boundary are broadly consistent with those reported in upgradient wells, indicating that the site is not adversely impacting the environment from a PFAS contribution perspective. Hence, while PFAS is known to be a highly mobile contaminant, there does not appear to be a significant or widespread PFAS migration issue occurring via groundwater at the site. In relation to surface water/stormwater, the reported PFAS concentrations remained below the adopted criteria, so this is also considered not to be a significant migration pathway for PFAS under the current management protocols.

- Having regard to the reported nature and distribution of PFAS at the site, the current concentrations of PFAS in soil, groundwater and stormwater are considered to not pose unacceptable risks to human health or the environment. However, the auditor concurs with the HHERA (EnRiskS 2022) recommendations that further monitoring data is required to confirm this into the future.

Other Contaminants (copper, lead, zinc and ammonia)

- Concentrations of copper, lead and zinc have not been reported above the adopted site criteria in soil.
- The concentrations of copper, lead, zinc and ammonia detected above the adopted site criteria in groundwater are within historical ranges and do not exhibit an upward trend.
- The concentrations of copper, lead and zinc detected above the adopted site criteria in stormwater are within historical ranges and do not exhibit an upward trend.
- Limited variable concentrations of zinc have been reported above the adopted site criteria in sediment. The reported concentrations are within historical ranges and do not exhibit an upward trend.
- The generally consistent concentrations of copper and zinc reported above the adopted criteria in groundwater across the site and over the various monitoring periods are indicative of background conditions. Concentrations of lead have only occasionally been detected above the adopted criteria. Similarly, the consistent concentrations of copper and zinc reported in stormwater at lower concentrations than those detected in the environment indicate that dissolved metals are present at background levels in the natural environment.
- Consistent concentrations of ammonia reported above the adopted criteria in both groundwater across the site and in stormwater is reflective of the estuarine environment at the site.
- Therefore, concentrations of copper, lead, zinc reported in soil, groundwater, stormwater and sediment are considered not to pose risks to human health or the environment under the current management protocols at the site. Similarly, concentrations of ammonia reported in groundwater and stormwater are considered to not pose risks to human health or the environment under the current management protocols at the site

9.2 Recommendations

As part of the environmental audit program, the activities undertaken in response to the AFFF solution pipeline leak incident were reviewed. The pipeline leak was repaired and impacts to the environment were mitigated. Recommended actions in the incident report have commenced but are not yet complete as at the time of this audit.

The development of interim water quality guidelines in the HHERA (EnRiskS 2022) is subject to limitations and uncertainties due to limited ecotoxicity data available. Recommendations have been made to provide additional data to support the conclusions of the HHERA.

Recommendations have been made based on the findings of this environmental audit program as outlined below:

- Implement the key recommendations of the incident report (VTD 2022) as follows:
  - Review firefighting pipeline systems inspection and testing regime;
  - Undertake protection of exposed section of pipeline prior to covering up excavation pit;
  - Independent review and verification of asset integrity inspection reports to be completed by Terminal Manager or Engineering Manager;
  - Maintain emergency stocks of rapid response clamping system;
  - Train terminal staff in emergency isolation process of the firefighting system to ensure potential impacts of any future events are minimised;
  - Check fitness for purpose of longitudinal weld/joint in each section of pipeline prior to installation;
  - Assess the need to have firefighting foam system charged 24/7 and undertake changes to allow firefighting foam system to remain ready for service without being under pressure;
  - One page lessons learnt to be shared;
  - Develop a methodology (preferably non-destructive in nature) to perform asset integrity inspections. Inspections to be scheduled using risk based approach.
- Continued environmental monitoring as follows:
  - Groundwater monitoring program – early wet season and late wet season
  - Stormwater monitoring program – early, mid and late wet season
  - Sediment monitoring program – include PFAS sampling at end of wet season

  PFAS monitoring in groundwater and stormwater should consider seasonality and all relevant potential sources for the site including the GRR site.

10. Limitations

This audit was conducted with a reasonable level of scrutiny, care and diligence on behalf of the client for the purposes outlined in the NT *Waste Management and Pollution Control Act 1998*. The data used to support the conclusions reached in this audit were obtained by other consultants and the limitations which apply to the consultant's report(s) apply equally to this environmental audit program report.

Every reasonable effort has been made to identify and obtain all relevant data, reports and other information that provide evidence about the condition of the site, and those that were held by the client and the client's consultants, or that were readily available. No liability can be accepted for unreported omissions, alterations or errors in the data collected and presented by other consultants. Accordingly, the data and information presented by others are taken and interpreted in good faith.

Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements.

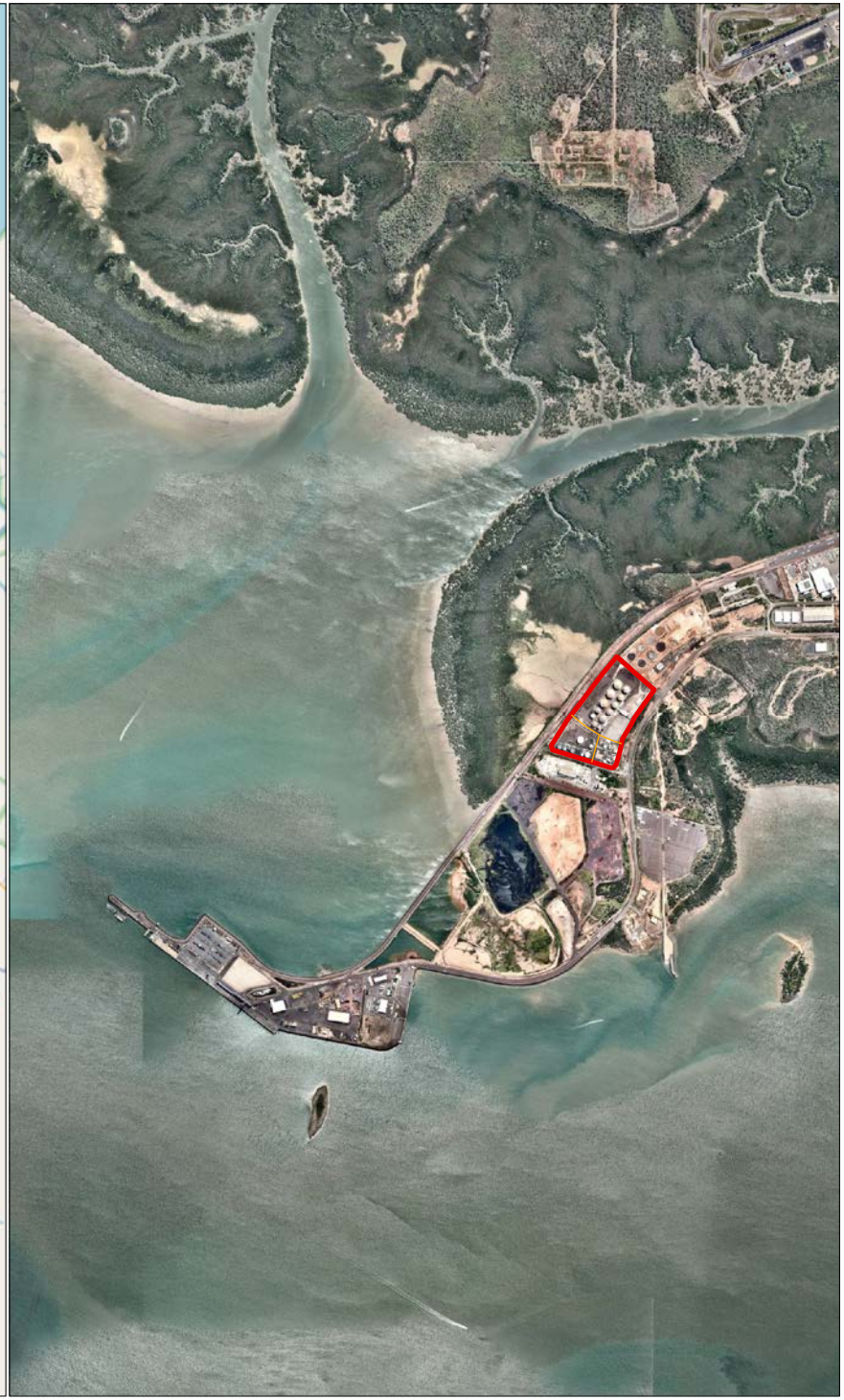
Limited sampling and laboratory analyses were undertaken as part of the investigations reviewed, as described herein. Ground conditions between sampling locations and media may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS&G reserves the right to review the report in the context of the additional information, subject to meeting relevant guideline requirements imposed by the NT EPA.

Figures





Legend

Approximate Site Boundary

JBS&G

Job No: 62148

Client: Vopak Terminals Australia Pty Ltd

Version: Audit	Date 25/07/22
Drawn By: RF	Checked By: CL

Scale 1:700,000 & 1:35,000

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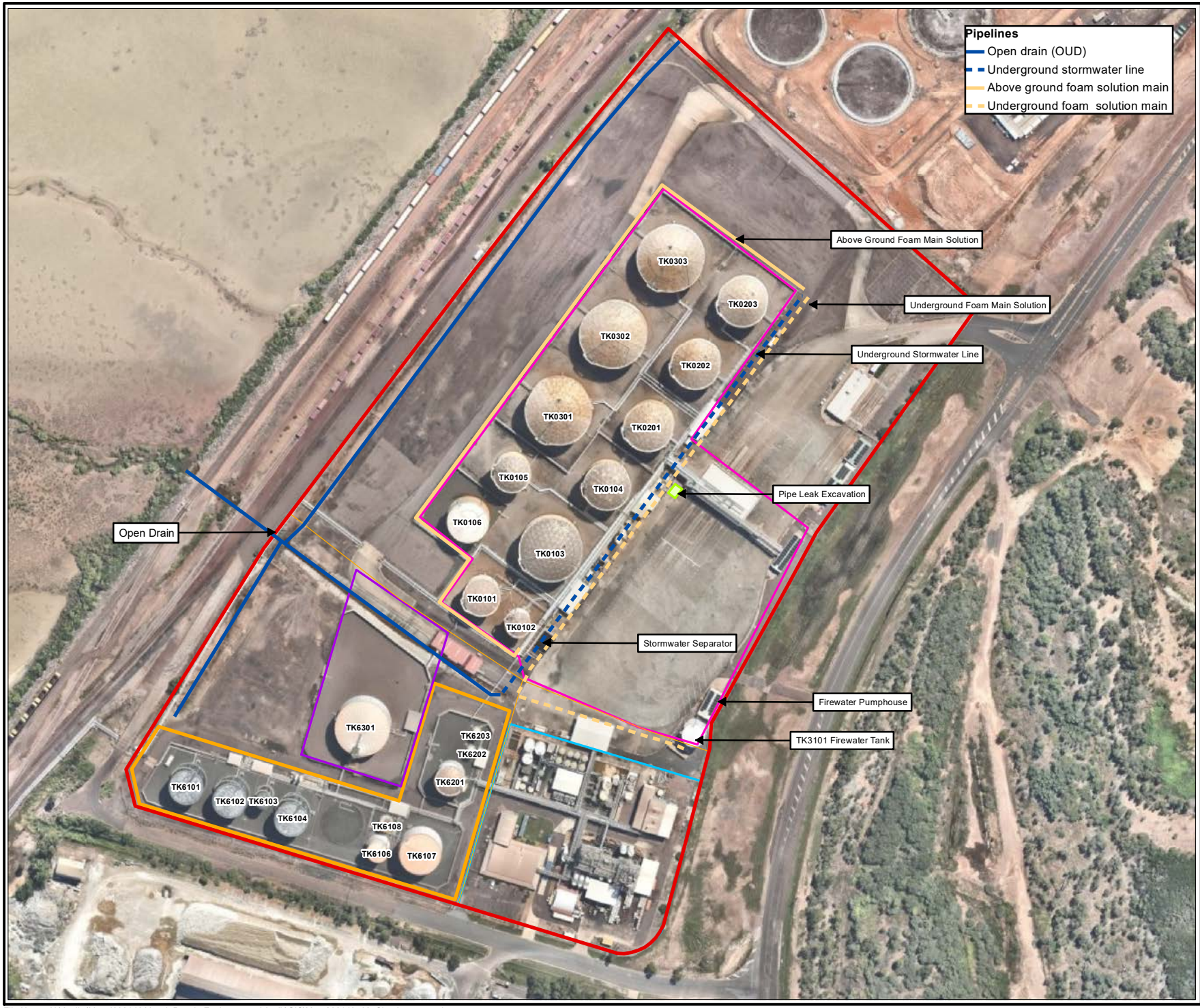
Coord. Sys. GDA 1994 MGA Zone 52

780 and 800 Berrimah Road
East Arm, Northern Territory
Portion 5719 and 5783
Hundred of Bagot

Site Location

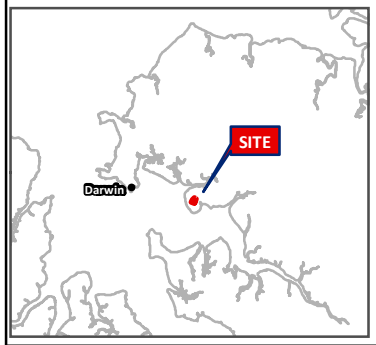
FIGURE 1

File Name: N:\Audits\Vopak\62148 Vopak Darwin Environmental Audit\GIS\Maps\62148_01_Site_Location.mxd
Reference: Service Layer Credits: © OpenStreetMap (and) contributors, CC-BY-SA
Reference: Imagery - Nearmpa (www.nearmap.com) - 20220502



Legend

- Approximate Site Boundary
- Cadastral Boundary
- DIFT Area
- 6-Series
- DAT Area
- GRR LWTF
- Pipe Leak Excavation



JBS&G

Job No: 62148

Client: Vopak Terminals Australia Pty Ltd

Version: Audit	Date 25/07/22
Drawn By: RF	Checked By: CL

Scale 1:3,000

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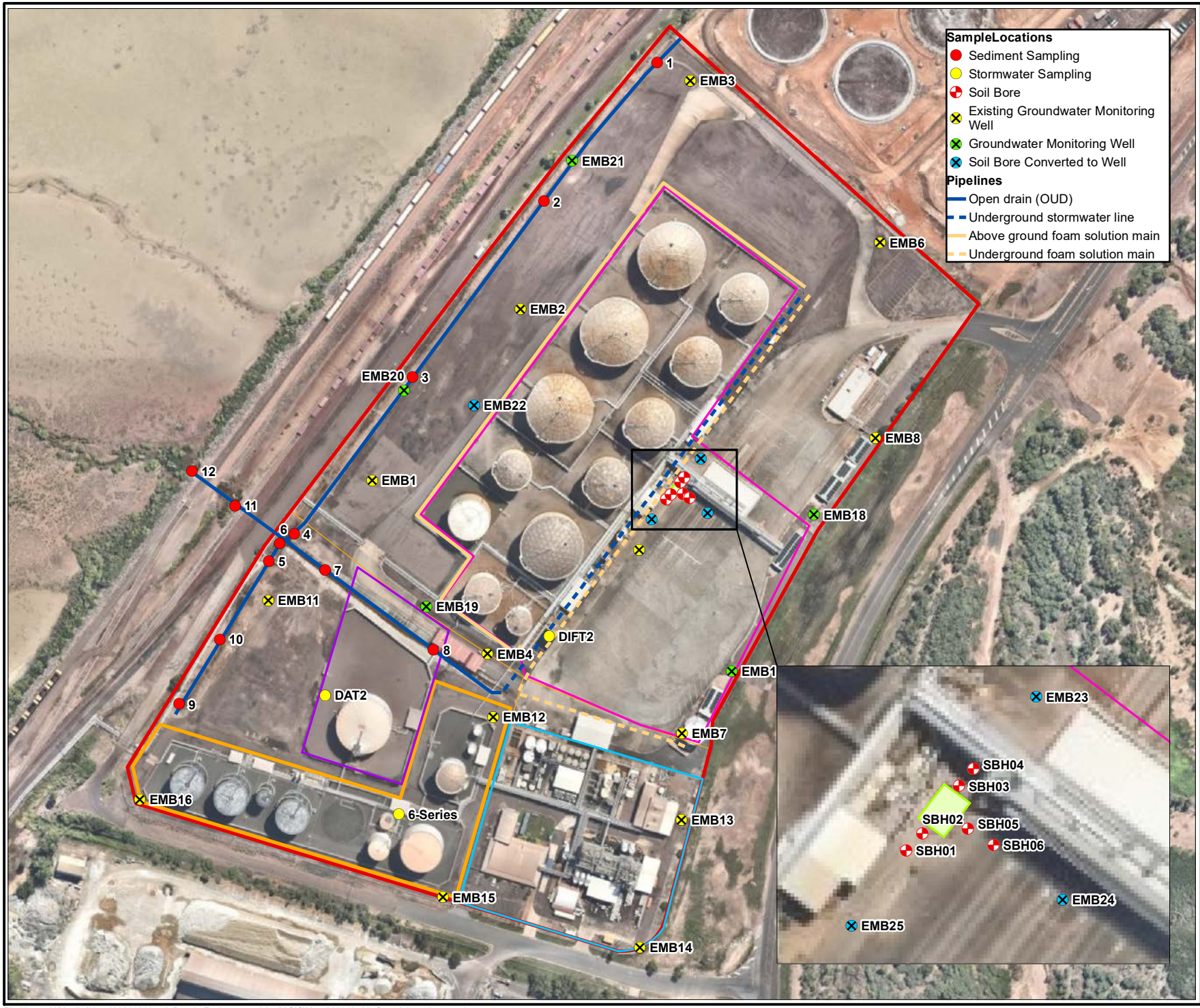
Coord. Sys. GDA 1994 MGA Zone 52

780 and 800 Berrimah Road
East Arm, Northern Territory
Portion 5719 and 5783
Hundred of Bagot

Site Layout

FIGURE 2

File Name: N:\Audits\Vopak\62148 Vopak Darwin Environmental Audit\GIS\Maps\62148_02_Site_Layout.mxd
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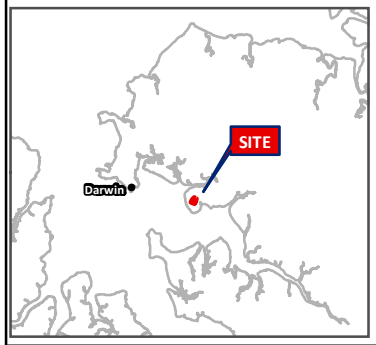


Legend

- Approximate Site
- Cadastral Boundary

Site Features

- DIFT
- 6-Series
- DAT
- GRR LWTF
- Pipe Leak Excavation



JBS&G

Job No: 62148	
Client: Vopak Terminals Australia Pty Ltd	
Version: Audit	Date 25/07/22
Drawn By: RF	Checked By: CL
Scale 1:3,000	

0 30 60 m

Coord. Sys. GDA 1994 MGA Zone 52

780 and 800 Berrimah Road
East Arm, Northern Territory
Portion 5719 and 5783
Hundred of Bagot

Sample Locations

FIGURE 3

File Name: N:\Audits\Vopak\62148 Vopak Darwin Environmental Audit\GIS\Maps\62148_03_SampleLocations.mxd
Reference: Imagery - Nearmpa (www.nearmap.com) -

Appendix A Vopak Terminal Environmental Monitoring December 2021 – April 2022 (GHD 2022)

Vopak Terminal Environmental Monitoring

December 2021 – April 2022

Vopak Terminal Darwin Pty Ltd

3 June 2022



The Power of Commitment

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S4	0	V. Milsom B. Littlejohn	C. Sylianteng		A Boden		03/06/2022
[Status code]							
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Executive summary

GHD Pty Ltd (GHD) was engaged by Vopak Terminal Darwin Pty Ltd (Vopak) to undertake the routine wet season monitoring events as required by the Operations Environmental Management Plan (OEMP). The monitoring involved groundwater, surface water and sediment sampling undertaken across three events during the 2021/22 wet season (referred to collectively as the 'Wet Season Monitoring Program') to assist Vopak complying with the requirement of the OEMP.

A requirement of the OEMP is to conduct a wet season monitoring program for the following:

– Stormwater pit monitoring: the DIFT, DAT and 6-Series tanks are contained within bunded areas, with stormwater pits. This drain then discharges onto mudflats and mangroves fringing Darwin Harbour. A requirement of the OEMP is that sampling of the stormwater pits is conducted three times during each wet season, early, mid, and late.
– Groundwater monitoring: a groundwater well network is present at the site. The OEMP requires that 12 monitoring bores (EMB1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 15 and 16) are sampled annually at the end of the wet season.
– Sediment monitoring: sediment monitoring is a requirement of the OEMP every two years and includes 10 sampling locations. The sediment monitoring program is an early warning action to detect any contaminant levels in sediments in the drains at Vopak that could potentially impact aquatic or intertidal ecosystems in the receiving Darwin Harbour environment.

The scope of works undertaken as part of the Wet Season Monitoring Program, included:

– Pre-wet season monitoring
  - Groundwater sampling at 12 borehole locations.
  - Stormwater sampling from four stormwater pits.
– Mid-wet season monitoring
  - Stormwater sampling from four stormwater pits.
– Post-wet season monitoring
  - Groundwater sampling at 12 borehole locations.
  - Stormwater sampling from four stormwater pits.
  - Sediment sampling at 10 locations.

Conclusions and recommendations

Groundwater

– Groundwater EC values, salinity and pH are reflective of the nature of the site along the coast. Copper, zinc and lead have been detected regularly throughout the Groundwater Monitoring Event (GMEs) undertaken to date and likely to reflect natural background concentrations at the Vopak site. TRH has been detected in groundwater samples during the pre and post wet season monitoring period. Presence of TRH is indicative of the nature of the fuel handling facility.
– BTEXN and PAH concentrations were below the laboratory limit of detection in all groundwater samples during both the pre and post wet season monitoring events.
– PFAS in groundwater did not exceed the adopted National Environmental Management Plan (NEMP) 2.0 guideline throughout the pre and post wet season monitoring period.
– Several nutrient analytes were detected, including ammonia, nitrate, nitrite, nitrite + nitrate as N, total nitrogen, total Kjeldahl nitrogen and phosphorus. Overall, these nutrients may be indicative of natural biological processes occurring around the site considering its estuarine nature and potential for mangrove areas to act as nutrient sinks

Stormwater

– TRH, BTEX, oil and grease were below the laboratory detection limits in samples obtained from all four stormwater sampling locations before and at the end of the wet season sampling events. Elevated concentrations of TRH and BTEX were detected at DIFT1, DIFT 2 and 6 series sampling sites during the mid-wet season sampling event.
– The temporal nature of the TRH and BTEX results, appearing during the mid-wet season sampling, is indicative of first flush scenario.
– PFAS has been consistently detected in the DIFT 1 and 2 site which was noted in the OEMP as having a foam leak in the Tanks 103 and 104 area (EcoOz, 2021d). Notwithstanding, none of the PFAS detections exceeded the adopted NEMP 2.0 guideline throughout the three sampling events.

Sediment

– Sediments collected from the site were characteristic of a tropical coastal environment with a relatively moist sandy/silty nature interspersed with vegetation.
– Metal concentrations were generally within the adopted ANZG (2018) values. Some arsenic concentrations exceeded the adopted ANZG (2018) values, however, substance is commonly associated with acid sulfate soils and typical of coastal areas such as the estuarine environment wherein the site is located.
– All lighter fraction TRH (C6-C16) and BTEXN concentrations were below the laboratory limit of reporting (LOR) at all sites. Heavier fraction TRH (C16-C40) were detected in varying concentrations, but these were constrained mainly to the sampling sites within the vicinity of the tank farm. The concentrations fall significantly leading outward to the harbor. This indicates that the hydrocarbons are unlikely reaching the Darwin Harbor environment.

Recommendations

It is recommended that Vopak continue to implement the necessary housekeeping and maintenance measures to manage and mitigate any potential fuel spills or foam leaks. Furthermore, continuation of the OEMP program will be beneficial to enable the continued monitoring of contaminants of concern at the site.

The next monitoring events will comprise:

– Groundwater: End of dry season (before December 2022)
– Stormwater: End of dry season (before December 2022)
– Sediment: April/May 2024

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Abbreviations

Abbreviation	Description
AHD	Australian Height Datum
ANZG	Australia and New Zealand Guidelines
bgl	below ground level
BTEX-N	Benzene, Toluene, Ethylene, Xylene, Naphthalene
bTOC	below top of casing
CBD	Central Business District
CoC	Chain of Custody
DIFT	Darwin Industry Fuel Terminal
DAT	Darwin Acid Terminal
DO	Dissolved Oxygen
EMB	Environmental Monitoring Bore
EC	Electrical Conductivity
FTS	Fluorotelomer Sulfonate
GME	Groundwater Monitoring Event
LOR	Limit of Reporting
MHF	major hazard facility
m	metre
mg/L	milligrams per litre
µg/L	micrograms per litre
NATA	National Accredited Testing Authority
NEPM	National Environmental Protection Measures
NEMP	National Environmental Management Plan
OEMP	Operations Environmental Management Plan
OUD	Open Unlined Drain
ORP	Oxidation reduction [potential
PAH	Poly-aromatic hydrocarbon
PID	Photoionization detector
PFAS	Per and poly-fluoroalkyl substances
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percentage Difference
SWL	Standing Water Level
TDS	Total Dissolved Solids
TRH	Total Recoverable Hydrocarbons
TPH	Total petroleum hydrocarbons
WQO	Water Quality Objective

1. Introduction

GHD Pty Ltd (GHD) was engaged by Vopak Terminal Darwin Pty Ltd (Vopak) to undertake groundwater, surface water and sediment monitoring at the Vopak Fuel Terminal located at 780 Berrimah Road, East Arm, Northern Territory (the site), in accordance with requirements of its Operations Environmental Management Plan (OEMP) (EcOz 2021d).

This report discusses the findings of groundwater, surface water and sediment sampling (referred to collectively as the 'wet season monitoring program') that was undertaken for 2021/2022.

1.1 Background

Vopak is an international provider of bulk storage facilities and transhipment solutions for liquids and gasses. Vopak owns and operates the Darwin Terminal, a licenced major hazard facility (MHF), located at 780 Berrimah Road, East Arm, NT (the site).

The site is located approximately 5.83 km southeast of Darwin Central Business District (CBD) across Darwin Harbour. The main site infrastructure comprises the Darwin Industry Fuel Terminal (DIFT), 6-Series tank farm and Darwin Acid Terminal (DAT). These facilities are designed for the storage and distribution of refined hydrocarbons and sulphuric acid. Intertidal mangrove ecosystems occur immediately north-west and east of the site and the Northern Cement Darwin facility is located south of the site.

An existing site OEMP sets out strategies to avoid, minimise and manage potential environmental impacts from Vopak operations. An OEMP requirement is to conduct a wet season monitoring program for the following:

– Stormwater pit monitoring: Water sampling undertaken at four sampling pits in the DIFT DAT and 6-Series tank area. This is undertaken during the start, middle and towards the end of the wet season.
– Groundwater monitoring: Groundwater sampling at 12 monitoring bores (EMB 1, 2, 3, 4, 5, 6, 7, 8, 11, 12, 15 and 16) undertaken yearly at the end of the wet season (i.e. March/April). Vopak have requested GHD to also undertake a ground water monitoring event at the start of the wet season for this reporting period[1].
– Sediment monitoring: sediment sampling at 10 drain locations every two years.

1.2 Purpose of this report

The purpose of this report is to present the findings of the 2021/2022 wet season monitoring program to assist with the ongoing management of the site in line with requirements of Vopak's OEMP.

1.3 Scope of works

The scope of works undertaken as part of the Wet Season Monitoring Program, included:

Pre-wet season monitoring

– Groundwater sampling at 12 borehole locations.
– Stormwater sampling from four stormwater pits.

Mid-wet season monitoring

– Stormwater sampling from four stormwater pits.

Post-wet season monitoring

– Groundwater sampling at 12 borehole locations.
– Stormwater sampling from four stormwater pits.
– Sediment sampling at 10 locations.

[1] Historically, a groundwater monitoring event was undertaken at the start of the wet season (i.e. October/ November). Based on information provided by Vopak, this event has been suspended for the past few years as per Appendix E, Section 2.2 of the OEMP.

Sample collection, laboratory analysis and reporting

- Collection of groundwater, stormwater, and sediment samples.
- Laboratory analysis for a suite of contaminants based on previous monitoring events.
- Assessment of analytical results against adopted guideline values.
- Uploading of field and laboratory analytical results into the Vopak Database for groundwater, stormwater, and sediment.
- Reporting findings of the wet season monitoring program.

1.4 Limitations

This report: has been prepared by GHD for Vopak Terminal Darwin Pty Ltd and may only be used and relied on by Vopak Terminal Darwin Pty Ltd for the purpose agreed between GHD and Vopak Terminal Darwin Pty Ltd as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Vopak Terminal Darwin Pty Ltd 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 in this report (refer section(s) 1.2 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

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.

GHD has prepared this report on the basis of information provided by Vopak Terminal Darwin Pty Ltd 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.

2. Methodology

Three sampling events were undertaken throughout different stages of the wet season period (Table 1). The methodology for each and relevant information are discussed in the subsections below.

Table 1 Monitoring timing and methodology summary

Pre-wet season (15 and 16/12/2021 Dec 2021)	Mid-wet season (21/2/2022 and 14/03 2022)	Post wet-season (11 and 12/4/2022, 5/5/2022)*
Groundwater purging & sampling	Surface water sampling	Groundwater purging & sampling
Surface water sampling		Surface water sampling
		Sediment sampling

**It is noted that EMB5 and stormwater was sampled on 5 May 2022 for the post-wet season monitoring event.*

2.1 Groundwater monitoring

2.1.1 Sampling locations

The groundwater environmental monitoring bore (EMB) network is summarised in Table 2. The spatial distribution of groundwater wells across the site aims to facilitate detection of any potential groundwater contamination that may arise from Vopak operations, such as product leakage from storage tanks, spills during product transfer, or from general operations on site.

Groundwater levels generally follow the relatively flat topography of the site, where the highest relative levels are along Berrimah Road (eastern site boundary) and lowest adjacent to Darwin Harbour (western site boundary) (Table 2).

Table 2 Groundwater monitoring network

Bore name	Ground level elevation (mAHD)	Total depth (m)	Screen depth (m)	Location
EMB1	5.7	10.0	7.0-10.0	North-western side of main tank farm, between tank farm and Darwin Harbour.
EMB2	5.7	10.0	7.0-10.0	
EMB3	5.7	10.0	7.0-10.0	
EMB4	6.3	10.0	7.0-10.0	Adjacent to sulfuric acid gantry, between tank farm and outer lined Open Unlined Drain (OUD).
EMB5	6.0	8.0	5.0-8.0	South-eastern side of main tank farm.
EMB6	6.0	10.0	7.0-10.0	North-eastern side of main tank farm.
EMB7	6.425	10.0	7.0-10.0	Eastern boundary of Vopak site, of all Vopak infrastructure.
EMB8	7.120	10.0	7.0-10.0	Eastern boundary of Vopak site of main tank farm and office building.
EMB 11	5.935	8.5	5.5 – 8.5	South-western side of diesel fuel tanks and acid tank, between these tanks and Darwin Harbour.
EMB12	6.500	9.5	6.5- 9.5	Near top of OUD of main tank farm, diesel tanks and acid tank, of former biodiesel plant.
EMB15	6.654	9.5	6.5- 9.5	Southern boundary of Vopak site, up-gradient of all Vopak infrastructure
EMB16	6.589	9.5	6.5- 9.5	South-western corner of Vopak site, cross-gradient of all Vopak infrastructure



Figure 3. Map of EMB locations across the Vopak site.

2.1.2 Method and timing

Groundwater monitoring was conducted on the following dates:

– Pre-wet season sampling on 15-16/12/2021.
– End of wet season sampling on 11-12/04/2022 and 05/05/2022.

During both events, all 12 bores were purged prior to sampling. Purging enables recharge water to flow into the well and allows collection of a representative water sample. The timing of the groundwater monitoring activities are detailed in Table 3.

Table 3 Groundwater monitoring timing

Action	Date	Methodology	Comments
Groundwater level monitoring	15 & 16/122021 11 & 12/04/ 2022	Interface probe manual dip	Levels measured from all wells
Groundwater sampling	16/12/2021 12/04/2022	Manual Bailer	All wells were accessible except for EMB5. Samples were collected from the eleven accessible wells.
	5 /05/2022.		Groundwater sample collected from EMB5

Notes on sampling

It is noted that EMB5 was purged and sampled on the same day (i.e. 05/05/2022) during the post wet season monitoring event. While this diverges from the methodology outlined in the OEMP, the well was allowed to equilibrate post purging. Water levels were measured during the purging event and samples only collected after water levels have risen to pre-purging levels. This indicates that recharge water from the local aquifer has entered the bore and enables collection of a representative sample.

Method

On the day before sampling, immediately after unscrewing the monitoring bore cap, a photoionization detector (PID) was inserted into the bore to detect escaping hydrocarbon vapours. The standing water level (SWL) of all bores were measured using a Solinst Meter. At least three times the volume within the bore was purged using a single use (Clear-View™ PVC) manual bailer and decanted into a container and discharged to ground a reasonable distance away from the bore. The method of using manual bailers is used over pumping to reduce the risk of spark from battery operated equipment at the Vopak site where large volumes of flammable liquids are stored. Bailers were returned to the borehole for 24 hours to recharge overnight.

On the following day, manual bailers from each bore were retrieved and field parameters using a hand-held water quality probe were taken from the water collected from the bailer in a decontaminated plastic container. Samples for laboratory analysis were then collected into laboratory supplied containers.

The following water quality parameters were monitored:

– pH
– oxidative redox potential (ORP)
– dissolved oxygen (DO)
– temperature
– electrical conductivity (EC)
– visual and olfactory indicators including turbidity, odour and sheen presence

Once the parameters had stabilised in accordance with the VIC EPA (2000) Groundwater Sampling Guidelines, sampling was initiated into laboratory supplied sample bottles. All groundwater samples for dissolved metals analysis were filtered during sampling using laboratory supplied 0.45-micron filters. Samples were immediately placed in insulated, chilled coolers and transported to the nominated National Association of Testing Authorities (NATA) accredited laboratory. Chain of custody (CoC) documentation was prepared for sample transfer from the site to the laboratory. Laboratory CoC documentation is provided in Appendix A.

Nitrile gloves were worn during all sample collection and equipment handling activities. These were changed in between groundwater bore locations, and all equipment decontaminated, to reduce the risk of cross-contamination.

All equipment was calibrated in accordance with manufacturer's instructions by an independent supplier and supplied with calibration certificates. Calibration certificates are located within Appendix B.

Groundwater samples were analysed for the analytes listed in Table 4, in accordance with the OEMP. One duplicate sample was collected per Groundwater Monitoring Event (GME) from EMB1. Per- and poly-fluoroalkyl substances (PFAS) was analysed in samples as requested by Vopak.

Table 4 Groundwater sampling laboratory analytes

Groundwater Wells	Laboratory analysed parameters
12	Total recoverable hydrocarbons (TRH)
	Total petroleum hydrocarbons (TPH)
	Benzene, toluene, ethylbenzene, xylenes and naphthalene (BTEXN)
	Polynuclear aromatic hydrocarbons (PAH)
	PFAS (28 analytes)
	Filtered dissolved metals: arsenic, cadmium, chromium, copper, mercury, nickel, lead, zinc
	Nutrients: ammonia, nitrite, nitrate, total Kjeldahl nitrogen, total oxidised nitrogen and phosphorus.
	Field parameters
	Temp (°C), pH, Conductivity, Turbidity, Total Dissolved Solids, Dissolved Oxygen, Oxidation Reduction Potential
	Photoionization Detector (PID)

2.2 Stormwater sampling

2.2.1 Sampling locations

Four stormwater monitoring sites were sampled during the Wet Season Monitoring Program as listed below. The locations are illustrated in Figure 2.

1. Darwin Industry Fuel Terminal (DIFT) 1 – Largest stormwater pit at Vopak; receives water captured within the bunds for the main tank farm (12 tanks storing unleaded fuel, diesel, Jet A1, Avgas), and from the main road tanker loading gantry. Samples are collected from the upper end of the stormwater pit.
2. DIFT 2 – Same pit as above, but samples are collected from the lower end of the pit; i.e. the final chamber from where water is released into the OUD.
3. Darwin Acid Tank (DAT) 2 – Stormwater pit receiving water captured within the acid tank bund. Note site is referred to as 'DAT2' to distinguish it from a different site that was previously named DAT.
4. 6-Series – Stormwater pit receiving water captured within the bund for the 6-Series tank farm (10 tanks storing diesel).

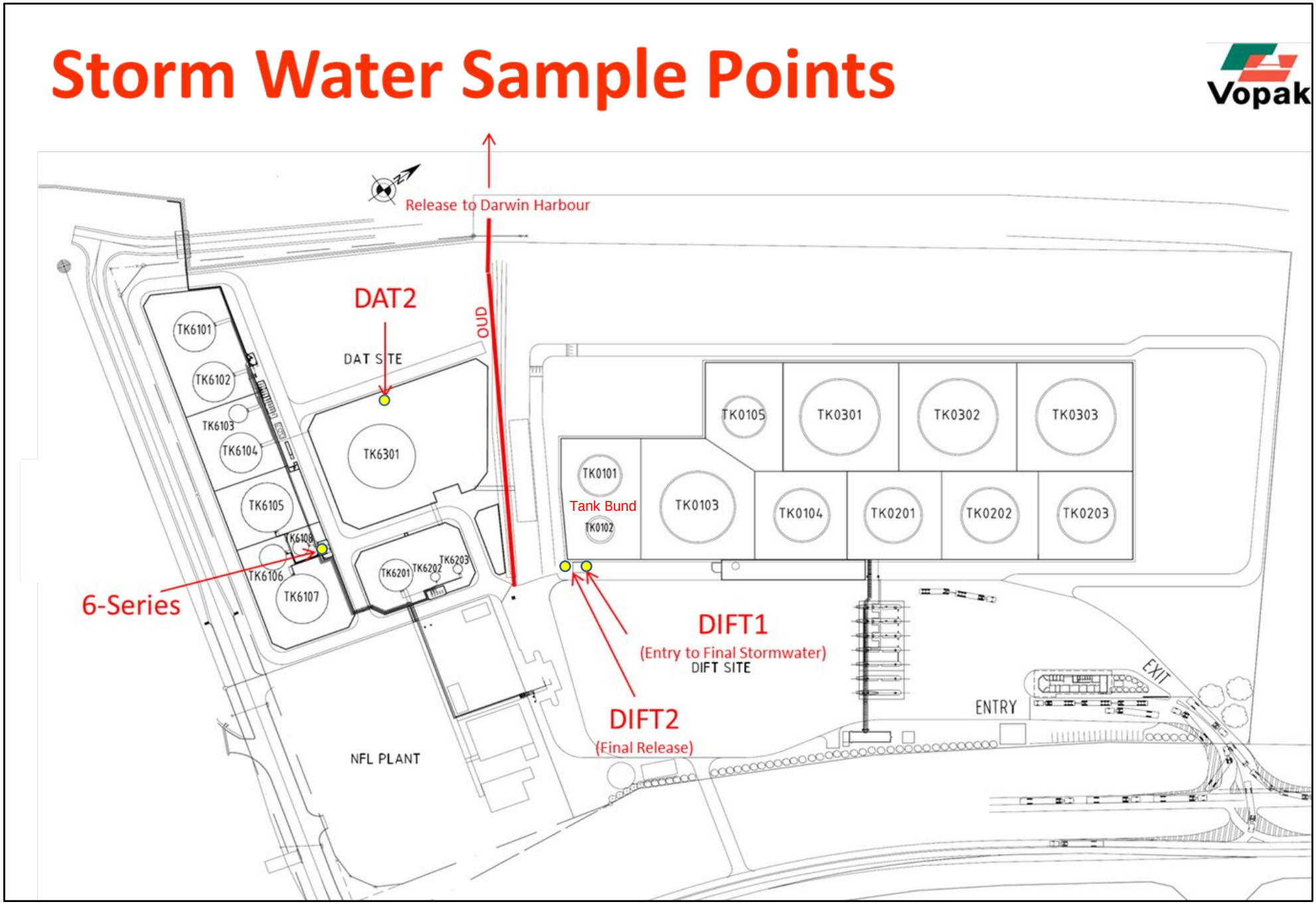


Figure 2. Map of stormwater pit sampling sites (yellow dots) and OUD; also location of foam product leak.

2.2.2 Method and timing

Stormwater sampling was undertaken in accordance with the OEMP method and relevant guidelines below:

– Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC 2000a)
– Australian/New Zealand Standard (1998), Water Quality Sampling - Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples (AS/NZS 5667.1:1998).
– Australian/New Zealand Standard (1998), Water Quality Sampling - Part 10: Guidance on sampling of waste waters (AS/NZS 5667.10:1998).

Prior to surface water sample collection, *in-situ* field parameters were measured in surface water from each pit using the YSI water quality probe, a handheld field instrument. The water quality probe was calibrated in accordance with manufacturer's instructions by an independent supplier and supplied with calibration certificates. Calibration certificates are located within Appendix B.

Where possible, the water quality probe attached to a 10 m long cord was lowered directly into the water of the stormwater pit for taking field parameter measurements (6 series, DIFT 1 and DIFT 2). When pit water was inaccessible due to safety reasons, specifically DAT 2, water is collected using the permanently fixed collection metal cup and poured into a decontaminated plastic jug. The water quality probe is then placed into the decontaminated jug to collect water quality parameters.

Samples for laboratory analysis were collected using the metal cup as described above and decanted into laboratory-supplied pre-preserved sample bottles. At some sites (6 Series), water level in the pit was too low for the permanently fixed metal cup to reach, and samples were obtained by filling an unpreserved sample bottle attached to the end of an extendable sampling pole, which was used to pour into the remaining sample bottles. Metals were field filtered using a syringe and micron filter. Samples were then immediately placed in an ice filled chiller.

A duplicate sample for laboratory analysis was collected from one site each monitoring round to assess the precision of field sampling. For consistency, duplicates were taken from the DIFT stormwater pits. For this monitoring round, a duplicate sample was taken from DIFT 1 during the pre-wet season sampling event on 16 December 2021, DIFT 2 during the mid-wet season event on 21/02/2022 monitoring round, and from DIFT 2 during the post wet season sampling event on 5/05/2022.

Samples are analysed by a NATA-accredited laboratory for analytes listed in Table 5, in accordance with OEMP. PFAS was analysed as requested by Vopak.

Notes on sampling

Pre-wet season stormwater sampling was undertaken on the 16/12/2021 and collected from the DIFT1, DIFT 2 and DAT2 stormwater pits. Due to insufficient water within the 6 series pit, a sample was unable to be taken from this site and was postponed until the pit was sufficiently full. A sample from 6 series was collected on 21 December 2021. Field quality parameters were not taken from this pit at that time as the probe had been sent back to the supplier in Adelaide.

The mid wet season sampling event was undertaken on 21/02/2022 and collected from the DIFT 2 and DAT 2 stormwater pits. Due to insufficient water levels, samples were unable to be taken from the 6 Series and DIFT 1 stormwater pits. Samples for these pits were taken on the 14/03/2022.

The post wet season sampling event was undertaken on 5 May 2022 and collected from the DIFT 1, DIFT 2, DAT 2 and 6 Series stormwater pits.

Table 5 Field and laboratory parameters for stormwater pits

Number of Samples per event	Laboratory analysed parameters
4	TRH
	TPH
	BTEXN

Number of Samples per event	Laboratory analysed parameters
	Oil and Grease
	PFAS
	Filtered dissolved metals: arsenic, cadmium, chromium, copper, mercury, nickel, lead, zinc
	Nutrients: Ammonia, nitrite, nitrate, total Kjeldahl nitrogen, total oxidised nitrogen and phosphorus.
	Total suspended solids
	Biochemical oxygen demand (BOD)
	Field parameters
	Temp (°C), pH, Conductivity, Turbidity, Total Dissolved Solids, Dissolved Oxygen, Oxidation Reduction Potential

2.3 Sediment sampling

2.3.1 Sampling locations

Sediment sampling at Vopak is routinely undertaken once per year following the end of the wet season. Samples are taken from drains located at the western boundary of the Vopak site. The sample locations comprise sites 1, 2, 3, 4, 5, 6, 9, 10, 11 and 12, as shown in Figure 3. Sites 11 and 12 are important assessment sites located at the OUD discharge point into the Darwin Harbour intertidal area.

In previous years, 12 sediment samples have been collected, with the additional two taken from within the OUD. The additional two samples were not taken from within the OUD during this sampling period as per Vopak request.

2.3.2 Method and timing

Sediment samples were collected on 12/04/2022 to coincide with the end of the wet season monitoring. 10 samples were collected along separate locations along the Northwest and Southwest Vopak drains, and across the railway at the end of the OUD. Sediment sample laboratory analysis details are presented in Table 6.Sediment samples were placed in pre-labelled sample jars for each site. Sediment is collected from a depth of 10cm using a small spade. Jars are filled to the top of the lid and compacted, leaving no airspace for soil vapours to release. The spade was decontaminated between each sample site using concentrated Decon® and deionised water mixture solution prepared in the ratio of approximate 1:20 to clean the equipment.

Samples were then immediately placed into ice filled chillers which wers taken to the laboratory. Chain of Custody (CoC) documentation was prepared for sample transfer from the site to the laboratory. Laboratory CoC documentation is provided in Appendix A.

Table 6 Laboratory parameters for sediment sampling

Number of Samples per event	Laboratory analysed parameters
10	TRH
	TPH
	BTEXN
	Metals: arsenic, cadmium, chromium, copper, nickel, lead, zinc, mercury
	Nutrients: Ammonia, nitrite, nitrate, total Kjeldahl nitrogen, total oxidised nitrogen and phosphorus.



Figure 3. Map of sediment sampling sites.

2.4 Assessment criteria

2.4.1 Stormwater

Stormwater field parameters and nutrient results were assessed against the local Water Quality Objectives (WQOs) developed by the Northern Territory Government for Darwin Harbour; specifically, those for the 'upper estuary' as provided in *Water Quality Objectives for the Darwin Harbour Region – Background Document* (NRETAS, 2010).

Dissolved heavy metal and hydrocarbons are assessed against the updated *Australian and New Zealand guidelines for fresh and marine water quality; trigger values for freshwater, 95% protection of aquatic ecosystem values* (ANZG, 2018). Previous monitoring was assessed by the ANZECC, 2000, however these guidelines have since been revised.

PFAS were assessed against the PFAS *National Environmental Management Plan Version (NEMP) 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems* and the PFAS *National Environmental Management Plan Version (NEMP) 2.0 2020 Recreational Water.* The assessment of PFAS began in December 2020.

2.4.2 Groundwater

To assess potential impacts to groundwater uses within Darwin Harbour analytical results were compared to the following guidelines:

– Australian and New Zealand guidelines for fresh and marine quality ANZG (2018) – Marine Water- 95% species protection
– Water Quality Objectives for the Darwin Harbour Region – Upper Estuary (NRETAS, 2010).
– PFAS National Environmental Management Plan Version (NEMP) 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems
– PFAS National Environmental Management Plan Version (NEMP) 2.0 2020 Recreational Water.

Sampling was undertaken in accordance with the Groundwater Sampling Procedure developed specifically for Vopak by GHD.

2.4.3 Sediment

Sediment sampling follows the Sediment Sampling Procedure developed for the Vopak site. This procedure is in accordance with the *Australian Guidelines AS 4482.1-2005, Guide to the investigation and sampling of sites with potentially contaminated soil, Part 1: Non-volatile and semi volatile compounds*.

Sediment contaminant levels are assessed against the *Australia and New Zealand 2018 Sediment toxicant values – DGV* and the *Australia and New Zealand 2018 Sediment toxicant values – GV-high.*

Previous monitoring results were assessed against the *Interim Sediment Quality Guidelines (ISQG)* sourced from the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000).*

The updated guidelines contain two concentrations, the GV-Low concentration (or trigger value) and the GV High concentration. The trigger value is a threshold concentration, and below this, the frequency of adverse biological effects is expected to be very low (Ecoz, 2020).

2.5 Data quality assurance and control

QA/QC (Quality Assurance/Quality Control) procedures adopted for the monitoring were in general accordance with the NEPC (2013) ASC National Environmental Protection Measures (NEPM) documentation, with consideration given to the requirements set out in the Australian Standard AS4482.1 (2005).

The QA/QC procedures adopted during the monitoring aimed to provide evidence that the collected data was fit for interpretive use. QA/QC sampling was carried out by GHD field personnel during the fieldwork together with sampling, handling and decontamination procedures.

2.5.1 Field sampling records

The data collected during the monitoring events was recorded and maintained on field sheets, the ESdat software package in data tables, and in the updated Vopak Environmental Database. The field data and information including groundwater level gauging records and groundwater and surface water field parameters are presented in Table 8 and Table 10. ESdat data tables are attached as Appendix C.

All sample labelling and identification was recorded using a CoC (CoC). This documentation is attached within Appendix A. Upon receipt of the samples at the laboratory, sample receipt notifications were issued. These are also attached within Appendix A.

2.5.2 Relative percentage difference

A quantitative measure of the duplicate sample results was made using calculated relative percentage difference (RPD) values for each analyte. The RPD values were calculated using the following equation:

$$RPD(\%) = \frac{(C_o - C_s)}{\left(\frac{C_o + C_s}{2}\right)} \times 100$$

Where: Co = reported concentration of the analyte of interest in the original parent sample

Cs = reported concentration of the analyte of interest in the duplicate sample

Acceptable RPD values were at or below 30% for the purposes of identifying potentially inaccurate results or potentially imprecise sampling methodology. Where exceedances to this criterion arose, an assessment would be made to determine the cause of the discrepancy in sample results.

3. Findings

3.1 Meteorology

Rainfall data was taken from the Fort Hill Wharf weather station (station number 14050) (BOM, 2022) which is the closest weather station with the most up to date weather conditions. Rainfall and site condition information during stormwater water sampling have been summarised in Table 7.

Table 7 Rainfall and site conditions before and leading up to sampling events

Monitoring event	Sampling date	Rainfall on day on sampling (mm)	Rainfall accumulation leading up to sampling	Conditions
Pre-wet season	15 and 16/12/2021	Nil	15.0 mm recorded for 13/12/2021	Humid and sunny
	21/12/ 2021	47.0	9.2 mm on 18/12/2021	
Mid-wet season	21/02/2022	Nil	3.5 mm of rainfall was recorded on 19/02/2022	
	14/03/2022	3.0	13.0 mm of rainfall was recorded on the 13/03/2022	
Post-wet season	11 and 12/04/ 2022	Nil	30.0 mm on 6/04/ 2022 & 2.0 mm on 7/04/2022	
	05/05/2022	Nil	Nil	

3.2 Groundwater results

3.2.1 Water quality parameters and field observations

The SWL measurements, field parameters and observations are captured in Table 8.

During the pre-wet season GME, pH's ranged between 4.26 (EMB15) to 7.84 (EMB2). During the post-wet season GME pH ranged from 5.48 (EMB15) to 8.29 (EMB1).

pH did not meet the Darwin Harbour WGO guidelines for 6 bores during the pre-wet season GME. pH was reported outside the NRETAS (2010) quality objective range at EMB4, EMB5, EMB7, EMB8, EMB12 and EMB15. During the post wet season GME, pH did not meet the NRETAS (2010) quality objective range at EMB15.

Electrical conductivity (EC) concentrations (and correspondingly salinity and TDS) vary widely across the Vopak site. During the pre-wet season GME, EMBs 3, 11 and 16 have, by far, the highest EC concentrations ranging from 24,850 to 66,241 and µS/cm respectively).

Table 8 Groundwater level, quality and observations

Pre- wet season – 15 and 16/12/2021															
Bore ID	Pre-purge SWL (m bTOC)		Post sample SWL (m bTOC)		Temp	pH	EC	NTU	TDS	DO % Sat	DO (mg/L)	Redox potential (ORP)	PID	Exceedance of WQO (6-8.5 pH)?	Observations
	Date / Time	SWL	Date / Time	SWL											
EMB1	15/12/2021	2.007	16/12/2021	2.086	34.8	7.18	3,027.00	46,884.11	1,968	54.4	3.76	135.7	0.1	No	Clear/cloudy, slight sediment load, no odour, no sheen.
EMB2	15/12/2021	2.007	16/12/2021	2.57	34.7	7.84	432.20	15.02	284	59.3	4.13	73.7	0	No	Clear, no odour, no sheen, slight organic matter/ sediment.
EMB3	15/12/2021	2.26	16/12/2021	2.52	34.9	7.26	51,202.00	19.58	33,319	56.6	3.3	-80.7	0	No	Clear, no odour, no sheen, no sediment. Slightly cloudy, low sediment load and plant matter before taking sample.
EMB4	15/12/2021	1.548	16/12/2021	3.004	34.2	5.89	268.20	41.45	174	57.9	4.07	122.8	0.2	Yes - pH	Clear, no odour, no sheen, no sediment load. Slight orange in colour, low sediment load while sampling
EMB5	15/12/2021	1.445	16/12/2021	1.53	36.7	5.64	669.00	14.50	436	52.7	3.56	276.1	0	Yes - pH	Clear, no odour, no sheen, then slight sediment/ pale orange deeper in well.
EMB6	15/12/2021	2.61	16/12/2021	2.07	34.1	6.5	10,523.00	25.50	6,878	23.3	1.59	1.2	0	No	Clear, no odour, no sheen, no sediment, then cloudy deeper in well.
EMB7	15/12/2021	1.59	16/12/2021	2.965	32.1	4.75	171.60	14.16	112	47.9	3.49	380.5	0	Yes - pH	Very clear, no odour, no sediment, no sheen.
EMB8	15/12/2021	2.53	16/12/2021	3.002	34.1	5.27	467.70	18.56	304	65.2	4.57	350.3	0	Yes - pH	Clear, no odour, no sheen, no sediment, then cloudy pale orange deeper in well.

Pre- wet season – 15 and 16/12/2021															
Bore ID	Pre-purge SWL (m bTOC)		Post sample SWL (m bTOC)		Temp	pH	EC	NTU	TDS	DO % Sat	DO (mg/L)	Redox potential (ORP)	PID	Exceedance of WQO (6-8.5 pH)?	Observations
	Date / Time	SWL	Date / Time	SWL											
EMB11	15/12/2021	2.034	16/12/2021	2.012	35	7.37	24,850.00	24.88	16,155	47.6	3.05	-77.8	0	No	Slightly cloudy, pale yellow/orange, no odour, no sheen.
EMB12	15/12/2021	1.747	16/12/2021	5.61	34.9	5.43	706	7.65	459	59	4.1	200.1	0.2	Yes - pH	Clear, no sheen, no turbidity, no odour. Then pale orange in colour.
EMB15	15/12/2021	1.315	16/12/2021	1.87	37.3	4.26	1,633	14.75	1,063	54.9	3.66	387.1	0.1	Yes - pH	Pale orange, Clear / Pale Very clear, no sheen, no sediment, no odour. Then pale orange/ pink
EMB16	15/12/2021	2.255	16/12/2021	3.46	35.4	6.71	66,241	14.88	43,056	59.3	3.23	29.9	0	No	Clear/ Pale Yellow

Post wet season – 11 and 12/04/2022															
Bore ID	Pre-purge SWL (m bTOC)		Pre-sample SWL (m bTOC)		Temp	pH	EC	NTU	TDS	DO % Sat	DO (mg/L)	Redox potential (ORP)	PID	Exceedance of WQO (6-8.5 pH)?	Observations
	Date	SWL	Date	SWL											
EMB1	11/4/2022	1.45	12/4/2022	1.745	35.7	8.29	3,045	90.75	1,980	23.7	16.1	58.5	0	No	Clear, no odour, no sheen, low sediment.
EMB2	11/4/2022	0.99	12/4/2022	1.34	35.3	8.05	404.7	15.77	263	47.2	3.26	-8.1	0	No	Clear, no odour, no sheen, low sediment. Clear and no sediment pre-sample.
EMB3	11/4/2022	1.85	12/4/2022	2.31	35.7	7.55	53,841	41.67	34,993	51	2.91	-54	0	No	Clear, no odour, no sheen, high sediment load
EMB4	11/4/2022	1.23	12/4/2022	2.24	36.9	6.32	253.2	207.84	165	34.5	2.32	171.4	0	No	Clear, no odour, no sheen, no sediment. High sediment, red in colour in bailer on first bail, then clear.

Post wet season – 11 and 12/04/2022															
Bore ID	Pre-purge SWL (m bTOC)		Pre-sample SWL (m bTOC)		Temp	pH	EC	NTU	TDS	DO % Sat	DO (mg/L)	Redox potential (ORP)	PID	Exceedance of WQO (6-8.5 pH)?	Observations
	Date	SWL	Date	SWL											
EMB5	5/5/2022	1.166	5/5/2022	1.165	38.7	6.23	1241	242.9	81	84.8	5.82	1526	-	No	Pale beige, no odour, no sheen, low sediment load.
EMB6	11/4/2022	1.23	12/4/2022	1.32	35	7.82	82.33	36.22	5364	48.1	3.25	-80.8	0	No	Clear, no odour, no sheen, no sediment. High sediment load in bailer pre-sample, then clear.
EMB7	11/4/2022	1.24	12/4/2022	1.77	35.2	7	191.5	41.1	130	21.5	1.55	184.6	0	No	Clear, no odour, no sheen, no sediment.
EMB8	11/4/2022	2.009	12/4/2022	2.034	33.6	7.48	159.9	34.06	104	50.2	3.57	209.3	0	No	Clear, no odour, no sheen, no sediment.
EMB11	11/4/2022	2.005	12/4/2022	2.01	34.9	7.7	22268	53.14	14,481	19.2	1.25	-58.6	0	No	Clear, no odour, no sheen, no sediment. High sediment load on first bail pre-sample.
EMB12	11/4/2022	1.34	12/4/2022	4.61	35.6	6.32	624	29.64	4.07	33.3	2.29	197.8	0	No	Clear, no odour, no sheen, no sediment, then orange deeper in well.
EMB15	11/4/2022	0.9	12/4/2022	1.345	36.8	5.48	1317	43.6	856	37.3	2.51	258.8	0	Yes - pH	Clear, no odour, no sheen, no sediment then pale pink deeper in well.
EMB16	11/4/2022	2.55	12/4/2022	3.36	35.1	7.42	57715	42.61	37,516	30.7	2.54	1.72	0	No	Pale orange, no odour, no sheen, no sediment

3.2.2 Analytical results

Laboratory results for the two GMEs, including adopted assessment criteria, are presented in ESdat data tables provided in Appendix C. Key findings are summarised below. Complete laboratory reports are provided in Appendix D.

3.2.2.1 Pre- wet season

– Copper, lead and zinc were detected in groundwater samples at concentrations above the *ANZG (2018) guidelines for Marine Water 95% species protection* in several wells as detailed in Table 9. Copper and zinc have been detected regularly throughout the GMEs undertaken to date and often exceed the respective trigger values in groundwater at the Vopak site.

– Several nutrient analytes were detected, including ammonia, nitrate, nitrite, nitrite + nitrate as N, total nitrogen, total Kjeldahl nitrogen and phosphorus. Ammonia, nitrite + nitrate as N, total nitrogen and total phosphorus concentrations exceeded the Darwin Harbour WQO and ANZG (2018) guidelines in most of the wells (Table 9).

– TRH was detected in all bores except for EMB6, with TRH C_{10} – C_{40} values being reported up to 460 µg/L (EMB8)

– BTEXN and PAH concentrations were below the laboratory limit of detection in all groundwater samples taken during this period.

– PFAS concentrations were detected in varying concentrations in wells EMB1 to 15 but did not exceed the nominated NEMP 2.0 guideline values. PFAS compounds were below the LOR for EMB16. PFAS was reported in highest concentrations at EMB5 and EMB7.

3.2.2.2 Post wet season

– Dissolved metals above the laboratory detection limit in groundwater samples include arsenic, copper, nickel and zinc. The following metals exceeded the adopted ANZG (2018) guidelines:
  - Zinc at EMB1, EMB2, EMB4, EMB5, EMB7 and EMB8, EMB 12 and EMB15.
  - Copper at EMB2, EMB5, EMB7, EMB 12, EMB15 and EMB16.
  - Lead at EMB15.

– Nutrients were detected across monitoring bores, with exceedances above the Darwin Harbour WQO and ANZG (2018) guidelines occurring for Ammonia, Nitrite + Nitrate as N, total nitrogen and total phosphorus (Table 9).

– TRH F3 (>C_{16}-C_{34} Fraction) were reported in two wells (EMB6 & EMB1), with concentrations ranging from 110 to 210 µg/L.

– Concentrations of BTEXN and PAHs were below detection limits and did not exceed relevant ANZG (2018) guideline values in all bores.

– PFAS was detected in all monitoring bores with the exception of EMB16. All PFAS detections did not exceed the adopted NEMP 2.0 guidelines. .

Table 9 Groundwater Exceedances

Well	Adopted Criteria	Pre- wet (16/12/2021)		Post-wet (12/04/2022 and 5/05/2022)	
		Exceedance of adopted criteria?	Analytes	Exceedance of adopted criteria?	Analytes
EMB1	ANZG 2018	Yes	Zinc (0.015 mg/L)	Yes	Zinc (0.03 mg/L), Ammonia as N (2.1 mg/L)
	NRETAS 2010	Yes	Nitrite + Nitrate as N (0.11 mg/L), Total Nitrogen as N (1.3 mg/L), Total Phosphorus as P (0.04 mg/L), Ammonia (0.44 mg/L)	Yes	Ammonia as N (2.1 mg/L), Total Nitrogen as N (2.7 mg/L), Total Phosphorus as P (0.04 mg/L), pH (8.29)
EMB2	ANZG 2018	Yes	Copper (0.003 mg/L), Zinc (0.129 mg/L)	Yes	Ammonia as N (1.25 mg/L), copper (0.002 mg/L), zinc (0.138 mg/L)
	NRETAS 2010	Yes	Ammonia (0.08 mg/L), Nitrite + Nitrate as N (0.1 mg/L), Total Nitrogen as N (0.7 mg/L), Total Phosphorus as P (0.04 mg/L)	Yes	Total Nitrogen as N (2.0 mg/L), Total Phosphorus as P (0.14 mg/L), pH (8.05)
EMB3	ANZG 2018	Yes	Ammonia (1.78 mg/L)	Yes	Ammonia (1.71 mg/L)
	NRETAS 2010	Yes	Nitrite + Nitrate as N (0.02 mg/L), Total Nitrogen as N (4.4 mg/L), Total Phosphorus as P (0.1 mg/L), Ammonia (1.78 mg/L)	Yes	Ammonia (1.71 mg/L), Total Nitrogen as N (1.9 mg/L)
EMB4	ANZG 2018	Yes	Copper (0.002 mg/L), Zinc (0.135 mg/L)	Yes	Zinc (0.018 mg/L)
	NRETAS 2010	Yes	Ammonia (0.04 mg/L), Nitrite + Nitrate as N (0.07 mg/L), Total Nitrogen as N (1.0 mg/L)	Yes	Ammonia (0.43 mg/L), Phosphorus as P (0.6 mg/L), Total Nitrogen as N (1.1 mg/L)
EMB5*	ANZG 2018	Yes	Copper (0.003 mg/L), Zinc (0.022 mg/L)	Yes	Copper (0.002 mg/L), zinc (0.012 mg/L)
	NRETAS 2010	Yes	Ammonia (0.02 mg/L), Nitrite + Nitrate as N (1.72 mg/L), Total Nitrogen as N (2.9 mg/L), Total Phosphorus as P (0.11 mg/L)	Yes	Ammonia (0.43 mg/L), Total Nitrogen as N (2.7 mg/L), Total Phosphorus as P (0.13 mg/L), Nitrogen (Total Oxidised) (as N) (1.27 mg/L)
EMB6	ANZG 2018	Yes	Ammonia (3.45 mg/L)	Yes	Ammonia (6.08 mg/L)
	NRETAS 2010	Yes	Nitrite + Nitrate as N (0.05 mg/L), Total Nitrogen as N (3.4 mg/L), Total Phosphorus as P (0.03 mg/L), Ammonia (3.45 mg/L)	Yes	Ammonia (6.08 mg/L), Total Nitrogen as N (7.4 mg/L), Total Phosphorus as P (0.08 mg/L)
EMB7	ANZG 2018	Yes	Copper (0.003 mg/L), Zinc (0.058 mg/L), Ammonia (1.22 mg/L)	Yes	Copper (0.003 mg/L), Zinc (0.02 mg/L), Ammonia (1.2 mg/L)

Well	Adopted Criteria	Pre- wet (16/12/2021)		Post-wet (12/04/2022 and 5/05/2022)	
		Exceedance of adopted criteria?	Analytes	Exceedance of adopted criteria?	Analytes
	NRETAS 2010	Yes	Nitrite + Nitrate as N (1.33 mg/L), Total Nitrogen as N (3.5 mg/L), Total Phosphorus as P (0.04 mg/L), Ammonia (1.22 mg/L)	Yes	Ammonia (1.2 mg/L), Nitrite + Nitrate as N (0.66 mg/L), Total Nitrogen as N (2.8 mg/L), Total Phosphorus as P (0.03 mg/L)
EMB8	ANZG 2018	Yes	Copper (0.008 mg/L),), Lead (0.008 mg/L), Zinc (0.04 mg/L)	Yes	Zinc (0.012 mg/L)
	NRETAS 2010	Yes	Ammonia (0.03 mg/L), Nitrite + Nitrate as N (2.78 mg/L), Total Nitrogen as N (4.2 mg/L), Total Phosphorus as P (0.10 mg/L)	Yes	Nitrite + Nitrate as N (4.64 mg/L), Total Nitrogen as N (6.1 mg/L), Total Phosphorus as P (0.05 mg/L)
EMB11	ANZG 2018	Yes	Ammonia as N (1.44 mg/L)	Yes	Ammonia as N (3.58 mg/L)
	NRETAS 2010	Yes	Nitrite + Nitrate as N (0.02 mg/L), Total Nitrogen as N (1.8 mg/L), Ammonia as N (1.44 mg/L)	Yes	Ammonia as N (3.58 mg/L), Total Nitrogen as N (5.2 mg/L), Total Phosphorus as P (0.1 mg/L)
EMB12	ANZG 2018	Yes	Copper (0.004 mg/L), Zinc (0.061 mg/L)	Yes	Copper (0.006 mg/L), Zinc (0.006 mg/L), Ammonia as N (2.47 mg/L)
	NRETAS 2010	Yes	Ammonia (0.04 mg/L), Nitrite + Nitrate as N (0.09 mg/L), Total Nitrogen as N (0.8 mg/L),	Yes	Ammonia as N (2.47 mg/L), Nitrite + Nitrate as N (0.04 mg/L), Total Nitrogen as N (3.4 mg/L), Total Phosphorus as P (0.05 mg/L)
EMB15	ANZG 2018	Yes	Copper (0.016 mg/L), Lead (0.007 mg/L), Zinc (0.049 mg/L)	Yes	Copper (0.017 mg/L), Lead (0.008 mg/L), Zinc (0.02 mg/L)
	NRETAS 2010	Yes	Nitrite + Nitrate as N (2.78 mg/L), Total Nitrogen as N (4.2 mg/L),	Yes	Ammonia (0.06 mg/L), Nitrite + Nitrate as N (0.85 mg/L), Total Nitrogen as N (2.2 mg/L), Total Phosphorus as P (0.09 mg/L), pH (5.48)
EMB16	ANZG 2018	Yes	Copper (0.147 mg/L)	Yes	Copper (0.074 mg/L)
	NRETAS 2010	Yes	Ammonia (0.24 mg/L), Nitrite + Nitrate as N (0.02 mg/L), Total Phosphorus as P (0.4 mg/L)	Yes	Ammonia (0.45 mg/L), Total Nitrogen as N (1.0 mg/L), Total Phosphorus as P (0.08 mg/L)

**EMB5 was sampled on 5 May 2022 for the end of wet season sampling*

3.3 Stormwater quality monitoring

3.3.1 Water quality parameters and field observations

Water quality parameters, visual and olfactory assessment of samples collected from the stormwater pits was undertaken. The assessment is summarised in Table 10 below.

Table 10 Surface water quality parameters, general and olfactory observations

Sampling event	Stormwater Pit ID	Date	Temp (°C)	pH	EC	Turbidity (NTU)	TDS (mg/L)	DO % Sat	DO (mg/L)	Redox potential (ORP)	Comments
Pre-wet season	DIFT 1	16/12/2021	34.2	8.60	47.6	40.42	31	96.5	6.79	173.7	Dark green/ algae bloom. No odour.
	DIFT 2	16/12/2021	31.6	7.49	37.3	8.95	24	91.6	6.72	183.4	Dark green/ algae bloom. No odour.
	DAT 2	16/12/2021	31.40	9.87	74.8	7.65	49	109.7	8.07	45.3	No odour, clear.
	6 Series	21/12/2021	No field parameters taken								
	Stormwater Pit ID	Date	Temp (°C)	pH	EC	Turbidity (NTU)	TDS (mg/L)	DO % Sat	DO (mg/L)	Redox potential (ORP)	Comments
Mid-wet season	DIFT 1	14/03/2022	32.0	6.58	732.0	-	422.52	65.10	4.73	138.8	Murky pale green / sheen on surface
	DIFT 2	21/02/2022	30.5	6.66	485.70	-	285.35	39.20	2.93	138.0	Dark murky green
	DAT 2	21/02/2022	30.0	7.83	-	-	32.50	51.20	3.98	108.1	No odour, clear.
	6 Series	21/02/2022	29.90	8.49	-	-	39.00	55.10	4.16	120.0	No odour, clear
	Stormwater Pit ID	Date	Temp	pH	EC	NTU	TDS (mg/L)	DO % Sat	DO (mg/L)	Redox potential (ORP)	Comments
Post-wet season	DIFT 1	05/05/2022	31.7	7.44	114.0	3.70	74	74.6	5.44	-	No odour, no sheen, low sediment load/ turbidity, clear
	DIFT 2	05/05/2022	29.4	7.40	1,383.0	0.75	-	47.7	3.63	181.3	No sheen, low sediment load, clear
	DAT 2	05/05/2022	29.6	7.65	49.6	6.72	32	101.0	7.76	147.8	No sheen, low sediment load/ turbidity, clear
	6 Series	05/05/2022	28.6	8.91	63.7	3.1	41	97.1	7.51	138.0	No odour, no sheen, low sediment load, clear.

3.3.2 Analytical results

Stormwater analytical for the monitoring period are summarised in Table 11. Detailed analytical results tables for the stormwater sampling are located in Appendix C of this report.

Table 11 Stormwater exceedances

ID	Adopted Criteria	Pre- wet		Mid-wet		Post-wet	
		Exceedance of adopted criteria?	Analytes	Exceedance of adopted criteria?	Analytes	Exceedance of adopted criteria?	Analytes
DIFT 1	ANZG 2018	Yes	Zinc (0.01 mg/L)	Yes	Zinc (0.045 mg/L)	Yes	Copper (0.002 mg/L), Zinc (0.047 mg/L)
	NRETAS 2010	Yes	Ammonia (0.03 mg/L), Nitrite + Nitrate as N (0.12 mg/L), pH (8.6)	Yes	Ammonia (0.27 mg/L), Nitrite + Nitrate as N (0.12 mg/L), nitrogen (Total) (0.5 mg/L)	No	TSS (23 mg/L), ammonia (0.03 mg/L), Nitrite + Nitrate as N (0.14 mg/L), total nitrogen as N (0.4 mg/L)
DIFT 2	ANZG 2018	Yes	Zinc (0.035 mg/L)	Yes	Zinc (0.054 mg/L), Toluene (331 mg/L)	Yes	Zinc (0.083 mg/L)
	NRETAS 2010	Yes	Ammonia (0.06 mg/L), Nitrite + Nitrate as N (0.25 mg/L), Total Nitrogen as N (0.4 mg/L)	Yes	Ammonia (0.13 mg/L), Nitrite + Nitrate as N (0.57 mg/L), Total Nitrogen as N (1.1 mg/L)	Yes	TSS (13 mg/L), Nitrite + Nitrate as N (0.05 mg/L), total nitrogen as N (0.6 mg/L)
DAT2	ANZG 2018	No	-	No	-	Yes	Copper (0.012 mg/L), zinc (0.053 mg/L)
	NRETAS 2010	Yes	Ammonia (0.05 mg/L), Nitrite + Nitrate as N (0.17 mg/L), Total phosphorus (0.26 mg/L)	Yes	Ammonia (0.05 mg/L), Nitrite + Nitrate as N (0.23 mg/L), Total phosphorus (0.26 mg/L), Total Nitrogen as N (0.3 mg/L)	Yes	TSS (28 mg/L), ammonia (0.04 mg/L), Nitrite + Nitrate as N (0.35 mg/L), nitrogen (total) (1.0 mg/L) total phosphorus (0.41 mg/L)
6 Series	ANZG 2018	No	-	No	-	Yes	Copper (0.006 mg/L), zinc (0.073 mg/L)
	NRETAS 2010	Yes	Ammonia (0.36 mg/L), Nitrite + Nitrate as N (0.21 mg/L), total nitrogen (0.6 mg/L)	Yes	Ammonia (0.14 mg/L), Nitrite + Nitrate as N (0.22 mg/L), total nitrogen (0.4 mg/L), pH (8.49)	Yes	Ammonia (0.16 mg/L), Nitrite + Nitrate as N 0.47 mg/L, Total Nitrogen as N (0.8 mg/L), pH (8.9)

During the three stormwater monitoring rounds conducted the following pertinent findings were recorded:

– Metals: Zinc was detected at concentrations above the ANZG (2018) guidelines in DIFT 1 and DIFT 2 during all sampling rounds. Zinc and/or copper were detected at concentrations above the ANZG (2018) guidelines in all of the sites during post-wet season monitoring.
– Nutrients: Nutrients (comprising ammonia, nitrate, nitrite, nitrite + nitrate as N, total nitrogen, total Kjeldahl nitrogen and phosphorus) were detected above the adopted Darwin Harbour water quality guidelines during all sampling rounds.
– TRH and BTEX:
    - Elevated concentrations of TRH and BTEX were detected at DIFT1, DIFT 2 and 6 series sampling sites during the mid-wet season sampling event. In DIFT 2, a concentration of Toluene (331 µg/L) that exceeded the ANZG (2018) was detected.
    - Results for TRH and BTEX from pre wet season and post-wet season sampling DIFT 1, 2, 6 Series and DAT2 were below the laboratory limits of reporting.
    - The temporal nature of the TRH and BTEX results, appearing during the mid-wet season sampling, is indicative of first flush scenario or a potential oil or hydrocarbon spill event that may have occurred prior to the commencement of mid-wet season sampling.
– PFAS: a variety of PFAS compounds reported detectable concentrations, however, were below the adopted criteria. PFAS has been consistency detected in DIFT 1 and 2 site which was noted in the OEMP as having a foam leak in the Tanks 103 and 104 area (EcoOz, 2021d).

3.4 Sediment sampling

3.4.1 Sediment characteristics

The sediment characteristics observed during sampling have been detailed in Table 12.

Table 12 Sediment characteristics across sampling locations

Sediment sample ID	Comments
Soil 1	Sandy / Silty / gravel (>3 cm) in size, red in colour, slightly moist under surface layer, no odour, no sheen, green algae solidified on surface, dried organic matter on surface (grass/ sticks/ leaves).
Soil 2	Sandy / Silty / gravel (>3 cm) in size, red in colour, slightly moist under surface layer, no odour, no sheen, green algae solidified on surface, dried organic matter on surface (grass/ sticks/ leaves).
Soil 3	Silty/ clay sediment, gravel (>3 cm) in size, dark brown in colour, moist under surface layer, slight organic matter odour, no sheen, green algae solidified on surface, dried organic matter on surface (grass/ sticks/ leaves)
Soil 4	Silty/ clay sediment, gravel (<2 cm) in size, dark brown to black in colour, very moist/wet sediment, strong organic matter odour, no sheen, alive organic matter on surface (grass), water in drain present.
Soil 5	Silty/ clay sediment, gravel (<2 cm) in size, dark brown to black in colour, very moist/wet sediment, strong organic matter odour, no sheen, alive organic matter on surface (grass), water in drain present.
Soil 6	Silty/ clay sediment, gravel (<2 cm) in size, dark brown to black in colour, very moist/wet sediment, strong organic matter odour, no sheen, alive organic matter on surface (grass), water in drain present.
Soil 9	Silty/ clay sediment, gravel (>3 cm) in size, dark brown in colour, moist under surface layer, slight organic matter odour, no sheen, dried organic matter on surface (grass/ sticks/ leaves).
Soil 10	Silty/ clay sediment, gravel (>3 cm) in size, dark brown in colour, moist under surface layer, slight organic matter odour, no sheen, dried organic matter on surface (grass/ sticks/ leaves).
Soil 11	Sandy clay, gravel (<1 cm) in size, dark brown/ black in colour, very moist, strong organic matter odour, no sheen, wet green algae on surface.
Soil 12	Sandy clay, gravelly (<1 cm) in size, dark brown in colour, moist under surface layer, slight organic matter odour, no sheen, green algae solidified on surface.

3.4.2 Analytical results

Sediment sample results including exceedances to assessment criteria are provided in Appendix C and summarised in Table 13. Laboratory reports are presented in Appendix D.

Table 13 Sediment exceedance results

	Adopted Criteria	Exceedance of adopted criteria?	Analytes
Soil 1	ANZG 2018 High	No	-
	ANZG 2018 Low	No	-
Soil 2	ANZG 2018 High	No	-
	ANZG 2018 Low	Yes	Arsenic
Soil 3	ANZG 2018 High	Yes	Arsenic
	ANZG 2018 Low	Yes	Arsenic
Soil 4	ANZG 2018 high	No	-
	ANZG 2018 Low	Yes	Arsenic, Chromium
Soil 5	ANZG 2018 High	No	-
	ANZG 2018 Low	Yes	Arsenic, Zinc
Soil 6	ANZG 2018 High	No	-
	ANZG 2018 Low	Yes	Arsenic
Soil 9	ANZG 2018 High	No	-
	ANZG 2018 Low	Yes	Arsenic
Soil 10	ANZG 2018 High	No	-
	ANZG 2018 Low	Yes	Arsenic
Soil 11	ANZG 2018 High	Yes	Arsenic
	ANZG 2018 Low	Yes	Arsenic
Soil 12	ANZG 2018 High	No	-
	ANZG 2018 Low	Yes	Arsenic

– A number of dissolved metal concentrations were detected above the LOR for all sediment sample locations, including arsenic, chromium, copper, lead, nickel and zinc. Mercury has been detected above the LOR in five of the ten samples but did not exceed the adopted ANZG 2018 guideline values.
– Arsenic was detected above the ANZG (2018) low toxicant values for all sites, except for sample soil 1, with values ranging from 28.6 mg/kg (Soil 9) to 74.9 mg/kg (Soil 3).
– Arsenic exceeded the ANZG (2018) high toxicant value for two sites, Soil 3 (74.9 mg/kg) and Soil 11 (74.3 mg/kg).
– Chromium values exceeded the ANZG (2018) low toxicant values for Soil 4 (80.6 mg/kg), and Zinc at Soil 5 (204 mg/kg).
– All lighter fraction TRH (C6-C16) and BTEXN concentrations were below the laboratory limit of reporting (LOR) at all sites. Heavier fraction TRH (C16-C40) were detected in varying concentrations (7-114 mg/kg) in sediment, but these were constrained mainly to the sampling sites within the vicinity of the tank farm. The concentrations fall to lower ranges between 4-14 mg/kg from Site 4, 11 and 12 leading outward to the harbor. This indicates that the hydrocarbons are unlikely reaching the Darwin Harbor environment.

4. Data quality assurance and control

4.1 QA/QC sample summary

Data quality was maintained by utilising the procedures mentioned in Section 4.2. Field duplicates were collected as described in Table 14. One field duplicate for each stormwater and groundwater event were taken alongside the primary sample from EMB1, DIFT 1 and DIFT2.

Table 14 QA/QC sampled summary

Primary sample	Sample type	Date	Duplicate ID	QA/QC Sample type
EMB1	Groundwater	16/12/2021	Duplicate	Field duplicate
DIFT1	Stormwater	16/12/2021		
EMB1	Groundwater	12/04/2022		
DIFT2	Stormwater	21/02/2022		
DIFT2	Stormwater	05/05/2022		

4.2 Relative percentage difference

RPDs were calculated for all analyses performed upon the primary/duplicate sample pairs. The results of these RPD calculations are documented in Table 15, showing exceedances to the RPD limits summarised in Table 15. Generally, the RPD exceedances found between QA/QC sample pairs are a consequence of very low concentrations of detected analytes. Generally, each analyte with an RPD above 30% was detected only slightly above its laboratory LOR. At such low concentrations, slight variations in results produce a large RPD variation.

It is likely that the RPD exceedance is influenced by the differences between low analyte concentrations rather than inconsistencies in laboratory analysis or field sampling methodology.

Table 15 RPD exceedance summary

Sample date	Primary sample:	Field duplicate name:	Analyte	RPD
16/12/2021	DIFT 1	Duplicate	– Ammonia as N – Nitrate (as N) – Nitrogen (Total Oxidised) (as N) – Zinc (filtered) – PFPeA – PFHxA – PFHpA – PFOA – PFDA – 8:2 Fluorotelomer Sulfonate (FTS) – 10:2 FTS	– 50% – 67% – 67% – 130% – 47% – 34% – 72% – 86% – 111% – 58% – 67%
16/12/2021	EMB 1	Duplicate	– Phosphorus (Total)	– 40%
21/2/2022	DIFT 2	Duplicate	– Ammonia as N – Phosphorus (Total) – BOD – Nickel (filtered)	– 48% – 67% – 40% – 67%
12/4/2022	EMB 1	Duplicate	– Phosphorus (Total) – Nickel (filtered)	– 77% – 67%
5/5/2022	DIFT2_5MAY22	DUP1_5MAY22	– Cadmium (filtered) – PFOS	– 40% – 67%

4.3 Sample temperature implications

As indicated in the ALS Sample Receipt Notification (SRN) documentation, as detailed in Appendix D samples were shipped to the laboratory in chilled coolers containing ice. A summary of the temperature readings of the samples for each monitoring round is retailed in below.

Table 16 Sample temperature readings for the Wet Season Monitoring Program

Monitoring event	Sampling Date	Sampling event	Date samples received	Temperature
Pre-wet season	16 /12/2021	– Groundwater – Surface water	N/A	10.8 °C
	21/12/2021		21/12/ 2021	
Mid-wet season	21/02/2022	– Surface water	22/02/ 2022	14.6 °C
	14/03/2022		17/03/2022	29.3 °C
Post-wet season	12/04/2022	– Groundwater – Sediment	14/04/ 2022	16.0 °C
	05/05/2022	– Surface water	06/05/2022	25.0 °C

Despite ice being present in the shipped coolers, upon receipt at the laboratory in Sydney, temperature readings of the samples were recorded at between 16.0 and 29.3 °C.

High temperatures could affect the stability of volatiles (most notably BTEX-N)) which may generate non-representative analysis results. However, based on the recorded data, the impact of this is considered minimal given majority of the below LOR results for the samples with the exception of the stormwater sample collected in DIFT 2 which based on the detected quantity is indicative of a potential spill event occurring prior to mid-wet season sampling rather than an effect of sample temperature changes.

4.3.1 Sample holding time breaches

4.3.1.1 Biological Oxygen Demand

BOD has a holding time of 6 hours and the interstate transport of samples for laboratory analysis resulted in the holding time breach. However, based on the results, majority of BOD results were within the LOR suggesting that the holding time breaches are not considered to have compromised the overall data quality or derived outcomes of this monitoring period.

4.3.1.2 Total recoverable hydrocarbons

TRH fractions C_{10} – C_{40} within sediment samples collected were analysed 13 days following the maximum allowable days to hold for TRH analysis. On balance, sediment samples have reported results of TRH in the heavier fractions above the LOR which indicates the potential for this fraction to be already present in the sediment rather than being attributed to breaches in sample holding times.

4.3.2 Internal laboratory QC reporting

Results of internal quality control procedures undertaken at the receiving National Accredited Testing Authority (NATA) accredited laboratory are within Appendix D.

Aside from the BOD and TRH holding time breaches mentioned in Section 4.3.1, other internal quality control breaches noted by the laboratory include insufficient internal quality control analysis frequencies for the following analytes:

– Nitrite as N
– BOD
– PAH/Phenols
– PFAS
– TRH (Semi-volatile Fraction)
– PFAS

These breaches were due to the collection of insufficient volume of groundwater within the sample bottles. While sufficient sample volume was collected to allow for the specific analytical suites and other quality control analyses, additional sample volumes (containers) are required to achieve the higher internal quality control testing frequency performed by the laboratory.

While there is some non-compliance with internal laboratory quality protocols, it is considered to be of low significance in the context of the assessment, analysis and reporting, over multiple events, undertaken within the project as a whole.

5. Discussion

5.1 Groundwater

Groundwater levels were generally high (between 1-2.6 m below ground level (bgl) reflective of the nature of the site along the coast. As expected, the slight rise in groundwater levels during the wet season is reflective of rainfall into the aquifer. The seasonal groundwater level variations are within the range expected for aquifers in the NT. pH indicates the ground water is moderately to slightly acidic further away from the coast with higher pH (7-8) being recorded at monitoring sites closer to the coastline indicative of intermixing with seawater. This is correlated with the EC and salinity values being higher along the coast (ex. EMB 3, 11 and 16). Higher EC values, salinity and pH are indicative of saltwater naturally mixing with groundwater in coastal areas.

Copper, zinc and lead were consistently detected in groundwater samples during the monitoring period. These metals have been detected regularly throughout the GMEs undertaken to date and often exceed the respective trigger values in groundwater at the Vopak site. The recorded levels are within the historic range of concentrations and is potentially reflective of natural background concentrations at the site.

TRH has been detected in groundwater samples during the pre and post wet season monitoring period. Presence of TRH is indicative of the nature of the fuel handling facility and the potential for underground leaks of minor nature to occur in either pipelines or storage tanks. BTEXN and PAH concentrations were below the laboratory limit of detection in all groundwater samples during both the pre and post wet season monitoring events.

PFAS in groundwater did not exceed the adopted NEMP 2.0 guideline throughout the pre and post wet season monitoring period

Several nutrient analytes were detected, including ammonia, nitrate, nitrite, nitrite + nitrate as N, total nitrogen, total Kjeldahl nitrogen and phosphorus. Overall, these nutrients may be indicative of natural biological processes occurring around the site considering its estuarine nature and potential for mangrove areas to act as nutrient sinks.

5.2 Stormwater

Zinc was detected at concentrations above the ANZG (2018) guidelines in DIFT 1 and DIFT 2 during all sampling rounds. Zinc and/or copper were detected at concentrations above the ANZG (2018) guidelines in all of the sites during post-wet season monitoring. Irrespective of the source, copper and zinc are considered to present a low to negligible risk to potential receptors based on the current industrial site use.

Nutrients (comprising ammonia, nitrate, nitrite, nitrite + nitrate as N, total nitrogen, total Kjeldahl nitrogen and phosphorus) were detected above the adopted Darwin Harbour water quality guidelines during all sampling rounds. The detection of these nutrients along with the observation of algae blooms in the stormwater pits indicates natural organic materials such as leaf litter or debris washing into the pits and undergoing the process of decomposition.

TRH, BTEX, oil and grease were below the laboratory detection limits in samples obtained from all four stormwater sampling locations before and at the end of the wet season sampling events. Elevated concentrations of TRH and BTEX were detected at DIFT1, DIFT 2 and 6 series sampling sites during the mid-wet season sampling event. In DIFT 2, a concentration of Toluene (331 µg/L) that exceeded the ANZG (2018) was detected.

The temporal nature of the TRH and BTEX results, appearing during the mid-wet season sampling, is indicative of first flush scenario or a potential oil or hydrocarbon spill event that may have occurred prior to the commencement of mid-wet season sampling.

PFAS has been consistency detected in the DIFT 1 and 2 site which was noted in the OEMP as having a foam leak in the Tanks 103 and 104 area (EcoOz, 2021d). Notwithstanding, none of the PFAS detections exceeded the adopted NEMP 2.0 guideline throughout the three sampling events.

5.3 Sediment

Sediments collected from the site were characteristic of a tropical coastal environment with a relatively moist sandy/silty nature intersperse with vegetation.

Metal concentrations were generally within the adopted ANZG (2018) values. Arsenic concentrations were similar to previous sampling events, whilst some samples exceeded the adopted ANZG (2018) values, this substance is commonly associated with acid sulfate soils and typical of coastal areas such as the estuarine environment wherein the site is located.

All lighter fraction TRH (C6-C16) and BTEXN concentrations were below the laboratory limit of reporting (LOR) at all sites. Heavier fraction TRH (C16-C40) were detected in varying concentrations (7-114 mg/kg) in sediment, but these were constrained mainly to the sampling sites within the vicinity of the tank farm. The concentrations fall to lower ranges between 4-14 mg/kg from Site 4, 11 and 12 leading outward to the harbor. This indicates that the hydrocarbons are unlikely reaching the Darwin Harbor environment.

6. Conclusion and recommendations

Groundwater

Groundwater EC values, salinity and pH are reflective of the nature of the site along the coast. Copper, zinc and lead have been detected regularly throughout the GMEs undertaken to date and likely to reflect natural background concentrations at the Vopak site. TRH has been detected in groundwater samples during the pre and post wet season monitoring period. Presence of TRH is indicative of the nature of the fuel handling facility.

BTEXN and PAH concentrations were below the laboratory limit of detection in all groundwater samples during both the pre and post wet season monitoring events.

PFAS in groundwater did not exceed the adopted NEMP 2.0 guideline throughout the pre and post wet season monitoring period

Stormwater

Several nutrient analytes were detected, including ammonia, nitrate, nitrite, nitrite + nitrate as N, total nitrogen, total Kjeldahl nitrogen and phosphorus. Overall, these nutrients may be indicative of natural biological processes occurring around the site considering its estuarine nature and potential for mangrove areas to act as nutrient sinks.

TRH, BTEX, oil and grease were below the laboratory detection limits in samples obtained from all four stormwater sampling locations before and at the end of the wet season sampling events. Elevated concentrations of TRH and BTEX were detected at DIFT1, DIFT 2 and 6 series sampling sites during the mid-wet season sampling event.

The temporal nature of the TRH and BTEX results, appearing during the mid-wet season sampling, is indicative of first flush scenario.

PFAS has been consistency detected in the DIFT 1 and 2 site which was noted in the OEMP as having a foam leak in the Tanks 103 and 104 area (EcoOz, 2021d). Notwithstanding, none of the PFAS detections exceeded the adopted NEMP 2.0 guideline throughout the three sampling events.

Sediment

Sediments collected from the site were characteristic of a tropical coastal environment with a relatively moist sandy/silty nature intersperse with vegetation.

Metal concentrations were generally within the adopted ANZG (2018) values. Some arsenic concentrations exceeded the adopted ANZG (2018) values, however, substance is commonly associated with acid sulfate soils and typical of coastal areas such as the estuarine environment wherein the site is located.

All lighter fraction TRH (C6-C16) and BTEXN concentrations were below the laboratory limit of reporting (LOR) at all sites. Heavier fraction TRH (C16-C40) were detected in varying concentrations, but these were constrained mainly to the sampling sites within the vicinity of the tank farm. The concentrations fall significantly leading outward to the harbor. This indicates that the hydrocarbons are unlikely reaching the Darwin Harbor environment.

Recommendations

It is recommended that Vopak continue to implement the necessary housekeeping and maintenance measures to manage and mitigate any potential fuel spills or foam leaks. Furthermore, continuation of the OEMP program will be beneficial to enable the continued monitoring of contaminants of concern at the site.

The next monitoring events will comprise:

Groundwater: End of dry season (before December 2022)

Stormwater: End of dry season (before December 2022)

Sediment: April/May 2024

7. References

Australian and New Zealand Environment and Conservation Council (ANZECC) (2000) Australian Guidelines for Water Quality Monitoring and Reporting

Australian Government Initiative (2018) Australian and New Zealand guidelines for fresh and marine quality (ANZG)

Australian Standard (2005). AS4482.1 - Guide to the investigation and sampling of sites with potentially contaminated soil Part 1: Non-volatile and semi-volatile compounds

Australian/New Zealand Standard (1998), AS/NZS 5667.10:1998 - Water Quality Sampling - Part 10: Guidance on sampling of waste waters

Australian/New Zealand Standard (1998), AS5667.1:1998 Water Quality Sampling - Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples

Bureau of Meteorology (BOM) (2022) Daily rainfall Fort Hill Wharf, http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=136&p_display_type=dailyDataFile&p_startYear=&p_c=&p_stn_num=14050 [accessed 10 May 2022]

Department of Natural Resources, Environment, The Arts and Sport (NTERAS) (2010) Northern Ter Water Quality Objectives for the Darwin Harbour Region

EcOz (2020) Vopak Sediment Monitoring – May 2020

EcOz (2021b) Vopak Stormwater Monitoring Report – March 2021

EcOz (2021c) Vopak Stormwater Monitoring Report – February 2021

EcOz (2021d) Operations Environmental Management Plan - Vopak Terminal, Darwin

EcOz Environmental Consultants (EcOz) (2021a) Vopak Groundwater Monitoring Report – April 2021

Environment Protection Authority (EPA) Victoria (2000) Groundwater Sampling Guidelines

Heads of EPAs Australia and New Zealand (2020) PFAS National Environmental Management Plan (NEMP) Version 2.0

National Environment Protection Council (1999, amended 2013) National Environment Protection Measure (NEPM)

Appendices

Appendix A

Chain of Custody and Sample Receipt Documentation

CHAIN OF CUSTODY

ALS Laboratory: please tick →

CLIENT: VOPAK	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):
OFFICE: Darwin	(Standard TAT may be longer for some tests. e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):
PROJECT: VOPAK GW monitoring PROJECT NO: 175661	ALS QUOTE NO.: ✱ SY/542/21 V3
ORDER NUMBER: PURCHASE ORDER NO.:	COUNTRY OF ORIGIN: AUS
PROJECT MANAGER: Terry Widdowson	CONTACT PH:
SAMPLER: Vasilica Milson	SAMPLER MOBILE: 0457952055
COC Emailed to ALS? (YES / NO)	EDD FORMAT (or default):
Email Reports to (will default to PM if no other addresses are listed): Vasilica.Milson@AHD.com	
Email Invoice to (will default to PM if no other addresses are listed): "	

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

FOR LABORATORY USE ONLY (Circle)
Custody Seal Intact? Yes No N/A
Free ice / frozen ice bricks present upon receipt? Yes No N/A
Random Sample Temperature on Receipt: 10-8 °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Vas. M	Kim		
DATE/TIME: 16/12. -2:00 PM	DATE/TIME: 21/12/21 7.30 Am	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).							Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Groundwater Table N.	Groundwater Table W.						Comments on likely contaminant levels, dilutions, or samples requiring specific QC analyses etc
1	DAT 2	16/12/21	W		7	X							Nitrite and Nitrate out of holding period - brenda BOD. Please test out of Holding time.
2	DIFT 1	16/12/21	W		7	X							
3	DIFT 2	16/12/21	W		7	X							
4	Duplicate	16/12	W		7	X							
5	EMB6	16/12	W		8		X						
6	EMB3	16/12	W		8		X						
7	EMB 2	16/12	W		8		X						
8	EMB 1	16/12	W		8		X						
9	EMB4	16/12	W		8		X						
10	EMB 12	16/12	W		8		X						
11	EMB 15	16/12	W		8		X						
12	EMB 16	16/12	W		8		X						
				TOTAL									

LAB OF ORIGIN: DARWIN
Environmental Division Sydney
Work Order Reference
ES2146547
Telephone : +61-2-8784 8555

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

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0390 E: adelaide@alsglobal.com

BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 4971 9030 E: gladstone@alsglobal.com

MELBOURNE 24 Wassil Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

NEWCASTLE 5/585 Maitland Road Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

NOWRA 4/13 Geary Place Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com

PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

TOWNSVILLE 14-15 Desma Court Stuart QLD 4811 Ph: 07 4796 0600 E: townsville@alsglobal.com

WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: VOPak	TURNAROUND REQUIREMENTS: ☐ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)	
OFFICE: Darwin	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact?	Yes / No / N/A
PROJECT: VOPak ENV monitoring PROJECT NO.: 256604	ALS QUOTE NO.: SYBE42121V3	Free ice / frozen ice bricks present upon receipt?	Yes / No / N/A
ORDER NUMBER: PURCHASE ORDER NO.:	COUNTRY OF ORIGIN:	Random Sample Temperature on Receipt	°C
PROJECT MANAGER: Terry Widdowson CONTACT PH:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 SP: 1 2 3 4 5 6 7	Other comment	
SAMPLER: Vasilea Milsom SAMPLER MOBILE: 0457 952 055	RELINQUISHED BY: Vas. M.	RECEIVED BY: Kim	RELINQUISHED BY: / RECEIVED BY:
COC Emailed to ALS? (YES / NO) EDD FORMAT (or default):	DATE/TIME: 16/12 - 2:00 pm	DATE/TIME: 9/12/21 7.30am	DATE/TIME: / DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed): Vasilea.Milsom@ghd.com			
Email Invoice to (will default to PM if no other addresses are listed):			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).							Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Groundwater TRH							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc: Nitrite and Nitrate out of holding time. + BOD. Please test out of holding time.
13	EMB 11	16/12	W		8	X							
14	EMB 7	16/12	W		8	X							
15	EMB 5	16/12	W		8	X							
16	EMB 8	16/12	W		8	X							
17	Duplicate		W		8	X							
				TOTAL									

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

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2146547**

Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: TERRY WIDDOWSON	Contact	: Sarah Mathew
Address	: Level 7 24 Mitchell Street DARWIN NT, AUSTRALIA 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: terry.widdowson@ghd.com	E-mail	: sarah.mathew@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 12566143	Page	: 1 of 3
Order number	: 12566143	Quote number	: ES2021GHDSER0046 (SY/542/21 V3)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Vasillea Milsom		

Dates

Date Samples Received	: 21-Dec-2021 07:30	Issue Date	: 22-Dec-2021
Client Requested Due Date	: 04-Jan-2022	Scheduled Reporting Date	: **04-Jan-2022**

Delivery Details

Mode of Delivery	: Client Drop Off	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: 10.8' C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 18 / 18

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **22/12/21: This is an updated SRN which indicates additional sample 6 SERIES (ALS #18) has been added.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

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

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

Summary of Sample(s) and Requested Analysis

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

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA025H Suspended Solids - Standard Level	WATER - EP020 Oil & Grease (O&G)	WATER - EP030 BOD	WATER - EP231X PFAS - Full Suite (28 analytes)	WATER - NT-08 Total Nitrogen + NO2 + NO3 + NH3 + Total P	WATER - W-05 TRH/BTEXN/8 Metals	WATER - W-26 TRH/BTEXN/PAH/8 Metals
ES2146547-001	16-Dec-2021 00:00	DAT 2	✓	✓	✓	✓	✓	✓	
ES2146547-002	16-Dec-2021 00:00	DIFT 1	✓	✓	✓	✓	✓	✓	
ES2146547-003	16-Dec-2021 00:00	DIFT 2	✓	✓	✓	✓	✓	✓	
ES2146547-004	16-Dec-2021 00:00	Duplicate	✓	✓	✓	✓	✓	✓	
ES2146547-005	16-Dec-2021 00:00	EMB 6				✓	✓		✓
ES2146547-006	16-Dec-2021 00:00	EMB 3				✓	✓		✓
ES2146547-007	16-Dec-2021 00:00	EMB 2				✓	✓		✓
ES2146547-008	16-Dec-2021 00:00	EMB 1				✓	✓		✓
ES2146547-009	16-Dec-2021 00:00	EMB 4				✓	✓		✓
ES2146547-010	16-Dec-2021 00:00	EMB 12				✓	✓		✓
ES2146547-011	16-Dec-2021 00:00	EMB 15				✓	✓		✓
ES2146547-012	16-Dec-2021 00:00	EMB 16				✓	✓		✓
ES2146547-013	16-Dec-2021 00:00	EMB 11				✓	✓		✓
ES2146547-014	16-Dec-2021 00:00	EMB 7				✓	✓		✓
ES2146547-015	16-Dec-2021 00:00	EMB 5				✓	✓		✓
ES2146547-016	16-Dec-2021 00:00	EMB 8				✓	✓		✓
ES2146547-017	16-Dec-2021 00:00	Duplicate				✓	✓		✓
ES2146547-018	21-Dec-2021 11:30	6 Series	✓	✓	✓	✓	✓	✓	

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

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

Method / Client Sample ID(s)	Container	Due for extraction	Due for analysis	Samples Received Date	Samples Received Evaluation	Instructions Received Date	Instructions Received Evaluation
EP030: Biochemical Oxygen Demand (BOD)							
DAT 2	Clear Plastic Bottle - Natural	----	18-Dec-2021	21-Dec-2021	×	----	----
DIFT 1	Clear Plastic Bottle - Natural	----	18-Dec-2021	21-Dec-2021	×	----	----
DIFT 2	Clear Plastic Bottle - Natural	----	18-Dec-2021	21-Dec-2021	×	----	----
Duplicate	Clear Plastic Bottle - Natural	----	18-Dec-2021	21-Dec-2021	×	----	----

Requested Deliverables

Accounts Payable Australia		
- A4 - AU Tax Invoice (INV)	Email	accountspayableAU@ghd.com
TERRY WIDDOWSON		
- *AU Certificate of Analysis - NATA (COA)	Email	terry.widdowson@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	terry.widdowson@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	terry.widdowson@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	terry.widdowson@ghd.com
- A4 - AU Tax Invoice (INV)	Email	terry.widdowson@ghd.com
- Chain of Custody (CoC) (COC)	Email	terry.widdowson@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	terry.widdowson@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	terry.widdowson@ghd.com
Vasillea Milsom		
- *AU Certificate of Analysis - NATA (COA)	Email	Vasillea.Milsom@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Vasillea.Milsom@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Vasillea.Milsom@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	Vasillea.Milsom@ghd.com
- A4 - AU Tax Invoice (INV)	Email	Vasillea.Milsom@ghd.com
- Chain of Custody (CoC) (COC)	Email	Vasillea.Milsom@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	Vasillea.Milsom@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	Vasillea.Milsom@ghd.com

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com

BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 4971 9600 E: gladstone@alsglobal.com

MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

MELBOURNE 4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

MUDGEE 106 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

NEWCASTLE 5/19 Mayfield Road Mayfield West NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com

ORANGE 1/10 Hughes Place North Nowra NSW 2541 Ph: 02 4421 3125 E: nowra@alsglobal.com

PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville@alsglobal.com

WAGGA WAGGA 2 Dalman Place Wagga Wagga NSW 2650 Ph: 02 6971 9696 E: wagga@alsglobal.com

CLIENT: VOPak.	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):		FOR LABORATORY USE ONLY (Circle)
OFFICE: Darwin.			Custody Seal Intact? Yes No N/A
PROJECT: VOPak ENV monitoring PROJECT NO.:	ALS QUOTE NO.: SY/542/21 V3	COC SEQUENCE NUMBER (Circle)	Free ice / frozen ice bricks present upon receipt? Yes No N/A
ORDER NUMBER: PURCHASE ORDER NO.:	COUNTRY OF ORIGIN: AUS	COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
PROJECT MANAGER: Carol Muzyk CONTACT PH:		OF: 1 2 3 4 5 6 7	Other comment: 9125 14/6.
SAMPLER: Vasillea Milson SAMPLER MOBILE: 0457 952 055	RELINQUISHED BY: Vasilea	RECEIVED BY: 1:30pm	RELINQUISHED BY:
COC Emailed to ALS? (YES / NO) EDD FORMAT (or default):		DATE/TIME: 21 FEB 2022	DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed): Vasillea.milson@GHD.com	DATE/TIME: 21/2/22 1240pm		RECEIVED BY: Brenda
Email Invoice to (will default to PM if no other addresses are listed):			DATE/TIME: 22/2/22 16:45pm

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	SW table.								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	DAT 2	21/2/22	W		7	X								
2	DIFT 2	21/2/22	W		7	X								
3	Duplicate	21/2/22	W		7	X								
				TOTAL										

Environmental Division
Sydney
Work Order Reference
ES2205893

Telephone : +61-2-8784 8555

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

LAB OF ORIGIN
DARWIN

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com

BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 4971 9600 E: gladstone@alsglobal.com

MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

MELBOURNE 4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

MUDGEE 106 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

NEWCASTLE 5/19 Mayfield Road Mayfield West NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com

ORANGE 1/10 Hughes Place North Nowra NSW 2541 Ph: 02 4421 3125 E: nowra@alsglobal.com

PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville@alsglobal.com

WAGGA WAGGA 2 Dalman Place Wagga Wagga NSW 2650 Ph: 02 6971 9696 E: wagga@alsglobal.com

CLIENT: VOPak.	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):		FOR LABORATORY USE ONLY (Circle)
OFFICE: Darwin.			Custody Seal Intact? Yes No N/A
PROJECT: VOPak ENV monitoring PROJECT NO.:	ALS QUOTE NO.: SY/542/21 V3	COC SEQUENCE NUMBER (Circle)	Free ice / frozen ice bricks present upon receipt? Yes No N/A
ORDER NUMBER: PURCHASE ORDER NO.:	COUNTRY OF ORIGIN: AUS	COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
PROJECT MANAGER: Carol Muzyk CONTACT PH:		OF: 1 2 3 4 5 6 7	Other comment: 9125 14/6.
SAMPLER: Vasillea Milson SAMPLER MOBILE: 0457 952 055	RELINQUISHED BY: Vasilea	RECEIVED BY: 1:30pm	RELINQUISHED BY:
COC Emailed to ALS? (YES / NO) EDD FORMAT (or default):		DATE/TIME: 21 FEB 2022	DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed): Vasillea.milson@GHD.com	DATE/TIME: 21/2/22 1240pm		RECEIVED BY: Brenda
Email Invoice to (will default to PM if no other addresses are listed):			DATE/TIME: 22/2/22 16:45pm

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	SW table.								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	DAT 2	21/2/22	W		7	X								
2	DIFT 2	21/2/22	W		7	X								
3	Duplicate	21/2/22	W		7	X								
				TOTAL										

Environmental Division
Sydney
Work Order Reference
ES2205893

Telephone : +61-2-8784 8555

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

LAB OF ORIGIN
DARWIN

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2205893**

Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Vasillea Milsom	Contact	: Sarah Mathew
Address	: Level 7 24 Mitchell Street DARWIN NT, AUSTRALIA 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: Vasillea.Milsom@ghd.com	E-mail	: sarah.mathew@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: Vopak ENV Monitoring	Page	: 1 of 2
Order number	: ----	Quote number	: ES2021GHDSER0046 (SY/542/21 V3)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Vasillea Milsom		

Dates

Date Samples Received	: 22-Feb-2022 16:45	Issue Date	: 22-Feb-2022
Client Requested Due Date	: 02-Mar-2022	Scheduled Reporting Date	: **02-Mar-2022**

Delivery Details

Mode of Delivery	: Client Drop Off	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: 14.6' C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 3 / 3

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

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

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

Summary of Sample(s) and Requested Analysis

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

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA025H Suspended Solids - Standard Level	WATER - EP020 Oil & Grease (O&G)	WATER - EP030 BOD	WATER - EP231X PFAS - Full Suite (28 analytes)	WATER - NT-08 Total Nitrogen + NO2 + NO3 + NH3 + Total P	WATER - W-05 TRH/BTEXN/8 Metals
ES2205893-001	21-Feb-2022 00:00	DAT 2	✓	✓	✓	✓	✓	✓
ES2205893-002	21-Feb-2022 00:00	DIFT 2	✓	✓	✓	✓	✓	✓
ES2205893-003	21-Feb-2022 00:00	Duplicate	✓	✓	✓	✓	✓	✓

Proactive Holding Time Report

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

Requested Deliverables

Accounts Payable Australia

- A4 - AU Tax Invoice (INV)	Email	accountspayableAU@ghd.com

Jenny Nicholls

- *AU Certificate of Analysis - NATA (COA)	Email	jenny.nicholls@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jenny.nicholls@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jenny.nicholls@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jenny.nicholls@ghd.com
- Chain of Custody (CoC) (COC)	Email	jenny.nicholls@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	jenny.nicholls@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	jenny.nicholls@ghd.com
- EDI Format - XTab (XTAB)	Email	jenny.nicholls@ghd.com

LEMUEL CABAHUG

- *AU Certificate of Analysis - NATA (COA)	Email	lemuel.cabahug@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	lemuel.cabahug@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	lemuel.cabahug@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	lemuel.cabahug@ghd.com
- Chain of Custody (CoC) (COC)	Email	lemuel.cabahug@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	lemuel.cabahug@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	lemuel.cabahug@ghd.com
- EDI Format - XTab (XTAB)	Email	lemuel.cabahug@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	lemuel.cabahug@ghd.com

Vasillea Milsom

- *AU Certificate of Analysis - NATA (COA)	Email	Vasillea.Milsom@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Vasillea.Milsom@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Vasillea.Milsom@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	Vasillea.Milsom@ghd.com
- Chain of Custody (CoC) (COC)	Email	Vasillea.Milsom@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	Vasillea.Milsom@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	Vasillea.Milsom@ghd.com

24.3.22

CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ADELAIDE 21 Burma Road Pooraka SA 5095 Ph 08 8359 0890 E adelaide@alsglobal.com
☐BRISBANE 2 Byth Street Stafford QLD 4053 Ph 07 3243 7222 E samples.brisbane@alsglobal.com
☐GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph 07 7471 5600 E gladstone@alsglobal.com
☐MACKAY 78 Harbour Road Mackay QLD 4740 Ph 07 4944 0177 E mackay@alsglobal.com
☐MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph 03 8549 9600 E samples.melbourne@alsglobal.com
☐MUDGEE 1/29 Sydney Road Mudgee NSW 2850 Ph 02 6372 6735 E mudgee.mail@alsglobal.com
☐NEWCASTLE 5/585 Maitland Road Mayfield West NSW 2304 Ph 02 4014 2500 E samples.newcastle@alsglobal.com
☐NOWRA 4-13 Geary Place North Nowra NSW 2541 Ph 02 4423 2063 E nowra@alsglobal.com
☐PERTH 10 Hod Way Malaga WA 6090 Ph 08 9209 7655 E samples.perth@alsglobal.com
☐SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph 02 8784 8555 E samples.sydney@alsglobal.com
☐TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph 07 4796 0600 E townsville.environmental@alsglobal.com
☐WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph 02 4225 3125 E wollongong@alsglobal.com

CLIENT: ~~[illegible]~~ GHD	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)	☐ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)
OFFICE: Darwin env monitoring		☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact? Yes No N/A
PROJECT: 12566143 -Vopak PROJECT NO.: 12566143	ALS QUOTE NO.: SY/542/21 V3	COC SEQUENCE NUMBER (Circle)	Free Ice / frozen ice bricks present upon receipt? Yes No N/A
ORDER NUMBER: PURCHASE ORDER NO.:	COUNTRY OF ORIGIN:	COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt: °C
PROJECT MANAGER: Sam Majchic	CONTACT PH:	OF: 1 2 3 4 5 6 7	Other comment:
SAMPLER: Vasilea Milsom	SAMPLER MOBILE: 0457 952 055		
COC Emailed to ALS? (YES / NO)	EDD FORMAT (or default):		
Email Reports to (will default to PM if no other addresses are listed):			
Email Invoice to (will default to PM if no other addresses are listed):			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Vas. M	DSandhu		Kim
DATE/TIME: 14.3.22 - 11:10am	DATE/TIME: 14/03/22 11:25am	DATE/TIME:	DATE/TIME: 17.03.22 7:30am

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Stormwater Table 2.								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
Bseries	6													
1	6 series	14.3.22	W		8	X								
2	DUP 1	14.3.22	W		8	X								
				TOTAL										

Environmental Division
Sydney
Work Order Reference
ES2208856

Telephone : +61-2-8784 8555

LAB OF ORIGIN: DARWIN

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

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2208856**

Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: VASILLEA MILSOM	Contact	: Sarah Mathew
Address	: Level 7 24 Mitchell Street DARWIN NT, AUSTRALIA 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: Vasillea.Milsom@ghd.com	E-mail	: sarah.mathew@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 12566143	Page	: 1 of 3
Order number	: ----	Quote number	: ES2021GHDSER0046 (SY/542/21 V3)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Vasillea Misom		

Dates

Date Samples Received	: 17-Mar-2022 07:30	Issue Date	: 17-Mar-2022
Client Requested Due Date	: 24-Mar-2022	Scheduled Reporting Date	: **24-Mar-2022**

Delivery Details

Mode of Delivery	: Client Drop Off	Security Seal	: Not Available
No. of coolers/boxes	: 1	Temperature	: 29.3' C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 2 / 2

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

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

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

Summary of Sample(s) and Requested Analysis

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

Matrix: **WATER**

Laboratory sample ID	*Sampling date / time*	*Sample ID*	WATER - EA025H Suspended Solids - Standard Level	WATER - EP020 Oil & Grease (O&G)	WATER - EP030 BOD	WATER - EP231X PFAS - Full Suite (28 analytes)	WATER - NT-08 Total Nitrogen + NO2 + NO3 + NH3 + Total P	WATER - W-05 TRH/BTEXN/8 Metals
ES2208856-001	14-Mar-2022 00:00	6 series	✓	✓	✓	✓	✓	✓
ES2208856-002	14-Mar-2022 00:00	DIFT 1	✓	✓	✓	✓	✓	✓

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

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

Method / Client Sample ID(s)	Container	Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation
EK057G: Nitrite as N by Discrete Analyser							
6 series	Clear Plastic Bottle - Natural	----	16-Mar-2022	17-Mar-2022	✘	----	----
DIFT 1	Clear Plastic Bottle - Natural	----	16-Mar-2022	17-Mar-2022	✘	----	----
EP030: Biochemical Oxygen Demand (BOD)							
6 series	Clear Plastic Bottle - Natural	----	16-Mar-2022	17-Mar-2022	✘	----	----
DIFT 1	Clear Plastic Bottle - Natural	----	16-Mar-2022	17-Mar-2022	✘	----	----

Requested Deliverables

Accounts Payable Australia		
- A4 - AU Tax Invoice (INV)	Email	accountspayableAU@ghd.com
Jenny Nicholls		
- *AU Certificate of Analysis - NATA (COA)	Email	jenny.nicholls@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jenny.nicholls@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jenny.nicholls@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jenny.nicholls@ghd.com
- Chain of Custody (CoC) (COC)	Email	jenny.nicholls@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	jenny.nicholls@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	jenny.nicholls@ghd.com
- EDI Format - XTab (XTAB)	Email	jenny.nicholls@ghd.com
LEMUEL CABAHUG		
- *AU Certificate of Analysis - NATA (COA)	Email	lemuel.cabahug@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	lemuel.cabahug@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	lemuel.cabahug@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	lemuel.cabahug@ghd.com
- Chain of Custody (CoC) (COC)	Email	lemuel.cabahug@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	lemuel.cabahug@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	lemuel.cabahug@ghd.com
- EDI Format - XTab (XTAB)	Email	lemuel.cabahug@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	lemuel.cabahug@ghd.com
SAM MAJETIC		
- A4 - AU Tax Invoice (INV)	Email	sam.majetic@ghd.com
VASILLEA MILSOM		
- *AU Certificate of Analysis - NATA (COA)	Email	Vasillea.Milsom@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Vasillea.Milsom@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Vasillea.Milsom@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	Vasillea.Milsom@ghd.com
- Chain of Custody (CoC) (COC)	Email	Vasillea.Milsom@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	Vasillea.Milsom@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	Vasillea.Milsom@ghd.com

(1) 26/4

CHAIN OF CUSTODY

ALS Laboratory: please tick →

CLIENT: Worley GHD	TURNAROUND REQUIREMENTS : ☐ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)	
OFFICE: Darwin	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact?	Yes No N/A
PROJECT: Vopak ENV Monitoring	ALS QUOTE NO.: Sy 1542/21/V3	Free ice / frozen ice bricks present upon receipt?	Yes No N/A
ORDER NUMBER:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt:	°C
PROJECT MANAGER: CONTACT PH:	OF: 1 2 3 4 5 6 7	Other comment:	16.0
SAMPLER: Vasillea. Milsom SAMPLER MOBILE: 0457 952 053	RELINQUISHED BY: VAS.M	RECEIVED BY:	RELINQUISHED BY:
COC emailed to ALS? (YES / NO) EDD FORMAT (or default):			
Email Reports to (will default to PM if no other addresses are listed): Vasillea.Milsom@GHD.com	DATE/TIME: 12/4 3:00pm	DATE/TIME: 12/04/22 3:10pm	DATE/TIME:
Email Invoice to (will default to PM if no other addresses are listed):			

| | | |

(12)

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph 08 8359 0890 E adelaide@alsglobal.com

BRISBANE 2 Byth Street Stafford QLD 4053 Ph 07 3243 7222 E samples.brisbane@alsglobal.com

GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph 07 7471 5600 E gladstone@alsglobal.com

MACKAY 78 Harbour Road Mackay QLD 4740 Ph 07 4944 0177 E mackay@alsglobal.com

MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph 03 8549 9600 E samples.melbourne@alsglobal.com

MUDGEE 1/20 Sydney Road Mudgee NSW 2850 Ph 02 6372 6735 E mudgee.mail@alsglobal.com

NEWCASTLE 5/585 Maitland Road Mayfield West NSW 2304 Ph 02 4014 2500 E samples.newcastle@alsglobal.com

NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph 02 4423 2063 E nowra@alsglobal.com

PERTH 10 Hod Way Malaga WA 6090 Ph 08 9209 7655 E samples.perth@alsglobal.com

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph 02 8784 8555 E samples.sydney@alsglobal.com

TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph 07 4796 0600 E townsville.environmental@alsglobal.com

WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph 02 4225 3125 E wollongong@alsglobal.com

CLIENT: GHD	TURNAROUND REQUIREMENTS : ☐ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)	
OFFICE: DARWIN	(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact?	Yes No N/A
PROJECT: PROJECT NO.:	ALS QUOTE NO.: SY/542/21/V3	Free Ice / frozen ice bricks present upon receipt?	Yes No N/A
ORDER NUMBER: PURCHASE ORDER NO.:	COUNTRY OF ORIGIN:	Random Sample Temperature on Receipt:	°C
PROJECT MANAGER: CONTACT PH:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	Other comment:	

SAMPLER: Vasilica Milsom	SAMPLER MOBILE:	RELINQUISHED BY: Vas-M	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
COC Emailed to ALS? (YES / NO)	EDD FORMAT (or default):				
Email Reports to (will default to PM if no other addresses are listed): Vasilica.milsom@GHD.com		DATE/TIME: 12/4 - 3:00 pm	DATE/TIME:	DATE/TIME:	DATE/TIME:
Email Invoice to (will default to PM if no other addresses are listed):					

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	GW Table 1	Soil / Sediment							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
13	Duplicate	12/4	W			X								
14	Soil_1	12/4	S				X							
15	Soil_2	12/4	S				X							
16	Soil_3	12/4	S				X							
17	Soil_4	12/4	S				X							
18	Soil_5	12/4	S				X							
19	Soil_6	12/4	S				X							
20	Soil_9	" "	S				X							
21	Soil_10	" "	S				X							
22	Soil_11	" "	S				X							
23	Soil_12	" "	S				X							
				TOTAL										

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

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2212961**

Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: VASILLEA MILSOM	Contact	: Sarah Mathew
Address	: Level 7 24 Mitchell Street DARWIN NT, AUSTRALIA 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: Vasillea.Milsom@ghd.com	E-mail	: sarah.mathew@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: Vopak ENV Monitoring	Page	: 1 of 3
Order number	: ----	Quote number	: ES2021GHDSER0046 (SY/542/21 V3)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: VASILLEA MILSOM		

Dates

Date Samples Received	: 14-Apr-2022 08:30	Issue Date	: 16-Apr-2022
Client Requested Due Date	: 26-Apr-2022	Scheduled Reporting Date	: **26-Apr-2022**

Delivery Details

Mode of Delivery	: Client Drop Off	Security Seal	: Not Available
No. of coolers/boxes	: 3	Temperature	: 16.0'C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 22 / 22
		No. of samples NOT collected	1

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- Sample EMB 5 was not received due to the following reason: Sample not received.
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

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

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

Summary of Sample(s) and Requested Analysis

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

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	SOIL - EA055-103 Moisture Content	SOIL - EG020-SD Total Metals in Sediments by ICPMS (NODG)	SOIL - EG035T-LL Total Mercury by FIMS - Low Level (SOLID)	SOIL - EP080-SD TRH(V)/BTEXN in Sediments
ES2212961-014	12-Apr-2022 00:00	Soil_1	✓	✓	✓	✓
ES2212961-015	12-Apr-2022 00:00	Soil_2	✓	✓	✓	✓
ES2212961-016	12-Apr-2022 00:00	Soil_3	✓	✓	✓	✓
ES2212961-017	12-Apr-2022 00:00	Soil_4	✓	✓	✓	✓
ES2212961-018	12-Apr-2022 00:00	Soil_5	✓	✓	✓	✓
ES2212961-019	12-Apr-2022 00:00	Soil_6	✓	✓	✓	✓
ES2212961-020	12-Apr-2022 00:00	Soil_9	✓	✓	✓	✓
ES2212961-021	12-Apr-2022 00:00	Soil_10	✓	✓	✓	✓
ES2212961-022	12-Apr-2022 00:00	Soil_11	✓	✓	✓	✓
ES2212961-023	12-Apr-2022 00:00	Soil_12	✓	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EP231X PFAS - Full Suite (28 analytes)	WATER - NT-08 Total Nitrogen + NO2 + NO3 + NH3 + Total P	WATER - W-26 TRH/BTEXN/PAH/8 Metals
ES2212961-001	12-Apr-2022 00:00	EMB 7	✓	✓	✓
ES2212961-002	12-Apr-2022 00:00	EMB 8	✓	✓	✓
ES2212961-003	12-Apr-2022 00:00	EMB 11	✓	✓	✓
ES2212961-004	12-Apr-2022 00:00	EMB 12	✓	✓	✓
ES2212961-005	12-Apr-2022 00:00	EMB 15	✓	✓	✓
ES2212961-006	12-Apr-2022 00:00	EMB 16	✓	✓	✓
ES2212961-007	12-Apr-2022 00:00	EMB 6	✓	✓	✓
ES2212961-008	12-Apr-2022 00:00	EMB 4	✓	✓	✓
ES2212961-009	12-Apr-2022 00:00	EMB 1	✓	✓	✓
ES2212961-010	12-Apr-2022 00:00	EMB 2	✓	✓	✓
ES2212961-011	12-Apr-2022 00:00	EMB 3	✓	✓	✓
ES2212961-013	12-Apr-2022 00:00	Duplicate	✓	✓	✓

Proactive Holding Time Report

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

Requested Deliverables

Accounts Payable Australia		
- A4 - AU Tax Invoice (INV)	Email	accountspayableAU@ghd.com
Jenny Nicholls		
- *AU Certificate of Analysis - NATA (COA)	Email	jenny.nicholls@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jenny.nicholls@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jenny.nicholls@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jenny.nicholls@ghd.com
- Chain of Custody (CoC) (COC)	Email	jenny.nicholls@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	jenny.nicholls@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	jenny.nicholls@ghd.com
- EDI Format - XTab (XTAB)	Email	jenny.nicholls@ghd.com
LEMUEL CABAHUG		
- *AU Certificate of Analysis - NATA (COA)	Email	lemuel.cabahug@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	lemuel.cabahug@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	lemuel.cabahug@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	lemuel.cabahug@ghd.com
- Chain of Custody (CoC) (COC)	Email	lemuel.cabahug@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	lemuel.cabahug@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	lemuel.cabahug@ghd.com
- EDI Format - XTab (XTAB)	Email	lemuel.cabahug@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	lemuel.cabahug@ghd.com
VASILLEA MILSOM		
- *AU Certificate of Analysis - NATA (COA)	Email	Vasillea.Milsom@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	Vasillea.Milsom@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	Vasillea.Milsom@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	Vasillea.Milsom@ghd.com
- A4 - AU Tax Invoice (INV)	Email	Vasillea.Milsom@ghd.com
- Chain of Custody (CoC) (COC)	Email	Vasillea.Milsom@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	Vasillea.Milsom@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	Vasillea.Milsom@ghd.com

13.05.22

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com
BRISBANE 2 Byth Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com
GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com
MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com
MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com
MUDGEE 1/29 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com
NEWCASTLE 5/585 Maitland Road Mayfield West NSW 2304 Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com
NOWRA 4-13 Geary Place North Nowra NSW 2541 Ph: 02 4423 2063 E: nowra@alsglobal.com
PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com
SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com
TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com
WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: Vopak	TURNAROUND REQUIREMENTS: ☑ Standard TAT (List due date):	FOR LABORATORY USE ONLY (Circle)	
OFFICE: Darwin	(Standard TAT may be longer for some tests e.g., Ultra Trace Organics) ☐ Non Standard or urgent TAT (List due date):	Custody Seal Intact?	Yes / No / N/A
PROJECT: Vopak Env Monitoring PROJECT NO.: 12566145	ALS QUOTE NO.: SY/542/21/V5	Free ice / frozen ice bricks present upon receipt?	Yes / No / N/A
ORDER NUMBER: PURCHASE ORDER NO.:	COUNTRY OF ORIGIN:	Random Sample Temperature on Receipt:	°C
PROJECT MANAGER: ~~Sam Mayfield~~ Vas Mitsom CONTACT PH: 0457 952 055	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7 OF: 1 2 3 4 5 6 7	Other comment:	

SAMPLER: Ken Littlejohn	SAMPLER MOBILE: 0403860676	RELINQUISHED BY: B. Littlejohn	RECEIVED BY: Kim	RELINQUISHED BY:
COC Emailed to ALS? (YES) / NO	EDD FORMAT (or default):	DATE/TIME: 5/5/22 - 12pm	DATE/TIME: 06.05.22 7.30am	DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed): ken.littlejohn@ghd.com				RECEIVED BY:
Email Invoice to (will default to PM if no other addresses are listed):				DATE/TIME: 05/05 12.00PM

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).				Additional Information
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	Table 1 of Cwaste Groundwater	Table 2 of Cwaste Storm Water			Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	EMB5_5MAY22	5/5/22	W		8	X				*
2	DAT2 - 5MAY22	5/5/22	W		9		X			
3	DIFT2 - 5MAY22	5/5/22	W		9		X			
4	DIFT2 - 5MAY22	5/5/22	W		9		X			
5	6-Series-5MAY22	5/5/22	W		9		X			
6	Dup1 - 5MAY22	5/5/22	W		9		X			
				TOTAL						

Environmental Division
Sydney
Work Order Reference
ES2215415

Telephone : +61-2-8784 8555

LAB OF ORIGIN: DARWIN

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

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2215415**

Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: BEN LITTLEJOHN	Contact	: Sarah Mathew
Address	: Level 7 24 Mitchell Street DARWIN NT, AUSTRALIA 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: ben.littlejohn@ghd.com	E-mail	: sarah.mathew@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 12566145 Vopak Env Monitoring	Page	: 1 of 3
Order number	: ----	Quote number	: ES2021GHDSER0046 (SY/542/21 V3)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: BEN LITTLEJOHN		

Dates

Date Samples Received	: 06-May-2022 07:30	Issue Date	: 06-May-2022
Client Requested Due Date	: 13-May-2022	Scheduled Reporting Date	: **13-May-2022**

Delivery Details

Mode of Delivery	: Client Drop Off	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: 25.0' C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 6 / 6

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

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

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

Summary of Sample(s) and Requested Analysis

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

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EA025H Suspended Solids - Standard Level	WATER - EP020 Oil & Grease (O&G)	WATER - EP030 BOD	WATER - EP231X PFAS - Full Suite (28 analytes)	WATER - NT-08 Total Nitrogen + NO2 + NO3 + NH3 + Total P	WATER - W-05 TRH/BTEXN/8 Metals	WATER - W-26 TRH/BTEXN/PAH/8 Metals
ES2215415-001	05-May-2022 00:00	EMB5_5MAY22				✓	✓		✓
ES2215415-002	05-May-2022 00:00	DAT2_5MAY22	✓	✓	✓	✓	✓	✓	
ES2215415-003	05-May-2022 00:00	DIFT1_5MAY22	✓	✓	✓	✓	✓	✓	
ES2215415-004	05-May-2022 00:00	DIFT2_5MAY22	✓	✓	✓	✓	✓	✓	
ES2215415-005	05-May-2022 00:00	6-Series_5MAY22	✓	✓	✓	✓	✓	✓	
ES2215415-006	05-May-2022 00:00	DUP1_5MAY22	✓	✓	✓	✓	✓	✓	

Proactive Holding Time Report

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

Requested Deliverables

Accounts Payable Australia		
- A4 - AU Tax Invoice (INV)	Email	accountspayableAU@ghd.com
BEN LITTLEJOHN		
- *AU Certificate of Analysis - NATA (COA)	Email	ben.littlejohn@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ben.littlejohn@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ben.littlejohn@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	ben.littlejohn@ghd.com
- A4 - AU Tax Invoice (INV)	Email	ben.littlejohn@ghd.com
- Chain of Custody (CoC) (COC)	Email	ben.littlejohn@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	ben.littlejohn@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	ben.littlejohn@ghd.com
Jenny Nicholls		
- *AU Certificate of Analysis - NATA (COA)	Email	jenny.nicholls@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jenny.nicholls@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jenny.nicholls@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jenny.nicholls@ghd.com
- Chain of Custody (CoC) (COC)	Email	jenny.nicholls@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	jenny.nicholls@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	jenny.nicholls@ghd.com
- EDI Format - XTab (XTAB)	Email	jenny.nicholls@ghd.com
LEMUEL CABAHUG		
- *AU Certificate of Analysis - NATA (COA)	Email	lemuel.cabahug@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	lemuel.cabahug@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	lemuel.cabahug@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	lemuel.cabahug@ghd.com
- Chain of Custody (CoC) (COC)	Email	lemuel.cabahug@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	lemuel.cabahug@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	lemuel.cabahug@ghd.com
- EDI Format - XTab (XTAB)	Email	lemuel.cabahug@ghd.com
- Electronic SRN for ESdat (ESRN_ESDAT)	Email	lemuel.cabahug@ghd.com

Vishal
06/05/2022
1536

Vishal Patel

From: Sarah Mathew
Sent: Friday, 6 May 2022 3:36 PM
To: rebatches.sydney; Andrew Makar; Jack Clifton
Cc: Wael Saleh
Subject: FW: [EXTERNAL] - Analysis Query

Hi team,

Can you please organise the below rebatch of ES2212961? Samples are in S846

Kind regards,

right solutions. right partner.

Sarah Mathew
Client Services Officer
Sydney, NSW

O: +61 2 8784 8555
D: +61 2 8784 8534
sarah.mathew@alsglobal.com
277-289 Woodpark Road
Smithfield NSW 2164 AUSTRALIA

alsglobal.com

for Easter holiday hours CLICK HERE

Environmental Division
Sydney
Work Order Reference
ES2215890

Telephone : +61-2-0784 8555

Appendix B

Equipment Calibration Certificates

Multi Parameter Water Meter

Instrument YSI Pro DSS
Serial No. 19D100844

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
	Recharge OK?	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH/ORP	✓	
	2. Turbidity	✓	
	3. Conductivity	✓	
	4. D.O	✓	
	5. Temp	✓	
	6. Depth	x	
Alarms	Beeper		
	Settings		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

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

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. EC		2.76mS		329027	2.75mS
2. Temp		22.2°C			22.2°C
3. pH 4		pH 4.00		330734	pH 4.05
4. pH 7		pH 7.00		330737	pH 7.00
6. DO		0.0ppm		10465	0.0ppm
7. ORP		231mV		333082/329762	231 mV
8.Turbidity		0NTU		N/A	0.0NTU
9.Turbidity		100NTU		332244	103NTU
10.Turbidity		1000NTU		17L801628	1010NTU

Calibrated by: Anoop Kumar

Calibration date: 29/11/2021

Next calibration due: 29/12/2021

PID Calibration Certificate

Instrument PhoCheck Tiger
Serial No. T-115202

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments			
Battery	Charge Condition	✓				
	Fuses	✓				
	Capacity	✓				
	Recharge OK?	✓				
Switch/keypad	Operation	✓				
Display	Intensity	✓				
	Operation (segments)	✓				
Grill Filter	Condition	✓				
	Seal	✓				
Pump	Operation	✓				
	Filter	✓				
	Flow	✓				
	Valves, Diaphragm	✓				
PCB	Condition	✓				
Connectors	Condition	✓				
Sensor	PID	✓	10.6 ev			
Alarms	Beeper	✓	**Low**	**High**	**TWA**	**STEL**
	Settings	✓	50ppm	100ppm		
Software	Version	✓				
Data logger	Operation	✓				
Download	Operation	✓				
Other tests:						

Certificate of Calibration

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

Diffusion mode Aspirated mode

Sensor	Serial no	Calibration gas and concentration	Certified	Gas bottle No		Instrument Reading
PID Lamp		100ppm Isobutylene	NIST	1006197		98.5

Calibrated by: **Asher May**

Calibration date: **25/11/2021**

Next calibration due: **24/05/2022**

Oil / Water Interface Meter

Instrument Interface Meter (30M)
Serial No. 348878

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	8.4V
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
	Checked for cuts	✓	
Instrument Test	At surface level	✓	

Certificate of Calibration

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

Calibrated by: Asher May

Calibration date: 26/11/2021

Next calibration due: 25/01/2022

Multi Parameter Water Meter

Instrument **YSI Quatro Pro Plus**
Serial No. **11C100756**

Air-Met Scientific Pty Ltd
1300 137 067

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

Certificate of Calibration

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

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. pH 7.00		pH 7.00		330737	pH 7.00
2. pH 4.00		pH 4.00		330734	pH 4.10
3. mV		231mV		333082/329762	229.0 mV
4. EC		2760 uS		329027	2760 uS
6. D.O		0 ppm		10640	0 ppm
7. Temp		20.8		MultiThem	20.8

Calibrated by: **Asher May**

Calibration date: **11-Feb-22**

Oil / Water Interface Meter

Instrument Geotech Interface Meter (30M)
Serial No. 5364

Air-Met Scientific Pty Ltd
1300 137 067

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

Certificate of Calibration

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

Calibrated by: Anoop Kumar

Calibration date: 4/04/2022

Next calibration due: 01-Oct-22

Multi Parameter Water Meter

Instrument **YSI Pro DSS**
Serial No. **21C100547**

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
	Recharge OK?	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	1. pH/ORP	✓	
	2. Turbidity	✓	
	3. Conductivity	✓	
	4. D.O	✓	
	5. Temp	✓	
	6. Depth	x	
Alarms	Beeper		
	Settings		
Software	Version		
Data logger	Operation		
Download	Operation		
Other tests:			

Certificate of Calibration

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

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
Temp					19.8
pH 7		pH 7.00		374422	7.01
pH 4		pH 4.00		363894	4.00
EC		Zero in Air			0.002mS/cm
EC		2.76mS		368682	2.76mS/cm
ORP		240mv @ 20°C		367761 / 367458	249.6
DO		Na^2SO^3 Zero		10959	0.1%
DO 100%		100%		Water Saturated Air	100%
Turbidity		0 NTU		Distilled water	0.5
Turbidity		100 NTU		358013	100

Calibrated by: **Anoop Kumar**

Calibration date: **4/04/2022**

PID Calibration Certificate

Instrument PhoCheck Tiger
Serial No. T-105520

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Charge Condition	✓	
	Fuses	✓	
	Capacity	✓	
	Recharge OK?	✓	
Switch/keypad	Operation	✓	
Display	Intensity	✓	
	Operation (segments)	✓	
Grill Filter	Condition	✓	
	Seal	✓	
Pump	Operation	✓	
	Filter	✓	
	Flow	✓	
	Valves, Diaphragm	✓	
PCB	Condition	✓	
Connectors	Condition	✓	
Sensor	PID	✓	10.6 ev
Alarms	Beeper	✓	**Low** / **High** / **TWA** / **STEL**
	Settings	✓	50ppm / 100ppm / /
Software	Version	✓	
Data logger	Operation	✓	
Download	Operation	✓	
Other tests:			

Certificate of Calibration

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

Diffusion mode Aspirated mode

Sensor	Serial no	Calibration gas and concentration	Certified	Gas bottle No		Instrument Reading
PID Lamp		**100ppm Isobutylene**	**NIST**	**1443932**		**101**

Calibrated by: **Anoop Kumar**

Calibration date: **4/04/2022**

Appendix C

ESdat DataTables

Appendix C Table 1 Groundwater Results
Pre -wet Season

Location Code							EMB 1		EMB 2	EMB 3	EMB 4	EMB 5	EMB 6	EMB 7	EMB 8	EMB 11	EMB 12	EMB 15	EMB 16
Date							16/12/2021		16/12/2021	16/12/2021	16/12/2021	16/12/2021	16/12/2021	16/12/2021	16/12/2021	16/12/2021	16/12/2021	16/12/2021	16/12/2021
Field ID							EMB 1	Duplicate	EMB 2	EMB 3	EMB 4	EMB 5	EMB 6	EMB 7	EMB 8	EMB 11	EMB 12	EMB 15	EMB 16
Lab Report Number							ES2146547	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547
		Unit	LOR	Darwin Harbour Water Quality Guidelines (Upper Estuary)	ANZG (2018) - MW - 95% species protection (updated 1/10/2021)	PFAS NEMP 2.0 2020 Interim marine - 95%-slightly-moderately disturbed system	PFAS NEMP 2.0 2020 Recreational Water												
Field Parameters																			
	Temperature	C°						34.8	34.8	34.7	34.9	34.2	36.7	34.1	32.1	34.1	35	34.9	37.3	35.4
	SWL	mBGL						2.07	2.07	2.07	2.26	1.548	1.445	2.61	1.59	2.53	2.034	1.747	1.315	2.255
	pH	Ph units		6.0 - 8.0				7.18	7.18	7.84	7.26	5.89	5.64	6.5	4.75	5.27	7.37	5.43	4.26	6.71
	Electrical conductivity	µS/cm						3027	3027	432.2	51202	268.2	669	10523	171.6	467.7	24850	706	1633	66241
	Turbidity	NTU						46884.11	46884.11	15.02	19.58	41.45	14.5	25.5	14.16	18.56	24.88	7.65	14.75	14.88
	Total Dissolved Solids	mg/L						1968	1968	284	33319	174	436	6878	112	304	16155	459	1063	43056
	Salinity	µS/cm						3.591	3.591	0.516	60.88	0.315	0.823	12.413	0.196	0.55	29.597	0.84	2.013	79.542
	Dissolved Oxygen % Saturation	% sat						54.4	54.4	59.3	56.6	57.9	52.7	23.3	47.9	65.2	47.6	59	54.9	59.3
	Dissolved Oxygen	(ppm/mg/L)						3.76	3.76	4.13	3.3	4.07	3.56	1.59	3.49	4.57	3.05	4.1	3.66	3.23
	Oxidation Reducation Potential	mV						135.7	135.7	73.7	-80.7	122.8	276.1	1.2	380.5	350.3	-77.8	200.1	387.1	29.9
Laboratory Parameters																			
Inorganics																			
	Total Suspended Solids	mg/L	5	10				-	-	-	-	-	-	-	-	-	-	-	-
Metals																			
	Arsenic (filtered)	mg/L	0.001					<0.001	<0.001	0.014	<0.010	0.002	0.001	0.002	<0.001	<0.001	0.074	0.001	0.002	0.175
	Cadmium (filtered)	mg/L	0.0001		0.0055			<0.0001	<0.0001	<0.0001	<0.0010	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0010
	Chromium (III+VI) (filtered)	mg/L	0.001		0.0044[#2]			<0.001	<0.001	<0.001	<0.010	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.010
	Copper (filtered)	mg/L	0.001		0.0013			<0.001	<0.001	0.003	<0.010	0.002	0.003	<0.001	0.003	0.001	<0.001	0.004	0.016	0.147
	Lead (filtered)	mg/L	0.001		0.0044			<0.001	<0.001	<0.001	<0.010	0.001	0.004	<0.001	0.004	0.008	<0.001	<0.001	0.007	<0.010
	Nickel (filtered)	mg/L	0.001		0.07			<0.001	<0.001	0.002	<0.010	0.002	0.002	0.004	0.001	0.002	<0.001	0.003	0.006	<0.010
	Zinc (filtered)	mg/L	0.005		0.008			0.015	0.017	0.129	<0.050	0.135	0.022	<0.005	0.058	0.040	<0.005	0.061	0.049	<0.050
	Mercury (filtered)	mg/L	0.0001		0.0004			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nutrients																			
	Ammonia as N	mg/L	0.01	0.02	0.91[#1]			0.44	0.37	0.08	1.78	0.04	0.02	3.45	1.22	0.03	1.44	0.04	0.01	0.24
	Nitrite (as N)	mg/L	0.01					0.04	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Nitrate (as N)	mg/L	0.01					0.07	0.06	0.10	0.02	0.07	1.72	0.05	1.33	2.78	0.02	0.09	0.56	0.02
	Nitrogen (Total Oxidised) (as N)	mg/L	0.01	0.02				0.11	0.11	0.10	0.02	0.07	1.72	0.05	1.33	2.78	0.02	0.09	0.56	0.02
	Kjeldahl Nitrogen Total	mg/L	0.1					1.2	1.3	0.6	4.4	0.9	1.2	3.4	2.2	1.4	1.8	0.7	0.5	<2.0
	Nitrogen (Total)	mg/L	0.1	0.3				1.3	1.4	0.7	4.4	1.0	2.9	3.4	3.5	4.2	1.8	0.8	1.1	<2.0
	Phosphorus (Total)	mg/L	0.01	0.03				0.04	0.06	0.04	0.10	<0.01	0.11	0.03	0.04	0.10	<0.05	<0.01	<0.01	0.40
Organic Indicators																			
TRH - NEPM 1999																			
	C6-C9 Fraction	µg/L	20					<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	C10-C14 Fraction	µg/L	50					190	220	160	170	290	80	<50	90	60	140	220	120	90
	C15-C28 Fraction	µg/L	100					<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
	C29-C36 Fraction	µg/L	50					<50	<50	<50	<50	<50	100	<50	140	360	<50	<50	<50	110
	C10-C36 (Sum of Total)	µg/L	50					190	220	160	170	290	180	<50	230	420	140	220	120	200
BTEXN																			
	Benzene	µg/L	1		700			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Toluene	µg/L	2		180			<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
	Ethylbenzene	µg/L	2		80			<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
	Xylene (m & p)	µg/L	2					<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
	Xylene (o)	µg/L	2					<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
	Naphthalene	µg/L	1		70			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	BTEX (Sum of Total) - Lab Calc	µg/L	1					<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Xylene Total	µg/L	2					<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
PAHs - standard 16																			
	Acenaphthylene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Acenaphthene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Fluorene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Phenanthrene	µg/L	1		2			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Anthracene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Fluoranthene	µg/L	1		1.4			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Pyrene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Benz(a)anthracene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Chrysene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Benzo[b+j]fluoranthene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Benzo(k)fluoranthene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Benzo(a)pyrene	µg/L	0.5		0.2			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Indeno(1,2,3-c,d)pyrene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Dibenz(a,h)anthracene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Benzo(g,h,i)perylene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	PAHs (Sum of total) - Lab calc	µg/L	0.5					<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

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Appendix C Table 1 Groundwater Results
Pre -wet Season

| | | |

Appendix C Table 1 Groundwater Results
Pre -wet Season

Location Code							EMB 1		EMB 2	EMB 3	EMB 4	EMB 5	EMB 6	EMB 7	EMB 8	EMB 11	EMB 12	EMB 15	EMB 16
Date							16/12/2021		16/12/2021	16/12/2021	16/12/2021	16/12/2021	16/12/2021	16/12/2021	16/12/2021	16/12/2021	16/12/2021	16/12/2021	16/12/2021
Field ID							EMB 1	Duplicate	EMB 2	EMB 3	EMB 4	EMB 5	EMB 6	EMB 7	EMB 8	EMB 11	EMB 12	EMB 15	EMB 16
Lab Report Number							ES2146547	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547
	Unit	LOR	Darwin Harbour Water Quality Guidelines (Upper Estuary)	ANZG (2018) - MW - 95% species protection (updated 1/10/2021)	PFAS NEMP 2.0 2020 Interim marine - 95%-slightly-moderately disturbed system	PFAS NEMP 2.0 2020 Recreational Water													
Field Parameters																			
Temperature	C°						34.8	34.8	34.7	34.9	34.2	36.7	34.1	32.1	34.1	35	34.9	37.3	35.4
SWL	mBGL						2.07	2.07	2.07	2.26	1.548	1.445	2.61	1.59	2.53	2.034	1.747	1.315	2.255
PFAS (Sum of Total)(WA DER List)	µg/L	0.01					9.58	8.00	9.31	6.63	121	100	4.59	184	3.31	0.48	2.88	0.14	<0.01
TRH - NEPM 2013																			
F1 (C6-C10 minus BTEX)	µg/L	20					<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
C6-C10 Fraction	µg/L	20					<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
F2 (>C10-C16 minus Naphthalene)	µg/L	100					190	220	150	170	290	<100	<100	<100	<100	140	220	120	<100
>C10-C16 Fraction	µg/L	100					190	220	150	170	290	<100	<100	<100	<100	140	220	120	<100
F3 (>C16-C34 Fraction)	µg/L	100					<100	<100	<100	<100	<100	100	<100	170	300	<100	<100	<100	120
F4 (>C34-C40 Fraction)	µg/L	100					<100	<100	<100	<100	<100	<100	<100	<100	160	<100	<100	<100	<100
>C10-C40 (Sum of Total)	µg/L	100					190	220	150	170	290	100	<100	170	460	140	220	120	120

Comments
#1 Ammonia as total ammonia, measured as [NH3-N] at pH 8.
#2 In absence of total Cr guideline, Cr (VI) guideline has been adopted.

Environmental Standards
Department of Agriculture and Water Resources, August 2018, ANZG (2018) - MW - 95% species protection (updated 1/10/2021)
HEPA, January 2020, PFAS NEMP 2.0 2020 Interim marine - 95%-slightly-moderately disturbed system
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Recreational Water

Appendix C Table 2 Groundwater Results
End of Wet Season

Vopak Terminal Darwin – Environmental Monitoring

Location Code							EMB 1		EMB 2	EMB 3	EMB 4	EMB 5	EMB 6	EMB 7	EMB 8	EMB 11	EMB 12	EMB 15	EMB 16
Date							12/04/2022		12/04/2022	12/04/2022	12/04/2022	5/05/2022	12/04/2022	12/04/2022	12/04/2022	12/04/2022	12/04/2022	12/04/2022	12/04/2022
Field ID							Duplicate	EMB 1	EMB 2	EMB 3	EMB 4	EMB5_5MAY22	EMB 6	EMB 7	EMB 8	EMB 11	EMB 12	EMB 15	EMB 16
Lab Report Number							ES2212961	ES2212961	ES2212961	ES2212961	ES2212961	ES2215415	ES2212961	ES2212961	ES2212961	ES2212961	ES2212961	ES2212961	ES2212961
			Darwin Harbour Water Quality Guidelines (Upper Estuary)	ANZG (2018) - MW - 95% species protection (updated 1/10/2021)	PFAS NEMP 2.0 2020 Interim marine - 95%- slightly-moderately disturbed system	PFAS NEMP 2.0 2020 Recreational Water													
Temperature	C°							35.7	35.3	35.7	36.9	38.7	35	35.2	33.6	34.9	35.6	36.8	35.1
SWL	mbgl							1.745	1.34	2.31	2.24	1.204	1.32	1.77	2.34	2.01	4.61	1.345	3.36
pH	Ph units		6.0 - 8.0					8.29	8.05	7.55	6.32	6.23	7.82	7	7.48	7.7	6.32	5.48	7.42
Electrical conductivity	µS/cm							3045	404.7	53841	253.2	1241	82.33	191.5	159.9	22268	624	1317	57715
Turbidity	NTU							90.75	15.77	41.67	207.84	242.9	36.22	41.1	34.06	53.14	29.64	43.6	42.61
Total Dissolved Solids	mg/L							1980	263	34993	165	81	5364	130	104	14481	4.07	856	37516
Dissolved Oxygen % Saturation	% sat							23.7	47.2	51	34.5	84.8	48.1	21.5	50.2	19.2	33.3	37.3	30.7
Dissolved Oxygen	(ppm/mg/L)							16.1	3.26	2.91	2.32	5.82	3.25	1.55	3.57	1.25	2.29	2.51	30.5
Oxidation Reducation Potential	mV							58.5	-8.1	-54	171.4	1526	-80.8	184.6	209.3	-58.6	197.8	258.8	1.72
Laboratory Parameters																			
Inorganics																			
Nutrients																			
Ammonia as N	mg/L	0.01	0.02	0.91[#1]			1.85	2.10	1.25	1.71	0.43	0.43	6.08	1.20	<0.01	3.58	2.47	0.06	0.45
Nitrite (as N)	mg/L	0.01					<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.09	<0.01
Nitrate (as N)	mg/L	0.01					<0.01	<0.01	0.01	<0.01	<0.01	1.27	<0.01	0.66	4.64	<0.01	0.04	0.76	<0.01
Nitrogen (Total Oxidised) (as N)	mg/L	0.01	0.02				<0.01	<0.01	0.01	<0.01	<0.01	1.27	<0.01	0.66	4.64	<0.01	0.04	0.85	<0.01
Kjeldahl Nitrogen Total	mg/L	0.1					2.7	2.7	2.0	1.9	1.1	1.4	7.4	2.1	1.5	5.2	3.4	1.3	1.0
Nitrogen (Total)	mg/L	0.1	0.3				2.7	2.7	2.0	1.9	1.1	2.7	7.4	2.8	6.1	5.2	3.4	2.2	1.0
Phosphorus (Total)	mg/L	0.01	0.03				0.09	0.04	0.14	<0.05	0.06	0.13	0.08	0.03	0.05	0.10	0.05	0.09	0.08
Metals																			
Arsenic (filtered)	mg/L	0.001					<0.001	<0.001	0.002	0.010	0.003	<0.001	<0.001	<0.001	<0.001	0.110	<0.001	0.002	0.205
Cadmium (filtered)	mg/L	0.0001		0.0055			<0.0001	<0.0001	<0.0001	<0.0010	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0010
Chromium (III+VI) (filtered)	mg/L	0.001		0.0044[#2]			<0.001	<0.001	<0.001	<0.010	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.010
Copper (filtered)	mg/L	0.001		0.0013			<0.001	<0.001	0.002	<0.010	<0.001	0.002	<0.001	0.003	<0.001	<0.001	0.006	0.017	0.074
Lead (filtered)	mg/L	0.001		0.0044			<0.001	<0.001	<0.001	<0.010	0.001	<0.001	<0.001	0.003	0.001	<0.001	<0.001	0.008	<0.010
Nickel (filtered)	mg/L	0.001		0.07			0.002	0.001	0.004	<0.010	0.003	<0.001	<0.001	0.002	0.002	<0.001	0.004	0.006	<0.010
Zinc (filtered)	mg/L	0.005		0.008			0.029	0.030	0.138	<0.050	0.018	0.012	0.005	0.020	0.012	<0.005	0.014	0.020	<0.050
Mercury (filtered)	mg/L	0.0001		0.0004			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
BTEXN																			
Benzene	µg/L	1		700			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/L	2		180			<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	µg/L	2		80			<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Xylene (m & p)	µg/L	2					<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Xylene (o)	µg/L	2					<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Naphthalene	µg/L	1		70			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
BTEX (Sum of Total) - Lab Calc	µg/L	1					<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Xylene Total	µg/L	2					<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
TRH - NEPM 2013																			
F1 (C6-C10 minus BTEX)	µg/L	20					<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
C6-C10 Fraction	µg/L	20					<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
F2 (>C10-C16 minus Naphthalene)	µg/L	100					<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C10-C16 Fraction	µg/L	100					<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
F3 (>C16-C34 Fraction)	µg/L	100					<100	110	<100	<100	<100	<100	210	<100	<100	170	<100	<100	<100
F4 (>C34-C40 Fraction)	µg/L	100					<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C10-C40 (Sum of Total)	µg/L	100					<100	110	<100	<100	<100	<100	210	<100	<100	170	<100	<100	<100
TRH - NEPM 1999																			
C6-C9 Fraction	µg/L	20					<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
C10-C14 Fraction	µg/L	50					60	60	<50	<50	60	<50	<50	70	70	70	70	<50	<50
C15-C28 Fraction	µg/L	100					<100	<100	<100	<100	<100	<100	170	<100	<100	110	<100	<100	<100
C29-C36 Fraction	µg/L	50					<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
C10-C36 (Sum of Total)	µg/L	50					60	60	<50	<50	60	<50	170	70	70	180	70	<50	<50
PAHs - standard 16																			
Acenaphthene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	µg/L	1		2			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	µg/L	1		1.4			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benz(a)anthracene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Chrysene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo[b+j]fluoranthene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	µg/L	0.5		0.2			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1,2,3-c,d)pyrene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a,h)anthracene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(g,h,i)perylene	µg/L	1					<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
PAHs (Sum of total) - Lab calc	µg/L	0.5					<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total 8 PAHs (as BaP TEQ)(zero LOR	µg/L	0.5					<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Appendix C Table 2 Groundwater Results
End of Wet

			Darwin Harbour Water Quality Guidelines (Upper Estuary)	ANZG (2018) - MW - 95% species protection (updated 1/10/2021)	PFAS NEMP 2.0 2020 Interim marine - 95%-slightly-moderately disturbed system	PFAS NEMP 2.0 2020 Recreational Water											
Location Code							EMB 1		EMB 2	EMB 3	EMB 4	EMB 5	EMB 6	EMB 7	EMB 8	EMB 11	EMB 12	EMB 15	EMB 16
Date							12/04/2022		12/04/2022	12/04/2022	12/04/2022	5/05/2022	12/04/2022	12/04/2022	12/04/2022	12/04/2022	12/04/2022	12/04/2022	12/04/2022
Field ID							Duplicate	EMB 1	EMB 2	EMB 3	EMB 4	EMB5_5MAY22	EMB 6	EMB 7	EMB 8	EMB 11	EMB 12	EMB 15	EMB 16
Lab Report Number							ES2212961	ES2212961	ES2212961	ES2212961	ES2212961	ES2215415	ES2212961	ES2212961	ES2212961	ES2212961	ES2212961	ES2212961	ES2212961
Temperature	C°							35.7	35.3	35.7	36.9	38.7	35	35.2	33.6	34.9	35.6	36.8	35.1
SWL	mbgl							1.745	1.34	2.31	2.24	1.204	1.32	1.77	2.34	2.01	4.61	1.345	3.36
PFAS - Perfluoroalkyl Carboxylic Acids																			
Perfluorobutanoic acid (PFBA)	µg/L	0.1					0.6	0.6	1.2	0.2	0.8	0.8	0.3	1.6	<0.1	<0.1	0.2	<0.1	<0.1
Perfluoropentanoic acid (PFPeA)	µg/L	0.02					3.06	3.10	4.43	1.33	4.35	3.72	0.65	5.55	0.25	0.20	0.74	0.11	<0.02
Perfluorohexanoic acid (PFHxA)	µg/L	0.02					3.16	3.17	4.26	1.32	6.52	2.87	1.26	14.0	0.16	0.14	0.63	0.08	<0.02
Perfluoroheptanoic acid (PFHpA)	µg/L	0.02					0.80	0.81	1.80	0.36	1.04	1.55	0.36	1.57	0.07	0.08	0.29	0.07	<0.02
Perfluorooctanoic acid (PFOA)	µg/L	0.01				220	10	0.20	0.19	0.25	0.15	1.52	0.91	0.18	3.68	0.03	0.02	0.06	0.01	<0.01
Perfluorononanoic acid (PFNA)	µg/L	0.02						0.04	0.04	0.03	0.02	0.09	0.18	0.54	0.06	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorodecanoic acid (PFDA)	µg/L	0.02						<0.02	<0.02	<0.02	<0.02	0.06	0.04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoroundecanoic acid (PFUnDA)	µg/L	0.02						<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorododecanoic acid (PFDoDA)	µg/L	0.02						<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.02						<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorotetradecanoic acid (PFTeDA)	µg/L	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
PFAS - Perfluoroalkyl Sulfonic Acids																			
Perfluorobutane sulfonic acid (PFBS)	µg/L	0.02						<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoropentane sulfonic acid (PFPeS	µg/L	0.02						<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorohexane sulfonic acid (PFHxS	µg/L	0.01					2	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.05	<0.01	<0.01	<0.01	<0.01
Perfluoroheptane sulfonic acid (PFHpS	µg/L	0.02						<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.01				0.13	2	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluorodecanesulfonic acid (PFDS)	µg/L	0.02						<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
PFAS - Perfluoroalkyl Sulfonamide																			
Perfluorooctane sulfonamide (FOSA)	µg/L	0.02						<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
N-Methyl perfluorooctane sulfonamide	µg/L	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
N-Ethyl perfluorooctane sulfonamide (	µg/L	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
N-Methyl perfluorooctane sulfonamido	µg/L	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
N-Ethyl perfluorooctane sulfonamidoet	µg/L	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
N-Methyl perfluorooctane sulfonamido	µg/L	0.02						<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
N-Ethyl perfluorooctane sulfonamidoa	µg/L	0.02						<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
PFAS - Fluorotelomer Sulfonic Acids																			
4:2 Fluorotelomer sulfonic acid (4:2 FT	µg/L	0.05						<0.05	<0.05	<0.05	<0.05	0.22	<0.05	<0.05	0.35	<0.05	<0.05	<0.05	<0.05	<0.05
6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.05						13.0	10.7	1.92	1.72	52.4	7.45	2.69	70.0	<0.05	<0.05	0.98	<0.05	<0.05
8:2 Fluorotelomer sulfonic acid (8:2 FT	µg/L	0.05						<0.05	<0.05	0.17	0.20	2.52	6.10	0.08	0.23	<0.05	<0.05	<0.05	<0.05	<0.05
10:2 Fluorotelomer sulfonic acid (10:2	µg/L	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
PFAS - Sums																			
PFAS (Sum of Total)	µg/L	0.01						20.9	18.6	14.1	5.30	69.5	23.7	6.06	97.0	0.56	0.44	2.90	0.27	<0.01
Sum of PFHxS and PFOS	µg/L	0.01					2	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	<0.01	<0.01	0.05	<0.01	<0.01	<0.01	<0.01
PFAS (Sum of Total)(WA DER List)	µg/L	0.01						20.8	18.6	14.0	5.28	69.2	23.4	5.52	96.6	0.56	0.44	2.90	0.27	<0.01

Comments

#1 Ammonia as total ammonia, measured as [NH3-N] at pH 8.

#2 In absence of total Cr guideline, Cr (VI) guideline has been adopted.

Environmental Standards

Department of Agriculture and Water Resources, August 2018, ANZG (2018) - MW - 95% species protection (updated 1/10/2021)

Department of Agriculture and Water Resources, 2018, updated September 2019, ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DGV

Department of Agriculture and Water Resources, 2018, updated September 2019, ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV-high

HEPA, January 2020, PFAS NEMP 2.0 2020 Interim marine - 95%-slightly-moderately disturbed system

HEPA, Jan 2020, PFAS NEMP 2.0 2020 Recreational Water

Appendix C Table 3
Stormwater Results Pre-wet Season

							Location Code	DIFT 1		DIFT 2	DAT 2	6 Series
							Date	16/12/2021		16/12/2021	16/12/2021	21/12/2021
							Field ID	DIFT 1	Duplicate	DIFT 2	DAT 2	6 Series
							Lab Report Number	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547
		Unit	LOR	Darwin Harbour Water Quality Guidelines (Upper Estuary)	ANZG (2018) - MW - 95% species protection (updated 1/10/2021)	PFAS NEMP 2.0 2020 Interim marine - 95%-slightly-moderately disturbed system	PFAS NEMP 2.0 2020 Recreational Water					
Field Parameters												
	Temperature	C°						34.2	34.2	31.6	31.4	N/A
	SWL	mBGL						N/A	N/A	N/A	N/A	N/A
	pH	Ph units		6.0 - 8.0				8.6	8.6	7.49	9.87	N/A
	Electrical conductivity	µS/cm						47.6	47.6	37.3	74.8	N/A
	Turbidity	NTU						40.42	40.42	8.95	7.65	N/A
	Total Dissolved Solids	mg/L						31	31	24	49	N/A
	Salinity	µS/cm						0.056	0.056	0.042	0.086	N/A
	Dissolved Oxygen % Saturation	% sat						96.5	96.5	91.6	109.7	N/A
	Dissolved Oxygen	(ppm/mg/L)						6.79	6.79	6.72	8.07	N/A
	Oxidation Reducation Potential	mV						173.7	173.7	183.4	45.3	N/A
Laboratory Parameters												
Inorganics												
	Total Suspended Solids	mg/L	5	10				<5	6	6	6	<5
Metals												
	Arsenic (filtered)	mg/L	0.001					<0.001	<0.001	<0.001	<0.001	0.002
	Cadmium (filtered)	mg/L	0.0001		0.0055			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Chromium (III+VI) (filtered)	mg/L	0.001		0.0044[#2]			<0.001	<0.001	<0.001	<0.001	<0.001
	Copper (filtered)	mg/L	0.001		0.0013			<0.001	<0.001	<0.001	<0.001	<0.001
	Lead (filtered)	mg/L	0.001		0.0044			<0.001	<0.001	<0.001	<0.001	<0.001
	Nickel (filtered)	mg/L	0.001		0.07			<0.001	<0.001	<0.001	<0.001	<0.001
	Zinc (filtered)	mg/L	0.005		0.008			0.010	0.047	0.035	<0.005	0.006
	Mercury (filtered)	mg/L	0.0001		0.0004			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nutrients												
	Ammonia as N	mg/L	0.01	0.02	0.91[#1]			0.03	0.05	0.06	0.05	0.36
	Nitrite (as N)	mg/L	0.01					<0.01	<0.01	<0.01	<0.01	<0.01
	Nitrate (as N)	mg/L	0.01					0.12	0.24	0.25	0.17	0.21
	Nitrogen (Total Oxidised) (as N)	mg/L	0.01	0.02				0.12	0.24	0.25	0.17	0.21
	Kjeldahl Nitrogen Total	mg/L	0.1					0.1	<0.1	0.1	<0.1	0.4
	Nitrogen (Total)	mg/L	0.1	0.3				0.2	0.2	0.4	0.2	0.6
	Phosphorus (Total)	mg/L	0.01	0.03				<0.01	<0.01	<0.01	0.26	<0.01
Organic Indicators												
	BOD	mg/L	2					<2	<2	<2	<2	<2
TRH - NEPM 1999												
	C6-C9 Fraction	µg/L	20					<20	<20	<20	<20	<20
	C10-C14 Fraction	µg/L	50					<50	<50	<50	<50	<50
	C15-C28 Fraction	µg/L	100					<100	<100	<100	<100	<100
	C29-C36 Fraction	µg/L	50					<50	<50	<50	<50	<50
	C10-C36 (Sum of Total)	µg/L	50					<50	<50	<50	<50	<50

Appendix C Table 3
Stormwater Results Pre-wet Season

							Location Code	DIFT 1		DIFT 2	DAT 2	6 Series
							Date	16/12/2021		16/12/2021	16/12/2021	21/12/2021
							Field ID	DIFT 1	Duplicate	DIFT 2	DAT 2	6 Series
							Lab Report Number	ES2146547	ES2146547	ES2146547	ES2146547	ES2146547
		Unit	LOR	Darwin Harbour Water Quality Guidelines (Upper Estuary)	ANZG (2018) - MW - 95% species protection (updated 1/10/2021)	PFAS NEMP 2.0 2020 Interim marine - 95%-slightly-moderately disturbed system	PFAS NEMP 2.0 2020 Recreational Water					
Field Parameters												
	Temperature	C°						34.2	34.2	31.6	31.4	N/A
	SWL	mBGL						N/A	N/A	N/A	N/A	N/A
BTEXN												
	Benzene	µg/L	1		700			<1	<1	<1	<1	<1
	Toluene	µg/L	2		180			<2	<2	<2	<2	<2
	Ethylbenzene	µg/L	2		80			<2	<2	<2	<2	<2
	Xylene (m & p)	µg/L	2					<2	<2	<2	<2	<2
	Xylene (o)	µg/L	2					<2	<2	<2	<2	<2
	Naphthalene	µg/L	1		70			<5	<5	<5	<5	<5
	BTEX (Sum of Total) - Lab Calc	µg/L	1					<1	<1	<1	<1	<1
	Xylene Total	µg/L	2					<2	<2	<2	<2	<2
TPH												
	Oil & Grease	µg/L	5,000					<5,000	<5,000	<5,000	<5,000	<5,000
PFAS - Perfluoroalkyl Sulfonic Acids												
	Perfluorobutane sulfonic acid (PFBS)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
	Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
	Perfluorohexane sulfonic acid (PFHxS)	µg/L	0.01				2	<0.01	<0.01	<0.01	<0.01	<0.01
	Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
	Perfluorooctane sulfonic acid (PFOS)	µg/L	0.01			0.13	2	0.03	<0.01	<0.01	<0.01	0.02
	Perfluorodecanesulfonic acid (PFDS)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
PFAS - Perfluoroalkyl Carboxylic Acids												
	Perfluorobutanoic acid (PFBA)	µg/L	0.1					<0.1	0.1	0.2	<0.1	<0.1
	Perfluoropentanoic acid (PFPeA)	µg/L	0.02					0.39	0.63	0.67	<0.02	<0.02
	Perfluorohexanoic acid (PFHxA)	µg/L	0.02					0.44	0.62	0.66	<0.02	<0.02
	Perfluoroheptanoic acid (PFHpA)	µg/L	0.02					0.16	0.34	0.36	<0.02	<0.02
	Perfluorooctanoic acid (PFOA)	µg/L	0.01			220	10	0.17	0.16	0.17	<0.01	<0.01
	Perfluorononanoic acid (PFNA)	µg/L	0.02					0.02	0.05	0.05	<0.02	<0.02
	Perfluorodecanoic acid (PFDA)	µg/L	0.02					0.02	0.07	0.07	<0.02	<0.02
	Perfluoroundecanoic acid (PFUnDA)	µg/L	0.02					<0.02	<0.02	0.02	<0.02	<0.02
	Perfluorododecanoic acid (PFDoDA)	µg/L	0.02					<0.02	0.03	0.03	<0.02	<0.02
	Perfluorotridecanoic acid (PFTrDA)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
	Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.05					<0.05	<0.05	<0.05	<0.05	<0.05

Appendix C Table 3
Stormwater Results Pre-wet Season

		Unit	LOR	Darwin Harbour Water Quality Guidelines (Upper Estuary)	ANZG (2018) - MW - 95% species protection (updated 1/10/2021)	PFAS NEMP 2.0 2020 Interim marine - 95%-slightly-moderately disturbed system	PFAS NEMP 2.0 2020 Recreational Water					
Location Code								DIFT 1		DIFT 2	DAT 2	6 Series
Date								16/12/2021		16/12/2021	16/12/2021	21/12/2021
Field ID								DIFT 1	Duplicate	DIFT 2	DAT 2	6 Series
Lab Report Number								ES2146547	ES2146547	ES2146547	ES2146547	ES2146547
Field Parameters												
	Temperature	C°						34.2	34.2	31.6	31.4	N/A
	SWL	mBGL						N/A	N/A	N/A	N/A	N/A
PFAS - Perfluoroalkyl Sulfonamide												
	Perfluorooctane sulfonamide (FOSA)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
	N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.05					<0.05	<0.05	<0.05	<0.05	<0.05
	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.05					<0.05	<0.05	<0.05	<0.05	<0.05
	N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	µg/L	0.05					<0.05	<0.05	<0.05	<0.05	<0.05
	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.05					<0.05	<0.05	<0.05	<0.05	<0.05
	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
PFAS - Fluorotelomer Sulfonic Acids												
	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.05					<0.05	<0.05	<0.05	<0.05	<0.05
	6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.05					2.84	3.23	3.24	<0.05	<0.05
	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/L	0.05					1.33	2.42	2.54	<0.05	<0.05
	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.05					0.10	0.20	0.22	<0.05	<0.05
PFAS - Sums												
	PFAS (Sum of Total)	µg/L	0.01					5.50	7.85	8.23	<0.01	0.02
	Sum of PFHxS and PFOS	µg/L	0.01				2	0.03	<0.01	<0.01	<0.01	0.02
	PFAS (Sum of Total)(WA DER List)	µg/L	0.01					5.36	7.50	7.84	<0.01	0.02
TRH - NEPM 2013												
	F1 (C6-C10 minus BTEX)	µg/L	20					<20	<20	<20	<20	<20
	C6-C10 Fraction	µg/L	20					<20	<20	<20	<20	<20
	F2 (>C10-C16 minus Naphthalene)	µg/L	100					<100	<100	<100	<100	<100
	>C10-C16 Fraction	µg/L	100					<100	<100	<100	<100	<100
	F3 (>C16-C34 Fraction)	µg/L	100					<100	<100	<100	<100	<100
	F4 (>C34-C40 Fraction)	µg/L	100					<100	<100	<100	<100	<100
	>C10-C40 (Sum of Total)	µg/L	100					<100	<100	<100	<100	<100

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Location Code						DIFT 1		DIFT 2	DAT 2	6 Series
Date						16/12/2021		16/12/2021	16/12/2021	21/12/2021
Field ID						DIFT 1	Duplicate	DIFT 2	DAT 2	6 Series
Lab Report Number						ES2146547	ES2146547	ES2146547	ES2146547	ES2146547
	Unit	LOR	Darwin Harbour Water Quality Guidelines (Upper Estuary)	ANZG (2018) - MW - 95% species protection (updated 1/10/2021)	PFAS NEMP 2.0 2020 Interim marine - 95%-slightly-moderately disturbed system	PFAS NEMP 2.0 2020 Recreational Water					
Field Parameters											
Temperature	C°						34.2	34.2	31.6	31.4	N/A
SWL	mBGL						N/A	N/A	N/A	N/A	N/A

Comments
#1 Ammonia as total ammonia, measured as [NH3-N] at pH 8.
#2 In absence of total Cr guideline, Cr (VI) guideline has been adopted.

Environmental Standards
Department of Agriculture and Water Resources, August 2018, ANZG (2018) - MW - 95% species protection (updated 1/10/2021)
HEPA, January 2020, PFAS NEMP 2.0 2020 Interim marine - 95%-slightly-moderately disturbed system
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Recreational Water

Appendix C Table 4
Stormwater Mid-wet Season

Location Code						DIFT 1	DIFT 2		DAT 2	6 Series
Date						14/03/2022	21/02/2022		21/02/2022	14/03/2022
Field ID						DIFT 1	DIFT 2	Duplicate	DAT 2	6 series
Depth										
Lab Report Number						ES2208856	ES2205893	ES2205893	ES2205893	ES2208856
	Unit	EQL	Darwin Harbour Water Quality Guidelines (Upper Estuary)	ANZG (2018) - MW - 95% species protection (updated 1/10/2021)	PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems	PFAS NEMP 2.0 2020 Recreational Water					
Field Parameters											
Temperature	C						32	30.5		30.0	29.90
pH	Ph units		6.0 - 8.0				6.58	6.66		7.83	8.49
Electrical conductivity	µS/cm						732.0	485.7		54.4	
Turbidity	NTU						-	-	-	-	-
Total Dissolved Solids	mg/L						0.42	0.29		0.32	0.39
Salinity	µS/cm						-	-		-	-
Dissolved Oxygen % Saturation	% sat						65.1	39.2		51.2	55.10
Dissolved Oxygen	(ppm/mg/L)						4.73	2.93		3.98	4.16
Oxidation Reducation Potential	mV						138.8	138.0		108.1	120.00
Labratory Parameters											
Inorganics											
Total Suspended Solids	mg/L	5	10.00				<5	8	8	5	<5
Nutrients											
Ammonia as N	mg/L	0.01	0.02	0.91[#1]			0.27	0.13	0.08	0.05	0.14
Nitrate (as N)	mg/L	0.01					0.12	0.57	0.56	0.23	0.22
Nitrite (as N)	mg/L	0.01					<0.01	<0.01	<0.01	<0.01	<0.01
Nitrogen (Total Oxidised) (as N)	mg/L	0.01	0.02				0.12	0.57	0.56	0.23	0.22
Nitrogen (Total)	mg/L	0.1	0.3				0.5	1.1	1.2	0.3	0.4
Kjeldahl Nitrogen Total	mg/L	0.1					0.4	0.5	0.6	0.1	0.2
Phosphorus (Total)	mg/L	0.01	0.03				<0.01	0.01	0.02	0.26	<0.01
Organic Indicators											
BOD	mg/L	2					<2	2	3	<2	<2
Metals											
Arsenic (filtered)	mg/L	0.001					0.002	<0.001	0.002	<0.001	0.001
Cadmium (filtered)	mg/L	0.0001		0.0055			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium (III+VI) (filtered)	mg/L	0.001		0.0044[#2]			<0.001	<0.001	<0.001	<0.001	0.001
Copper (filtered)	mg/L	0.001		0.0013			<0.001	<0.001	<0.001	<0.001	<0.001
Lead (filtered)	mg/L	0.001		0.0044			<0.001	<0.001	<0.001	<0.001	<0.001
Mercury (filtered)	mg/L	0.0001		0.0004			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel (filtered)	mg/L	0.001		0.07			<0.001	0.001	0.002	<0.001	<0.001
Zinc (filtered)	mg/L	0.005		0.008			0.045	0.054	0.056	<0.005	<0.005
BTEXN											
Benzene	µg/L	1		700			<1	50	50	<1	<1
Toluene	µg/L	2		180			<2	331	321	<2	<2
Ethylbenzene	µg/L	2		80			<2	8	8	<2	<2
Xylene (o)	µg/L	2					<2	65	65	<2	<2
Xylene (m & p)	µg/L	2					<2	50	49	<2	<2
Xylene Total	µg/L	2					<2	115	114	<2	<2
BTEX (Sum of Total) - Lab Calc	µg/L	1					<1	504	493	<1	<1
Naphthalene	µg/L	5		70			<5	7	7	<5	<5
TRH - NEPM 2013											
F1 (C6-C10 minus BTEX)	µg/L	20					<20	210	230	<20	<20
C6-C10 Fraction	µg/L	20					<20	710	720	<20	<20
F2 (>C10-C16 minus Naphthalene)	µg/L	100					<100	<100	110	<100	<100
>C10-C16 Fraction	µg/L	100					<100	100	120	<100	<100
F3 (>C16-C34 Fraction)	µg/L	100					<100	<100	<100	<100	<100
F4 (>C34-C40 Fraction)	µg/L	100					<100	<100	<100	<100	<100
>C10-C40 (Sum of Total)	µg/L	100					<100	100	120	<100	<100
TRH - NEPM 1999											
C6-C9 Fraction	µg/L	20					<20	670	680	<20	<20
C10-C14 Fraction	µg/L	50					<50	110	130	<50	<50
C15-C28 Fraction	µg/L	100					<100	<100	<100	<100	<100
C29-C36 Fraction	µg/L	50					<50	<50	<50	<50	<50
C10-C36 (Sum of Total)	µg/L	50					<50	110	130	<50	<50
TPH											
Oil & Grease	µg/L	5,000					<5,000	7,000	<5,000	<5,000	<5,000
PFAS - Perfluoroalkyl Carboxylic Acids											
Perfluorobutanoic acid (PFBA)	µg/L	0.1					0.2	1.2	1.2	<0.1	<0.1
Perfluoropentanoic acid (PFPeA)	µg/L	0.02					1.05	5.40	5.40	<0.02	<0.02
Perfluorohexanoic acid (PFHxA)	µg/L	0.02					1.41	7.10	7.41	<0.02	<0.02
Perfluoroheptanoic acid (PFHpA)	µg/L	0.02					0.42	2.48	2.37	<0.02	<0.02
Perfluorooctanoic acid (PFOA)	µg/L	0.01			220	10	0.64	2.68	2.73	<0.01	<0.01
Perfluorononanoic acid (PFNA)	µg/L	0.02					0.04	0.18	0.15	<0.02	<0.02
Perfluorodecanoic acid (PFDA)	µg/L	0.02					0.02	0.08	0.07	<0.02	<0.02
Perfluoroundecanoic acid (PFUnDA)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorododecanoic acid (PFDoDA)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.05					<0.05	<0.05	<0.05	<0.05	<0.05

Appendix C Table 4
Stormwater Mid-wet Season

Location Code							DIFT 1	DIFT 2		DAT 2	6 Series
Date							14/03/2022	21/02/2022		21/02/2022	14/03/2022
Field ID							DIFT 1	DIFT 2	Duplicate	DAT 2	6 series
Depth											
Lab Report Number							ES2208856	ES2205893	ES2205893	ES2205893	ES2208856
	Unit	EQL	Darwin Harbour Water Quality Guidelines (Upper Estuary)	ANZG (2018) - MW - 95% species protection (updated 1/10/2021)	PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems	PFAS NEMP 2.0 2020 Recreational Water					
Field Parameters											
Temperature	C						32	30.5		30.0	29.90
PFAS - Perfluoroalkyl Sulfonic Acids											
Perfluorobutane sulfonic acid (PFBS)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorohexane sulfonic acid (PFHxS)	µg/L	0.01				2	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.01			0.13	2	0.01	<0.01	<0.01	<0.01	<0.01
Perfluorodecanesulfonic acid (PFDS)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
PFAS - Perfluoroalkyl Sulfonamide											
Perfluorooctane sulfonamide (FOSA)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.05					<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.05					<0.05	<0.05	<0.05	<0.05	<0.05
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	µg/L	0.05					<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.05					<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
PFAS - Fluorotelomer Sulfonic Acids											
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.05					<0.05	0.06	0.06	<0.05	<0.05
6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.05					12.8	49.2	47.8	<0.05	<0.05
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/L	0.05					2.41	8.90	8.71	<0.05	<0.05
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.05					0.06	0.12	0.12	<0.05	<0.05
PFAS - Sums											
Sum of PFHxS and PFOS	µg/L	0.01				2	0.01	<0.01	<0.01	<0.01	<0.01
PFAS (Sum of Total)	µg/L	0.01					19.1	77.4	76.0	<0.01	<0.01
PFAS (Sum of Total)(WA DER List)	µg/L	0.01					18.9	77.0	75.6	<0.01	<0.01

Comments
#1 Ammonia as total ammonia, measured as [NH3-N] at pH 8.
#2 In absence of total Cr guideline, Cr (VI) guideline has been adopted.

Environmental Standards
Department of Agriculture and Water Resources, August 2018, ANZG (2018) - MW - 95% species protection (updated 1/10/2021)
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Freshwater - 95% - slightly to moderately disturbed systems
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Recreational Water

Appendix C Table 5
Stormwater Results End of Wet

						Location Code	DIFT 1	DIFT 2	DIFT 2 DUPE	DAT 2	6 Series
						Date	5/05/2022	5/05/2022	5/05/2022	5/05/2022	5/05/2022
						Field ID	DIFT1_5MAY22	DIFT2_5MAY22	DUP1_5MAY22	DAT2_5MAY22	6-Series_5MAY22
						Lab Report Number	ES2215415	ES2215415	ES2215415	ES2215415	ES2215415
	Unit	EQL	Darwin Harbour Water Quality Guidelines (Upper Estuary)	ANZG (2018) - MW - 95% species protection (updated 1/10/2021)	PFAS NEMP 2.0 2020 Interim marine - 95%- slightly-moderately disturbed system	PFAS NEMP 2.0 2020 Recreational Water					
Field Parameters											
Temperature	C°						31.7	29.4	-	29.6	28.6
pH	pH units		6.0 - 8.0				7.44	7.4	-	7.65	8.9
Electrical conductivity	µS/cm						114	1383	-	49.6	63.7
Turbidity	NTU						3.7	0.75	-	6.72	3.13
Total Dissolved Solids	mg/L						0.074	-	-	0.032	0.041
Dissolved Oxygen % Saturation	% sat						74.6	47.7	-	101.9	97.1
Dissolved Oxygen	(ppm/mg/L)						5.44	3.63	-	7.76	7.51
Oxidation Reducation Potential	mV						-	181.3	-	147.8	138
Laboratory Parameters											
Inorganics											
Total Suspended Solids	mg/L	5	10.00				23	13	12	28	<5
Nutrients											
Ammonia as N	mg/L	0.01	0.02	0.91[#1]			0.03	<0.01	0.02	0.04	0.16
Nitrate (as N)	mg/L	0.01					0.14	0.05	0.04	0.35	0.47
Nitrite (as N)	mg/L	0.01					<0.01	<0.01	<0.01	<0.01	<0.01
Nitrogen (Total Oxidised) (as N)	mg/L	0.01	0.02				0.14	0.05	0.04	0.35	0.47
Nitrogen (Total)	mg/L	0.1	0.3				0.4	0.6	0.5	1.0	0.8
Kjeldahl Nitrogen Total	mg/L	0.1					0.3	0.5	0.5	0.6	0.3
Phosphorus (Total)	mg/L	0.01	0.03				0.02	0.03	0.03	0.41	0.01
Organic Indicators											
BOD	mg/L	2					2	2	<2	2	<2
Metals											
Arsenic (filtered)	mg/L	0.001					<0.001	<0.001	<0.001	<0.001	0.001
Cadmium (filtered)	mg/L	0.0001		0.0055			<0.0001	0.0002	0.0003	0.0002	0.0002
Chromium (III+VI) (filtered)	mg/L	0.001		0.0044[#2]			<0.001	<0.001	<0.001	<0.001	<0.001
Copper (filtered)	mg/L	0.001		0.0013			0.002	<0.001	0.001	0.012	0.006
Lead (filtered)	mg/L	0.001		0.0044			<0.001	<0.001	<0.001	<0.001	<0.001
Mercury (filtered)	mg/L	0.0001		0.0004			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel (filtered)	mg/L	0.001		0.07			0.001	0.001	0.001	0.001	0.002
Zinc (filtered)	mg/L	0.005		0.008			0.047	0.083	0.082	0.053	0.073
BTEXN											
Benzene	µg/L	1		700			<1	<1	<1	<1	<1
Toluene	µg/L	2		180			<2	<2	<2	<2	<2
Ethylbenzene	µg/L	2		80			<2	<2	<2	<2	<2
Xylene (o)	µg/L	2					<2	<2	<2	<2	<2
Xylene (m & p)	µg/L	2					<2	<2	<2	<2	<2
Xylene Total	µg/L	2					<2	<2	<2	<2	<2
BTEX (Sum of Total) - Lab Calc	µg/L	1					<1	<1	<1	<1	<1
Naphthalene	µg/L	1		70			<5	<5	<5	<5	<5
TRH - NEPM 2013											
F1 (C6-C10 minus BTEX)	µg/L	20					<20	<20	<20	<20	<20
C6-C10 Fraction	µg/L	20					<20	<20	<20	<20	<20
F2 (>C10-C16 minus Naphthalene)	µg/L	100					<100	<100	<100	<100	<100
>C10-C16 Fraction	µg/L	100					<100	<100	<100	<100	<100
F3 (>C16-C34 Fraction)	µg/L	100					<100	<100	<100	<100	<100
F4 (>C34-C40 Fraction)	µg/L	100					<100	<100	<100	<100	<100
>C10-C40 (Sum of Total)	µg/L	100					<100	<100	<100	<100	<100
TRH - NEPM 1999											
C6-C9 Fraction	µg/L	20					<20	<20	<20	<20	<20
C10-C14 Fraction	µg/L	50					<50	<50	<50	<50	<50
C15-C28 Fraction	µg/L	100					<100	<100	<100	<100	<100
C29-C36 Fraction	µg/L	50					<50	<50	<50	<50	<50
C10-C36 (Sum of Total)	µg/L	50					<50	<50	<50	<50	<50
TPH											
Oil & Grease	µg/L	5,000					<5,000	<5,000	<5,000	<5,000	<5,000
PFAS - Perfluoroalkyl Carboxylic Acids											
Perfluorobutanoic acid (PFBA)	µg/L	0.1					0.3	0.3	0.3	<0.1	<0.1
Perfluoropentanoic acid (PFPeA)	µg/L	0.02					1.25	1.35	1.24	0.04	<0.02
Perfluorohexanoic acid (PFHxA)	µg/L	0.02					1.28	1.44	1.36	0.03	<0.02
Perfluoroheptanoic acid (PFHpA)	µg/L	0.02					0.44	0.49	0.46	0.02	<0.02
Perfluorooctanoic acid (PFOA)	µg/L	0.01			220	10	0.39	0.46	0.44	0.01	<0.01
Perfluorononanoic acid (PFNA)	µg/L	0.02					0.04	0.05	0.04	<0.02	<0.02
Perfluorodecanoic acid (PFDA)	µg/L	0.02					0.02	0.03	0.03	<0.02	<0.02
Perfluoroundecanoic acid (PFUnDA)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorododecanoic acid (PFDoDA)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.05					<0.05	<0.05	<0.05	<0.05	<0.05
PFAS - Perfluoroalkyl Sulfonic Acids											
Perfluorobutane sulfonic acid (PFBS)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorohexane sulfonic acid (PFHxS)	µg/L	0.01				2	<0.01	<0.01	<0.01	<0.01	<0.01
Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.01			0.13	2	<0.01	0.01	0.02	<0.01	<0.01
Perfluorodecanesulfonic acid (PFDS)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02

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Appendix C Table 5
Stormwater Results End of Wet

						Location Code	DIFT 1	DIFT 2	DIFT 2 DUPE	DAT 2	6 Series
						Date	5/05/2022	5/05/2022	5/05/2022	5/05/2022	5/05/2022
						Field ID	DIFT1_5MAY22	DIFT2_5MAY22	DUP1_5MAY22	DAT2_5MAY22	6-Series_5MAY22
						Lab Report Number	ES2215415	ES2215415	ES2215415	ES2215415	ES2215415
	Unit	EQL	Darwin Harbour Water Quality Guidelines (Upper Estuary)	ANZG (2018) - MW - 95% species protection (updated 1/10/2021)	PFAS NEMP 2.0 2020 Interim marine - 95%-slightly-moderately disturbed system	PFAS NEMP 2.0 2020 Recreational Water					
Field Parameters											
Temperature	C°						31.7	29.4	-	29.6	28.6
PFAS - Perfluoroalkyl Sulfonamide											
Perfluorooctane sulfonamide (FOSA)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.05					<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.05					<0.05	<0.05	<0.05	<0.05	<0.05
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	µg/L	0.05					<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.05					<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	µg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02
PFAS - Fluorotelomer Sulfonic Acids											
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.05					<0.05	<0.05	<0.05	<0.05	<0.05
6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.05					7.34	7.78	7.85	0.10	<0.05
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/L	0.05					2.33	2.58	2.50	0.11	<0.05
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.05					0.09	0.08	0.07	<0.05	<0.05
PFAS - Sums											
Sum of PFHxS and PFOS	µg/L	0.01				2	<0.01	0.01	0.02	<0.01	<0.01
PFAS (Sum of Total)	µg/L	0.01					13.5	14.6	14.3	0.31	<0.01
PFAS (Sum of Total)(WA DER List)	µg/L	0.01					13.3	14.4	14.2	0.31	<0.01

Comments
#1 Ammonia as total ammonia, measured as [NH3-N] at pH 8.
#2 In absence of total Cr guideline, Cr (VI) guideline has been adopted.

Environmental Standards
Department of Agriculture and Water Resources, August 2018, ANZG (2018) - MW - 95% species protection (updated 1/10/2021)
HEPA, January 2020, PFAS NEMP 2.0 2020 Interim marine - 95%-slightly-moderately disturbed system
HEPA, Jan 2020, PFAS NEMP 2.0 2020 Recreational Water

Appendix C Table 6
Sediment Results - End of Wet

	Unit	LOR	ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DGV	ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV-high	Location Code: Soil 1	Soil 2	Soil 3	Soil 4	Soil 5	Soil 6	Soil 9	Soil 10	Soil 11	Soil 12
					Date: 12/04/2022	12/04/2022	12/04/2022	12/04/2022	12/04/2022	12/04/2022	12/04/2022	12/04/2022	12/04/2022	12/04/2022
					Field ID: Soil_1	Soil_2	Soil_3	Soil_4	Soil_5	Soil_6	Soil_9	Soil_10	Soil_11	Soil_12
					Lab Report Number: ES2212961 & ES2215890	ES2212961 & ES2215890	ES2212961 & ES2215890	ES2212961 & ES2215890	ES2212961 & ES2215890	ES2212961 & ES2215890	ES2212961 & ES2215890	ES2212961 & ES2215890	ES2212961 & ES2215890	ES2212961 & ES2215890
Inorganics														
Moisture (%)	%	0.1			17.0	27.0	13.0	18.3	32.0	27.9	26.2	24.5	19.6	22.5
Metals														
Arsenic	mg/kg	1	20	70	14.9	41.7	74.9	43.5	35.1	52.7	28.6	44.2	74.3	50.7
Cadmium	mg/kg	0.1	1.5	10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium (III+VI)	mg/kg	1	80	370	16.8	19.9	24.5	80.6	54.2	64.1	23.4	24.1	48.8	17.3
Copper	mg/kg	1	65	270	15.8	14.1	10.4	9.4	24.7	25.9	23.8	18.3	13.1	12.9
Lead	mg/kg	1	50	220	28.2	25.9	14.3	18.1	23.4	28.4	19.6	18.1	19.1	14.0
Mercury	mg/kg	0.01	0.15	1	0.01	0.01	<0.01	<0.01	0.04	0.02	0.01	<0.01	<0.01	<0.01
Nickel	mg/kg	1	21	52	4.7	3.4	2.8	3.6	11.2	12.0	8.5	5.6	3.8	5.7
Zinc	mg/kg	1	200	410	38.7	27.1	10.8	25.2	204	81.2	54.1	45.3	13.5	29.4
BTEXN														
Benzene	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Xylene (o)	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Xylene (m & p)	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Xylene Total	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BTEX (Sum of Total) - Lab Calc	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	mg/kg	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
TRH - NEPM 2013														
F1 (C6-C10 minus BTEX)	mg/kg	3			<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
C6-C10 Fraction	mg/kg	3			<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
>C10-C16 Fraction	mg/kg	3			<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
F3 (>C16-C34 Fraction)	mg/kg	3			20	10	15	6	62	25	26	27	<3	8
F4 (>C34-C40 Fraction)	mg/kg	5			22	8	26	<5	52	18	17	38	<5	6
>C10-C40 (Sum of Total)	mg/kg	3			42	18	41	6	114	43	43	65	<3	14
TRH - NEPM 1999														
C6-C9 Fraction	mg/kg	3			<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
C10-C14 Fraction	mg/kg	3			<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
C15-C28 Fraction	mg/kg	3			11	6	7	4	34	14	15	13	<3	5
C29-C36 Fraction	mg/kg	5			16	7	16	<5	47	18	17	27	<5	5
C10-C36 (Sum of Total)	mg/kg	3			27	13	23	4	81	32	32	40	<3	10

Comments

#1 Ammonia as total ammonia, measured as [NH3-N] at pH 8.

#2 In absence of total Cr guideline, Cr (VI) guideline has been adopted.

Environmental Standards

Department of Agriculture and Water Resources, August 2018, ANZG (2018) - MW - 95% species protection (updated 1/10/2021)

Department of Agriculture and Water Resources, 2018, updated September 2019, ANZG 2018 (updated 11/09/2019) Sediment toxicant values – DGV

Department of Agriculture and Water Resources, 2018, updated September 2019, ANZG 2018 (updated 11/09/2019) Sediment toxicant values – GV-high

HEPA, January 2020, PFAS NEMP 2.0 2020 Interim marine - 95%-slightly-moderately disturbed system

HEPA, Jan 2020, PFAS NEMP 2.0 2020 Recreational Water

Appendix C Table 7
RPD Table

		Date	16/12/2021				16/12/2021				21/02/2022				12/04/2022				5/05/2022		
		Field ID	DIFT 1	Duplicate	RPD	RPD	EMB 1	Duplicate	RPD	RPD	DIFT 2	Duplicate	RPD	RPD	EMB 1	Duplicate	RPD	RPD	DIFT2_5MAY22	DUP1_5MAY22	RPD
		Sample Type	Normal	Field_D			Normal	Field_D			Normal	Field_D			Normal	Field_D			Normal	Field_D	
		Lab Report Number	ES2146547	ES2146547			ES2146547	ES2146547			ES2205893	ES2205893			ES2212961	ES2212961			ES2215415	ES2215415	
		Matrix Type	Water	Water			Water	Water			Water	Water			Water	Water			Water	Water	
	Unit	EQL																			
Inorganics																					
Total Suspended Solids	mg/L	5	<5	6		18	-	-	-	8	8	0	-	-	-	13	12	8
Nutrients																					
Ammonia as N	mg/L	0.01	0.03	0.05	-36	**50**	0.44	0.37	17	0.13	0.08	**48**	2.10	1.85	13	<0.01	0.02	0
Nitrate (as N)	mg/L	0.01	0.12	0.24	-50	**67**	0.07	0.06	15	0.57	0.56	2	<0.01	<0.01	0	0.05	0.04	22
Nitrite (as N)	mg/L	0.01	<0.01	<0.01		0	0.04	0.05	22	<0.01	<0.01	0	<0.01	<0.01	0	<0.01	<0.01	0
Nitrogen (Total Oxidised) (as N)	mg/L	0.01	0.12	0.24	-50	**67**	0.11	0.11	0	0.57	0.56	2	<0.01	<0.01	0	0.05	0.04	22
Nitrogen (Total)	mg/L	0.1	0.2	0.2	0	0	1.3	1.4	7	1.1	1.2	9	2.7	2.7	0	0.6	0.5	18
Kjeldahl Nitrogen Total	mg/L	0.1	0.1	<0.1		0	1.2	1.3	8	0.5	0.6	18	2.7	2.7	0	0.5	0.5	0
Phosphorus (Total)	mg/L	0.01	<0.01	<0.01		0	0.04	0.06	**40**	0.01	0.02	**67**	0.04	0.09	**77**	0.03	0.03	0
Organic Indicators																					
BOD	mg/L	2	<2	<2		0	-	-	-	2	3	**40**	-	-	-	2	<2	0
Metals																					
Arsenic (filtered)	mg/L	0.001	<0.001	<0.001		0	<0.001	<0.001	0	<0.001	0.002	0	<0.001	<0.001	0	<0.001	<0.001	0
Cadmium (filtered)	mg/L	0.0001	<0.0001	<0.0001		0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	0.0002	0.0003	**40**
Chromium (III+VI) (filtered)	mg/L	0.001	<0.001	<0.001		0	<0.001	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0
Copper (filtered)	mg/L	0.001	<0.001	<0.001		0	<0.001	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0	<0.001	0.001	0
Lead (filtered)	mg/L	0.001	<0.001	<0.001		0	<0.001	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0	<0.001	<0.001	0
Mercury (filtered)	mg/L	0.0001	<0.0001	<0.0001		0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0	<0.0001	<0.0001	0
Nickel (filtered)	mg/L	0.001	<0.001	<0.001		0	<0.001	<0.001	0	0.001	0.002	**67**	0.001	0.002	**67**	0.001	0.001	0
Zinc (filtered)	mg/L	0.005	0.010	0.047	-110	**130**	0.015	0.017	13	0.054	0.056	4	0.030	0.029	3	0.083	0.082	1
BTEXN																					
Benzene	µg/L	1	<1	<1		0	<1	<1	0	50	50	0	<1	<1	0	<1	<1	0
Toluene	µg/L	2	<2	<2		0	<2	<2	0	331	321	3	<2	<2	0	<2	<2	0
Ethylbenzene	µg/L	2	<2	<2		0	<2	<2	0	8	8	0	<2	<2	0	<2	<2	0
Xylene (o)	µg/L	2	<2	<2		0	<2	<2	0	65	65	0	<2	<2	0	<2	<2	0
Xylene (m & p)	µg/L	2	<2	<2		0	<2	<2	0	50	49	2	<2	<2	0	<2	<2	0
Xylene Total	µg/L	2	<2	<2		0	<2	<2	0	115	114	1	<2	<2	0	<2	<2	0
BTEX (Sum of Total) - Lab Calc	µg/L	1	<1	<1		0	<1	<1	0	504	493	2	<1	<1	0	<1	<1	0
Naphthalene	µg/L	1	<5	<5		0	<1.0	<1.0	0	7	7	0	<1.0	<1.0	0	<5	<5	0
TRH - NEPM 2013																					
F1 (C6-C10 minus BTEX)	µg/L	20	<20	<20		0	<20	<20	0	210	230	9	<20	<20	0	<20	<20	0
C6-C10 Fraction	µg/L	20	<20	<20		0	<20	<20	0	710	720	1	<20	<20	0	<20	<20	0
F2 (>C10-C16 minus Naphthalene)	µg/L	100	<100	<100		0	190	220	15	<100	110	0	<100	<100	0	<100	<100	0
>C10-C16 Fraction	µg/L	100	<100	<100		0	190	220	15	100	120	18	<100	<100	0	<100	<100	0
F3 (>C16-C34 Fraction)	µg/L	100	<100	<100		0	<100	<100	0	<100	<100	0	110	<100	0	<100	<100	0
F4 (>C34-C40 Fraction)	µg/L	100	<100	<100		0	<100	<100	0	<100	<100	0	<100	<100	0	<100	<100	0
>C10-C40 (Sum of Total)	µg/L	100	<100	<100		0	190	220	15	100	120	18	110	<100	0	<100	<100	0
TRH - NEPM 1999																					
C6-C9 Fraction	µg/L	20	<20	<20		0	<20	<20	0	670	680	1	<20	<20	0	<20	<20	0
C10-C14 Fraction	µg/L	50	<50	<50		0	190	220	15	110	130	17	60	60	0	<50	<50	0
C15-C28 Fraction	µg/L	100	<100	<100		0	<100	<100	0	<100	<100	0	<100	<100	0	<100	<100	0
C29-C36 Fraction	µg/L	50	<50	<50		0	<50	<50	0	<50	<50	0	<50	<50	0	<50	<50	0
C10-C36 (Sum of Total)	µg/L	50	<50	<50		0	190	220	15	110	130	17	60	60	0	<50	<50	0
TPH																					
Oil & Grease	µg/L	5,000	<5,000	<5,000		0	-	-	-	7,000	<5,000	0	-	-	-	<5,000	<5,000	0
PAHs - standard 16																					
Acenaphthene	µg/L	1	-	-		-	<1.0	<1.0	0	-	-	-	<1.0	<1.0	0	-	-	-
Acenaphthylene	µg/L	1	-	-		-	<1.0	<1.0	0	-	-	-	<1.0	<1.0	0	-	-	-
Anthracene	µg/L	1	-	-		-	<1.0	<1.0	0	-	-	-	<1.0	<1.0	0	-	-	-
Benz(a)anthracene	µg/L	1	-	-		-	<1.0	<1.0	0	-	-	-	<1.0	<1.0	0	-	-	-
Benzo(a)pyrene	µg/L	0.5	-	-		-	<0.5	<0.5	0	-	-	-	<0.5	<0.5	0	-	-	-
Benzo[b+j]fluoranthene	µg/L	1	-	-		-	<1.0	<1.0	0	-	-	-	<1.0	<1.0	0	-	-	-
Benzo(k)fluoranthene	µg/L	1	-	-		-	<1.0	<1.0	0	-	-	-	<1.0	<1.0	0	-	-	-
Benzo(g,h,i)perylene	µg/L	1	-	-		-	<1.0	<1.0	0	-	-	-	<1.0	<1.0	0	-	-	-
Chrysene	µg/L	1	-	-		-	<1.0	<1.0	0	-	-	-	<1.0	<1.0	0	-	-	-
Dibenz(a,h)anthracene	µg/L	1	-	-		-	<1.0	<1.0	0	-	-	-	<1.0	<1.0	0	-	-	-
Fluoranthene	µg/L	1	-	-		-	<1.0	<1.0	0	-	-	-	<1.0	<1.0	0	-	-	-
Fluorene	µg/L	1	-	-		-	<1.0	<1.0	0	-	-	-	<1.0	<1.0	0	-	-	-
Indeno(1,2,3-c,d)pyrene	µg/L	1	-	-		-	<1.0	<1.0	0	-	-	-	<1.0	<1.0	0	-	-	-
Phenanthrene	µg/L	1	-	-		-	<1.0	<1.0	0	-	-	-	<1.0	<1.0	0	-	-	-
Pyrene	µg/L	1	-	-		-	<1.0	<1.0	0	-	-	-	<1.0	<1.0	0	-	-	-
PAHs (Sum of total) - Lab calc	µg/L	0.5	-	-		-	<0.5	<0.5	0	-	-	-	<0.5	<0.5	0	-	-	-
Total 8 PAHs (as BaP TEQ)(zero LOR) - Lab Calc	µg/L	0.5	-	-		-	<0.5	<0.5	0	-	-	-	<0.5	<0.5	0	-	-	-

Appendix C Table 7
RPD Table

	Date	16/12/2021				16/12/2021				21/02/2022				12/04/2022				5/05/2022		
	Field ID	DIFT 1	Duplicate			EMB 1	Duplicate			DIFT 2	Duplicate			EMB 1	Duplicate			DIFT2_5MAY22	DUP1_5MAY22	
	Sample Type	Normal	Field_D	RPD	RPD	Normal	Field_D	RPD		Normal	Field_D	RPD		Normal	Field_D	RPD		Normal	Field_D	RPD
	Lab Report Number	ES2146547	ES2146547			ES2146547	ES2146547			ES2205893	ES2205893			ES2212961	ES2212961			ES2215415	ES2215415	
	Matrix Type	Water	Water			Water	Water			Water	Water			Water	Water			Water	Water	
	Unit	EQL																		
Inorganics																				
Total Suspended Solids	mg/L	5	<5	6		18	-	-	-	8	8	0	-	-	-		13	12	8	
PFAS - Perfluoroalkyl Carboxylic Acids																				
Perfluorobutanoic acid (PFBA)	µg/L	0.1	<0.1	0.1		0	0.4	0.4	0	1.2	1.2	0	0.6	0.6	0		0.3	0.3	0	
Perfluoropentanoic acid (PFPeA)	µg/L	0.02	0.39	0.63	-34	**47**	2.02	1.64	21	5.40	5.40	0	3.10	3.06	1		1.35	1.24	8	
Perfluorohexanoic acid (PFHxA)	µg/L	0.02	0.44	0.62	-24	**34**	2.03	1.67	19	7.10	7.41	4	3.17	3.16	0		1.44	1.36	6	
Perfluoroheptanoic acid (PFHpA)	µg/L	0.02	0.16	0.34	-55	**72**	0.56	0.47	17	2.48	2.37	5	0.81	0.80	1		0.49	0.46	6	
Perfluorooctanoic acid (PFOA)	µg/L	0.01	0.17	0.16	4	6	0.12	0.10	18	2.68	2.73	2	0.19	0.20	5		0.46	0.44	4	
Perfluorononanoic acid (PFNA)	µg/L	0.02	0.02	0.05	-67	**86**	0.02	<0.02	0	0.18	0.15	18	0.04	0.04	0		0.05	0.04	22	
Perfluorodecanoic acid (PFDA)	µg/L	0.02	0.02	0.07	-91	**111**	<0.02	<0.02	0	0.08	0.07	13	<0.02	<0.02	0		0.03	0.03	0	
Perfluoroundecanoic acid (PFUnDA)	µg/L	0.02	<0.02	<0.02		0	<0.02	<0.02	0	<0.02	<0.02	0	<0.02	<0.02	0		<0.02	<0.02	0	
Perfluorododecanoic acid (PFDoDA)	µg/L	0.02	<0.02	0.03		0	<0.02	<0.02	0	<0.02	<0.02	0	<0.02	<0.02	0		<0.02	<0.02	0	
Perfluorotridecanoic acid (PFTrDA)	µg/L	0.02	<0.02	<0.02		0	<0.02	<0.02	0	<0.02	<0.02	0	<0.02	<0.02	0		<0.02	<0.02	0	
Perfluorotetradecanoic acid (PFTeDA)	µg/L	0.05	<0.05	<0.05		0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0		<0.05	<0.05	0	
PFAS - Perfluoroalkyl Sulfonic Acids																				
Perfluorobutane sulfonic acid (PFBS)	µg/L	0.02	<0.02	<0.02		0	<0.02	<0.02	0	<0.02	<0.02	0	<0.02	<0.02	0		<0.02	<0.02	0	
Perfluoropentane sulfonic acid (PFPeS)	µg/L	0.02	<0.02	<0.02		0	<0.02	<0.02	0	<0.02	<0.02	0	<0.02	<0.02	0		<0.02	<0.02	0	
Perfluorohexane sulfonic acid (PFHxS)	µg/L	0.01	<0.01	<0.01		0	<0.01	<0.01	0	<0.01	<0.01	0	<0.01	<0.01	0		<0.01	<0.01	0	
Perfluoroheptane sulfonic acid (PFHpS)	µg/L	0.02	<0.02	<0.02		0	<0.02	<0.02	0	<0.02	<0.02	0	<0.02	<0.02	0		<0.02	<0.02	0	
Perfluorooctane sulfonic acid (PFOS)	µg/L	0.01	0.03	<0.01		0	<0.01	<0.01	0	<0.01	<0.01	0	<0.01	<0.01	0		0.01	0.02	**67**	
Perfluorodecanesulfonic acid (PFDS)	µg/L	0.02	<0.02	<0.02		0	<0.02	<0.02	0	<0.02	<0.02	0	<0.02	<0.02	0		<0.02	<0.02	0	
PFAS - Perfluoroalkyl Sulfonamide																				
Perfluorooctane sulfonamide (FOSA)	µg/L	0.02	<0.02	<0.02		0	<0.02	<0.02	0	<0.02	<0.02	0	<0.02	<0.02	0		<0.02	<0.02	0	
N-Methyl perfluorooctane sulfonamide (MeFOSA)	µg/L	0.05	<0.05	<0.05		0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0		<0.05	<0.05	0	
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	µg/L	0.05	<0.05	<0.05		0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0		<0.05	<0.05	0	
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	µg/L	0.02	<0.02	<0.02		0	<0.02	<0.02	0	<0.02	<0.02	0	<0.02	<0.02	0		<0.02	<0.02	0	
N-Methyl perfluorooctane sulfonamidoethanol (MEFOSE)	µg/L	0.05	<0.05	<0.05		0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0		<0.05	<0.05	0	
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	µg/L	0.05	<0.05	<0.05		0	<0.05	<0.05	0	<0.05	<0.05	0	<0.05	<0.05	0		<0.05	<0.05	0	
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	µg/L	0.02	<0.02	<0.02		0	<0.02	<0.02	0	<0.02	<0.02	0	<0.02	<0.02	0		<0.02	<0.02	0	
PFAS - Fluorotelomer Sulfonic Acids																				
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	µg/L	0.05	<0.05	<0.05		0	<0.05	<0.05	0	0.06	0.06	0	<0.05	<0.05	0		<0.05	<0.05	0	
6:2 Fluorotelomer Sulfonate (6:2 FTS)	µg/L	0.05	2.84	3.23	-9	13	4.45	3.72	18	49.2	47.8	3	10.7	13.0	19		7.78	7.85	1	
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	µg/L	0.05	1.33	2.42	-43	**58**	<0.05	<0.05	0	8.90	8.71	2	<0.05	<0.05	0		2.58	2.50	3	
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	µg/L	0.05	0.10	0.20	-50	**67**	<0.05	<0.05	0	0.12	0.12	0	<0.05	<0.05	0		0.08	0.07	13	

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

Appendix D

Laboratory Reports

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2146547**	Page	: 1 of 23
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: TERRY WIDDOWSON	Contact	: Sarah Mathew
Address	: Level 7 24 Mitchell Street DARWIN NT, AUSTRALIA 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 12566143	Date Samples Received	: 21-Dec-2021 07:30
Order number	: 12566143	Date Analysis Commenced	: 21-Dec-2021
C-O-C number	: ----	Issue Date	: 04-Jan-2022 14:12
Sampler	: Vasillea Milsom		
Site	: ----		
Quote number	: SY/542/21 V3		
No. of samples received	: 18		
No. of samples analysed	: 18		

ilac-MRA NATA
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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Dian Dao	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

- EP075 (SIM): Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP231X - Per- and Polyfluoroalkyl Substances (PFAS): Samples received in 20ml or 125ml bottles have been tested in accordance with the QSM5.3 compliant, NATA accredited method. 60mL or 250mL bottles have been tested to the legacy QSM 5.1 aligned, NATA accredited method.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EG020: LOR's have been raised due to matrix interference. (High Total Dissolved Solids)
- EP231X: PFAS results for sample #18 confirmed by re-extraction and re-analysis.
- LOR raised due to sample matrix.
- It has been noted that Ammonia is greater than TKN, however this difference is within the limits of experimental variation.
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. 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. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	DAT 2	DIFT 1	DIFT 2	Duplicate	EMB 6
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
Compound	CAS Number	LOR	Unit		ES2146547-001	ES2146547-002	ES2146547-003	ES2146547-004	ES2146547-005
					Result	Result	Result	Result	Result
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		**6**	<5	**6**	**6**	**----**
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	**0.002**
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	**0.004**
Zinc	7440-66-6	0.005	mg/L		<0.005	**0.010**	**0.035**	**0.047**	<0.005
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.05**	**0.03**	**0.06**	**0.05**	**3.45**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.17**	**0.12**	**0.25**	**0.24**	**0.05**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.17**	**0.12**	**0.25**	**0.24**	**0.05**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		<0.1	**0.1**	**0.1**	<0.1	**3.4**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**0.2**	**0.2**	**0.4**	**0.2**	**3.4**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.26**	<0.01	<0.01	<0.01	**0.03**
EP020: Oil and Grease (O&G)									
Oil & Grease	----	5	mg/L		<5	<5	<5	<5	**----**
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		<2	<2	<2	<2	**----**
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		**----**	**----**	**----**	**----**	<1.0
Acenaphthylene	208-96-8	1.0	µg/L		**----**	**----**	**----**	**----**	<1.0
Acenaphthene	83-32-9	1.0	µg/L		**----**	**----**	**----**	**----**	<1.0

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	DAT 2	DIFT 1	DIFT 2	Duplicate	EMB 6
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
					ES2146547-001	ES2146547-002	ES2146547-003	ES2146547-004	ES2146547-005
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Fluorene	86-73-7	1.0	µg/L		----	----	----	----	<1.0
Phenanthrene	85-01-8	1.0	µg/L		----	----	----	----	<1.0
Anthracene	120-12-7	1.0	µg/L		----	----	----	----	<1.0
Fluoranthene	206-44-0	1.0	µg/L		----	----	----	----	<1.0
Pyrene	129-00-0	1.0	µg/L		----	----	----	----	<1.0
Benz(a)anthracene	56-55-3	1.0	µg/L		----	----	----	----	<1.0
Chrysene	218-01-9	1.0	µg/L		----	----	----	----	<1.0
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		----	----	----	----	<1.0
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		----	----	----	----	<1.0
Benzo(a)pyrene	50-32-8	0.5	µg/L		----	----	----	----	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		----	----	----	----	<1.0
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		----	----	----	----	<1.0
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		----	----	----	----	<1.0
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L		----	----	----	----	<0.5
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L		----	----	----	----	<0.5
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	<20	<20
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		<100	<100	<100	<100	<100
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	DAT 2	DIFT 1	DIFT 2	Duplicate	EMB 6
			Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
Compound	CAS Number	LOR	Unit	ES2146547-001	ES2146547-002	ES2146547-003	ES2146547-004	ES2146547-005
				Result	Result	Result	Result	Result
EP080: BTEXN - Continued								
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	<2
^ Total Xylenes	----	2	µg/L	<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	<5
EP231A: Perfluoroalkyl Sulfonic Acids								
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	0.01	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
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	<0.01	**0.03**	<0.01	<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
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	**0.2**	**0.1**	**0.2**
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	**0.39**	**0.67**	**0.63**	**0.85**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	**0.44**	**0.66**	**0.62**	**1.13**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	**0.16**	**0.36**	**0.34**	**0.27**
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	**0.17**	**0.17**	**0.16**	**0.13**
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	**0.02**	**0.05**	**0.05**	**0.30**
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	**0.02**	**0.07**	**0.07**	<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	**0.03**	**0.03**	<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
EP231C: Perfluoroalkyl Sulfonamides								

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	DAT 2	DIFT 1	DIFT 2	Duplicate	EMB 6
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
Compound	CAS Number	LOR	Unit		ES2146547-001	ES2146547-002	ES2146547-003	ES2146547-004	ES2146547-005
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
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
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
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	**2.84**	**3.24**	**3.23**	**1.89**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	**1.33**	**2.54**	**2.42**	**0.12**
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	**0.10**	**0.22**	**0.20**	<0.05
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		<0.01	**5.50**	**8.23**	**7.85**	**4.89**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		<0.01	**0.03**	<0.01	<0.01	<0.01
Sum of PFAS (WA DER List)	----	0.01	µg/L		<0.01	**5.36**	**7.84**	**7.50**	**4.59**
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		----	----	----	----	**21.3**
2-Chlorophenol-D4	93951-73-6	1.0	%		----	----	----	----	**51.0**
2.4.6-Tribromophenol	118-79-6	1.0	%		----	----	----	----	**60.8**
EP075(SIM)T: PAH Surrogates									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	DAT 2	DIFT 1	DIFT 2	Duplicate	EMB 6
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
Compound	CAS Number	LOR	Unit		ES2146547-001	ES2146547-002	ES2146547-003	ES2146547-004	ES2146547-005
					Result	Result	Result	Result	Result
EP075(SIM)T: PAH Surrogates - Continued									
2-Fluorobiphenyl	321-60-8	1.0	%		----	----	----	----	59.1
Anthracene-d10	1719-06-8	1.0	%		----	----	----	----	72.5
4-Terphenyl-d14	1718-51-0	1.0	%		----	----	----	----	73.4
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		104	106	104	103	122
Toluene-D8	2037-26-5	2	%		99.8	104	101	100	116
4-Bromofluorobenzene	460-00-4	2	%		98.5	101	97.5	97.2	110
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		84.5	86.4	91.7	82.2	85.4
13C8-PFOA	----	0.02	%		89.6	91.1	95.9	91.1	94.2

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 3	EMB 2	EMB 1	EMB 4	EMB 12
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
Compound	CAS Number	LOR	Unit		ES2146547-006	ES2146547-007	ES2146547-008	ES2146547-009	ES2146547-010
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		<0.010	**0.014**	<0.001	**0.002**	**0.001**
Cadmium	7440-43-9	0.0001	mg/L		<0.0010	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.010	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		<0.010	**0.003**	<0.001	**0.002**	**0.004**
Lead	7439-92-1	0.001	mg/L		<0.010	<0.001	<0.001	**0.001**	<0.001
Nickel	7440-02-0	0.001	mg/L		<0.010	**0.002**	<0.001	**0.002**	**0.003**
Zinc	7440-66-6	0.005	mg/L		<0.050	**0.129**	**0.015**	**0.135**	**0.061**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**1.78**	**0.08**	**0.44**	**0.04**	**0.04**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	**0.04**	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.02**	**0.10**	**0.07**	**0.07**	**0.09**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.02**	**0.10**	**0.11**	**0.07**	**0.09**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**4.4**	**0.6**	**1.2**	**0.9**	**0.7**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**4.4**	**0.7**	**1.3**	**1.0**	**0.8**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.10**	**0.04**	**0.04**	<0.01	<0.01
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 3	EMB 2	EMB 1	EMB 4	EMB 12
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
Compound	CAS Number	LOR	Unit		ES2146547-006	ES2146547-007	ES2146547-008	ES2146547-009	ES2146547-010
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L		**170**	**160**	**190**	**290**	**220**
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L		**170**	**160**	**190**	**290**	**220**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L		**170**	**150**	**190**	**290**	**220**
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L		**170**	**150**	**190**	**290**	**220**
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		**170**	**150**	**190**	**290**	**220**
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	<2
^ Total Xylenes	----	2	µg/L		<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L		<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5
EP231A: Perfluoroalkyl Sulfonic Acids									

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	EMB 3	EMB 2	EMB 1	EMB 4	EMB 12
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
					ES2146547-006	ES2146547-007	ES2146547-008	ES2146547-009	ES2146547-010
					Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids - Continued									
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	0.01	µg/L		<0.01	<0.01	<0.01	**0.01**	<0.01
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		<0.01	<0.01	<0.01	<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
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		**0.4**	**0.7**	**0.4**	**1.1**	**0.2**
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		**1.88**	**2.94**	**2.02**	**4.56**	**0.76**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		**1.75**	**2.75**	**2.03**	**6.57**	**0.66**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		**0.47**	**1.11**	**0.56**	**1.27**	**0.36**
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		**0.16**	**0.20**	**0.12**	**2.12**	**0.07**
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		**0.02**	**0.03**	**0.02**	**0.15**	<0.02
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	<0.02	<0.02	**0.08**	<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
EP231C: Perfluoroalkyl Sulfonamides									
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: WATER (Matrix: WATER)				Sample ID	EMB 3	EMB 2	EMB 1	EMB 4	EMB 12
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
Compound	CAS Number	LOR	Unit		ES2146547-006	ES2146547-007	ES2146547-008	ES2146547-009	ES2146547-010
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	<0.05	<0.05	**0.17**	<0.05
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		**1.77**	**1.44**	**4.45**	**102**	**0.83**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		**0.20**	**0.17**	<0.05	**3.11**	<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
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		**6.65**	**9.34**	**9.60**	**121**	**2.88**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		<0.01	<0.01	<0.01	**0.01**	<0.01
Sum of PFAS (WA DER List)	----	0.01	µg/L		**6.63**	**9.31**	**9.58**	**121**	**2.88**
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		**22.3**	**21.2**	**19.5**	**17.6**	**17.2**
2-Chlorophenol-D4	93951-73-6	1.0	%		**52.6**	**43.0**	**45.7**	**46.0**	**46.4**
2.4.6-Tribromophenol	118-79-6	1.0	%		**60.9**	**45.4**	**51.1**	**64.3**	**48.8**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		**63.1**	**56.9**	**58.1**	**55.5**	**54.1**
Anthracene-d10	1719-06-8	1.0	%		**77.2**	**68.6**	**71.2**	**71.0**	**63.0**
4-Terphenyl-d14	1718-51-0	1.0	%		**80.1**	**69.4**	**68.5**	**74.6**	**65.4**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**130**	**114**	**117**	**112**	**117**
Toluene-D8	2037-26-5	2	%		**121**	**108**	**110**	**107**	**108**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 3	EMB 2	EMB 1	EMB 4	EMB 12
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
Compound	CAS Number	LOR	Unit		ES2146547-006	ES2146547-007	ES2146547-008	ES2146547-009	ES2146547-010
					Result	Result	Result	Result	Result
EP080S: TPH(V)/BTEX Surrogates - Continued									
4-Bromofluorobenzene	460-00-4	2	%		**116**	**103**	**105**	**102**	**103**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**82.0**	**86.5**	**90.0**	**83.1**	**80.4**
13C8-PFOA	----	0.02	%		**92.7**	**91.6**	**93.0**	**94.1**	**91.7**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	EMB 15	EMB 16	EMB 11	EMB 7	EMB 5
			Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
Compound	CAS Number	LOR	Unit	ES2146547-011	ES2146547-012	ES2146547-013	ES2146547-014	ES2146547-015
				Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	**0.002**	**0.175**	**0.074**	<0.001	**0.001**
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0010	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.010	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	**0.016**	**0.147**	<0.001	**0.003**	**0.003**
Lead	7439-92-1	0.001	mg/L	**0.007**	<0.010	<0.001	**0.004**	**0.004**
Nickel	7440-02-0	0.001	mg/L	**0.006**	<0.010	<0.001	**0.001**	**0.002**
Zinc	7440-66-6	0.005	mg/L	**0.049**	<0.050	<0.005	**0.058**	**0.022**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.01**	**0.24**	**1.44**	**1.22**	**0.02**
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.56**	**0.02**	**0.02**	**1.33**	**1.72**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.56**	**0.02**	**0.02**	**1.33**	**1.72**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.5**	<2.0	**1.8**	**2.2**	**1.2**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	**1.1**	<2.0	**1.8**	**3.5**	**2.9**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	<0.01	**0.40**	<0.05	**0.04**	**0.11**
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	83-32-9	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	86-73-7	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	85-01-8	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	120-12-7	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	206-44-0	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	129-00-0	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Chrysene	218-01-9	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 15	EMB 16	EMB 11	EMB 7	EMB 5
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
Compound	CAS Number	LOR	Unit		ES2146547-011	ES2146547-012	ES2146547-013	ES2146547-014	ES2146547-015
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L		**120**	**90**	**140**	**90**	**80**
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	**110**	<50	**140**	**100**
^ C10 - C36 Fraction (sum)	----	50	µg/L		**120**	**200**	**140**	**230**	**180**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L		**120**	<100	**140**	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	**120**	<100	**170**	**100**
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L		**120**	**120**	**140**	**170**	**100**
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		**120**	<100	**140**	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	<2
^ Total Xylenes	----	2	µg/L		<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L		<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5
EP231A: Perfluoroalkyl Sulfonic Acids									

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	EMB 15	EMB 16	EMB 11	EMB 7	EMB 5
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
					ES2146547-011	ES2146547-012	ES2146547-013	ES2146547-014	ES2146547-015
					Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids - Continued									
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	0.01	µg/L		<0.01	<0.01	<0.01	**0.01**	<0.01
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		<0.01	<0.01	<0.01	<0.01	**0.02**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	<0.1	<0.1	**2.6**	**1.4**
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		**0.06**	<0.02	**0.18**	**9.36**	**6.76**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		**0.05**	<0.02	**0.14**	**22.2**	**7.20**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		**0.03**	<0.02	**0.08**	**2.63**	**2.88**
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		<0.01	<0.01	**0.02**	**6.59**	**2.33**
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<0.02	<0.02	<0.02	**0.10**	**0.38**
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	**0.11**
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
EP231C: Perfluoroalkyl Sulfonamides									
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: WATER (Matrix: WATER)				Sample ID	EMB 15	EMB 16	EMB 11	EMB 7	EMB 5
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
Compound	CAS Number	LOR	Unit		ES2146547-011	ES2146547-012	ES2146547-013	ES2146547-014	ES2146547-015
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	<0.05	<0.05	**0.51**	<0.05
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	<0.05	**0.06**	**140**	**67.2**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	<0.05	<0.05	**0.30**	**12.7**
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	**0.07**
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		**0.14**	<0.01	**0.48**	**184**	**101**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		<0.01	<0.01	<0.01	**0.01**	**0.02**
Sum of PFAS (WA DER List)	----	0.01	µg/L		**0.14**	<0.01	**0.48**	**184**	**100**
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		**17.5**	**17.1**	**16.1**	**18.0**	**16.9**
2-Chlorophenol-D4	93951-73-6	1.0	%		**47.4**	**40.0**	**33.3**	**42.9**	**42.7**
2.4.6-Tribromophenol	118-79-6	1.0	%		**59.1**	**55.6**	**28.8**	**56.4**	**61.1**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		**57.3**	**55.5**	**69.7**	**53.9**	**57.0**
Anthracene-d10	1719-06-8	1.0	%		**71.2**	**67.6**	**77.3**	**64.8**	**69.6**
4-Terphenyl-d14	1718-51-0	1.0	%		**75.6**	**65.2**	**71.9**	**64.3**	**71.3**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**88.8**	**89.3**	**131**	**117**	**119**
Toluene-D8	2037-26-5	2	%		**82.4**	**84.7**	**122**	**111**	**112**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 15	EMB 16	EMB 11	EMB 7	EMB 5
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00	16-Dec-2021 00:00
Compound	CAS Number	LOR	Unit		ES2146547-011	ES2146547-012	ES2146547-013	ES2146547-014	ES2146547-015
					Result	Result	Result	Result	Result
EP080S: TPH(V)/BTEX Surrogates - Continued									
4-Bromofluorobenzene	460-00-4	2	%		**78.5**	**80.3**	**114**	**104**	**104**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**82.9**	**88.7**	**86.8**	**86.4**	**87.4**
13C8-PFOA	----	0.02	%		**88.8**	**95.6**	**91.2**	**92.6**	**92.4**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 8	Duplicate	6 Series	----	----
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	21-Dec-2021 11:30	----	----
Compound	CAS Number	LOR	Unit		ES2146547-016	ES2146547-017	ES2146547-018	--------	--------
					Result	Result	Result	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		----	----	<5	----	----
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	**0.002**	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Copper	7440-50-8	0.001	mg/L		**0.001**	<0.001	<0.001	----	----
Lead	7439-92-1	0.001	mg/L		**0.008**	<0.001	<0.001	----	----
Nickel	7440-02-0	0.001	mg/L		**0.002**	<0.001	<0.001	----	----
Zinc	7440-66-6	0.005	mg/L		**0.040**	**0.017**	**0.006**	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.03**	**0.37**	**0.36**	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	**0.05**	<0.01	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**2.78**	**0.06**	**0.21**	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**2.78**	**0.11**	**0.21**	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**1.4**	**1.3**	**0.4**	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**4.2**	**1.4**	**0.6**	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.10**	**0.06**	<0.01	----	----
EP020: Oil and Grease (O&G)									
Oil & Grease	----	5	mg/L		----	----	<5	----	----
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		----	----	<2	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 8	Duplicate	6 Series	----	----
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	21-Dec-2021 11:30	----	----
Compound	CAS Number	LOR	Unit		ES2146547-016	ES2146547-017	ES2146547-018	--------	--------
					Result	Result	Result	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	----	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	----	----	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	----	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	----	----	----
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	----	----	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L		<0.5	<0.5	----	----	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L		<0.5	<0.5	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	----	----
C10 - C14 Fraction	----	50	µg/L		**60**	**220**	<50	----	----
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	----	----
C29 - C36 Fraction	----	50	µg/L		**360**	<50	<50	----	----
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		**420**	**220**	<50	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	----	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		<20	<20	<20	----	----
>C10 - C16 Fraction	----	100	µg/L		<100	**220**	<100	----	----
>C16 - C34 Fraction	----	100	µg/L		**300**	<100	<100	----	----
>C34 - C40 Fraction	----	100	µg/L		**160**	<100	<100	----	----
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		**460**	**220**	<100	----	----
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	**220**	<100	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	----	----
Toluene	108-88-3	2	µg/L		<2	<2	<2	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 8	Duplicate	6 Series	----	----
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	21-Dec-2021 11:30	----	----
Compound	CAS Number	LOR	Unit		ES2146547-016	ES2146547-017	ES2146547-018	--------	--------
					Result	Result	Result	----	----
EP080: BTEXN - Continued									
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	----	----
^ Total Xylenes	----	2	µg/L		<2	<2	<2	----	----
^ Sum of BTEX	----	1	µg/L		<1	<1	<1	----	----
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		<0.02	<0.02	<0.02	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		<0.02	<0.02	<0.02	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L		**0.02**	<0.01	<0.01	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		<0.02	<0.02	<0.02	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		<0.01	<0.01	**0.02**	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	<0.02	<0.02	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		**0.3**	**0.4**	<0.1	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		**1.02**	**1.64**	<0.02	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		**1.10**	**1.67**	<0.02	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		**0.60**	**0.47**	<0.02	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		**0.17**	**0.10**	<0.01	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		**0.04**	<0.02	<0.02	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	<0.02	<0.02	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	<0.02	<0.02	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	<0.02	<0.02	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	<0.02	<0.02	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	<0.05	<0.05	----	----
EP231C: Perfluoroalkyl Sulfonamides									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 8	Duplicate	6 Series	----	----
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	21-Dec-2021 11:30	----	----
Compound	CAS Number	LOR	Unit		ES2146547-016	ES2146547-017	ES2146547-018	--------	--------
					Result	Result	Result	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.02	<0.02	<0.02	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.05	<0.05	<0.05	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	<0.05	<0.05	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	<0.05	<0.05	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	<0.05	<0.05	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	<0.02	<0.02	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	<0.02	<0.02	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	<0.05	<0.05	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		**0.10**	**3.72**	<0.05	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<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	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		**3.35**	**8.00**	**0.02**	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		**0.02**	<0.01	**0.02**	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		**3.31**	**8.00**	**0.02**	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		**19.1**	**17.4**	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%		**39.2**	**35.0**	----	----	----
2.4.6-Tribromophenol	118-79-6	1.0	%		**57.4**	**54.2**	----	----	----
EP075(SIM)T: PAH Surrogates									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 8	Duplicate	6 Series	----	----
				Sampling date / time	16-Dec-2021 00:00	16-Dec-2021 00:00	21-Dec-2021 11:30	----	----
Compound	CAS Number	LOR	Unit		ES2146547-016	ES2146547-017	ES2146547-018	--------	--------
					Result	Result	Result	----	----
EP075(SIM)T: PAH Surrogates - Continued									
2-Fluorobiphenyl	321-60-8	1.0	%		53.8	59.0	----	----	----
Anthracene-d10	1719-06-8	1.0	%		70.0	67.9	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		63.7	67.6	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		120	119	110	----	----
Toluene-D8	2037-26-5	2	%		115	113	100	----	----
4-Bromofluorobenzene	460-00-4	2	%		106	106	95.5	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		84.9	88.7	91.1	----	----
13C8-PFOA	----	0.02	%		91.2	91.5	96.1	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

QUALITY CONTROL REPORT

Work Order	: **ES2146547**	Page	: 1 of 10
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: TERRY WIDDOWSON	Contact	: Sarah Mathew
Address	: Level 7 24 Mitchell Street DARWIN NT, AUSTRALIA 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 12566143	Date Samples Received	: 21-Dec-2021
Order number	: 12566143	Date Analysis Commenced	: 21-Dec-2021
C-O-C number	: ----	Issue Date	: 04-Jan-2022
Sampler	: Vasillea Milsom		
Site	: ----		
Quote number	: SY/542/21 V3		
No. of samples received	: 18		
No. of samples analysed	: 18		

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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Dian Dao	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 4090219)									
ES2146547-001	DAT 2	EA025H: Suspended Solids (SS)	----	5	mg/L	6	8	20.7	No Limit
ES2146674-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	120	123	3.1	0% - 20%
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 4095037)									
ES2146547-018	6 Series	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.0	No Limit
ES2146866-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4098103)									
ES2146500-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.004	0.002	69.6	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.006	0.006	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
ES2146500-014	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4098106)									
ES2146547-007	EMB 2	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.014	0.014	0.0	0% - 50%

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4098106) - continued									
ES2146547-007	EMB 2	EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.003	0.003	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.129	0.126	1.8	0% - 20%
ES2146547-018	6 Series	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.006	0.006	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 4098104)									
ES2146500-002	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
ES2146500-008	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 4098107)									
ES2146547-010	EMB 12	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
ES2146547-018	6 Series	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 4100704)									
ES2146500-011	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.03	0.03	0.0	No Limit
ES2146547-007	EMB 2	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.08	0.08	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 4100706)									
ES2146547-018	6 Series	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.36	0.36	0.0	0% - 20%
ES2146604-007	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.23	0.23	0.0	0% - 20%
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 4090923)									
ES2146547-001	DAT 2	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES2146680-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 4096613)									
ES2146547-018	6 Series	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES2147098-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<2.00	<2.00	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 4100703)									
ES2146500-011	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.04	0.04	0.0	No Limit
ES2146547-007	EMB 2	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.10	0.09	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 4100705)									
ES2146547-018	6 Series	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.21	0.20	0.0	0% - 20%
ES2146604-007	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	6.25	6.34	1.5	0% - 20%
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4100700)									
ES2146269-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	5.6	5.2	7.3	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4100700) - continued									
ES2146547-006	EMB 3	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	4.4	2.0	72.3	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4100701)									
ES2146547-016	EMB 8	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.4	1.4	0.0	No Limit
ES2146604-004	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	228	234	2.4	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 4100699)									
ES2146269-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	1.19	1.21	1.7	0% - 20%
ES2146547-006	EMB 3	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.10	0.14	32.0	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 4100702)									
ES2146547-016	EMB 8	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.10	0.09	14.8	0% - 50%
ES2146604-004	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	136	137	0.9	0% - 20%
EP030: Biochemical Oxygen Demand (BOD) (QC Lot: 4094140)									
ES2144655-001	Anonymous	EP030: Biochemical Oxygen Demand	----	2	mg/L	13	10	26.1	No Limit
ES2146701-002	Anonymous	EP030: Biochemical Oxygen Demand	----	2	mg/L	4	<2	66.7	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4100870)									
ES2146547-001	DAT 2	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
ES2146547-011	EMB 15	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4100870)									
ES2146547-001	DAT 2	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
ES2146547-011	EMB 15	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP080: BTEXN (QC Lot: 4100870)									
ES2146547-001	DAT 2	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
ES2146547-011	EMB 15	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (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 Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 4090219)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	103	83.0	129
				<5	1000 mg/L	97.4	82.0	110
				<5	463 mg/L	102	83.0	118
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 4095037)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	100	83.0	129
				<5	1000 mg/L	96.2	82.0	110
				<5	463 mg/L	104	83.0	118
EG020F: Dissolved Metals by ICP-MS (QCLot: 4098103)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	89.6	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	90.6	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	94.3	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	88.4	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	91.1	83.0	111
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	87.4	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	88.5	81.0	117
EG020F: Dissolved Metals by ICP-MS (QCLot: 4098106)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	92.9	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	90.5	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	91.8	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	90.9	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	92.1	83.0	111
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	90.9	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	90.8	81.0	117
EG035F: Dissolved Mercury by FIMS (QCLot: 4098104)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	95.6	83.0	105
EG035F: Dissolved Mercury by FIMS (QCLot: 4098107)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	95.3	83.0	105
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4100704)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	103	90.0	114
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4100706)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	104	90.0	114
EK057G: Nitrite as N by Discrete Analyser (QCLot: 4090923)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	95.5	82.0	114

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EK057G: Nitrite as N by Discrete Analyser (QCLot: 4096613)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	107	82.0	114
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4100703)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	102	91.0	113
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4100705)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	103	91.0	113
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4100700)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	89.3	69.0	101
				<0.1	1 mg/L	99.5	70.0	118
				<0.1	5 mg/L	94.8	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4100701)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	88.8	69.0	101
				<0.1	1 mg/L	99.7	70.0	118
				<0.1	5 mg/L	92.2	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4100699)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	93.9	71.0	101
				<0.01	0.442 mg/L	102	72.0	108
				<0.01	1 mg/L	100	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4100702)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	90.8	71.0	101
				<0.01	0.442 mg/L	103	72.0	108
				<0.01	1 mg/L	96.2	70.0	130
EP020: Oil and Grease (O&G) (QCLot: 4102514)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	102	81.0	121
EP030: Biochemical Oxygen Demand (BOD) (QCLot: 4094140)								
EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	200 mg/L	92.0	74.0	112
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 4090167)								
EP075(SIM): Naphthalene	91-20-3	1	µg/L	<1.0	5 µg/L	74.7	50.0	94.0
EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<1.0	5 µg/L	71.1	63.6	114
EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<1.0	5 µg/L	88.4	62.2	113
EP075(SIM): Fluorene	86-73-7	1	µg/L	<1.0	5 µg/L	89.3	63.9	115
EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<1.0	5 µg/L	69.8	62.6	116
EP075(SIM): Anthracene	120-12-7	1	µg/L	<1.0	5 µg/L	67.8	64.3	116
EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<1.0	5 µg/L	75.5	63.6	118
EP075(SIM): Pyrene	129-00-0	1	µg/L	<1.0	5 µg/L	77.2	63.1	118
EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<1.0	5 µg/L	81.6	64.1	117
EP075(SIM): Chrysene	218-01-9	1	µg/L	<1.0	5 µg/L	90.6	62.5	116
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2	1	µg/L	<1.0	5 µg/L	74.2	61.7	119
	205-82-3							

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 4090167) - continued								
EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<1.0	5 µg/L	76.0	63.0	115
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	5 µg/L	69.4	63.3	117
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<1.0	5 µg/L	70.3	59.9	118
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	1	µg/L	<1.0	5 µg/L	75.3	61.2	117
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	1	µg/L	<1.0	5 µg/L	76.7	59.1	118
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4090166)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	400 µg/L	68.6	55.8	112
EP071: C15 - C28 Fraction	----	100	µg/L	<100	600 µg/L	74.9	71.6	113
EP071: C29 - C36 Fraction	----	50	µg/L	<50	400 µg/L	72.7	56.0	121
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4094142)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	400 µg/L	75.4	55.8	112
EP071: C15 - C28 Fraction	----	100	µg/L	<100	600 µg/L	87.9	71.6	113
EP071: C29 - C36 Fraction	----	50	µg/L	<50	400 µg/L	93.3	56.0	121
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4100870)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	93.1	75.0	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4090166)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	500 µg/L	74.5	57.9	119
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	700 µg/L	89.6	62.5	110
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	300 µg/L	83.5	61.5	121
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4094142)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	500 µg/L	72.4	57.9	119
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	700 µg/L	93.2	62.5	110
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	300 µg/L	101	61.5	121
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4100870)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	97.7	75.0	127
EP080: BTEXN (QCLot: 4100870)								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	95.9	70.0	122
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	91.9	69.0	123
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	82.4	70.0	120
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	81.1	69.0	121
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	83.1	72.0	122
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	91.5	70.0	120
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4101399)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.25 µg/L	114	72.0	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.25 µg/L	102	71.0	127
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	0.25 µg/L	101	68.0	131
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.25 µg/L	104	69.0	134

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4101399) - continued								
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.25 µg/L	89.4	65.0	140
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.25 µg/L	103	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4101399)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	109	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	114	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	107	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	105	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	103	71.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.25 µg/L	110	69.0	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.25 µg/L	118	71.0	129
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.25 µg/L	118	69.0	133
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.25 µg/L	116	72.0	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.25 µg/L	116	65.0	144
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	0.625 µg/L	103	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4101399)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.25 µg/L	104	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	0.625 µg/L	101	68.0	141
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	0.625 µg/L	89.2	62.6	147
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	0.625 µg/L	91.6	66.0	145
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	0.625 µg/L	100	57.6	145
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.25 µg/L	103	65.0	136
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.25 µg/L	109	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4101399)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.25 µg/L	118	63.0	143
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.25 µg/L	98.8	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.25 µg/L	107	67.0	138
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.25 µg/L	98.6	71.4	144

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: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4098103)							
ES2146459-023	Anonymous	EG020A-F: Arsenic	7440-38-2	1 mg/L	82.0	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	96.9	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	102	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	93.2	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	90.0	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	93.0	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	95.6	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 4098106)							
ES2146547-008	EMB 1	EG020A-F: Arsenic	7440-38-2	1 mg/L	94.5	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	91.0	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	92.3	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	93.0	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	85.6	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	91.7	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	93.6	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 4098104)							
ES2146459-007	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	93.5	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 4098107)							
ES2146547-009	EMB 4	EG035F: Mercury	7439-97-6	0.01 mg/L	88.9	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4100704)							
ES2146500-011	Anonymous	EK055G: Ammonia as N	7664-41-7	1 mg/L	92.2	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4100706)							
ES2146547-018	6 Series	EK055G: Ammonia as N	7664-41-7	1 mg/L	85.3	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 4090923)							
ES2146547-001	DAT 2	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	112	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 4096613)							
ES2146547-018	6 Series	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	127	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4100703)							
ES2146500-011	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	88.9	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4100705)							
ES2146547-018	6 Series	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	86.5	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4100700)							
ES2146269-004	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	50 mg/L	91.1	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4100701)							
ES2146547-017	Duplicate	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	94.5	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4100699)							
ES2146269-004	Anonymous	EK067G: Total Phosphorus as P	----	1 mg/L	100	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4100702)							
ES2146547-017	Duplicate	EK067G: Total Phosphorus as P	----	1 mg/L	100	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4100870)							
ES2146547-001	DAT 2	EP080: C6 - C9 Fraction	----	325 µg/L	98.9	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4100870)							
ES2146547-001	DAT 2	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	94.1	70.0	130
EP080: BTEXN (QCLot: 4100870)							
ES2146547-001	DAT 2	EP080: Benzene	71-43-2	25 µg/L	93.1	70.0	130
		EP080: Toluene	108-88-3	25 µg/L	95.8	70.0	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	97.5	70.0	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	25 µg/L	99.2	70.0	130
		EP080: ortho-Xylene	95-47-6	25 µg/L	102	70.0	130
		EP080: Naphthalene	91-20-3	25 µg/L	97.9	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2146547**	Page	: 1 of 13
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: TERRY WIDDOWSON	Telephone	: +61-2-8784 8555
Project	: 12566143	Date Samples Received	: 21-Dec-2021
Site	: ----	Issue Date	: 04-Jan-2022
Sampler	: Vasillea Milsom	No. of samples received	: 18
Order number	: 12566143	No. of samples analysed	: 18

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)		Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural							
DAT 2,	DIFT 1,	----	----	----	21-Dec-2021	18-Dec-2021	**3**
DIFT 2,	Duplicate,						
EMB 6,	EMB 3,						
EMB 2,	EMB 1,						
EMB 4,	EMB 12,						
EMB 15,	EMB 16,						
EMB 11,	EMB 7,						
EMB 5,	EMB 8,						
Duplicate							
EP030: Biochemical Oxygen Demand (BOD)							
Clear Plastic Bottle - Natural							
DAT 2,	DIFT 1,	----	----	----	22-Dec-2021	18-Dec-2021	**4**
DIFT 2,	Duplicate						

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
PAH/Phenols (GC/MS - SIM)	0	14	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	0	20	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	28	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
PAH/Phenols (GC/MS - SIM)	0	14	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	0	20	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	28	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: **WATER**

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

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
EA025: Total Suspended Solids dried at 104 ± 2°C							
Clear Plastic Bottle - Natural (EA025H)							
DAT 2, DIFT 1, DIFT 2, Duplicate	**16-Dec-2021**	**----**	----	----	**21-Dec-2021**	23-Dec-2021	✓
Clear Plastic Bottle - Natural (EA025H)							
6 Series	**21-Dec-2021**	**----**	----	----	**23-Dec-2021**	28-Dec-2021	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)							
DAT 2, DIFT 1, DIFT 2, Duplicate, EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**----**	----	----	**24-Dec-2021**	14-Jun-2022	✓
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)							
6 Series	**21-Dec-2021**	**----**	----	----	**24-Dec-2021**	19-Jun-2022	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F)							
DAT 2, DIFT 1, DIFT 2, Duplicate, EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**----**	----	----	**24-Dec-2021**	13-Jan-2022	✓
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F)							
6 Series	**21-Dec-2021**	**----**	----	----	**24-Dec-2021**	18-Jan-2022	✓

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
EK055G: Ammonia as N by Discrete Analyser							
Amber TOC Vial - Sulfuric Acid (EK055G)							
6 Series	**21-Dec-2021**	**----**	----	----	**29-Dec-2021**	18-Jan-2022	✓
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
DAT 2, DIFT 1, DIFT 2, Duplicate, EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**----**	----	----	**29-Dec-2021**	13-Jan-2022	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
DAT 2, DIFT 1, DIFT 2, Duplicate, EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**----**	----	----	**21-Dec-2021**	18-Dec-2021	×
Clear Plastic Bottle - Natural (EK057G)							
6 Series	**21-Dec-2021**	**----**	----	----	**23-Dec-2021**	23-Dec-2021	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Amber TOC Vial - Sulfuric Acid (EK059G)							
6 Series	**21-Dec-2021**	**----**	----	----	**29-Dec-2021**	18-Jan-2022	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
DAT 2, DIFT 1, DIFT 2, Duplicate, EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**----**	----	----	**29-Dec-2021**	13-Jan-2022	✓

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
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Amber TOC Vial - Sulfuric Acid (EK061G)							
6 Series	**21-Dec-2021**	**29-Dec-2021**	18-Jan-2022	✓	**29-Dec-2021**	18-Jan-2022	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
DAT 2, DIFT 1, DIFT 2, Duplicate, EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**29-Dec-2021**	13-Jan-2022	✓	**29-Dec-2021**	13-Jan-2022	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Amber TOC Vial - Sulfuric Acid (EK067G)							
6 Series	**21-Dec-2021**	**29-Dec-2021**	18-Jan-2022	✓	**29-Dec-2021**	18-Jan-2022	✓
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
DAT 2, DIFT 1, DIFT 2, Duplicate, EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**29-Dec-2021**	13-Jan-2022	✓	**29-Dec-2021**	13-Jan-2022	✓
EP020: Oil and Grease (O&G)							
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EP020)							
DAT 2, DIFT 1, DIFT 2, Duplicate	**16-Dec-2021**	**----**	----	----	**30-Dec-2021**	13-Jan-2022	✓
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EP020)							
6 Series	**21-Dec-2021**	**----**	----	----	**30-Dec-2021**	18-Jan-2022	✓
EP030: Biochemical Oxygen Demand (BOD)							
Clear Plastic Bottle - Natural (EP030)							
DAT 2, DIFT 1, DIFT 2, Duplicate	**16-Dec-2021**	**----**	----	----	**22-Dec-2021**	18-Dec-2021	✗
Clear Plastic Bottle - Natural (EP030)							
6 Series	**21-Dec-2021**	**----**	----	----	**22-Dec-2021**	23-Dec-2021	✓

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
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075(SIM))							
EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**23-Dec-2021**	23-Dec-2021	✓	**30-Dec-2021**	01-Feb-2022	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP071)							
DAT 2, DIFT 1, DIFT 2, Duplicate, EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**23-Dec-2021**	23-Dec-2021	✓	**29-Dec-2021**	01-Feb-2022	✓
Amber Glass Bottle - Unpreserved (EP071)							
6 Series	**21-Dec-2021**	**22-Dec-2021**	28-Dec-2021	✓	**30-Dec-2021**	31-Jan-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080)							
DAT 2, DIFT 1, DIFT 2, Duplicate, EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**30-Dec-2021**	30-Dec-2021	✓	**30-Dec-2021**	30-Dec-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080)							
6 Series	**21-Dec-2021**	**30-Dec-2021**	04-Jan-2022	✓	**30-Dec-2021**	04-Jan-2022	✓

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
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Amber Glass Bottle - Unpreserved (EP071)							
DAT 2, DIFT 1, DIFT 2, Duplicate, EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**23-Dec-2021**	23-Dec-2021	✓	**29-Dec-2021**	01-Feb-2022	✓
Amber Glass Bottle - Unpreserved (EP071)							
6 Series	**21-Dec-2021**	**22-Dec-2021**	28-Dec-2021	✓	**30-Dec-2021**	31-Jan-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080)							
DAT 2, DIFT 1, DIFT 2, Duplicate, EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**30-Dec-2021**	30-Dec-2021	✓	**30-Dec-2021**	30-Dec-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080)							
6 Series	**21-Dec-2021**	**30-Dec-2021**	04-Jan-2022	✓	**30-Dec-2021**	04-Jan-2022	✓
EP080: BTEXN							
Amber VOC Vial - Sulfuric Acid (EP080)							
DAT 2, DIFT 1, DIFT 2, Duplicate, EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**30-Dec-2021**	30-Dec-2021	✓	**30-Dec-2021**	30-Dec-2021	✓
Amber VOC Vial - Sulfuric Acid (EP080)							
6 Series	**21-Dec-2021**	**30-Dec-2021**	04-Jan-2022	✓	**30-Dec-2021**	04-Jan-2022	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
DAT 2, DIFT 1, DIFT 2, Duplicate, EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**30-Dec-2021**	14-Jun-2022	✓	**30-Dec-2021**	14-Jun-2022	✓
HDPE (no PTFE) (EP231X)							
6 Series	**21-Dec-2021**	**30-Dec-2021**	19-Jun-2022	✓	**30-Dec-2021**	19-Jun-2022	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X)							
DAT 2, DIFT 1, DIFT 2, Duplicate, EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**30-Dec-2021**	14-Jun-2022	✓	**30-Dec-2021**	14-Jun-2022	✓
HDPE (no PTFE) (EP231X)							
6 Series	**21-Dec-2021**	**30-Dec-2021**	19-Jun-2022	✓	**30-Dec-2021**	19-Jun-2022	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X)							
DAT 2, DIFT 1, DIFT 2, Duplicate, EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**30-Dec-2021**	14-Jun-2022	✓	**30-Dec-2021**	14-Jun-2022	✓
HDPE (no PTFE) (EP231X)							
6 Series	**21-Dec-2021**	**30-Dec-2021**	19-Jun-2022	✓	**30-Dec-2021**	19-Jun-2022	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
DAT 2, DIFT 1, DIFT 2, Duplicate, EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**30-Dec-2021**	14-Jun-2022	✓	**30-Dec-2021**	14-Jun-2022	✓
HDPE (no PTFE) (EP231X)							
6 Series	**21-Dec-2021**	**30-Dec-2021**	19-Jun-2022	✓	**30-Dec-2021**	19-Jun-2022	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X)							
DAT 2, DIFT 1, DIFT 2, Duplicate, EMB 6, EMB 3, EMB 2, EMB 1, EMB 4, EMB 12, EMB 15, EMB 16, EMB 11, EMB 7, EMB 5, EMB 8, Duplicate	**16-Dec-2021**	**30-Dec-2021**	14-Jun-2022	✓	**30-Dec-2021**	14-Jun-2022	✓
HDPE (no PTFE) (EP231X)							
6 Series	**21-Dec-2021**	**30-Dec-2021**	19-Jun-2022	✓	**30-Dec-2021**	19-Jun-2022	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Ammonia as N by Discrete analyser	EK055G	4	31	**12.90**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	4	37	**10.81**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	4	38	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	4	34	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	14	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	0	20	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	4	36	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	4	38	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	28	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Ammonia as N by Discrete analyser	EK055G	2	31	**6.45**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	37	**5.41**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	38	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	34	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	6	36	**16.67**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	6	40	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	6	38	**15.79**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	28	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	2	31	**6.45**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	37	**5.41**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	38	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	34	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	36	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	38	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	28	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	2	31	**6.45**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	37	**5.41**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	38	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	34	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	14	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	0	20	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	38	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	28	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Oil and Grease	EP020	WATER	In house: Referenced to APHA 5520 B. Oil & grease is a gravimetric procedure to determine the amount of oil & grease residue in an aqueous sample. The sample is serially extracted three times n-hexane. The resultant extracts are combined, dehydrated and concentrated prior to gravimetric determination. This method is compliant with NEPM Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Biochemical Oxygen Demand (BOD)	EP030	WATER	In house: Referenced to APHA 5210 B. The 5-Day BOD test provides an empirical measure of the oxygen consumption capacity of a given water. A portion of the sample is diluted into oxygenated, nutrient rich water, and a seed added to begin biological decay. The initial dissolved oxygen content is measured, then the bottle is sealed and incubated for five days. The remaining dissolved oxygen is measured, and from the difference, the demand for oxygen, by biological decay, is determined. This method is compliant with NEPM Schedule B(3).
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.
Solid Phase Extraction (SPE) for PFAS in water	ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2205893**	Page	: 1 of 7
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Vasillea Milsom	Contact	: Sarah Mathew
Address	: Level 7 24 Mitchell Street DARWIN NT, AUSTRALIA 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Vopak ENV Monitoring	Date Samples Received	: 22-Feb-2022 16:45
Order number	: ----	Date Analysis Commenced	: 22-Feb-2022
C-O-C number	: ----	Issue Date	: 01-Mar-2022 15:22
Sampler	: Vasillea Milsom		
Site	: ----		
Quote number	: SY/542/21 V3		
No. of samples received	: 3		
No. of samples analysed	: 3		

ilac-MRA NATA
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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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 - Per- and Polyfluoroalkyl Substances (PFAS): Samples received in 20ml or 125ml bottles have been tested in accordance with the QSM5.3 compliant, NATA accredited method. 60mL or 250mL bottles have been tested to the legacy QSM 5.1 aligned, NATA accredited method.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP080: ES2205893#1,#2 and #3 have been confirmed by re-analysis.
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. 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. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	DAT 2	DIFT 2	Duplicate	----	----
				Sampling date / time	21-Feb-2022 00:00	21-Feb-2022 00:00	21-Feb-2022 00:00	----	----
Compound	CAS Number	LOR	Unit		ES2205893-001	ES2205893-002	ES2205893-003	--------	--------
					Result	Result	Result	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		5	8	8	----	----
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	0.002	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Nickel	7440-02-0	0.001	mg/L		<0.001	0.001	0.002	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Zinc	7440-66-6	0.005	mg/L		<0.005	0.054	0.056	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		0.05	0.13	0.08	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		0.23	0.57	0.56	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		0.23	0.57	0.56	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		0.1	0.5	0.6	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		0.3	1.1	1.2	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		0.26	0.01	0.02	----	----
EP020: Oil and Grease (O&G)									
Oil & Grease	----	5	mg/L		<5	7	<5	----	----
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		<2	2	3	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	670	680	----	----
C10 - C14 Fraction	----	50	µg/L		<50	110	130	----	----
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	DAT 2	DIFT 2	Duplicate	----	----
			Sampling date / time	21-Feb-2022 00:00	21-Feb-2022 00:00	21-Feb-2022 00:00	----	----
Compound	CAS Number	LOR	Unit	ES2205893-001	ES2205893-002	ES2205893-003	--------	--------
				Result	Result	Result	----	----
EP080/071: Total Petroleum Hydrocarbons - Continued								
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	110	130	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	710	720	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	210	230	----	----
>C10 - C16 Fraction	----	100	µg/L	<100	100	120	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	100	120	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	<100	110	----	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	50	50	----	----
Toluene	108-88-3	2	µg/L	<2	331	321	----	----
Ethylbenzene	100-41-4	2	µg/L	<2	8	8	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	50	49	----	----
ortho-Xylene	95-47-6	2	µg/L	<2	65	65	----	----
^ Total Xylenes	----	2	µg/L	<2	115	114	----	----
^ Sum of BTEX	----	1	µg/L	<1	504	493	----	----
Naphthalene	91-20-3	5	µg/L	<5	7	7	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	<0.02	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	<0.02	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	<0.01	<0.01	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	<0.02	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	<0.01	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	<0.02	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	DAT 2	DIFT 2	Duplicate	----	----
				Sampling date / time	21-Feb-2022 00:00	21-Feb-2022 00:00	21-Feb-2022 00:00	----	----
Compound	CAS Number	LOR	Unit		ES2205893-001	ES2205893-002	ES2205893-003	--------	--------
					Result	Result	Result	----	----
EP231B: Perfluoroalkyl Carboxylic Acids - Continued									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	**1.2**	**1.2**	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		<0.02	**5.40**	**5.40**	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		<0.02	**7.10**	**7.41**	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		<0.02	**2.48**	**2.37**	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		<0.01	**2.68**	**2.73**	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<0.02	**0.18**	**0.15**	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	**0.08**	**0.07**	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	<0.02	<0.02	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	<0.02	<0.02	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	<0.02	<0.02	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	<0.05	<0.05	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.02	<0.02	<0.02	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.05	<0.05	<0.05	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	<0.05	<0.05	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	<0.05	<0.05	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	<0.05	<0.05	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	<0.02	<0.02	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	<0.02	<0.02	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	**0.06**	**0.06**	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	DAT 2	DIFT 2	Duplicate	----	----
				Sampling date / time	21-Feb-2022 00:00	21-Feb-2022 00:00	21-Feb-2022 00:00	----	----
Compound	CAS Number	LOR	Unit		ES2205893-001	ES2205893-002	ES2205893-003	--------	--------
					Result	Result	Result	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued									
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	**49.2**	**47.8**	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	**8.90**	**8.71**	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	**0.12**	**0.12**	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		<0.01	**77.4**	**76.0**	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		<0.01	<0.01	<0.01	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		<0.01	**77.0**	**75.6**	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**107**	**108**	**109**	----	----
Toluene-D8	2037-26-5	2	%		**102**	**107**	**107**	----	----
4-Bromofluorobenzene	460-00-4	2	%		**103**	**105**	**104**	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**96.7**	**99.4**	**101**	----	----
13C8-PFOA	----	0.02	%		**93.8**	**103**	**107**	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

QUALITY CONTROL REPORT

Work Order	: **ES2205893**	Page	: 1 of 7
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Vasillea Milsom	Contact	: Sarah Mathew
Address	: Level 7 24 Mitchell Street DARWIN NT, AUSTRALIA 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Vopak ENV Monitoring	Date Samples Received	: 22-Feb-2022
Order number	: ----	Date Analysis Commenced	: 22-Feb-2022
C-O-C number	: ----	Issue Date	: 01-Mar-2022
Sampler	: Vasillea Milsom		
Site	: ----		
Quote number	: SY/542/21 V3		
No. of samples received	: 3		
No. of samples analysed	: 3		

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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 4196941)									
ES2205893-001	DAT 2	EA025H: Suspended Solids (SS)	----	5	mg/L	5	<5	0.0	No Limit
ES2206049-002	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	9	59.6	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4194672)									
ES2205893-001	DAT 2	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
ES2206122-002	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.004	0.004	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.008	0.008	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 4194671)									
ES2206069-010	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
ES2205893-001	DAT 2	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 4196957)									
ES2205586-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.22	0.25	14.6	No Limit
ES2206035-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.30	0.30	0.0	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 4188898)									
ES2205893-001	DAT 2	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 4196958)									
ES2205586-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.47	0.47	0.0	0% - 20%
ES2206035-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.07	0.07	0.0	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4196954)									
ES2205586-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.7	0.8	0.0	No Limit
ES2206011-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	3.4	3.5	0.0	0% - 50%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 4196953)									
ES2205586-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.05	<0.05	0.0	No Limit
ES2206011-002	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.16	0.16	0.0	0% - 50%
EP030: Biochemical Oxygen Demand (BOD) (QC Lot: 4190648)									
ES2205893-001	DAT 2	EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	4	66.7	No Limit
ES2206094-002	Anonymous	EP030: Biochemical Oxygen Demand	----	2	mg/L	2	7	111	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4192728)									
ES2205893-001	DAT 2	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
ES2206047-001	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	70	60	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4192728)									
ES2205893-001	DAT 2	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
ES2206047-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	80	70	0.0	No Limit
EP080: BTEXN (QC Lot: 4192728)									
ES2205893-001	DAT 2	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
ES2206047-001	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (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 Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 4196941)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	106	83.0	129
				<5	1000 mg/L	103	82.0	110
				<5	463 mg/L	100	83.0	118
EG020F: Dissolved Metals by ICP-MS (QCLot: 4194672)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	97.0	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	93.6	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	94.1	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	95.1	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	95.9	83.0	111
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	95.1	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	94.4	81.0	117
EG035F: Dissolved Mercury by FIMS (QCLot: 4194671)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	90.7	83.0	105
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4196957)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	109	90.0	114
EK057G: Nitrite as N by Discrete Analyser (QCLot: 4188898)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	103	82.0	114
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4196958)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	101	91.0	113
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4196954)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	91.7	69.0	101
				<0.1	1 mg/L	98.7	70.0	118
				<0.1	5 mg/L	114	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4196953)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	91.5	71.3	126
				<0.01	0.442 mg/L	99.3	71.3	126
				<0.01	1 mg/L	116	71.3	126
EP020: Oil and Grease (O&G) (QCLot: 4197725)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	108	81.0	121
EP030: Biochemical Oxygen Demand (BOD) (QCLot: 4190648)								
EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	200 mg/L	102	74.0	112
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4189676)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	400 µg/L	64.3	55.8	112

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4189676) - continued								
EP071: C15 - C28 Fraction	----	100	µg/L	<100	600 µg/L	96.7	71.6	113
EP071: C29 - C36 Fraction	----	50	µg/L	<50	400 µg/L	87.7	56.0	121
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4192728)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	101	75.0	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4189676)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	500 µg/L	67.2	57.9	119
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	700 µg/L	101	62.5	110
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	300 µg/L	84.4	61.5	121
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4192728)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	103	75.0	127
EP080: BTEXN (QCLot: 4192728)								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	102	70.0	122
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	111	69.0	123
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	108	70.0	120
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	106	69.0	121
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	114	72.0	122
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	119	70.0	120
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4193491)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.25 µg/L	105	72.0	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.25 µg/L	95.2	71.0	127
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	0.25 µg/L	93.0	68.0	131
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.25 µg/L	97.0	69.0	134
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.25 µg/L	92.2	65.0	140
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.25 µg/L	98.2	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4193491)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	102	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	100	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	117	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	104	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	101	71.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.25 µg/L	92.8	69.0	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.25 µg/L	97.6	71.0	129
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.25 µg/L	100	69.0	133
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.25 µg/L	105	72.0	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.25 µg/L	102	65.0	144
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	0.625 µg/L	114	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4193491)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4193491) - continued								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.25 µg/L	100	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	0.625 µg/L	110	68.0	141
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	0.625 µg/L	99.4	62.6	147
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	0.625 µg/L	91.8	66.0	145
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	0.625 µg/L	88.2	57.6	145
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.25 µg/L	100	65.0	136
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.25 µg/L	101	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4193491)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.25 µg/L	109	63.0	143
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.25 µg/L	106	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.25 µg/L	102	67.0	138
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.25 µg/L	98.0	71.4	144

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: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4194672)							
ES2205893-002	DIFT 2	EG020A-F: Arsenic	7440-38-2	1 mg/L	112	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	117	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	118	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	118	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	118	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	116	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	118	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 4194671)							
ES2205623-001	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	86.6	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4196957)							
ES2205586-001	Anonymous	EK055G: Ammonia as N	7664-41-7	10 mg/L	95.3	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 4188898)							
ES2205893-001	DAT 2	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	111	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4196958)							
ES2205586-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	95.9	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4196954)							
ES2205586-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	25 mg/L	105	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4196953)							
ES2205586-002	Anonymous	EK067G: Total Phosphorus as P	----	5 mg/L	109	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4192728)							
ES2205893-001	DAT 2	EP080: C6 - C9 Fraction	----	325 µg/L	110	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4192728)							
ES2205893-001	DAT 2	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	109	70.0	130
EP080: BTEXN (QCLot: 4192728)							
ES2205893-001	DAT 2	EP080: Benzene	71-43-2	25 µg/L	104	70.0	130
		EP080: Toluene	108-88-3	25 µg/L	112	70.0	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	109	70.0	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	25 µg/L	105	70.0	130
		EP080: ortho-Xylene	95-47-6	25 µg/L	118	70.0	130
		EP080: Naphthalene	91-20-3	25 µg/L	108	70.0	130

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2205893**	Page	: 1 of 8
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Vasillea Milsom	Telephone	: +61-2-8784 8555
Project	: Vopak ENV Monitoring	Date Samples Received	: 22-Feb-2022
Site	: ----	Issue Date	: 01-Mar-2022
Sampler	: Vasillea Milsom	No. of samples received	: 3
Order number	: ----	No. of samples analysed	: 3

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count QC	Count Regular	Rate (%) Actual	Rate (%) Expected	Quality Control Specification
Laboratory Duplicates (DUP)					
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	0	19	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	16	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	0	19	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	16	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: **WATER**

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

Method / ***Container*** / Client Sample ID(s)	***Sample Date***	*Extraction / Preparation* ***Date extracted***	*Due for extraction*	*Evaluation*	*Analysis* ***Date analysed***	*Due for analysis*	*Evaluation*
EA025: Total Suspended Solids dried at 104 ± 2°C							
Clear Plastic Bottle - Natural (EA025H)							
DAT 2, DIFT 2, Duplicate	**21-Feb-2022**	**----**	----	----	**26-Feb-2022**	28-Feb-2022	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)							
DAT 2, DIFT 2, Duplicate	**21-Feb-2022**	**----**	----	----	**25-Feb-2022**	20-Aug-2022	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F)							
DAT 2, DIFT 2, Duplicate	**21-Feb-2022**	**----**	----	----	**25-Feb-2022**	21-Mar-2022	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
DAT 2, DIFT 2, Duplicate	**21-Feb-2022**	**----**	----	----	**26-Feb-2022**	21-Mar-2022	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
DAT 2, DIFT 2, Duplicate	**21-Feb-2022**	**----**	----	----	**22-Feb-2022**	23-Feb-2022	✓

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
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G)								
DAT 2, Duplicate	DIFT 2,	**21-Feb-2022**	**----**	----	----	**26-Feb-2022**	21-Mar-2022	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK061G)								
DAT 2, Duplicate	DIFT 2,	**21-Feb-2022**	**26-Feb-2022**	21-Mar-2022	✓	**26-Feb-2022**	21-Mar-2022	✓
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G)								
DAT 2, Duplicate	DIFT 2,	**21-Feb-2022**	**26-Feb-2022**	21-Mar-2022	✓	**26-Feb-2022**	21-Mar-2022	✓
EP020: Oil and Grease (O&G)								
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EP020)								
DAT 2, Duplicate	DIFT 2,	**21-Feb-2022**	**----**	----	----	**28-Feb-2022**	21-Mar-2022	✓
EP030: Biochemical Oxygen Demand (BOD)								
Clear Plastic Bottle - Natural (EP030)								
DAT 2, Duplicate	DIFT 2,	**21-Feb-2022**	**----**	----	----	**23-Feb-2022**	23-Feb-2022	✓
EP080/071: Total Petroleum Hydrocarbons								
Amber Glass Bottle - Unpreserved (EP071)								
DAT 2, Duplicate	DIFT 2,	**21-Feb-2022**	**23-Feb-2022**	28-Feb-2022	✓	**25-Feb-2022**	04-Apr-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080)								
DAT 2, Duplicate	DIFT 2,	**21-Feb-2022**	**25-Feb-2022**	07-Mar-2022	✓	**25-Feb-2022**	07-Mar-2022	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
Amber Glass Bottle - Unpreserved (EP071)								
DAT 2, Duplicate	DIFT 2,	**21-Feb-2022**	**23-Feb-2022**	28-Feb-2022	✓	**25-Feb-2022**	04-Apr-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080)								
DAT 2, Duplicate	DIFT 2,	**21-Feb-2022**	**25-Feb-2022**	07-Mar-2022	✓	**25-Feb-2022**	07-Mar-2022	✓
EP080: BTEXN								
Amber VOC Vial - Sulfuric Acid (EP080)								
DAT 2, Duplicate	DIFT 2,	**21-Feb-2022**	**25-Feb-2022**	07-Mar-2022	✓	**25-Feb-2022**	07-Mar-2022	✓
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE (no PTFE) (EP231X)								
DAT 2, Duplicate	DIFT 2,	**21-Feb-2022**	**25-Feb-2022**	20-Aug-2022	✓	**25-Feb-2022**	20-Aug-2022	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X)								
DAT 2, Duplicate	DIFT 2,	**21-Feb-2022**	**25-Feb-2022**	20-Aug-2022	✓	**25-Feb-2022**	20-Aug-2022	✓
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X)								
DAT 2, Duplicate	DIFT 2,	**21-Feb-2022**	**25-Feb-2022**	20-Aug-2022	✓	**25-Feb-2022**	20-Aug-2022	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X)								
DAT 2, Duplicate	DIFT 2,	**21-Feb-2022**	**25-Feb-2022**	20-Aug-2022	✓	**25-Feb-2022**	20-Aug-2022	✓
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X)								
DAT 2, Duplicate	DIFT 2,	**21-Feb-2022**	**25-Feb-2022**	20-Aug-2022	✓	**25-Feb-2022**	20-Aug-2022	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Ammonia as N by Discrete analyser	EK055G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	2	9	**22.22**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	0	19	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	16	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Ammonia as N by Discrete analyser	EK055G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	0	19	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	16	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Oil and Grease	EP020	WATER	In house: Referenced to APHA 5520 B. Oil & grease is a gravimetric procedure to determine the amount of oil & grease residue in an aqueous sample. The sample is serially extracted three times n-hexane. The resultant extracts are combined, dehydrated and concentrated prior to gravimetric determination. This method is compliant with NEPM Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Biochemical Oxygen Demand (BOD)	EP030	WATER	In house: Referenced to APHA 5210 B. The 5-Day BOD test provides an empirical measure of the oxygen consumption capacity of a given water. A portion of the sample is diluted into oxygenated, nutrient rich water, and a seed added to begin biological decay. The initial dissolved oxygen content is measured, then the bottle is sealed and incubated for five days. The remaining dissolved oxygen is measured, and from the difference, the demand for oxygen, by biological decay, is determined. This method is compliant with NEPM Schedule B(3).
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.
Solid Phase Extraction (SPE) for PFAS in water	ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2208856**	Page	: 1 of 7
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: VASILLEA MILSOM	Contact	: Sarah Mathew
Address	: Level 7 24 Mitchell Street DARWIN NT, AUSTRALIA 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 12566143	Date Samples Received	: 17-Mar-2022 07:30
Order number	: ----	Date Analysis Commenced	: 17-Mar-2022
C-O-C number	: ----	Issue Date	: 24-Mar-2022 12:46
Sampler	: Vasillea Misom		
Site	: ----		
Quote number	: SY/542/21 V3		
No. of samples received	: 2		
No. of samples analysed	: 2		

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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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 - Per- and Polyfluoroalkyl Substances (PFAS): Samples received in 20ml or 125ml bottles have been tested in accordance with the QSM5.3 compliant, NATA accredited method. 60mL or 250mL bottles have been tested to the legacy QSM 5.1 aligned, NATA accredited method.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. 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. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	6 series	DIFT 1	----	----	----
				Sampling date / time	14-Mar-2022 00:00	14-Mar-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES2208856-001	ES2208856-002	--------	--------	--------
					Result	Result	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		<5	<5	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		**0.001**	**0.002**	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L		**0.001**	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	----	----	----
Nickel	7440-02-0	0.001	mg/L		<0.001	<0.001	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L		<0.005	**0.045**	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.14**	**0.27**	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.22**	**0.12**	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.22**	**0.12**	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**0.2**	**0.4**	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**0.4**	**0.5**	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		<0.01	<0.01	----	----	----
EP020: Oil and Grease (O&G)									
Oil & Grease	----	5	mg/L		<5	<5	----	----	----
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		<2	<2	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	----	----	----
C10 - C14 Fraction	----	50	µg/L		<50	<50	----	----	----
C15 - C28 Fraction	----	100	µg/L		<100	<100	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	6 series	DIFT 1	----	----	----
				Sampling date / time	14-Mar-2022 00:00	14-Mar-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES2208856-001	ES2208856-002	--------	--------	--------
					Result	Result	----	----	----
EP080/071: Total Petroleum Hydrocarbons - Continued									
C29 - C36 Fraction	----	50	µg/L		<50	<50	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	<20	----	----	----
>C10 - C16 Fraction	----	100	µg/L		<100	<100	----	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	----	----	----
Toluene	108-88-3	2	µg/L		<2	<2	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	----	----	----
^ Total Xylenes	----	2	µg/L		<2	<2	----	----	----
^ Sum of BTEX	----	1	µg/L		<1	<1	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	<5	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L		<0.01	<0.01	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		<0.01	**0.01**	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	<0.02	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	6 series	DIFT 1	----	----	----
				Sampling date / time	14-Mar-2022 00:00	14-Mar-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES2208856-001	ES2208856-002	--------	--------	--------
					Result	Result	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids - Continued									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	**0.2**	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		<0.02	**1.05**	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		<0.02	**1.41**	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		<0.02	**0.42**	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		<0.01	**0.64**	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<0.02	**0.04**	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	**0.02**	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	<0.05	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.02	<0.02	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.05	<0.05	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	<0.05	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	<0.05	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	<0.05	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	<0.02	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	<0.02	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	<0.05	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	6 series	DIFT 1	----	----	----
				Sampling date / time	14-Mar-2022 00:00	14-Mar-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES2208856-001	ES2208856-002	--------	--------	--------
					Result	Result	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued									
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	**12.8**	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	**2.41**	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	**0.06**	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		<0.01	**19.1**	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		<0.01	**0.01**	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		<0.01	**18.9**	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**113**	**114**	----	----	----
Toluene-D8	2037-26-5	2	%		**104**	**105**	----	----	----
4-Bromofluorobenzene	460-00-4	2	%		**108**	**109**	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**101**	**101**	----	----	----
13C8-PFOA	----	0.02	%		**98.6**	**99.9**	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

QUALITY CONTROL REPORT

Work Order	: **ES2208856**	Page	: 1 of 7
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: VASILLEA MILSOM	Contact	: Sarah Mathew
Address	: Level 7 24 Mitchell Street DARWIN NT, AUSTRALIA 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 12566143	Date Samples Received	: 17-Mar-2022
Order number	: ----	Date Analysis Commenced	: 17-Mar-2022
C-O-C number	: ----	Issue Date	: 24-Mar-2022
Sampler	: Vasillea Misom		
Site	: ----		
Quote number	: SY/542/21 V3		
No. of samples received	: 2		
No. of samples analysed	: 2		

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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 4238632)									
ES2208856-001	6 series	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.0	No Limit
ES2209253-004	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	524	586	11.3	0% - 20%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4234691)									
ES2208954-006	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.005	0.005	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
ES2208857-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.002	0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.011	0.011	0.0	0% - 50%
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.035	0.036	0.0	0% - 20%
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.008	0.008	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 4234690)									
ES2208856-001	6 series	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
ES2208957-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 4238096)									
ES2208856-001	6 series	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.14	0.14	0.0	0% - 50%
ES2209274-003	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.07	0.07	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 4233813)									
ES2209366-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES2209159-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	0.02	0.02	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 4238097)									
ES2208856-001	6 series	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.22	0.22	0.0	0% - 20%
ES2209274-003	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.06	0.06	0.0	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4238093)									
ES2208856-001	6 series	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.2	0.2	0.0	No Limit
ES2209274-002	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.6	0.6	0.0	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 4238092)									
ES2208856-001	6 series	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES2209274-002	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.22	0.19	13.4	0% - 50%
EP030: Biochemical Oxygen Demand (BOD) (QC Lot: 4233835)									
ES2208856-001	6 series	EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	<2	0.0	0% - 20%
ES2209335-001	Anonymous	EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	<2	0.0	0% - 20%
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4239174)									
ES2208856-001	6 series	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
ES2209411-002	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4239174)									
ES2208856-001	6 series	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
ES2209411-002	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP080: BTEXN (QC Lot: 4239174)									
ES2208856-001	6 series	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
ES2209411-002	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (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 Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 4238632)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	104	83.0	129
				<5	1000 mg/L	93.9	82.0	110
				<5	463 mg/L	100	83.0	118
EG020F: Dissolved Metals by ICP-MS (QCLot: 4234691)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	96.9	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	95.1	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	94.1	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	95.8	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	93.2	83.0	111
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	96.6	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	95.6	81.0	117
EG035F: Dissolved Mercury by FIMS (QCLot: 4234690)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	94.0	83.0	105
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4238096)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	102	90.0	114
EK057G: Nitrite as N by Discrete Analyser (QCLot: 4233813)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	101	82.0	114
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4238097)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	102	91.0	113
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4238093)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	90.4	69.0	101
				<0.1	1 mg/L	96.2	70.0	118
				<0.1	5 mg/L	97.6	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4238092)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	86.0	71.3	126
				<0.01	0.442 mg/L	86.2	71.3	126
				<0.01	1 mg/L	94.9	71.3	126
EP020: Oil and Grease (O&G) (QCLot: 4241403)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	86.9	81.0	121
EP030: Biochemical Oxygen Demand (BOD) (QCLot: 4233835)								
EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	200 mg/L	93.5	74.0	112
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4233075)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	400 µg/L	59.5	55.8	112

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4233075) - continued								
EP071: C15 - C28 Fraction	----	100	µg/L	<100	600 µg/L	87.7	71.6	113
EP071: C29 - C36 Fraction	----	50	µg/L	<50	400 µg/L	110	56.0	121
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4239174)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	89.2	75.0	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4233075)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	500 µg/L	64.8	57.9	119
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	700 µg/L	99.1	62.5	110
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	300 µg/L	103	61.5	121
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4239174)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	91.3	75.0	127
EP080: BTEXN (QCLot: 4239174)								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	104	70.0	122
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	103	69.0	123
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	101	70.0	120
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	101	69.0	121
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	104	72.0	122
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	108	70.0	120
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4240084)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.25 µg/L	105	72.0	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.25 µg/L	101	71.0	127
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	0.25 µg/L	102	68.0	131
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.25 µg/L	107	69.0	134
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.25 µg/L	89.4	65.0	140
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.25 µg/L	93.2	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4240084)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	93.7	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	91.4	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	118	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	91.0	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	100	71.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.25 µg/L	91.4	69.0	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.25 µg/L	102	71.0	129
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.25 µg/L	93.0	69.0	133
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.25 µg/L	107	72.0	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.25 µg/L	81.6	65.0	144
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	0.625 µg/L	127	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4240084)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4240084) - continued								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.25 µg/L	95.6	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	0.625 µg/L	104	68.0	141
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	0.625 µg/L	92.0	62.6	147
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	0.625 µg/L	97.3	66.0	145
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	0.625 µg/L	99.7	57.6	145
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.25 µg/L	88.2	65.0	136
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.25 µg/L	80.4	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4240084)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.25 µg/L	96.2	63.0	143
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.25 µg/L	105	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.25 µg/L	98.0	67.0	138
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.25 µg/L	92.0	71.4	144

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: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4234691)							
ES2208856-001	6 series	EG020A-F: Arsenic	7440-38-2	1 mg/L	91.2	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	92.2	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	92.0	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	91.0	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	107	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	91.4	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	90.9	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 4234690)							
ES2208531-002	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	83.3	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4238096)							
ES2208856-001	6 series	EK055G: Ammonia as N	7664-41-7	1 mg/L	98.2	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 4233813)							
ES2209159-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	111	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4238097)							
ES2208856-001	6 series	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	94.3	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4238093)							
ES2208856-002	DIFT 1	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	96.7	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4238092)							
ES2208856-002	DIFT 1	EK067G: Total Phosphorus as P	----	1 mg/L	98.6	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4239174)							
ES2208856-001	6 series	EP080: C6 - C9 Fraction	----	325 µg/L	94.5	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4239174)							
ES2208856-001	6 series	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	96.6	70.0	130
EP080: BTEXN (QCLot: 4239174)							
ES2208856-001	6 series	EP080: Benzene	71-43-2	25 µg/L	82.1	70.0	130
		EP080: Toluene	108-88-3	25 µg/L	86.6	70.0	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	91.8	70.0	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	25 µg/L	91.2	70.0	130
		EP080: ortho-Xylene	95-47-6	25 µg/L	95.3	70.0	130
		EP080: Naphthalene	91-20-3	25 µg/L	92.8	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2208856**	Page	: 1 of 8
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: VASILLEA MILSOM	Telephone	: +61-2-8784 8555
Project	: 12566143	Date Samples Received	: 17-Mar-2022
Site	: ----	Issue Date	: 24-Mar-2022
Sampler	: Vasillea Misom	No. of samples received	: 2
Order number	: ----	No. of samples analysed	: 2

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)		Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA025: Total Suspended Solids dried at 104 ± 2°C							
Clear Plastic Bottle - Natural							
6 series,	DIFT 1	----	----	----	22-Mar-2022	21-Mar-2022	**1**
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural							
6 series,	DIFT 1	----	----	----	17-Mar-2022	16-Mar-2022	**1**
EP030: Biochemical Oxygen Demand (BOD)							
Clear Plastic Bottle - Natural							
6 series,	DIFT 1	----	----	----	17-Mar-2022	16-Mar-2022	**1**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	0	19	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	2	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	0	19	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	2	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: **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
EA025: Total Suspended Solids dried at 104 ± 2°C								
Clear Plastic Bottle - Natural (EA025H)								
6 series,	DIFT 1	**14-Mar-2022**	**----**	----	----	**22-Mar-2022**	21-Mar-2022	×
EG020F: Dissolved Metals by ICP-MS								
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)								
6 series,	DIFT 1	**14-Mar-2022**	**----**	----	----	**18-Mar-2022**	10-Sep-2022	✓

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
EG035F: Dissolved Mercury by FIMS								
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F)								
6 series,	DIFT 1	**14-Mar-2022**	**----**	----	----	**18-Mar-2022**	11-Apr-2022	✓
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G)								
6 series,	DIFT 1	**14-Mar-2022**	**----**	----	----	**21-Mar-2022**	11-Apr-2022	✓
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G)								
6 series,	DIFT 1	**14-Mar-2022**	**----**	----	----	**17-Mar-2022**	16-Mar-2022	×
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G)								
6 series,	DIFT 1	**14-Mar-2022**	**----**	----	----	**21-Mar-2022**	11-Apr-2022	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK061G)								
6 series,	DIFT 1	**14-Mar-2022**	**21-Mar-2022**	11-Apr-2022	✓	**21-Mar-2022**	11-Apr-2022	✓
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G)								
6 series,	DIFT 1	**14-Mar-2022**	**21-Mar-2022**	11-Apr-2022	✓	**21-Mar-2022**	11-Apr-2022	✓
EP020: Oil and Grease (O&G)								
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EP020)								
6 series,	DIFT 1	**14-Mar-2022**	**----**	----	----	**22-Mar-2022**	11-Apr-2022	✓
EP030: Biochemical Oxygen Demand (BOD)								
Clear Plastic Bottle - Natural (EP030)								
6 series,	DIFT 1	**14-Mar-2022**	**----**	----	----	**17-Mar-2022**	16-Mar-2022	×
EP080/071: Total Petroleum Hydrocarbons								
Amber Glass Bottle - Unpreserved (EP071)								
6 series,	DIFT 1	**14-Mar-2022**	**17-Mar-2022**	21-Mar-2022	✓	**22-Mar-2022**	26-Apr-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080)								
6 series,	DIFT 1	**14-Mar-2022**	**22-Mar-2022**	28-Mar-2022	✓	**22-Mar-2022**	28-Mar-2022	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
Amber Glass Bottle - Unpreserved (EP071)								
6 series,	DIFT 1	**14-Mar-2022**	**17-Mar-2022**	21-Mar-2022	✓	**22-Mar-2022**	26-Apr-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080)								
6 series,	DIFT 1	**14-Mar-2022**	**22-Mar-2022**	28-Mar-2022	✓	**22-Mar-2022**	28-Mar-2022	✓
EP080: BTEXN								
Amber VOC Vial - Sulfuric Acid (EP080)								
6 series,	DIFT 1	**14-Mar-2022**	**22-Mar-2022**	28-Mar-2022	✓	**22-Mar-2022**	28-Mar-2022	✓
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE (no PTFE) (EP231X)								
6 series,	DIFT 1	**14-Mar-2022**	**22-Mar-2022**	10-Sep-2022	✓	**22-Mar-2022**	10-Sep-2022	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X)								
6 series,	DIFT 1	**14-Mar-2022**	**22-Mar-2022**	10-Sep-2022	✓	**22-Mar-2022**	10-Sep-2022	✓
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X)								
6 series,	DIFT 1	**14-Mar-2022**	**22-Mar-2022**	10-Sep-2022	✓	**22-Mar-2022**	10-Sep-2022	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X)								
6 series,	DIFT 1	**14-Mar-2022**	**22-Mar-2022**	10-Sep-2022	✓	**22-Mar-2022**	10-Sep-2022	✓
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X)								
6 series,	DIFT 1	**14-Mar-2022**	**22-Mar-2022**	10-Sep-2022	✓	**22-Mar-2022**	10-Sep-2022	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Ammonia as N by Discrete analyser	EK055G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	0	19	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	2	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Ammonia as N by Discrete analyser	EK055G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	0	19	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	2	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Oil and Grease	EP020	WATER	In house: Referenced to APHA 5520 B. Oil & grease is a gravimetric procedure to determine the amount of dissolved or emulsified oil & grease residue in an aqueous sample. The sample is serially extracted three times n-hexane. The resultant extracts are combined, dehydrated and concentrated prior to gravimetric determination. This method is compliant with NEPM Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Biochemical Oxygen Demand (BOD)	EP030	WATER	In house: Referenced to APHA 5210 B. The 5-Day BOD test provides an empirical measure of the oxygen consumption capacity of a given water. A portion of the sample is diluted into oxygenated, nutrient rich water, and a seed added to begin biological decay. The initial dissolved oxygen content is measured, then the bottle is sealed and incubated for five days. The remaining dissolved oxygen is measured, and from the difference, the demand for oxygen, by biological decay, is determined. This method is compliant with NEPM Schedule B(3).
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.
Solid Phase Extraction (SPE) for PFAS in water	ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2212961**	Page	: 1 of 20
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: VASILLEA MILSOM	Contact	: Sarah Mathew
Address	: Level 7 24 Mitchell Street DARWIN NT, AUSTRALIA 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Vopak ENV Monitoring	Date Samples Received	: 14-Apr-2022 08:30
Order number	: ----	Date Analysis Commenced	: 16-Apr-2022
C-O-C number	: ----	Issue Date	: 27-Apr-2022 14:17
Sampler	: VASILLEA MILSOM		
Site	: ----		
Quote number	: SY/542/21 V3		
No. of samples received	: 23		
No. of samples analysed	: 22		

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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

- EP075 (SIM): Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP231X - Per- and Polyfluoroalkyl Substances (PFAS): Samples received in 20ml or 125ml bottles have been tested in accordance with the QSM5.3 compliant, NATA accredited method. 60mL or 250mL bottles have been tested to the legacy QSM 5.1 aligned, NATA accredited method.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP080-SD: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EG020: LOR's have been raised due to matrix interference. (High Total Dissolved Solids)
- EG020: LORs have been raised for some samples due to matrix interference (High sample salinity)
- EK067G:LOR raised due to sample matrix.
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. 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. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Soil_1	Soil_2	Soil_3	Soil_4	Soil_5
			Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2212961-014	ES2212961-015	ES2212961-016	ES2212961-017	ES2212961-018
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**17.0**	**27.0**	**13.0**	**18.3**	**32.0**
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	**14.9**	**41.7**	**74.9**	**43.5**	**35.1**
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg	**16.8**	**19.9**	**24.5**	**80.6**	**54.2**
Copper	7440-50-8	1.0	mg/kg	**15.8**	**14.1**	**10.4**	**9.4**	**24.7**
Lead	7439-92-1	1.0	mg/kg	**28.2**	**25.9**	**14.3**	**18.1**	**23.4**
Nickel	7440-02-0	1.0	mg/kg	**4.7**	**3.4**	**2.8**	**3.6**	**11.2**
Zinc	7440-66-6	1.0	mg/kg	**38.7**	**27.1**	**10.8**	**25.2**	**204**
EG035T: Total Recoverable Mercury by FIMS (Low Level)								
Mercury	7439-97-6	0.01	mg/kg	**0.01**	**0.01**	<0.01	<0.01	**0.04**
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	<3	<3	<3
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg	<3.0	<3.0	<3.0	<3.0	<3.0
EP080-SD: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EP080-SD: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	**96.0**	**91.2**	**88.3**	**101**	**69.0**
Toluene-D8	2037-26-5	0.2	%	**109**	**97.1**	**102**	**111**	**75.3**
4-Bromofluorobenzene	460-00-4	0.2	%	**96.5**	**93.6**	**92.6**	**100**	**73.2**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Soil_6	Soil_9	Soil_10	Soil_11	Soil_12
			Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2212961-019	ES2212961-020	ES2212961-021	ES2212961-022	ES2212961-023
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**27.9**	**26.2**	**24.5**	**19.6**	**22.5**
EG020-SD: Total Metals in Sediments by ICPMS								
Arsenic	7440-38-2	1.00	mg/kg	**52.7**	**28.6**	**44.2**	**74.3**	**50.7**
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1.0	mg/kg	**64.1**	**23.4**	**24.1**	**48.8**	**17.3**
Copper	7440-50-8	1.0	mg/kg	**25.9**	**23.8**	**18.3**	**13.1**	**12.9**
Lead	7439-92-1	1.0	mg/kg	**28.4**	**19.6**	**18.1**	**19.1**	**14.0**
Nickel	7440-02-0	1.0	mg/kg	**12.0**	**8.5**	**5.6**	**3.8**	**5.7**
Zinc	7440-66-6	1.0	mg/kg	**81.2**	**54.1**	**45.3**	**13.5**	**29.4**
EG035T: Total Recoverable Mercury by FIMS (Low Level)								
Mercury	7439-97-6	0.01	mg/kg	**0.02**	**0.01**	<0.01	<0.01	<0.01
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
C6 - C10 Fraction	C6_C10	3	mg/kg	<3	<3	<3	<3	<3
C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	3.0	mg/kg	<3.0	<3.0	<3.0	<3.0	<3.0
EP080-SD: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Naphthalene	91-20-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EP080-SD: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	**71.1**	**90.0**	**88.3**	**90.0**	**98.3**
Toluene-D8	2037-26-5	0.2	%	**82.7**	**107**	**97.3**	**108**	**110**
4-Bromofluorobenzene	460-00-4	0.2	%	**77.8**	**94.9**	**84.9**	**91.7**	**93.9**

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	EMB 7	EMB 8	EMB 11	EMB 12	EMB 15
				Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00
					ES2212961-001	ES2212961-002	ES2212961-003	ES2212961-004	ES2212961-005
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	**0.110**	<0.001	**0.002**
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	**0.0001**	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		**0.003**	<0.001	<0.001	**0.006**	**0.017**
Lead	7439-92-1	0.001	mg/L		**0.003**	**0.001**	<0.001	<0.001	**0.008**
Nickel	7440-02-0	0.001	mg/L		**0.002**	**0.002**	<0.001	**0.004**	**0.006**
Zinc	7440-66-6	0.005	mg/L		**0.020**	**0.012**	<0.005	**0.014**	**0.020**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**1.20**	<0.01	**3.58**	**2.47**	**0.06**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	**0.09**
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.66**	**4.64**	<0.01	**0.04**	**0.76**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.66**	**4.64**	<0.01	**0.04**	**0.85**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**2.1**	**1.5**	**5.2**	**3.4**	**1.3**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		**2.8**	**6.1**	**5.2**	**3.4**	**2.2**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.03**	**0.05**	**0.10**	**0.05**	**0.09**
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 7	EMB 8	EMB 11	EMB 12	EMB 15
				Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2212961-001	ES2212961-002	ES2212961-003	ES2212961-004	ES2212961-005
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L		**70**	**70**	**70**	**70**	<50
C15 - C28 Fraction	----	100	µg/L		<100	<100	**110**	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L		**70**	**70**	**180**	**70**	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	<100	**170**	<100	<100
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	**170**	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	<2
^ Total Xylenes	----	2	µg/L		<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L		<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5
EP231A: Perfluoroalkyl Sulfonic Acids									

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	EMB 7	EMB 8	EMB 11	EMB 12	EMB 15
				Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00
					ES2212961-001	ES2212961-002	ES2212961-003	ES2212961-004	ES2212961-005
					Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids - Continued									
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	0.01	µg/L		<0.01	**0.05**	<0.01	<0.01	<0.01
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		<0.01	<0.01	<0.01	<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
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		**1.6**	<0.1	<0.1	**0.2**	<0.1
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		**5.55**	**0.25**	**0.20**	**0.74**	**0.11**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		**14.0**	**0.16**	**0.14**	**0.63**	**0.08**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		**1.57**	**0.07**	**0.08**	**0.29**	**0.07**
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		**3.68**	**0.03**	**0.02**	**0.06**	**0.01**
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		**0.06**	<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
EP231C: Perfluoroalkyl Sulfonamides									
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: WATER (Matrix: WATER)			Sample ID	EMB 7	EMB 8	EMB 11	EMB 12	EMB 15
			Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2212961-001	ES2212961-002	ES2212961-003	ES2212961-004	ES2212961-005
				Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	**0.35**	<0.05	<0.05	<0.05	<0.05
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	**70.0**	<0.05	<0.05	**0.98**	<0.05
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	**0.23**	<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
EP231P: PFAS Sums								
Sum of PFAS	----	0.01	µg/L	**97.0**	**0.56**	**0.44**	**2.90**	**0.27**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	<0.01	**0.05**	<0.01	<0.01	<0.01
Sum of PFAS (WA DER List)	----	0.01	µg/L	**96.6**	**0.56**	**0.44**	**2.90**	**0.27**
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	1.0	%	**20.2**	**24.7**	**28.8**	**17.3**	**26.4**
2-Chlorophenol-D4	93951-73-6	1.0	%	**44.8**	**52.6**	**59.2**	**34.2**	**56.5**
2.4.6-Tribromophenol	118-79-6	1.0	%	**54.8**	**61.4**	**65.2**	**39.3**	**59.9**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	1.0	%	**57.0**	**55.6**	**58.6**	**53.5**	**58.1**
Anthracene-d10	1719-06-8	1.0	%	**68.5**	**61.6**	**63.5**	**64.1**	**61.6**
4-Terphenyl-d14	1718-51-0	1.0	%	**75.8**	**79.7**	**86.7**	**63.2**	**79.3**
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	2	%	**105**	**108**	**135**	**112**	**136**
Toluene-D8	2037-26-5	2	%	**104**	**102**	**118**	**109**	**127**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 7	EMB 8	EMB 11	EMB 12	EMB 15
				Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2212961-001	ES2212961-002	ES2212961-003	ES2212961-004	ES2212961-005
					Result	Result	Result	Result	Result
EP080S: TPH(V)/BTEX Surrogates - Continued									
4-Bromofluorobenzene	460-00-4	2	%		**112**	**109**	**127**	**98.7**	**128**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**99.8**	**83.5**	**101**	**92.3**	**101**
13C8-PFOA	----	0.02	%		**109**	**91.8**	**94.6**	**89.4**	**90.8**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	EMB 16	EMB 6	EMB 4	EMB 1	EMB 2
			Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2212961-006	ES2212961-007	ES2212961-008	ES2212961-009	ES2212961-010
				Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	**0.205**	<0.001	**0.003**	<0.001	**0.002**
Cadmium	7440-43-9	0.0001	mg/L	<0.0010	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	<0.010	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	**0.074**	<0.001	<0.001	<0.001	**0.002**
Lead	7439-92-1	0.001	mg/L	<0.010	<0.001	**0.001**	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	<0.010	<0.001	**0.003**	**0.001**	**0.004**
Zinc	7440-66-6	0.005	mg/L	<0.050	**0.005**	**0.018**	**0.030**	**0.138**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.45**	**6.08**	**0.43**	**2.10**	**1.25**
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	**0.01**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	**0.01**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**1.0**	**7.4**	**1.1**	**2.7**	**2.0**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	**1.0**	**7.4**	**1.1**	**2.7**	**2.0**
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.08**	**0.08**	**0.06**	**0.04**	**0.14**
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	83-32-9	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	86-73-7	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	85-01-8	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	120-12-7	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	206-44-0	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	129-00-0	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Chrysene	218-01-9	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 16	EMB 6	EMB 4	EMB 1	EMB 2
				Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2212961-006	ES2212961-007	ES2212961-008	ES2212961-009	ES2212961-010
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L		<50	<50	**60**	**60**	<50
C15 - C28 Fraction	----	100	µg/L		<100	**170**	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	**170**	**60**	**60**	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	**210**	<100	**110**	<100
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	**210**	<100	**110**	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	<2
^ Total Xylenes	----	2	µg/L		<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L		<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5
EP231A: Perfluoroalkyl Sulfonic Acids									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 16	EMB 6	EMB 4	EMB 1	EMB 2
				Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2212961-006	ES2212961-007	ES2212961-008	ES2212961-009	ES2212961-010
					Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids - Continued									
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	0.01	µg/L		<0.01	<0.01	<0.01	<0.01	<0.01
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		<0.01	<0.01	<0.01	<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
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	**0.3**	**0.8**	**0.6**	**1.2**
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		<0.02	**0.65**	**4.35**	**3.10**	**4.43**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		<0.02	**1.26**	**6.52**	**3.17**	**4.26**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		<0.02	**0.36**	**1.04**	**0.81**	**1.80**
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		<0.01	**0.18**	**1.52**	**0.19**	**0.25**
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<0.02	**0.54**	**0.09**	**0.04**	**0.03**
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	<0.02	**0.06**	<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
EP231C: Perfluoroalkyl Sulfonamides									
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: WATER (Matrix: WATER)			Sample ID	EMB 16	EMB 6	EMB 4	EMB 1	EMB 2
			Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2212961-006	ES2212961-007	ES2212961-008	ES2212961-009	ES2212961-010
				Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	**0.22**	<0.05	<0.05
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	**2.69**	**52.4**	**10.7**	**1.92**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	**0.08**	**2.52**	<0.05	**0.17**
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
EP231P: PFAS Sums								
Sum of PFAS	----	0.01	µg/L	<0.01	**6.06**	**69.5**	**18.6**	**14.1**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Sum of PFAS (WA DER List)	----	0.01	µg/L	<0.01	**5.52**	**69.2**	**18.6**	**14.0**
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	1.0	%	**26.4**	**27.4**	**28.5**	**28.8**	**26.8**
2-Chlorophenol-D4	93951-73-6	1.0	%	**48.4**	**55.8**	**63.4**	**62.2**	**57.5**
2.4.6-Tribromophenol	118-79-6	1.0	%	**49.3**	**66.4**	**67.9**	**73.8**	**60.4**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	1.0	%	**57.4**	**67.7**	**65.4**	**73.8**	**69.5**
Anthracene-d10	1719-06-8	1.0	%	**60.7**	**65.5**	**64.1**	**66.1**	**61.7**
4-Terphenyl-d14	1718-51-0	1.0	%	**69.2**	**83.9**	**83.8**	**96.2**	**82.1**
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	2	%	**129**	**117**	**129**	**131**	**136**
Toluene-D8	2037-26-5	2	%	**112**	**107**	**113**	**115**	**124**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 16	EMB 6	EMB 4	EMB 1	EMB 2
				Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2212961-006	ES2212961-007	ES2212961-008	ES2212961-009	ES2212961-010
					Result	Result	Result	Result	Result
EP080S: TPH(V)/BTEX Surrogates - Continued									
4-Bromofluorobenzene	460-00-4	2	%		**123**	**115**	**122**	**123**	**128**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**94.4**	**95.6**	**99.2**	**92.9**	**97.3**
13C8-PFOA	----	0.02	%		**104**	**104**	**102**	**110**	**104**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 3	Duplicate	----	----	----
				Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES2212961-011	ES2212961-013	--------	--------	--------
					Result	Result	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		**0.010**	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0010	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.010	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L		<0.010	<0.001	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.010	<0.001	----	----	----
Nickel	7440-02-0	0.001	mg/L		<0.010	**0.002**	----	----	----
Zinc	7440-66-6	0.005	mg/L		<0.050	**0.029**	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**1.71**	**1.85**	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	<0.01	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	<0.01	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**1.9**	**2.7**	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ **Total Nitrogen as N**	----	0.1	mg/L		**1.9**	**2.7**	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		<0.05	**0.09**	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	----	----	----
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	----	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	----	----	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	----	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	----	----	----
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 3	Duplicate	----	----	----
				Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES2212961-011	ES2212961-013	--------	--------	--------
					Result	Result	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L		<0.5	<0.5	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	----	----	----
C10 - C14 Fraction	----	50	µg/L		<50	60	----	----	----
C15 - C28 Fraction	----	100	µg/L		<100	<100	----	----	----
C29 - C36 Fraction	----	50	µg/L		<50	<50	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	60	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	<20	----	----	----
>C10 - C16 Fraction	----	100	µg/L		<100	<100	----	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	----	----	----
Toluene	108-88-3	2	µg/L		<2	<2	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	----	----	----
^ Total Xylenes	----	2	µg/L		<2	<2	----	----	----
^ Sum of BTEX	----	1	µg/L		<1	<1	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	<5	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 3	Duplicate	----	----	----
				Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES2212961-011	ES2212961-013	--------	--------	--------
					Result	Result	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids - Continued									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L		<0.01	<0.01	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		<0.01	<0.01	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	<0.02	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		**0.2**	**0.6**	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		**1.33**	**3.06**	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		**1.32**	**3.16**	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		**0.36**	**0.80**	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		**0.15**	**0.20**	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		**0.02**	**0.04**	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	<0.05	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.02	<0.02	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.05	<0.05	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	<0.05	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 3	Duplicate	----	----	----
				Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES2212961-011	ES2212961-013	--------	--------	--------
					Result	Result	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	<0.05	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	<0.05	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	<0.02	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	<0.02	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	<0.05	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		**1.72**	**13.0**	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		**0.20**	<0.05	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	<0.05	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		**5.30**	**20.9**	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		<0.01	<0.01	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		**5.28**	**20.8**	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		**27.8**	**26.9**	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%		**54.6**	**59.4**	----	----	----
2.4.6-Tribromophenol	118-79-6	1.0	%		**61.6**	**58.0**	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1.0	%		**68.5**	**74.4**	----	----	----
Anthracene-d10	1719-06-8	1.0	%		**63.5**	**64.3**	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		**86.2**	**85.7**	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**137**	**125**	----	----	----
Toluene-D8	2037-26-5	2	%		**122**	**131**	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB 3	Duplicate	----	----	----
				Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES2212961-011	ES2212961-013	--------	--------	--------
					Result	Result	----	----	----
EP080S: TPH(V)/BTEX Surrogates - Continued									
4-Bromofluorobenzene	460-00-4	2	%		**119**	**126**	**----**	**----**	**----**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**92.1**	**94.6**	**----**	**----**	**----**
13C8-PFOA	----	0.02	%		**111**	**101**	**----**	**----**	**----**

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP080-SD: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	67	137
Toluene-D8	2037-26-5	74	134
4-Bromofluorobenzene	460-00-4	73	137

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES2212961**	Page	: 1 of 16
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: VASILLEA MILSOM	Contact	: Sarah Mathew
Address	: Level 7 24 Mitchell Street DARWIN NT, AUSTRALIA 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Vopak ENV Monitoring	Date Samples Received	: 14-Apr-2022
Order number	: ----	Date Analysis Commenced	: 16-Apr-2022
C-O-C number	: ----	Issue Date	: 27-Apr-2022
Sampler	: VASILLEA MILSOM		
Site	: ----		
Quote number	: SY/542/21 V3		
No. of samples received	: 23		
No. of samples analysed	: 22		

ilac-MRA NATA
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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QC Lot: 4296860)									
ES2212961-014	Soil_1	EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	0.01	0.01	0.0	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 4296873)									
ES2212961-016	Soil_3	EA055: Moisture Content	----	0.1	%	13.0	13.5	3.6	0% - 20%
ES2212965-022	Anonymous	EA055: Moisture Content	----	0.1	%	15.4	15.5	0.0	0% - 50%
EG020-SD: Total Metals in Sediments by ICPMS (QC Lot: 4296861)									
ES2212961-014	Soil_1	EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020-SD: Arsenic	7440-38-2	1	mg/kg	14.9	14.9	0.2	0% - 50%
		EG020-SD: Chromium	7440-47-3	1	mg/kg	16.8	17.8	5.9	0% - 50%
		EG020-SD: Copper	7440-50-8	1	mg/kg	15.8	15.1	4.5	0% - 50%
		EG020-SD: Lead	7439-92-1	1	mg/kg	28.2	26.9	4.6	0% - 20%
		EG020-SD: Nickel	7440-02-0	1	mg/kg	4.7	4.6	2.3	No Limit
		EG020-SD: Zinc	7440-66-6	1	mg/kg	38.7	35.2	9.4	0% - 20%
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 4296298)									
ES2212961-014	Soil_1	EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
EP080-SD: BTEXN (QC Lot: 4296298)									
ES2212961-014	Soil_1	EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	<0.2	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4295794)									
ES2212961-001	EMB 7	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.003	0.003	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.003	0.003	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.020	0.020	0.0	No Limit
ES2212961-011	EMB 3	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0010	<0.0010	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.010	<0.010	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.010	<0.010	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.010	<0.010	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.010	<0.010	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.010	<0.010	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.050	<0.050	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 4295792)									
ES2212950-003	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
ES2212950-010	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 4295796)									
ES2212961-004	EMB 12	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
ES2212961-013	Duplicate	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 4295636)									
ES2212961-001	EMB 7	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	1.20	1.18	1.7	0% - 20%
ES2212961-010	EMB 2	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	1.25	1.26	1.0	0% - 20%
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 4290150)									
ES2212961-001	EMB 7	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES2213008-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 4295637)									
ES2212961-001	EMB 7	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.66	0.66	0.0	0% - 20%
ES2212961-010	EMB 2	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.01	0.01	0.0	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4295633)									
ES2212961-001	EMB 7	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	2.1	2.1	0.0	0% - 50%
ES2212961-011	EMB 3	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.9	2.5	25.9	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 4295632)									
ES2212961-001	EMB 7	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.03	0.03	0.0	No Limit
ES2212961-011	EMB 3	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.05	0.12	82.4	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4291464)									
ES2212961-001	EMB 7	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
ES2213254-001	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4291464)									
ES2212961-001	EMB 7	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
ES2213254-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP080: BTEXN (QC Lot: 4291464)									
ES2212961-001	EMB 7	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
ES2213254-001	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4300437)									
ES2213765-002	Anonymous	EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	0.02	0.01	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.03	0.02	0.0	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
ES2213767-002	Anonymous	EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	0.04	0.05	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.06	0.07	19.4	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4300443)									
ES2213066-001	Anonymous	EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	0.06	0.05	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.07	0.06	0.0	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
ES2213066-004	Anonymous	EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	0.01	0.02	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.02	0.02	0.0	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4300443) - continued									
ES2213066-004	Anonymous	EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4300437)									
ES2213765-002	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
ES2213767-002	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.06	0.06	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4300443)									
ES2213066-001	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.03	<0.02	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
ES2213066-004	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4300443) - continued									
ES2213066-004	Anonymous	EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4300437)									
ES2213765-002	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
ES2213767-002	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4300443)									
ES2213066-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4300443) - continued									
ES2213066-001	Anonymous	EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
ES2213066-004	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 4300437)									
ES2213765-002	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
ES2213767-002	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 4300443)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 4300443) - continued									
ES2213066-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
ES2213066-004	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231P: PFAS Sums (QC Lot: 4300437)									
ES2213765-002	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	0.05	0.03	50.0	No Limit
ES2213767-002	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	0.16	0.18	11.8	0% - 50%
EP231P: PFAS Sums (QC Lot: 4300443)									
ES2213066-001	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	0.16	0.11	37.0	0% - 50%
ES2213066-004	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	0.03	0.04	28.6	No Limit

Method Blank (MB) and Laboratory Control Sample (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 Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 4296860)								
EG035T-LL: Mercury	7439-97-6	0.01	mg/kg	<0.01	0.087 mg/kg	88.5	72.0	116
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 4296861)								
EG020-SD: Arsenic	7440-38-2	1	mg/kg	<1.00	110 mg/kg	96.5	80.0	139
EG020-SD: Cadmium	7440-43-9	0.1	mg/kg	<0.1	0.8 mg/kg	94.3	83.0	127
EG020-SD: Chromium	7440-47-3	1	mg/kg	<1.0	20.3 mg/kg	99.6	73.0	130
EG020-SD: Copper	7440-50-8	1	mg/kg	<1.0	49 mg/kg	113	76.0	130
EG020-SD: Lead	7439-92-1	1	mg/kg	<1.0	57.4 mg/kg	92.2	74.0	130
EG020-SD: Nickel	7440-02-0	1	mg/kg	<1.0	14.7 mg/kg	98.2	83.0	130
EG020-SD: Zinc	7440-66-6	1	mg/kg	<1.0	125.8 mg/kg	96.4	82.0	137
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 4296298)								
EP080-SD: C6 - C9 Fraction	----	3	mg/kg	<3	6.2 mg/kg	97.5	61.0	133
EP080-SD: BTEXN (QCLot: 4296298)								
EP080-SD: Benzene	71-43-2	0.2	mg/kg	<0.2	0.2 mg/kg	119	66.0	122
EP080-SD: Toluene	108-88-3	0.2	mg/kg	<0.2	0.2 mg/kg	126	70.0	130
EP080-SD: Ethylbenzene	100-41-4	0.2	mg/kg	<0.2	0.2 mg/kg	124	66.0	126
EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.2	mg/kg	<0.2	0.4 mg/kg	122	59.0	129
EP080-SD: ortho-Xylene	95-47-6	0.2	mg/kg	<0.2	0.2 mg/kg	122	66.0	126

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4295794)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	93.6	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	96.1	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	95.8	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	93.9	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	91.8	83.0	111
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	94.0	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	93.4	81.0	117
EG035F: Dissolved Mercury by FIMS (QCLot: 4295792)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	91.5	83.0	105
EG035F: Dissolved Mercury by FIMS (QCLot: 4295796)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	89.5	83.0	105

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4295636)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	94.7	90.0	114
EK057G: Nitrite as N by Discrete Analyser (QCLot: 4290150)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	101	82.0	114
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4295637)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	102	91.0	113
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4295633)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	98.4	69.0	101
				<0.1	1 mg/L	95.5	70.0	118
				<0.1	5 mg/L	98.9	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4295632)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	93.8	71.3	126
				<0.01	0.442 mg/L	104	71.3	126
				<0.01	1 mg/L	101	71.3	126
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 4291087)								
EP075(SIM): Naphthalene	91-20-3	1	µg/L	<1.0	5 µg/L	68.4	50.0	94.0
EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<1.0	5 µg/L	76.4	63.6	114
EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<1.0	5 µg/L	76.9	62.2	113
EP075(SIM): Fluorene	86-73-7	1	µg/L	<1.0	5 µg/L	77.6	63.9	115
EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<1.0	5 µg/L	77.6	62.6	116
EP075(SIM): Anthracene	120-12-7	1	µg/L	<1.0	5 µg/L	71.9	64.3	116
EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<1.0	5 µg/L	98.0	63.6	118
EP075(SIM): Pyrene	129-00-0	1	µg/L	<1.0	5 µg/L	96.9	63.1	118
EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<1.0	5 µg/L	97.0	64.1	117
EP075(SIM): Chrysene	218-01-9	1	µg/L	<1.0	5 µg/L	85.7	62.5	116
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<1.0	5 µg/L	93.4	61.7	119
EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<1.0	5 µg/L	97.5	63.0	115
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	5 µg/L	94.2	63.3	117
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<1.0	5 µg/L	97.5	59.9	118
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	1	µg/L	<1.0	5 µg/L	97.1	61.2	117
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	1	µg/L	<1.0	5 µg/L	97.1	59.1	118
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4291088)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	400 µg/L	83.3	55.8	112
EP071: C15 - C28 Fraction	----	100	µg/L	<100	600 µg/L	88.9	71.6	113
EP071: C29 - C36 Fraction	----	50	µg/L	<50	400 µg/L	101	56.0	121
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4291464)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	88.9	75.0	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4291088)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4291088) - continued								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	500 µg/L	73.0	57.9	119
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	700 µg/L	90.8	62.5	110
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	300 µg/L	89.9	61.5	121
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4291464)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	89.9	75.0	127
EP080: BTEXN (QCLot: 4291464)								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	94.0	70.0	122
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	97.6	69.0	123
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	103	70.0	120
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	104	69.0	121
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	105	72.0	122
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	102	70.0	120
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4300437)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.25 µg/L	120	72.0	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.25 µg/L	119	71.0	127
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	0.25 µg/L	121	68.0	131
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.25 µg/L	115	69.0	134
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.25 µg/L	114	65.0	140
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.25 µg/L	120	53.0	142
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4300443)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.25 µg/L	110	72.0	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.25 µg/L	89.2	71.0	127
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	0.25 µg/L	89.8	68.0	131
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.25 µg/L	95.8	69.0	134
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.25 µg/L	88.2	65.0	140
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.25 µg/L	86.4	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4300437)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	107	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	118	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	128	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	117	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	118	71.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.25 µg/L	115	69.0	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.25 µg/L	118	71.0	129
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.25 µg/L	123	69.0	133
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.25 µg/L	111	72.0	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.25 µg/L	105	65.0	144

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4300437) - continued								
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	0.625 µg/L	120	71.0	132
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4300443)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	79.5	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	104	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	121	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	107	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	106	71.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.25 µg/L	92.0	69.0	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.25 µg/L	103	71.0	129
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.25 µg/L	101	69.0	133
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.25 µg/L	108	72.0	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.25 µg/L	103	65.0	144
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	0.625 µg/L	115	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4300437)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.25 µg/L	105	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	0.625 µg/L	121	68.0	141
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	0.625 µg/L	105	62.6	147
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	0.625 µg/L	119	66.0	145
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	0.625 µg/L	111	57.6	145
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.25 µg/L	121	65.0	136
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.25 µg/L	117	61.0	135
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4300443)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.25 µg/L	97.2	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	0.625 µg/L	98.6	68.0	141
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	0.625 µg/L	110	62.6	147
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	0.625 µg/L	86.0	66.0	145
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	0.625 µg/L	82.8	57.6	145
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.25 µg/L	91.6	65.0	136
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.25 µg/L	94.8	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4300437)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.25 µg/L	111	63.0	143

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4300437) - continued								
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.25 µg/L	112	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.25 µg/L	106	67.0	138
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.25 µg/L	98.8	71.4	144
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4300443)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.25 µg/L	108	63.0	143
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.25 µg/L	94.6	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.25 µg/L	92.6	67.0	138
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.25 µg/L	81.4	71.4	144

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	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG035T: Total Recoverable Mercury by FIMS (Low Level) (QCLot: 4296860)							
ES2212961-014	Soil_1	EG035T-LL: Mercury	7439-97-6	0.05 mg/kg	94.0	70.0	130
EG020-SD: Total Metals in Sediments by ICPMS (QCLot: 4296861)							
ES2212961-014	Soil_1	EG020-SD: Arsenic	7440-38-2	50 mg/kg	84.0	70.0	130
		EG020-SD: Cadmium	7440-43-9	50 mg/kg	91.2	70.0	130
		EG020-SD: Chromium	7440-47-3	50 mg/kg	89.5	70.0	130
		EG020-SD: Copper	7440-50-8	250 mg/kg	79.6	70.0	130
		EG020-SD: Lead	7439-92-1	250 mg/kg	83.5	70.0	130
		EG020-SD: Nickel	7440-02-0	50 mg/kg	90.3	70.0	130
		EG020-SD: Zinc	7440-66-6	250 mg/kg	87.0	70.0	130
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 4296298)							
ES2212961-014	Soil_1	EP080-SD: C6 - C9 Fraction	----	6.5 mg/kg	130	70.0	130
EP080-SD: BTEXN (QCLot: 4296298)							
ES2212961-014	Soil_1	EP080-SD: Benzene	71-43-2	0.5 mg/kg	124	70.0	130
		EP080-SD: Toluene	108-88-3	0.5 mg/kg	121	70.0	130
		EP080-SD: Ethylbenzene	100-41-4	0.5 mg/kg	122	70.0	130
		EP080-SD: meta- & para-Xylene	108-38-3 106-42-3	0.5 mg/kg	116	70.0	130
		EP080-SD: ortho-Xylene	95-47-6	0.5 mg/kg	118	70.0	130

Sub-Matrix: **WATER**

Matrix Spike (MS) Report: Spike	SpikeRecovery(%)	Acceptable Limits (%)

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4295794)							
ES2212961-002	EMB 8	EG020A-F: Arsenic	7440-38-2	1 mg/L	95.3	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	95.3	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	93.3	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	98.7	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	110	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	96.7	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	96.5	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 4295792)							
ES2212950-001	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	84.9	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 4295796)							
ES2212961-003	EMB 11	EG035F: Mercury	7439-97-6	0.01 mg/L	76.3	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4295636)							
ES2212961-001	EMB 7	EK055G: Ammonia as N	7664-41-7	1 mg/L	80.0	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 4290150)							
ES2212961-001	EMB 7	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	116	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4295637)							
ES2212961-001	EMB 7	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	94.8	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4295633)							
ES2212961-002	EMB 8	EK061G: Total Kjeldahl Nitrogen as N	----	50 mg/L	107	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4295632)							
ES2212961-002	EMB 8	EK067G: Total Phosphorus as P	----	1 mg/L	102	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4291464)							
ES2212961-001	EMB 7	EP080: C6 - C9 Fraction	----	325 µg/L	78.0	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4291464)							
ES2212961-001	EMB 7	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	86.4	70.0	130
EP080: BTEXN (QCLot: 4291464)							
ES2212961-001	EMB 7	EP080: Benzene	71-43-2	25 µg/L	74.3	70.0	130
		EP080: Toluene	108-88-3	25 µg/L	76.9	70.0	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	80.8	70.0	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	25 µg/L	81.5	70.0	130
		EP080: ortho-Xylene	95-47-6	25 µg/L	84.3	70.0	130
		EP080: Naphthalene	91-20-3	25 µg/L	78.1	70.0	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4300437)							
ES2213765-003	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.25 µg/L	129	72.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4300437) - continued							
ES2213765-003	Anonymous	EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.25 µg/L	104	71.0	127
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.25 µg/L	108	68.0	131
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.25 µg/L	124	69.0	134
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.25 µg/L	118	65.0	140
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.25 µg/L	118	53.0	142
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4300443)							
ES2213066-002	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.25 µg/L	105	72.0	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.25 µg/L	106	71.0	127
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.25 µg/L	97.4	68.0	131
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.25 µg/L	92.4	69.0	134
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.25 µg/L	90.6	65.0	140
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.25 µg/L	104	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4300437)							
ES2213765-003	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	1.25 µg/L	104	73.0	129
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.25 µg/L	118	72.0	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.25 µg/L	126	72.0	129
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.25 µg/L	115	72.0	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.25 µg/L	105	71.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.25 µg/L	107	69.0	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.25 µg/L	100	71.0	129
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.25 µg/L	116	69.0	133
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.25 µg/L	105	72.0	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.25 µg/L	110	65.0	144
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.625 µg/L	101	71.0	132
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4300443)							
ES2213066-002	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	1.25 µg/L	83.8	73.0	129
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.25 µg/L	118	72.0	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.25 µg/L	126	72.0	129
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.25 µg/L	113	72.0	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.25 µg/L	112	71.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.25 µg/L	94.2	69.0	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.25 µg/L	96.6	71.0	129
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.25 µg/L	84.6	69.0	133
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.25 µg/L	109	72.0	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.25 µg/L	99.0	65.0	144
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.625 µg/L	118	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4300437)							
ES2213765-003	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.25 µg/L	106	67.0	137

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4300437) - continued							
ES2213765-003	Anonymous	EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.625 µg/L	125	68.0	141
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.625 µg/L	111	62.6	147
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.625 µg/L	109	66.0	145
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.625 µg/L	110	57.6	145
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.25 µg/L	109	65.0	136
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.25 µg/L	113	61.0	135
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4300443)							
ES2213066-002	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.25 µg/L	104	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.625 µg/L	103	68.0	141
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.625 µg/L	100	62.6	147
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.625 µg/L	106	66.0	145
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.625 µg/L	96.1	57.6	145
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.25 µg/L	112	65.0	136
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.25 µg/L	92.8	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4300437)							
ES2213765-003	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.25 µg/L	113	63.0	143
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.25 µg/L	113	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.25 µg/L	107	67.0	138
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.25 µg/L	115	71.4	144
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4300443)							
ES2213066-002	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.25 µg/L	119	63.0	143
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.25 µg/L	98.4	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.25 µg/L	85.2	67.0	138
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.25 µg/L	88.8	71.4	144

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2212961**	Page	: 1 of 12
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: VASILLEA MILSOM	Telephone	: +61-2-8784 8555
Project	: Vopak ENV Monitoring	Date Samples Received	: 14-Apr-2022
Site	: ----	Issue Date	: 27-Apr-2022
Sampler	: VASILLEA MILSOM	No. of samples received	: 23
Order number	: ----	No. of samples analysed	: 22

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)		Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural							
EMB 7,	EMB 8,	----	----	----	16-Apr-2022	14-Apr-2022	**2**
EMB 11,	EMB 12,						
EMB 15,	EMB 16,						
EMB 6,	EMB 4,						
EMB 1,	EMB 2,						
EMB 3,	Duplicate						

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
PAH/Phenols (GC/MS - SIM)	0	12	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	15	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
PAH/Phenols (GC/MS - SIM)	0	12	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	15	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: **SOIL**

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

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055)								
Soil_1,	Soil_2,	**12-Apr-2022**	**----**	----	----	**21-Apr-2022**	26-Apr-2022	✓
Soil_3,	Soil_4,							
Soil_5,	Soil_6,							
Soil_9,	Soil_10,							
Soil_11,	Soil_12							

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
EG020-SD: Total Metals in Sediments by ICPMS							
Soil Glass Jar - Unpreserved (EG020-SD)							
Soil_1, Soil_2, Soil_3, Soil_4, Soil_5, Soil_6, Soil_9, Soil_10, Soil_11, Soil_12	**12-Apr-2022**	**22-Apr-2022**	09-Oct-2022	✓	**22-Apr-2022**	09-Oct-2022	✓
EG035T: Total Recoverable Mercury by FIMS (Low Level)							
Soil Glass Jar - Unpreserved (EG035T-LL)							
Soil_1, Soil_2, Soil_3, Soil_4, Soil_5, Soil_6, Soil_9, Soil_10, Soil_11, Soil_12	**12-Apr-2022**	**22-Apr-2022**	10-May-2022	✓	**24-Apr-2022**	10-May-2022	✓
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080-SD)							
Soil_1, Soil_2, Soil_3, Soil_4, Soil_5, Soil_6, Soil_9, Soil_10, Soil_11, Soil_12	**12-Apr-2022**	**21-Apr-2022**	26-Apr-2022	✓	**22-Apr-2022**	26-Apr-2022	✓
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080-SD)							
Soil_1, Soil_2, Soil_3, Soil_4, Soil_5, Soil_6, Soil_9, Soil_10, Soil_11, Soil_12	**12-Apr-2022**	**21-Apr-2022**	26-Apr-2022	✓	**22-Apr-2022**	26-Apr-2022	✓
EP080-SD: BTEXN							
Soil Glass Jar - Unpreserved (EP080-SD)							
Soil_1, Soil_2, Soil_3, Soil_4, Soil_5, Soil_6, Soil_9, Soil_10, Soil_11, Soil_12	**12-Apr-2022**	**21-Apr-2022**	26-Apr-2022	✓	**22-Apr-2022**	26-Apr-2022	✓

Matrix: **WATER**

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

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

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020F: Dissolved Metals by ICP-MS								
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)								
EMB 7,	EMB 8,	**12-Apr-2022**	**----**	----	----	**21-Apr-2022**	09-Oct-2022	✓
EMB 11,	EMB 12,							
EMB 15,	EMB 16,							
EMB 6,	EMB 4,							
EMB 1,	EMB 2,							
EMB 3,	Duplicate							
EG035F: Dissolved Mercury by FIMS								
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F)								
EMB 7,	EMB 8,	**12-Apr-2022**	**----**	----	----	**21-Apr-2022**	10-May-2022	✓
EMB 11,	EMB 12,							
EMB 15,	EMB 16,							
EMB 6,	EMB 4,							
EMB 1,	EMB 2,							
EMB 3,	Duplicate							
EK055G: Ammonia as N by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK055G)								
EMB 7,	EMB 8,	**12-Apr-2022**	**----**	----	----	**21-Apr-2022**	10-May-2022	✓
EMB 11,	EMB 12,							
EMB 15,	EMB 16,							
EMB 6,	EMB 4,							
EMB 1,	EMB 2,							
EMB 3,	Duplicate							
EK057G: Nitrite as N by Discrete Analyser								
Clear Plastic Bottle - Natural (EK057G)								
EMB 7,	EMB 8,	**12-Apr-2022**	**----**	----	----	**16-Apr-2022**	14-Apr-2022	×
EMB 11,	EMB 12,							
EMB 15,	EMB 16,							
EMB 6,	EMB 4,							
EMB 1,	EMB 2,							
EMB 3,	Duplicate							
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK059G)								
EMB 7,	EMB 8,	**12-Apr-2022**	**----**	----	----	**21-Apr-2022**	10-May-2022	✓
EMB 11,	EMB 12,							
EMB 15,	EMB 16,							
EMB 6,	EMB 4,							
EMB 1,	EMB 2,							
EMB 3,	Duplicate							

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
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK061G)								
EMB 7,	EMB 8,	**12-Apr-2022**	**21-Apr-2022**	10-May-2022	✓	**21-Apr-2022**	10-May-2022	✓
EMB 11,	EMB 12,							
EMB 15,	EMB 16,							
EMB 6,	EMB 4,							
EMB 1,	EMB 2,							
EMB 3,	Duplicate							
EK067G: Total Phosphorus as P by Discrete Analyser								
Clear Plastic Bottle - Sulfuric Acid (EK067G)								
EMB 7,	EMB 8,	**12-Apr-2022**	**21-Apr-2022**	10-May-2022	✓	**21-Apr-2022**	10-May-2022	✓
EMB 11,	EMB 12,							
EMB 15,	EMB 16,							
EMB 6,	EMB 4,							
EMB 1,	EMB 2,							
EMB 3,	Duplicate							
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Amber Glass Bottle - Unpreserved (EP075(SIM))								
EMB 7,	EMB 8,	**12-Apr-2022**	**19-Apr-2022**	19-Apr-2022	✓	**21-Apr-2022**	29-May-2022	✓
EMB 11,	EMB 12,							
EMB 15,	EMB 16,							
EMB 6,	EMB 4,							
EMB 1,	EMB 2,							
EMB 3,	Duplicate							
EP080/071: Total Petroleum Hydrocarbons								
Amber Glass Bottle - Unpreserved (EP071)								
EMB 7,	EMB 8,	**12-Apr-2022**	**19-Apr-2022**	19-Apr-2022	✓	**21-Apr-2022**	29-May-2022	✓
EMB 11,	EMB 12,							
EMB 15,	EMB 16,							
EMB 6,	EMB 4,							
EMB 1,	EMB 2,							
EMB 3,	Duplicate							
Amber TOC Vial - Sulfuric Acid (EP080)								
Duplicate		**12-Apr-2022**	**20-Apr-2022**	26-Apr-2022	✓	**20-Apr-2022**	26-Apr-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080)								
EMB 7,	EMB 8,	**12-Apr-2022**	**20-Apr-2022**	26-Apr-2022	✓	**20-Apr-2022**	26-Apr-2022	✓
EMB 11,	EMB 12,							
EMB 15,	EMB 16,							
EMB 6,	EMB 4,							
EMB 1,	EMB 2,							
EMB 3								

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
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Amber Glass Bottle - Unpreserved (EP071)							
EMB 7, EMB 8, EMB 11, EMB 12, EMB 15, EMB 16, EMB 6, EMB 4, EMB 1, EMB 2, EMB 3, Duplicate	**12-Apr-2022**	**19-Apr-2022**	19-Apr-2022	✓	**21-Apr-2022**	29-May-2022	✓
Amber TOC Vial - Sulfuric Acid (EP080)							
Duplicate	**12-Apr-2022**	**20-Apr-2022**	26-Apr-2022	✓	**20-Apr-2022**	26-Apr-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080)							
EMB 7, EMB 8, EMB 11, EMB 12, EMB 15, EMB 16, EMB 6, EMB 4, EMB 1, EMB 2, EMB 3	**12-Apr-2022**	**20-Apr-2022**	26-Apr-2022	✓	**20-Apr-2022**	26-Apr-2022	✓
EP080: BTEXN							
Amber TOC Vial - Sulfuric Acid (EP080)							
Duplicate	**12-Apr-2022**	**20-Apr-2022**	26-Apr-2022	✓	**20-Apr-2022**	26-Apr-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080)							
EMB 7, EMB 8, EMB 11, EMB 12, EMB 15, EMB 16, EMB 6, EMB 4, EMB 1, EMB 2, EMB 3	**12-Apr-2022**	**20-Apr-2022**	26-Apr-2022	✓	**20-Apr-2022**	26-Apr-2022	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
EMB 7, EMB 8, EMB 11, EMB 12, EMB 15, EMB 16, EMB 6, EMB 4, EMB 1, EMB 2, EMB 3, Duplicate	**12-Apr-2022**	**26-Apr-2022**	09-Oct-2022	✓	**26-Apr-2022**	09-Oct-2022	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X)							
EMB 7, EMB 8, EMB 11, EMB 12, EMB 15, EMB 16, EMB 6, EMB 4, EMB 1, EMB 2, EMB 3, Duplicate	**12-Apr-2022**	**26-Apr-2022**	09-Oct-2022	✓	**26-Apr-2022**	09-Oct-2022	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X)								
EMB 7,	EMB 8,	**12-Apr-2022**	**26-Apr-2022**	09-Oct-2022	✓	**26-Apr-2022**	09-Oct-2022	✓
EMB 11,	EMB 12,							
EMB 15,	EMB 16,							
EMB 6,	EMB 4,							
EMB 1,	EMB 2,							
EMB 3,	Duplicate							
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X)								
EMB 7,	EMB 8,	**12-Apr-2022**	**26-Apr-2022**	09-Oct-2022	✓	**26-Apr-2022**	09-Oct-2022	✓
EMB 11,	EMB 12,							
EMB 15,	EMB 16,							
EMB 6,	EMB 4,							
EMB 1,	EMB 2,							
EMB 3,	Duplicate							
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X)								
EMB 7,	EMB 8,	**12-Apr-2022**	**26-Apr-2022**	09-Oct-2022	✓	**26-Apr-2022**	09-Oct-2022	✓
EMB 11,	EMB 12,							
EMB 15,	EMB 16,							
EMB 6,	EMB 4,							
EMB 1,	EMB 2,							
EMB 3,	Duplicate							

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS (Low Level)	EG035T-LL	1	10	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	1	10	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	1	10	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Total Mercury by FIMS (Low Level)	EG035T-LL	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Total Mercury by FIMS (Low Level)	EG035T-LL	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Total Mercury by FIMS (Low Level)	EG035T-LL	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals in Sediments by ICPMS	EG020-SD	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX in Sediments	EP080-SD	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Ammonia as N by Discrete analyser	EK055G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	4	40	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	12	0.00	10.00	×	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	4	36	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	15	0.00	10.00	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Ammonia as N by Discrete analyser	EK055G	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	40	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Control Samples (LCS) - Continued							
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	36	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	12	**8.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	36	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	40	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	12	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	36	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	15	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Total Metals in Sediments by ICPMS	EG020-SD	SOIL	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector. Analyte list and LORs per NODG.
Total Mercury by FIMS (Low Level)	EG035T-LL	SOIL	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX in Sediments	EP080-SD	SOIL	In house: Referenced to USEPA SW 846 - 8260 Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve.
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.

Preparation Methods	Method	Matrix	Method Descriptions
Solid Phase Extraction (SPE) for PFAS in water	ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2215415**	Page	: 1 of 12
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: BEN LITTLEJOHN	Contact	: Sarah Mathew
Address	: Level 7 24 Mitchell Street DARWIN NT, AUSTRALIA 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 12566145 Vopak Env Monitoring	Date Samples Received	: 06-May-2022 07:30
Order number	: ----	Date Analysis Commenced	: 06-May-2022
C-O-C number	: ----	Issue Date	: 12-May-2022 12:43
Sampler	: BEN LITTLEJOHN		
Site	: ----		
Quote number	: SY/542/21 V3		
No. of samples received	: 6		
No. of samples analysed	: 6		

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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

- EP075 (SIM): Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- EP231X - Per- and Polyfluoroalkyl Substances (PFAS): Samples received in 20ml or 125ml bottles have been tested in accordance with the QSM5.3 compliant, NATA accredited method. 60mL or 250mL bottles have been tested to the legacy QSM 5.1 aligned, NATA accredited method.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. 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. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	EMB5_5MAY22	DAT2_5MAY22	DIFT1_5MAY22	DIFT2_5MAY22	6-Series_5MAY22
				Sampling date / time	05-May-2022 00:00	05-May-2022 00:00	05-May-2022 00:00	05-May-2022 00:00	05-May-2022 00:00
					ES2215415-001	ES2215415-002	ES2215415-003	ES2215415-004	ES2215415-005
					Result	Result	Result	Result	Result
EA025: Total Suspended Solids dried at 104 ± 2°C									
Suspended Solids (SS)	----	5	mg/L		**----**	**28**	**23**	**13**	<5
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	**0.001**
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	**0.0002**	<0.0001	**0.0002**	**0.0002**
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		**0.002**	**0.012**	**0.002**	<0.001	**0.006**
Nickel	7440-02-0	0.001	mg/L		<0.001	**0.001**	**0.001**	**0.001**	**0.002**
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L		**0.012**	**0.053**	**0.047**	**0.083**	**0.073**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.43**	**0.04**	**0.03**	<0.01	**0.16**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**1.27**	**0.35**	**0.14**	**0.05**	**0.47**
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**1.27**	**0.35**	**0.14**	**0.05**	**0.47**
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**1.4**	**0.6**	**0.3**	**0.5**	**0.3**
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**2.7**	**1.0**	**0.4**	**0.6**	**0.8**
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.13**	**0.41**	**0.02**	**0.03**	**0.01**
EP020: Oil and Grease (O&G)									
Oil & Grease	----	5	mg/L		**----**	<5	<5	<5	<5
EP030: Biochemical Oxygen Demand (BOD)									
Biochemical Oxygen Demand	----	2	mg/L		**----**	**2**	**2**	**2**	<2
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	**----**	**----**	**----**	**----**
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	**----**	**----**	**----**	**----**
Acenaphthene	83-32-9	1.0	µg/L		<1.0	**----**	**----**	**----**	**----**

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	EMB5_5MAY22	DAT2_5MAY22	DIFT1_5MAY22	DIFT2_5MAY22	6-Series_5MAY22
				Sampling date / time	05-May-2022 00:00	05-May-2022 00:00	05-May-2022 00:00	05-May-2022 00:00	05-May-2022 00:00
					ES2215415-001	ES2215415-002	ES2215415-003	ES2215415-004	ES2215415-005
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Fluorene	86-73-7	1.0	µg/L		<1.0	----	----	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	----	----	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	----	----	----	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	----	----	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	----	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	----	----	----	----
Chrysene	218-01-9	1.0	µg/L		<1.0	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	----	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	----	----	----	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L		<0.5	----	----	----	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L		<0.5	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	<20	<20
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		<100	<100	<100	<100	<100
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB5_5MAY22	DAT2_5MAY22	DIFT1_5MAY22	DIFT2_5MAY22	6-Series_5MAY22
				Sampling date / time	05-May-2022 00:00	05-May-2022 00:00	05-May-2022 00:00	05-May-2022 00:00	05-May-2022 00:00
Compound	CAS Number	LOR	Unit		ES2215415-001	ES2215415-002	ES2215415-003	ES2215415-004	ES2215415-005
					Result	Result	Result	Result	Result
EP080: BTEXN - Continued									
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	<2
^ Total Xylenes	----	2	µg/L		<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L		<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5
EP231A: Perfluoroalkyl Sulfonic Acids									
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	0.01	µg/L		**0.01**	<0.01	<0.01	<0.01	<0.01
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		**0.03**	<0.01	<0.01	**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
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		**0.8**	<0.1	**0.3**	**0.3**	<0.1
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		**3.72**	**0.04**	**1.25**	**1.35**	<0.02
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		**2.87**	**0.03**	**1.28**	**1.44**	<0.02
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		**1.55**	**0.02**	**0.44**	**0.49**	<0.02
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		**0.91**	**0.01**	**0.39**	**0.46**	<0.01
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		**0.18**	<0.02	**0.04**	**0.05**	<0.02
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		**0.04**	<0.02	**0.02**	**0.03**	<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
EP231C: Perfluoroalkyl Sulfonamides									

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	EMB5_5MAY22	DAT2_5MAY22	DIFT1_5MAY22	DIFT2_5MAY22	6-Series_5MAY22
				Sampling date / time	05-May-2022 00:00	05-May-2022 00:00	05-May-2022 00:00	05-May-2022 00:00	05-May-2022 00:00
					ES2215415-001	ES2215415-002	ES2215415-003	ES2215415-004	ES2215415-005
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
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
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
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		**7.45**	**0.10**	**7.34**	**7.78**	<0.05
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		**6.10**	**0.11**	**2.33**	**2.58**	<0.05
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	<0.05	**0.09**	**0.08**	<0.05
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		**23.7**	**0.31**	**13.5**	**14.6**	<0.01
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		**0.04**	<0.01	<0.01	**0.01**	<0.01
Sum of PFAS (WA DER List)	----	0.01	µg/L		**23.4**	**0.31**	**13.3**	**14.4**	<0.01
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1.0	%		**23.4**	----	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%		**55.4**	----	----	----	----
2.4.6-Tribromophenol	118-79-6	1.0	%		**61.5**	----	----	----	----
EP075(SIM)T: PAH Surrogates									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB5_5MAY22	DAT2_5MAY22	DIFT1_5MAY22	DIFT2_5MAY22	6-Series_5MAY22
				Sampling date / time	05-May-2022 00:00	05-May-2022 00:00	05-May-2022 00:00	05-May-2022 00:00	05-May-2022 00:00
Compound	CAS Number	LOR	Unit		ES2215415-001	ES2215415-002	ES2215415-003	ES2215415-004	ES2215415-005
					Result	Result	Result	Result	Result
EP075(SIM)T: PAH Surrogates - Continued									
2-Fluorobiphenyl	321-60-8	1.0	%		69.2	----	----	----	----
Anthracene-d10	1719-06-8	1.0	%		75.8	----	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%		79.8	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		94.7	104	104	92.7	109
Toluene-D8	2037-26-5	2	%		94.1	96.7	96.9	85.7	101
4-Bromofluorobenzene	460-00-4	2	%		95.0	99.8	101	86.8	102
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		99.7	103	95.4	96.9	103
13C8-PFOA	----	0.02	%		95.3	97.1	93.2	94.0	93.3

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	DUP1_5MAY22	----	----	----	----
			Sampling date / time	05-May-2022 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2215415-006	--------	--------	--------	--------
				Result	----	----	----	----
EA025: Total Suspended Solids dried at 104 ± 2°C								
Suspended Solids (SS)	----	5	mg/L	**12**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0003**	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.001**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.001**	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.082**	----	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**0.02**	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	**0.04**	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	**0.04**	----	----	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	**0.5**	----	----	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	**0.5**	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.03**	----	----	----	----
EP020: Oil and Grease (O&G)								
Oil & Grease	----	5	mg/L	<5	----	----	----	----
EP030: Biochemical Oxygen Demand (BOD)								
Biochemical Oxygen Demand	----	2	mg/L	<2	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	----	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	----	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	DUP1_5MAY22	----	----	----	----
				Sampling date / time	05-May-2022 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2215415-006	--------	--------	--------	--------
					Result	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons - Continued									
C29 - C36 Fraction	----	50	µg/L		<50	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	----	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	----	----	----	----
>C10 - C16 Fraction	----	100	µg/L		<100	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	----	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	----	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	----	----	----	----
Toluene	108-88-3	2	µg/L		<2	----	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	----	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	----	----	----	----
^ Total Xylenes	----	2	µg/L		<2	----	----	----	----
^ Sum of BTEX	----	1	µg/L		<1	----	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		<0.02	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L		<0.01	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		**0.02**	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	DUP1_5MAY22	----	----	----	----
				Sampling date / time	05-May-2022 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2215415-006	--------	--------	--------	--------
					Result	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids - Continued									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		**0.3**	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		**1.24**	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		**1.36**	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		**0.46**	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		**0.44**	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		**0.04**	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		**0.03**	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.02	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	----	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	DUP1_5MAY22	----	----	----	----
				Sampling date / time	05-May-2022 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2215415-006	--------	--------	--------	--------
					Result	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued									
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		**7.85**	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		**2.50**	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		**0.07**	----	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		**14.3**	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		**0.02**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		**14.2**	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**119**	----	----	----	----
Toluene-D8	2037-26-5	2	%		**93.0**	----	----	----	----
4-Bromofluorobenzene	460-00-4	2	%		**110**	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**102**	----	----	----	----
13C8-PFOA	----	0.02	%		**90.2**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

QUALITY CONTROL REPORT

Work Order	: **ES2215415**	Page	: 1 of 8
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: BEN LITTLEJOHN	Contact	: Sarah Mathew
Address	: Level 7 24 Mitchell Street DARWIN NT, AUSTRALIA 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 12566145 Vopak Env Monitoring	Date Samples Received	: 06-May-2022
Order number	: ----	Date Analysis Commenced	: 06-May-2022
C-O-C number	: ----	Issue Date	: 12-May-2022
Sampler	: BEN LITTLEJOHN		
Site	: ----		
Quote number	: SY/542/21 V3		
No. of samples received	: 6		
No. of samples analysed	: 6		

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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW
Sanjeshni Jyoti	Senior Chemist Volatiles	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA025: Total Suspended Solids dried at 104 ± 2°C (QC Lot: 4327996)									
ES2215041-001	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	99	85	15.8	0% - 50%
ES2215509-004	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	10	10	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4327328)									
ES2215415-001	EMB5_5MAY22	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.012	0.012	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 4327329)									
ES2215415-004	DIFT2_5MAY22	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 4327683)									
ES2215103-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	31.4	32.3	2.9	0% - 20%
ES2215105-008	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	10.3	10.4	1.7	0% - 20%
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 4327685)									
ES2215415-006	DUP1_5MAY22	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.02	0.02	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 4324319)									
ES2215415-002	DAT2_5MAY22	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
ES2215310-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 4327684)									
ES2215509-002	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	5.98	5.96	0.2	0% - 20%
ES2215415-006	DUP1_5MAY22	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	0.04	0.06	33.8	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 4327688)									
ES2215415-001	EMB5_5MAY22	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.4	1.3	0.0	No Limit
ES2215509-004	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	16.0	15.5	2.9	0% - 20%
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 4327689)									
ES2215415-001	EMB5_5MAY22	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.13	0.12	11.2	No Limit
ES2215509-004	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.08	0.08	0.0	No Limit
EP030: Biochemical Oxygen Demand (BOD) (QC Lot: 4324349)									
ES2215364-001	Anonymous	EP030: Biochemical Oxygen Demand	----	2	mg/L	2480	2290	7.8	0% - 20%
ES2215415-004	DIFT2_5MAY22	EP030: Biochemical Oxygen Demand	----	2	mg/L	2	4	66.7	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4327633)									
ES2215261-125	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
ES2215415-001	EMB5_5MAY22	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4327633)									
ES2215261-125	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
ES2215415-001	EMB5_5MAY22	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP080: BTEXN (QC Lot: 4327633)									
ES2215261-125	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
ES2215415-001	EMB5_5MAY22	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (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 Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA025: Total Suspended Solids dried at 104 ± 2°C (QCLot: 4327996)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	107	83.0	129
				<5	1000 mg/L	101	82.0	110
				<5	835 mg/L	106	83.0	118
EG020F: Dissolved Metals by ICP-MS (QCLot: 4327328)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	89.7	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	86.9	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	85.6	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	89.2	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	83.0	83.0	111
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	86.7	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	82.2	81.0	117
EG035F: Dissolved Mercury by FIMS (QCLot: 4327329)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	94.2	83.0	105
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4327683)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	98.3	90.0	114
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4327685)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	99.4	90.0	114
EK057G: Nitrite as N by Discrete Analyser (QCLot: 4324319)								
EK057G: Nitrite as N	14797-65-0	0.01	mg/L	<0.01	0.5 mg/L	102	82.0	114
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4327684)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	101	91.0	113
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4327688)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10 mg/L	98.3	69.0	101
				<0.1	1 mg/L	106	70.0	118
				<0.1	5 mg/L	111	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4327689)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.42 mg/L	96.8	71.3	126
				<0.01	0.442 mg/L	106	71.3	126
				<0.01	1 mg/L	115	71.3	126
EP020: Oil and Grease (O&G) (QCLot: 4329497)								
EP020: Oil & Grease	----	5	mg/L	<5	5000 mg/L	94.2	81.0	121
EP030: Biochemical Oxygen Demand (BOD) (QCLot: 4324349)								
EP030: Biochemical Oxygen Demand	----	2	mg/L	<2	200 mg/L	98.5	74.0	112

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 4330681)								
EP075(SIM): Naphthalene	91-20-3	1	µg/L	<1.0	5 µg/L	80.6	50.0	94.0
EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<1.0	5 µg/L	73.6	63.6	114
EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<1.0	5 µg/L	70.9	62.2	113
EP075(SIM): Fluorene	86-73-7	1	µg/L	<1.0	5 µg/L	68.8	63.9	115
EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<1.0	5 µg/L	76.9	62.6	116
EP075(SIM): Anthracene	120-12-7	1	µg/L	<1.0	5 µg/L	68.8	64.3	116
EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<1.0	5 µg/L	86.3	63.6	118
EP075(SIM): Pyrene	129-00-0	1	µg/L	<1.0	5 µg/L	87.0	63.1	118
EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<1.0	5 µg/L	91.6	64.1	117
EP075(SIM): Chrysene	218-01-9	1	µg/L	<1.0	5 µg/L	85.2	62.5	116
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<1.0	5 µg/L	99.8	61.7	119
EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<1.0	5 µg/L	76.7	63.0	115
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	5 µg/L	88.6	63.3	117
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<1.0	5 µg/L	86.7	59.9	118
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	1	µg/L	<1.0	5 µg/L	88.9	61.2	117
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	1	µg/L	<1.0	5 µg/L	88.9	59.1	118
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4327633)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	91.7	75.0	127
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4330682)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	400 µg/L	67.8	55.8	112
EP071: C15 - C28 Fraction	----	100	µg/L	<100	600 µg/L	86.8	71.6	113
EP071: C29 - C36 Fraction	----	50	µg/L	<50	400 µg/L	110	56.0	121
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4327633)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	95.5	75.0	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4330682)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	500 µg/L	73.8	57.9	119
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	700 µg/L	82.5	62.5	110
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	300 µg/L	74.8	61.5	121
EP080: BTEXN (QCLot: 4327633)								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	94.8	70.0	122
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	97.4	69.0	123
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	101	70.0	120
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	102	69.0	121
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	102	72.0	122
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	105	70.0	120
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4327673)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4327673) - continued								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.25 µg/L	109	72.0	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.25 µg/L	111	71.0	127
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	0.25 µg/L	110	68.0	131
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.25 µg/L	116	69.0	134
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.25 µg/L	118	65.0	140
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.25 µg/L	96.4	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4327673)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	101	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	123	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	126	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	120	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	110	71.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.25 µg/L	118	69.0	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.25 µg/L	125	71.0	129
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.25 µg/L	127	69.0	133
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.25 µg/L	121	72.0	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.25 µg/L	123	65.0	144
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	0.625 µg/L	106	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4327673)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.25 µg/L	125	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	0.625 µg/L	110	68.0	141
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	0.625 µg/L	121	62.6	147
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	0.625 µg/L	106	66.0	145
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	0.625 µg/L	120	57.6	145
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.25 µg/L	129	65.0	136
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.25 µg/L	124	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4327673)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.25 µg/L	115	63.0	143
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.25 µg/L	110	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.25 µg/L	129	67.0	138
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.25 µg/L	98.4	71.4	144

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: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4327328)							
ES2215415-003	DIFT1_5MAY22	EG020A-F: Arsenic	7440-38-2	1 mg/L	81.8	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	84.9	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	84.5	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	83.2	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	80.2	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	81.5	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	83.6	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 4327329)							
ES2215415-002	DAT2_5MAY22	EG035F: Mercury	7439-97-6	0.01 mg/L	91.4	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4327683)							
ES2215103-001	Anonymous	EK055G: Ammonia as N	7664-41-7	1 mg/L	# Not Determined	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4327685)							
ES2215415-006	DUP1_5MAY22	EK055G: Ammonia as N	7664-41-7	1 mg/L	105	70.0	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 4324319)							
ES2215310-001	Anonymous	EK057G: Nitrite as N	14797-65-0	0.5 mg/L	112	70.0	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 4327684)							
ES2215415-006	DUP1_5MAY22	EK059G: Nitrite + Nitrate as N	----	0.5 mg/L	102	70.0	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 4327688)							
ES2215415-002	DAT2_5MAY22	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	102	70.0	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 4327689)							
ES2215415-002	DAT2_5MAY22	EK067G: Total Phosphorus as P	----	1 mg/L	106	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4327633)							
ES2215261-125	Anonymous	EP080: C6 - C9 Fraction	----	325 µg/L	112	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4327633)							
ES2215261-125	Anonymous	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	111	70.0	130
EP080: BTEXN (QCLot: 4327633)							
ES2215261-125	Anonymous	EP080: Benzene	71-43-2	25 µg/L	101	70.0	130
		EP080: Toluene	108-88-3	25 µg/L	104	70.0	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	106	70.0	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	25 µg/L	110	70.0	130
		EP080: ortho-Xylene	95-47-6	25 µg/L	110	70.0	130
		EP080: Naphthalene	91-20-3	25 µg/L	98.4	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2215415**	Page	: 1 of 9
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: BEN LITTLEJOHN	Telephone	: +61-2-8784 8555
Project	: 12566145 Vopak Env Monitoring	Date Samples Received	: 06-May-2022
Site	: ----	Issue Date	: 12-May-2022
Sampler	: BEN LITTLEJOHN	No. of samples received	: 6
Order number	: ----	No. of samples analysed	: 6

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

- **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: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EK055G: Ammonia as N by Discrete Analyser	ES2215103--001	Anonymous	**Ammonia as N**	7664-41-7	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
PAH/Phenols (GC/MS - SIM)	0	1	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	0	7	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	6	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
PAH/Phenols (GC/MS - SIM)	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	0	7	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	6	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: **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
EA025: Total Suspended Solids dried at 104 ± 2°C							
Clear Plastic Bottle - Natural (EA025H)							
DAT2_5MAY22, DIFT1_5MAY22, DIFT2_5MAY22, 6-Series_5MAY22, DUP1_5MAY22	**05-May-2022**	**----**	----	----	**10-May-2022**	12-May-2022	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)							
EMB5_5MAY22, DAT2_5MAY22, DIFT1_5MAY22, DIFT2_5MAY22, 6-Series_5MAY22, DUP1_5MAY22	**05-May-2022**	**----**	----	----	**09-May-2022**	01-Nov-2022	✓

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
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F)							
EMB5_5MAY22, DAT2_5MAY22, DIFT1_5MAY22, DIFT2_5MAY22, 6-Series_5MAY22, DUP1_5MAY22	**05-May-2022**	**----**	----	----	**10-May-2022**	02-Jun-2022	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
EMB5_5MAY22, DAT2_5MAY22, DIFT1_5MAY22, DIFT2_5MAY22, 6-Series_5MAY22, DUP1_5MAY22	**05-May-2022**	**----**	----	----	**10-May-2022**	02-Jun-2022	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G)							
EMB5_5MAY22, DAT2_5MAY22, DIFT1_5MAY22, DIFT2_5MAY22, 6-Series_5MAY22, DUP1_5MAY22	**05-May-2022**	**----**	----	----	**06-May-2022**	07-May-2022	✓
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G)							
EMB5_5MAY22, DAT2_5MAY22, DIFT1_5MAY22, DIFT2_5MAY22, 6-Series_5MAY22, DUP1_5MAY22	**05-May-2022**	**----**	----	----	**10-May-2022**	02-Jun-2022	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G)							
EMB5_5MAY22, DAT2_5MAY22, DIFT1_5MAY22, DIFT2_5MAY22, 6-Series_5MAY22, DUP1_5MAY22	**05-May-2022**	**10-May-2022**	02-Jun-2022	✓	**10-May-2022**	02-Jun-2022	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G)							
EMB5_5MAY22, DAT2_5MAY22, DIFT1_5MAY22, DIFT2_5MAY22, 6-Series_5MAY22, DUP1_5MAY22	**05-May-2022**	**10-May-2022**	02-Jun-2022	✓	**10-May-2022**	02-Jun-2022	✓
EP020: Oil and Grease (O&G)							
Amber Jar - Sulfuric Acid or Sodium Bisulfate (EP020)							
DAT2_5MAY22, DIFT1_5MAY22, DIFT2_5MAY22, 6-Series_5MAY22, DUP1_5MAY22	**05-May-2022**	**----**	----	----	**10-May-2022**	02-Jun-2022	✓
EP030: Biochemical Oxygen Demand (BOD)							
Clear Plastic Bottle - Natural (EP030)							
DAT2_5MAY22, DIFT1_5MAY22, DIFT2_5MAY22, 6-Series_5MAY22, DUP1_5MAY22	**05-May-2022**	**----**	----	----	**06-May-2022**	07-May-2022	✓

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
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Amber Glass Bottle - Unpreserved (EP075(SIM))								
EMB5_5MAY22		**05-May-2022**	**11-May-2022**	12-May-2022	✓	**11-May-2022**	20-Jun-2022	✓
EP080/071: Total Petroleum Hydrocarbons								
Amber Glass Bottle - Unpreserved (EP071)								
EMB5_5MAY22,	DAT2_5MAY22,	**05-May-2022**	**11-May-2022**	12-May-2022	✓	**11-May-2022**	20-Jun-2022	✓
DIFT1_5MAY22,	DIFT2_5MAY22,							
6-Series_5MAY22,	DUP1_5MAY22							
Amber VOC Vial - Sulfuric Acid (EP080)								
EMB5_5MAY22,	DAT2_5MAY22,	**05-May-2022**	**10-May-2022**	19-May-2022	✓	**10-May-2022**	19-May-2022	✓
DIFT1_5MAY22,	DIFT2_5MAY22,							
6-Series_5MAY22,	DUP1_5MAY22							
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
Amber Glass Bottle - Unpreserved (EP071)								
EMB5_5MAY22,	DAT2_5MAY22,	**05-May-2022**	**11-May-2022**	12-May-2022	✓	**11-May-2022**	20-Jun-2022	✓
DIFT1_5MAY22,	DIFT2_5MAY22,							
6-Series_5MAY22,	DUP1_5MAY22							
Amber VOC Vial - Sulfuric Acid (EP080)								
EMB5_5MAY22,	DAT2_5MAY22,	**05-May-2022**	**10-May-2022**	19-May-2022	✓	**10-May-2022**	19-May-2022	✓
DIFT1_5MAY22,	DIFT2_5MAY22,							
6-Series_5MAY22,	DUP1_5MAY22							
EP080: BTEXN								
Amber VOC Vial - Sulfuric Acid (EP080)								
EMB5_5MAY22,	DAT2_5MAY22,	**05-May-2022**	**10-May-2022**	19-May-2022	✓	**10-May-2022**	19-May-2022	✓
DIFT1_5MAY22,	DIFT2_5MAY22,							
6-Series_5MAY22,	DUP1_5MAY22							
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE (no PTFE) (EP231X)								
EMB5_5MAY22,	DAT2_5MAY22,	**05-May-2022**	**10-May-2022**	01-Nov-2022	✓	**10-May-2022**	01-Nov-2022	✓
DIFT1_5MAY22,	DIFT2_5MAY22,							
6-Series_5MAY22,	DUP1_5MAY22							
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X)								
EMB5_5MAY22,	DAT2_5MAY22,	**05-May-2022**	**10-May-2022**	01-Nov-2022	✓	**10-May-2022**	01-Nov-2022	✓
DIFT1_5MAY22,	DIFT2_5MAY22,							
6-Series_5MAY22,	DUP1_5MAY22							
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X)								
EMB5_5MAY22,	DAT2_5MAY22,	**05-May-2022**	**10-May-2022**	01-Nov-2022	✓	**10-May-2022**	01-Nov-2022	✓
DIFT1_5MAY22,	DIFT2_5MAY22,							
6-Series_5MAY22,	DUP1_5MAY22							

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
EMB5_5MAY22, DAT2_5MAY22, DIFT1_5MAY22, DIFT2_5MAY22, 6-Series_5MAY22, DUP1_5MAY22	**05-May-2022**	**10-May-2022**	01-Nov-2022	✓	**10-May-2022**	01-Nov-2022	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X)							
EMB5_5MAY22, DAT2_5MAY22, DIFT1_5MAY22, DIFT2_5MAY22, 6-Series_5MAY22, DUP1_5MAY22	**05-May-2022**	**10-May-2022**	01-Nov-2022	✓	**10-May-2022**	01-Nov-2022	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Ammonia as N by Discrete analyser	EK055G	3	27	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	7	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	14	**14.29**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	1	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	0	7	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	2	13	**15.38**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	6	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Ammonia as N by Discrete analyser	EK055G	2	27	**7.41**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	3	20	**15.00**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	3	19	**15.79**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	3	13	**23.08**	**15.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	2	27	**7.41**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Biochemical Oxygen Demand (BOD)	EP030	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Oil and Grease	EP020	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Suspended Solids (High Level)	EA025H	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	2	27	**7.41**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	14	**7.14**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	1	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	0	7	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Phosphorus as P By Discrete Analyser	EK067G	1	13	**7.69**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	6	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Suspended Solids (High Level)	EA025H	WATER	In house: Referenced to APHA 2540D. A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM Schedule B(3)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrite as N by Discrete Analyser	EK057G	WATER	In house: Referenced to APHA 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Nitrate as N by Discrete Analyser	EK058G	WATER	In house: Referenced to APHA 4500-NO3- F. Nitrate is reduced to nitrite by way of a chemical reduction followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM Schedule B(3)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	In house: Referenced to APHA 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Chemical Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	In house: Referenced to APHA 4500-Norg D (In house). An aliquot of sample is digested using a high temperature Kjeldahl digestion to convert nitrogenous compounds to ammonia. Ammonia is determined colorimetrically by discrete analyser. This method is compliant with NEPM Schedule B(3)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	In house: Referenced to APHA 4500-Norg / 4500-NO3-. This method is compliant with NEPM Schedule B(3)
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	In house: Referenced to APHA 4500-P H, Jirka et al, Zhang et al. This procedure involves sulphuric acid digestion of a sample aliquot to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using discrete analyser. This method is compliant with NEPM Schedule B(3)
Oil and Grease	EP020	WATER	In house: Referenced to APHA 5520 B. Oil & grease is a gravimetric procedure to determine the amount of dissolved or emulsified oil & grease residue in an aqueous sample. The sample is serially extracted three times n-hexane. The resultant extracts are combined, dehydrated and concentrated prior to gravimetric determination. This method is compliant with NEPM Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Biochemical Oxygen Demand (BOD)	EP030	WATER	In house: Referenced to APHA 5210 B. The 5-Day BOD test provides an empirical measure of the oxygen consumption capacity of a given water. A portion of the sample is diluted into oxygenated, nutrient rich water, and a seed added to begin biological decay. The initial dissolved oxygen content is measured, then the bottle is sealed and incubated for five days. The remaining dissolved oxygen is measured, and from the difference, the demand for oxygen, by biological decay, is determined. This method is compliant with NEPM Schedule B(3).
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	In house: Referenced to APHA 4500 Norg - D; APHA 4500 P - H. This method is compliant with NEPM Schedule B(3)
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.
Solid Phase Extraction (SPE) for PFAS in water	ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2215890**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Vasillea Milsom	Contact	: Sarah Mathew
Address	: Level 7 24 Mitchell Street DARWIN NT, AUSTRALIA 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Vopak ENV Monitoring	Date Samples Received	: 14-Apr-2022 08:30
Order number	: ----	Date Analysis Commenced	: 13-May-2022
C-O-C number	: ----	Issue Date	: 16-May-2022 14:51
Sampler	: VASILLEA MILSOM		
Site	: ----		
Quote number	: SY/542/21 V3		
No. of samples received	: 10		
No. of samples analysed	: 10		

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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	Soil_1	Soil_2	Soil_3	Soil_4	Soil_5
				Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2215890-001	ES2215890-002	ES2215890-003	ES2215890-004	ES2215890-005
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		**15.2**	**23.1**	**13.7**	**17.4**	**32.1**
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons									
C10 - C14 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
C15 - C28 Fraction	----	3	mg/kg		**11**	**6**	**7**	**4**	**34**
C29 - C36 Fraction	----	5	mg/kg		**16**	**7**	**16**	<5	**47**
^ **C10 - C36 Fraction (sum)**	----	3	mg/kg		**27**	**13**	**23**	**4**	**81**
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons									
>C10 - C16 Fraction	----	3	mg/kg		<3	<3	<3	<3	<3
>C16 - C34 Fraction	----	3	mg/kg		**20**	**10**	**15**	**6**	**62**
>C34 - C40 Fraction	----	5	mg/kg		**22**	**8**	**26**	<5	**52**
^ **>C10 - C40 Fraction (sum)**	----	3	mg/kg		**42**	**18**	**41**	**6**	**114**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	Soil_6	Soil_9	Soil_10	Soil_11	Soil_12
			Sampling date / time	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00	12-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2215890-006	ES2215890-007	ES2215890-008	ES2215890-009	ES2215890-010
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	23.0	29.2	28.3	23.6	24.4
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons								
C10 - C14 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
C15 - C28 Fraction	----	3	mg/kg	14	15	13	<3	5
C29 - C36 Fraction	----	5	mg/kg	18	17	27	<5	5
^ C10 - C36 Fraction (sum)	----	3	mg/kg	32	32	40	<3	10
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons								
>C10 - C16 Fraction	----	3	mg/kg	<3	<3	<3	<3	<3
>C16 - C34 Fraction	----	3	mg/kg	25	26	27	<3	8
>C34 - C40 Fraction	----	5	mg/kg	18	17	38	<5	6
^ >C10 - C40 Fraction (sum)	----	3	mg/kg	43	43	65	<3	14

QUALITY CONTROL REPORT

Work Order	: **ES2215890**	Page	: 1 of 3
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Vasillea Milsom	Contact	: Sarah Mathew
Address	: Level 7 24 Mitchell Street DARWIN NT, AUSTRALIA 0800	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: Vopak ENV Monitoring	Date Samples Received	: 14-Apr-2022
Order number	: ----	Date Analysis Commenced	: 13-May-2022
C-O-C number	: ----	Issue Date	: 16-May-2022
Sampler	: VASILLEA MILSOM		
Site	: ----		
Quote number	: SY/542/21 V3		
No. of samples received	: 10		
No. of samples analysed	: 10		

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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 4336555)									
ES2215856-009	Anonymous	EA055: Moisture Content	----	0.1	%	14.9	15.1	1.5	0% - 50%
ES2215890-008	Soil_10	EA055: Moisture Content	----	0.1	%	28.3	32.6	14.2	0% - 20%
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QC Lot: 4330946)									
ES2215890-001	Soil_1	EP071-SD-SV: C10 - C14 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD-SV: C15 - C28 Fraction	----	3	mg/kg	11	11	0.0	No Limit
		EP071-SD-SV: C10 - C36 Fraction (sum)	----	3	mg/kg	27	27	0.0	No Limit
		EP071-SD-SV: C29 - C36 Fraction	----	5	mg/kg	16	16	0.0	No Limit
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QC Lot: 4330946)									
ES2215890-001	Soil_1	EP071-SD-SV: >C10 - C16 Fraction	----	3	mg/kg	<3	<3	0.0	No Limit
		EP071-SD-SV: >C16 - C34 Fraction	----	3	mg/kg	20	19	0.0	No Limit
		EP071-SD-SV: >C10 - C40 Fraction (sum)	----	3	mg/kg	42	40	4.9	0% - 50%
		EP071-SD-SV: >C34 - C40 Fraction	----	5	mg/kg	22	21	5.5	No Limit

Method Blank (MB) and Laboratory Control Sample (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 Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 4330946)								
EP071-SD-SV: C10 - C14 Fraction	----	3	mg/kg	<3	5 mg/kg	93.0	73.0	119
EP071-SD-SV: C15 - C28 Fraction	----	3	mg/kg	<3	7.5 mg/kg	96.6	70.0	130
EP071-SD-SV: C29 - C36 Fraction	----	5	mg/kg	<5	5 mg/kg	95.0	84.0	118
EP071-SD-SV: C10 - C36 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons (QCLot: 4330946)								
EP071-SD-SV: >C10 - C16 Fraction	----	3	mg/kg	<3	6.25 mg/kg	93.2	78.0	118
EP071-SD-SV: >C16 - C34 Fraction	----	3	mg/kg	<3	8.75 mg/kg	95.7	74.0	138
EP071-SD-SV: >C34 - C40 Fraction	----	5	mg/kg	<5	3.75 mg/kg	95.6	63.0	131
EP071-SD-SV: >C10 - C40 Fraction (sum)	----	3	mg/kg	<3	----	----	----	----

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**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons (QCLot: 4330946)							
ES2215890-001	Soil_1	EP071-SD-SV: C10 - C14 Fraction	----	14 mg/kg	70.4	70.0	130
		EP071-SD-SV: C15 - C28 Fraction	----	59 mg/kg	104	70.0	130
		EP071-SD-SV: C29 - C36 Fraction	----	42 mg/kg	128	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2215890**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: Vasillea Milsom	Telephone	: +61-2-8784 8555
Project	: Vopak ENV Monitoring	Date Samples Received	: 14-Apr-2022
Site	: ----	Issue Date	: 16-May-2022
Sampler	: VASILLEA MILSOM	No. of samples received	: 10
Order number	: ----	No. of samples analysed	: 10

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method / Container / Client Sample ID(s)		Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved							
Soil_1,	Soil_2,	----	----	----	13-May-2022	26-Apr-2022	**17**
Soil_3,	Soil_4,						
Soil_5,	Soil_6,						
Soil_9,	Soil_10,						
Soil_11,	Soil_12						
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved							
Soil_1,	Soil_2,	13-May-2022	26-Apr-2022	**17**	----	----	----
Soil_3,	Soil_4,						
Soil_5,	Soil_6,						
Soil_9,	Soil_10,						
Soil_11,	Soil_12						
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons							
Soil Glass Jar - Unpreserved							
Soil_1,	Soil_2,	13-May-2022	26-Apr-2022	**17**	----	----	----
Soil_3,	Soil_4,						
Soil_5,	Soil_6,						
Soil_9,	Soil_10,						
Soil_11,	Soil_12						

Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

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

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

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055)							
Soil_1, Soil_2, Soil_3, Soil_4, Soil_5, Soil_6, Soil_9, Soil_10, Soil_11, Soil_12	**12-Apr-2022**	**----**	----	----	**13-May-2022**	26-Apr-2022	×
EP080-SD / EP071-SD: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP071-SD-SV)							
Soil_1, Soil_2, Soil_3, Soil_4, Soil_5, Soil_6, Soil_9, Soil_10, Soil_11, Soil_12	**12-Apr-2022**	**13-May-2022**	26-Apr-2022	×	**14-May-2022**	22-Jun-2022	✓
EP080-SD / EP071-SD: Total Recoverable Hydrocarbons							
Soil Glass Jar - Unpreserved (EP071-SD-SV)							
Soil_1, Soil_2, Soil_3, Soil_4, Soil_5, Soil_6, Soil_9, Soil_10, Soil_11, Soil_12	**12-Apr-2022**	**13-May-2022**	26-Apr-2022	×	**14-May-2022**	22-Jun-2022	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TPH - Semivolatile Fractions Only	EP071-SD-SV	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
TPH - Semivolatile Fractions Only	EP071-SD-SV	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
TPH - Semivolatile Fractions Only	EP071-SD-SV	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
TPH - Semivolatile Fractions Only	EP071-SD-SV	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
TPH - Semivolatile Fractions Only	EP071-SD-SV	SOIL	In house: Referenced to USEPA SW 846 - 8270. Extracts are analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Tumbler Extraction of Solids (Option A - Concentrating)	ORG17A	SOIL	In house: Mechanical agitation (tumbler). 20g of sample, Na2SO4 and surrogate are extracted with 150mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.



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Appendix B Vopak Darwin Terminal Site Investigations (SMEC 2022b) and Human Health and Ecological Risk Assessment (EnRiskS 2022)

SMEC
Member of the Surbana Jurong Group



SMEC INTERNAL REF. 30080099-03 DRAFT REV2

Vopak Darwin Terminal

Site Investigations

Client Reference No. 30080099
Prepared for Vopak Terminal Darwin Pty Ltd
18 July 2022

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The findings of this this report are the result of methodologies used in accordance with normal practices and standards. We consider that they represent a reasonable interpretation of the general conditions of the site at the time they were assessed and at the time of writing this report, but under no circumstances, can it be considered that these findings represent the actual state of the site in all areas.

In preparing this report, current guidelines for assessment and management of contaminated land were followed. This work has been conducted in good faith in accordance with SMECs understanding of the client's brief and general accepted practice for environmental consulting.

The intrusive investigations were typically constrained due to the operational nature of the site. This report has relied on information provided by Vopak Terminal Darwin Pty Ltd and presented in other reports and historical monitoring data provided in electronic format. We note that reports by other consultants generally provide a limitation stating that the documents were prepared solely for Vopak and reliance by others is at their own risk. It was not within the scope of SMEC to validate the results of the previous reports and data and we have therefore relied that the information contained in those reports and data is a true and accurate reflection of the site conditions. SMEC has also relied that the conclusions made in those reports are reasonable and made on a sound scientific basis. Each report has its own set of limitations and those limitations also apply to the interpretations made by SMEC. SMEC do not take responsibility for errors, omissions or negligence in the use of the information contained in previous reports made available by Vopak Terminal Darwin Pty Ltd in this report. We note that this assessment was of current concentrations of contaminants from more recent monitoring and therefore cannot assess for past impacts to offsite areas from historical discharges.

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Abbreviations and Acronyms

Abbreviation / Acronym	Meaning
ACM	Asbestos Containing Material
AHD	Australian height datum
ARC	Alcohol resistant concentrate
ASLP	Australian standard leaching procedure
BoM	Bureau of Meteorology
BTEX	Benzene, toluene, ethylbenzene, xylene
CoC	Chain of custody
CSM	Conceptual site model
CoPC	Contaminants of potential concern
DAT	Darwin Acid Terminal
DHWQO	Darwin Harbour water quality objectives
DIFT	Darwin Industry Fuel Terminal
DQI	Data quality indicator
DQO	Data quality objective
EIL	Ecological investigation levels
EnRiskS	Environmental Risk Sciences Pty Ltd
EPL	Environment Protection Licence
FTS	Fluorotelomer sulfonic acid
GRR	Global Resource Recovery
HHERA	Human Health and Ecological Risk Assessment
HIL	Health investigation levels
HSL	Health screening levels
LA ULP	low aromatic unleaded premium
LAF	Low aromatic unleaded fuel
LCS	Laboratory control samples
LD	Laboratory duplicate
LNAPL	Light Non-Aqueous Phase Liquid
LOR	Limit of reporting
LPS	Laboratory-prepared spikes
LWTF	Liquid Waste Treatment Facility

Abbreviation / Acronym	Meaning
m bgl	Metres below ground level
mbTOC	Metres below top of casing
MS	Matrix spike
NATA	National Association of Testing Authorities Australia
NT EPA	Norther Territory Environment Protection Authority
OEMP	Operations Environmental Management Plan
PAH	Polycyclic aromatic hydrocarbons
PFAS	Per- and poly-fluoroalkyl substances
PFOS	perfluorooctane sulfonic acid
PFOA	perfluorooctanoic acid
PFHxA	Perfluorohexanoic acid
PFHxS	Perfluorohexane sulfonic acid
6:2 FTS	6:2 Fluorotelomer sulfonic acid
8:2 FTS	8:2 Fluorotelomer sulfonic acid
RL	Reduced level
RPD	Relative percentage differences
PFOS	Perfluorooctane sulfonic acid
PFOA	Perfluorooctanoic acid
PID	Photoionisation Detector
PQL	Practical quantitation limit
PULP	Premium unleaded petrol
QA/QC	Quality assurance and quality control
RPD	Relative percentage difference
SAQP	Sampling, Analysis and Quality Plan
SDS	Safety data sheet
SOP	Standard operating procedure
SRA	Sample receipt advice
TPH	Total petroleum hydrocarbons
TRH	Total recoverable hydrocarbons
ULP	Unleaded petrol
VOC	Volatile organic compounds

Executive Summary

SMEC was engaged by Vopak to carry out a Site investigation at the Vopak Darwin Terminal located at 780-800 Berrimah Road, East Arm, Northern Territory 0822 (the Site) which operates as a bulk fuel storage facility.

A firefighting foam solution leak occurred at the Site on 26 September 2020. The foam solution has a component of per- and poly-fluoroalkyl substances (PFAS) which are persistent organic pollutants with potential for health and environmental impacts. The incident was reported and assessed by the Northern Territory Environment Protection Authority (NT EPA).

NT EPA issued Vopak with a notice requiring Vopak to carry out an environmental audit program to evaluate the types, amount, distribution and mobility of petroleum hydrocarbons, PFAS, and other contaminants of concern (copper, lead, zinc and ammonia) present in the environment at the Site.

The objectives of the investigation was to collect additional data to assist meet the NT EPA notice. Specifically, this assessment focused on:

- Assessing the potential extent and significance of PFAS in soil and groundwater near the 2020 foam solution leak to inform the need for soil remediation and potential extent of remediation (if required).
- Assessing the potential for petroleum hydrocarbons, PFAS, copper, lead, zinc and ammonia to be present at unacceptable levels broadly across the Site in groundwater, stormwater and stormwater channel sediment where they could pose unacceptable risk to human health, but more specifically nearby offsite environmental receptors should they be moving offsite.
- Make recommendations on the need for further assessment and/or the need for remediation.

The scope of work included:

- Desktop review of relevant information sources
- Site walkover and fieldwork (soil and groundwater sampling/analysis)
- Developing a Conceptual Site Model (CSM)
- Human health and ecological risk assessment for PFAS
- Preparing this report presenting the findings of the assessment and making conclusions and recommendations as per the objectives.

PFAS

Site history information has shown that releases of substances containing PFAS have occurred at the site due to past practices (prior to knowledge of the potential harm of PFAS compounds) and/or unforeseen site incidents. This investigation included instigating a sampling plan involving soil and groundwater sampling targeting the area of the former 2020 PFAS foam solution leak and broader terminal. In addition, data was supplemented from previous monitoring data supplied by Vopak.

Soil and groundwater sampling has shown PFAS is present at the Site with concentrations not necessarily highest at the location of the 2020 foam solution leak. The PFAS distribution across broader parts of the Site suggests impacts from past releases, not just the 2020 foam solution leak.

Based on the currently available PFAS monitoring data, through comparison to guidelines in NEMP 2020 and interim guideline values derived in the Human Health and Ecological Risk Assessment (HHERA), the current PFAS concentrations within the Vopak site in soil, groundwater and stormwater do not appear to pose an unacceptable risk to human health or ecological receptors. Additional monitoring is recommended to support the conclusion that the levels of key PFAS chemicals (6:2 FTS and 8:2 FTS) are in compliance with the proposed guideline developed in the HHERA.

Due to the broader distribution of PFAS at the Site in both soil and groundwater, and that the risk assessment indicated risks to health and the environment are unlikely, remediation in the area of the 2020 foam solution leak is currently not considered warranted.

Other Contaminants (petroleum hydrocarbons, copper, lead, zinc and ammonia)

Monitoring of petroleum hydrocarbons and other contaminants of concern (including copper, lead, zinc and ammonia) has been carried out at the Site since as early as 2005 in groundwater, stormwater and stormwater drain sediment. Based on a review of the monitoring data, the following is noted:

- Specific sources of copper, lead, zinc and ammonia within the Vopak Terminal are generally not known, except for lead in AVgas. Copper, lead, zinc and ammonia could be associated with various wastewaters accepted within the GRR LWTF, but the LWTF has operated at the Site only since 2017.
- The groundwater monitoring results have shown that concentrations of these contaminants of concern have generally been either below adopted assessment criteria or within the typical baseline ranges. In general, there does not appear to be a consistent upward trend in these contaminant concentrations post-baseline monitoring. There is variability in concentrations, which could be associated with natural variability, variability due to different climatic conditions (wet/dry seasons) or events at the terminal. Results of recently installed wells are generally within ranges of other wells and did not show concentrations to suggest significant anomalies.
- Some exceedances of zinc, copper, ammonia and/or hydrocarbons have been recorded in recent monitoring in stormwater. The metals and ammonia were assessed to be similar to and lower than other concentrations observed in this environment and naturally occurring. The hydrocarbons are likely a result of operational processes for which Vopak has procedures for managing stormwater to reduce potential for impacts. Based on our assessment as described in this report, the stormwater quality with respect to other contaminants (petroleum hydrocarbons, copper, lead, zinc and ammonia) is not likely to be posing unacceptable environmental harm.
- Sediments within drains at the Vopak Site have been tested biannually. Recent monitoring showed concentrations below assessment criteria and/or likely associated with natural processes. Based on our assessment, sediment quality with respect to petroleum hydrocarbons, copper, lead, zinc and ammonia is not likely to be posing unacceptable environmental harm.

Recommendations

Additional monitoring is recommended to support the conclusion that the levels of key PFAS chemicals (6:2 FTS and 8:2 FTS) are in compliance with the proposed guideline developed in the risk assessment. If monitoring for PFAS is included in the ongoing monitoring program for groundwater, stormwater and sediment, that will provide appropriate data to support the conclusions of risk assessment. The monitoring program has included:

- Groundwater – twice a year, early wet season and late wet season, from a network of at least 14 bores
- Stormwater pit – three times a year, early, mid and late wet season, from at least four locations. Inclusion of additional monitoring points for stormwater in the routine monitoring, such as at the point where stormwater exits the Vopak site via the open drain would also be useful
- Sediment in drains – once every 2 years at the end of the wet season, from 12 locations.

It would also be prudent to check the quality of discharges from the liquid waste treatment facility (operated by others).

Monitoring should continue and exceedances should be a trigger to review the potential cause of the exceedance, and where potentially associated with operational processes or housekeeping, correction action should be taken to avoid potential impacts.

PFAS are persistent, bioaccumulative chemicals, some of which are listed on the Stockholm Convention for persistent organic pollutants. Where possible and practical, methods to reduce levels in discharges are important to implement. An approach that may be relevant for this site is an investigation of how PFAS are entering the stormwater system. We understand from Vopak that a robust process is now used during deluge testing so that zero foam solution spills occur to ground surface with all discharge (however small) being captured. This process should continue.

Vopak should continue good housekeeping practices and maintenance to mitigate the potential for impacts to the environment.

1 Introduction

1.1 General

SMEC Australia Pty Ltd (SMEC) was engaged by Vopak Terminal Darwin Pty Ltd (Vopak) to carry out a Site investigation at the Vopak Darwin Terminal located at 780-800 Berrimah Road, East Arm, Northern Territory 0822 (the Site). The Site operates as a bulk fuel storage facility.

A firefighting foam solution leak occurred at the Site on 26 September 2020. The foam solution has a component of per- and poly-fluoroalkyl substances (PFAS) which are persistent organic pollutants with potential for health and environmental impacts. The incident was reported and assessed by the Northern Territory Environment Protection Authority (NT EPA).

NT EPA issued Vopak with a notice on 25 October 2021 under Section 48(1) of the Waste Management and Pollution Control Act 1988. The notice requires Vopak to carry out an environmental audit program to evaluate the types, amount, distribution and mobility of petroleum hydrocarbons, PFAS, and other contaminants of concern (copper, lead, zinc and ammonia) present in the environment at the Site.

This report provides a Site investigation report, which will form part of the environmental audit program.

The Site location is described in Section 2 and presented in Figure 1, Appendix A.

1.2 Objectives

The objectives of this investigation were to collect additional data to assist with the evaluation of the types, amount, distribution and mobility of petroleum hydrocarbons, PFAS, and other contaminants of concern (specifically only copper, lead, zinc and ammonia) present in the environment at the Site to comply with the NT EPA notice.

Specifically, this assessment focuses on:

- Assessing the potential extent and significance of PFAS in soil and groundwater near the 2020 foam solution leak to inform the need for soil remediation and potential extent of remediation (if required).
- Assessing the potential for petroleum hydrocarbons, PFAS, copper, lead, zinc and ammonia to be present at unacceptable levels broadly across the Site in groundwater, stormwater and stormwater channel sediment where they could pose unacceptable risk to human health, but more specifically nearby offsite environmental receptors should they be moving offsite.
- Make recommendations on the need for further assessment and/or the need for remediation.

This assessment does not intend to assess small internal areas of potential contamination that could be present adjacent to infrastructure, but looks for larger sitewide issues.

1.3 Scope of Work

The scope of this report has been prepared with reference to the policy, standards and guidelines outlined in Section 1.4. This Site investigation report includes:

- Desktop review of relevant information sources, including review of:
    - Published information relating to the Site including geological, soil landscapes and topographical mapping
    - Site management plans and layout plans provided by Vopak
    - Historical site monitoring reports provided by Vopak

- Site chronology of events report provided by Vopak
- Selected, publicly available historical aerial photographs

- Site walkover by an Environmental Engineer to visually assess surface conditions of the Site
- Developing a Conceptual Site Model (CSM);
- Sampling of soils at targeted locations across the Site
- Installation of groundwater wells and sampling of groundwater, at targeted locations across the Site
- Laboratory testing of soil and water samples at a NATA accredited laboratory for the identified contaminants of potential concern
- Human health and ecological risk assessment for PFAS
- Preparing this report presenting the findings of the assessment and making conclusions and recommendations as per the objectives identified in Section 1.2

1.4 Published Guidelines

This report was prepared with reference to the following main applicable published guidelines:

- Australian Standard AS4482.1-2005 Guide the investigation and sampling of site with potentially contaminated soil Part 1: Non-volatile and semi-volatile compounds.
- Australian Standard AS4482.1-2005 Guide the investigation and sampling of site with potentially contaminated soil Part 1: Non-volatile and semi-volatile compounds.
- Australian Standard AS4482.2-1999 Guide to the sampling and investigation of potentially contaminated soil Part 2: Volatile substances.
- NEPC, National Environment Protection (Assessment of site contamination) Measure 1999.
- NT EPA, Northern Territory Contaminated Land Guideline Version 1.0, Northern Territory Environmental Protection Authority, June 2017.
- PFAS NEMP, Per-and poly-fluoroalkyl substances National Environmental Management Plan, Version 2.0 – January 2020.

2 Site Description

2.1 Site Location

The Site has been defined in the NT EPA notice. A summary of Site information is presented below in Table 2-1. The Site location is shown in Figure 1, Appendix A. The Site layout is shown in Figures 2, 2A and 2B, Appendix A.

Table 2-1 Summary of Site Information.

Address	780 and 800 Berrimah Road, East Arm, Northern Territory 0822
Parcel and Location	5719 and 5783 Hundred of Bagot
Area	130 000 m^2 (approximately)
Owner	Vopak Terminal Darwin Pty Ltd (Vopak)
Zoning	Industrial (Zone DV - Development)
Current Land Use	North: Bulk liquid transfer and storage facility South-east: Sub-lease to Global Resource Recovery (GRR) for liquid waste treatment management
Surrounding Land use	North: Vacant land immediately to the north of the Site, followed by the Ghan Passenger Rail Terminal. South: Northern Cement Darwin East: Berrima Road spans the eastern boundary of the Site, adjacent to wetland area, then Hudson Creek. West: A railway spans the western boundary of the Site, adjacent to wetland area, then Bleesers Creek and Frances Bay/Darwin Harbour.

2.2 Site Environmental Setting

2.2.1 Climate

Darwin has a tropical climate with distinct wet and dry seasons. The dry season is typically from about May to September and wet season from about November to March. Darwin has an average annual rainfall of 1,723mm (BoM).

2.2.2 Topography and Landforms

The site and surrounds are relatively flat forming a peninsula style formation within the broader Darwin Port. The site is at an elevation of approximately 5-8m Australian height datum (AHD).

2.2.3 Regional Geology

The history of the site prior to use as the Vopak terminal has not been previously documented. Aerial images available to SMEC dating back to 2001 show the general site area and surrounds to be filled over surrounding mudflat areas prior to the terminal construction in 2005. The land use prior (if any) is unknown.

Reference to the 1:100,000 scale geology map of Darwin (Published by the Department of Mines and Energy) indicates the site is likely to be underlain by Siltstone; shale; sandstone (quarts arenite, sublitharenite); quartz pebble conglomerate; metamorphosed to lower greeschist facies (Burrell Creek Formation). Surrounding areas comprise intertidal marine alluvium.

Site specific geology is limited. A geotechnical report for the biodiesel area (to the south-east) reported some fill material, overlying shallow weathered phyllite rock and 'coffee' rock (however logs or plans showing test locations were not available).

2.2.4 Hydrology and Hydrogeology

2.2.4.1 Hydrology

The terminal captures surface water within bunds around tanks and paved areas into an onsite drainage/treatment system which discharges to the west into the wetland/harbour. The treatment system in the Vopak terminal comprises a first flush sump and oil/water separator.

Indicative predictive surface water flows are shown in Figure 4, Appendix A based on topography contours. These may change in times of very heavy rain and flows could move in multiple directions.

2.2.4.1 Hydrogeology

Data provided to SMEC by Vopak shows that fourteen (14) groundwater monitoring wells exist at the Site (EMB1-EMB8 and EMB11-EMB16 – shown in Figure 3, Appendix A). Logs for these wells are not available, but well completion details as presented in a previous report (EcOz, 2020) are provided in Table 2-2.

Standing water levels from these wells has been generally recorded biannually since 2009 and the range of standing water levels from past monitoring is also presented in Table 2-2 below.

Table 2-2 Existing Groundwater Monitoring Well Details

Bore ID	Total Depth (m)	Screen Depth (m)	Standing Water Level Range 2009-2022 (mbgl)[1]
EMB1	10	7 to 10	0.63-3.50
EMB2	10	7 to 10	0-5.33
EMB3	10	7 to 10	1.57-3.49
EMB4	10	7 to 10	1.13-7.63
EMB5	8	5 to 8	0.61-3.80
EMB6	10	7 to 10	0.64-3.89
EMB7	10	7 to 10	0.64-5.72
EMB8	10	7 to 10	1.50-4.93
EMB11	8.5	5.5 to 8.5	1.20-3.90
EMB12	9.5	6.5 to 9.5	1.16-7.04
EMB13	8.9[2]	Not available	2.267-5.5[3]
EMB14	9.4[2]	Not available	3.206-5.4[3]
EMB15	9.5	6.5 to 9.5	0.68-3.40
EMB16	9.5	6.5 to 9.5	2.06-5.39

Notes:

1. Data from electronic database provided by Vopak
2. Based on data recorded by SMEC in April 2022 (refer to Table 9-2 for other data)
3. Standing water levels for EMB13 and EMB14 from past data only available for two events, Feb and Sep 2009

Electrical conductivity values from more recent sampling events showed a range of 82µS/cm to 70,194µS/cm which suggests a range between fresh to hypersaline conditions.

Groundwater flow directions have not been previously calculated. It may be possible that flows could move preferentially in multiple directions due to the shallow nature of groundwater and heavy rain in wet seasons. Generally, groundwater would be expected to flow east to west. Additional hydrogeological information is presented in later sections of this report from results of this investigation (see Section 9.2). Estimated groundwater contours and flow direction based on the water level monitoring on 11 April 2022 are presented in Figure 8, Appendix A. On the date of the water level gauging the general groundwater flow was inferred to flow to the west.

2.2.1 Vegetation

The Site is located within a cleared area near the Darwin Harbour Estuary. The Site does not contain vegetation. Review of available aerial imagery (GoogleEarth, 2021) indicates that the Site is surrounded by an estuarine environment including mudflats, tidal creeks, and mangroves.

2.2.1 Threatened Species

An ecological study has not been carried out. Various threatened flora and fauna species are listed as being in nearby areas of Darwin Harbour as shown in Figure 5, Appendix A. Charles Darwin National Park is located to the north-west of the Site as shown in Figure 6, Appendix A.

3 Desktop Review

3.1 General

SMEC reviewed a number of documents made available by Vopak relating to the foam solution leak, including other environmental reports and terminal information. In addition, SMEC carried out a Site visit and also obtained information on the history of the leak and history of foam use at the terminal through discussions Vopak employees, primarily Paul Birch (Darwin Terminal Manager).

Key documents reviewed included:

- Vopak (2016) Operations Environmental Management Plan (OEMP), dated December 2016.
- SKM (2003) Darwin Industry Fuel Terminal, Environmental Assessment Report
- Vopak Chronology of events – AFFF Spill – Vopak (undated, 2020)
- EcOz (2004) Revised Public Environment Report for the Development of a Biodiesel Plant at the East Arm Development Area
- EcOz (2017) Vopak Terminals Darwin Biodiesel Baseline, Inspection and Monitoring Report
- EcOz (2020) Groundwater Quality Monitoring, Early Wet Season, October 2020, Vopak Terminal Darwin
- EcOz (2020a) Firefighting foam leak – soil and water analysis results (letter dated 10 November 2020)
- EcOz (2020b) Stormwater Pit Monitoring, December 2020, Vopak Terminal Darwin
- GHD (2022) Vopak Terminal Environmental Monitoring December 2021-April 2022, (Ref: 12566143, dated 3 June 2022)
- JBS&G (2021), Vopak Darwin (East Arm) Terminal Incident & Environmental Advice (letter dated 29 January 2021)
- EcOz (2021) Stormwater Pit Monitoring, February 2021, Vopak Terminal Darwin
- EcOz (2021a) Groundwater Quality Monitoring, Late Wet Season, April 2021, Vopak Terminal Darwin
- Vopak Industrial Fuel Terminal Fire System block plan and terminal drawings (various)
- Vopak Industrial Fuel Terminal tankage general arrangement and profile drawings (various)
- Vopak Industrial Fuel Terminal sanitary drainage layout drawings

Details of the Site layout and operations are provided in the sections below based on the review of documents provided by Vopak, publicly available aerial images. Selected drawings of the facility provided by Vopak are included in Appendix B.

3.2 Site History

Review of aerial images dating back to 2001 show the general site area and surrounds to be filled over surrounding mudflat areas prior to the terminal construction in 2005.

The SKM (2003) Environmental Assessment report prepared prior to the construction of the terminal indicated the following relating to the Site condition:

"The proposed site encompasses Quarantine Island and a low lying section of land previously containing mangrove vegetation and soft mangrove muds, south of East Arm Peninsula. Site preparation was undertaken by the former Department of Transport and Works Construction Agency (now part of the DIPE), and included reclamation using quality imported fill material, surcharging the mangrove muds and the construction of a bund wall to level 5.5 m AHD along the northern perimeter. The site has been cut/filled to bring it to a required elevation of RL 5.5 m AHD."

The land use prior to development by Vopak is therefore inferred to have been vacant land that was subsequently filled and recontoured for the terminal construction.

3.3 Site Layout and Operations

The northern part of the Site is used as a bulk liquid fuel transfer and storage facility operated by Vopak. The south-eastern part of the Site is subleased to GRR for treatment and management of liquid wastes. Each area is described in the sections below.

3.3.1 Vopak Terminal

A high-level overview of the operations at the Vopak Terminal is as follows:

- Bulk liquids are delivered to the Site from East Arm Port via a pipeline;
- All bulk liquids are stored in above ground tanks around the Site; and,
- Bulk liquids are transferred to road tankers using bottom-loading gantries for offsite movement of the bulk liquids

The Site storage areas are divided into three main zones, described below and shown in Figure 2, Appendix A along with key layout features:

1. Darwin Industry Fuel Terminal (DIFT)
2. Darwin Acid Terminal (DAT), and
3. The 6-Series (previously the Darwin Biodiesel Terminal).

There are two pipelines which transfer fuels from the wharf at the Port to the DIFT facility. There is one pipeline which supplies diesel from the DIFT facility to the wharf, and one pipeline which supplies sulfuric acid from the wharf to the DAT facility. There is also a pipeline to the 6-Series from the wharf.

The DIFT zone includes:

- 12 above ground bulk fuel storage tanks
- Various smaller above ground fuel additive tanks
- Above ground fuel slops tanks
- One underground oil/water tank
- Road tanker loading gantry
- One above ground firewater tank and associated pumphouse (The pump house contains a 7,100 litre above ground storage tank to store fire extinguishing agent concentrate - Ansulite low viscosity 3x3 Alcohol Resistant Concentrate (ARC))

A building housing the Site office, control room and amenities is located in the north-east of the Site.

The DAT zone includes one above ground bulk fuel storage tank and associated connections and pipework. There is also a 1m^3 pump out sump to contain spills.

The 6-Series zone contains ten (10) above ground bulk fuel storage tanks.

Details of current bulk storage tank volumes contents are provided in Table 3-1, below.

Table 3-1 Details of Site tank volumes and bulk liquid products.

Location	Tank ID	Product	Approx. Working Volume (m^3)
DIFT	TK0101	PULP[1]	5,000
	TK0102	PULP[1]	2,000
	TK0103	ULP[2]	15,000
	TK0104	ULP[2]	8,000
	TK0105	AV gas	5,000
	TK0106	LAF[3]	7,500
	TK0201	JET A1	9,000
	TK0202	JET A1	9,000
	TK0203	JET A1	9,000
	TK0301	Diesel	17,000
	TK0302	Diesel	17,000
	TK0303	Diesel	17,000
	-	Oil water slops	3 x 100
	-	Nalco	30
	-	Fuel Additives (various) FG00040M NALCO® 5403 (Corrosion inhibitor/lubricity) NEMO 6164 AMP DSL 200 (diesel fuel additive) Stadis 450 (antistatic) FD00032B	Ranging from 1.4 to 30
DAT	TK6301	Sulfuric acid (H_2SO_4)	10,870
6-Series	TK6101	Diesel	5,000
	TK6102	Diesel	5,000
	TK6103	Diesel	1,000
	TK6104	Diesel	5,000
	TK6106	Diesel	2,000
	TK6107	Diesel	8,200
	TK6108	Oily water[4]	250
	TK6201	Gasoline (out of service)	3,000
	TK6202	Gasoline (out of service)	100
	TK6203	Gasoline(out of service)	100

Table Notes:

[1] Premium unleaded petrol (PULP)

[2] Unleaded petrol (ULP)

[3] Low aromatic unleaded fuel (LAF), low aromatic unleaded premium (LA ULP)

[4] This is a collection tank storing water from the truck loading bays and water from the bund drainage pits around the Site

There are large open areas surrounding the fuel infrastructure. Areas to the east are paved with pavers and areas to the north and west are gravel surface. A concrete paved area for trafficking is located south of tank TK0101, adjacent the open drain.

Site stormwater which enters subsurface drainage systems flows to a first flush tank and water separator. Stormwater undergoes pH testing and a visual assessment prior to release to an open drain which discharges to the environment in the west. If the water is assessed to be of poor quality, it is either recycled through the Site stormwater treatment system or disposed of offsite at a licensed waste facility.

Tank sludge and waste oil generated from onsite processes is disposed of offsite at a licensed waste facility.

We understand that the Site originally had a 3,000 litre septic tank, pump chamber and 12m soakage trench in the central western part of the Site. This was upgraded in 2010 to a rising main sewerage system connected to Power and Water Corporation infrastructure.

3.3.1 GRR Liquid Waste Treatment Facility (GRR LWTF)

Information provided by the Vopak terminal manager indicates that the south-eastern part of the Site was initially constructed for the purposes of being a biodiesel facility, but following construction was not operated for this purpose. This area is licenced to GRR for treatment and management of liquid wastes. Specific details of operations were not available from Vopak except for details on waste types and storage amounts, but SMEC sourced a copy of the Environmental Management Plan (GRR, 2020) online. A summary of relevant details from this plan are provided below:

- Environment Protection Licence (EPL 229) was granted by NT EPA on 21 December 2017
- The biodiesel facility was upgraded and repurposed into the Liquid Waste Treatment Facility (LWTF) which can treat industrial liquid waste streams including:
  - Acid and alkali waste streams
  - Industrial wash waters including low level amine wash waters
  - Waste oil and Oily Water including bunker oils from shipping
  - Glycol based waste streams
  - Contaminated stormwater and ground water
  - PFAS Separation
- The facility can also consolidate hazardous wastes such as:
  - Solvents
  - Cyanides
  - Chromic Acid
  - Mercury

- Chlorinated hydrocarbons
- Pesticides
- And similar wastes requiring specialised treatment for consignment and transport to GRR's LWTF in Laverton North, Victoria or other interstate licensed facilities.

- The LWTF has the capacity to treat up to 20 million litres per annum of industrial wastewater, 24 million litres per annum of Glycol and up to 10 million litres per annum of used engine oil and oily-water.
- A copy of a table provided by Vopak with details of waste type and storage is included in Appendix C. Appendix C also includes an extract from the Environmental Management Plan with details of tank storage and volumes.
- The plan lists the layout of the facility to comprise the following as listed below. A detailed layout of the facility is not included within the copy of the plan available online. SMEC has inferred details of the layout based on the information within the plan and from the GRR website (Refer to Figure 2).
  - Storm Water Area
  - Filter Press Area
  - Sludge Tank Area for filter press
  - Sludge Bay
  - Reagent Storage Area
  - Industrial Waste Water Treatment Area
  - Tank Farm for Waste and Product
  - Utilities Area
  - Waste Storage and Consignment Area
  - Waste Receival Area
  - Waste Glycol Recovery Area
  - Waste Oil and Oily-Water Recycling Area
  - Container Storage Area (Hazardous Waste and Flammable Waste)
  - Reverse Osmosis processing area
  - Trade waste Locked Batch Tank
  - Administration Building (Control Room, Offices, Commercial Laboratory)
  - Car Park.

Vopak indicated that the GRR LWTF utilises the same fire fighting foam system from the Vopak Terminal.

3.4 2020 Foam Solution Leak

3.4.1 Initial Actions

The history of the 2020 foam solution leak within the Vopak terminal has been documented in reasonable detail in previous reports and therefore not fully repeated in this report. A high-level summary is provided below:

- A leak in a foam solution pipe occurred on 26 September 2020

- The leak was detected when the electric foam solution pump automatically started and foam solution was observed coming up through gaps in the pavers. Some foam solution entered the adjacent onsite stormwater system
- The pinhole leak in the pipe was found via exposing the pipe located at about 1m below ground and temporarily repaired within 24hrs
- The foam solution was comprised of a fire extinguishing agent concentrate (Ansulite low viscosity 3x3 ARC) diluted with water to a 3% solution. Vopak estimated that about 223 litres of foam concentrate was lost during the leak equating to about 7,500 litres of foam solution
- Vopak took prompt action to mitigate the amount of foam solution leaked and prevent it from spreading, which included:
  - Absorbent booms were placed in front of nearby drains to try and reduce the amount of foam solution entering the drain
  - Vacuum trucks were used to create the excavation to expose the foam solution pipe, removing soil for disposal offsite (~48,000 litres)
  - Pavers surrounding the area of the leak were pressure cleaned and water was collected and stored for disposal
- The approximate location of the leak is shown in Figure 2 and Figure 3, Appendix A.

3.4.2 Sampling Results

Vopak engaged consultants to carry out sampling at the terminal associated with the foam solution leak which included sampling of soil from the pipe excavation (sampled 28 September 2020) and sampling of stormwater that had been captured in the stormwater pit that receives runoff from the area (sampled 29 September 2020)[1]. Laboratory analysis included PFAS analysis.

In addition to the above, the following PFAS testing has been carried out post the September 2020 foam solution leak:

- Groundwater from twelve (12) groundwater monitoring wells which are located around the terminal and used for ongoing compliance monitoring – sampled 08 October 2020, 07 April 2021, 16 December 2021 and 12 April 2022
- Stormwater pit monitoring from 4-5 monitoring locations within the terminal – sampled 1 December 2020, 2 February 2021, 11 March 2021, 31 March 2021, 16 December 2022, 14 March 22, 21 February 2022 and 5 May 2022
- Pumping out water collected within the stormwater system during the leak to prevent offsite discharge including storage and later disposal offsite. In addition, Vopak captured stormwater from the pit that receives water from the area of the leak from the first two rain events post the leak (~271,000 litres). These were initially stored within the bund of adjacent onsite fuel tanks and later transferred into a disused above ground storage tank. This water has since been disposed offsite to a licenced facility in Laverton, Victoria.

Soil results from the pipe excavation recorded the presence of PFAS (along with other foam components such as anionic surfactants and glycols). Stormwater captured within the few days preceding the leak mitigation work was also tested and shown to have PFAS.

[1] We note that the foam solution leak in the consultants report (EcOz, 2020a) is shown to be further to the south, than the actual location as observed by SMEC during our site visit.

JBS&G undertook testing of stormwater that was contained in tanks TK6106 and TK6107 as a result of the remedial works undertaken by Vopak following the foam solution leak in 2020 (JBS&G 2021). As mentioned above, this water has since been disposed offsite.

The results from the groundwater monitoring events recorded PFAS in most wells. PFAS has also been recorded in some of the stormwater samples.

Prior to the September 2020 foam solution leak, Vopak has not carried out analysis for PFAS during their ongoing water quality monitoring. Therefore historical data on PFAS at the terminal is generally not available, with the exception of a baseline assessment GRR LWTF in June 2017. Two monitoring wells within this area recorded PFAS.

In general terms, PFAS concentrations in water samples have been below guidelines published in the PFAS National Environmental Management Plan Version 2.0 (NEMP, 2020), noting that guidelines only currently exist for perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA). One of the predominant PFAS compounds detected is 6:2 Fluorotelomer sulfonic acid (6:2 FTS). Fluorotelomers can degrade in the environment to form more persistent PFAS compounds such as PFOS and PFOA.

We note that borehole logs for geotechnical holes and the groundwater monitoring wells are not available. Well construction details included in the groundwater reports indicate that the monitoring wells and well screens are relatively deep compared with the standing water levels. This could affect the quality of the data with respect to assessment of PFAS concentrations. Not being able to draw on information outlining subsoil conditions and groundwater well construction introduces uncertainty in assessing the likely movement of groundwater and groundwater impacts which will be considered in this investigation.

3.5 Historical Use of Foam and Incidents

A summary of the historical foam use at the terminal provided by Vopak is described below:

- Vopak used the protein based foaming agent Angus Alcoseal 3x3 from commissioning in September 2005 until April 2014 when the product was changed to Ansulite.
- The foaming agent is stored in an above ground tank (7,100 litre capacity) in the south-eastern corner of the terminal within the fire water pump house (See Figure 2, Appendix A).
- Fire system deluge testing has occurred monthly at the facility since commissioning. This involves testing that the foam system works and foam solution is discharged via about fifteen (15) tell tails where a relatively small quantity of foam solution is released. Prior to 2016/17, when testing the fire deluge system the water / foam was not captured and went to ground. Since 2016/17 the water / foam solution has been captured in IBC's and disposed of by a licensed contractor offsite. The approximate location of the fire deluge system tell tails are shown on Figure 2B, Appendix A.
- In 2006, during the construction of the biodiesel terminal (now the GRR LWTF) there was a water / foam pipe "separation". Vopak has no formal record of the quantity of foam potentially released. The leak was apparently just south of the fire water tank and the foam solution spilt out across the site boundary to the east into a low point in the adjacent grassed area.
- In 2014 there was a foaming of a JET-A1 aviation tank event. Vopak has no record of the type and quantity of foam solution released during that event. Vopak indicated that foam from that event was released only into the inside of the tank.

3.5.1 Foam – Ansulite Low Viscosity 3x3 ARC

The firefighting foam concentrate used at the Vopak Terminal is Ansulite Low Viscosity 3x3 ARC. The foam Safety Data Sheet (SDS) is attached in Appendix D.

The foam constituents reported in the material SDS are 2-2-Butoxyethoxy)ethanol, 1,2-Propanediol, D-Glucopyranoside C9-C11 Oligomer, n-Butanol, glycerol, methylene chloride, and 1,3-Dichloropropene. EcOz (2021) states that the foam "***contains small amounts of fluorochemical surfactants i.e. chemicals included under the term PFAS***".

3.6 Historical Monitoring Results

SMEC has reviewed the monitoring data made available by Vopak. Vopak has provided a digital database which includes historical results of groundwater, stormwater and stormwater sediment monitoring.

Groundwater results date back to 2005 and appear to have been initially carried out annually and then biannually since 2010 from a network of fourteen monitoring wells (EMB1-EMB8 and EMB11-EMB16). Not all wells have been sampled on all occasions.

Stormwater monitoring has been variable based on the location with some results available back to 2009. Typically, they have included two locations in the DIFT area, one location in 6 Series and one location in DAT area.

Monitoring has been carried out by consultants engaged by Vopak and we were advised that the database was also maintained by consultants. Some original monitoring reports of more recent rounds have been made available, but not all reports.

Figure 3, Appendix A shows the approximate location of the groundwater monitoring points. Figure 3-1 and Figure 3-2 below show the approximate location of stormwater and sediment samples.

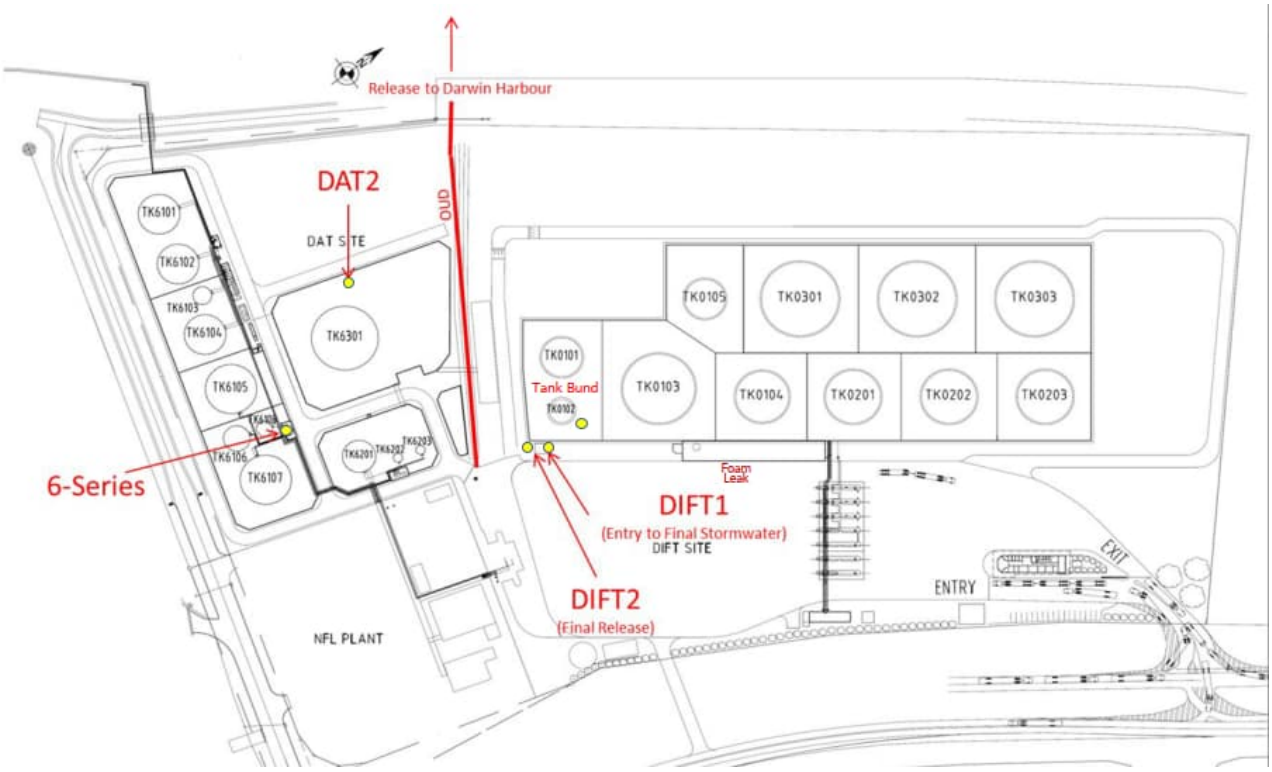


Figure 3-1 Stormwater Sample locations (Ref: EcOz, 2021)

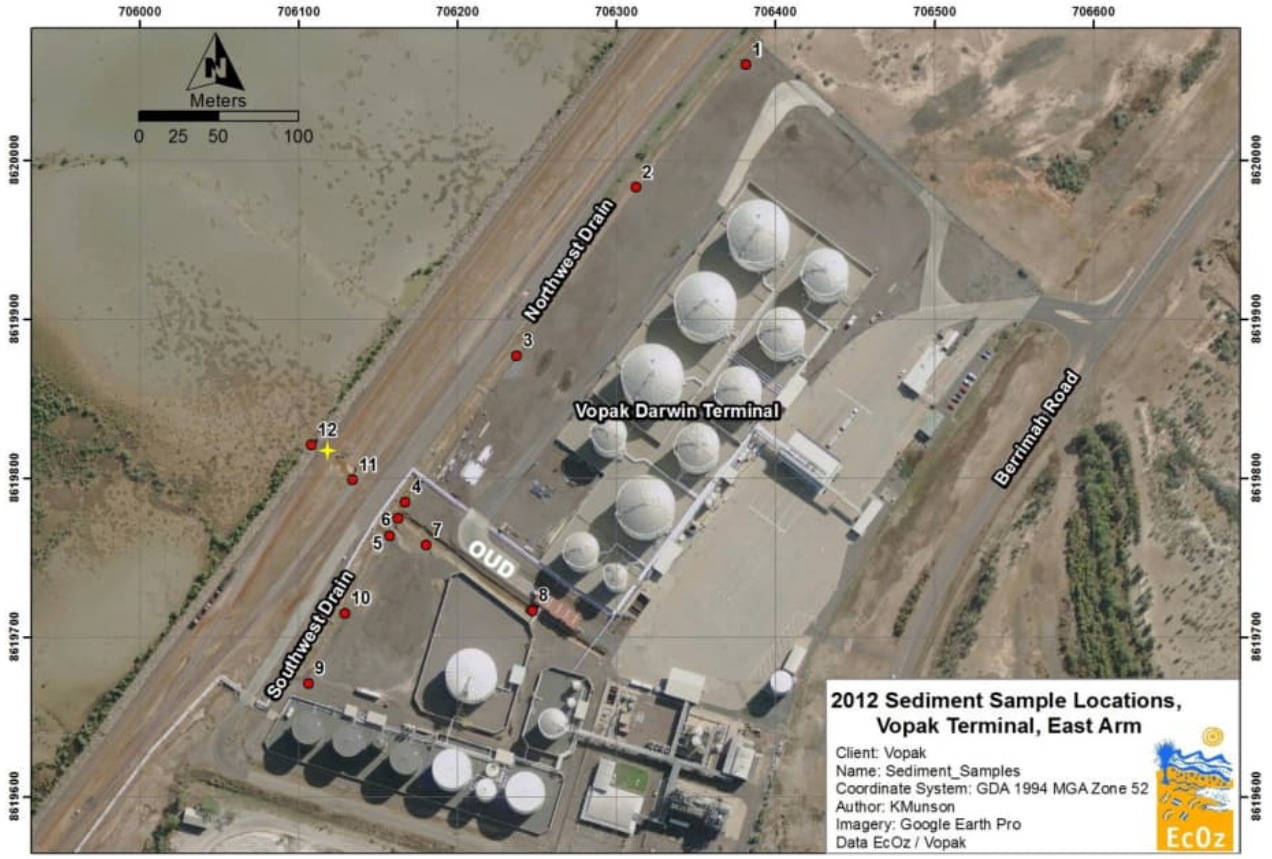


Figure 3-2 Sediment Sample Locations (Ref: GHD, 2022)

Graphs presenting the trends of selected contaminants in groundwater have been prepared by SMEC and included in Appendix E.

A summary of some of the relevant points from the latest monitoring reports (EcOz 2021a and GHD 2022) made available to SMEC are below, with respect to groundwater:

- Copper, lead, zinc and ammonia are often detected in concentrations exceeding the respective trigger values in groundwater. The concentrations recorded remain within the historic normal range, with no indication of an increasing trend. The historic range of concentrations recorded are considered reflective of natural, background concentrations.
- With respect to ammonia, concentrations are said to be natural background concentrations associated with the organic-rich estuarine sediments underlying the site
- All PFOS, PFHxS and PFOA concentrations were below the adopted NEMP 2.0 guideline values. However, significant concentrations of PFAS that don't have guideline values, were detected.

The historical data has been assessed in combination with data collected as part of this site investigation (refer to Section 11).

4 Preliminary Conceptual Site Model

4.1 Overview

A critical element of any site assessment is the development of a conceptual site model (CSM). The CSM describes the environmental setting, identifies contaminant sources (potential areas of concern and associated contaminants), modes of contaminant movement (migration pathways), the person / ecosystem components / environmental values potentially affected by the contamination (potential receptors) and how exposure may occur (exposure routes).

The development of the CSM is an iterative process, whereby the initial CSM is developed in the first stage of site assessment and revised as more detailed information on the site and the nature of contamination becomes available. A preliminary CSM has been prepared which presents potential source(s), pathway(s) and ecological / human receptor(s) linkages. Potential source(s), pathway(s) and ecological/human receptor(s) are identified below.

The preliminary CSM is used to identify risks to human health, the environment and environmental values, as well as uncertainties or critical gaps in information that need to be addressed in subsequent stages. For a risk to exist all three components (source, pathway, receptor) of the CSM must exist. The CSM is made up of contaminants of potential concern (CoPC) and receptors that could be exposed to the CoPC.

A preliminary CSM has been prepared for the Site, which presents potential source(s), pathway(s) and ecological/human receptor(s) with respect to PFAS, petroleum hydrocarbons, select heavy metals (zinc, copper, lead), and ammonia. The site and environmental setting were described in earlier sections. The CSM components of sources-pathways-receptors are described in sections below and also represented in Figure 7, Appendix A.

4.2 Potential Contamination Sources

4.2.1 PFAS

Based on the data currently reviewed by SMEC it appears that whilst the 2020 foam solution leak is a source of PFAS at least in a local area, there have been other historical releases of foam solution containing PFAS at the Site. This included:

- An incident comprising a pipe breach in 2006
- Monthly deluge testing of the fire system since commissioning in 2005 has resulted in foam solution releases to ground, as foam solution was not captured from the testing prior to 2016/17.

Groundwater monitoring data has shown detections of PFAS across the broader Site. Groundwater monitoring in October 2020 recorded PFAS compounds in wells over 200m away suggesting impact from other historical discharges as rainfall records showed little rain between the date of the 2020 leak and the monitoring event. PFAS has also been recorded in stormwater pits.

PFAS was recorded in soil adjacent the pipe excavation in the September 2020 foam solution leak.

On site sources may include existing soil and groundwater impacted with PFAS. Whilst the GRR LWTF in the south-eastern part of the Site is licenced to accept and manage wastewater containing PFAS, we are not certain about the details of this storage.

4.2.1 Petroleum Hydrocarbons

There are various sources of petroleum hydrocarbons at the Site. The main source being bulk liquids that are transferred and stored on the Site as described earlier in Section 3.2. The GRR LWTF also has potential sources from the wastes they accept and manage, including oily wastewaters. The bulk fuel storage facilities, transfer pipelines, stormwater treatment and wastewater treatment are a potential sources of hydrocarbon contamination at the Site, via leaks/spills and/or surface and stormwater run-off on the Site (if they were to have occurred). SMEC did not observe visual evidence of surface leaks or spills during fieldworks.

4.2.2 Metals (copper, lead zinc) and ammonia

Specific sources of copper, lead, zinc and ammonia within the Vopak Terminal are generally not known, except for lead in AVgas. Copper, lead, zinc and ammonia could be associated with various wastewaters accepted within the GRR LWTF.

Other potential sources may include the following:

- Ammonia:
  - Naturally occurring associated with the organic-rich estuarine sediments underlying the site as suggested by EcOz
  - On Site and offsite sewerage systems (due to potential leaks)
- Metals (copper, lead, zinc)
  - Lead in Avgas. SMEC was advised by Vopak that AVgas can contain between 0.28g/l (min.) and 0.55g/l (max.) of lead.
  - Fill imported to the Site as part of the historical Site establishment could contain metals. The source and quantity of the fill material is unknown.
  - Liberation of metals from soil from low pH spills (e.g. either low pH wastewater or acids)
  - Zinc – From potential weathering of galvanised iron structures.
  - Metals within wastewaters accepted and managed at the GRR LWTF.

4.3 Exposure Pathways

The pathways of exposure consist of:

- A transport mechanism
- A route of exposure

Based on Site information, there is potential for the following contamination pathways to exist at the Site:

- Disturbance of potential soil contamination and exposure by ingestion, dermal contact or inhalation.
- Leaching of contaminants from soil into onsite groundwater followed by offsite migration (vertical).
- Migration of contaminated groundwater/surface water to adjacent receiving environment and entering food chain.
- Surface water runoff.
- Contaminated groundwater migration from the Site to offsite surface water receptor (lateral).
- Air transport of particulates (dust) and exposure by inhalation

4.4 Potential Receptors

4.4.1 Human Receptors

Based on the information available, and the current land use, the potential human receptors have been assessed to include the following:

- Site workers/maintenance workers onsite and nearby the site.
- Consumers of seafood (fish, shellfish or other biota) from receiving wetland/harbour environment.

Recreational use of adjacent harbour waters is considered unlikely as there appear to be no nearby netted/protected bathing areas offering protection from dangerous marine wildlife such as sharks/crocodiles.

Groundwater beneath the site has been recorded to be saline to hypersaline therefore drinking of groundwater is not considered a pathway.

4.4.2 Ecological Receptors

Based on the information available, and the current land use, the potential ecological receptors could comprise of the following:

- Offsite ecological receptors in the adjacent wetlands/Darwin Harbour (may include aquatic and terrestrial organisms and consumers of these organisms within the food chain (birds, mammals etc)).

4.5 Potential Source Pathway Receptor Linkages

Potential source-pathway-receptor linkages are where contaminated media (e.g. soil, surface water and/or groundwater) (if present) has the potential to adversely impact on human health or ecological values for the Site via complete exposure pathways. For a risk to exist all three components (source, pathway, receptor) of the CSM must exist.

The potential receptors for concern for which there are potential contamination pathways are summarised in Table 4-1.

Table 4-1 Potential Contamination Source, Pathways and Receptors.

Source		Potential Pathway		Potential Receptor(s)
Primary	Secondary	Migration Pathway(s)	Exposure Route	
PFAS from previous spills and deluge testing	• PFAS in soil	• Exposure during excavation	• Dermal contact • Inhalation of soil dust • Ingestion of contaminated soil	• Site workers • Maintenance workers.
	• PFAS in Groundwater	• Exposure during excavation • Transport in groundwater to surface water, then to wetlands and Darwin Harbour	• Dermal contact • Incidental ingestion (human) • Ingestion (biota)	• Maintenance workers • Downgradient offsite ecological receptors (including predators) • Consumers of seafood (fish, shellfish, crustaceans)
	• PFAS in Surface water/ stormwater/ sediment	• Transport through stormwater system and open drain to wetlands and Darwin Harbour		
Ammonia and metals (Cu, Pb, Zn) in groundwater (natural sources or anthropogenic from waste water/sewer)	-	• Transport in groundwater to surface water, then to wetlands and Darwin Harbour	• Dermal contact • Incidental ingestion (human) • Ingestion (biota)	• Maintenance workers • Downgradient offsite ecological receptors
Petroleum hydrocarbons in groundwater from bulk storage/distribution	-	• Exposure during excavation • Vapour intrusion (to building structures or in trenches) • Transport in groundwater to surface water, then to wetlands and Darwin Harbour	• Direct dermal • Vapour intrusion/inhalation (Workers in structures) • Vapour intrusion/inhalation (Maintenance workers in trenches) • Ingestion of contaminated groundwater or surface water • Incidental ingestion (human) • Ingestion (biota)	• Site workers • Maintenance workers • Downgradient offsite ecological receptors

Source-pathway-receptor linkages are potentially complete if contamination actually exists and is not managed.

4.6 Data Gaps

Based on the preliminary CSM described above. Some relevant data gaps were considered to be:

- Site specific geology / hydrogeology – currently lacking data on the site subsurface conditions and aquifer properties to understand possible movement and pathways for contaminant migration in the subsurface.
- Groundwater data quality – existing monitoring wells are deep with deep screens and therefore existing data from these wells may not be indicative of the true concentrations at each location.
- Sources at the GRR LWTF – details of the exact processes and waste storage are not known.
- Site history – the land use history prior to the terminal is not known and if historical PFAS sources could have been present.

5 Assessment Criteria

5.1 Soil Assessment Criteria

Evaluation against assessment criteria is used to identify levels of contamination that may pose unacceptable risks to potential receptors as identified in the CSM. Assessment criteria have been sourced from:

- NEPC, National Environment Protection (Assessment of site contamination) Measure 1999, amended 2013. Schedule B (1) ***Guideline on Investigation Levels for Soil and Groundwater***
- CRC Care Technical Report No. 10 (Friebel and Nadebaum 2011).
- PFAS National Environmental Management Plan Version 2.0′, Heads of EPA Australia and New Zealand 2020

Soil data was collected within the Site boundaries and health criteria is considered relevant. Ecological soil criteria is not considered relevant within the Site of an operational facility of this nature.

Health investigation levels (HIL) are scientifically based, generic assessment criteria designed to be used in the first stage (Tier 1 or 'screening') of an assessment of potential risks to human health from chronic exposure to contaminants. They are intentionally conservative and are based on a reasonable worst-case scenario for four generic land use settings.

HIL D 'commercial/industrial' criteria are considered relevant for an ongoing fuel terminal land use.

Health Screening Levels (HSLs) for petroleum hydrocarbons are available from NEPM (2013) and CRC Care (Friebel E and Nadebaum P, 2010). These references provide HSLs for vapour intrusion for soil at various depth ranges. CRC Care also provides HSLs for direct contact and for vapour intrusion for intrusive maintenance worker (shallow trench). The HSLs have been based on relevant soil type and depth.

PFAS was screened against criteria available in NEMP 2020 and initial screening assessment criteria from the Human Health and Ecological Risk Assessment (HHERA) prepared by Environmental Risk Sciences Pty Ltd (EnRiskS). Details of the HHERA are further described in Section 10 and the HHERA report is included in Appendix M. The HHERA assumes that fluorotelomers and sulfonic acid type PFAS have similar toxicity to PFOS; and that carboxylic acid and sulfonamides PFAS have a similar toxicity to PFOA. This was adopted in the absence of Australian guidelines for other PFAS compounds.

Table 5-1 below summarises the adopted assessment criteria for soil.

Table 5-1 Soil Assessment Criteria

Analyte	Health (mg/kg)
Metals	
Arsenic	3,000 [1]
Cadmium	900 [1]
Chromium (VI)	3,600 [1]
Copper	240,000 [1]
Lead	1,500 [1]
Mercury	730 [1]
Nickel	6,000 [1]
Zinc	400,000 [1]
Total Petroleum Hydrocarbons	
TRH/BTEXN	Depends on soil type and depth
PAH	
Carcinogenic PAHs (as BaP TEQ)	40 [1]
Total PAH	4,000[1]
PFAS[3]	
Sum of PFOS and PFHxS	20 [2]
PFOS related compounds	20 [3a]
Sum of PFOS related compounds	
PFOA	50 [2]
PFOA related compounds	50 [3b]
Sum of PFOA related compounds	

Notes:

1. ASC NEPM (2013) - Commercial/industrial (HIL D)

2. NEMP (2020) – Commercial/industrial (HIL D)

3a. EnRiskS (2022) HHERA - guidelines for PFOS have been applied to the sulfonic acid type PFAS (e.g. PFBS, PFPeS, PFHxS etc) and the fluorotelomers including 6:2 FTS (i.e. 4:2, 6:2, 8:2 and 10:2 FTS)

3b. EnRiskS (2022) HHERA - guidelines for PFOA have been applied to the carboxylic acid PFAS (i.e. PFBA, PFPeA, PFHxA etc) and other PFAS (sulfonamides including EtFOSA, EtFOSAA, EtFOSE, MeFOSA, MeFOSAA, MeFOSE and FOSA).

5.2 Groundwater

The Northern Territory Government has published Water Quality Objectives for the Darwin Harbour Region (NT Government, 2010).

The process for setting marine and freshwater quality objectives is based on the national framework outlined in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000).

The Water Quality Objectives are:

- aimed at protecting human health and the health of the aquatic ecosystems;
- for regions of relative homogeneity in water quality;
- not for heavily urbanised areas;
- applied to perennial rivers and streams;
- not developed for intermittent/episodic streams, lakes, wetlands (base-flow only); and
- not to be used as a value to 'pollute up to' but instead be used to limit the amount and type of discharge flushed into waterways or a particular body of water

The Framework for Marine and Estuarine Water Quality Protection recommends that reference values (called guidelines) for each indicator should be based on locally derived data so as to reflect local (ambient) conditions. Where derivation of guidelines based on local monitoring is not possible NWQMS recommends that default figures (national guidelines) for tropical Australia are used instead. Detailed procedures for applying the national guidelines are described in the ANZECC Water Quality Guidelines (ANZECC & ARMCANZ 2000).

In the case of Darwin Harbour the most stringent water quality criterion is the environmental Beneficial Use category because the intent of environmental beneficial use is to maintain the health of aquatic ecosystems and a water body that meets an environmental beneficial use will in almost all circumstances also meet the requirements for all other beneficial uses. Human health related guidelines are also provided to protect recreational and cultural values in the region.

Ambient guideline vales are provided for the type of water system. For toxicants, reference is made back to ANZECC & ARMCANZ 2000.

Based on the preliminary conceptual site model, values requiring protection with respect to groundwater are considered to be human health (vapour intrusion and direct contact) and downslope ecological receptors (marine water ecosystems).

5.2.1 Health Criteria - Vapour Intrusion

Health screening levels (HSLs) for petroleum hydrocarbons are available from ASC NEPM (2013) and CRC Care Health screening levels for petroleum hydrocarbons in soil and groundwater (Friebel E and Nadebaum P, 2010). These references provide HSLs for groundwater at various depth ranges and soil types and assume groundwater to be greater than 2m below ground level. We have adopted criteria for vapour intrusion into structures and vapour intrusion for maintenance workers in shallow trench.

5.2.2 Ecological Criteria

Groundwater from this Site is inferred to discharge to adjacent wetland areas and Darwin Harbour. Surface water within the terminal discharges via a stormwater system and open drain to the west to adjacent wetland areas and Darwin Harbour.

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, August 2018) provide guidelines for protection of aquatic ecosystems and default guideline values have been adopted for the Site as preliminary (i.e. Tier 1) assessment criteria, that is, levels above which a further assessment is required. We note that the guidelines apply at the discharge point and consideration of background concentrations can also be taken into account.

Default Guideline Values for toxicants applying to 'marine water' aquatic ecosystems were considered most applicable. Based on the industrial setting of the Site, the 95% level of species protection applying to slightly-moderately disturbed systems is considered applicable for initial screening. Where toxicants are noted to be potentially bio-accumulative (i.e. cadmium, mercury, nickel), the trigger value for the protection of 99% of species was adopted. PFAS is described in Section 5.2.3.

ANZG (2018) have not published guidelines for petroleum hydrocarbons. For this assessment, the laboratory limits of reporting has been adopted as initial screening criteria.

Baseline conditions are used as a primary measure of potential impacts to water quality.

5.2.3 PFAS

PFAS was screened against criteria available in NEMP 2020 and initial screening assessment criteria from the HHERA prepared by EnRiskS. Details of the HHERA are further described in Section 10 and the HHERA report is included in Appendix M.

In relation to bioaccumulation, the HHERA (EnRisKs, 2022) describes a methodology for assessment and indicates:

- For PFAS that have potential to bioaccumulate the potential for different/increased risk due to this characteristic must be considered but for those PFAS that are not bioaccumulative only the potential for direct toxicity effects needs to be considered.
- The use of the 99% protection trigger value is a policy decision that does not include specific consideration of scientific information relating to bioaccumulation processes and is simply a trigger for more careful and detailed assessment as the chemical has been identified to be bioaccumulative.
- Another option for dealing with bioaccumulative substances is the use of actual sampling of aquatic biota to determine whether organisms that may be present in an aquatic system are actually being exposed to chemicals like PFOS in a form that can get into their systems and be accumulated.
- The currently preferred approach for sites where PFOS may be present is to use the 95% protection trigger value to determine if there is a potential for direct toxicity to aquatic organisms and to use field sampling of aquatic biota to assess the potential for bioaccumulation/secondary poisoning.

Based on the above we have used both 99% and 95% species protection guidelines for initial screening. The HHERA provides a detailed discussion of the screening criteria and also expands into a refined assessment for exceedances based on site specific details.

Table 5-2 below summarises the adopted assessment criteria for water.

Table 5-2 Water Assessment Criteria

Analyte	Health (µg/l)	Ecological (µg/l)	
pH	-	6 – 8.5[4]	
Metals			
Arsenic	-	2.3[1]	
Cadmium	-	0.7 [3]	
Chromium total	-	4.4 [2]	
Copper	-	1.3 [2]	
Lead	-	4.4 [2]	
Zinc	-	8.0 [2]	
Mercury	-	0.1 [3]	
Nickel	-	70 [2]	
Inorganics			
Ammonia	-	20 [4]	
PFAS[6]			
PFOS	2 [5a]	0.13 [5b]	(95% species)
PFOS related compounds		0.00023 [5c]	(99% species)
Sum of PFOS related compounds			
PFOA	10 [5a]	220 [5b]	(95% species)
PFOA related compounds		19 [5c]	(99% species)
Sum of PFOA related compounds			
Total Petroleum Hydrocarbons[8]			
F1 (C_6-C_{10} minus BTEX)	6,000 [6]	-	
F2 (>C_{10}-C_{16} minus naphthalene)	NL[6]	-	
C_6-C_{40}	-	<LOR [7]	

Analyte	Health (µg/l)	Ecological (µg/l)
BTEX		
Benzene	5,000 [6]	700 [2]
Toluene	NL [6]	180 [2]
Ethylbenzene	-	80 [2]
Xylene	-	75 [2]
Polycyclic Aromatic Hydrocarbons		
Naphthalene	NL[6]	70 [2]
Anthracene	-	0.01 [3]
Benzo(a)pyrene	-	0.1 [3]
Fluoranthene	-	1 [3]
Phenanthrene	-	0.6 [3]

Notes:

1. Conservatively based on As (III) low reliability trigger value
2. ANZG 95% species protection
3. ANZG 99% species protection (to account for bioaccumulation)
4. WQO for Darwin Harbour
5. NEMP
    a Recreational water use as adopted in the HHERA
    b Interim marine 95% species protection – slightly to moderately disturbed systems
    c Interim marine 99% species protection – high conservation value systems
    As per EnRiskS (2022) HHERA:
    - guidelines for PFOS have been applied to the sulfonic acid type PFAS (e.g. PFBS, PFPeS, PFHxS etc) and the fluorotelomers including 6:2 FTS (i.e. 4:2, 6:2, 8:2 and 10:2 FTS)
    - guidelines for PFOA have been applied to the carboxylic acid PFAS (i.e. PFBA, PFPeA, PFHxA etc) and other PFAS (sulfonamides including EtFOSA, EtFOSAA, EtFOSE, MeFOSA, MeFOSAA, MeFOSE and FOSA).
6. NEPM Health criteria - Vapour intrusion (HIL D, 2-<4m, sand conservatively assumed)
7. Conservatively used as investigation level in the absence of ANZG criteria
8. CRC Care Criteria for TPH/BTEX intrusive maintenance worker (shallow trench) are all non-limiting

NL – non limiting
LOR – Limit of reporting

6 Data Quality Objectives

The data quality objectives (DQO) in Table 6-1 were developed for this project and are based on the requirements described in ASC NEPM (1999). Data Quality Indicators (DQIs) are included in Appendix F.

Table 6-1 Data Quality Objectives

Step	Tasks
Step 1 State the problem	The primary objectives are outlined in Section 1.2. The main considerations are: • How many samples should be collected? • What sample layout should be used to achieve the above objectives? • What analytes should be tested? • What media should be tested? A preliminary conceptual site model is presented within Section 4 based on current available desktop information. The main problem is to determine what sample layout should be used to achieve the above objectives? The key assessment team consisted of SMEC staff Pauline Voukidis (Environmental Engineer), Manuel Fernandez (Principal Engineer – Environmental – CEnvP Site Contamination Specialist) and risk assessment subconsultant EnRiskS.
Step 2 Identify the decisions	The decisions to be made on the basis of the sampling were: • Are soils impacted with PFAS at unacceptable levels near the site of the 2020 foam solution leak and if so, what is their potential extent? • Is groundwater impacted at unacceptable levels within the Site from PFAS, petroleum hydrocarbons, metals (Pb, Cu, Zn) and ammonia that could cause unacceptable risk to health or the receiving environment? • Is stormwater impacted at unacceptable levels within the Site from PFAS, petroleum hydrocarbons, metals (Pb, Cu, Zn) and ammonia that could cause unacceptable risk to health or the receiving environment? • Is onsite stormwater channel sediment impacted at unacceptable levels within the Site from metals (Pb, Cu, Zn) and ammonia that could cause unacceptable risk to health or the receiving environment? • Is further assessment or remediation/management required?
Step 3 Identify information inputs	The inputs required to make the decisions listed in Step 2 were as follows: • Site history information • Site observations made during the intrusive investigations, including unusual odours, staining or buried waste materials • Soil and water concentrations of contaminants of potential concern, including historical data • Applicable NT EPA endorsed guidelines (refer to Section 5).

Step	Tasks
Step 4 Define the study boundaries	Laterally, the study boundary is defined by the Site boundary (i.e. the investigation boundary), as shown on Figure 1, Appendix A. Vertically, the study boundary for this investigation will be about 6m (around 2m past the lowest water table).
Step 5 Develop the analytical approach (decision rule)	The decision rule was as follows: • A data validation assessment will be carried out for all data collected with respect to quality assurance and quality control (QA/QC) and conclude if the data collected is useable, partially useable with some limitations, or unusable in forming conclusions to the assessment. • Where contaminant concentrations for each sample were below the investigation levels then the potential for contamination at that location will be assessed to be low. • Where contaminant concentrations are reported to exceed the investigation levels, or where potential for significant variability is noted within sample data or Site conditions (i.e. reduced sampling density, changes to temporal conditions), a refined assessment will be carried out. This may include review of background concentrations and other published data. Where a refined assessment shows potential for harm, additional assessment or remediation or management may be recommended. A This may include further monitoring and/or management measures. • The data will be used to refine the CSM and assess the need for what other data would be needed to further assess the Site.
Step 6 Specify performance or acceptance criteria	We have assumed the following to be true in the absence of contrary evidence (i.e. the null hypothesis): • Contamination at the Site currently poses a potential risk to human and/or environmental receptors. The possibility exists of making the following decision errors based on the data obtained during this investigation: • Type 1 error – Deciding the above null hypothesis is false, when it is true • Type 2 error – Deciding the above null hypothesis is true, when it is false. The consequence of making a Type 1 error is more detrimental as it can result in adverse consequences or may include material impact to human and environmental health. The consequence of making a Type 2 error may result in 'over-conservatism' and unnecessary expense of conceptual remediation options. The potential for decision errors will be minimised by completing a robust QA/QC program and by completing an investigation that has an appropriate sampling and analytical density for the purposes of the investigation.

Step	Tasks
Step 7 Optimise the design for obtaining data	The general Site assessment methodology comprised: • Collection of soil data stepping out from the area of the 2020 foam solution leak to assess the potential extent of PFAS in soil in that area. There was limited environmental data in the area of the foam solution leak to inform an adequate assessment of the extent and significance of the impacts from the foam solution leak incident. It may be difficult to fully assess the source of impact and extent due to there being other historical sources of PFAS in the vicinity. Concentration gradients and chemical make-up may however be able to give some indication. • Assessment of leachability of PFAS from soil. • Installing additional groundwater wells away from the area of the 2020 foam solution leak to assess potential impact and also supplementing additional wells within the Vopak terminal area to further assess extent and significance of the nominated contaminants. • Assessment of groundwater flow direction through gauging groundwater depths and well survey. • Use of recent and historical monitoring data (provided by Vopak) and the above data to refine the CSM. • Use of existing monitoring data and assessments by others to assess stormwater and stormwater channel sediment. • Developing site specific trigger values for PFAS for the terminal, in particular a methodology for PFAS compounds for which there are no specific guidelines in the NEMP. • Assessing the significance of the contaminant concentrations. Sampling was carried out in accordance with the methodology in Section 7.

7 Field and Laboratory Investigations

7.1 General

Field investigations were carried out between 4-13 April 2022 by a suitably qualified Environmental Engineer in general accordance with the Sampling, Analysis and Quality Plan (SMEC, 2022). Investigation locations are presented in Figure 3, Appendix A.

The Site investigation included the following:

- Soil sampling from ten (10) boreholes (SBH01 to SBH06 and EMB22 to EMB25) drilled in three accessible directions stepping out from the existing pipe leak excavation Step outs were to be at about 2m from the existing foam solution leak excavation, then a further 5m and then a further 15m
- Boreholes were drilled using 150mm diameter solid stem auger drilling techniques using a Comacchio Geo 305 track mounted drilling rig. Soil samples were collected up to about 3m below ground level (bgl), which is typically just past the top of the water table.
- The upper 1m (or depth to refusal) of the borehole was drilled with non-destructive drilling techniques. This employed a high pressure water lance to liquify the soil and the sediment was removed with a vacuum truck. Potable water was used.
- Four of the boreholes (EMB23 to EMB25) were extended to allow groundwater monitoring wells to be installed at these locations (well installation is described further in Section 7.2.1).
- Five additional groundwater monitoring wells (EMB17 to EMB21) were installed closer to Site boundaries and in inferred downgradient locations to assess groundwater concentrations and extent as follows:
  - Soil samples were generally collected at two depths within soil and weathered rock where possible within the upper 3m of these well locations.
  - Installation of a groundwater monitoring bore (EMB17) south of EMB7 (highest concentrations of PFOA and sum of PFAS) and EMB8 (sum of PFHxS and PFOS detected above LOR).
  - Installation of two groundwater monitoring bores (EMB20 to EMB21) to assess downgradient and along the boundary of EMB1 and EMB3.
  - Installation of a groundwater monitoring bore (EMB19) downgradient of EMB4.
- Air percussion drilling techniques were employed to reach the groundwater monitoring well target depths, where solid stem auger drilling had refusal on weathered material (rock).
- Each borehole was logged.
- One round of water level gauging from existing and new wells at the Site (23 in total) was carried out to assist with assessing groundwater flow direction.
- Groundwater sampling from the newly installed wells.
- Survey of existing and new wells was undertaken by a subconsultant surveyor (Land Surveys)for location and elevation at ground level and top of casing.

There were only slight deviations from the SAQP, which included:

- The location of the 2020 PFAS foam solution line leak as observed on Site was further to the north-east (closer to the gantry) from what was shown in the SAQP. Sample locations in this area were amended accordingly and slightly adjusted due to the presence of the gantry. Drilling could not take place under the gantry fuel lines

- Sample depths were adjusted due to the presence of coarse fill and shallow rock. Sampling also occurred from solid stem augers due to this material.
- Locations EMB17 and EMB20 were slightly moved.

7.1.1 Soil Sampling Procedure

The following procedure was adopted for soil sampling:

- Prior to sample collection, the field Engineer washed their hands with soap and rinsed thoroughly with tap water before donning a clean, new pair of disposable nitrile gloves. A new pair of nitrile gloves was worn for each different sampling location.
- Soil samples in the upper sections of the borehole where non-destructive digging was used were collected by hand directly out of the bottom of the borehole. Samples beyond 1m were collected from the stem of the auger. The use of push tube sampling techniques was not practicable due to the coarse nature of the fill and shallow weathered rock
- Soil samples in the ten step out boreholes were generally collected at regular intervals down the soil profile. Samples were to be collected typically near the surface (beneath pavers) at 1m, 2m and 3m below ground surface. Depths had to be adjusted due to the presence of coarse fill and shallow weathered rock.
- Soil samples from the other five monitoring well locations were collected at two depths. (typically one in the upper 0-1m and another in 1-2m due to weathered rock). These were also collected in duplicate into a zip lock bag and field-screened using a photoionisation detector (PID). The PID was calibrated in accordance with manufacturer instructions. Calibration certificates are provided in Appendix G.
- Sample depths were adjusted to target specific layers (such as changes in stratigraphy, more permeable layers or if there was a suspect layer/material or visual/olfactory evidence of contamination, if relevant).
- Soil samples were collected directly from decontaminated sampling equipment (hand augers, auger stem). Any reusable equipment was decontaminated prior to use and this is described in Section 8.1.2.
- A visual assessment was made of encountered soil material for the potential presence of contamination indicators such as staining or odours.
- Each soil sample was collected within clean laboratory supplied containers. PFAS sampling containers were double bagged to prevent potential cross contamination. Details on preservation and holding times are shown in Table 7-1.

Table 7-1 Soil Sampling Requirements

Parameter	Container	Sample volume	Preservation	Holding Time
PFAS	HDPE Jar	150ml	Cool to <6°C, minimise exposure of sample to light	180 days
Total Recoverable Hydrocarbons (TRH C_6-C_9) and BTEX	Glass jar with Teflon lined lid	150ml	Cool to <6°C	14 days
Total Recoverable Hydrocarbons (TRH C_{10}-C_{40}) (with silica gel clean up)				14 days
Metals (As, Cd, Cu, Cr, Pb, Hg, Ni, Zn)				180 days
PAH				14 days

7.2 Groundwater

7.2.1 Groundwater Monitoring Well Installation

Nine groundwater monitoring wells (EMB17 to EMB25) were installed at the Site at the locations presented on Figure 3, Appendix A. The monitoring wells were installed using the following method:

- All wells were completed in general accordance with the relevant sections of NUDLC (2020) The Minimum Construction Requirements for Water Bores in Australia 3rd Ed.
- Monitoring wells were installed using a 150mm solid flight rotary auger to a depth of 5-6m bgl. Where the solid flight rotary auger had refusal before the target depth, air percussion techniques were employed to reach the target depths. This depth was selected based on previous groundwater level monitoring which suggests this is about 2m past the top of the previously observed water table when at its lowest.
- The wells were completed as follows:
  - 50mm machine slotted class 18 u-PVC screen was installed from the base of the well to around 1.5m below the ground surface. Unslotted class 18 u-PVC casing was then be used to just below ground level. A longer screen was selected to account for potential variability in groundwater table between wet and dry seasons
  - The base was fitted with an end cap
  - A filter pack comprising clean sand was backfilled around the annulus of the borehole to about 0.2m above the top of the screen
  - A bentonite seal of about 1m was then installed above the filter media above which concrete was used and a steel trafficable cover used at the ground surface
  - The top of each well was capped with a torque plug
  - A mark was cut into the top of each well casing from which survey and water levels were measured.
- Each well was developed following installation using a dedicated PFAS-free bailer.

- A surging action was used to promote groundwater movement followed by removal of a minimum of 3 to 5 well volumes from each until water clarity improved or until dry, whichever occurred first (refer to Appendix J).
- Following installation, a survey of each well was carried out to measure the location (easting and northing) and elevation in metres above Australia height datum (ground surface and top of casing).
- All re-useable sampling equipment e.g. solid flight auger was subjected to de-contamination as described within Section 8.1.2.

7.2.2 Groundwater Sampling

Groundwater sampling comprised the following method:

- A water level interface probe was used to gauge the depth of standing water level and total well depth.
- The interface probe was also used to assess presence of measurable Light Non-Aqueous Phase Liquid (LNAPL).
- Groundwater samples were collected using bailer sampling techniques in general accordance with Victoria EPA (2000) Groundwater Sampling Guidelines. Bailers have been used for previous historical sampling and the same technique was used for comparability.
- During purging, a calibrated water quality meter was used to take frequent measurements of field water quality parameters, including pH, EC, temperature, redox and dissolved oxygen until parameters stabilised. A minimum of three well volumes were purged prior to collection of samples. Parameters were considered stable when three consecutive readings (obtained about 3-4 litres apart) were within:
  - 10% for dissolved oxygen and turbidity
  - 3% for electrical conductivity (specific conductance)
  - +/- 0.05 for pH
  - +/- 10 mV for redox potential.
- Following purging, representative groundwater samples were collected into laboratory supplied containers for the specified analysis suite. Sample volumes and containers were suitable to achieve the required reporting limits. Samples for heavy metals analysis were field filtered through dedicated 45µm filters for assessing dissolved concentrations, ensuring data is comparable with previous monitoring rounds.

Details on preservation and holding times are shown in Table 7-2.

Table 7-2 Water Sampling Requirements

Parameter	Container	Sample volume	Preservation	Holding Time (for extraction)
Metals (As, Cd, Cu, Cr, Pb, Hg, Ni, Zn)	Plastic bottle	1 x 60mL	Cool to <6°C, HNO_3, preservative, field filtered	6 months
Ammonia	Plastic bottle	1 x 60mL	Cool to <6°C, H_2SO_4 preservative	28 days
Total Recoverable Hydrocarbons (TRH C_6-C_9) and BTEX	Amber glass vial, Teflon lined lid	2 x 40mL (vials)	Cool to <6°C, H_2SO_4 preservative	7 to 14 days
Total Recoverable Hydrocarbons (TRH C_{10}-C_{40}) (with silica gel clean up)	Amber glass bottle Amber glass vial, Teflon lined lid	1 x 100ml 2 x 40mL (vials)	Cool to <6°C, H_2SO_4 preservative	7 to 14 days
PAH	Amber glass bottle	1 x 500ml	Cool to <6°C	7 days
PFAS	HDPE plastic bottle	2 x 125ml (note 1 extra set of bottles required per 10 samples for lab duplicate and matrix spike analysis)	Cool to <6°C,	180 days

7.2.3 Water Level Gauging

One round of water level gauging was undertaken on 11 April 2022 at all newly installed and existing groundwater monitoring wells (23 locations total).

A water level interface probe was used to gauge the depth of standing water level at each location accurate to 1mm.

A survey of all existing and newly installed groundwater monitoring wells was carried out to measure the location (easting and northing) and elevation in metres above Australia height datum (ground surface and top of casing).

7.2.4 Waste Management

Excess spoil material resulting from the drilling that could not be returned to the boreholes was stored in drums for storage and disposal by Vopak. Excess decontamination liquids and groundwater was stored in containers for storage and disposal by Vopak.

7.3 Field and Laboratory Testing Schedule

Samples for contamination testing were submitted to the following laboratories for testing for the nominated potential contaminants of concern:

- Primary samples: ALS Environmental (277-289 Woodpark Road, Smithfield NSW 2164)
- Secondary samples: Eurofins Services (16 Mars Road, Lane Cove West, NSW, 2066)

Both laboratories are accredited by the National Association of Testing Authorities Australia (NATA) for the tests to be performed. A summary of testing quantities is provided in Table 7-3.

Table 7-3 Summary of testing quantities.

Media	Analysis	Number of Primary Samples	Comments
Soil	Metals (As, Cd, Cu, Cr, Pb, Hg, Ni, Zn), TRH, BTEX, PAH	10	Generally, 2 samples per location from perimeter wells and 1 from a borehole near the 2020 PFAS foam solution line leak[2]
	PFAS	30	2 samples per location[2]
	PFAS Australian standard leaching procedure (ASLP) testing	5	Based on analytical results
Groundwater	Total Recoverable Hydrocarbons (TRH) (with silica gel clean up)	9	1 per well
	Benzene, toluene, ethylbenzene, xylene (BTEX)		
	Polycyclic aromatic hydrocarbons (PAHs)		
	Metals (As, Cd, Cu, Cr, Pb, Hg, Ni, Zn)		
	Ammonia		
	PFAS[1]		

Notes:

[1] A lower limit of reporting was scheduled for PFAS sampling in order to meet 99% species protection criteria.

[2] At some locations the number of samples specified in the SAQP (SMEC 2022) could not be met, as a result of the solid flight rotary auger hitting refusal and air percussion techniques being employed, preventing additional sample collection.

8 Quality Assurance and Quality Control

Quality assurance and quality control was carried out generally as per the SAQP based in general accordance with NEPM 1999 requirements. Data quality indicators are presented in Appendix F.

8.1.1 Sample Handling, Storage and Transportation

Sampling of soil and water was carried out by trained and experienced environmental staff using sampling protocols which minimise potential cross contamination occurring in between sampling locations.

During fieldworks, samples were placed in an ice-filled chest to keep the samples below the recommended preservation temperature of approximately 6 °C. Samples were kept cool in ice chests with ice until delivered to the SMEC Darwin office, or directly to a satellite office in Darwin operated by ALS where samples were refrigerated. Samples were kept refrigerated at the SMEC Darwin office until they could be delivered to the ALS Darwin office. Samples were then be re-packed in ice filled chests for transport to the ALS Sydney laboratory via an overnight service.

Samples, including QA samples, were transported to the laboratories with relevant Chain of Custody (CoC) documentation. The CoC form was completed with the sample names, sampling date and required analyses. The samples were sent in a sealed ice chest to the laboratory for analysis within the prescribed analyte holding times.

8.1.2 Equipment Decontamination

Reusable sampling equipment with the potential to cross contaminate samples (e.g. hand augers or stainless steel trowel, if required), were decontaminated using a triple wash procedure; that is, washed in diluted Liquinox (PFAS free) detergent solution, rinsed in potable water and then rinsed in distilled water. At a minimum, equipment decontamination occurred prior to use, in between each sample, at the end of each day and prior to equipment return to suppliers.

During soil sampling and water quality monitoring events, rinsate blanks were collected to assess decontamination procedures.

8.1.3 Equipment Calibration

Monitoring equipment used to collect data was calibrated and/or serviced at regular frequency in accordance with manufacturers recommendations. At a minimum, this included a PID calibration within one month of fieldwork (i.e. minimum monthly), and a water quality meter calibrated within one week prior to monitoring (i.e. minimum weekly). Calibration certificates are included in Appendix G.

8.1.4 Methods

Analytical methods were in accordance with NEPM (2013) testing procedures. Refer to Appendix F for details on the analytical techniques.

8.1.5 Trip Blank and Trip Spike Samples

One PFAS soil trip blank, one soil BTEX trip spike/blank, and one water BTEX trip spike/blank were taken into the field, transported and analysed together with soil samples collected within this project.

One laboratory-prepared water trip blank and BTEX trip spike was taken into the field, transported and analysed together with groundwater samples collected within this project. The trip blank and spike samples were analysed for volatile contaminants (i.e. BTEX, TRH C_6-C_9 fraction). In addition, a PFAS water trip blank was used during groundwater quality monitoring.

Laboratory QA/QC, including matrix spikes, laboratory method blanks and laboratory duplicates, were performed in accordance with the laboratory NATA accreditation and the requirements of the ASC NEPM, 2013 and NEMP.

8.1.6 Field Duplicate Samples

Duplicate samples were collected and tested for each analyte to assess precision in field sampling techniques and laboratory methods. Duplicate samples (comprising both inter and intra-laboratory) were analysed at a frequency as follows:

- Minimum of 1 in every 20 samples as recommended in NEPM (i.e. Analysis of intra-laboratory (5%) and inter-laboratory duplicates (5%)).
- PFAS only – Minimum of 1 in every 10 samples as recommended in NEMP (i.e. Analysis of intra-laboratory (10%) and inter-laboratory duplicates (10%)).

Table 8-1 below provides a summary of the duplicate identification and analysis.

Table 8-1 Field Duplicate Samples.

Primary Sample ID	Media	Duplicate ID	Type	Analysis
EMB18/0.1-0.2	Soil	QA01	Intra lab duplicate	Metals (As, Cd, Cu, Cr, Pb, Hg, Ni, Zn), TRH, BTEX, PAH, PFAS
		QA01A	Inter lab duplicate	
EMB22/0.02-0.1	Soil	QA02	Intra lab duplicate	PFAS
		QA02A	Inter lab duplicate	
SBH06/0.08-0.15	Soil	QA04	Intra lab duplicate	PFAS
		QA04A	Inter lab duplicate	
EMB21	Groundwater	QA06	Intra lab duplicate	TRH (with silica gel clean up) BTEX, PAH, metals (As, Cd, Cu, Cr, Pb, Hg, Ni, Zn), ammonia, PFAS
		QA06A[1]	Inter lab duplicate	

Table Notes:

[1] PFAS analytes were not analysed for intra-laboratory duplicate sample QA06A during the water sampling round.

A sufficient number of duplicates were analysed for this preliminary assessment.

Results of relative percent differences (RPDs) are included in Table K2 and Table K3, Appendix K.

8.1.7 PFAS Protocols

The following additional protocols were adopted for all fieldwork due to soil and groundwater samples requiring analysis for PFAS:

- Prior to sampling, the sampling personnel washed their hands with plain soap and rinsed thoroughly in tap water before donning a clean, new pair of disposable nitrile gloves.
- All monitoring well gear was new, unused with original seals and original undamaged wrapping.
- Field clothes – were not new (i.e. had been washed minimum of six times).
- No stain resistant, water resistant/waterproof coatings or treated fabric were used.
- No Teflon products were used.
- No fast food wrappers, pre-wrapped foods (only rigid plastic or stainless-steel containers) were permitted on Site.

- No aluminium foil was permitted to be used.
- No 'post it' notes were permitted to be used.
- No reusable chemical ice packs were permitted to be used.
- No sunscreen, moisturiser or cosmetics were used.

8.1.8 Field QAQC

The following DQI non-compliances were noted within field QAQC:

- Sample temperatures were recorded slightly above the recommended 6oC on Sample Receipt Notification for the samples from the following batches: ES2212085 (12.1 OC), ES2212247 (8.4OC), ES2212731 (21.8OC), ES2213150 (16.1OC), ES2213154 (16.1OC), 878534 (13.4 OC), 882131 (13.1OC), and 882408 (16.2OC). SMEC contacted the laboratory (ALS) and they indicated that the sample temperatures are recorded at the ALS Darwin office. Since field temperatures were in excess of 30OC, the samples would take time to get down to lower temperatures and the higher temperatures are most likely a function of this. ALS confirmed that they place the samples in the bottom of the ice chest and layer a large amount of ice on top. The ice chests are put on a premium service and arrive in Sydney the next morning. We consider that the efforts made to keep samples at lower temperatures were reasonable and were carried out as discussed in Section 8.1.1.

  SMEC consider that slightly elevated sample temperatures are unlikely to affect the data useability noting:

  - Samples were kept in ice chilled eskies during fieldwork and refrigerated upon arrival at laboratory.
  - Trip spikes were collected and analysed with each batch, and recorded recoveries were within control limits, suggesting loss of volatiles was unlikely to have occurred.
  - Temperatures were relatively lower than ambient and subsurface temperatures at the time of sampling (for example, the groundwater temperatures at the site were well over 30°C)
- Holding times were exceeded for the following samples:
  - Analysis of moisture content for several samples in batch ES2212731 exceeded analysis holding times by 1 day.
  - Analysis of TPH and TRH (sample TRIP BLANK), and BTEXN (samples TRIP SPIKE – 2, TCS – 2) (batch ES2213150) exceeded extraction and analysis holding times by 4 days.
  - It is noted that the analysis on the CoCs for batches ES2212731 and ES2213150 were not scheduled by the laboratory at the time of receipt of the CoC, resulting in the holding time exceedance.
  - Analysis of TPH, TRH, BTEXN, and PAH for several samples in batch ES2213154 exceeded extraction and analysis holding times by 1-2 days.
  - Samples from batch ES2213154 were sampled on 11-12 April 2022 and received at the laboratory with a completed CoC on 13-14 April 2022. Holding times were a result of the delayed laboratory extraction date of 20 April 2022.
- PFAS analytes were not analysed for intra-laboratory duplicate sample QA06A during the water sampling round. The omission was due to the sample not being delivered by the primary laboratory. It is noted that relative percentage difference (RPD) of all other analytes in this batch were within DQIs.
- Field duplicates recorded relative percentage difference (RPDs) outside of adopted control limits including:
  - Several RPDs which were recorded above the field or laboratory acceptance limits have been disregarded where sample concentrations were less than 10 times the laboratory limit of reporting.

8.1.9 Laboratory QA/QC

The following DQI non-compliances were noted within laboratory QAQC:

- The expected QC frequencies were not met for laboratory duplicate and matrix spike ((water) analysis in the following batches:
  - laboratory duplicates and matrix spikes were not analysed for PAH/phenols, and TRH in batch ES2212085.
  - A laboratory duplicate was not analysed for PAH/phenols, PFAS, and TRH, and matrix spike was not analysed for PAH/phenols and TRH in batch ES2212247.
  - LD and MS were not analysed for PAH, PFAS, and TRH in batch ES2213154.
  - These batches contained the inter-laboratory duplicate sample and the omission of these tests are not considered to affect useability for purposes of precision assessment.
- Matrix spike recoveries exceeded acceptance criteria in the following samples:
  - Matrix spike recoveries could not be determined for 6:2 FTS and 8:2 FTS (batch ES2212247), and ammonia as N (batch ES2213154). An acceptable recovery was obtained for laboratory control spikes, indicating a sample matrix interference.
  - Matrix spike recoveries could not be determined for anonymous samples in batch ES2212085 for several analytes (PFOS, 6:2 FTS, and 8:2 FTS). These are unlikely to be representative of sampled material, and thus are not expected to affect useability of the sampled data.
- Laboratory duplicates exceeded acceptance criteria in the following samples:
  - Laboratory duplicate recovery recorded RPDs outside of adopted control limits for arsenic in anonymous sample in batch 878534, and for nickel in anonymous sample in batch 882131. These are unlikely to be representative of sampled material, and thus are not expected to affect useability of the sampled data.
- Concentrations of TRH analytes >C10-C16 fraction (F2), >C10-C16 fraction (F2 minus naphthalene), and >C10-C40 fraction (sum) in rinsate sample RINSATE 01 (batch ES2212085) were above the detection limit. It is noted that TRH-free rinsate water was not available at the time of sampling at the time this rinsate sample was collected. The TRH recorded could be associated with the original rinsate water. Concentrations of all other analytes were not detected. Additionally, TRH was not detected in rinsate samples collected using TRH-free rinsate water (i.e. Sample RINSATE 05, batch ES2212247). Thus, this is not expected to affect the useability of the sample data.

8.1.10 QAQC Summary

Based on the above data evaluation, SMEC consider the data to be useable for the purposes of this assessment.

9 Field and Laboratory Results

The following sections discuss the field and laboratory results from the fieldwork completed by SMEC in this investigation.

9.1 Subsurface Conditions

Borehole logs are presented in Appendix I. Photographs of typical soil profiles and examples of the soil material observed during sampling are included in Appendix H.

The generalised subsurface conditions encountered at the sampling locations are summarised in Table 9-1 below.

Table 9-1 General Summary of Subsurface Conditions.

Unit	Typical depth to Top of Unit (m bgl)	Indicative Thickness (m)	Typical Description	Location and Photo Reference (Appendix H)
Roadbase or Pavers	0	~0.08	Typically, medium to coarse gravel or concrete pavers.	EMB17-22 (gravel road base) EMB22-25, SBH01-06 (pavement) Photos 1, 5-6, 13-14, 17, 21
FILL	0.08	~0.15-1.32	General fill mixtures/layers: SILT, Gravelly SILT or silty gravelly SAND, transitioning into sandy silty GRAVEL, cobbly GRAVEL, gravelly COBBLES or COBBLES, transitioning into cobbly BOULDERS or BOULDERS (siltstone). Note: Gravel and cobble size generally increased with depth)	All locations Photos 2-4, 8-10, 15, 18-20, 22-23, 25-27
Estuarine	1.7	1.2	Sandy clay Note: this layer was only encountered at location EMB20.	EMB20 only Photos 11-12
Weathered material (Rock)	~0.5-1.2 (Range 0.18-2.9)	-	SILTSTONE	All locations Photos 7, 16, 24, 28

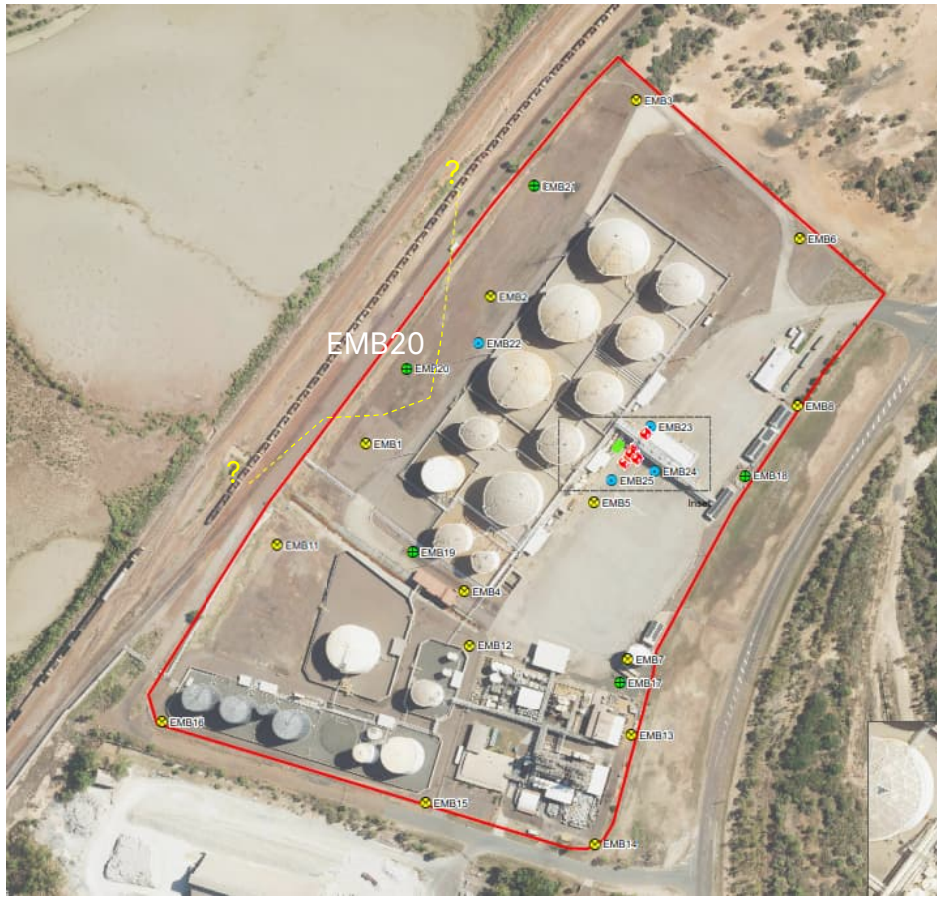
No unusual staining or odours were observed during the sampling. No visual indicators of suspected asbestos containing material (ACM) were noted at the sampling locations.

PID field screening of soil samples recorded negligible to low results ranging between 0 parts per million (ppm) (in samples EMB18/0.1-0.2 and EMB17/1.2-1.3) to 19.2 ppm (in sample EMB18/1.4-1.5) (refer to Appendix J). These results are considered negligible and do not suggest the presence of volatile contaminants.

The Site investigations generally encountered relatively shallow bedrock underlying the Site at depths ranging from near the surface to about 1.2m. One exception was at borehole EMB20 in the central-western part of the Site where a layer of estuarine material (black sandy clay) was identified with weathered rock slightly deeper at 2.9m. Fill materials above the natural soils appeared to be of similar origin to the natural underlying rock and were typically coarse. Figure 9-1 below provides a representation of where estuarine soils were found and represented in an overlay on the 2001 aerial photo prior to the terminal development and current layout. The 2001 aerial photo shows likely filling/recontouring of the land and surrounds. Other portions of estuarine soil could be present within or nearby the Site at some Site extremities.



2001 Aerial photo (Ref: Metromap)



2022 Aerial photo (Ref: Metromap)

Figure 9-1 Area where estuarine soil encountered

9.2 Groundwater

Photographs of completed groundwater wells, taken at the time of monitoring, are included in Appendix H.

The following observations were noted during the single round of groundwater sampling (11 and 12 April 2022):

- Standing water level was recorded between 1.06 m bgl (location EMB23 and EMB25) and 1.84 m bgl (location EMB18) (refer to Appendix J).
- pH was recorded between 3.54 (EMB21) and 6.11 (location EMB20) (refer to Appendix J and Table K3, Appendix K).
- No odour was observed at any locations, at the time of sampling.
- Groundwater was observed to be medium or medium to high turbidity, red-brown coloured at locations EMB17, EMB18, EMB19, EMB20, EMB24.
- Groundwater was observed to be low to medium turbidity, pale red-brown coloured at locations EMB22, EMB23, EMB25.
- Groundwater was observed to be low to medium turbidity, pale grey coloured at location EMB21.

Water level gauging was undertaken at all newly installed and existing groundwater monitoring wells (23 locations total) on 11 April 2022. Water level measurements are presented in Table 9-2 below.

Table 9-2 Water level measurements, recorded on 11 April 2022.

Bore ID	Top of Casing RL[1]	Ground Level RL[1]	Bottom of Well RL[1]	Time (24hr)	Standing Water Level		
	mAHD	*mAHD*	*mAHD*		*mbTOC*	*m bgl*	*mAHD*
EMB1	5.730	5.780	-3.940	1010	1.46	1.510	4.270
EMB2	5.666	5.733	-3.264	1005	0.99	1.057	4.676
EMB3	5.731	5.795	-2.039	1213	2.19	2.254	3.541
EMB4	6.309	6.355	-3.351	1056	1.23	1.276	5.079
EMB5	6.049	6.087	-1.681	1140	1.13	1.168	4.919
EMB6	6.052	6.098	-3.678	1205	1.25	1.296	4.802
EMB7	6.373	6.379	-2.817	1130	1.27	1.276	5.103
EMB8	7.060	7.109	-1.930	1227	2.11	2.159	4.950
EMB11	5.860	5.939	-2.000	1105	2.05	2.129	3.810
EMB12	6.398	6.508	2.158	1025	1.33	1.440	5.068
EMB13	7.993	7.225	-1.717	1243	2.82	2.052	5.173
EMB14	8.511	7.838	-1.569	1247	2.77	2.097	5.741
EMB15	6.593	6.661	-1.637	1122	0.93	0.998	5.663
EMB16	6.530	6.595	-2.850	1111	2.25	2.315	4.280
EMB17	6.441	6.464	0.491	1125	1.43	1.453	5.011
EMB18	6.810	6.858	1.300	1159	1.84	1.888	4.970
EMB19	6.394	6.323	0.464	1017	1.82	1.749	4.574
EMB20	5.700	5.752	0.200	1015	1.78	1.832	3.920
EMB21	5.625	5.679	-0.275	0900	1.1	1.154	4.525
EMB22	5.693	5.779	2.673	1000	1.11	1.196	4.583
EMB23	6.016	6.162	0.106	1154	1.06	1.206	4.956
EMB24	6.376	6.499	1.316	1150	1.44	1.563	4.936
EMB25	6.010	6.103	0.350	1145	1.06	1.153	4.950

Table Notes:

[1] Survey conducted 11 April 2022

TOC = Top of casing; mbTOC = Metres Below Top of Casing; AHD = Australian Height Datum; m bgl = Metres Below Ground Level; RL = Reduced Level

Estimated groundwater contours and flow direction based on the water level monitoring on 11 April 2022 are presented in Figure 8, Appendix A. Groundwater level records are presented in Appendix J. On the date of the water level gauging the general groundwater flow was inferred to flow to the west.

The groundwater table on the day of water level gauging was typically just below the top of the weathered rock, except in EMB20 where it was within the estuarine layer. This gauging event was towards the end of the wet season and therefore the water table would be expected to be lower in the dry season. During periods of heavy rain, the water table could also rise higher locally.

9.3 Laboratory Results

9.3.1 Soil

Tabulated analytical results for soil analysis are summarised in Table K1, Appendix K. The laboratory analysis reports are included in Appendix L.

The following results are noted from soil sampling at borehole locations:

- Concentrations of PFAS (including PFOS and PFOA related compounds in the samples analysed were below the respective adopted Site assessment criteria.
- The higher concentrations of PFAS were typically fluorotelomers, 6:2 FTS and 8:2 FTS.
- PFAS was measurable in 29 out of 30 soil samples tested which included locations near the 2020 foam solution leak and areas away, closer to Site boundaries. All concentrations were well below the adopted assessment criteria. Figure 9, Appendix A provides an indication of the distribution of PFAS across the Site represented as the sum of PFAS concentrations.
- The highest PFAS concentration was recorded at EMB17 near the location of the foam solution release in 2006. The concentration at this location is greater than PFAS concentrations recorded within the excavation of PFAS foam solution leak in 2020.
- The spatial distribution of PFAS in soil was irregular stepping away from the 2020 foam solution leak excavation with no clear pattern and did not suggest decreasing concentrations stepping away from the leak location. PFAS concentrations were generally lower in deeper soil samples.
- TPH, TRH, BTEX and PAHs were not detected in the samples analysed. The detection limits were below the respective adopted Site assessment criteria.
- Concentrations of heavy metals were below the respective adopted Site assessment criteria.

9.3.2 Soil PFAS Leachability

Tabulated analytical results for soil leachability analysis are summarised in Table K6, Appendix K. The laboratory analysis reports are included in Appendix L.

- Human Health
  - Exceedances of health (recreational) screening criteria were recorded for PFOS and PFOS related compounds (6:2 FTS and 8:2 FTS) in two samples from locations EMB17 and SBH04
- Ecological
  - PFOS related compounds (6:2 FTS, 8:2 FTS and/or 10:2 FTS) and Sum of PFOS related compounds were recorded above the adopted ecological interim marine 95% criteria in two samples from EMB17 and SBH04
  - The concentration of PFOS was recorded above the PFAS NEMP (2020) ecological interim marine 99% criteria (0.00023 µg/L) in all samples and ranged between 0.0003 µg/L and 0.0214 µg/L.

Soil leachability results recorded some exceedances of the adopted health and ecological criteria. As described in the HHERA (EnRisKs, 2022, Appendix M), the leach test used the Australian Standard Leaching Procedure (ASLP) which uses a small amount of soil (sieved smaller particles) mixed with a large volume of liquid and tumbled for 16 hours. The test is designed more for assessment of waste behaviour in a landfill, not for leaching from a single rain event and therefore it is not common for such large volumes of water to move through small amount of solids. Due to limited methods, this more practical test was used but is likely to provide a significant over estimate of what these chemicals will leach in a single rain event. The leachability data is used to provide a preliminary assessment. The HHERA notes that the leachability results show that PFAS are highly leachable as would be expected for these chemicals and calculates that PFOS is around 50% leachable for samples with detected levels and 6:2 FTS is highly leachable for samples with detected levels. This confirms that PFAS in the soil could have leached from the soil into water at the site (groundwater or stormwater). Since at this Site groundwater quality has been directly measured through installation and sampling of wells, the groundwater data is considered more representative and is discussed in sections below.

9.3.3 Groundwater

Tabulated analytical results for groundwater analysis are summarised in Table K3, Appendix K. The laboratory analysis reports are included in Appendix L.

The following results are noted from water sampling from the newly installed groundwater well locations:

- pH below the lower range limit of 6 was recorded in all but one sample with values outside the lower limit ranging between 3.54-5.81
- Concentrations of ammonia were above the respective adopted Site assessment criteria for all samples except EMB21 and EMB24. Exceeding concentrations ranged between 40 µg/L and 6,850 µg/L
- A copper concentration was recorded above the ANZG (2018) marine water 95% species protection trigger value (0.3 µg/L) in sample EMB24 (1 µg/L).
- Zinc concentrations were recorded above the ANZG (2018) marine water 95% species protection trigger value (8 µg/L) in samples EMB19 (12 µg/L) and EMB22 (22 µg/L).
- TRH, BTEX and PAH and were below the respective adopted Site assessment criteria.
- PFAS
  - Human Health
    - Exceedances of health (recreational) screening criteria were recorded for PFOS related compounds (6:2 FTS and 8:2 FTS) in all wells except EMB18
    - Exceedances of health (recreational) screening criteria were recorded for Sum of PFOA related compounds in all wells except EMB18 and EMB19. No exceedances of PFOA or individual PFOA related compounds were recorded.
  - Ecological
    - The concentration of PFOS was recorded above the PFAS NEMP (2020) ecological interim marine 99% criteria (0.00023 µg/L) in all samples and ranged between 0.0004 µg/L and 0.0203 µg/L.
    - PFOS related compounds (6:2 FTS and/or 8:2 FTS) recorded exceedances of the 95% interim marine criteria in all wells except EMB18. All wells recorded exceedances of the 99% interim marine criteria

- Exceedances of ecological 99% screening criteria were recorded for Sum of PFOA related compounds in four wells (EMB21[2] to EMB24). No exceedances of PFOA or individual PFOA related compounds were recorded.

Graphs presenting the trends of selected contaminants in groundwater are included Appendix E from a database of previous monitoring provided by Vopak. Monitoring has occurred from up to sixteen on site wells since 2005.

Note that where the concentration was below the laboratory limit of reporting, the graphed value was set at this limit.

Appendix E also shows a summary table with recorded data ranges.

Metals

We note that baseline and initial monitoring events for metals up to and including 16 June 2008 were measured as total concentrations. Post 16 June 2008 metal concentrations were reported as dissolved metals (i.e. the sample was filtered prior to testing). Therefore, not all post baseline metal concentrations are directly comparable to the baseline data and this should be noted in the graphical representations.

Arsenic

Baseline concentrations ranged from <0.001 to 0.23 mg/L with variable results, some above and some below the adopted environmental concern level (0.0023 mg/L). Post-baseline concentrations were recorded between <0.001 to 0.319 mg/L, similarly some above and some below the adopted criteria. The highest concentration was recorded at EMB16 on 14/09/2009. This monitoring well appears to have recorded the higher arsenic concentrations, but based on the history of the terminal, there is no known source of arsenic.

In general, there does not appear to be a consistent upward trend in the dissolved arsenic concentrations in groundwater wells EMB1 to EMB16 post-baseline. There is variability in results, which could be associated with natural variability, different climatic conditions (wet/dry seasons) or events at the terminal. Results of recently installed wells are generally within ranges of other wells.

Cadmium

Baseline concentrations ranged from <0.001 to <0.001 mg/L with variable results, some above and some below the adopted 99% species protection criteria (0.0007 mg/L). Post-baseline concentrations were recorded between <0.0001 to 0.005 mg/L, similarly some above and some below the adopted criteria. All results are below the 95% species protection criteria.

The peak concentrations for cadmium (0.005 mg/L recorded 01 October 2010 at EMB 11, EMB16, EMB3, and 03 May at EMB16) were a result of a raised limit of reporting.

In general, there does not appear to be a consistent upward trend in the dissolved cadmium concentrations in groundwater wells EMB1 to EMB16 post-baseline. There is variability in results, which could be associated with natural variability, different climatic conditions (wet/dry seasons) or events at the terminal. Results of recently installed wells are generally within ranges of other wells.

Chromium

Baseline concentrations ranged from <0.001 to 0.18 mg/L with variable results, some above and some below the adopted 95% species protection criteria (0.0044 mg/L). Post-baseline concentrations were recorded between <0.001 to 0.014 mg/L, similarly some above and some below the adopted criteria. Most chromium concentrations have been below the laboratory reporting limits.

[2] The exceedance at EMB21 was recorded in the inter lab duplicate, whereas the primary sample did not record an exceedance.

Copper

Baseline concentrations ranged from 0.002 to 0.12 mg/L with variable results, some above and some below the adopted 95% species protection criteria (0.0013 mg/L). Post-baseline concentrations were recorded between <0.001 to 1.08 mg/L, similarly some above and some below the adopted criteria. The highest concentration of 1.08mg/L was recorded in well EMB11, but was not a dissolved concentration so could be unusually high due to unfiltered material.

Some wells in the southern parts of the terminal showed some concentrations which appear to spike at different times, potentially higher than what would be background for that location (e.g. EMB11 and EMB16). Based on the history of the terminal, there is no known source of copper, except possibly after 2017 when the LWTF started operating.

There is variability in results, which could be associated with natural variability, different climatic conditions (wet/dry seasons) or events at the terminal. It is not clear if the copper in some of these wells could be background or increased due to activities in the southern parts of the terminal. Results of recently installed wells are generally within ranges of other wells.

Lead

Baseline concentrations ranged from 0.023 to 0.47 mg/L with variable results, some above and some below the adopted 95% species protection criteria (0.0044 mg/L). Post-baseline concentrations were recorded between <0.001 to 0.13 mg/L, similarly some above and some below the adopted criteria.

In general, there does not appear to be a consistent upward trend in the dissolved lead concentrations in groundwater wells EMB1 to EMB16 post-baseline. There is variability in results, which could be associated with natural variability, different climatic conditions (wet/dry seasons) or events at the terminal. Results of recently installed wells are generally within ranges of other wells.

Mercury

Baseline concentrations ranged from <0.0001 to 0.0006 mg/L. Results have generally been below laboratory reporting limits.

Nickel

Baseline concentrations ranged from <0.05 to 0.09 mg/L with variable results, some above and some below the adopted environmental concern level (0.0023 mg/L,). Post-baseline concentrations were recorded between <0.001 to 0.05mg/L, below the adopted criteria.

Zinc

Baseline concentrations ranged from 0.009 to 0.38 mg/L with variable results, some above and some below the adopted 95% species protection criteria (0.008 mg/L). Post-baseline concentrations were recorded between <0.005 to 0.98 mg/L, similarly some above and some below the adopted criteria.

Some wells showed concentrations which appear to spike at different times, potentially higher than what would be background for that location (e.g. EMB2). It unsure what the peak concentrations for zinc (0.758 mg/L recorded 16 September 2011, and 0.977 mg/L recorded 20 September 2012 at EMB2) represented. Based on the history of the terminal, there is no known source of zinc.

In general, there does not appear to be a consistent upward trend in the dissolved zinc concentrations in groundwater wells EMB1 to EMB16 post-baseline. There is variability in results, which could be associated with natural variability, different climatic conditions (wet/dry seasons) or events at the terminal. Results of recently installed wells are generally within ranges of other wells.

Petroleum Hydrocarbons

The C_{10}-C_{36} sum of fraction had a baseline concentration range of <50 to 260 mg/L, and a post-baseline concentration range of <50 to 1,520 mg/L, with variable results across all events.

Baseline concentrations of petroleum hydrocarbons demonstrated no apparent consistent upward trend in concentrations in groundwater wells EMB1 to EMB16 post-baseline. There is variability in results, which could be associated with natural variability, different climatic conditions (wet/dry seasons) or events at the terminal. Results of recently installed wells are generally within ranges of other wells.

Ammonia

Monitoring for ammonia only commenced from 17 March 2011 therefore there is no true baseline. We have assumed baseline to be the first monitoring event for the purposes of this assessment. Baseline concentrations ranged from <0.01 to 3.93 mg/L with variable results, some above and some below the adopted NT government (2010) WQO for Darwin Harbour criteria (0.02 mg/L). Post-baseline concentrations were recorded between <0.01 to 7.68 mg/L, similarly some above and some below the adopted criteria.

Well EMB6 (inferred upgradient location) has generally recorded the higher ammonia concentrations which could be associated with general background water quality with potential nearby estuarine soils. An ammonia concentration of 6.85mg/L was recorded in a new monitoring well (EMB20). This well intersected natural estuarine soils.

In general, there does not appear to be a consistent upward trend in the ammonia concentrations in groundwater wells EMB1 to EMB16 post-baseline. There is variability in results, which could be associated with natural variability, different climatic conditions (wet/dry seasons) or events at the terminal. Results of recently installed wells are generally within ranges of other wells.

PFAS

PFAS has been monitored at the Site since 8 October 2020 with four events across the previously established monitoring network. Sum of PFOS related compound concentrations have been above the adopted screening criteria in most wells. Wells EMB7 and EMB4 have shown the higher concentrations. The highest concentration of the sum of PFOS related compounds was in EMB7 on 16 December 2021 with a concentration of 140.82µg/L (compared with the highest concentration recorded by SMEC of new wells 61.86 µg/L).

Sum of PFOA related compound concentrations have been above the ecological 99% species protection screening criteria in EMB7 (all occasions) and EMB5 (2 occasions). The highest concentration of the sum of PFOA related compounds was in EMB7 on 16 December 2021 with a concentration of 43.48µg/L (compared with the highest concentration recorded by SMEC of new wells 22.81 µg/L). Concentrations have fluctuated over the monitoring period. Wells EMB7, EMB4 and EMB5 which had the higher PFAS concentrations, have shown similar trends with higher concentrations in the October 2020 and December 2021 events and lower concentrations in the April 2021 and 2022 events. The duration of the monitoring period is insufficient to establish any clear trends.

Figure 10 and Figure 11, Appendix A present the spatial concentrations of Sum of PFOS related and PFOA related compounds, respectively. These results are for the latest monitoring rounds which were in April/May 2022.

Groundwater monitoring well locations are documented to be screened at depth in the rock that underlies the Site and screened several metres below the top of the water table. Depending on the contaminant source and transport route the depth of the monitoring wells could influence the data. New groundwater wells installed and sampled by SMEC as part of this investigation installed to shallower depths did not show anomalous results compared to other wells, therefore this was not considered significant in the context of this investigation.

10 Human Health and Ecological Risk Assessment (for PFAS)

10.1 General

EnRiskS was commissioned to carry out a human health and ecological risk assessment with respect to PFAS for the Site. EnRiskS was provided with a draft copy of this report as a preliminary issue (5 May 2022) which contained all the field and laboratory data collected by SMEC and copies of some of the available historical data that had been made available by Vopak at that time (including soil, groundwater and stormwater data). The human health and ecological risk assessment report is included in Appendix M which provides extensive detail on the assessment process, background information on PFAS, toxicity of PFAS, screening assessment and uncertainties and should be read in conjunction with this report.

Key elements of the risk assessment are drawn out in an overall discussion presented in Section 11. The HHERA screening assessment showed exceedances of the adopted initial criteria in groundwater and stormwater from the NEMP 2020, therefore a refined assessment was carried out which included developing refined criteria. Key information from the HHERA refined assessment is provided below.

10.2 Human Health – Refined Assessment

The chemicals of most interest (i.e. present at highest levels) are 6:2 FTS, 8:2 FTS, PFHxA and PFPeA. These PFAS are not ones that bioaccumulate significantly in people.

This lack of significant bioaccumulation is an important aspect when considering the toxicology as the accumulation of PFOS and PFOA has been a major driver of the very low values for the TRVs for these 2 chemicals. Leaving bioaccumulation out of the calculation of the TRV means such values would be much smaller for these chemicals (6:2 FTS, 8:2 FTS, PFHxA and PFPeA).

The investigation of a spill at Brisbane Airport made use of a tolerable daily intake (TDI) of 0.005 mg/kg bw/day for 6:2 FTS based on liver toxicity in mice (ERM 2017). The Department of Defence investigation at RAAF Williamtown made use of a tolerable daily intake of 0.1 mg/kg bw/day for PFHxA based on impacts on kidney in rats (AECOM 2017). A comparison was made with the TDI for PFOS and PFOA and shows that 6:2 FTS is around 250 times less toxic than PFOS and PFHxA is around 5,000 times less toxic than PFOS. Using these ratios to adjust the recreational guidelines for PFOS to be more appropriate for these 2 chemicals (and 8:2 FTS by assuming its similar to 6:2 FTS), gives the following interim guidelines for this assessment:

- 6:2 FTS and 8:2 FTS – **500 µg/L** (i.e. 2 µg/L x 250)
- PFHxA – **10,000 µg/L** (i.e. 2 µg/L x 5,000)

These values still assume a person comes into contact with the water on 150 days per year and incidentally ingests 200 mLs on each occasion which will be conservative for workers on the site and for people in the neighbouring areas who may come into occasional direct contact with stormwater being discharged from the site via the open drain. It also assumes that only 10% of the TDI is available for this pathway (EnRisKs, 2022).

10.3 Ecological – Refined Assessment

Exceedances of the 99% species protection value for PFOS (and like chemicals) were recorded, but the chemicals that are key at this site are different to PFOS. The key chemicals are 6:2 FTS and 8:2 FTS.

The HHERA looked into a range of matters that required further refinement and are summarised below.

Comparison of ecotoxicity of 6:2 FTS and 8:2 FTS with ecotoxicity of PFOS and PFOA

The HHERA reviewed a number of published studies on ecotoxicity of these chemicals. The assessment factor method was adopted. This approach is recommended when there are limited data for a particular chemical and involves taking the most sensitive data point for ecologically relevant endpoints and combining that value with an assessment factor relevant for the dataset. The HHERA references various studies and an interim water quality guideline was generated for 6:2 FTS. The revised guideline value derived was **210µg/L** and this value is to be used for each fluorotelomer and for the sum of all of the fluorotelomers that require more detailed assessment (EnRisKs, 2022).

Robustness in relation to the 99% species protection value for PFOS

The HHERA describes that the water quality guidelines in the NEMP (2020) are draft guidelines and there has been much discussion about the appropriateness of the 99% species protection value given it is 1000 times lower than the 95% species protection value which is much greater than for most bioaccumulative chemicals. The HHERA describes other studies by CSIRO and other unpublished studies which ae likely to support a change in the PFOS water quality guideline from 0.00023µg/L to around 0.01-0.05µg/L (EnRisKs, 2022).

Ambient PFAS Concentrations

The HHERA presents detailed discussion and data from published sources on ambient PFAS concentrations. The HHERA

Concentrations for PFOS in urban areas are mostly within the range of 0.01 to 0.05 µg/L where there is no specific contamination source such as an airport or defence base. The PFAS present in urban waterways come from a range of diffuse and point sources.

A range of studies have been undertaken in Australia specifically looking at ambient levels of these chemicals (Allinson et al. 2019; Baddiley et al. 2020; Coggan et al. 2019; Sardiña et al. 2019; Sharp et al. 2021; Szabo et al. 2018; Thompson et al. 2011). These studies indicate that these chemicals are routinely detected in urban surface waters but may only be occasionally present in water away from urban areas (i.e. more remote areas). They also indicate that a wide range of PFAS may be found in urban waters. Data from different states is presented in tables in the HHERA (EnRisKs, 2022).

Existing data for PFAS in Darwin Harbour (sediments and fish/crab)

The HHERA sourced data from Darwin Harbour from fish and crab samples caught around Bleesers Creek and analysed for PFAS in 2017. Bleesers Creek is located to the north of this site in the mudflats/mangroves to the west of the Vopak site. These results are all well in compliance with the trigger points developed by Food Standards Australia and New Zealand (FSANZ). These organisms will travel around this embayment, so these results will be relevant for potential impacts from this site.

Sediments were collected in various locations around Darwin Harbour in 2016 (Munksgaard et al. 2016). The locations were not close to this site, but they do include 2 samples in urban areas (Ludmilla Creek and Rapid Creek) and one in a more remote location (Fright Point). CSIRO researchers have undertaken ecotoxicity testing for sediment dwelling organisms (Simpson et al. 2021). The sediment quality guidelines they developed are 0.25mg PFOS/kg for 95% species protection and 0.06 mg PFOS/kg for 99% species protection. The published sediment data in Darwin Harbour referenced above were in compliance with these guideline values, so no impacts are expected. If samples in the area close to this site are similar, no impacts would be expected (EnRisKs, 2022).

Accumulation into dietary items for higher organisms

The HHERA reported that the key chemicals for this site (namely 6:2 FTS and 8:2 FTS) do not bioaccumulate to the same extent as PFOS and PFOA. The bioconcentration factor measured for 6:2 FTS in one study was well below the criteria specified in the Globally Harmonised System for labelling to indicate bioaccumulation (the value was 35 compared to the GHS criteria of >500) (Menger et al. 2020).

The PFAS NEMP provides guidelines for dietary items for higher organisms to ensure higher organisms are not exposed to excess amounts of these chemicals (HEPA 2020). Because the key chemicals at this site do not bioaccumulate, the need to consider such exposures is more limited. This also means consideration of the 99% species protection value is less relevant for this site. Guidelines designed to protect 95% of species are most relevant for 6:2 FTS and 8:2 FTS. These chemicals will not accumulate in fish and other aquatic organisms so higher organisms could be exposed when they come into contact with the water but exposure via their diet will be low.

For chemicals that do not bioaccumulate, it is usual for risks to aquatic organisms to be more important to consider than risks to higher organisms simply because their exposure is higher – they live in the impacted water at all times rather than having occasional contact with the water during wading or drinking etc. Therefore, the assessment has focused on risks to aquatic organisms (EnRisKs, 2022).

11 Discussion

This discussion draws on data collected from the SMEC investigations and HHERA, along with monitoring data provided by Vopak on groundwater, stormwater and stormwater channel sediment.

11.1 Soil

11.1.1 PFAS

Soil samples analysed for PFAS did not exceed the adopted assessment criteria for industrial land use. The HHERA (EnRisKs, 2022) provides background information on ambient concentrations of PFAS from published sources with PFAS being detected in most sites including remote regions far from sources. The HHERA also compared results to ecological screening criteria and have considered transitory wildlife (direct contact) as per criteria presented in NEMP (2020). The screening showed that relevant PFAS concentrations were below the national guidelines protective for soil organisms and plants that directly grow or contact soil and for organisms that eat soil organisms or plants. The HHERA also notes that the indirect soil guideline listed in the NEMP is for use in situations where bioaccumulation may be important. Both PFOS and PFOA are bioaccumulative and so this aspect is an important consideration. However, the only chemicals at this site with maximum concentrations above the indirect soil guideline for PFOS were 6:2 FTS, 8:2 FTS, PFPeA and PFHxA. All of these PFAS are considered to not be bioaccumulative or to have much lower potential for bioaccumulation than PFOS and PFOA. Consequently, the screening assessment provided above is appropriate for this site (EnRisKs, 2022).

Soil leachability was assessed through testing using the ASLP. Leachability results show that PFAS are highly leachable and suggests that PFAS in the soil could have leached from the soil into water at the site (groundwater or stormwater). Since at this Site groundwater quality has been directly measured through installation and sampling of wells, the groundwater data is considered more representative and is discussed in sections below.

The HHERA concluded that no further consideration of potential risks to ecosystems due to the presence of PFAS in soil at this site was required.

11.1.2 Other Contaminants

Soil samples were collected from various parts of the Site in the SMEC investigation. No exceedances were recorded of the assessment criteria for TRH, BTEX, PAH and metals. Investigation locations were broadly spaced and targeted mainly the 2020 PFAS foam solution leak and other areas mainly for the purposes of installing groundwater monitoring wells. Widespread impact of the Site from these contaminants in soil was not observed from the data of this investigation.

11.2 Groundwater

11.2.1 PFAS

PFAS has been monitored at the Site since 8 October 2020 with four events across the previously established monitoring network and additional wells were installed and sampled by SMEC in this investigation.

Groundwater samples were found to have PFAS concentrations in excess of the guideline values provided within NEMP (2020) for human health and ecological protection. The key chemicals that were present in these samples were 6:2 FTS, 8:2 FTS and PFHxA.

The HHERA screening assessment (EnRisKs, 2022) was undertaken by grouping wells into a number of groups depending on where they were located. The groups were:

- Upgradient wells away from areas where leaks have been identified (i.e. EMB3, EMB6, EMB8, EMB18)
- Wells around the location of the 2020 incident (i.e. EMB5, EMB23, EMB24, EMB25)

- Wells around the historic incident in the south east part of the site (i.e. EMB7 and EMB17)
- Wells along the western boundary (i.e. EMB21, EMB2, EMB22, EMB20, EMB1, EMB11)
- Wells along the southern boundary (i.e. EMB15, EMB16)
- Wells around stormwater management system and drain (EMB4, EMB12, EMB19)

Human Health

The HHERA screening showed the following:

- Upgradient groundwater has detectable PFAS present indicating that there is likely to be other sources of these chemicals on the peninsula.
- Concentrations of PFAS in groundwater along the southern Site boundary are very low.
- Concentrations of PFAS are highest near the locations where incidents have occurred historically or near the stormwater treatment system.
- Groundwater along the western boundary has concentrations similar to those measured in the most upgradient wells.
- The only chemicals present at concentrations in excess of screening guidelines (based on PFOS and PFOA only) were 6:2 FTS, 8:2 FTS and PFHxA.
- Concentrations in groundwater are generally higher at the end of the dry season.
- The recreational guidelines assume a person comes into contact with the water on 150 days per year and incidentally ingests 200 mLs on each occasion. This is extremely conservative for this site as it would appear the only way a person might come into contact with groundwater is when taking samples for environmental monitoring. Such sampling only occurs on up to 4 occasions per year and incidental ingestion during sampling would be of the order of 1-5 mLs per occasion (a splash). Groundwater is not accessed at the site for use in any of the processes undertaken at the site (industrial use, irrigation etc).
- Further refinement of the assessment was undertaken by adjusting the recreational water quality guideline for PFOS to be more appropriate for the key chemicals based on the difference in toxicity between 6:2 FTS, 8:2 FTS and PFHxA and PFOS.
- All concentrations in groundwater for these three key PFAS chemicals are in compliance with the adjusted guidelines from the refined assessment: 500 µg/L (6:2 FTS and 8:2 FTS) and 10,000 µg/L (PFHxA)
- No data have been collected from any off-site surface water environments into which groundwater would mix. Fish and crabs collected from Bleesers Creek in Darwin Harbour were analysed for PFAS by the University of Queensland on behalf of NT Health in 2017. The results for these samples indicate that levels of PFOS and PFOA were in compliance with the Food Standards Australia and New Zealand (FSANZ) trigger points for fish. The levels were around 10 times lower than the trigger point for PFOS. The key chemicals for this site are PFAS that are not bioaccumulative and would not be expected to be present in seafood (EnRisKs, 2022).

Given the compliance with the recreational guidelines (and the adjusted recreational guidelines) which are considered conservative for groundwater in this area, the HHERA concluded that no further consideration of potential human health risks due to the presence of PFAS in groundwater was required (EnRisKs, 2022).

Ecological

The HHERA screening showed the following:

- The groundwater samples were found to have PFAS concentrations in excess of the guideline values provided within the NEMP relevant for the protection of ecosystems, based on data for PFOS and PFOA.
- Upgradient groundwater has detectable PFAS present.

- Concentrations of PFAS in groundwater along the southern boundary are very low.
- Concentrations of PFAS are highest near the locations where leaks/spills have occurred historically and near the stormwater treatment system.
- Groundwater along the western boundary has concentrations similar to those measured in the most upgradient wells.
- Potential for impacts on ecosystems from groundwater is relevant in areas where the groundwater discharges into surface water bodies which would occur in the off-site area to the west of the site.
- Potential ecological risks to aquatic organisms are most relevant to consider where groundwater mixes into surface water within the off-site area. There is no information about the concentrations of these chemicals that would be present in the off-site area where surface water and groundwater mix, but it would be expected that concentrations of PFAS in groundwater measured at the site would be diluted as it mixes into surface water.
- There are also no surface water bodies located on the site into which this groundwater might mix and for which these guideline values would be relevant.
- Given the available information, the concentrations reported for wells along the western boundary are the most relevant for the assessment of potential risks to ecosystems.
- 6:2 FTS and 8:2 FTS are the key chemicals present in groundwater along the western boundary.
- The concentrations of these two chemicals in wells along the western boundary (and all wells at the site, even the most impacted wells) are in compliance with the interim water quality guidelines.
- PFOS concentrations are generally similar to those for urban waterways throughout Australia.
- Regardless of the potential for dilution, further refinement of the screening assessment has been undertaken assuming the concentrations measured in groundwater at the site (both concentrations along the western boundary and the maximum concentrations anywhere on the site) might reach the off-site area without any dilution which will be conservative. The key chemicals in these samples were 6:2 FTS and 8:2 FTS. All results in groundwater samples were in compliance with these interim water quality guidelines.

The maximum concentrations at the site are generally in compliance with relevant water quality guidelines (i.e. 6:2 FTS) and/or ambient levels (i.e. PFOS). However, there are a number of limitations/uncertainties in this assessment including:

- interim water quality guideline for 6:2 FTS is based on only limited ecotoxicity data – available data would not be sufficient to calculate an official water quality guideline
- data for groundwater are limited to 3 rounds (April 2021, December 2021 and April 2022)
- data for April 2021 and 2022 were collected at the end of the wet season while the December round was at the beginning of the wet season
- monitoring of groundwater has not yet occurred during the dry season
- data show that there is a 2-4 fold variability across these monitoring events (i.e. within the wet season)
- differences in groundwater concentrations between the wet and dry season cannot be determined with the available data
- based on the limited data:
  - maximum concentration reported in groundwater at this site was around 140 µg/L and this is around 65% of the proposed guideline
  - variation in groundwater concentrations across the wet season appears to be around 2-4 fold
  - concentrations of 6:2 FTS in the existing data vary from 15% to 65% of the proposed guideline.

Therefore, additional monitoring will be important to support the conclusion that the levels of these key chemicals (6:2 FTS and 8:2 FTS) in groundwater are in compliance with the proposed guideline.

If monitoring for PFAS is included in the ongoing monitoring program for groundwater samples, that will provide appropriate data to support the conclusions of this HHERA.

It is also important to note that the key chemicals for this site are PFAS that are not bioaccumulative – i.e. 6:2 FTS, 8:2 FTS. It is expected that, if risks to aquatic organisms from direct contact with water are acceptable, then risks to higher organisms from consumption of aquatic organisms will also be acceptable (EnRisKs, 2022).

11.2.2 Other Contaminants

As per the NT EPA notice, other contaminants (petroleum hydrocarbons, copper, lead, zinc and ammonia) were assessed in groundwater as part of this investigation at additional monitoring locations which supplemented ongoing monitoring data held by Vopak from their ongoing monitoring program. A discussion on exceedances and trends was provided in Section 9.3.3.

Specific sources of copper, lead, zinc and ammonia within the Vopak Terminal are generally not known, except for lead in AVgas. Copper, lead, zinc and ammonia could be associated with various wastewaters accepted within the GRR LWTF, but the LWTF has operated at the Site only since 2017.

Some exceedances of the adopted assessment criteria were recorded for copper, lead and zinc (and other tested metals) and ammonia. These were checked against initial baseline concentrations and trends over time. In general, there did not appear to be a consistent upward trend in concentrations in the established groundwater wells EMB1 to EMB16 post-baseline. Results of recently installed wells (EMB17 to EMB25) are generally within ranges of other wells. Metals occur naturally in the environment and can be elevated from the parent rock of the area. Similarly the ammonia is likely to be naturally occurring and correlated with higher concentrations in a recently installed well (EMB20) where estuarine soils were intersected. The monitoring data has shown variability in results, which is inferred to be associated with natural variability from different climatic conditions (wet/dry seasons). Previous monitoring reports (by EcOz and GHD) made available to SMEC similarly reported concentrations of these contaminants to be within historic ranges and reflective of natural background concentrations.

Petroleum hydrocarbons have typically been below or close to the laboratory reporting limits. TRH was detected in groundwater samples in the latest pre and post wet season monitoring. The presence of TRH was reported to be indicative of the nature of the fuel handling facility and the potential for underground leaks of minor nature to occur in either pipelines or storage tanks (GHD, 2022). Nine additional monitoring wells were installed and sampled by SMEC in this investigation and also tested for petroleum hydrocarbons. TRH was analysed using silica gel clean up and TRH was not recorded above the laboratory reporting limits and therefore suggests that widespread TRH impacts are not likely at the Site.

Based on the available groundwater monitoring data and in particular more recent data, SMEC consider that these other contaminants (petroleum hydrocarbons, copper, lead, zinc and ammonia) are not likely to be currently posing unacceptable environmental harm.

11.3 Stormwater and Stormwater Drain Sediment

Stormwater quality was not directly tested by SMEC in this investigation. Data on stormwater quality was provided by Vopak through a database of past monitoring data and some selected reports. The latest monitoring report (GHD, 2022) provided presented data from monitoring and included:

- Stormwater monitoring
  - pre-wet season (December 2021)
  - mid-wet season (Feb/March 2022)
  - post-wet season (May 2022)

- Sediment monitoring at 10 locations within on-site open drains.

The data was reviewed by SMEC and also formed part of the HHERA for PFAS. We note that sediment is not tested for PFAS.

11.3.1 PFAS

PFAS has been monitored at the Site since 1 December 2020 with six events at four stormwater pit locations.

Stormwater samples were found to have PFAS concentrations in excess of the guideline values provided within NEMP (2020) for human health and ecological protection. The key chemicals that were present in these samples were 6:2 FTS, 8:2 FTS and PFHxA.

Human Health

The HHERA screening showed the following:

- The stormwater systems servicing DAT2 and 6-series areas have limited contamination from PFAS and most concentrations for individual PFAS are close to the limits of reporting. All concentrations for individual PFAS and for the relevant sums are in compliance with the screening criteria.
- The stormwater system servicing the DIFT area is impacted by PFAS contamination.
- The stormwater treatment system focuses on the management of oily water and is not designed to remove PFAS.
- The results over different sampling events for DIFT1 and DIFT2 show that concentrations are quite variable. At times, the concentrations in DIFT1 and DIFT2 are similar and at other times they are different with one event showing DIFT1>DIFT2 and one event showing DIFT2>DIFT1.
- These results indicate that the levels found in stormwater are quite dependent on the nature of the rain events as well as likely variations in potential sources across the site.
- Some of the individual PFAS (or the relevant sum) were above the screening criteria.

The chemicals of most interest (i.e. present at highest levels) are 6:2 FTS, 8:2 FTS, PFHxA and PFPeA. These specific PFAS are not ones that bioaccumulate significantly in people.

Revised screening criteria (the same as described in Section 11.2.1 for groundwater) were developed. None of the results for stormwater samples at this site are close to the adjusted values. The maximum concentration for any PFAS at the site is for 6:2 FTS with a concentration of 140 µg/L measured on one occasion. This maximum concentration is well in compliance with these adjusted guidelines.

Given the compliance with the recreational guidelines (and the adjusted recreational guidelines) which are considered conservative for stormwater in this area, no further consideration of potential human health risks due to the presence of PFAS in stormwater is required.

Bioaccumulation was assessed in the same way as for groundwater. The key chemicals for this site are PFAS that are not bioaccumulative and would not be expected to be present in seafood.

No data have been collected from any off-site surface water environments into which stormwater would discharge. However, given that recreational contact with stormwater was considered acceptable using data from the site, no further consideration is required in regard to human health.

Ecological

The HHERA screening showed the following:

- Concentrations of PFOA like chemicals are all well in compliance with the relevant ecosystem protection guidelines (both 95 and 99% species protection values).

- Concentrations of PFOS are above the 99% species protection value but in compliance with the 95% species protection value
- Concentrations of some of the PFOS like chemicals (and the sum of all relevant chemicals) are above the relevant ecosystem protection guidelines (both 95 and 99% species protection values).
- 6:2 FTS and 8:2 FTS are the primary chemicals that are in excess of screening criteria.
- There are no water bodies on the site that are relevant for ecosystem protection.
- It is possible that PFAS may be present in stormwater released from the site, but the concentrations present in the off-site area have not been assessed.
- The levels of most PFAS within stormwater are in compliance with the current draft national water quality guidelines for PFOS or PFOA (depending on the individual chemical).
- The levels of 6:2 FTS and 8:2 FTS are above the water quality guidelines that are relevant for PFOS – the chemical they are assumed to be similar too in a screening assessment.
- Making use of the USEPA ECOTOX database and Australian guidance for water quality guideline development, it is possible to generate a guideline more appropriate for 6:2 FTS. This value is 210 µg/L. This value has been developed using an approach relevant for 95% species protection.
- A 95% species protection value is relevant for these chemicals as they are not bioaccumulative unlike PFOS and PFOA.
- All concentrations for 6:2 FTS and 8:2 FTS in stormwater are in compliance with this interim water quality guideline.
- The concentrations of PFOS are similar to ambient PFOS concentrations in urban areas of Australia, so no further assessment is required for this specific PFAS.
- While this assessment indicates that the potential ecological impacts due to the presence of 6:2 FTS and 8:2 FTS are likely to be low, there are important aspects that are somewhat uncertain including:
  - interim water quality guideline for 6:2 FTS is based on only limited ecotoxicity data – available data would not be sufficient to calculate an official water quality guideline
  - data for PFAS in stormwater are limited to 3 rounds during the wet season (February, December 2021 and March 2022) and 1 round during the dry season (May 2022)
  - wet season data includes 2 rounds toward the later parts of the wet (February 2021, March 2022) and 1 round toward the beginning of the wet (December 2021) and these rounds show around 10 fold variation between late and early in the wet season
  - dry season data includes only data for early in the dry (May 2022), but these data are similar to the data for early in the wet (i.e. December 2021)
  - based on the limited data:
    - maximum concentration reported in stormwater at this site was around 50 µg/L and this is around 25% of the proposed guideline
    - variation in stormwater concentrations appears to be around 10 fold
    - concentrations of 6:2 FTS in the existing data vary from 3% to 25% of the proposed guideline.
- Therefore, additional monitoring will be important to support the conclusion that the levels of these key chemicals (6:2 FTS and 8:2 FTS) in stormwater are in compliance with the proposed guideline.
- If monitoring for PFAS is included in the ongoing monitoring program for stormwater samples, that will provide appropriate data to support the conclusions of this HHERA (EnRisKs, 2022).

11.3.2 Other Contaminants

As per the NT EPA notice, other contaminants (petroleum hydrocarbons, copper, lead, zinc and ammonia) were assessed in stormwater based on results of monitoring data held by Vopak from their ongoing monitoring program and recent monitoring reports. Graphs of selected contaminants showing historical trends in stormwater and drain sediment quality are included in Appendix E. Stormwater quality can change over time based on operational practices and we have therefore focused more on the more recent stormwater quality data (GHD, 2022) to provide an indication of current quality.

Stormwater

Some exceedances of zinc, copper, ammonia and/or hydrocarbons have been recorded in recent monitoring in stormwater (GHD, 2022). As discussed earlier, specific sources of copper, lead, zinc and ammonia within the Vopak Terminal are generally not known, except for lead in AVgas. Lead is a relatively small component of the AVgas and wold not be expected to dissociate alone and would be co-present with higher concentrations of hydrocarbons. Hydrocarbon concentrations were generally recorded to be low and the lead is unlikely to be associated with an on site source.

In context, the metal and ammonia concentrations ranges in the stormwater are lower than the same metal concentrations in groundwater during the same monitoring period. These ranges are shown in Table 11-1 below.

Table 11-1 Stormwater and Groundwater Concentration Ranges (µg/L)

Analyte	Stormwater Range (Dec 21-May22)								Groundwater Range (Dec 21-April 22)	
	DIFT 1		DIFT 2		DAT 2		6-series			
Copper	<0.001	0.002	<0.001	<0.001	<0.001	0.012	<0.001	0.006	<0.001	0.147
Lead	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.008
Zinc	0.01	0.047	0.035	0.083	<0.005	0.053	<0.005	0.073	<0.05	0.138
Ammonia	0.03	0.27	<0.01	0.13	0.04	0.05	0.14	0.16	0.01	6.08

Based on these ranges, the metals and ammonia in stormwater are similar to and lower than what is observed in this environment. The monitoring report described that the nutrients (including ammonia) were indicative of natural biological processes occurring around the site considering its estuarine nature and potential for mangrove areas to act as nutrient sinks (GHD, 2022).

Petroleum hydrocarbon concentrations in recent stormwater pit sampling showed concentrations below laboratory limits at 6-Series, DAT2 and DIFT1. The sample from DIFT2 which represents the final pit prior to release to the open drain from the Darwin Industry Fuel Terminal (the northern part of the Site), recorded a toluene concentration of 331µg/L which exceeds the adopted ecological criteria of 180 µg/L. The monitoring report suggested this was indicative of a first flush scenario (GHD, 2022). Hydrocarbons (including PAH and BTEX) were not recorded at DIFT2 or other pits during the pre and post wet season monitoring suggesting this is not an ongoing issue. Vopak advised SMEC that operational processes are in place to avoid hydrocarbons entering stormwater and to prevent discharges of stormwater with hydrocarbons. The DIFT stormwater pits and oil/water separator system is cleaned at the beginning of each wet season, visual checking of stormwater is carried out prior to discharge with stormwater run through an oil/water separator if there is visual evidence of hydrocarbons. The toluene concentration recorded is likely to be further diluted as it mixes with other stormwater in the open drain. Some volatilisation is also likely to occur during discharge due to the tropical climate.

Based on the above the stormwater quality with respect to other contaminants (petroleum hydrocarbons, copper, lead, zinc and ammonia) is not likely to be posing unacceptable environmental harm. We however note that Vopak should maintain good housekeeping practices and management of stormwater discharges as per the OEMP (at a minimum).

Sediment

Sediments within drains at the Vopak Site have been tested biannually. The most recent testing occurred in April 2022. Graphs of selected contaminant trends are shown in Appendix E.

Copper, lead and zinc concentrations show variability in concentrations, but recent sampling suggest concentrations of similar orders of magnitude to earlier events with no apparent increasing trend. Results of the most recent monitoring (GHD, 2022) are summarised below:

- Results were compared to Australia and New Zealand 2018 Sediment toxicant values – default guideline values (DGV) and the Australia and New Zealand 2018 Sediment toxicant values – GV-high.
- Sediments were said to be characteristic of a tropical coastal environment with a relatively moist sandy/silty nature intersperse with vegetation.
- Arsenic concentrations were similar to previous events with some samples exceeding the adopted assessment criteria. The report indicated that arsenic is commonly associated with acid sulfate soils and typical of coastal areas such as the estuarine environment wherein the site is located.
- Other metal concentrations were generally within the assessment criteria.
- Some heavier fraction TRH (C16-C40) were detected. These values were below the DGV of 280mg/kg.

Based on the above, sediment quality with respect to petroleum hydrocarbons, copper, lead, zinc and ammonia is not likely to be posing unacceptable environmental harm.

12 Conclusions and Recommendations

12.1 Conclusions

An investigation was carried out to assist with the evaluation of the types, amount, distribution and mobility of petroleum hydrocarbons, PFAS, and other contaminants of concern (specifically only copper, lead, zinc and ammonia) present in the environment at the Site to comply with the NT EPA notice.

PFAS

Site history information has shown that releases of substances containing PFAS have occurred at the site due to past practices (prior to knowledge of the potential harm of PFAS compounds) and/or unforeseen site incidents. This investigation included instigating a sampling plan involving soil and groundwater sampling targeting the area of the former 2020 PFAS foam solution leak and broader terminal. In addition, data was supplemented from previous monitoring data supplied by Vopak.

Soil and groundwater sampling has shown PFAS is present at the Site with concentrations not necessarily highest at the location of the 2020 foam solution leak. The PFAS distribution across broader parts of the Site suggests impacts from past releases, not just the 2020 foam solution leak.

Based on the currently available PFAS monitoring data, through comparison to guidelines in NEMP 2020 and interim guideline values derived in the HHERA, the current PFAS concentrations within the Vopak site in soil, groundwater and stormwater do not appear to pose an unacceptable risk to human health or ecological receptors. Additional monitoring is recommended to support the conclusion that the levels of key PFAS chemicals (6:2 FTS and 8:2 FTS) are in compliance with the proposed guideline developed in the HHERA.

Due to the broader distribution of PFAS at the Site in both soil and groundwater, and that the risk assessment indicated risks to health and the environment are unlikely, remediation in the area of the 2020 foam solution leak is currently not considered warranted.

Other Contaminants (petroleum hydrocarbons, copper, lead, zinc and ammonia)

Monitoring of petroleum hydrocarbons and other contaminants of concern (including copper, lead, zinc and ammonia) has been carried out at the Site since as early as 2005 in groundwater, stormwater and stormwater drain sediment. Based on a review of the monitoring data, the following is noted:

- Specific sources of copper, lead, zinc and ammonia within the Vopak Terminal are generally not known, except for lead in AVgas. Copper, lead, zinc and ammonia could be associated with various wastewaters accepted within the GRR LWTF, but the LWTF has operated at the Site only since 2017.
- The groundwater monitoring results have shown that concentrations of these contaminants of concern have generally been either below adopted assessment criteria or within the typical baseline ranges. In general, there does not appear to be a consistent upward trend in these contaminant concentrations post-baseline monitoring. There is variability in concentrations, which could be associated with natural variability, variability due to different climatic conditions (wet/dry seasons) or events at the terminal. Results of recently installed wells are generally within ranges of other wells and did not show concentrations to suggest significant anomalies.
- Some exceedances of zinc, copper, ammonia and/or hydrocarbons have been recorded in recent monitoring in stormwater. The metals and ammonia were assessed to be similar to and lower than other concentrations observed in this environment and naturally occurring. The hydrocarbons are likely a result of operational processes for which Vopak has procedures for managing stormwater to reduce potential for impacts. Based on our assessment as described in this report, the stormwater quality with respect to other contaminants (petroleum hydrocarbons, copper, lead, zinc and ammonia) is not likely to be posing unacceptable environmental harm.

- Sediments within drains at the Vopak Site have been tested biannually. Recent monitoring showed concentrations below assessment criteria and/or likely associated with natural processes. Based on our assessment, sediment quality with respect to petroleum hydrocarbons, copper, lead, zinc and ammonia is not likely to be posing unacceptable environmental harm.

12.2 Recommendations

Additional monitoring is recommended to support the conclusion that the levels of key PFAS chemicals (6:2 FTS and 8:2 FTS) are in compliance with the proposed guideline developed in the HHERA. If monitoring for PFAS is included in the ongoing monitoring program for groundwater, stormwater and sediment, that will provide appropriate data to support the conclusions of HHERA. The monitoring program has included:

- Groundwater – twice a year, early wet season and late wet season, from a network of at least 14 bores
- Stormwater pit – three times a year, early, mid and late wet season, from at least four locations. Inclusion of additional monitoring points for stormwater in the routine monitoring, such as at the point where stormwater exits the Vopak site via the open drain would also be useful
- Sediment in drains – once every 2 years at the end of the wet season, from 12 locations.

It would also be prudent to check the quality of discharges from the liquid waste treatment facility (operated by others).

Monitoring should continue and exceedances should be a trigger to review the potential cause of the exceedance, and where potentially associated with operational processes or housekeeping, correction action should be taken to avoid potential impacts.

PFAS are persistent, bioaccumulative chemicals, some of which are listed on the Stockholm Convention for persistent organic pollutants. While some of the key chemicals at this site are not listed on this convention nor are they bioaccumulative, chemicals like 6:2 FTS are persistent. Best practice measures are important to consider whenever there is potential for these chemicals to move into off-site areas around a facility using products containing them. Where possible and practical, methods to reduce levels in discharges are important to implement. An approach that may be relevant for this site is an investigation of how PFAS are entering the stormwater system. If, for example, there are minor leaks in the infrastructure that could be easily repaired, then this would be appropriate to determine and implement (EnRisKs, 2022). We understand from Vopak that a robust process is now used during deluge testing so that zero foam solution spills occur to ground surface with all discharge (however small) being captured. This process should continue.

Vopak should continue good housekeeping practices and maintenance to mitigate the potential for impacts to the environment.

13 References

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Australian Standard AS4482.2-1999 Guide to the sampling and investigation of potentially contaminated soil Part 2: Volatile substances.

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NT Government, Department of Natural Resources, Environment, The Arts and Sport (2010) Water Quality Objectives for the Darwin Harbour Region – Background Document.

NT EPA, Northern Territory Contaminated Land Guideline Version 1.0, Northern Territory Environmental Protection Authority, June 2017.

SKM (2003) Darwin Industry Fuel Terminal, Environmental Assessment Report

SMEC 2022, 30080099 Vopak Darwin Terminal – Site Investigations; Sampling, Analysis and Quality Plan Rev1, dated 31 March 2022.

Vopak (2016) Operations Environmental Management Plan (OEMP), dated December 2016

Vopak Chronology of events – AFFF Spill – Vopak (undated, 2020)

Vopak Industrial Fuel Terminal Fire System block plan and terminal drawings (various)

Vopak Industrial Fuel Terminal tankage general arrangement and profile drawings (various)

Vopak Industrial Fuel Terminal sanitary drainage layout drawings

Vopak – electronic monitoring databases

Appendix A **Figures**



FIG NO. 1

FIGURE TITLE Site Locality

DATE 11/03/2022

0 25 50 100 150
1:4,000 Meters

PAGE SIZE A3

COORDINATE SYSTEM GDA 1994 MGA Zone 52

PROJECT NO. 30080099

PROJECT TITLE Vopak Darwin Terminal, 780 Berrimah Road

CREATED BY FA13847

SOURCES Roadnet MDS 2022
MetroMap Imagery © Aerometrex Pty Ltd

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Location: V:\Projectz\30080099\Maps\30080099_F0001_SiteLocality.mxd

Last updated by: FA13847 on 11/03/2022 at 15:32

LEGEND

- DIFT Area
- 6-Series Area
- DAT Area
- GRR LWTF
- Approximate location of firefighting foam solution leak 2020
- Site Location

TK0303
TK0203
TK0302
TK0202
TK0301
TK0201
TK0105
TK0104
TK0106
TK0103
TK0101
TK0102
TK6301
TK6203
TK6202
TK6201
TK6101
TK6102
TK6103
TK6104
TK6108
TK6107
TK6106

Refer to Figure 2A for details

Sewage pump station
Office / control room
Former Septic Tank & Pump Chamber
Soakage trench
Switchroom
Wharf lines
Acid road tanker loading bay
Pump Bay
Stormwater Separator
Fire Box
Wastewater treatment
Firewater pumphouse
TK3101 (Fire water tank)
Tank Farm
Filter Press
Glycol recovery processing
Packaging waste
Oil processing
Recieval bay
Sludge bay

Berrimah Rd

FIG NO. 2

FIGURE TITLE Site Layout

DATE 05/05/2022

0 25 50 100
1:2,750 Meters

PAGE SIZE A3

COORDINATE SYSTEM GDA 1994 MGA Zone 52

PROJECT NO. 30080099

PROJECT TITLE Vopak Darwin Terminal, 780 Berrimah Road

CREATED BY FA13847

SOURCES Roadnet MDS 2022
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Location: V:\Projectz\30080099\Maps\30080099_F0002_SiteLayout.mxd

Last updated by: FA13847 on 5/05/2022 at 11:08



FIG NO. 2A

FIGURE TITLE Site Layout

DATE 11/03/2022

0 25 50
Meters
1:1,000

PAGE SIZE A3

COORDINATE SYSTEM GDA 1994 MGA Zone 52

PROJECT NO. 30080099

PROJECT TITLE Vopak Darwin Terminal, 780 Berrimah Road

CREATED BY FA13847

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Location: V:\Projectz\30080099\Maps\30080099_F0002A_Inset1.mxd

Last updated by: FA13847 on 11/03/2022 at 15:29



FIG NO. 2B

FIGURE TITLE Site Layout

DATE 28/03/2022

0 25 50 100
1:2,750 Meters

PAGE SIZE A3

COORDINATE SYSTEM GDA 1994 MGA Zone 52

PROJECT NO. 30080099

PROJECT TITLE Vopak Darwin Terminal, 780 Berrimah Road

CREATED BY FA13847

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Location: V:\Projectz\30080099\Maps\30080099_F0002B_Waterlines.mxd

Last updated by: FA13847 on 28/03/2022 at 14:48



FIG NO. 3

FIGURE TITLE Sample Locations

DATE 08/07/2022

0 25 50 100 Meters

1:2,500

PAGE SIZE A3

COORDINATE SYSTEM GDA 1994 MGA Zone 52

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PROJECT NO. 30080099

PROJECT TITLE Vopak Darwin Terminal, 780 Berrimah Road

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SOURCES Roadnet MDS 2022
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Location: V:\Projectz\30080099\Maps\30080099_F0003_SampleLocations.mxd

Last updated by: FA13847 on 8/07/2022 at 11:25

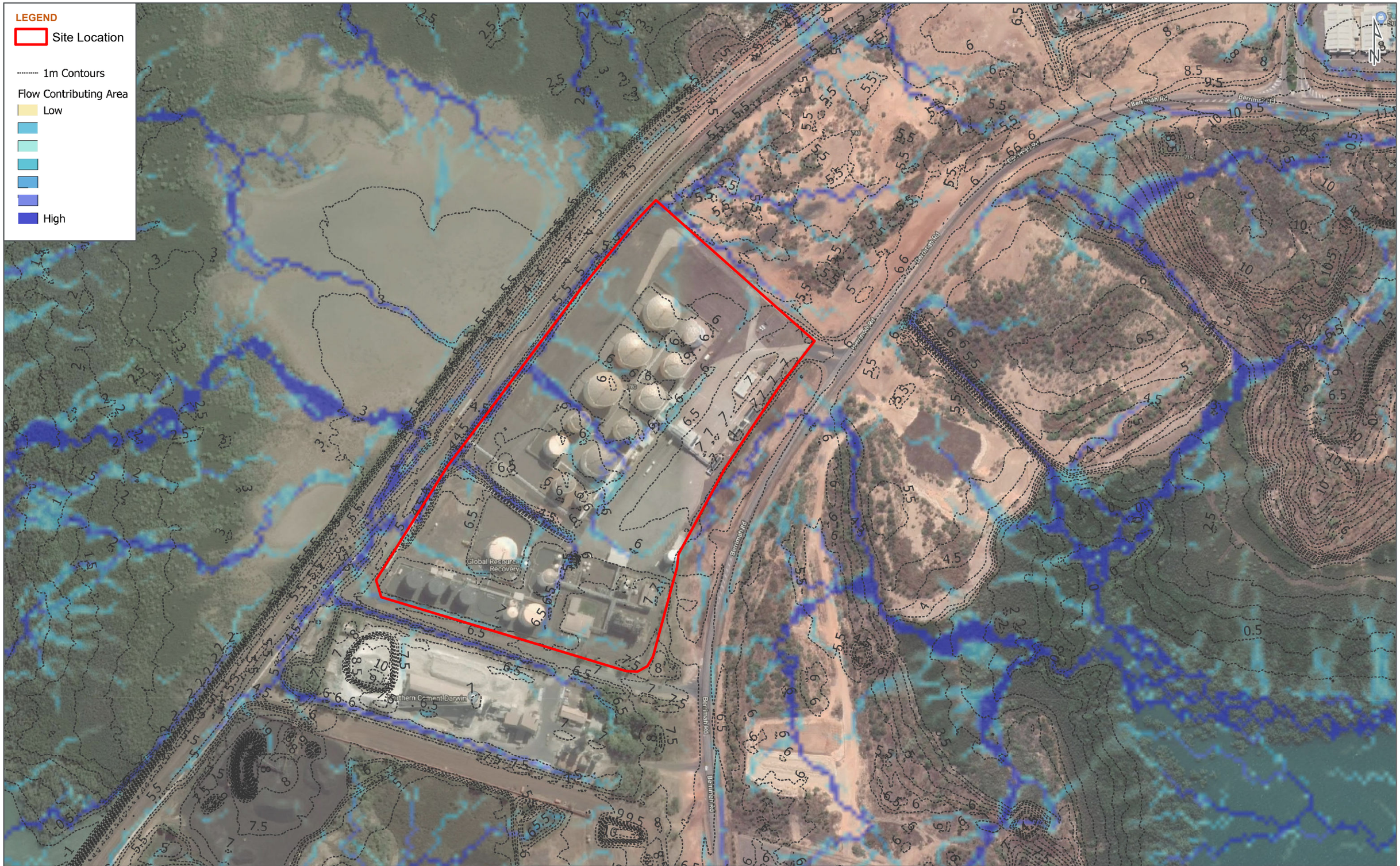


FIG NO. 4	**FIGURE TITLE** Surface Water Flow	**DATE** 11/03/2022	0 25 50 100 150 Meters 1:4,000	**PAGE SIZE** A3	**COORDINATE SYSTEM** GDA 1994 MGA Zone 52
PROJECT NO. 30080099	**PROJECT TITLE** Vopak Darwin Terminal, 780 Berrimah Road	**CREATED BY** FA13847	**SOURCES** Roadnet MDS 2022, Map provided by client and sourced from Surface Water and Erosion Solutions figure		

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Location: V:\Projectz\30080099\Maps\30080099_F0004_SurfaceWater.mxd

Last updated by: FA13847 on 11/03/2022 at 15:33

LEGEND

- Site Location
- Threatened Flora
- Threatened Fauna

Yellow-spotted Monitor
Black-footed Tree-rat (Kimberley and mainland Northern Territory)
Cycas armstrongii
Pale Field-rat
Far Eastern Curlew
Bar-tailed Godwit
Green Turtle
Greater Sand Plover
Gouldian Finch
Northern Quoll
Lesser Sand Plover
Great Knot
Hawksbill Turtle
Asian Dowitcher
Flatback Turtle
Loggerhead Turtle
Common Brushtail Possum (north-western)
Red Knot
Curlew Sandpiper
Northern Quoll
Berrimah Rd
Tiger Brennan Dr
Knuckey St
Bennett St
Wishart
Wishart Rd
Kirkland Rd
Tivendale
Cleome insolata
East Arm
N

FIG NO. 5	**FIGURE TITLE** Environmental Constraints - Threatened Species	**DATE** 11/03/2022	0 175 350 700 1,050 1,400 Meters 1:30,000	**PAGE SIZE** A3	**COORDINATE SYSTEM** GDA 1994 MGA Zone 52
PROJECT NO. 30080099	**PROJECT TITLE** Vopak Darwin Terminal, 780 Berrimah Road	**CREATED BY** FA13847	**SOURCES** Roadnet MDS 2022 MetroMap Imagery © Aerometrex Pty Ltd Flora and Fauna © Department of Environment, Parks and Water Security		

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LEGEND

Site Location

Remote Community Bushfire Risk Rating

Moderate

NT Parks and Reserves

NT Parks and Reserves

Charles Darwin National Park

Railway Dam

McMinn St

Knuckey St

Bennett St

Tiger Brennan Dr

Berrimah Rd

Stuart Hwy

Tiger Brennan Dr

Wishart

Wishart Rd

Kirkland Rd

Tivendale

East Arm

N

FIG NO. 6	**FIGURE TITLE** Environmental Constraints	**DATE** 11/03/2022	0 175 350 700 1,050 1,400 Meters 1:30,000	**PAGE SIZE** A3	**COORDINATE SYSTEM** GDA 1994 MGA Zone 52
PROJECT NO. 30080099	**PROJECT TITLE** Vopak Darwin Terminal, 780 Berrimah Road	**CREATED BY** FA13847	**SOURCES** Roadnet MDS 2022, MetroMap Imagery © Aerometrex Pty Ltd, Bushfire Risk © Department of Environment, Parks and Water Security, Northern Territory Parks and Reserves © Department of Industry, Tourism and Trade		

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Location: V:\Projectz\30080099\Maps\30080099_F0006_EnviroConstraints.mxd

Last updated by: FA13847 on 11/03/2022 at 15:38

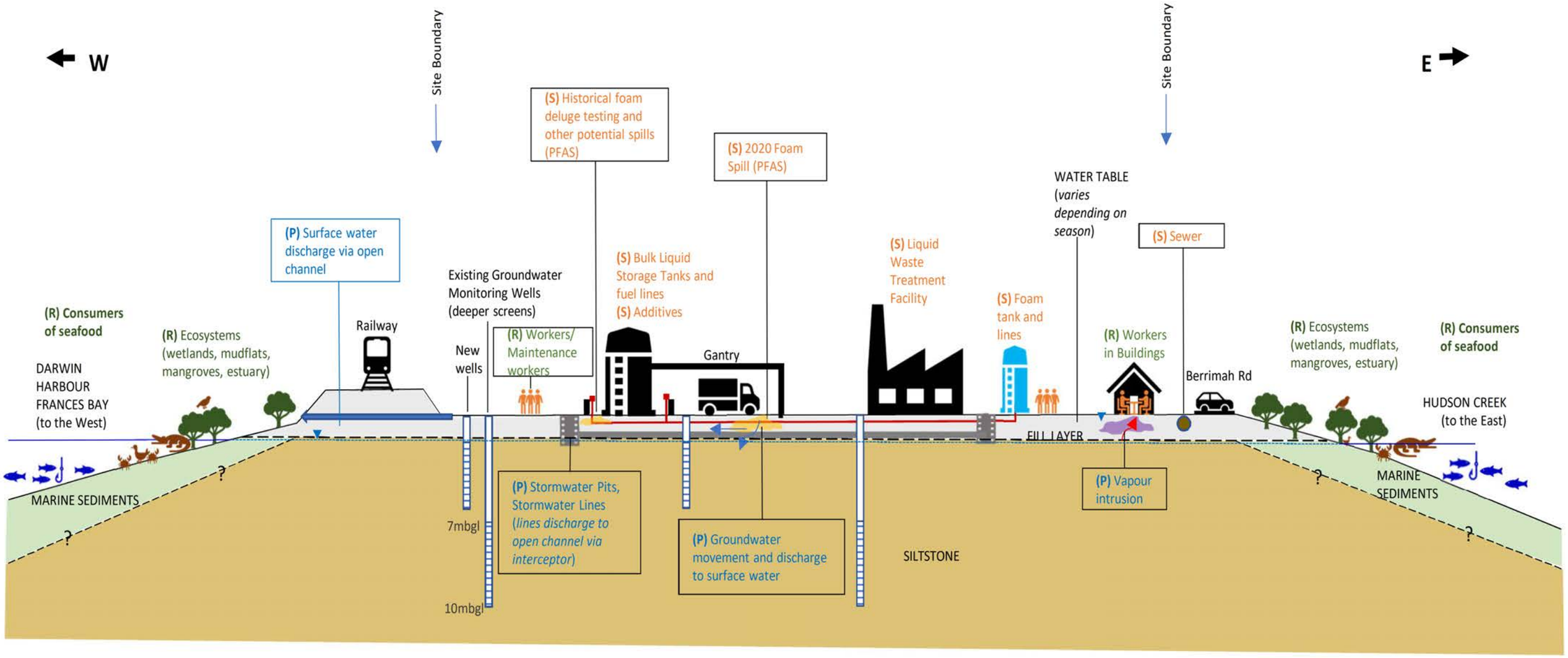


FIG NO. 7	**FIGURE TITLE** Preliminary CSM	**DATE** 4/05/2022	Not to scale	**PAGE SIZE** A3 **COORDINATE SYSTEM** NA
PROJECT NO. 30080099	**PROJECT TITLE** Vopak Darwin Terminal, 780 Berrimah Road	**CREATED BY** PV/MF		

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Location: V:\Projectz\30080099\Maps\30080099_F0001_SiteLocality.mxd

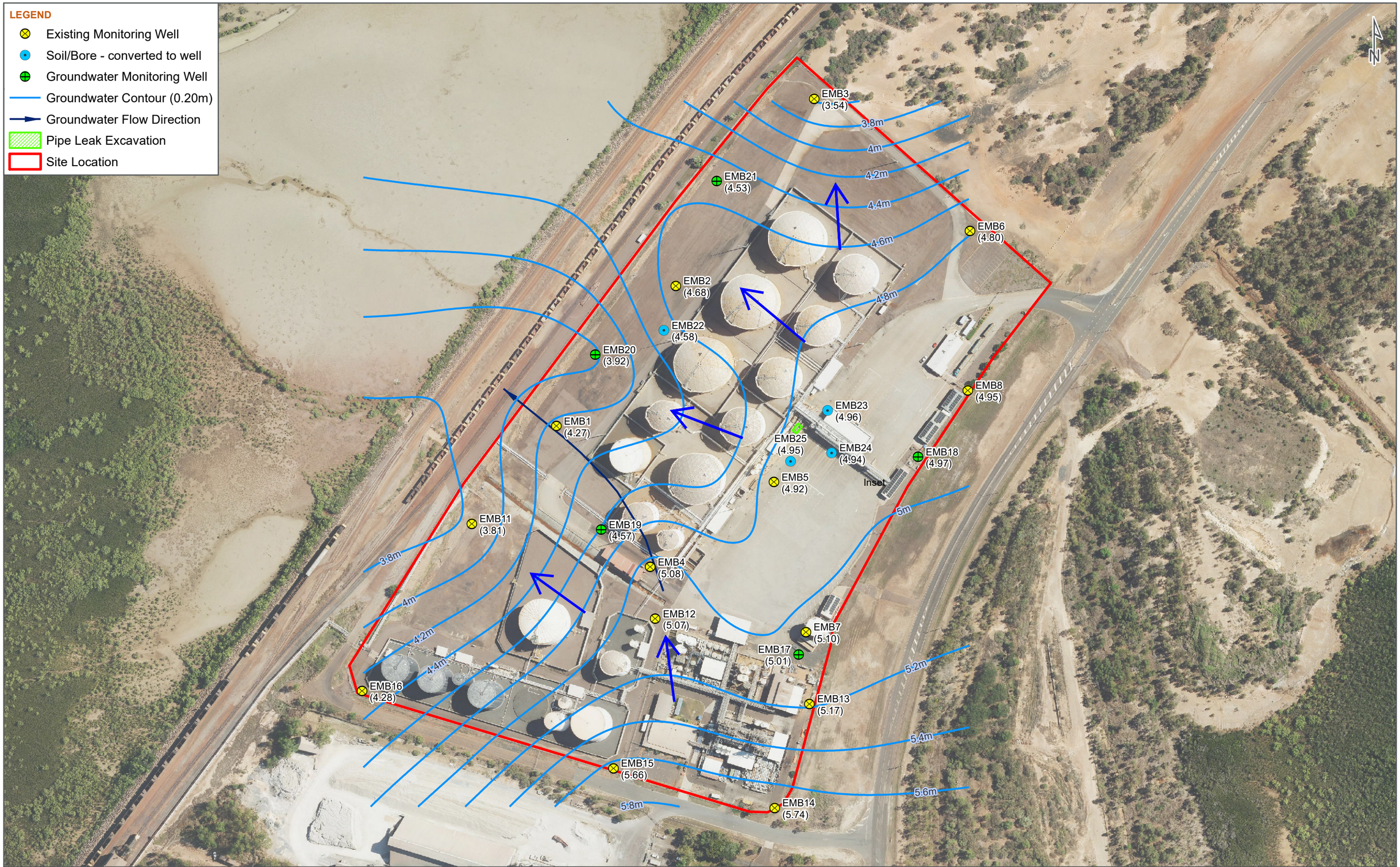


FIG NO. 8	**FIGURE TITLE** Groundwater Contours and Flow Direction	**DATE** 05/05/2022	0 25 50 100 Meters 1:2,500	**PAGE SIZE** A3	**COORDINATE SYSTEM** GDA 1994 MGA Zone 52
PROJECT NO. 30080099	**PROJECT TITLE** Vopak Darwin Terminal, 780 Berrimah Road	**CREATED BY** FA13847	**SOURCES** Roadnet MDS 2022 MetroMap Imagery © Aerometrex Pty Ltd		

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Location: V:\Projectz\30080099\Maps\30080099_F0008_GW_Contours.mxd

Last updated by: FA13847 on 5/05/2022 at 10:13

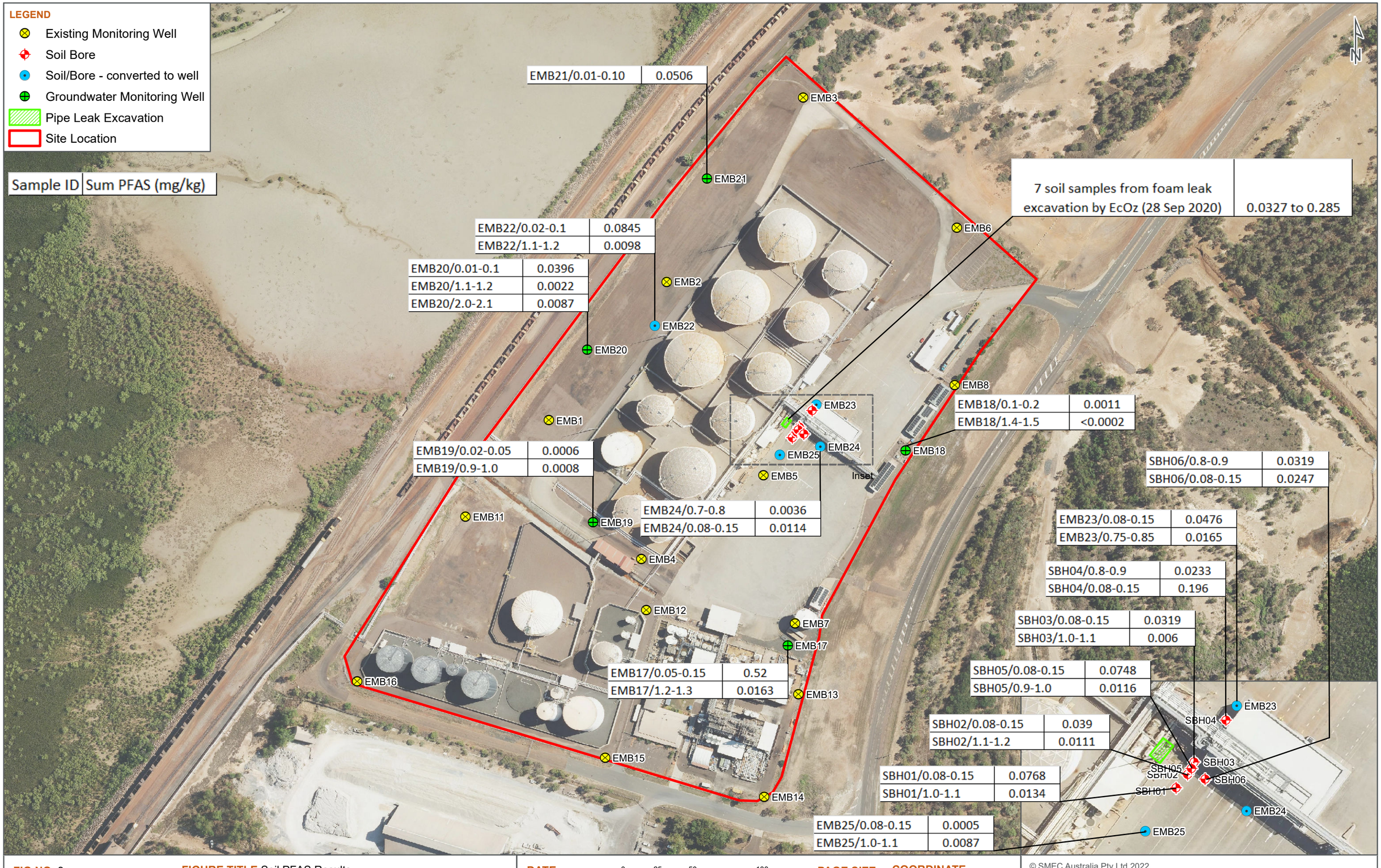


FIG NO. 9	**FIGURE TITLE** Soil PFAS Results	**DATE** 12/07/2022	**PAGE SIZE** A3	**COORDINATE SYSTEM** GDA 1994 MGA Zone 52
PROJECT NO. 30080099	**PROJECT TITLE** Vopak Darwin Terminal, 780 Berrimah Road	**CREATED BY** FA13847	**SOURCES** Roadnet MDS 2022 MetroMap Imagery © Aerometrex Pty Ltd	

0 25 50 100
1:2,500 Meters

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Location: V:\Projectz\30080099\Maps\30080099_F0003_SampleLocations.mxd

Last updated by: FA13847 on 5/05/2022 at 10:10

LEGEND

- Existing Monitoring Well
- Soil Bore
- Soil/Bore - converted to well
- Groundwater Monitoring Well
- Pipe Leak Excavation
- Site Location

	Exceeds health (recreation) criteria
red	Exceeds marine 95% species protection criteria
underline	Exceeds marine 99% species protection criteria

EMB1 to EMB16 (GHD April/May 2022)
EMB17 to EMB25 (SMEC April 2022)
Note: GHD limit of reporting were higher

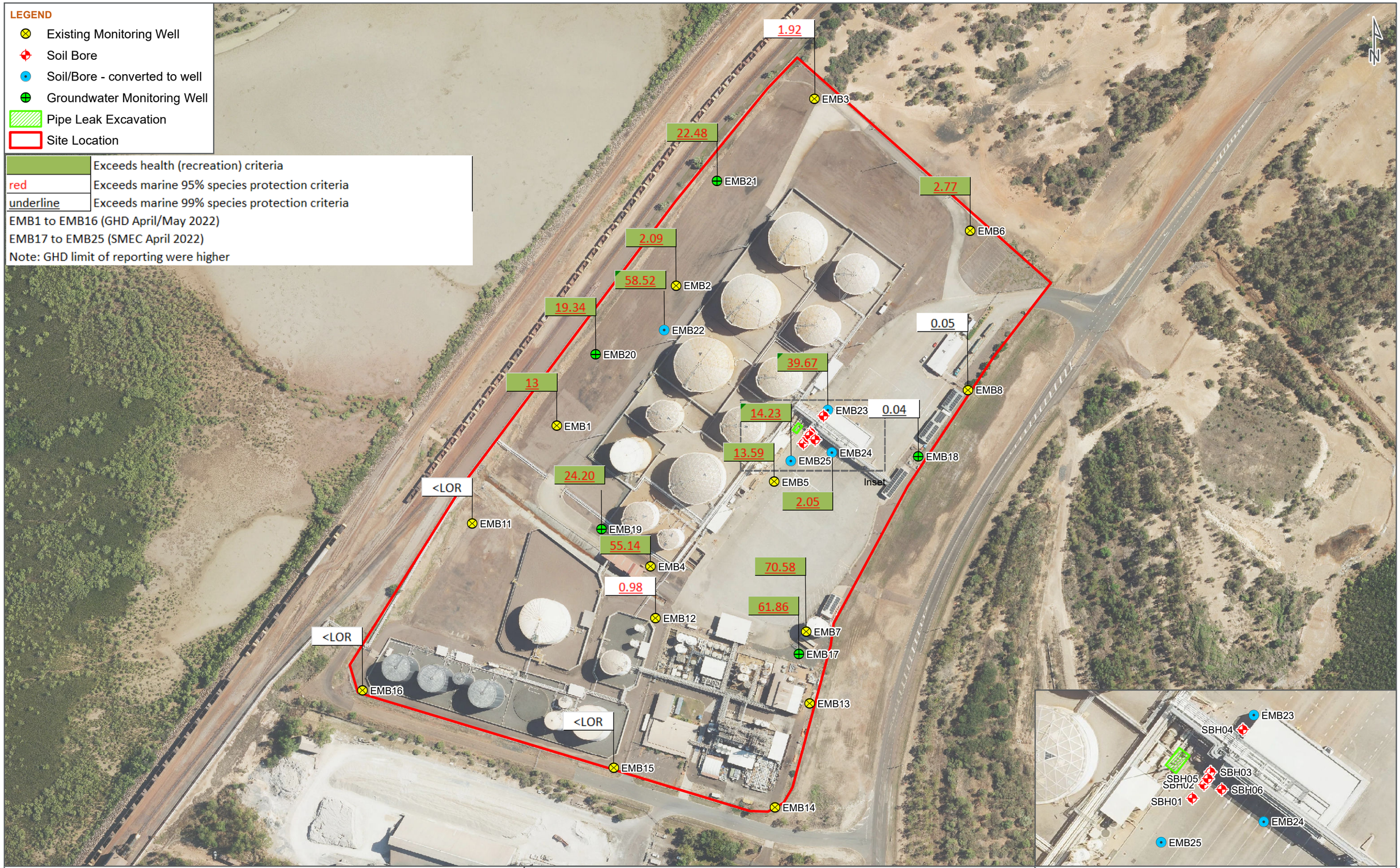


FIG NO. 10	**FIGURE TITLE** Sum PFOS related compounds in Groundwater	**DATE** 10/07/2022	**PAGE SIZE** A3	**COORDINATE SYSTEM** GDA 1994 MGA Zone 52
PROJECT NO. 30080099	**PROJECT TITLE** Vopak Darwin Terminal, 780 Berrimah Road	**CREATED BY** FA13847	**SOURCES** Roadnet MDS 2022 MetroMap Imagery © Aerometrex Pty Ltd	

0 25 50 100
1:2,500 Meters

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Location: V:\Projectz\30080099\Maps\30080099_F0003_SampleLocations.mxd

Last updated by: FA13847 on 5/05/2022 at 10:10

LEGEND

- Existing Monitoring Well
- Soil Bore
- Soil/Bore - converted to well
- Groundwater Monitoring Well
- Pipe Leak Excavation
- Site Location

Groundwater Concentrations (µg/L) (Sum of PFOA related

	Exceeds health (recreation) criteria
red	Exceeds marine 95% species protectioncriteria
underline	Exceeds marine 99% species protectioncriteria

EMB1 to EMB16 (GHD April/May 2022)
EMB17 to EMB25 (SMEC April 2022)
Note: GHD limit of reporting were higher

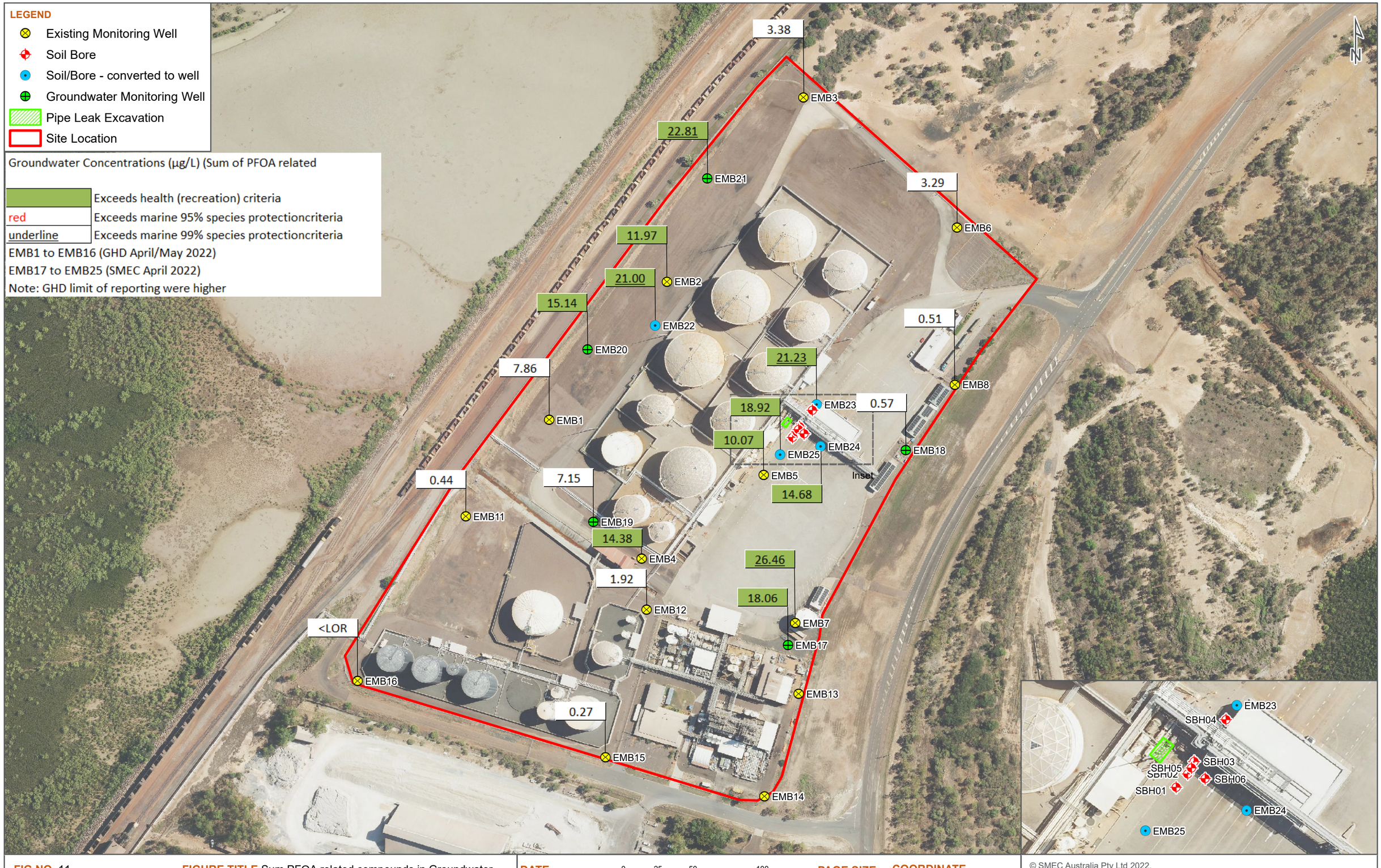


FIG NO. 11	**FIGURE TITLE** Sum PFOA related compounds in Groundwater	**DATE** 10/07/2022	0 25 50 100 Meters 1:2,500	**PAGE SIZE** A3	**COORDINATE SYSTEM** GDA 1994 MGA Zone 52
PROJECT NO. 30080099	**PROJECT TITLE** Vopak Darwin Terminal, 780 Berrimah Road	**CREATED BY** FA13847		**SOURCES** Roadnet MDS 2022 MetroMap Imagery © Aerometrex Pty Ltd	

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Location: V:\Projectz\30080099\Maps\30080099_F0003_SampleLocations.mxd

Last updated by: FA13847 on 5/05/2022 at 10:10

Appendix B **Site Layout/Process Drawings**

LEGEND

- H - FIRE HYDRANT
- HR - FIRE HOSE REEL
- AB - ACCESSORIES BOX
- ⊠ - OSCILLATING FIRE MONITOR
- FW - FIRE WATER CONNECTION
- ⋈ - FIRE WATER STOP VALVE
- □FH - FOAM HYDRANT
- • EX - POWDER TYPE EXTINGUISHER
- • F - FOAM EXTINGUISHER
- • W - WATER EXTINGUISHER
- ⊙EX - CO2 EXTINGUISHER
- ⊕BA - BREATHING APPARATUS
- ⊞FAB - FIRST AID BOX
- △SS - SAFTEY SHOWER / EYE WASH
- ESD - EMERGENCY SHUTDOWN BUTTON
- FA - FIRE ALARM
- - WARNING BELL
- - EVACUATION SPEAKER/SIREN
- IR - TRIPLE SPECTRUM IR FLAME DETECTOR IR = INFRA-RED
- - SMOKE DETECTOR
- - FOAM STOP/START PUSH BUTTON (AS LABELLEO)
- - HEAT DETECTOR
- F - MANUAL CALL POINT ON FIRE SYSTEM
- PXF - FOAM VALVE CONTROL SOLENOID
- PXW - WATER DELUGE VALVE CONTROL SOLENOID
- PS - FIRE SUPPRESSION SYSTEM "OPERATED" PRESSURE SWITCH
- T - VALVE TAMPER SWITCH
- FIP - FIRE INDICATOR PANEL
- WH-00 - WATER HYDRANT ——— FIRE WATER MAIN
- FH-00 - FOAM HYDRANT —·— FOAM MAIN
- WM-00 - WATER MONITOR
- SV-00 - DELUGE VALVE

TK0101 TK0102 TK0103 TK0104 TK0105 TK0201 TK0202 TK0203 TK0301 TK0302 TK0303 TK3101

PUMP HOUSE · SWITCHROOM · WORKSHOP · OFFICE/CONTROL ROOM · ENTRY · EXIT

DIRECT BRIGADE ALARM

ENTERED
18 APR 2005

REV	DATE		BY	CHK	CIV/STR	MECH	E/I	PROCESS
A	13-04-05	ISSUED FOR REVIEW	A.A.					D.P.

APPROVED

REFERENCE

DRAWING NUMBER	TITLE
JDE1889-86-101	FIRE FIGHTING SYSTEM - P&ID
JDE1889-81-302	MAIN EQUIPMENT LOCATION SITE PLAN
JDE1889-81-713	FIRE EQUIPMENT & EXTINGUISHER SITE LOCATION PLAN
JDE1889-86-100	FOAM RING MAIN & HYDRANTS - P&ID
JDE1889-86-081	COOLING WATER RING MAIN & HYDRANTS - P&ID

PRELIMINARY
NOT FOR CONSTRUCTION

HWE
HENRY WALKER ELTIN

CONTRACT No.	JDE1889	
ENG. DESIGN BY	DAVID PINCOTT	
DRAWN	RPZ	24-03-05
CHECKED		
CIV & STRUCT DESIGN APPR.		
MECHANICAL DESIGN APPR.		
ELECT. & INSTR. DESIGN APPR.		
PROCESS DESIGN APPR.		
WEIGHTS CHECKED		

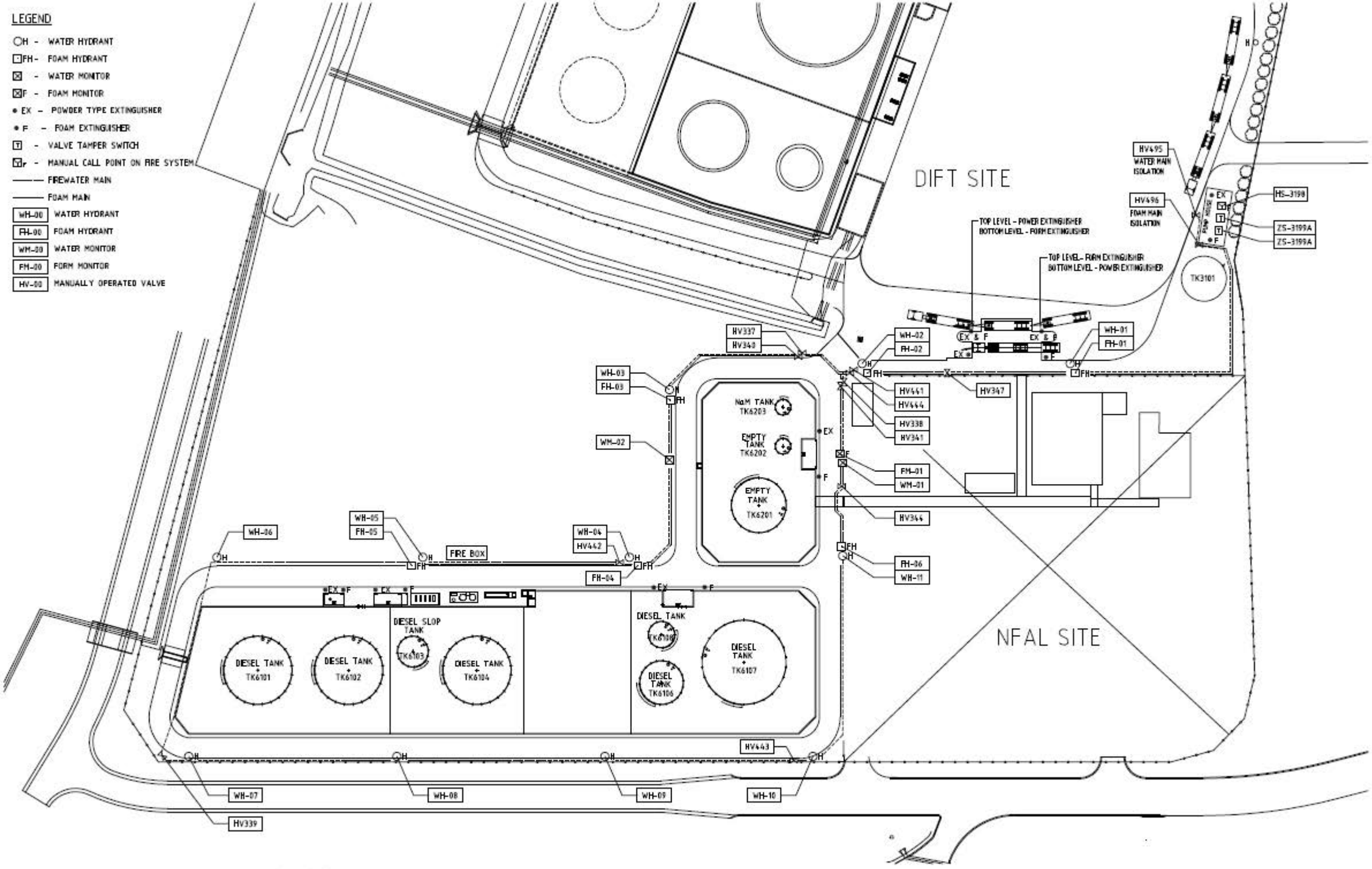
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VOPAK TERMINALS DARWIN AUSTRALIA

DARWIN INDUSTRY FUEL TERMINAL EMERGENCY FACILITIES GENERAL ARRANGEMENT

Scale	SEA DRAWING No.	REV.
A1 1:500	JDE1889-81-060	A



REV	DATE		BY	CHK	APPROVED				REFERENCE		
B	05/10/16	UPDATED TO SITE CHANGES	MB	PB		HP					
A	5/10/16	ISSUED FOR CLIENT'S REVIEW	AGS	BP		ARF		BP			
					OWNER	HSE	QA	PROCESS	---	DRAWING NUMBER	TITLE

CONTRACT No.	5498
ENG. DESIGNED	A FERNANDES
DRAWN	J SHIM 05/10/16
CHECKED	
QA/QC APPR.	
ENGINEER APPR.	
ENG. MGR. APPR.	
PROJECT APPR.	
CONTRACT MANAGER	

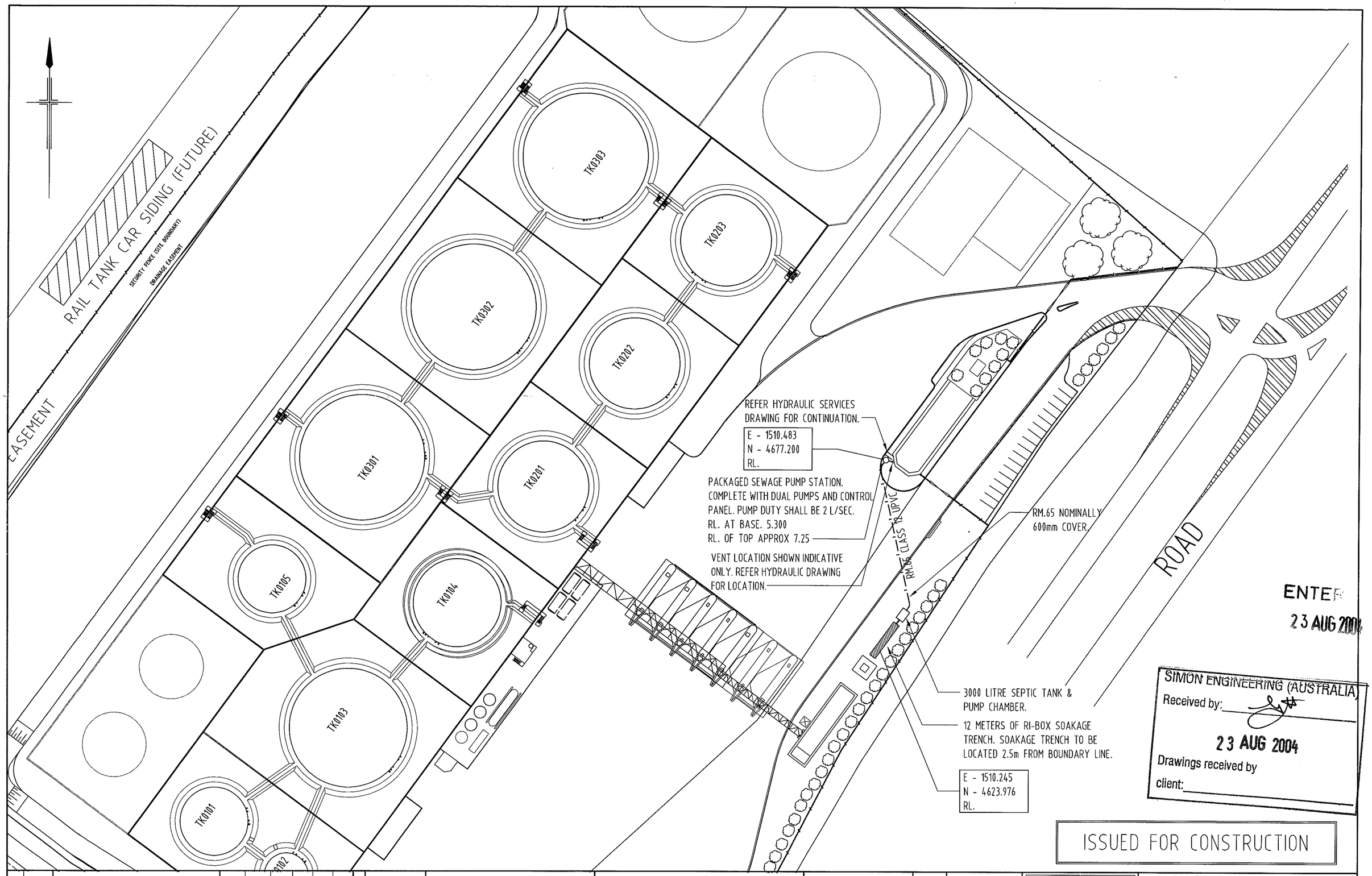
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VOPAK TERMINALS DARWIN PTY LIMITED

DARWIN BIODIESEL TERMINAL
EMERGENCY FACILITIES
GENERAL ARRANGEMENT

Scale		BBSA DRG No.	REV.
1:500	A1	5498-81-003	B



ENTER
23 AUG 2004

SIMON ENGINEERING (AUSTRALIA)
Received by:
23 AUG 2004
Drawings received by client:

ISSUE FOR CONSTRUCTION

REV	DATE		BY	CHK	CIV/STR	MECH	E/I	PROCESS
A	18/08/04	ISSUE FOR CONSTRUCTION	RDH	RBM	APPROVED			

REFERENCE

DRAWING NUMBER	TITLE

CW-DC Pty Ltd
CW-DC Pty Ltd ABN 66 009 310 169
62 Cavenagh Street (PO Box 919) Darwin
Northern Territory 0800 Australia
Telephone: +61 8 89818022
Facsimile: +61 8 89818050
Email: cwdrw@cw-dc.com.au

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CW-DC PROJECT NUMBER: GD22.00

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HENRY WALKER ELTIN

CONTRACT No.	JDE1889
ENG. DESIGN BY	
DRAWN	T.E. Feb.'04
CHECKED	
CIV & STRUCT DESIGN APPR.	
MECHANICAL DESIGN APPR.	
ELECT. & INSTR. DESIGN APPR.	
PROCESS DESIGN APPR.	
WEIGHTS CHECKED	

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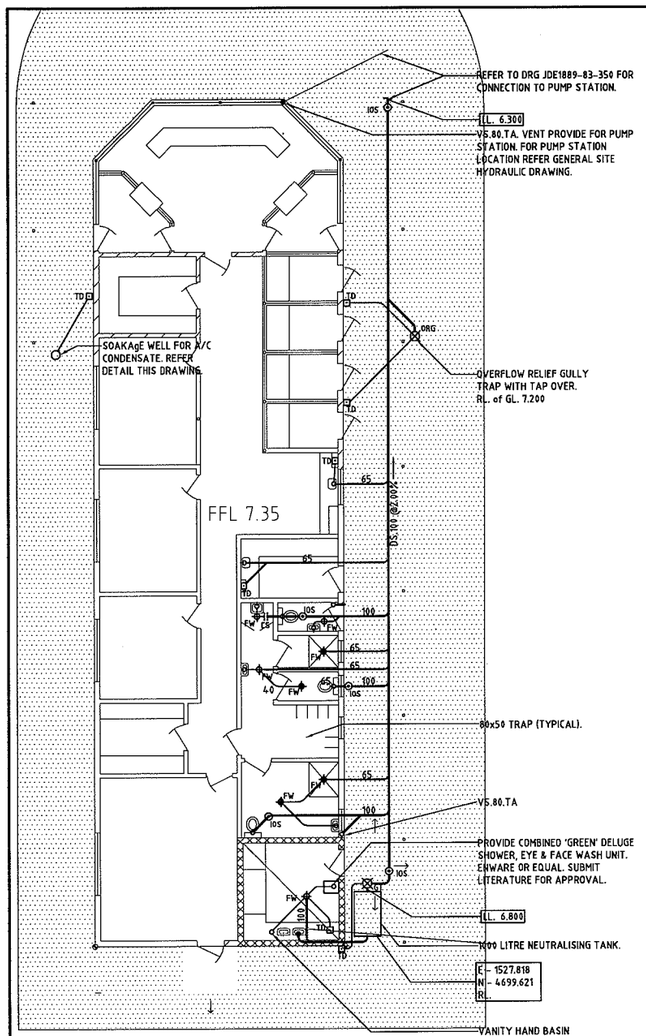
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A1

VOPAK TERMINALS DARWIN PTY LIMITED

DARWIN INDUSTRIAL FUEL TERMINAL
GENERAL SITE
HYDRAULIC PLAN

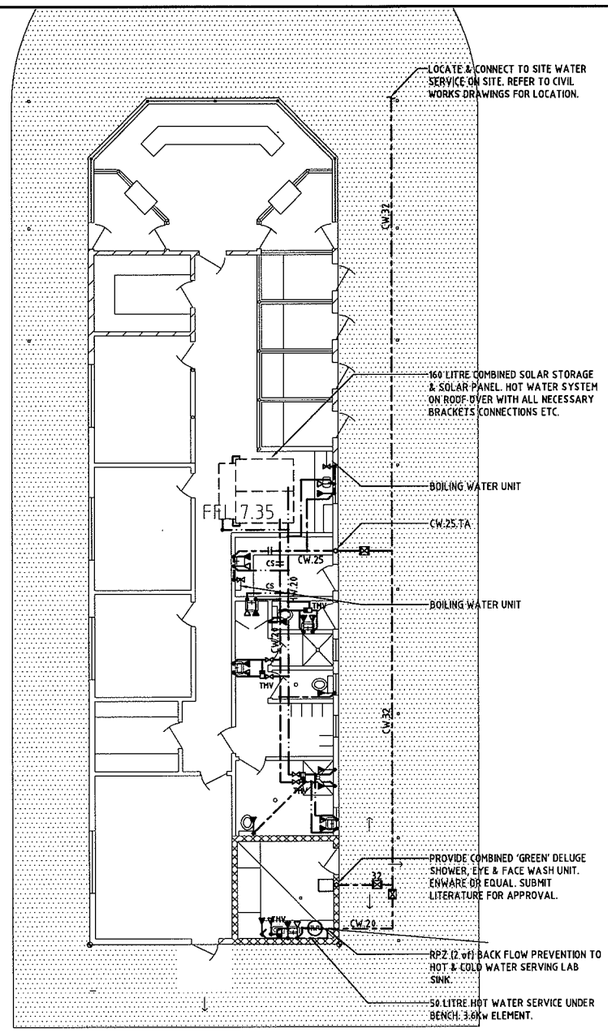
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1 :500 (A1)	JDE1889-83-351	A



FLOOR PLAN

SANITARY DRAINAGE LAYOUT.

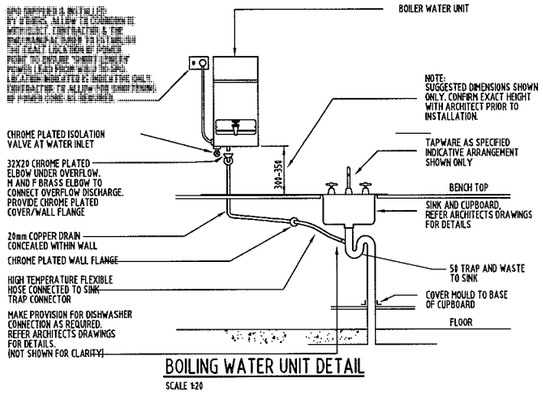
SCALE: 1:100



FLOOR PLAN

RETICULATION LAYOUT.

SCALE: 1:100



BOILING WATER UNIT DETAIL

SCALE 1:20

HYDRAULICS LEGEND

NEW 100mm SEWER DRAIN		RISER/DROPPER	DS	DRAIN SOIL	PUMP
NEW 65mm SEWER DRAIN	IV	ISOLATION VALVE	DW	DRAIN WASTE	BE BLANK END
NEW 40mm SEWER DRAIN		ISOLATION VALVE IN VALVE BOX FINISHED FLUSH WITH ADJOINING LEVELS	T&W	TRAP & WASTE	AG ACCESS GATE
NEW VENT PIPE	THV	THERMOSTATIC MIXING VALVE	VS	VENT SOIL	I.L.XXXX DRAIN INVERT LEVEL
NEW COLD WATER PIPEWORK	SNB	SCREW NOSE BIBTAP COMPLETE WITH INTEGRAL DUAL CHECK VALVE	CW	COLD WATER	FFL.XXXX FINISHED FLOOR LEVEL
NEW HOT WATER PIPEWORK			HW	HOT WATER	TD TUNDISH
EXISTING SEWER DRAIN		HOT WATER OUTLET	FA	FROM ABOVE	IOS INSPECTION OPENING - SURFACE ACCESS
EXISTING WATER PIPEWORK		COLD WATER OUTLET	TA	TO ABOVE	FW FLOOR WASTE
REDUNDANT SERVICE		MIXED WATER OUTLET	FB	FROM BELOW	GT GULLY TRAP
EXG EXISTING	BFP	BACKFLOW PREVENTION VALVE	TB	TO BELOW	ORG OVERFLOW RELIEF GULLY
		NON RETURN VALVE	1.65%	GRADE IN DRAIN	CS CHANGE IN SIZE

HYDRAULIC SERVICES SPECIFICATION NOTES

SITE VISIT

THE SUB-CONTRACTOR SHALL BE DEEMED TO HAVE THOROUGHLY INSPECTED THE SITE PRIOR TO TENDER AND TO HAVE TAKEN INTO ACCOUNT ANY CONDITIONS LIKELY TO EFFECT THE EXTENT OR PERFORMANCE OF THE CONTRACT.

SCOPE

SUPPLY AND INSTALL ALL LABOUR, MATERIALS, PLANT, SERVICES AND NECESSARY OPERATIONS FOR THE COMPLETE HYDRAULIC SERVICES INSTALLATION AND DEMOLITION AS SHOWN ON THESE DRAWINGS. CONTRACTOR SHALL BE RESPONSIBLE FOR THE DISCONNECTION OF THE HYDRAULIC SERVICES TO THE EXISTING FIXTURES AND EQUIPMENT AND TO ISOLATE THE SERVICE TO ALLOW FOR THE REMOVAL OF THE PIPEWORK AND FIXTURES. AT PROJECT COMPLETION, THE CONTRACTOR IS TO PROVIDE DETAILED 'AS BUILT' DRAWINGS (REFER PRELIMINARIES FOR FORMAT). AND OPERATING MANUALS.

REGULATIONS AND STANDARDS

CARRY OUT ALL WORKS AND PROVIDE ALL EQUIPMENT IN ACCORDANCE WITH THE CURRENT EDITIONS OF RELEVANT AUSTRALIAN STANDARDS, AS 3500 PARTS 1 - 4, POWERWATER REGULATIONS AND DIRECTIVES AND THE BUILDING CODE OF AUSTRALIA. CONTRACTOR TO SUBMIT ALL DETAILS, PAY ALL FEES AND OBTAIN APPROVALS FROM POWERWATER PRIOR TO THE COMMENCEMENT OF ANY WORKS. CARRY OUT ALL MANDATORY TESTS REQUIRED BY THE AUTHORITY AND AS 3500 AND SUBMIT WRITTEN TEST RESULTS TO THE SUPERINTENDENT. SUBMIT CERTIFICATE OF COMPLIANCE FOR WORKS CARRIED OUT.

WORKMANSHIP

ALL WORK SHALL BE EXECUTED IN A NEAT AND BEST TRADE PRACTICE MANNER, CARRIED OUT BY COMPETENT EXPERIENCED TRADES PERSONS, POSSESSING CURRENT PLUMBING WORKERS LICENCES SUITABLY ENDORSED FOR THE TYPE OF WORK. (PROGRAMME THE WORKS TO MINIMISE INTERRUPTION. SURROUNDING AREAS NOT UNDERGOING RENOVATION SHALL REMAIN OPERATIONAL AT ALL TIMES. ANY DISRUPTION OR DAMAGE TO THE EXISTING REMAINING SERVICES SHALL BE REPAIRED IMMEDIATELY AT THE CONTRACTOR'S EXPENSES. LIAISE WITH SUPERINTENDENT AND OBTAIN APPROVAL IN WRITING, AT LEAST 48 HOURS PRIOR TO THE DISCONNECTION OF ANY SERVICES.
DO NOT USE THE DRAWINGS FOR SETTING OUT AND, IF DIRECTED BY THE SUPERINTENDENT, RELOCATE ANY ITEM UP TO FIVE METRES IN ANY DIRECTION, PRIOR TO FINAL INSTALLATION AT NO ADDITIONAL COST. SEAL ALL PENETRATIONS FOR HYDRAULIC SERVICES AND MAKE SAFE, MAINTAINING THE ARCHITECTURAL, VISUAL, FIRE STOPPING, AIR SEALING AND WATER PROOFING PROPERTIES OF THE SURROUNDING SURFACE. ALL EXPOSED SERVICES SHALL BE CHROME PLATE FINISH. ALL RELEVANT O.H.&S REQUIREMENTS MUST BE ADHERED WITH.

TESTING & COMMISSIONING:

THE HYDRAULIC SERVICES CONTRACTOR SHALL FULLY TEST AND COMMISSION THE COMPLETE HYDRAULIC INSTALLATION.

COMPLIANCE CERTIFICATES:

ISSUE A CERTIFICATE OF COMPLIANCE BEFORE THE DATE OF PRACTICAL COMPLETION. THE CERTIFICATE SHALL STATE THAT THE COMPLETE INSTALLATION COMPLIES WITH ALL THE REQUIREMENTS OF THIS SPECIFICATION AS WELL AS THE RELEVANT AUSTRALIAN STANDARDS AND REGULATIONS WHICH APPLY TO THE INSTALLATION.

MAINTENANCE AND SERVICING

PROVIDE MAINTENANCE AND SERVICING FOR ALL INSTALLED AND MODIFIED ITEMS FOR A PERIOD OF 12 MONTHS FROM THE DATE OF PRACTICAL COMPLETION. PROVIDE PROMPT ATTENDANCE TO ALL REQUESTS FOR SERVICING DURING THIS PERIOD.

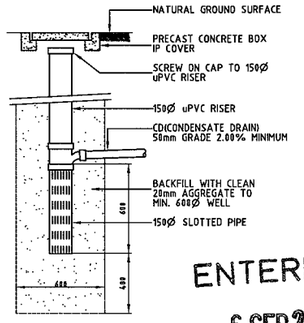
FIXTURE & TAPWARE SELECTIONS:

TAPWARE:
SANITARY FIXTURES:

PIPE SELECTION:

SEWER	:	uPVC
VENT	:	uPVC
EXPOSED FINISHES	:	CHROME PLATE FINISH
COLD WATER - IN-GROUND	:	COPPER TUBE TYPE B
HOT & COLD WATER ABOVE GROUND	:	COPPER TUBE TYPE B OR XLPE WITH MECHANICAL CRIMPED FITTINGS.

Description	Supply Source	Tapware Selection
Basin	Caroma Cotton twin hole vanity basin as appropriate.	Tapware Selection Three piece basin set with "Star style" handles, swivel goose neck outlet nominally 205mm high x 125 mm radius, complete with 7 litre per minute flow regulated aerator shroud and stream diverter.
Basin disabled	Caroma Integra 540V shrouded wall basin Complete with one tap hole.	Caroma "Economiser" tap with disabled persons lever handle complete with individual hot and cold isolation non return valves.
Boiling water unit 5.0L	Dux 4 inch Zip Standard finish, 5.0 litre capacity 6 kilowatt Tundish	15mm cold water isolation valve adjacent to the equipment.
Dishwasher domestic	Supplied and installed by Principal	15mm cold water isolation valve adjacent to the equipment.
Shower staff	Tiled shower base by Superintendent.	15mm hot and cold water wall mounted Ironbrien valves with fixed 95mm dia shower head and "Star style" handles.
Shower emergency	Enware Combined Safety Deluge Wall mounted shower and Eye and Face wash unit.	25mm cold water isolation valve
Sink kitchen	Oliveri inset style, single and/or double bowl sink of varying lengths ranging from 900mm to 1800mm. Refer to Architectural drawings for overall size, location and position of sink bowls.	15 mm hot and cold bob mounted sink set complete with swivel goose neck outlet and "Star style" handles.
Sink cleaner	Caroma WC cleaner sink complete with bucket grate and wooden rest pad.	15mm hot and cold water hose taps complete with integral dual check valves and atmospheric.
Sink laboratory bowl & drainer	Purpose made 316 grade Stainless steel sink. Nominally 600W x 600D x 300 deep inset bowl. Refer fit up drawings for approval.	15mm hot and cold Enware laboratory tapware. Type 5 One way Standard right angle valve and tube.
Toilet disabled assembly	Caroma care Disabled Trident shrouded pedestal Toilet suite complete with "Celano" disabled toilet seat.	15mm cold water right angled cistern tap and connector
Toilet patient and public areas	Caroma "Trident" shrouded pedestal toilet suite. Caroma Commercial toilet seat	15mm cold water right angled cistern tap and connector
Disabled Shower	Tiled shower base by Superintendent	Shower 15mm Hot and cold wall mounted Ironbrien valves pacemaker hand shower and 40mm sliding cistern fixing bracket and flexible chrome plate hose.



A/C CONDENSATE SOAKAGE WELL

SCALE 1:20

SIMON ENGINEERING (AUSTRALIA)
Received by:
06 SEP 2004
Drawings received by
client:

ENTERED
6 SEP 2004

ISSUED FOR CONSTRUCTION

REV	DATE		BY	CHK	CIV/STR	MECH	E/I	PROCESS
2	03/09/04	RE-ISSUED FOR CONSTRUCTION	RH	BM				
1	19/08/04	ISSUED FOR CONSTRUCTION	RH	BM				
B	28/07/04	ISSUED FOR TENDER	RH	BM				
A	22/07/04	ISSUED FOR INFORMATION	RH	BM				

APPROVED

REFERENCE

DRAWING NUMBER

TITLE

CW-DC Pty Ltd
CW-DC Pty Ltd ABN 66 009 310 169
62 Cavenagh Street (PO Box 919) Darwin
Northern Territory 0800 Australia
Telephone: +61 8 89818022
Facsimile: +61 8 89818050
Email: cwdrw@cw-dc.com.au

A person using CW-DC Pty Ltd drawings and other data accepts the risk of:
1. using the drawings and other data in electronic form without requesting and checking them for accuracy against the original hard copy versions;
2. using the drawings or other data for any purpose not agreed to in writing by CW-DC Pty Ltd.

CW-DC PROJECT NUMBER: GD22.00

HWE
HENRY WALKER ELTIN

CONTRACT No.	JDE1889
ENG. DESIGN BY	RBM
DRAWN	RDH Jun.'04
CHECKED	RBM 19-7-04
CIV & STRUCT DESIGN APPR.	
MECHANICAL DESIGN APPR.	
ELECT. & INSTR. DESIGN APPR.	
PROCESS DESIGN APPR.	
WORKS CHECKED	

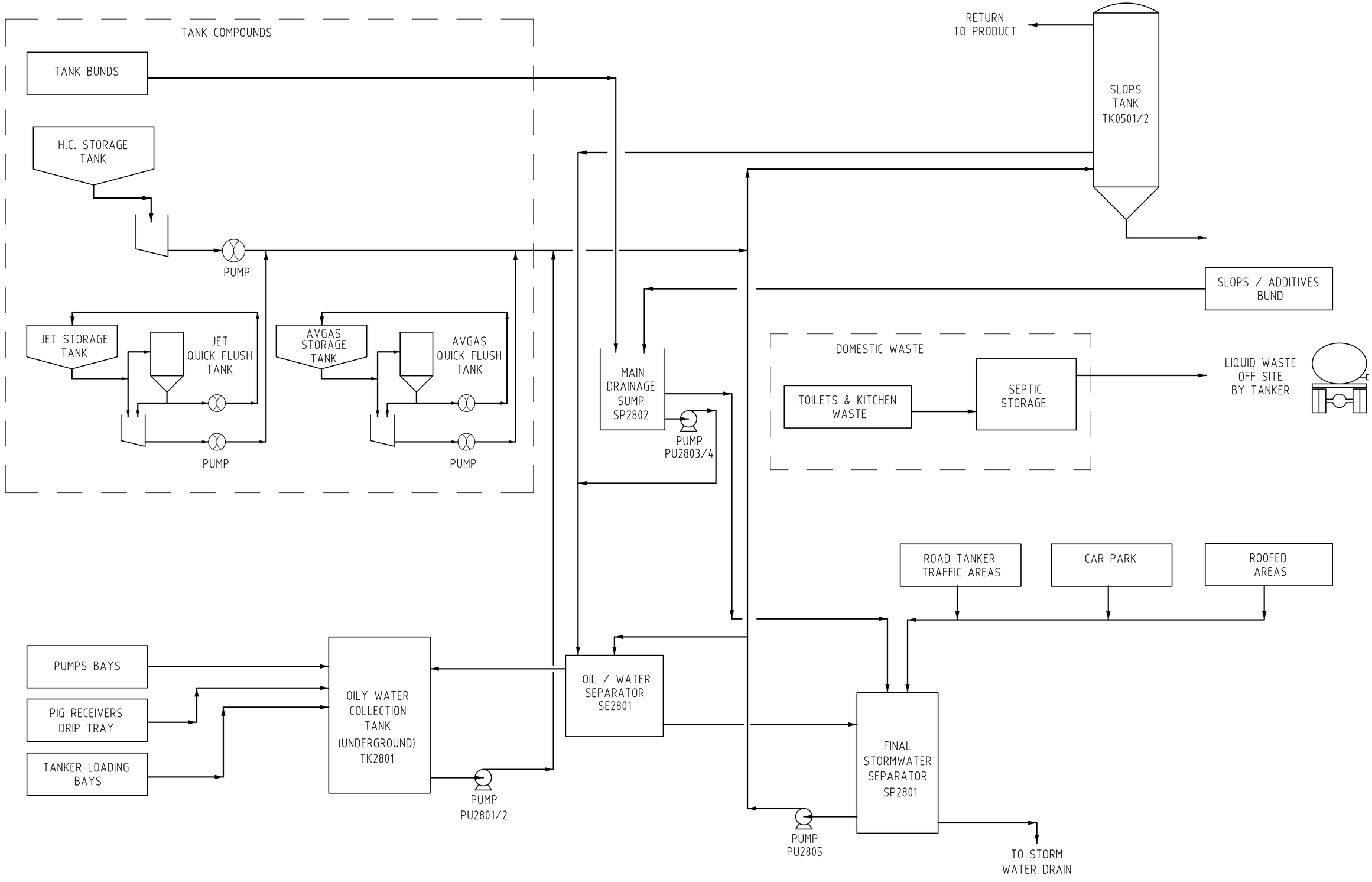
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VOPAK TERMINALS DARWIN PTY LIMITED

DARWIN INDUSTRIAL FUEL TERMINAL
CONTROL ROOM
SANITARY DRAINAGE LAYOUT

Scale	SEA DRAWING No.	REV.
AS SHOWN A1	JDE1889-83-350	2



REV	DATE		BY	CHK	APPROVED			
					CIV/STR	MECH	E/I	PROCESS
0	01.07.05	GENERAL REVISION	VDP	AFF			PM	DP
B	12.05.04	ISSUED FOR HAZOP REVIEW	RJG	AFF			TMcC	JS
A	21.04.04	ISSUED FOR CLIENTS REVIEW	RPZ	AFF			TMcC	JS

REFERENCE: ---

DRAWING NUMBER | TITLE

HENRY WALKER ELTIN

CONTRACT No.	JDE1889	
ENG. DESIGN BY		
DRAWN	L DA SILVA	15 Mar 04
CHECKED		
CIV & STRUCT DESIGN APPR.		
MECHANICAL DESIGN APPR.		
ELECT. & INSTR. DESIGN APPR.		
PROCESS DESIGN APPR.		
WEIGHTS CHECKED		

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A1

VOPAK TERMINALS DARWIN PTY LIMITED

DARWIN INDUSTRY FUEL TERMINAL PROCESS FLOW DIAGRAM DRAINAGE

Scale: NONE

SEA DRAWING No.: JDE1889-86-003

REV.: 0

Appendix C **GRR LWTF Storage Details**

Annexure G	
Prior to introducing each and any of the following materials on the Premises Vopak's review is required.	
The review and inspection will take place in 2 stages	
1. GRR will provide Vopak with a detailed specification on the composition of the hardstand, storage vessels, bunds, applicable linings etc to be constructed/installed for Vopak's review.	
2. Once completed Vopak will inspect the works to ensure it meets the specification and required regulatory standard.	

Waste Code	Material	Waste Storage Limit (tonnes)	Treat	Expected Annual Volume (tonnes)	DG Class	Designated Area	Storage Area Characteristics	Comments
A100	Waste resulting from surface treatment of metals and plastics	25	Waste water Treatment	200		E	Storage tanks within bunded hardstand area	
A130	Cyanides (inorganic)	1	Offsite Treatment	50	6.1	D	Small quantities stored in secure bunded storage area within workshop	
B100	Acidic solutions or acids in solid form	150	Waste water Treatment and/or offsite treatment	2000	8	A	Roofed, bunded hardstand area within secondary production bund	
C100	Basic solutions or bases in solid form	100	Waste water Treatment and/or offsite treatment	2000	8	A	Roofed, bunded hardstand area within secondary production bund	
D110	Inorganic fluorine compounds excluding calcium fluoride	1	Waste water Treatment	50	6.1	E	Storage tanks within bunded hardstand area	
D120	Mercury, mercury compounds	1	Offsite Treatment	10	6.1	A	Roofed, bunded hardstand area within secondary production bund	
D130	Arsenic, arsenic compounds	1	Offsite Treatment	50	6.1	A	Roofed, bunded hardstand area within secondary production bund	
D140	Chromium compounds that are hexavalent or trivalent	20	Waste water Treatment and/or offsite treatment	300	6.1	A or E	Roofed, bunded hardstand area within secondary production bund OR Storage tanks within bunded hardstand area	
D150	Cadmium, cadmium compounds	20	Offsite Treatment	50	6.1	A	Roofed, bunded hardstand area within secondary production bund	
D160	Beryllium, beryllium compounds	20	Offsite Treatment	5	6.1	A	Roofed, bunded hardstand area within secondary production bund	
D170	Antimony, antimony compounds	20	Offsite Treatment	50	6.1	A	Roofed, bunded hardstand area within secondary production bund	
D190	Copper compounds	20	Waste water Treatment and/or offsite treatment	500		A or E	Roofed, bunded hardstand area within secondary production bund OR Storage tanks within bunded hardstand area	
D200	Cobalt compounds	20	Offsite Treatment	50		A	Roofed, bunded hardstand area within secondary production bund	
D210	Nickel compounds	20	Waste water Treatment and/or offsite treatment	500		A or E	Roofed, bunded hardstand area within secondary production bund OR Storage tanks within bunded hardstand area	
D220	Lead, lead compounds	20	Waste water Treatment and/or offsite treatment	500	6.1	A or E	Roofed, bunded hardstand area within secondary production bund OR Storage tanks within bunded hardstand area	

D230	Zinc Compounds	20	Waste water Treatment and/or offsite treatment	500		A or E	Roofed, bunded hardstand area within secondary production bund OR Storage tanks within bunded hardstand area	
D270	Vanadium compounds	20	Offsite Treatment	50	6.1	A	Roofed, bunded hardstand area within secondary production bund	
D290	Barium compounds other than barium sulphate	20	Waste water Treatment and/or offsite treatment	50		A or E	Roofed, bunded hardstand area within secondary production bund OR Storage tanks within bunded hardstand area	
D300	Non-toxic salts	50	Waste water Treatment and/or offsite treatment	2000		A or E	Roofed, bunded hardstand area within secondary production bund OR Storage tanks within bunded hardstand area	
D310	Boron compounds	20	Waste water Treatment and/or offsite treatment	50		A or E	Roofed, bunded hardstand area within secondary production bund OR Storage tanks within bunded hardstand area	
D340	Perchlorates	5	Offsite Treatment	5	5.1	B	Purpose built bunded storage container	
D350	Chlorates	10	Offsite Treatment	20	5.1 or 8	B	Purpose built bunded storage container	
D360	Phosphorus compounds other than mineral phosphates	10	Offsite Treatment	2	4	D	Small quantities stored in secure bunded storage area within workshop	
E100	Wastes containing peroxides other than hydrogen peroxide	2	Waste water Treatment and/or offsite treatment	100	5.1	B	Purpose built bunded storage container	
F100	Waste from the production, formulation and use of inks, dyes, pigments, paints, lacquers and varnish	50	Waste water Treatment and/or offsite treatment	100	9	A or E	Roofed, bunded hardstand area within secondary production bund OR Storage tanks within bunded hardstand area	
F110	Waste from the production, formulation and use of resins, latex, plasticisers, glues and adhesives	50	Waste water Treatment and/or offsite treatment	100	9	A or E	Roofed, bunded hardstand area within secondary production bund OR Storage tanks within bunded hardstand area	
G110	Organic solvents excluding halogenated solvents	150	Offsite Treatment	500	6.1	A	Roofed, bunded hardstand area within secondary production bund	
G150	Halogenated organic solvents	1	Offsite Treatment	120	6.1	A	Roofed, bunded hardstand area within secondary production bund	
G160	Waste from the production, formulation and use of organic solvents	150	Offsite Treatment	12,000	6.1	A	Roofed, bunded hardstand area within secondary production bund	
H100	Waste from the production, formulation and use of biocides and phytopharmaceuticals	5	Offsite Treatment	100	6.1	A	Roofed, bunded hardstand area within secondary production bund	
H110	Organic phosphorus compounds	1	Offsite Treatment	100	6.1	A	Roofed, bunded hardstand area within secondary production bund	
J100	Waste mineral oils unfit for their original intended use	150	Oil Recycling	10,000		F	Storage tanks within bunded hardstand area	
J120	Waste mixtures, or waste emulsions, of oil and water or hydrocarbon and water	750	Oil Recycling	50,000		F	Storage tanks within bunded hardstand area	
M100	Waste substances and articles containing or contaminated with polychlorinated biphenyls (PCBs), polychlorinated nalthalenes (PCNs), polychlorinated terphenyls (PCTs) and/or polybrominated biphenyls (PBBS)	20	Offsite Treatment	100	9	A	Roofed, bunded hardstand area within secondary production bund	

M150	Phenols, phenol compounds including chlorophenols	10	Offsite Treatment	100	6.1	A	Roofed, bunded hardstand area within secondary production bund	
M160	Organohalogen compounds that are not otherwise specified in this Schedule	1	Offsite Treatment	50		A	Roofed, bunded hardstand area within secondary production bund	
M220	Isocyanate compounds	10	Offsite Treatment	50	6.1	A	Roofed, bunded hardstand area within secondary production bund	
M250	Surface active agents (surfactants) that contain principally organic constituents and that may contain metals and inorganic materials	50	Waste water Treatment and/or offsite treatment	1000		A or E	Roofed, bunded hardstand area within secondary production bund OR Storage tanks within bunded hardstand area	
N100	Containers that are contaminated with residues of a listed waste	20	Waste water Treatment and/or offsite treatment	50		A or E	Roofed, bunded hardstand area within secondary production bund OR Storage tanks within bunded hardstand area	
N140	Fire debris and fire washwaters	100	Waste water Treatment and/or offsite treatment	1000		A or E	Roofed, bunded hardstand area within secondary production bund OR Storage tanks within bunded hardstand area	
N190	Filter cake	20	Offsite Treatment	200		G	Skips stored within enclosed bunded hardstand area	
N205	Residue from industrial waste treatment or disposal operations	100	Waste water Treatment and/or offsite treatment	2000		A or E	Roofed, bunded hardstand area within secondary production bund OR Storage tanks within bunded hardstand area	
R120	Waste pharmaceuticals, waste drugs and waste medicines	1	Offsite Treatment	10		D	Small quantities stored in secure bunded storage area within workshop	
R140	Waste from the production and preparation of pharmaceutical products	20	Offsite Treatment	50		A	Roofed, bunded hardstand area within secondary production bund	
T100	Waste chemical substances arising from research and development or teaching activities, including those substances which are not identified and/or are new and the effects of which on human health and/or the environment are not known	5	Waste water Treatment and/or offsite treatment	50	8	D	Small quantities stored in secure bunded storage area within workshop	
M130	Glycols	400	Glycol Recycling	24000		E	Storage tanks within bunded hardstand area	

Tank Reference	Purpose	Volume (L)
07F06A	Wastewater Storage	250,000
07F06B	Glycol Product Storage	250,000
04F01	Wastewater Storage	96,000
04F02	Wastewater Storage	96,000
07F13.1A	Ferric Chloride Reagent tank (Acid)	33,000
07F13.2A	Acid Waste Storage	33,000
07F15	Lime Reagent Storage	23,000
85D01	Trade Waste Treatment	50,000
85D02	Trade Waste Treatment	50,000
85D03	Sludge Storage	51,000
85D04	SLudge Storage	51,000
86F01	RO Feed Tank 1	36,000
86F02	RO Feed Tank 2	36,000
86F03	RO Feed Tank 3	36,000
86F04	PFAS Tank 1	30,000
86F05	PFAS Tank 2	30,000
86F06	Brine 1 and Back wash	30,000
86F07	Brine 2	30,000
86F08	PFAS back wash	30,000
86F09	PFAS Brine	30,000
86F10	RO Permeate 1	30,000
86F11	RO Permeate 2	30,000
86F12	RO Permeate 3	30,000
86F15	Trade Waste Discharge Tank 1	250,000
86F16	Trade Waste Discharge Tank 2	250,000
86F17	Trade Waste Discharge Tank 3	250,000
85F06	Treated Water Storage	60,000
03F01	Sludge Receival Pit	10,000
03F02	Sludge Receival Pit	10,000
03D01	Interceptor Tank	10,000
03F03	Waste Oil Storage	50,000
03F04	Waste Oil Storage	50,000
03F05	Bunker Oil Storage	50,000
10D01	Oil processing Reactor	46,000
10D03	Oil processing Reactor	46,000
10D04	Oily Water Separator	5,000
03F06	Intermediate Oil Storage	50,000
03F08	Product Oil Storage	50,000
03F09	Product Bunker Oil Storage	50,000
10F08	Process Water Distribution	23,000
06F01	TEG/MEG Receival Tank 1	50,000
06F02	TEG/MEG Receival Tank 2	50,000
06F03	MEG receival Tank 3	50,000
06F04	Flammable MEG Receival Tank 4	50,000
11F01	Recovered Flammables Storage	8,000
07F12	Crude Glycol Storage	90,000
07F11	MEG Receival Tank 11	100,000
07F09	Crude TEG Storage	25,000
07F20	Crude TEG Storage	25,000
07F19A	TEG Product Storage	25,000
07F19B	TEG Product Storage	25,000
Vopak Tank Farm	Glycol Storage	3,000,000

Table 2: Existing Tankage Volumes and Reuse in LWTF

Appendix D **Ansulite Safety Data Sheet**

Safety Data Sheet

This safety data sheet complies with the requirements of: WHS regulation 2011

Product name ANSULITE LOW VISCOSITY 3x3 ALCOHOL RESISTANT CONCENTRATE

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product Identifier

Product name	ANSULITE LOW VISCOSITY 3x3 ALCOHOL RESISTANT CONCENTRATE
Product code	431780
Pure substance/mixture	Mixture

1.2. Relevant identified uses of the substance or mixture and uses advised against

Sold to the general public	No
Recommended use	Fire extinguishing agent
Uses advised against	Consumer use

1.3. Details of the supplier of the safety data sheet

Supplier Tyco Fire Protection Products
Level 3, 95 Coventry Street,
Southbank, Australia-Victoria 3006
+613 9313 9711

For further information, please contact
E-mail address psra@tycofp.com

1.4. Emergency telephone number

Emergency Telephone Number 612 9037 2994 (Australia)

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Regulation (EC) No 1272/2008

Serious eye damage/eye irritation	Category 2 - (H319)

2.2. Label Elements

Product Identifier



Signal Word
WARNING
hazard statements
H319 - Causes serious eye irritation

precautionary statements
P264 - Wash face, hands and any exposed skin thoroughly after handling
P280 - Wear protective gloves/protective clothing/eye protection/face protection
P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue

rinsing
P337 + P313 - If eye irritation persists: Get medical advice/attention

2.3. Other Hazards
No information available

SECTION 3: Composition/information on ingredients

3.1 Mixtures

Chemical name	CAS No	weight-%	Classification according to Regulation (EC) No. 1272/2008 [CLP]
2-(2-Butoxyethoxy)ethanol	112-34-5	10 < 30%	Eye Irrit. 2 (H319)
1,2-Propanediol	57-55-6	< 10%	no data available
D-Glucopyranoside, C9-C11 Oligomer	132778-08-6	<10%	Eye Dam. 1 (H318) Skin Irrit. 2 (H315)
n-Butanol	71-36-3	< 1%	Acute Tox. 4 (H302) Skin Irrit. 2 (H315) Eye Dam. 1 (H318) STOT SE 3 (H335) STOT SE 3 (H336) Flam. Liq. 3 (H226)
Glycerol	56-81-5	< 0.1%	no data available
Methylene chloride	75-09-2	< 0.0001%	Carc. 2 (H351)
1,3-Dichloropropene	542-75-6	< 0.0001%	Acute Tox. 3 (H301) Acute Tox. 3 (H311) Acute Tox. 4 (H332) Skin Irrit. 2 (H315) Eye Irrit. 2 (H319) Skin Sens. 1 (H317) STOT SE 3 (H335) Asp. Tox. 1 (H304) Aquatic Acute 1 (H400) Aquatic Chronic 1 (H410) Flam. Liq. 3 (H226)

Full text of H- and EUH-phrases: see section 16

Section 4: First aid measures

4.1. Description of first aid measures

Inhalation Remove to fresh air. If breathing is difficult, give oxygen. (Get medical attention immediately if symptoms occur.).

Skin contact Wash skin with soap and water. Get medical attention if irritation develops and persists.

Eye Contact Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids. Consult a doctor.

Ingestion Rinse mouth. Do not induce vomiting without medical advice. If swallowed, call a poison control centre or physician immediately.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms No information available.

4.3. Indication of any immediate medical attention and special treatment needed

Note to doctors Treat symptomatically.

Section 5: FIRE FIGHTING MEASURES

5.1. Extinguishing media

Suitable Extinguishing Media
Product is extinguishing agent. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable Extinguishing Media
None

5.2. Special hazards arising from the substance or mixture

None known

Hazardous Combustion Products Carbon oxides. Fluorinated oxides. Nitrogen oxides (NOx). Oxides of sulphur.

5.3. Advice for firefighters

Wear self-contained breathing apparatus and protective suit. Use personal protective equipment as required.

Section 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Personal Precautions
Ensure adequate ventilation, especially in confined areas.

For emergency responders
Use personal protection recommended in Section 8.

6.2. Environmental precautions

Prevent further leakage or spillage if safe to do so. Prevent entry into waterways, sewers, basements or confined areas. See Section 12 for additional Ecological Information.

6.3. Methods and material for containment and cleaning up

Methods for Containment Prevent further leakage or spillage if safe to do so.

Methods for Cleaning Up Pick up and transfer to properly labelled containers.

6.4. Reference to other sections

See section 13 for more information.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Advice on safe handling
Avoid contact with skin and eyes. Handle in accordance with good industrial hygiene and safety practice.

General hygiene considerations
Do not eat, drink or smoke when using this product. Handle in accordance with good industrial hygiene and safety practice.

7.2. Conditions for safe storage, including any incompatibilities

Storage Conditions
Keep containers tightly closed in a dry, cool and well-ventilated place.

7.3. Specific end use(s)

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Exposure Limits

Chemical name	Australia
1,2-Propanediol 57-55-6	150 ppm 474 mg/m³ 10 mg/m³
n-Butanol 71-36-3	50 ppm Peak 152 mg/m³ Peak Skin
Glycerol 56-81-5	10 mg/m³
Methylene chloride 75-09-2	50 ppm 174 mg/m³ Skin
1,3-Dichloropropene 542-75-6	1 ppm 4.5 mg/m³ Skin

Derived No Effect Level (DNEL) No information available

Predicted No Effect Concentration (PNEC) No information available.

8.2. Exposure controls

Engineering controls Ensure adequate ventilation, especially in confined areas.

Personal Protective Equipment

Eye/Face Protection Avoid contact with eyes. Tight sealing safety goggles.

Skin and Body Protection Suitable protective clothing.

Environmental exposure controls No information available.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical State	Liquid		
Odour	Characteristic	**Colour**	Light yellow
odour threshold	No data available		

Property	**VALUES**	**Remarks • Method**
pH	7	
Melting point/freezing point		No data available
Boiling point / boiling range	100 °C	
Flash Point	> 100 °C	
Evaporation Rate		No data available
flammability (solid, gas)		No data available
Flammability limit in air		
Upper flammability limit:		No data available
Lower flammability limit:		No data available
Vapour Pressure		No data available
Vapour Density		No data available
Specific gravity		No data available
Water Solubility		No data available
solubility(ies)		No data available
Partition coefficient		No data available
Autoignition Temperature		No data available
Decomposition Temperature		No data available
Kinematic viscosity		No data available
Dynamic viscosity		No data available
Explosive Properties	No data available	
Oxidising Properties	No data available	
density	1.01	

Section 10: Stability and reactivity

10.1. Reactivity
No data available.

10.2. Chemical stability
Stable under recommended storage conditions.

10.3. Possibility of hazardous reactions
hazardous polymerisation
Hazardous polymerisation does not occur.

Possibility of hazardous reactions
None under normal processing.

10.4. Conditions to avoid
Extremes of temperature and direct sunlight.

10.5. Incompatible materials
Strong oxidising agents. Strong acids. Strong bases.

10.6. Hazardous decomposition products
Carbon oxides. Nitrogen oxides (NOx). Oxides of sulphur. Fluorinated oxides.

Section 11: Toxicological information

11.1. Information on toxicological effects

Acute Toxicity

Product information
Product does not present an acute toxicity hazard based on known or supplied information.

INHALATION no data available.
Eye Contact no data available.
Skin contact no data available.
INGESTION no data available.

The following values are calculated based on chapter 3.1 of the GHS document
ATEmix (oral) 22,171.00 mg/kg
ATEmix (dermal) 23,945.00 mg/kg

Chemical name	Oral LD50	dermal LD50	Inhalation LC50
2-(2-Butoxyethoxy)ethanol	= 3384 mg/kg (Rat)	= 2700 mg/kg (Rabbit)	
1,2-Propanediol	= 20000 mg/kg (Rat)	= 20800 mg/kg (Rabbit)	
n-Butanol	= 790 mg/kg (Rat)	= 3400 mg/kg (Rabbit)	= 8000 ppm (Rat) 4 h
Glycerol	= 12600 mg/kg (Rat)	> 10 g/kg (Rabbit)	> 570 mg/m³ (Rat) 1 h
Methylene chloride	= 1410 mg/kg (Rat)		= 76000 mg/m³ (Rat) 4 h
1,3-Dichloropropene	= 57 mg/kg (Rat)	= 220 mg/kg (Rabbit)	2.7 - 3.07 mg/L (Rat) 4 h

Skin Corrosion/Irritation No information available.

Serious eye damage/eye irritation No information available.

sensitisation No information available.

Germ Cell Mutagenicity No information available.

carcinogenicity No information available.

Chemical name	European Union
Methylene chloride	Carc. 2

Reproductive Toxicity No information available.

STOT - Single Exposure No information available.

STOT - Repeated Exposure No information available.

Aspiration Hazard No information available.

Section 12: Ecological information

12.1. Toxicity

Chemical name	Algae/aquatic plants	Fish	Crustacea
2-(2-Butoxyethoxy)ethanol	EC50 96 h > 100 mg/L Desmodesmus subspicatus	LC50 96 h = 1300 mg/L Lepomis macrochirus static	EC50 24 h = 2850 mg/L Daphnia magna EC50 48 h > 100 mg/L Daphnia magna
1,2-Propanediol	EC50 96 h = 19000 mg/L Pseudokirchneriella subcapitata	LC50 96 h = 51600 mg/L Oncorhynchus mykiss static LC50 96 h 41 - 47 mL/L Oncorhynchus mykiss static LC50 96 h = 51400 mg/L Pimephales promelas static LC50 96 h = 710 mg/L Pimephales promelas	EC50 48 h > 1000 mg/L Daphnia magna Static EC50 24 h > 10000 mg/L Daphnia magna
n-Butanol	EC50 72 h > 500 mg/L Desmodesmus subspicatus EC50 96 h > 500 mg/L Desmodesmus subspicatus	LC50 96 h = 1910000 µg/L Pimephales promelas static LC50 96 h 100000 - 500000 µg/L Lepomis macrochirus static LC50 96 h = 1740 mg/L Pimephales promelas flow-through LC50 96 h 1730 - 1910 mg/L Pimephales promelas static	EC50 48 h = 1983 mg/L Daphnia magna EC50 48 h 1897 - 2072 mg/L Daphnia magna Static
Glycerol	-	LC50 96 h 51 - 57 mL/L Oncorhynchus mykiss static	EC50 24 h > 500 mg/L Daphnia magna
Methylene chloride	EC50 96 h > 500 mg/L Pseudokirchneriella subcapitata EC50 72 h > 500 mg/L Pseudokirchneriella subcapitata	LC50 96 h 140.8 - 277.8 mg/L Pimephales promelas flow-through LC50 96 h 262 - 855 mg/L Pimephales promelas static LC50 96 h = 193 mg/L Lepomis macrochirus static LC50 96 h = 193 mg/L Lepomis macrochirus flow-through	EC50 48 h 1532 - 1847 mg/L Daphnia magna Static EC50 48 h = 190 mg/L Daphnia magna
1,3-Dichloropropene	EC50 96 h 2.45 - 6.45 mg/L Pseudokirchneriella subcapitata EC50 72 h 3.12 - 10.5 mg/L Pseudokirchneriella subcapitata	LC50 96 h 1.52 - 2.68 mg/L Pimephales promelas static LC50 96 h 0.211 - 0.271 mg/L Pimephales promelas flow-through LC50 96 h 3.1 - 4.9 mg/L Oncorhynchus mykiss static LC50 96 h = 4.5 mg/L Oncorhynchus mykiss semi-static LC50 96 h = 2 mg/L Oncorhynchus mykiss LC50 96 h 5.1 - 6.8 mg/L Lepomis macrochirus static	EC50 48 h 0.063 - 0.129 mg/L Daphnia magna Static EC50 48 h = 0.09 mg/L Daphnia magna

12.2. Persistence and degradability

No information available.

12.3. Bioaccumulative potential

No information available.

Chemical name	Partition coefficient
n-Butanol	0.785
Glycerol	-1.76
Methylene chloride	1.25
1,3-Dichloropropene	2.3

12.4. Mobility in soil

No information available.

12.5. Results of PBT and vPvB assessment
No information available.

12.6. Other adverse effects
No information available

Section 13: Disposal considerations

13.1. Waste treatment methods

Waste from Residues/Unused Products	Disposal should be in accordance with applicable regional, national and local laws and regulations.
Contaminated Packaging	Do not re-use container.

Section 14: Transport information

Note: No information available

IMDG

14.1 UN/ID no	NOT REGULATED
14.2 Proper Shipping Name	NOT REGULATED
14.3 Hazard class	NOT REGULATED
14.4 Packing group	NOT REGULATED
14.5 Marine Pollutant	Not Applicable
14.6 Special Provisions	None
14.7 Transport in Bulk According to Annex II of MARPOL 73/78 and the IBC CODE	No information available

RID

14.1 UN/ID no	NOT REGULATED
14.2 Proper Shipping Name	NOT REGULATED
14.3 Hazard class	NOT REGULATED
14.4 Packing group	NOT REGULATED
14.5 Environmental Hazard	Not Applicable
14.6 Special Provisions	None

ADR

14.1 UN/ID no	NOT REGULATED
14.2 Proper Shipping Name	NOT REGULATED
14.3 Hazard class	NOT REGULATED
14.4 Packing group	NOT REGULATED
14.5 Environmental Hazard	Not Applicable
14.6 Special Provisions	None

ICAO (air)

14.1 UN/ID no	NOT REGULATED
14.2 Proper Shipping Name	NOT REGULATED
14.3 Hazard class	NOT REGULATED
14.4 Packing group	NOT REGULATED

14.5 Environmental Hazard	Not Applicable
14.6 Special Provisions	None

IATA

14.1 UN/ID no	NOT REGULATED
14.2 Proper Shipping Name	NOT REGULATED
14.3 Hazard class	NOT REGULATED
14.4 Packing group	NOT REGULATED
14.5 Environmental Hazard	Not Applicable
14.6 Special Provisions	None

Section 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

National Regulations

Australia
See section 8 for national exposure control parameters

carcinogenicity

Chemical name	Australia
Methylene chloride	suspected carcinogen
1,3-Dichloropropene	suspected carcinogen

International Inventories

TSCA	Complies
DSL/NDSL	Does not comply
EINECS/ELINCS	Does not comply
ENCS	Does not comply
IECSC	Does not comply
KECL	Does not comply
PICCS	Does not comply
AICS	Complies

Legend:

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances

15.2. Chemical safety assessment
No information available

SECTION 16: Other information

Full text of H-Statements referred to under section 3

H319 - Causes serious eye irritation
H318 - Causes serious eye damage
H315 - Causes skin irritation

Revision date 31-Oct-2016

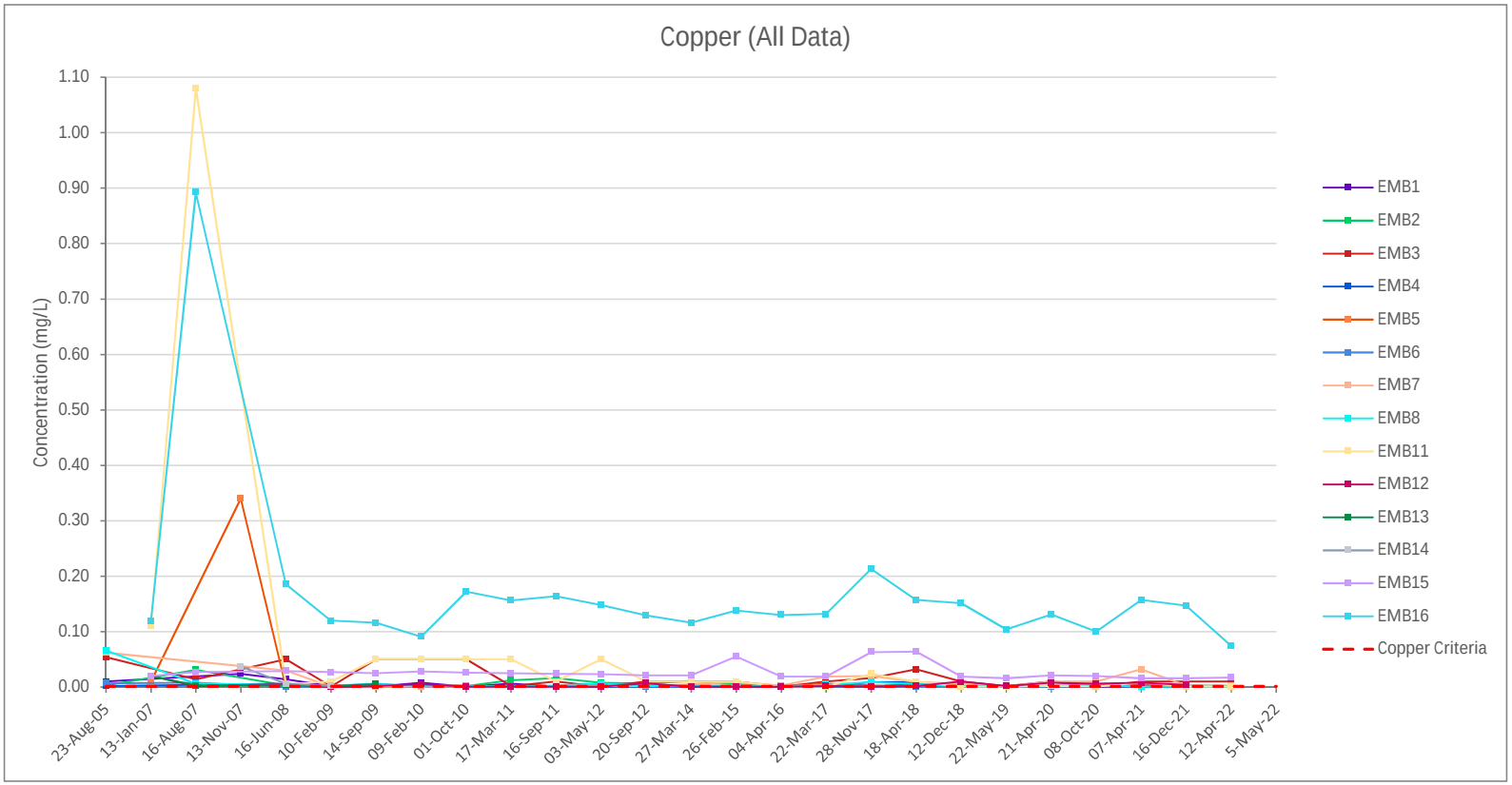
Revision note Not Applicable.

This safety data sheet complies with the requirements of WHS regulation 2011

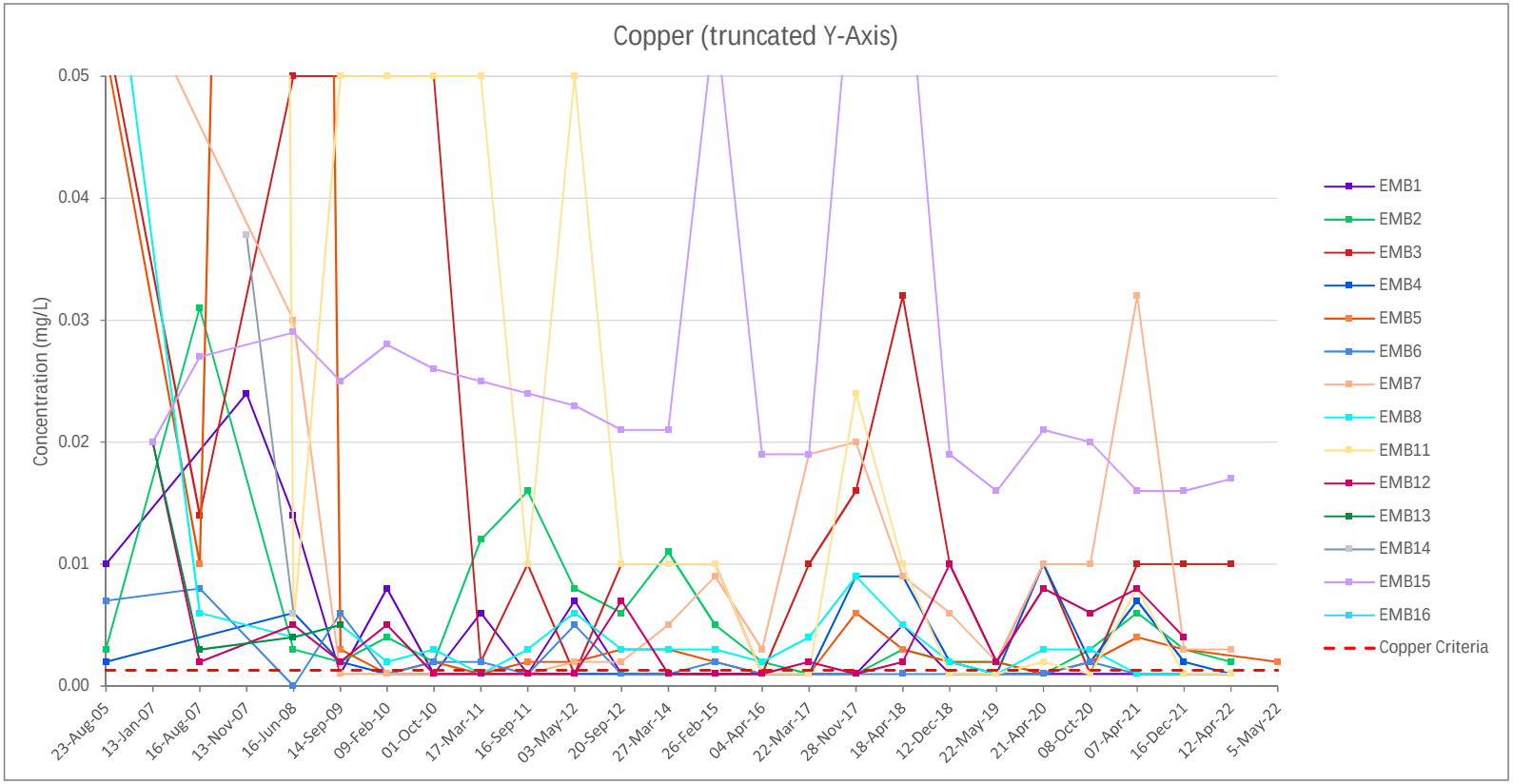
End of Safety Data Sheet

Appendix E **Graphs of Contaminant Trends**

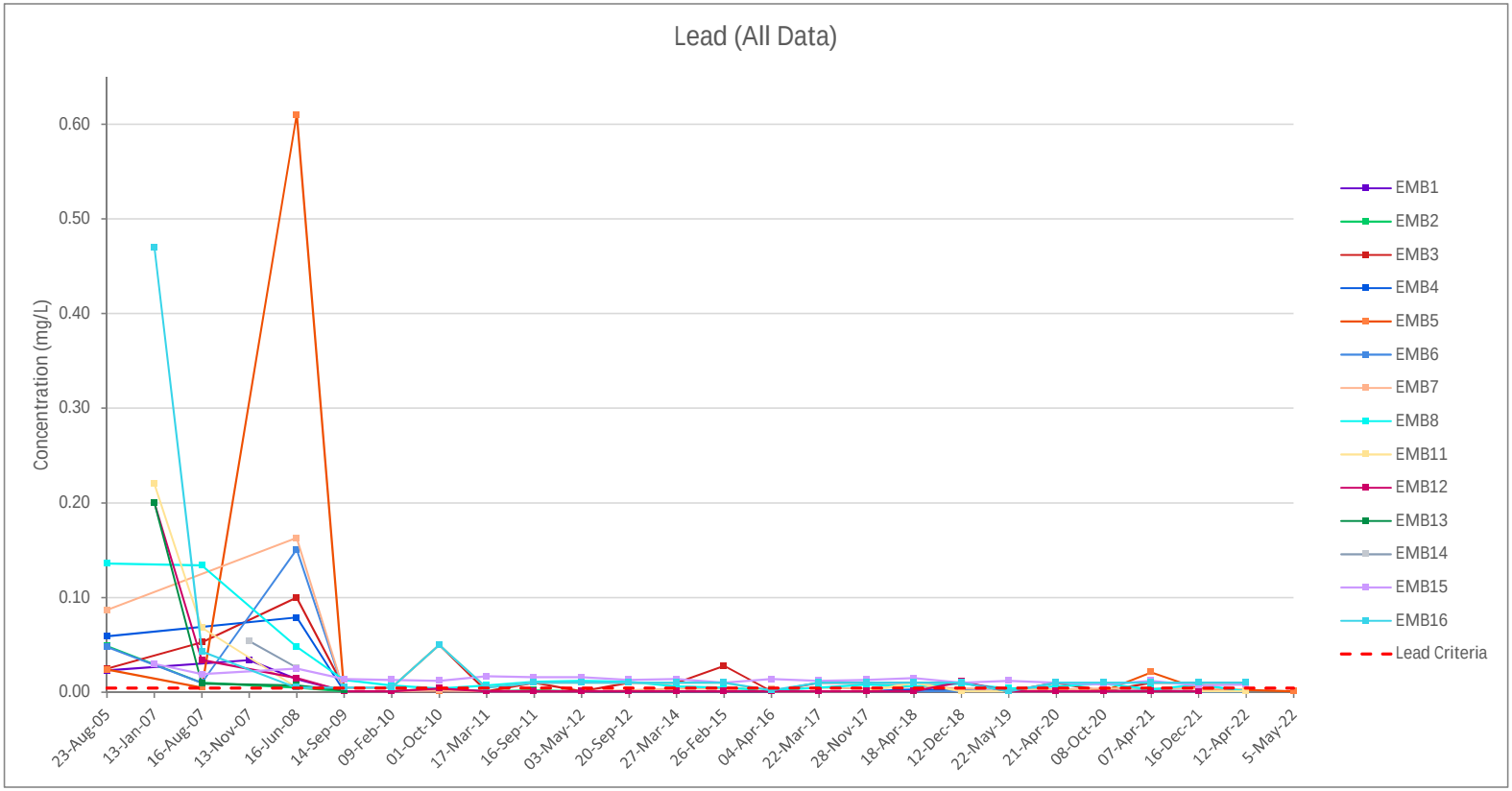
Groundwater Database Summary Graphs



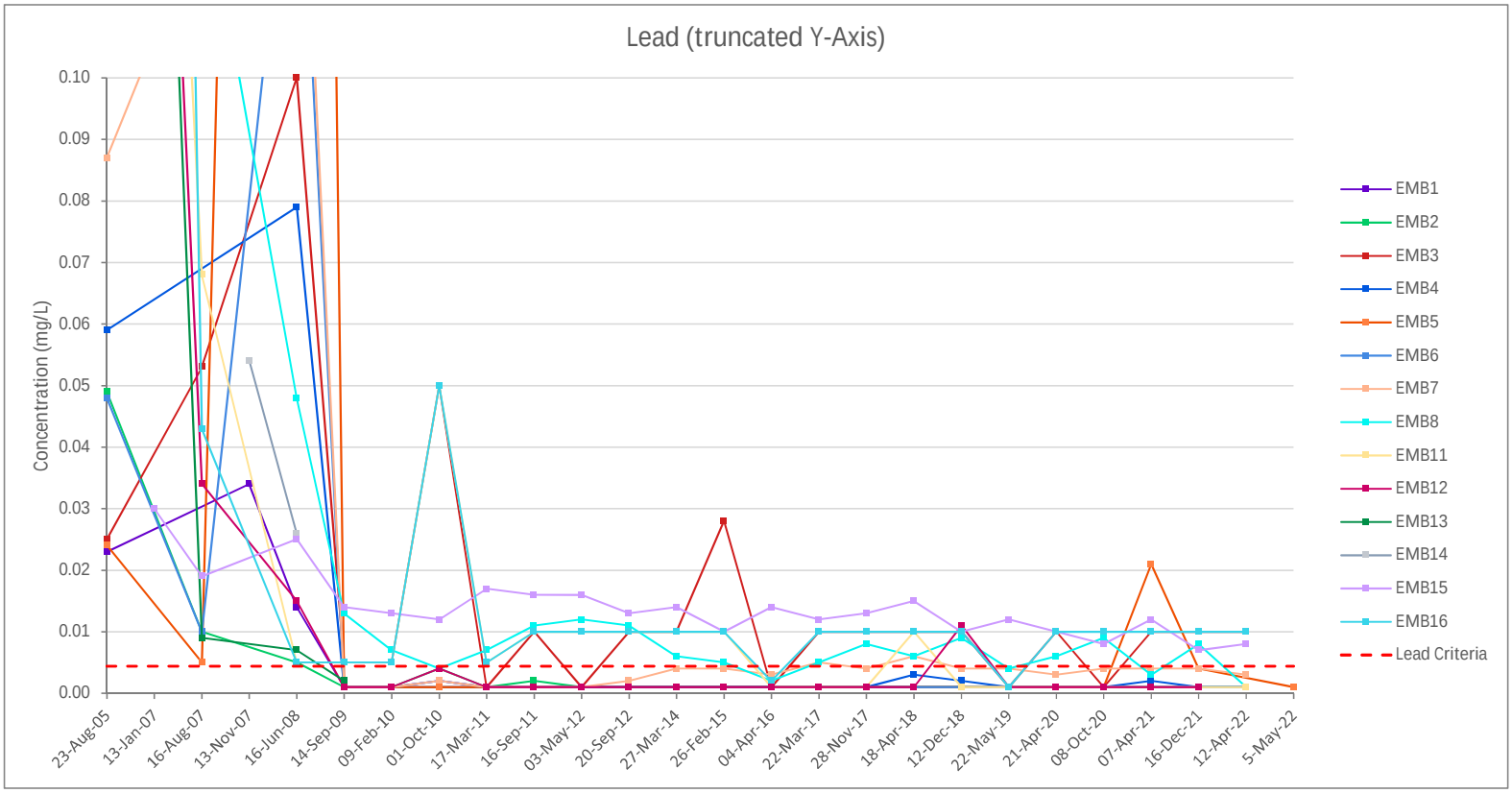
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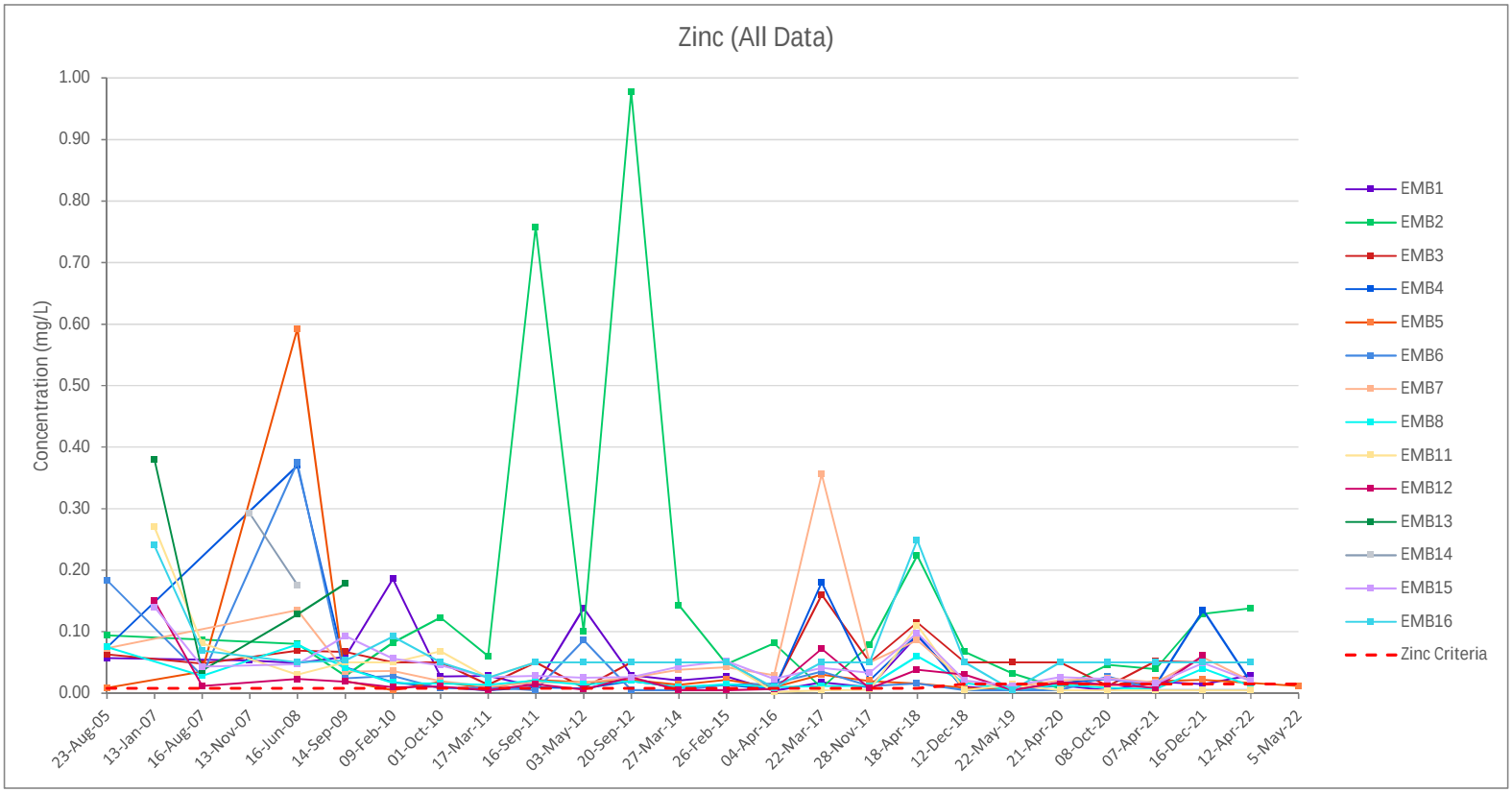
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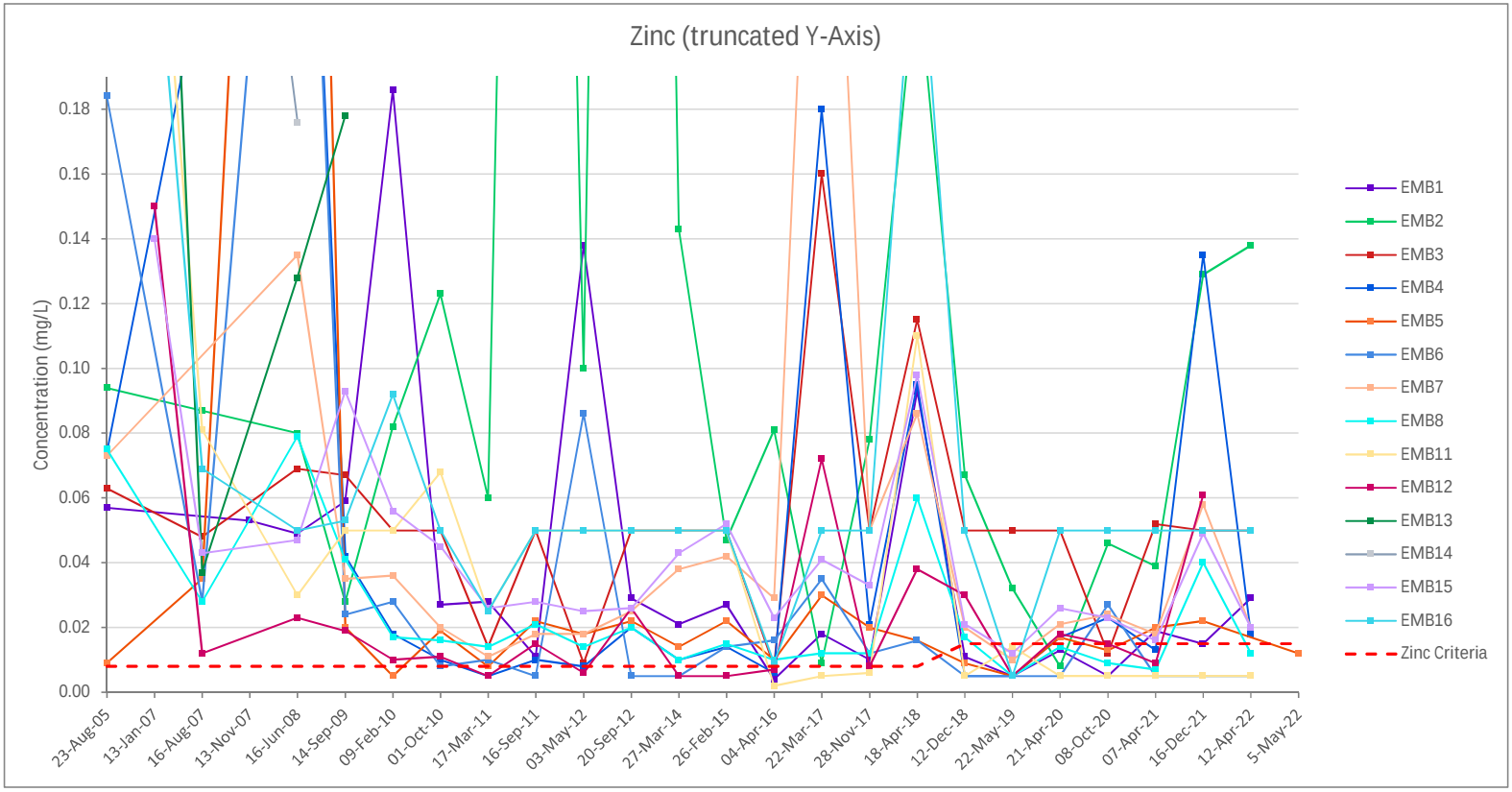
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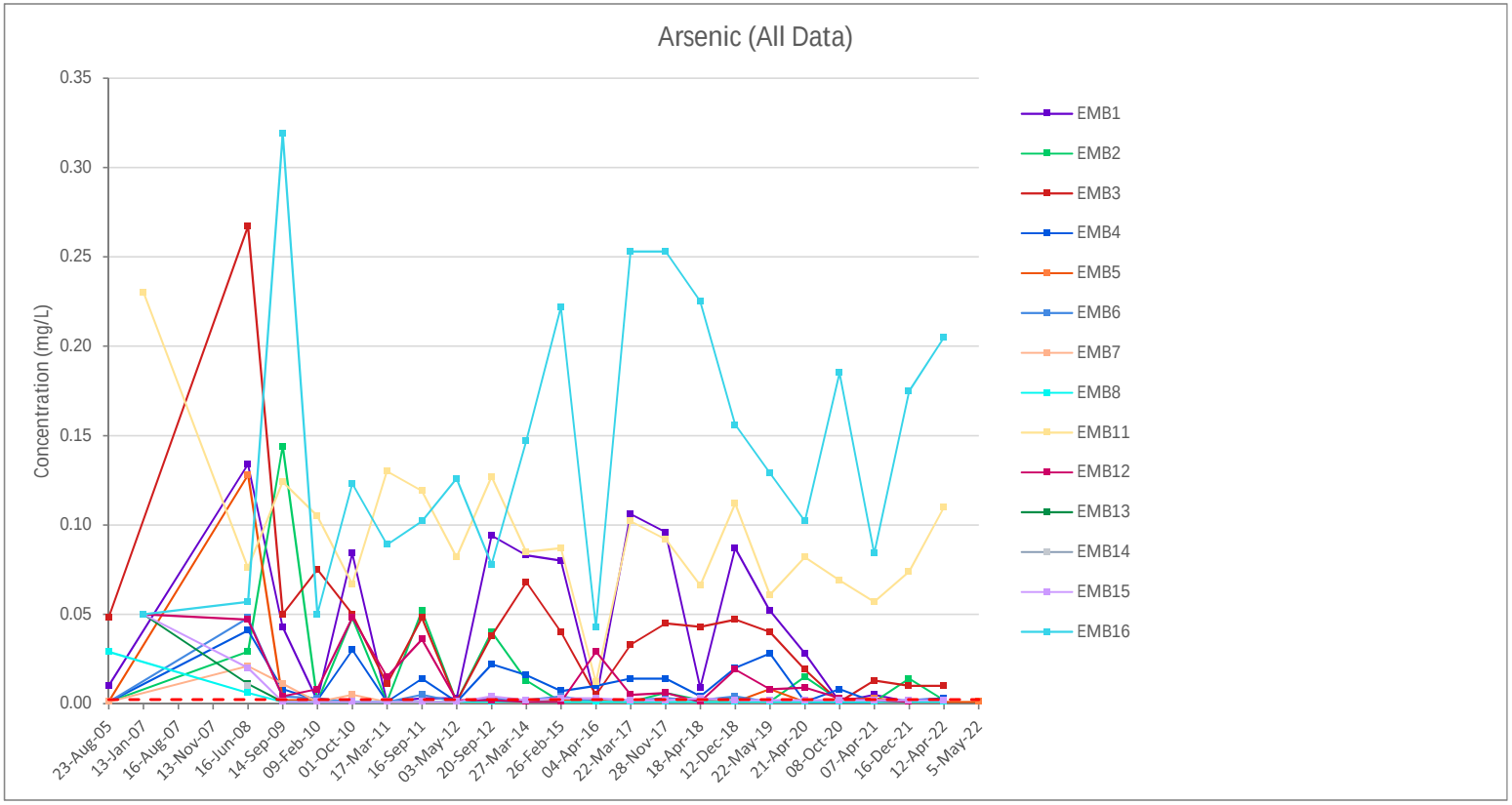
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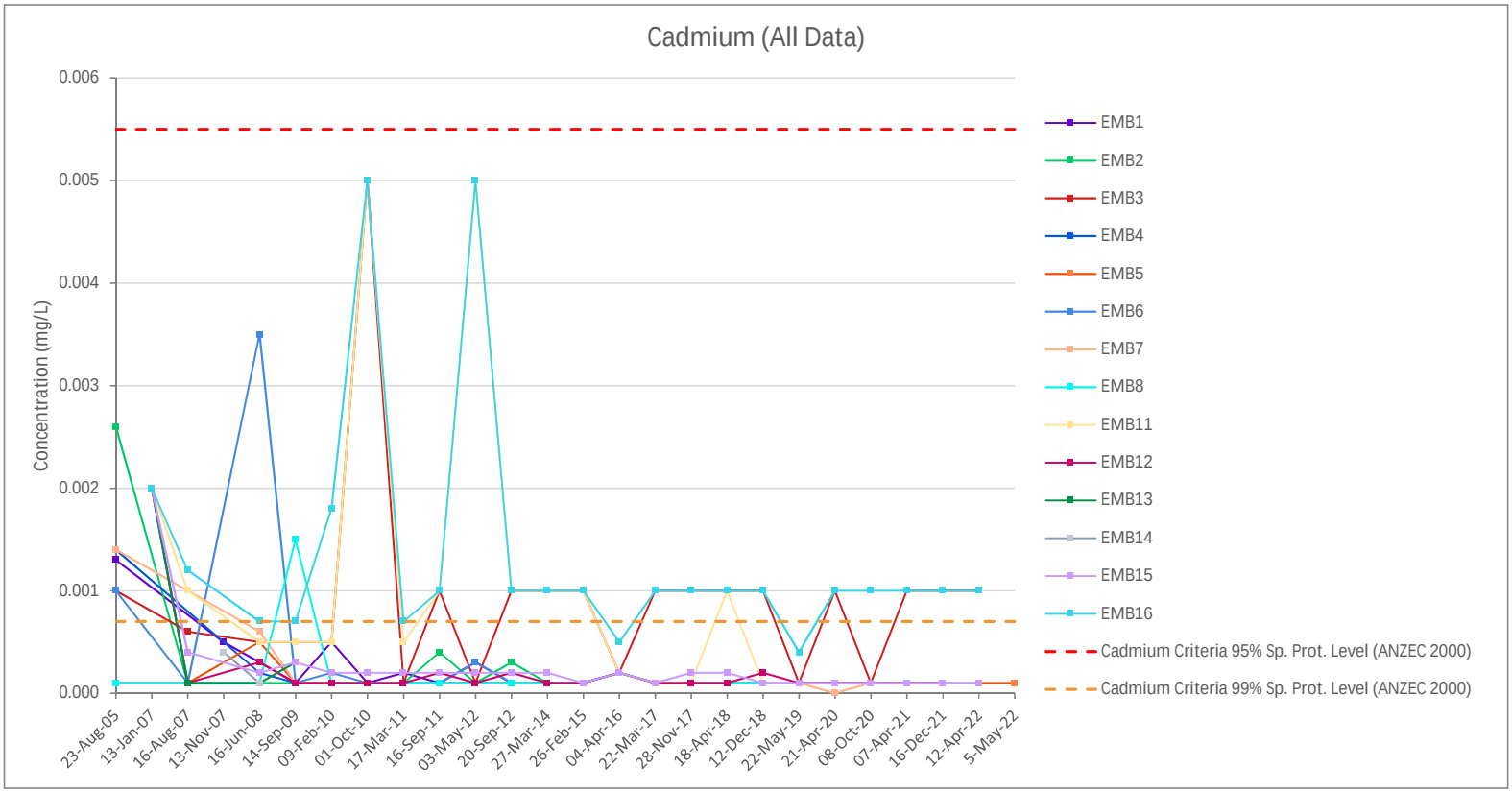
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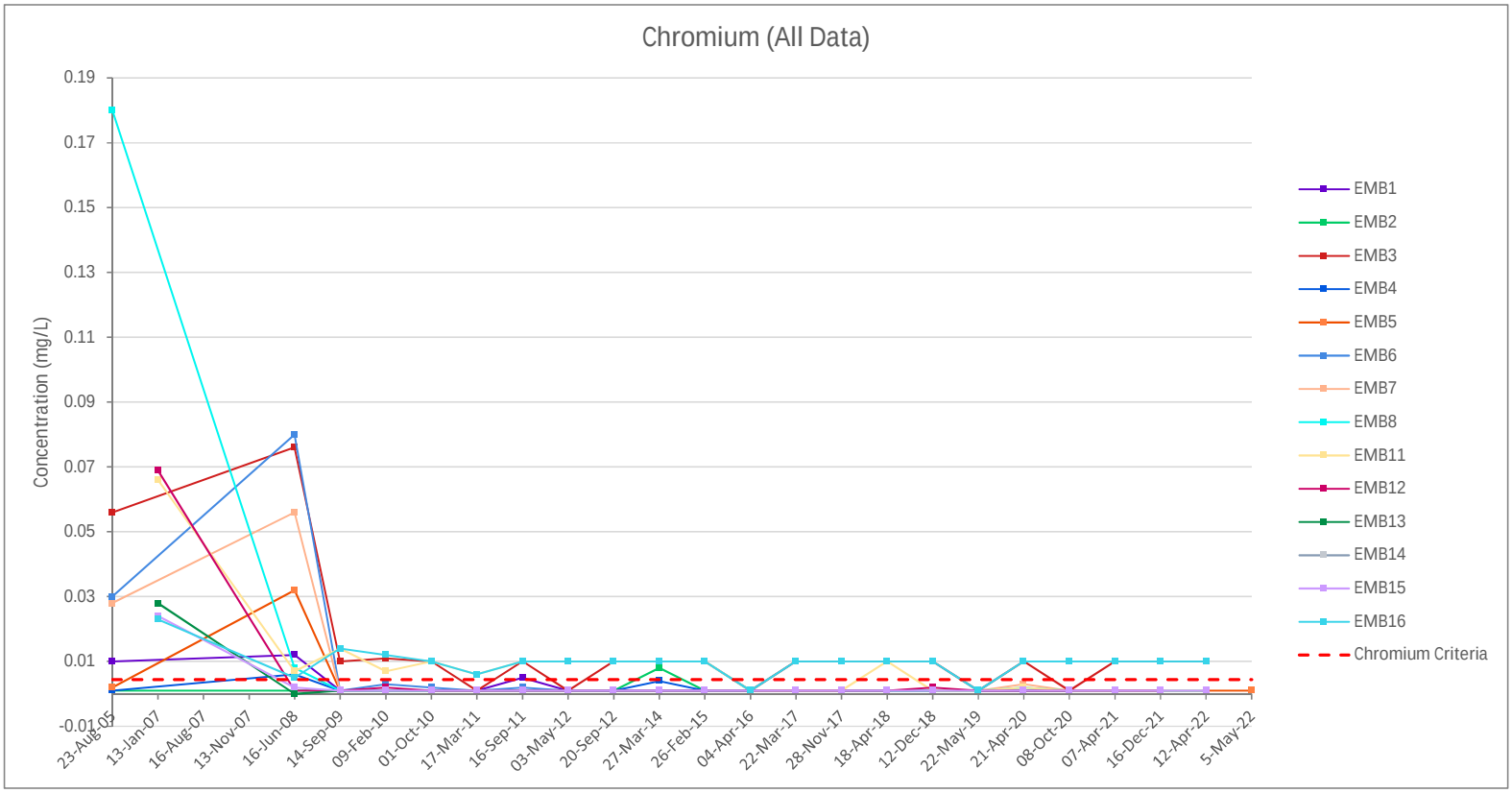
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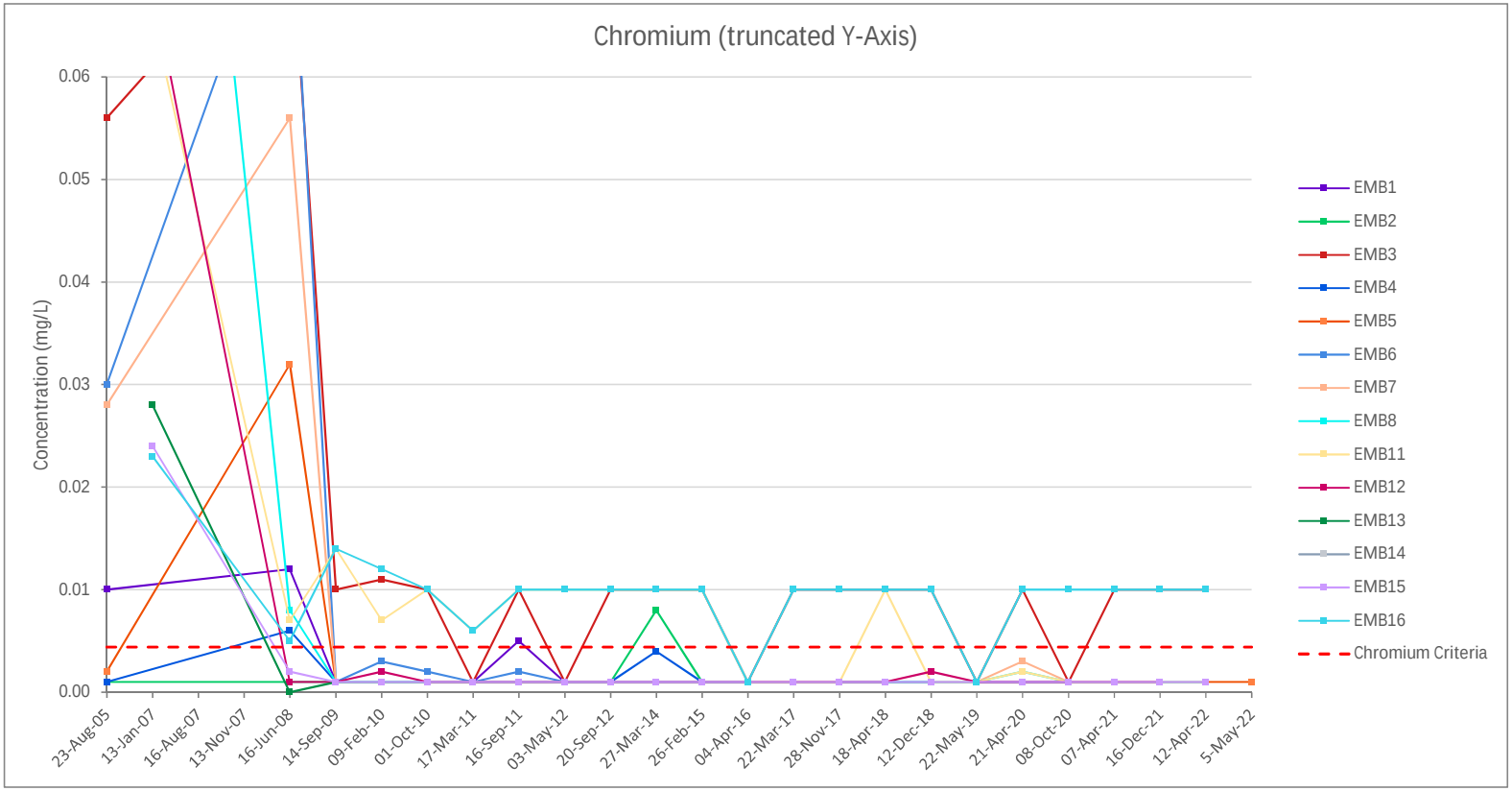
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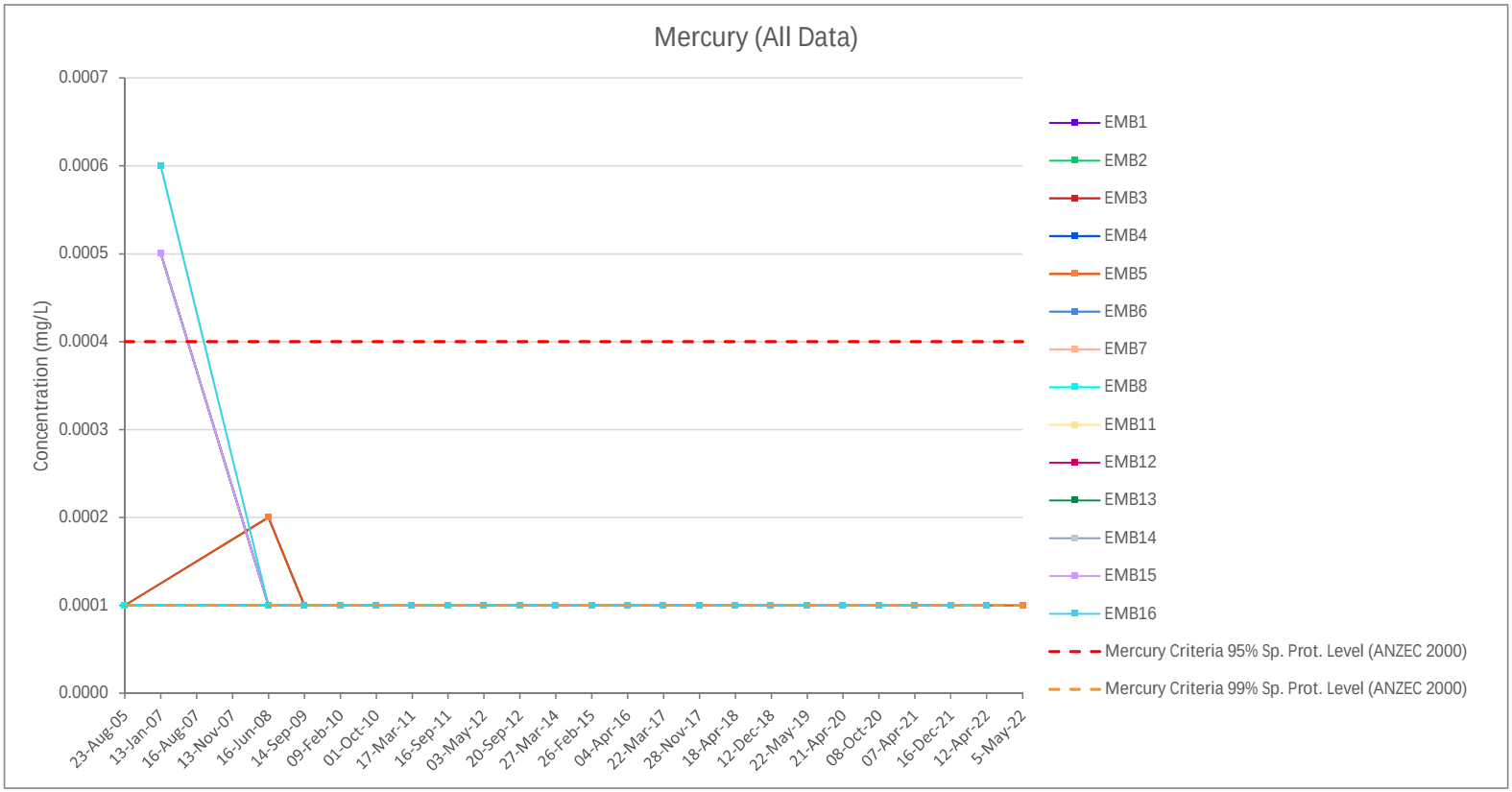
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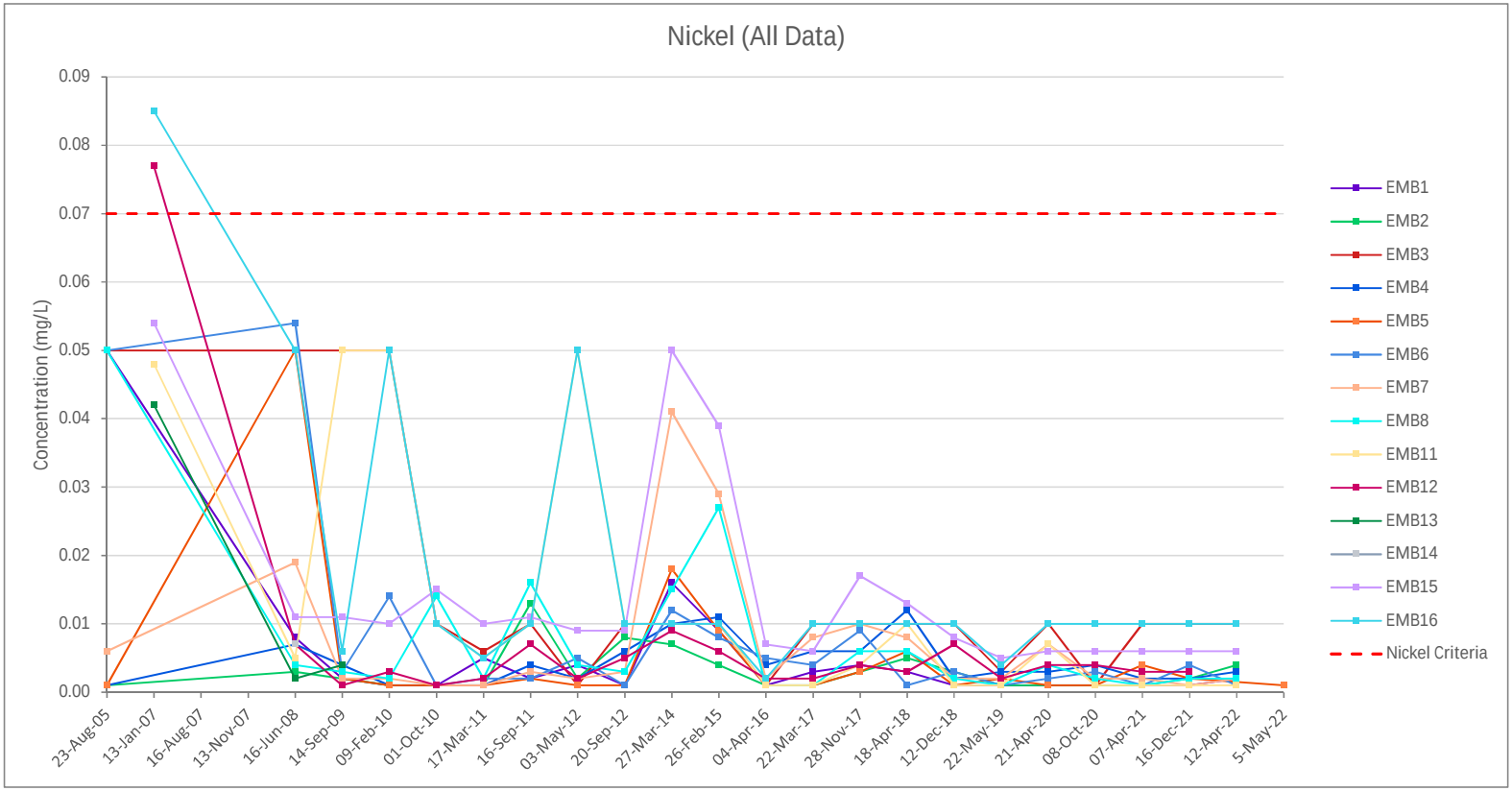
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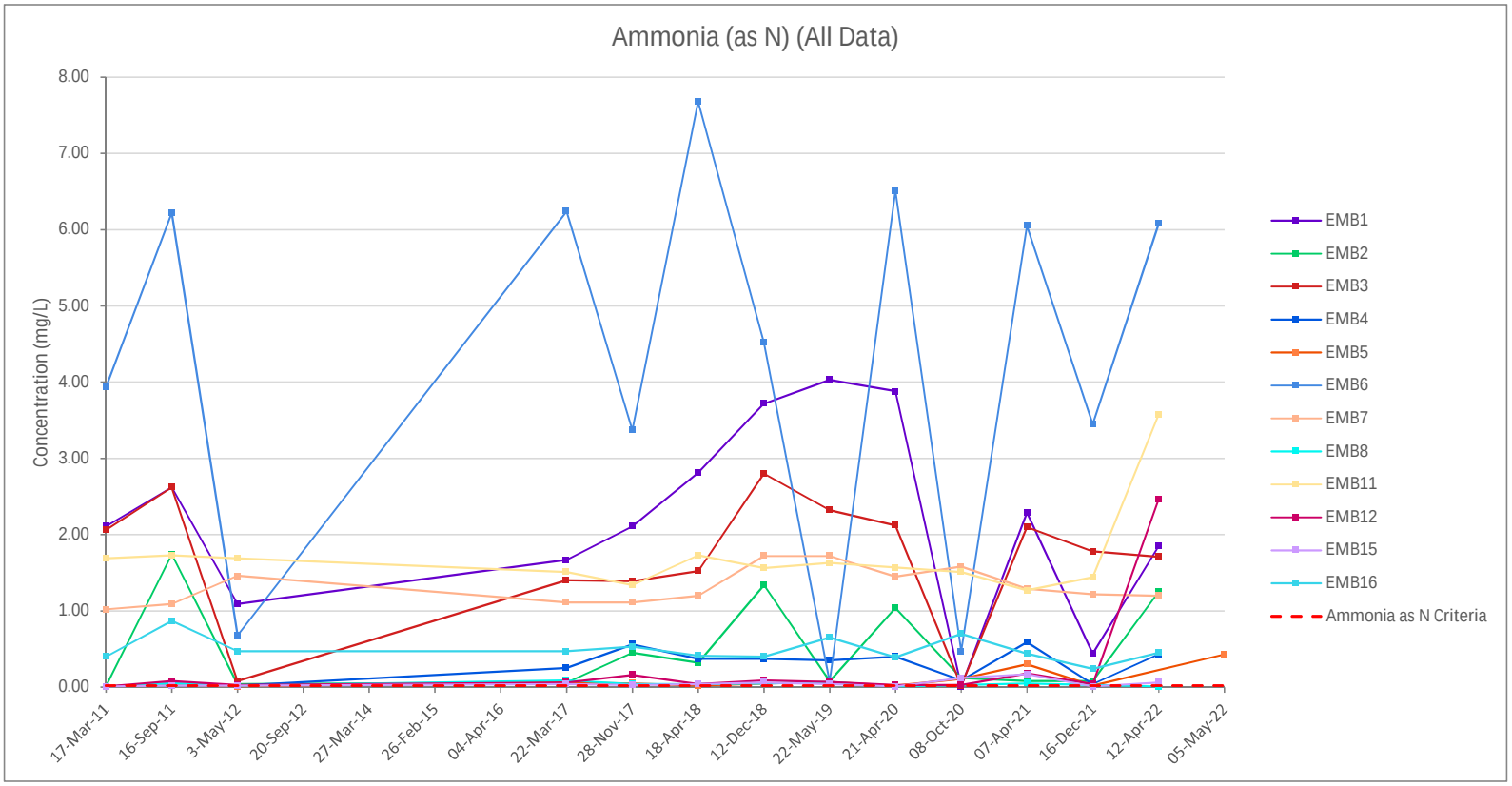
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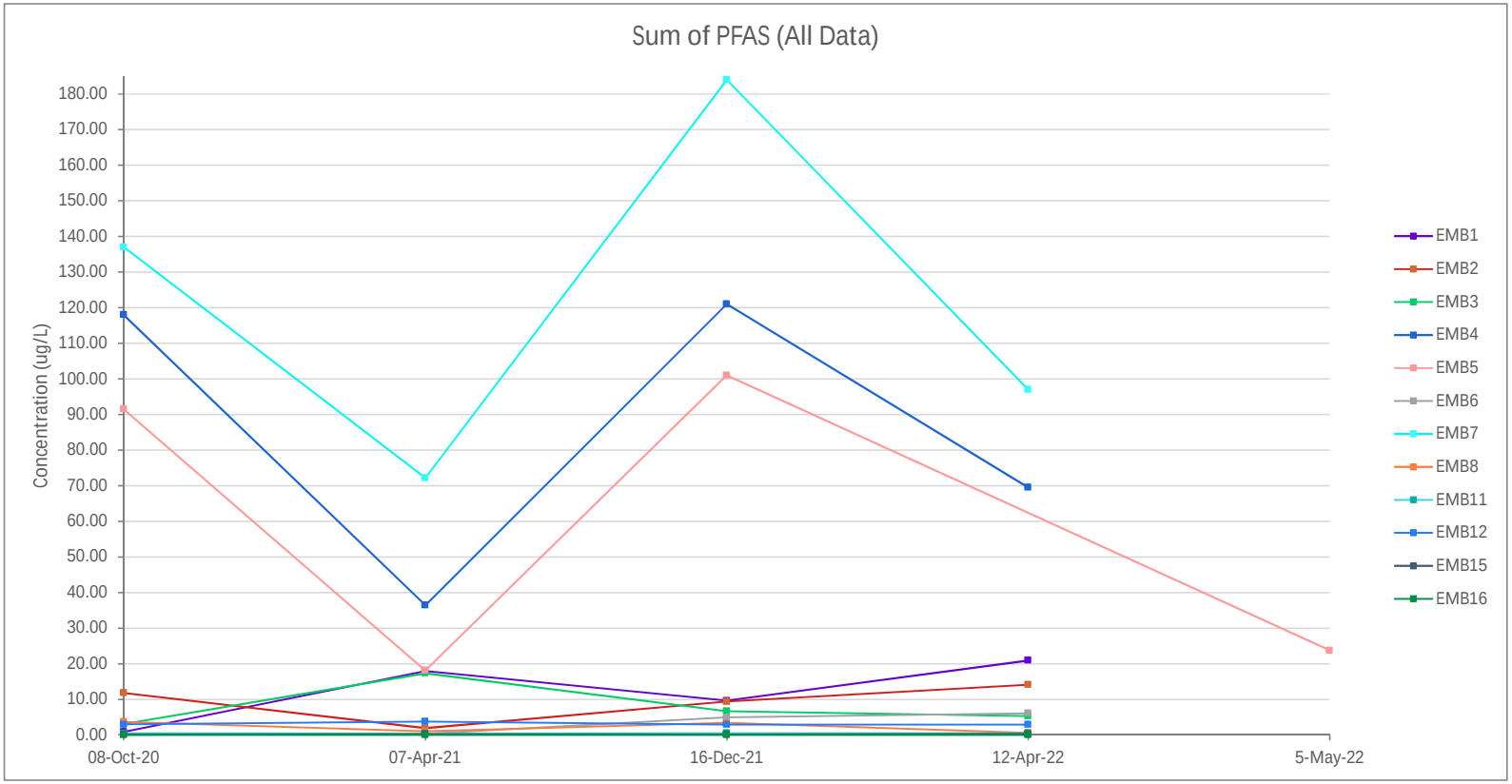
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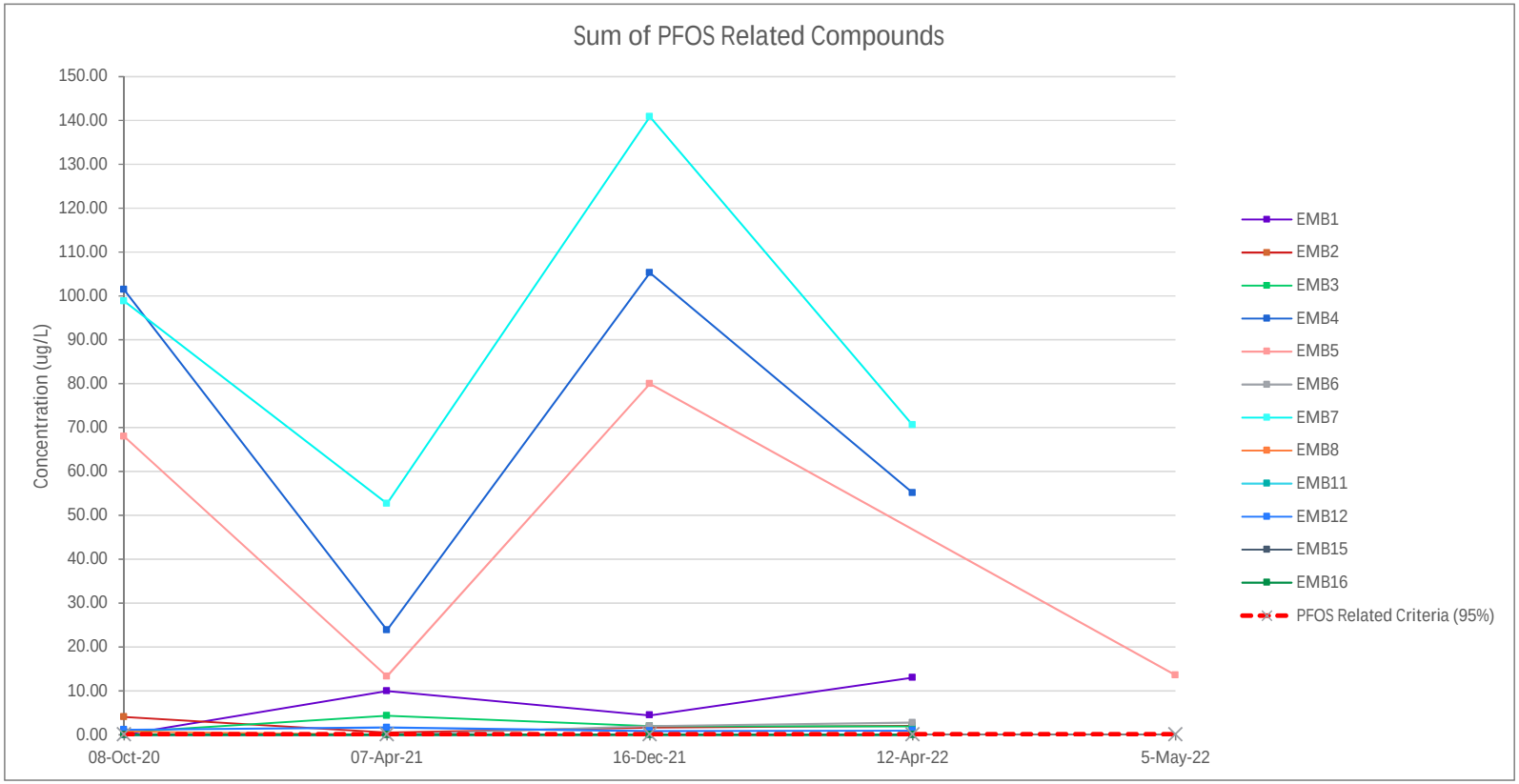
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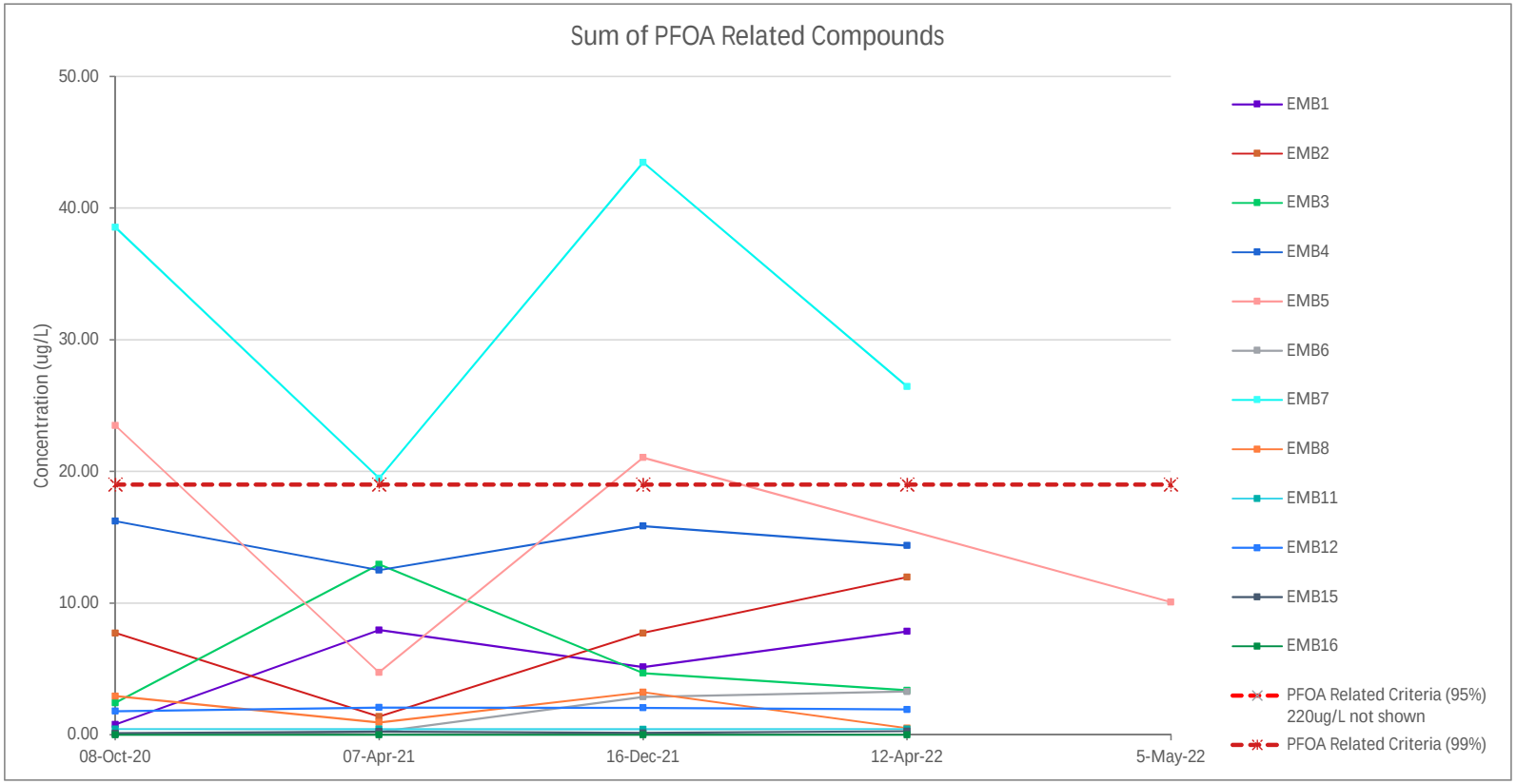
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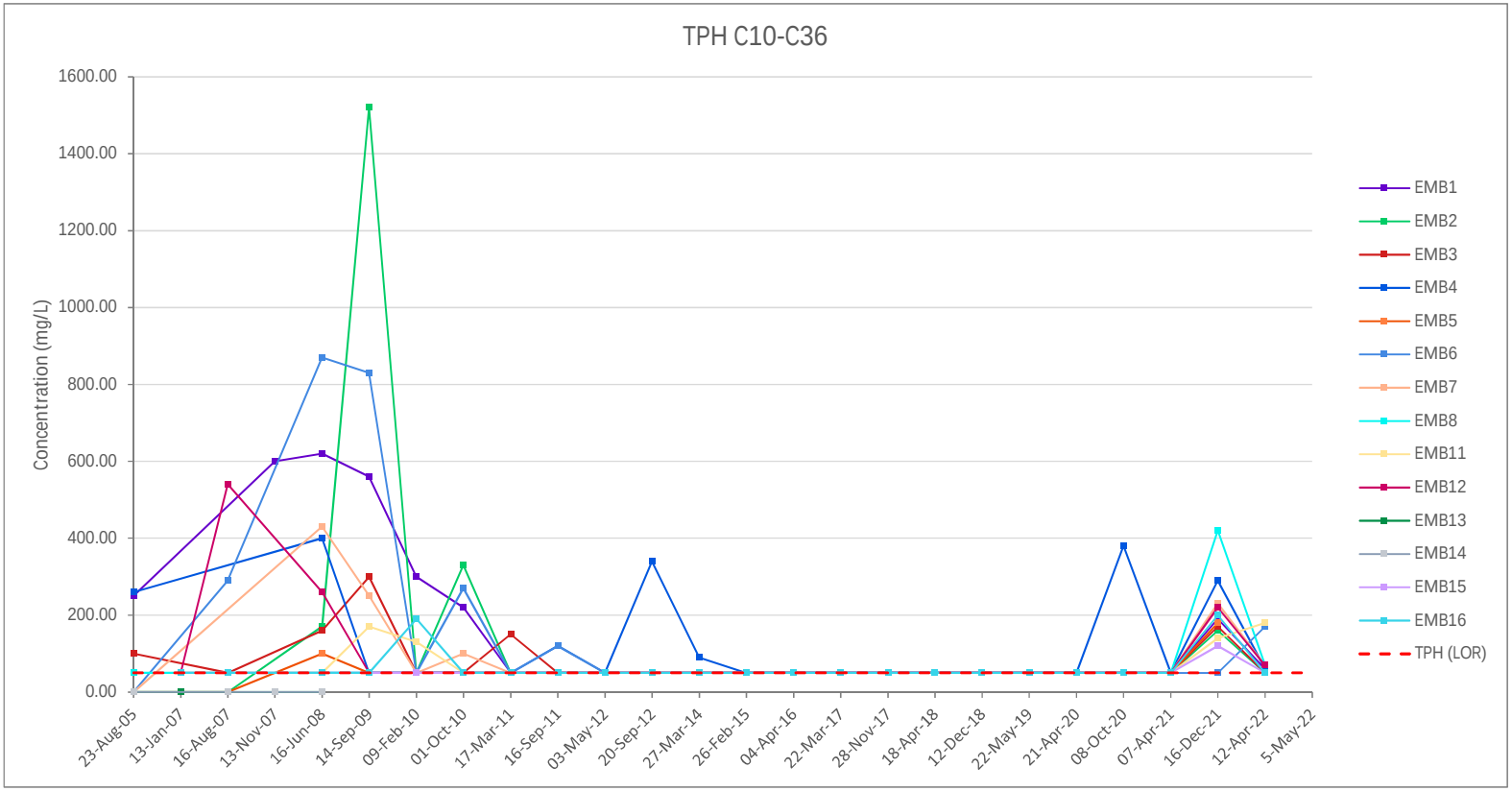
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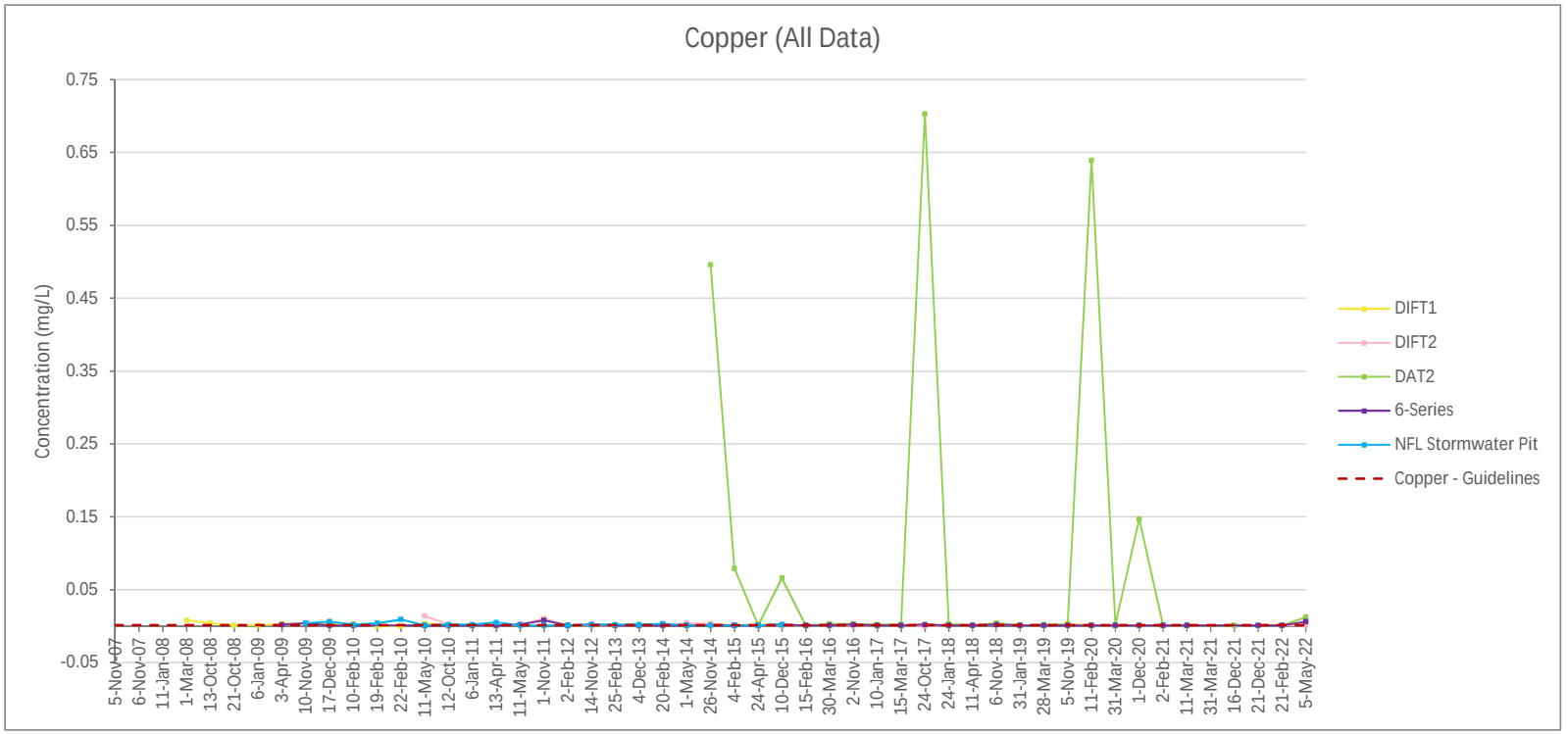
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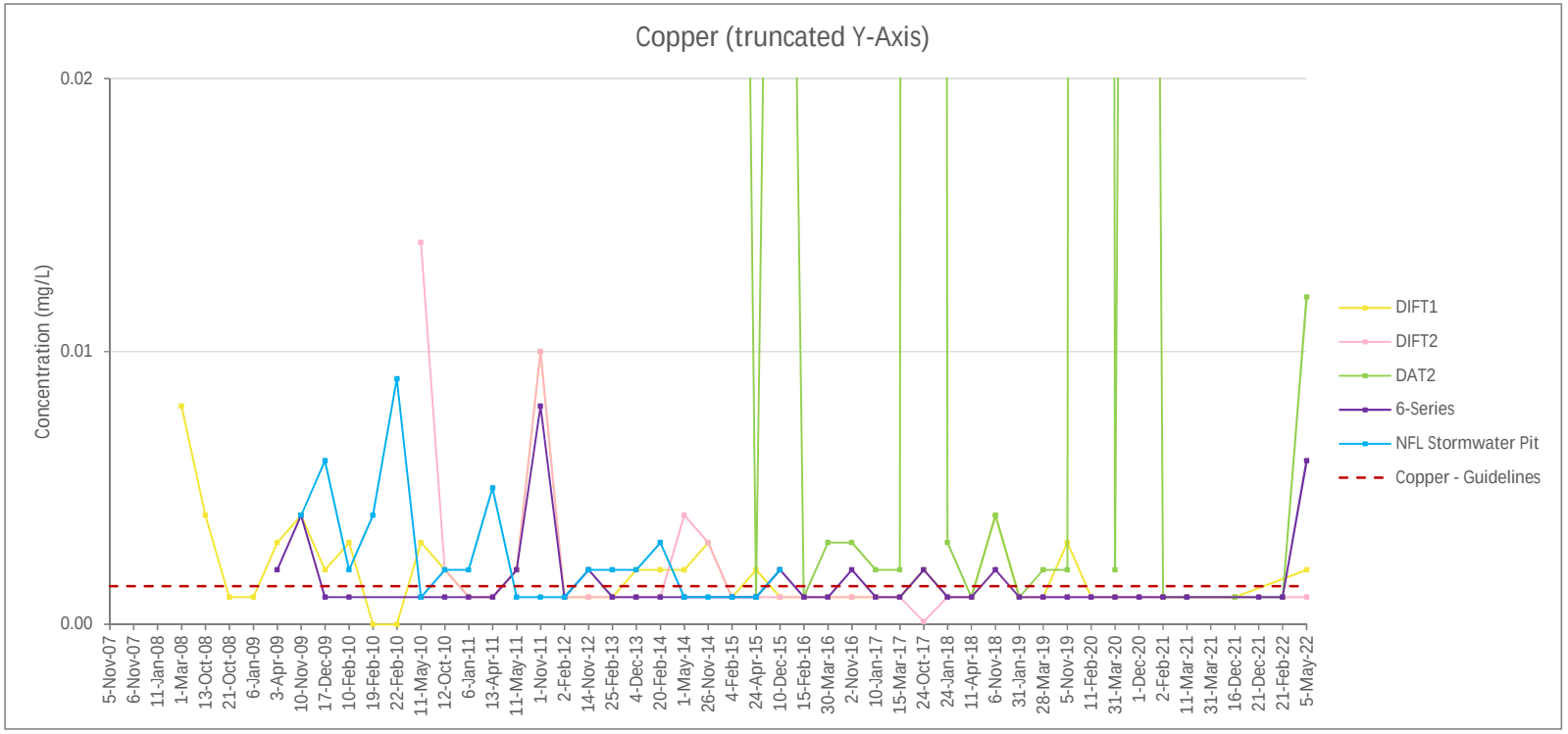
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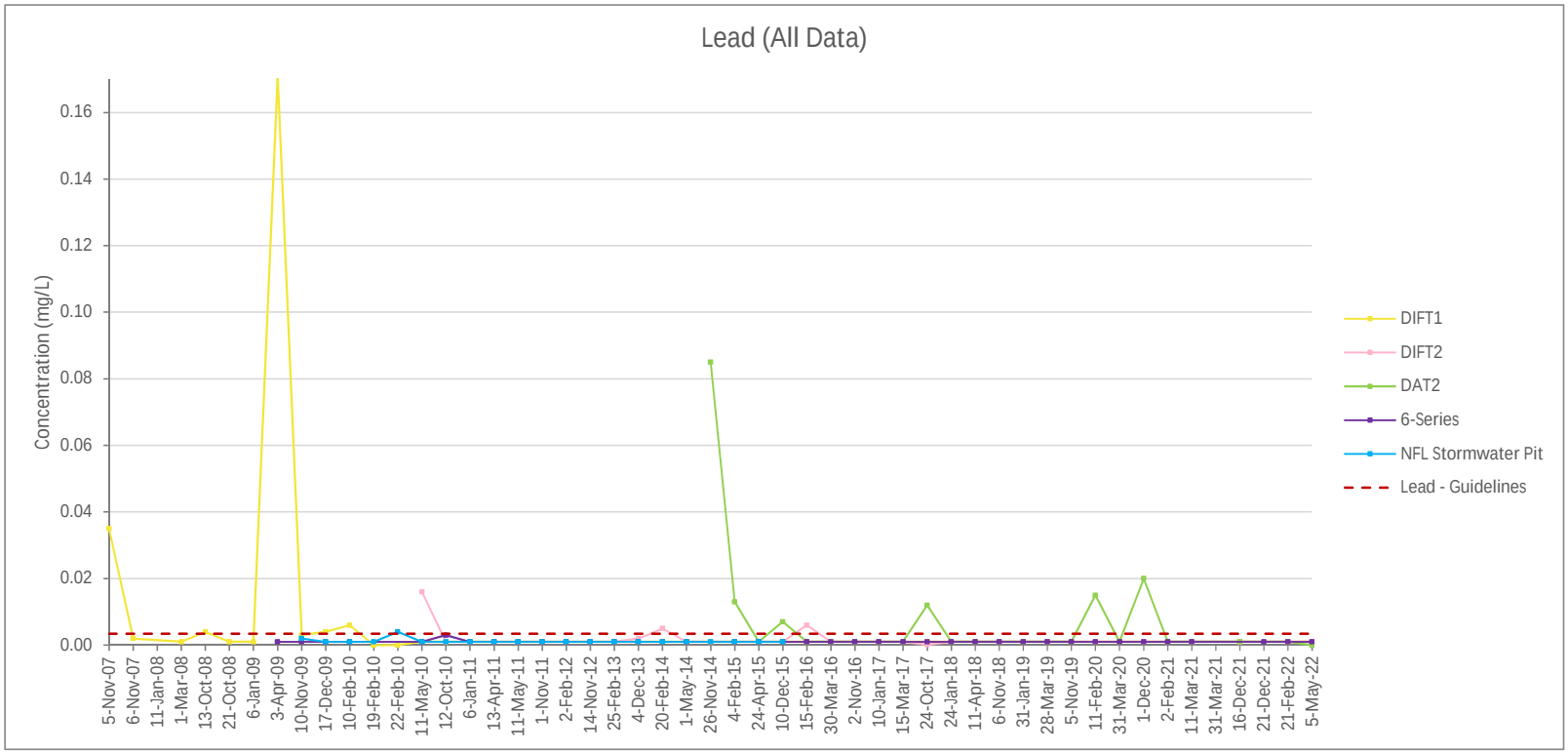


Stormwater Database Summary Graphs

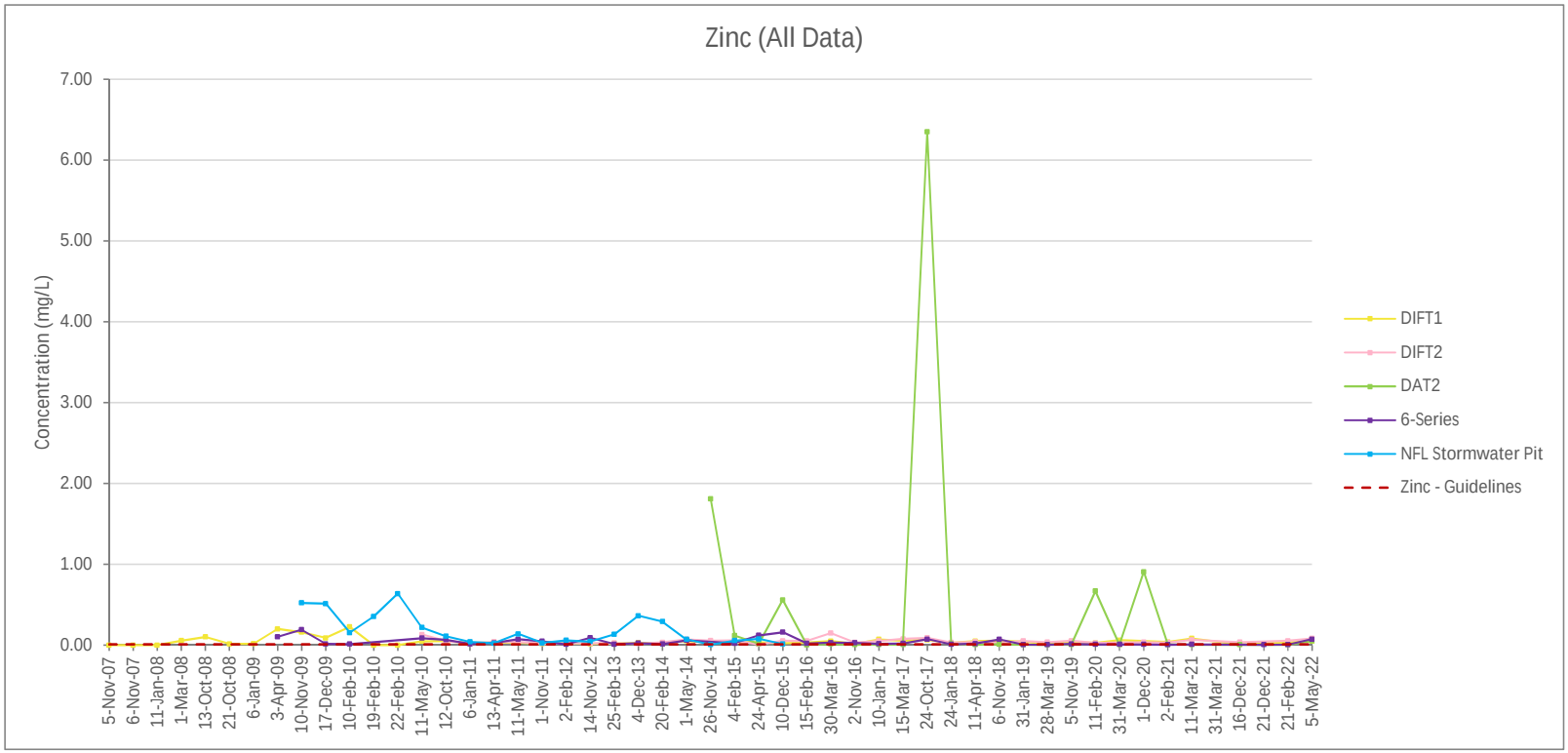


Stormwater Database Summary Graphs

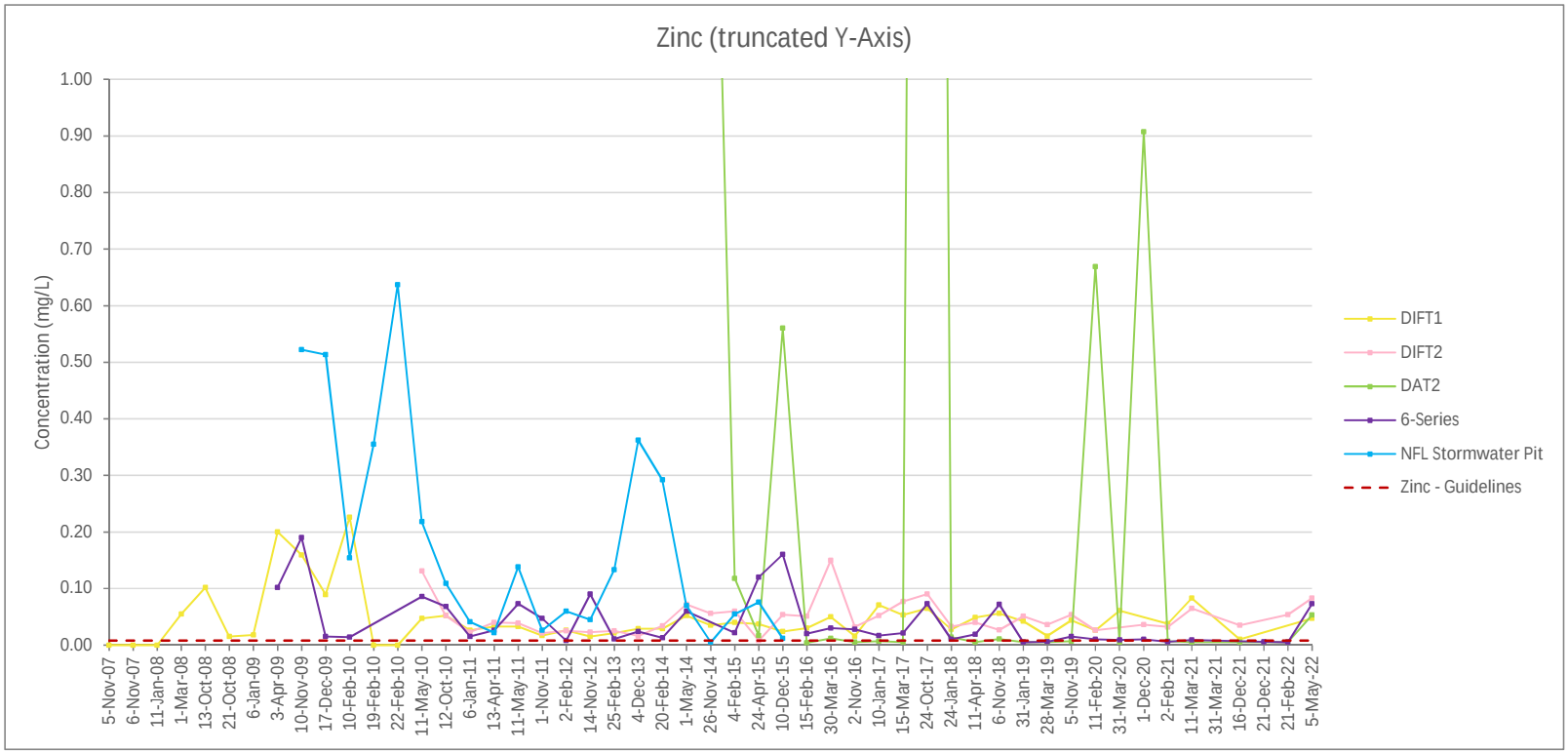


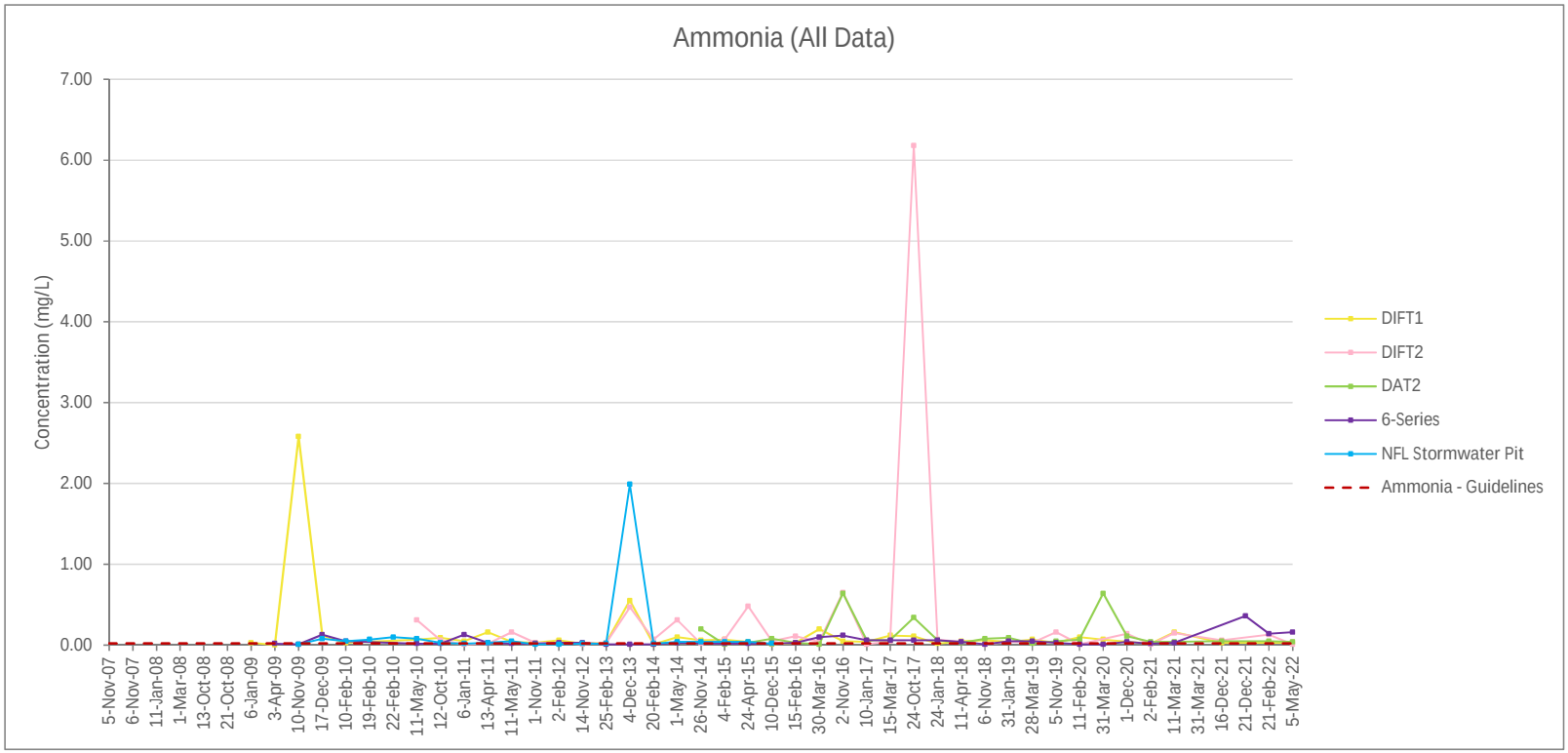

Lead (All Data)
Concentration (mg/L)
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
5-Nov-07
6-Nov-07
11-Jan-08
1-Mar-08
13-Oct-08
21-Oct-08
6-Jan-09
3-Apr-09
10-Nov-09
17-Dec-09
10-Feb-10
19-Feb-10
22-Feb-10
11-May-10
12-Oct-10
6-Jan-11
13-Apr-11
11-May-11
1-Nov-11
2-Feb-12
14-Nov-12
25-Feb-13
4-Dec-13
20-Feb-14
1-May-14
26-Nov-14
4-Feb-15
24-Apr-15
10-Dec-15
15-Feb-16
30-Mar-16
2-Nov-16
10-Jan-17
15-Mar-17
24-Oct-17
24-Jan-18
11-Apr-18
6-Nov-18
31-Jan-19
28-Mar-19
5-Nov-19
11-Feb-20
31-Mar-20
1-Dec-20
2-Feb-21
11-Mar-21
31-Mar-21
16-Dec-21
21-Dec-21
21-Feb-22
5-May-22
DIFT1
DIFT2
DAT2
6-Series
NFL Stormwater Pit
Lead - Guidelines

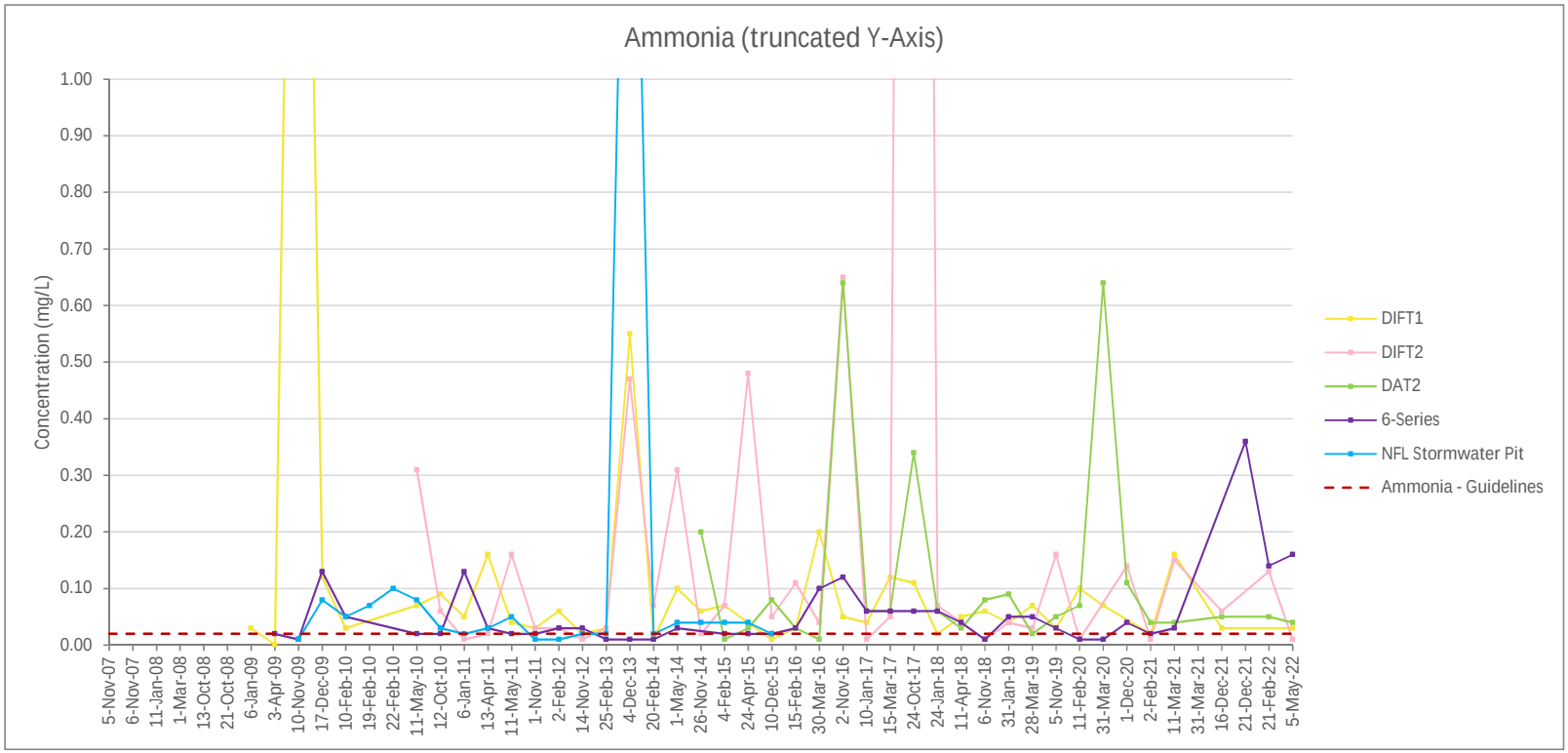
Stormwater Database Summary Graphs



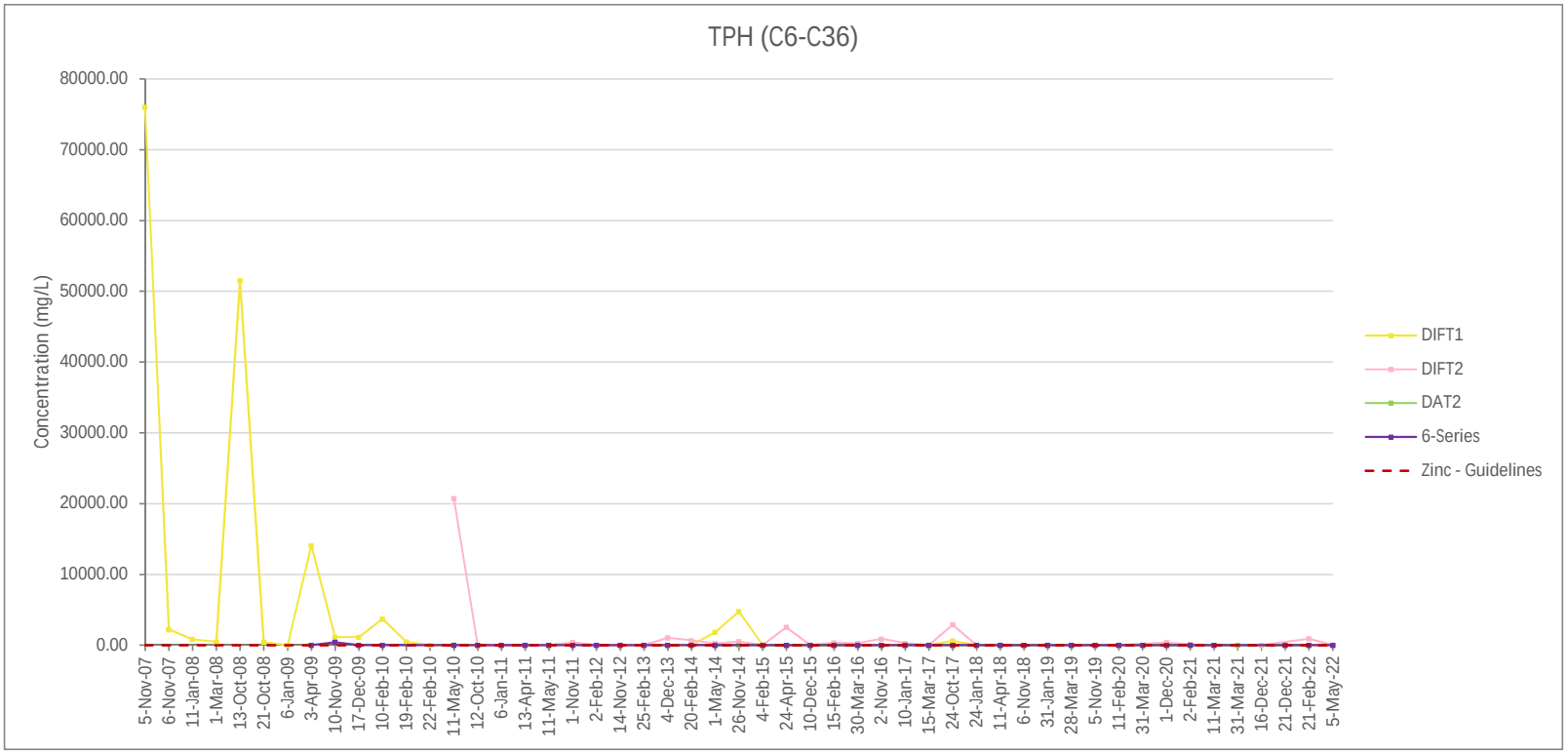
Stormwater Database Summary Graphs



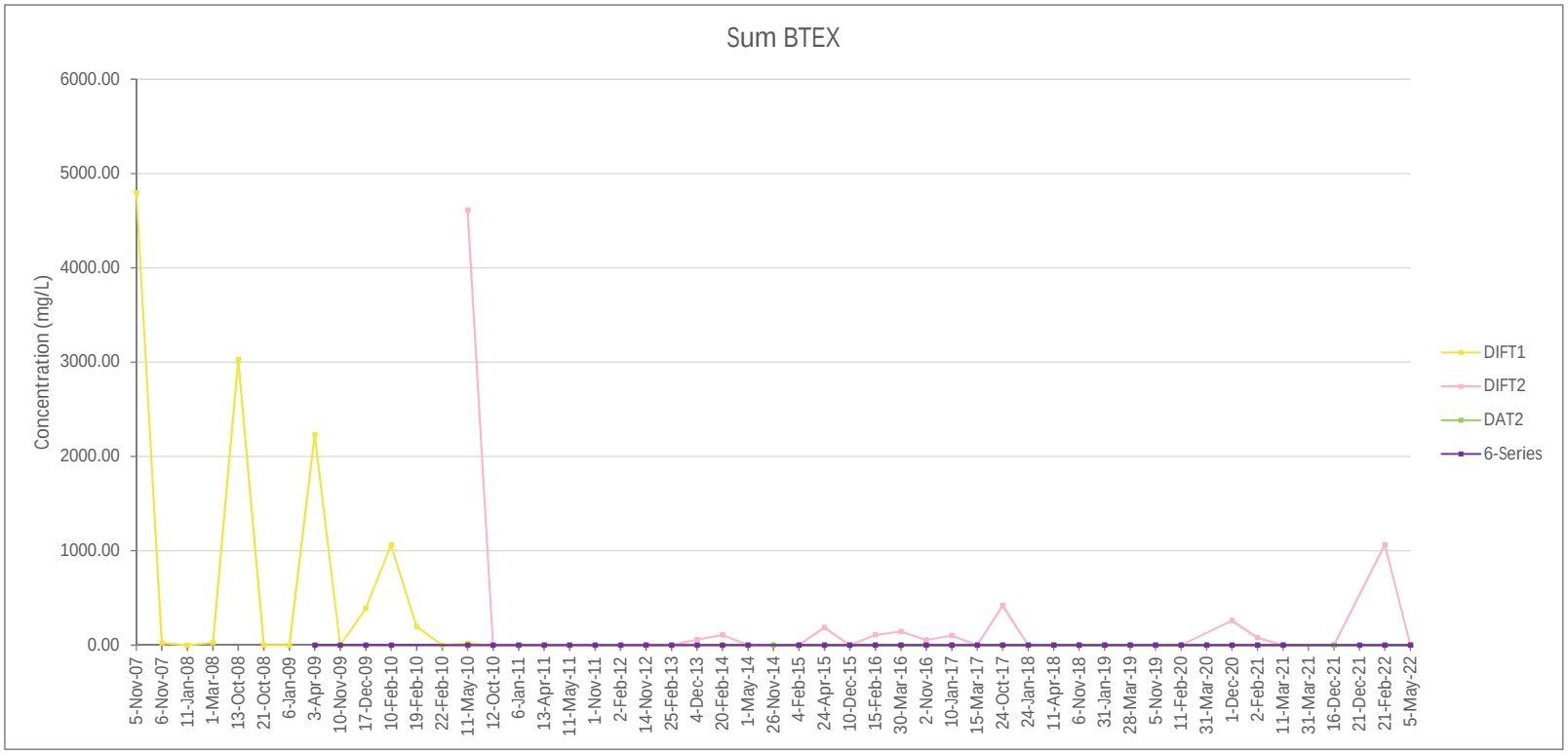

Ammonia (All Data)
Concentration (mg/L)
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
5-Nov-07
6-Nov-07
11-Jan-08
1-Mar-08
13-Oct-08
21-Oct-08
6-Jan-09
3-Apr-09
10-Nov-09
17-Dec-09
10-Feb-10
19-Feb-10
22-Feb-10
11-May-10
12-Oct-10
6-Jan-11
13-Apr-11
11-May-11
1-Nov-11
2-Feb-12
14-Nov-12
25-Feb-13
4-Dec-13
20-Feb-14
1-May-14
26-Nov-14
4-Feb-15
24-Apr-15
10-Dec-15
15-Feb-16
30-Mar-16
2-Nov-16
10-Jan-17
15-Mar-17
24-Oct-17
24-Jan-18
11-Apr-18
6-Nov-18
31-Jan-19
28-Mar-19
5-Nov-19
11-Feb-20
31-Mar-20
1-Dec-20
2-Feb-21
11-Mar-21
31-Mar-21
16-Dec-21
21-Dec-21
21-Feb-22
5-May-22
DIFT1
DIFT2
DAT2
6-Series
NFL Stormwater Pit
Ammonia - Guidelines


Ammonia (truncated Y-Axis)
Concentration (mg/L)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
5-Nov-07
6-Nov-07
11-Jan-08
1-Mar-08
13-Oct-08
21-Oct-08
6-Jan-09
3-Apr-09
10-Nov-09
17-Dec-09
10-Feb-10
19-Feb-10
22-Feb-10
11-May-10
12-Oct-10
6-Jan-11
13-Apr-11
11-May-11
1-Nov-11
2-Feb-12
14-Nov-12
25-Feb-13
4-Dec-13
20-Feb-14
1-May-14
26-Nov-14
4-Feb-15
24-Apr-15
10-Dec-15
15-Feb-16
30-Mar-16
2-Nov-16
10-Jan-17
15-Mar-17
24-Oct-17
24-Jan-18
11-Apr-18
6-Nov-18
31-Jan-19
28-Mar-19
5-Nov-19
11-Feb-20
31-Mar-20
1-Dec-20
2-Feb-21
11-Mar-21
31-Mar-21
16-Dec-21
21-Dec-21
21-Feb-22
5-May-22
DIFT1
DIFT2
DAT2
6-Series
NFL Stormwater Pit
Ammonia - Guidelines

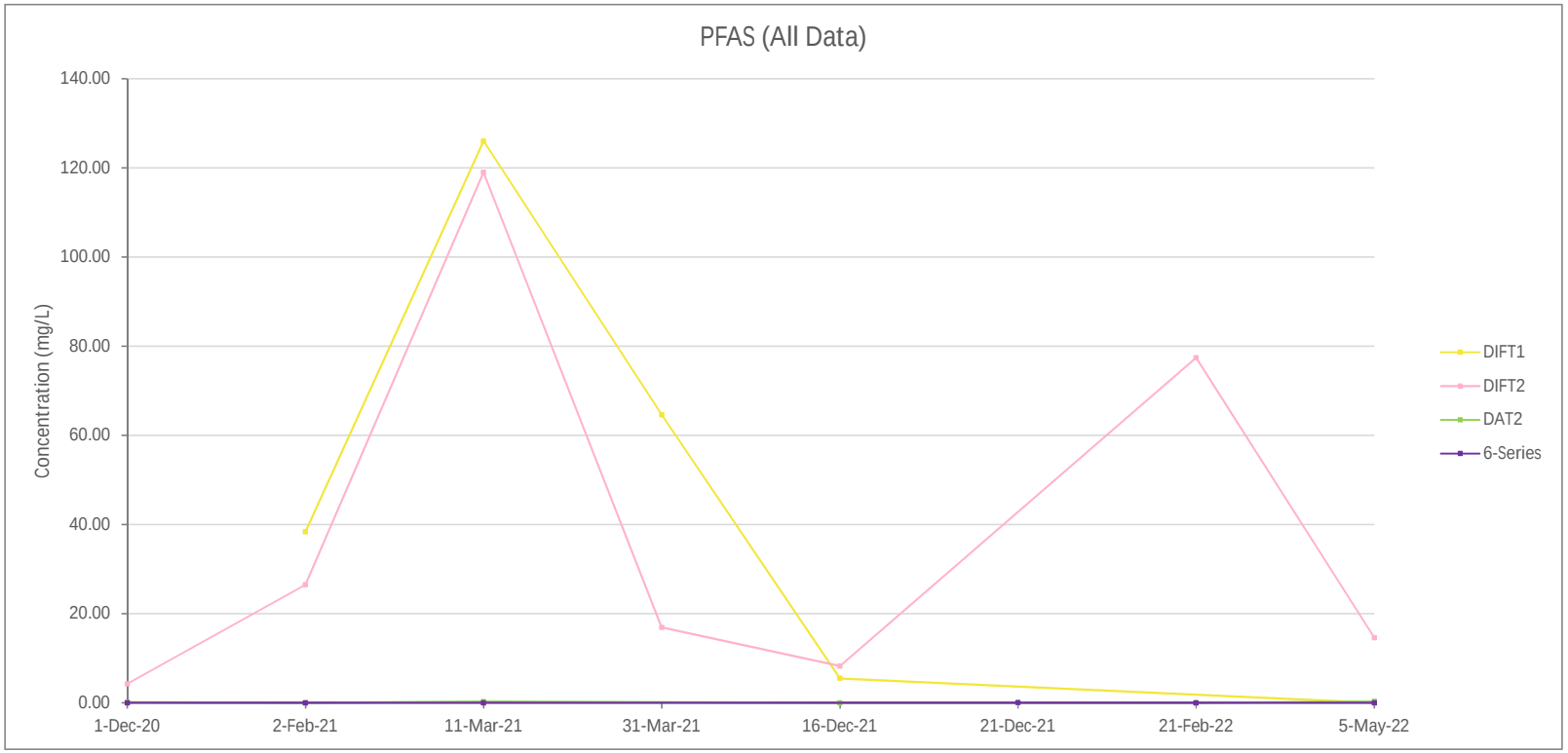
Stormwater Database Summary Graphs

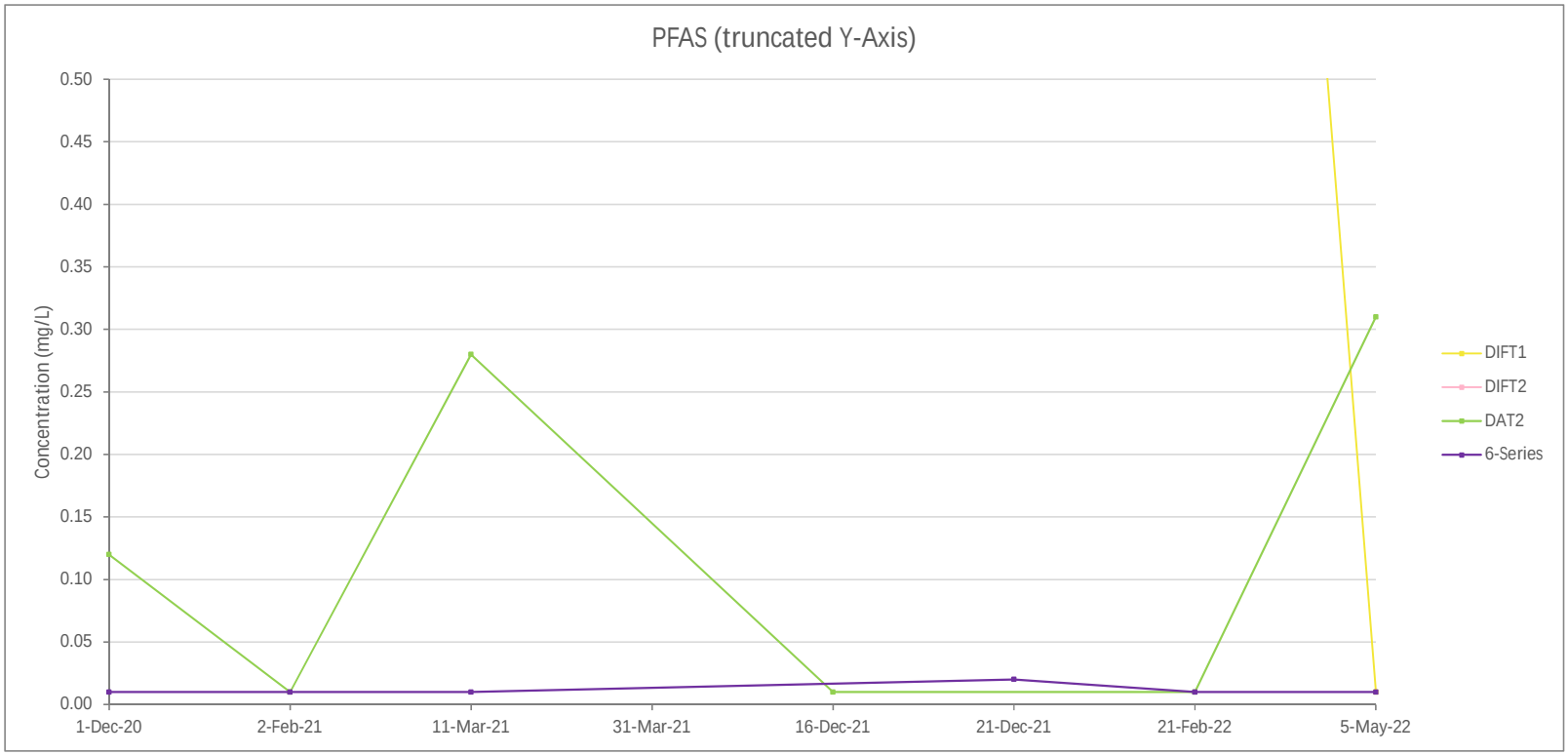


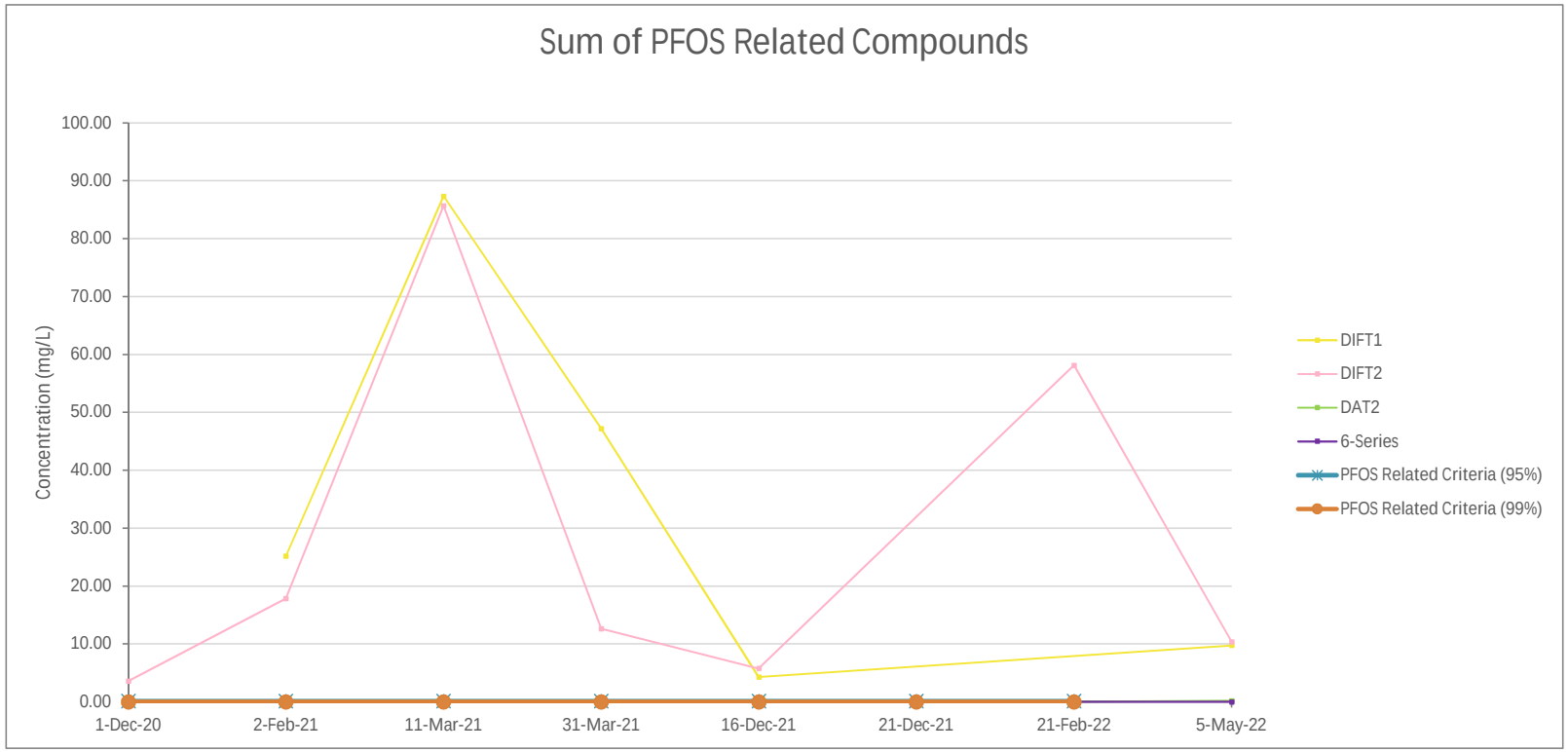
Stormwater Database Summary Graphs

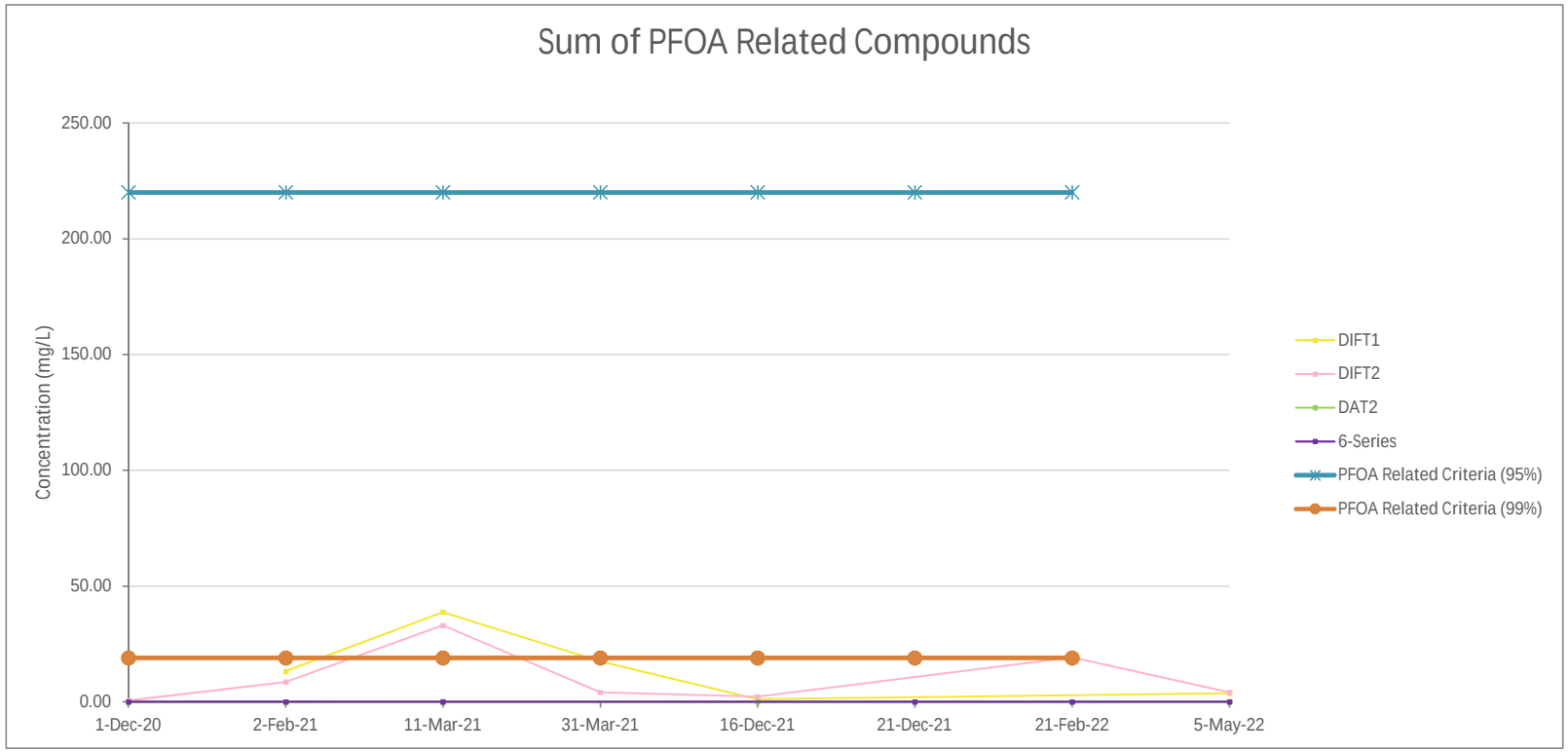


Stormwater Database Summary Graphs

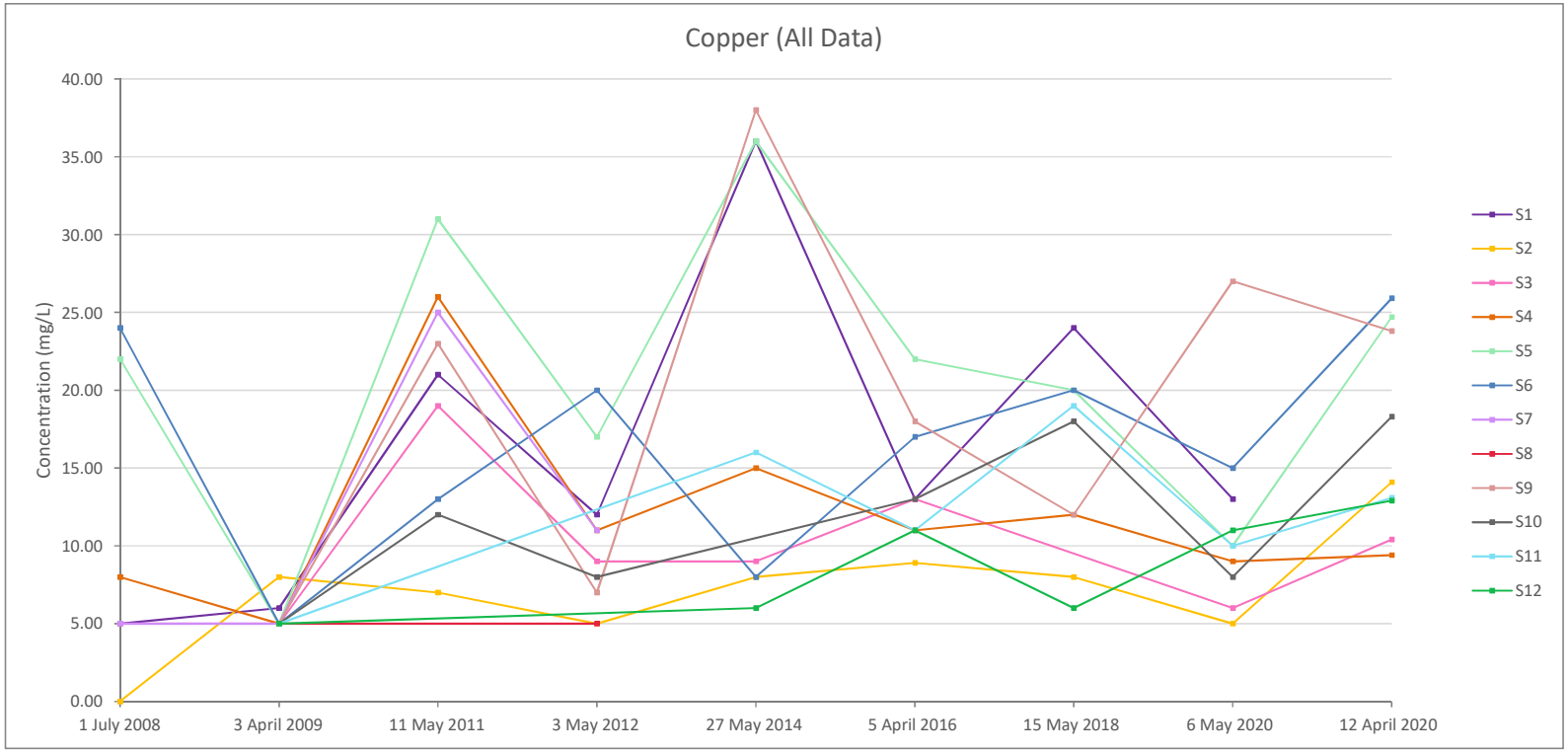



PFAS (truncated Y-Axis)
Concentration (mg/L)
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1-Dec-20
2-Feb-21
11-Mar-21
31-Mar-21
16-Dec-21
21-Dec-21
21-Feb-22
5-May-22
DIFT1
DIFT2
DAT2
6-Series

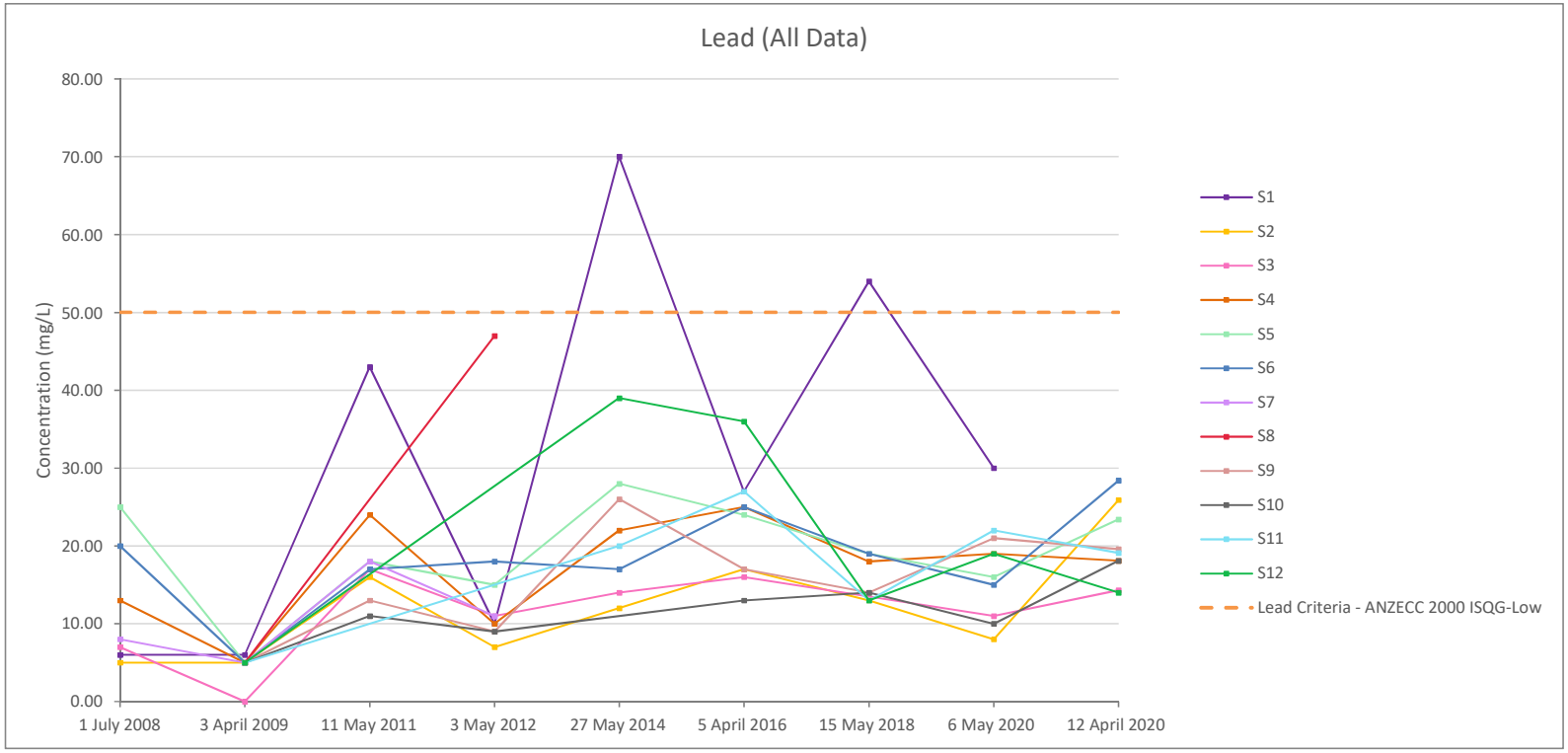

Sum of PFOS Related Compounds
Concentration (mg/L)
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
1-Dec-20
2-Feb-21
11-Mar-21
31-Mar-21
16-Dec-21
21-Dec-21
21-Feb-22
5-May-22
DIFT1
DIFT2
DAT2
6-Series
PFOS Related Criteria (95%)
PFOS Related Criteria (99%)


Sum of PFOA Related Compounds
Concentration (mg/L)
250.00
200.00
150.00
100.00
50.00
0.00
1-Dec-20
2-Feb-21
11-Mar-21
31-Mar-21
16-Dec-21
21-Dec-21
21-Feb-22
5-May-22
DIFT1
DIFT2
DAT2
6-Series
PFOA Related Criteria (95%)
PFOA Related Criteria (99%)

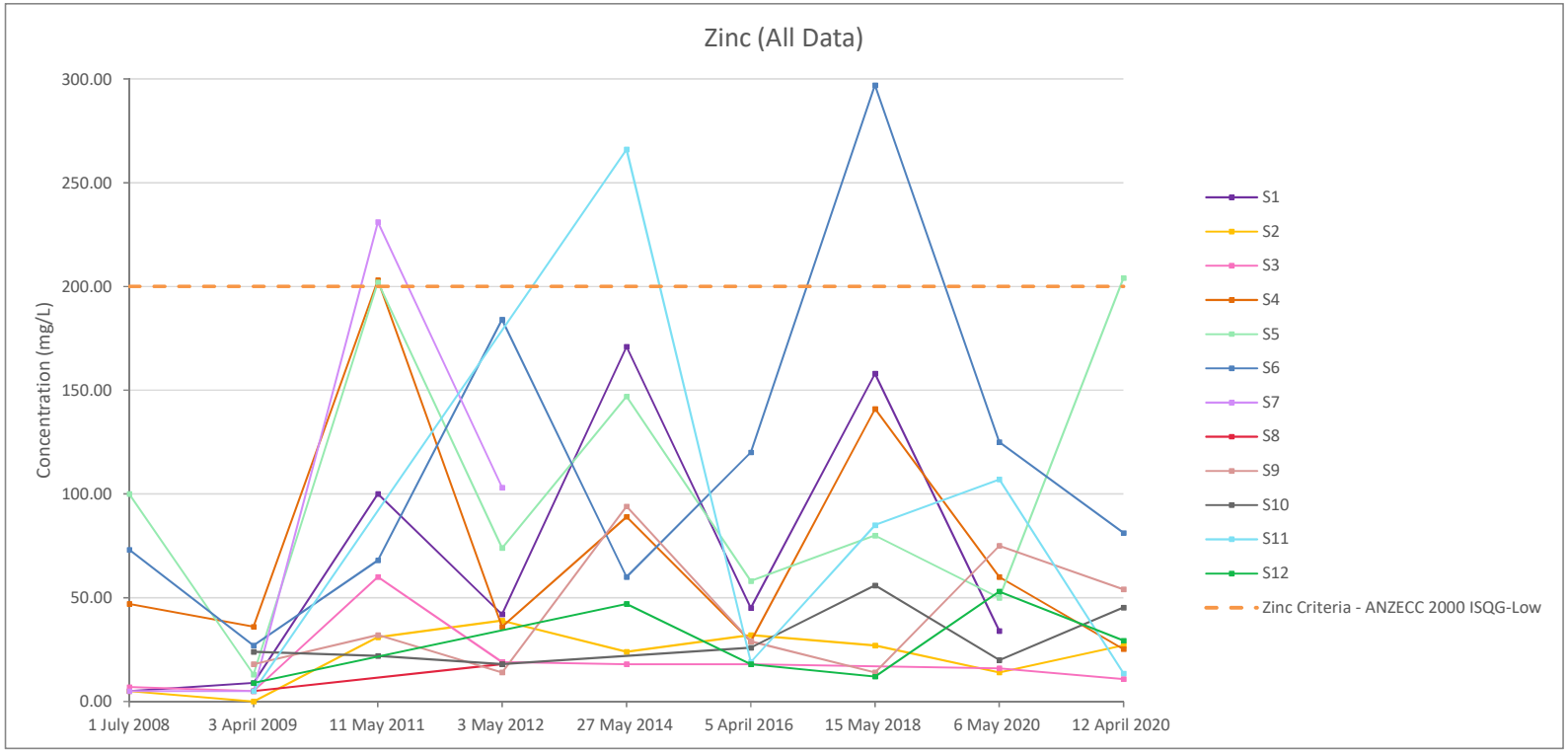
Sediment Monitoring Database Summary Graphs



Sediment Monitoring Database Summary Graphs



Sediment Monitoring Database Summary Graphs



		Adopted Criteria	Baseline EMB1-16		Post Baseline EMB1-16 (up to 27 rounds)		Post Post Baseline EMB17-25 (1 round - April 2020 only)	
	Units		Min	Max	Min	Max	Min	Max
Metals								
Arsenic	mg/L	0.0023	<0.001	0.23	<0.001	0.319	<0.001	0.012
Cadmium	mg/L	0.0007	<0.001	<0.0001	<0.0001	0.005	<0.0001	<0.0001
Chromium	mg/L	0.0044	<0.001	0.18	<0.001	0.08	<0.001	<0.001
Copper	mg/L	0.0013	0.002	0.12	<0.001	1.08	<0.001	0.001
Lead	mg/L	0.0044	0.023	0.47	<0.001	0.61	<0.001	<0.001
Nickel	mg/L	0.07	<0.05	0.09	<0.001	0.05	<0.001	0.009
Zinc	mg/L	0.008	0.009	0.38	<0.005	0.98	<0.005	0.022
Mercury	mg/L	0.0001	<0.0001	0.0006	<0.0001	0.0002	<0.0001	<0.0001
Nutrients								
Ammonia as N	mg/L	0.02	<0.01	3.93	0.01	7.68	<0.01	6.85
Nitrite as N	mg/L		<0.01	0.04	<0.01	0.09	-	-
Nitrate as N	mg/L		<0.01	2.29	<0.01	4.65	-	-
Nitrite + Nitrate as N	mg/L		<0.01	2.29	<0.01	4.65	-	-
Total Kjeldahl Nitrogen as N	mg/L		<0.01	4.00	<0.1	8.00	-	-
Total Nitrogen as N	mg/L		<0.1	4.00	<0.1	8.00	-	-
Total Phosphorus as P	mg/L		<0.05	0.18	<0.05	1.05	-	-
Total Petroleum Hydrocarbons								
C6 - C9 Fraction	µg/L	<20	<20	210	<20	210	<20	<20
C10 - C14 Fraction	µg/L	<50	<50	60	<50	290	<50	<50
C15 - C28 Fraction	µg/L	<100	<100	200	<100	1100	<50	<50
C29 - C36 Fraction	µg/L	<50	<50	60	<50	360	<100	<100
C10 - C36 Fraction (sum)	µg/L	<50	<50	260	<50	1520	<50	<50
BTEX						0		
Benzene	µg/L	500	<1	<1	<1	2	<1	<1
Toluene	µg/L	110	<2	2	<2	5	<2	<2
Ethylbenzene	µg/L	50	<2	<2	<2	<2	<2	<2
Total Xylenes	µg/L	50	<2	<2	<2	<2	<2	<2
Polynuclear Aromatic Hydrocarbons								
Naphthalene	µg/L	70	1.6	2.1	<1	<1	<0.004	0.012
Acenaphthylene	µg/L		<1.0	<1.0	<1	<1	<0.002	0.005
Acenaphthene	µg/L		<1.0	<1.0	<1	<1	<0.002	0.003
Fluorene	µg/L		<1.0	<1.0	<1	<1	0.003	0.009
Phenanthrene	µg/L	0.6	<1.0	<1.0	<1	1.6	0.007	0.012
Anthracene	µg/L	0.01	<1.0	<1.0	<1	<1	<0.001	<0.001
Fluoranthene	µg/L	1	<1.0	<1.0	<1	33.8	0.003	0.014
Pyrene	µg/L		<1.0	<1.0	<1	<1	0.010	0.010
Benz(a)anthracene	µg/L		<1.0	<1.0	<1	<1	<0.002	<0.002
Chrysene	µg/L		<1.0	<1.0	<1	<1	<0.001	<0.001
Benzo(b)fluoranthene	µg/L		<1.0	<1.0	<1	<1	<0.004	<0.004
Benzo(k)fluoranthene	µg/L		<1.0	<1.0	<1	<1	<0.004	<0.004
Benzo(a)pyrene	µg/L	0.1	<0.5	<0.5	<0.5	<0.5	<0.001	<0.001
Indeno(1.2.3.cd)pyrene	µg/L		<1.0	<1.0	<1	<1	<0.002	<0.002
Dibenz(a.h)anthracene	µg/L		<1.0	<1.0	<1	<1	<0.001	<0.001
Benzo(g.h.i)perylene	µg/L		<1.0	<1.0	<1	<1	<0.002	<0.002

Notes

- Note that baseline metal results (and results up to 16 June 2008) are reported as total concentrations whereas post monitoring results are reported as dissolved concentrations

- Excludes QA sample results

Exceeds adopted criteria

Appendix F **Data Quality Indicators**

DQIs for the project will be based on the field and laboratory considerations in NEPM Schedule B2 Appendix B, (NEPC 1999), which include:

- Completeness – a measure of the amount of useable data (expressed as %) from a data collection activity;
- Comparability – the confidence (expressed qualitatively) that data may be considered to be equivalent for each sampling and analytical event;
- Representativeness – the confidence (expressed qualitatively) that data are representative of each media present on the site;
- Precision – A quantitative measure of the variability (or reproducibility) of data; and
- Accuracy – a quantitative measure of the closeness of reported data to the true value.

The DQIs adopted for this assessment and checking of compliance is discussed in the tables below.

Completeness					
Field considerations	**DQI**	**DQI Compliance**	**Laboratory considerations**	**DQI**	**DQI Compliance**
All critical locations will be sampled	Samples will be collected as per Section 7	Yes	All critical samples analysed.	Samples will be analysed as per Section 7.3	Yes
All samples collected	Samples will be collected from relevant media as per Section SAQP	Yes	All analytes analysed according to sampling plan.	Samples will be analysed as per SAQP	Yes
Standard Operating Procedures (SOPs) appropriate and complied with	SMEC SOPs/Field instructions will be implemented.	Yes	Appropriate methods and limits of reporting .	Samples will be analysed by laboratories NATA accredited for the analyses to be performed and appropriate methods will be used. LORs were less than or equal to the assessment criteria.	Yes
Experienced sampler	An experienced SMEC environmental consultant will conduct the sampling.	Yes	Sample documentation complete	CoCs will be returned, signed and dated by laboratory. NATA endorsed laboratory certificates were completed in accordance with NEPC (1999). Field documentation was completed in accordance with SMEC SOPs/Field instructions.	Yes (refer to Appendix J and Appendix L)
Documentation correct	Samples will be handled and transported under appropriate chain of custody documentation. Sample Receipt Advice (SRA) (or equivalent) from the laboratory will be reviewed to assess that samples are received cool and in good condition. Calibration certificates for the field instruments will be provided on a daily basis.	Yes, with some exceptions.	Sample holding times complied with.	Samples will be analysed within holding times specified by NEPC (1999, amended 2013)	Yes, with some exceptions (refer to Section 8)

Comparability					
Field considerations	**DQI**	**DQI Compliance**	**Laboratory considerations**	**DQI**	**DQI Compliance**
Same SOPs/Field instructions used on each occasion	SMEC SOPs/Field instructions will be implemented.	Yes	Same sample analytical methods used.	The same NATA accredited laboratory will be used to undertake analyses of all primary samples collected for this study. The laboratory used the same analytical methods for each sample for each analytical parameter.	Yes
Experienced sampler	An experienced SMEC environmental consultant will conduct the sampling.	Yes	Same sample LOR.		Yes
Climatic conditions (temperature, rainfall, wind, barometric pressure…)	Where practical soil and water sampling will be carried out whilst not raining Sampling for this work will be completed when necessary. Climatic conditions are not expected to cause issues for comparability of data	Yes	Same laboratories.		Yes
Same types of samples collected	Samples will be collected in the appropriate laboratory supplied container specific to the analyses performed.		Same units.		Yes

Representativeness					
Field considerations	**DQI**	**DQI Compliance**	**Laboratory considerations**	**DQI**	**DQI Compliance**
Appropriate media sampled according to sample plan	Samples will be collected and analysed as per SAQP. Any variations will be justified.	Yes	All samples analysed according to sample plan.	Samples will be collected and analysed as per SAQP. NATA Accredited environmental testing laboratories will implement a quality control plan conforming to Schedule B(3) 'Guideline on Laboratory Analysis of Potentially Contaminated Soils' of the National Environment Protection (Assessment of Site Contamination Measure 1999 as amended (NEPC, 1999).	Yes
All media identified in sample plan sampled	Samples will be collected and analysed as per SAQP	Yes	All samples analysed according to sample plan.	Samples will be collected and analysed as listed in the SAQP.	Yes

Precision					
Field considerations	**DQI**	**DQI Compliance**	**Laboratory considerations**	**DQI**	**DQI Compliance**
SOPs appropriate and complied with	SMEC SOPs/Field instructions will be implemented	Yes	Analysis of: laboratory duplicates.	The number of duplicate analyses should be the smaller of one per process batch or one per 10 samples.	Yes
Analysis of: field duplicates	Collection of field duplicate samples including: • Field intra-laboratory duplicate samples (1 in 10 samples for PFAS and 1 in 20 samples for other contaminants). • Field inter-laboratory duplicate samples (1 in 10 samples for PFAS and 1 in 20 samples for other contaminants).	Yes	Analysis of: field duplicates.	Field duplicates relative percentage difference (RPD) control limits: • Less than 50%, where result is greater than 10 times limit of reporting (LOR). • No limit where result is less than 10 times LOR.	Yes
	Experienced and trained staff to carry out sampling. Sampling methodologies appropriate and complied with.	Yes	Analysis of: laboratory duplicates	Laboratory duplicates RPD control limits: • 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% In accordance with laboratory specific QC Acceptance criteria.	Yes (minor exceptions noted in Section 8.1.9)

		Yes	Analysis of: laboratory-prepared trip spikes.	At least one BTEX trip spike per soil sampling and water quality monitoring event was analysed for volatile contaminants (BTEX). Recovery to be 70-130%.	Yes
		Yes	Analysis of: laboratory-prepared trip blanks.	At least one trip blank per soil sampling and water quality monitoring event was analysed for volatile contaminants (BTEX) and PFAS. Blanks to be <LOR.	Yes

Accuracy (bias)					
Field considerations	**DQI**	**DQI Compliance**	**Laboratory considerations**	**DQI**	**DQI Compliance**
SOP appropriate and complied with	SMEC SOPs/Field instructions will be implemented	Yes	Analysis of field blanks	One PFAS soil trip blank will be taken into the field, transported and analysed together with soil samples collected within this project. One laboratory-prepared water trip blank and BTEX trip spike will be taken into the field, transported and analysed together with groundwater samples collected within this project. The trip blank and spike samples will be analysed for volatile contaminants (i.e. BTEX, TRH C6-C9 fraction). In addition, a PFAS water trip blank will be used during groundwater quality monitoring. Results are to be less than the LOR.	Yes
Rinsate blank	Where reusable sampling equipment is utilised (if any) a rinsate blank will be analysed and results compared against the practical quantitation limit (PQL).	Yes	Analysis of method blank	Method blanks will be analysed as per NEPC (1999) at least 1 per process batch (typically 1 in 20, 1 in 10 for PFAS). Results to be less than LOR	Yes
Trip spike	One BTEX trip spike will be taken in the field and analysed. DQI - recoveries to be within 70% - 130% for organics	Yes	Analysis of matrix spike	Matrix spikes will be analysed as per NEPC (1999) (one matrix spike per soil type per process batch). Results were within laboratory acceptance limits based on NEPC (1999). Acceptance limits are on the laboratory certificates (typically 70-130%, depends on analyte. A lower range typically accepted for phenols 30%-130%)	Yes (minor exceptions noted in Section 8.1.9)
Preservation, transport and storage	Samples appropriately preserved in laboratory supplied containers, stored and transported correctly and within holding times	Yes	Analysis of surrogate spike	Surrogates will be analysed as per NEPC Schedule B3 (1999). All samples spiked where appropriate (e.g. chromatographic analysis of organics). Acceptance limits 70% to 130% (inorganics), or 50% to 150% (organics).	Yes

		Yes	Analysis of laboratory control samples (LCS)	LCSs will be analysed as per NEPC Schedule B3 (1999) (at least 1 per batch). Results were within laboratory acceptance limits based on NEPC (1999). Acceptance limits are on the laboratory certificates (typically 70-130%, depends on analyte)	Yes
		Yes	Analysis of laboratory-prepared spikes (LPS)	LPS will be analysed as per NEPC Schedule B3 (1999). Recovery results were within laboratory acceptance limits based on NEPC Schedule B3 (1999). Acceptance limits are on the laboratory certificates.	Yes

Appendix G **Calibration Certificates**

Calibration & Service Report
Gas Monitor

Company:	Active Environmental Solutions Hire	**Manufacturer:**	BW	**Serial #:**	MA218-034365
Contact:	Aleks Todorovic	**Instrument:**	GasAlertMax XT II	**Asset #:**	-
Address:	2 Merchant Avenue Thomastown Vic 3074	**Model:**	-	**Part #:**	-
		Configuration:	OFCH	**Sold:**	-
Phone:	03 9464 2300 | **Fax:** 03 9464 3421	**Wireless:**	-	**Last Cal:**	-
Email:	Hire@aesolutions.com.au	**Network ID:**	-	**Job #:**	-
		Unit ID:	-	**Cal Spec:**	Std

Item	Test	Pass/Fail	Comments
Battery	Li Ion	✓	
Charger	Charger, Power supply	✓	
	Cradle	-	
Pump	Flow	✓	>200 mL/min
Filter	Filter, fitting, etc	✓	
Alarms	Audible, visual, vibration	✓	
Display	Operation	✓	
PCB	Operation	✓	
Connectors	Condition	✓	
Firmware	Version	✓	13.0
Datalogger	Operation	✓	
Monitor Housing	Condition	✓	
Case	Condition/Type	✓	
Sensors			
Oxygen	O2	✓	
LEL	LEL	✓	
PID		-	
Toxic 1	CO	✓	
Toxic 2	H2S	✓	
Toxic 3		-	
Toxic 4		-	
Toxic 5		-	

Engineer's Report

Setup, service and calibration for hire

Calibration Certificate

Sensor	Type	Serial No:	Span Gas	Concentration	Traceability Lot #	CF	Reading	
							Zero	Span
Oxygen	O_2		Fresh Air	20.9%	Fresh Air		20.9	
			Oxygen	18%	WO271733-11			18.0
LEL	LEL		Methane	50% LEL	WO271733-11		0	50
PID								
Toxic 1	CO		Carbon Monoxide	50 PPM	WO271733-11		0	50
Toxic 2	H_2S		Hydrogen Sulfide	10 PPM	WO271733-11		0	10
Toxic 3								
Toxic 4								
Toxic 5								

Calibrated/Repaired by: Nenad Savic

Date: 18/03/2022

Next due: 18/09/2022

Calibration & Service Report
Gas Monitor

Company:	Active Environmental Solutions Hire
Contact:	Aleks Todorovic
Address:	2 Merchant Avenue Thomastown Vic 3074
Phone:	03 9464 2300 | **Fax**: 03 9464 3421
Email:	hire@aesolutions.com.au

Manufacturer:	RAE Systems
Instrument:	MiniRAE 3000
Model:	PGM 7320
Configuration:	VOC
Wireless:	-
Network ID:	-
Unit ID:	-

Serial #:	592-915461
Asset #:	-
Part #:	-
Sold:	-
Last Cal:	-
Job #:	-
Cal Spec:	Std

Item	Test	Pass/Fail	Comments
Battery	Li Ion	✓	
Charger	Charger, Power supply	✓	
	Cradle	✓	
Pump	Flow	✓	>500 mL/min
Filter	Filter, fitting, etc	✓	
Alarms	Audible, visual, vibration	✓	
Display	Operation	✓	
PCB	Operation	✓	
Connectors	Condition	✓	
Firmware	Version	✓	
Datalogger	Operation	✓	
Monitor Housing	Condition	✓	
Case	Condition/Type	✓	
Sensors			
Oxygen		-	
LEL		-	
PID	10.6eV	✓	
Toxic 1		-	
Toxic 2		-	
Toxic 3		-	
Toxic 4		-	
Toxic 5		-	

Engineer's Report

Setup, Service and Calibration for Hire

Calibration Certificate

Sensor	Type	Serial No:	Span Gas	Concentration	Traceability Lot #	CF	Reading	
							Zero	Span
Oxygen								
LEL							0	100.4
PID	10.6eV		Isobutylene	100 PPM	4835-1-1			
Toxic 1								
Toxic 2								
Toxic 3								
Toxic 4								
Toxic 5								

Calibrated/Repaired by: Nenad Savic

Date: 17/03/2022

Next due: 17/09/2022

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 18G103116

airmet
Air-Met Scientific Pty Ltd
1300 137 067

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

Certificate of Calibration

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

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. D.O		0 ppm		10640	0 ppm
2. Conductivity		2760uS		343511	2760 uS
3. pH7		pH 7.00		330737	Ph 7.00
4. pH4		pH 4.00		330734	pH 4.00
5. ORP mV		242.6mV		333082/329762	230.7mV
7. Temp °C		21.5		Multimeter	21.5

Calibrated by: Asher May

Calibration date: 4-Apr-22

Next calibration due: 1-Oct-22

Appendix H **Photographic Log**

Appendix H: Photographic Log



Photo 1: 04/04/2022 Example of road base gravel material, observed at location EMB17.



Photo 2: 04/04/2022 Example of silt material with gravel and trace sand, observed at location EMB18.



Photo 3: 04/04/2022 Example of silt material with gravel and trace sand, observed at location EMB18.



Photo 4: 04/04/2022 Example of silt, cobbles, and gravel material, observed at location EMB18.

Appendix H: Photographic Log



Photo 5: 05/04/2022 Example of road base gravel material, observed at location EMB19.



Photo 6: 05/04/2022 Example of road base gravel material, observed at location EMB19.



Photo 7: 05/04/2022 Example of siltstone material (crushed from auger), observed at location EMB19.



Photo 8: 05/04/2022 Example of gravelly silt material with trace sand, observed at location EMB21.

Appendix H: Photographic Log



Photo 9: 05/04/2022 Downhole image at location EMB21, with the top of siltstone layer visible.



Photo 10: 05/04/2022 Example of boulder and cobble (siltstone) material (crushed from auger), observed at location EMB20.



Photo 11: 05/04/2022 Example of sandy clay with gravel material, observed at location EMB20.



Photo 12: 05/04/2022 Example of sandy clay with gravel material, observed at location EMB20.

Appendix H: Photographic Log



Photo 13: 05/04/2022 Example of road base gravel material, observed at location EMB22.



Photo 14: 05/04/2022 Example of road base gravel material, observed at location EMB22.



Photo 15: 07/04/2022 Example of siltstone material (crushed from auger), observed at location EMB23.



Photo 16: 08/04/2022 Example of siltstone material (crushed from auger), observed at location EMB24.

Appendix H: Photographic Log



Photo 17: 06/04/2022 Example of concrete paver, observed at location EMB25.



Photo 18: 06/04/2022 Downhole image at location EMB25, with silty gravelly sand material visible.



Photo 19: 06/04/2022 Example of gravelly silty sand material, observed at location SBH01.



Photo 20: 06/04/2022 Example of silty gravelly sand material, observed at location SBH02.

Appendix H: Photographic Log



Photo 21: 07/04/2022 Example of concrete pavers, observed at location SBH04.



Photo 22: 07/04/2022 Example of silty gravelly sand material, observed at location SBH04.



Photo 23: 07/04/2022 Example of cobbly boulder (siltstone) material with trace gravel (crushed from auger), observed at location SBH03.



Photo 24: 07/04/2022 Example of siltstone material (crushed from auger), observed at location SBH03.

Appendix H: Photographic Log



Photo 25: 07/04/2022 Downhole image at location SBH05, with gravelly silty sand material visible.



Photo 26: 07/04/2022 Example of cobbly boulder (siltstone) material with trace gravel (crushed from auger), observed at location SBH05.



Photo 27: 07/04/2022 Example of silty gravelly sand material, observed at location SBH06.



Photo 28: 07/04/2022 Example of siltstone material with gravel inclusions (crushed from auger), observed at location SBH06.

Appendix H: Photographic Log



Photo 29: 12/04/2022 Groundwater well EMB17.



Photo 30: 12/04/2022 Groundwater well EMB18.



Photo 31: 12/04/2022 Groundwater well EMB19.



Photo 32: 11/04/2022 Groundwater well EMB20.

Appendix H: Photographic Log



Photo 33: 11/04/2022 Groundwater well EMB21.



Photo 34: 11/04/2022 Groundwater well EMB22.



Photo 35: 11/04/2022 Groundwater well EMB23.



Photo 36: 12/04/2022 Groundwater well EMB24.

Appendix H: Photographic Log



Photo 37: 12/04/2022 Groundwater well EMB25.

Appendix I **Logs**

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Explanatory Notes of Abbreviations and Terms

Used on Borehole and Excavation Logs

General

The “Geological and Engineering Log” presents data from drilling or excavation operations where material recovery is soil and or rock. Data presented is a combination of material recovered, regular sampling and in-situ testing. Excavations may present data obtained on the subsurface profile from observations of natural or man-made excavations. Logs may contain scaled graphical presentations, photography, or downhole imagery results. Logs may not contain all data types presented in these notes.

The “Non Core Drill Hole Engineering Log” presents data from drilling operations where a core barrel has not been used. The material is penetrated using methods other than those designed to recover core and is commonly soil or extremely to highly weathered. The “Cored Drill Hole Engineering Log” presents data from drilling operations where a core barrel has been used. The “Excavation - Geological Log” presents data obtained on the subsurface profile from observations of excavations, either natural or anthropogenic.

As far as is practicable, the data contained on the log sheet is factual. Some interpretation is inevitable with respect to the:

a. assessment of material boundaries in areas of partial sampling and recovery,

b. location of areas of core loss,

c. description and classification of material,

d. estimate of field strength, and

e. identification of drilling induced fractures.

Material description and classification is generally based on AS1726-2017 (as amended).

Drilling Method

Code	Description
ADT	Auger drilling with TC-bit
ADV	Auger drilling V-bit
AS	Auger screwing
AT	Air track
CA	Casing advancer
CC	Concrete core
CTR	Cable tool rig
DB	Wash bore drag bit
HA	Hand auger
HAND	Hand methods
HF	Hollow flight auger
HMLC	Diamond core 63.5 mm diameter
HQ / HRQ	Wire line core barrel 63.5 mm diameter
HQ3	Wire line core barrel 61.1 mm diameter
NDD	Non destructive drilling
NMLC	Diamond core 51.9 mm diameter
NQ	Wire line core barrel 47.6 mm diameter
NQ3	Wire line core barrel 45.1 mm diameter
PT	Continuous push tube
PQ	Wire line core barrel 85.0 mm diameter
RAB	Rotary air blast
RC	Reverse circulation
RD	Rotary blade or drag bit
RR	Rock roller
RT	Rotary tricone bit
SD	Sonic drilling
TBX	Tube-X
VC	Vibro-core drilling
WB	Wash bore drilling

Drilling Penetration

Ease of penetration in non-core drilling

Term	Description
VE	Very easy
E	Easy
F	Firm
H	Hard
VH	Very hard

Support and Casing

Code	Description	Code	Description
C	Casing	Hw	114.3 mm
M	Mud	Nw	88.9 mm
W	Water	PVC 150	150 mm

Core Run

Core lifts are identified by a line and depth with core loss per run as a percentage. Core loss is shown in the core run unless otherwise indicated.

Defect Spacing

The average distance between defects is measured parallel to the core axis in mm and may be expressed as a range or average.

Angle / Orientation

Angle from horizontal and orientation to magnetic north.

For inclined cored boreholes the Alpha and Beta angles are presented for orientated core. Alpha (α) is measured relative to the core axis, whilst Beta (β) is measured clockwise from the reference line looking down the core axis in the direction of drilling.

Excavation Method

Term	Definition
N	Natural exposure
X	Existing excavation
BB	Tractor mounted backhoe bucket
EX	Hydraulic excavator
EH	Hydraulic excavator with hammer
B	Bulldozer blade
R	Ripper

Water / Drilling Fluid

The drilling fluid used is identified and loss of return to the surface is estimated as a percentage, generally of each core lift.

Symbol	Description
	Water inflow
	Water outflow
	Water level: during drilling or immediately after completion of drilling
	Groundwater level with date observed prior to introduction of fluids or after standpipe construction
Not observed	The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole / test pit.
Not encountered	The borehole / test pit was dry soon after excavation, however groundwater could be present in less permeable strata. Inflow may have been observed had the borehole / test pit been left open for a longer period.

Colour

The colour of a soil or rock is described in a moist/wet condition using simple terms, such as black, white, grey, red, brown, orange, yellow green or blue. These are modified as necessary by 'pale', 'dark' or 'mottled'. Borderline colours are described as a combination of these colours (e.g. orange-brown). Where a soil or rock consists of a primary colour with a secondary mottling it is described as (primary colour) mottled (first colour) and (secondary colour). Where colour is described outside of the material description it is for the interval.



Description of Soil

vi. Soil name (BLOCK LETTERS)

vii. Plasticity or particle size of soil

viii. Colour (i.e. dominant colour of material)

ix. Secondary soil components names & estimated proportions, including their plasticity / particle characteristics, colour

x. Minor soil components name, estimated proportions, including their plasticity / particle characteristics, colour

xi. Other minor soil components

xii. Moisture condition

xiii. Consistency / density

xiv. Structure of soil, geological origin

xv. Additional observations

Particle Size

Term		Grain Size
Clay		< 2 µm
Silt		2 – 75 µm
Sand	Fine	0.075 – 0.21 mm
	Medium	0.21 – 0.6 mm
	Coarse	0.6 – 2.36 mm
Gravel	Fine	2.36 – 6.7 mm
	Medium	6.7 – 19 mm
	Coarse	19 – 63 mm
Cobbles		63 – 200 mm
Boulders		> 200 mm

Fine Grained and Coarse Grained Soils

Term	Description
Fine Grained Soil (cohesive)	More than 35% of the material less than 63 mm is smaller than 0.075 mm (silts and clays)
Coarse Grained Soil	More than 65% of the material less than 63 mm is larger than 0.075 mm (sands, gravels and cobbles)

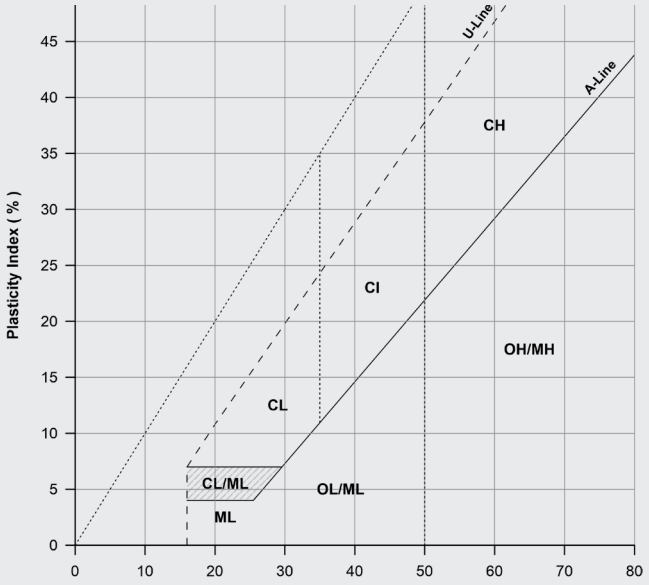
Descriptive Terms for Secondary and Minor Components

Designation of Components	In coarse grained soils				In fine grained soils	
	% Fines	Terminology	% Accessory coarse fraction	Terminology	% Sand / Gravel	Terminology
Minor	≤5	trace	≤ 15	trace	≤ 15	trace
	> 5, ≤ 12	with	> 15, ≤ 30	with	> 15, ≤ 30	with
Secondary	> 12	prefix	> 30	prefix	> 30	prefix

Plasticity – Fine Grained Soils

Liquid Limit (LL) %	Description
≤ 35	Low plasticity (L)
> 35 to ≤ 50	Medium plasticity (I)
> 50	High plasticity (H)

Plasticity Chart– Fine Grained Soils



Consistency Terms – Fine Grained Soils

Term	Undrained shear strength (kPa)	Indicative SPT (N) Blow Count	Field Guide to Consistency
Very Soft (VS)	< 12	0 – 2	Easily penetrated several centimetres by fist, exudes between fingers when squeezed in fist
Soft (S)	12 – 25	2 – 4	Easily penetrated several centimetres by thumb, easily moulded by light finger pressure
Firm (F)	25 – 50	4 – 8	Can be penetrated several centimetres by thumb with moderate effort, and moulded between the fingers by strong pressure
Stiff (St)	50 – 100	8 – 15	Readily indented by thumb but penetrated only with difficultly. Cannot be moulded by fingers
Very Stiff (VSt)	100 – 200	15 – 30	Readily indented by thumb nail, still very tough
Hard (H)	> 200	> 30	Indented with difficulty by thumb nail, brittle
Friable (Fr)	-		Can be easily crumbled or broken into small pieces

Density Terms – Coarse Grained Soils

Term	Density Index (%)	SPT (N) Blow Count
Very Loose (VL)	< 15	0 – 4
Loose (L)	15 – 35	4 – 10
Medium Dense (MD)	35 – 65	10 – 30
Dense (D)	65 – 85	30 – 50
Very Dense (VD)	> 85	> 50

Particle Characteristics – Coarse Grained Soils

Term	Description
Well graded	Having good representation of all particle sizes
Poorly graded	With one or more intermediate size poorly represented
Gap graded	With one or more intermediate sizes absent
Uniform	Essentially of one size

Angularity – Coarse Grained Soils

	Rounded
	Sub-rounded
	Angular
	Sub-angular

Origin of Soil

Fill	Formed by anthropogenic activity
Aeolian	Formed by wind
Alluvial	Formed by streams and rivers
Colluvial	Formed on slopes (talus)
Estuarine	Formed in marine environments
Lacustrine	Formed in lakes
Residual	Formed by weathering insitu

Soil Moisture

	Term	Code	Description
Coarse Grained	Dry	D	Looks and feels dry and free running
	Moist	M	Soil feels cool, darkened in colour, soils tend to stick together, soil grains do not run freely through fingers and no visible free water
	Wet	W	Soil feels cool, darkened in colour, soils tend to stick together, free water on remoulding
Fine Grained	Moist, Less than Plastic Limit	W < PL	Hard and friable or powdery, moisture content well below Plastic Limit
	Moist, Near Plastic Limit	W ≈ PL	Soil feels cool, darkened in colour, can be moulded, near Plastic Limit
	Moist, Wet of Plastic Limit	W > PL	Soil feels cool, dark, usually weakened, free water, moisture content well above Plastic Limit
	Wet, Near Liquid Limit	W ≈ LL	Soil exudes easily
	Wet, Wet of Liquid Limit	W > LL	Soil behaves as a liquid

Boundary Classifications

Soils possessing characteristics of two groups are designated by combinations of group symbols. For example, GW-GC, well graded gravel-sand mixture with clay binder.

Graphic Symbols

	Asphalt		MH
	CH		ML
	CI		OH
	CL		OL
	Concrete		PT
	Fill		SC
	GC		SM
	GM		SP
	GP		SW
	GW		Topsoil

Soil Classification

Soils are described in general accordance with AS1726-2017 as shown below.

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 63 mm and basing fractions on estimated mass)						GROUP SYMBOL	PRIMARY NAME
COARSE GRAINED SOILS More than 65% of the material is less than 63 mm and is larger than 0.075 mm	A particle size of 0.075 is about the smallest size distinguishable to the naked eye	**GRAVELS** More than half of coarse fraction is larger than 2.36 mm	**CLEAN GRAVELS** (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes, not enough fines to bind coarse grains, no dry strength; ≤ 5% fines		GW	GRAVEL
				Predominantly one size or a range of sizes with more intermediate sizes missing, not enough fines to bind coarse grains, no dry strength; ≤ 5% fines		GP	GRAVEL
			GRAVELS w/ FINES (Appreciable amount of fines)	'Dirty' materials with excess of non-plastic fines, none to medium dry strength; ≥ 12% silty fines		GM	SILTY GRAVEL
				'Dirty' materials with excess of plastic fines, medium to high dry strength; ≥ 12% clayey fines		GC	CLAYEY GRAVEL
		SANDS More than half of coarse fraction is smaller than 2.36 mm	**CLEAN SANDS** (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes, not enough fines to bind coarse grains, no dry strength; ≤ 5% fines		SW	SAND
				Predominantly one size or a range of sizes with more intermediate sizes missing, not enough fines to bind coarse grains, no dry strength; ≤ 5% fines		SP	SAND
			SANDS w/ FINES (Appreciable amount of fines)	'Dirty' materials with excess of non-plastic fines, none to medium dry strength; ≥ 12% silty fines		SM	SILTY SAND
				'Dirty' materials with excess of plastic fines, medium to high dry strength; ≥ 12% clayey fines		SC	CLAYEY SAND
FINE GRAINED SOILS More than 35% of the material less than 63 mm is less than 0.075 mm		**IDENTIFICATION PROCEDURES ON FRACTIONS** < 0.075 mm					
		SILTS AND CLAYS Liquid Limit < 50%	**DRY STRENGTH**	**DILATANCY**	**TOUGHNESS**	**GROUP SYMBOL**	**PRIMARY NAME**
			None to low	Slow to rapid	Low	ML	SILT
			Medium to high	≥ 12% clayey fines	Medium	CL, CI*	CLAY
			Low to medium	Slow	Low	OL	ORGANIC SILT
		SILTS AND CLAYS Liquid Limit > 50%	Low to medium	None to slow	Low to medium	MH	SILT
			High to very high	None	High	CH	CLAY
			Medium to high	None to very slow	Low to medium	OH	ORGANIC CLAY
HIGHLY ORGANIC SOILS: readily identified by colour, odour, spongy feel and frequently fibrous texture						PT	PEAT

* CL is low plasticity clay, CI is medium plasticity clay

Description of Rock

i. Rock name (BLOCK LETTERS)
ii. Grain size and mineralogy
iii. Colour (i.e. dominant colour of material)
iv. Fabric and texture
v. Features, inclusions, minor components, moisture content and durability
vi. Strength
vii. Weathering and/or alteration
viii. Rock mass properties – discontinuities and structure of rock
ix. Interpreted stratigraphic unit
x. Additional observations including geological structure

Simple rock names are used to provide a reasonable engineering description, rather than a precise geological classification. The rock name is chosen by considering the nature and shape of the grains or crystals, the texture and fabric of the rock material, the geological structure and setting, and information from the geological map of the area. Further guidance on the naming of rocks can be found in AS1726-2017, Tables 15, 16, 17 and 18. Typical rock types are described below, though subject to site specific variations.

Rock Type	Description	Example of Rock Name
Sedimentary	Formed by deposited beds of sediments, have grains that are cemented together and often rounded. Significant porosity	COMMON: Conglomerate, Breccia, Sandstone, Mudstone, Siltstone, Claystone ≥90% CARBONATE: Limestone, Dolomite, Calcirudite, Calcarenite, Calcisiltite, Calcilutite PYROCLASTIC: Agglomerate, Volcanic Breccia, Tuff
Igneous	Formed from molten rock and have a crystalline texture. Typically massive and low porosity. Rock types are from coarse to fine grained.	HIGH QUARTZ CONTENT: Granite, Microgranite, Rhyolite MODERATE QUARTZ CONTENT: Diorite, Microdiorite, Andesite LOW QUARTZ CONTENT: Gabbro, Dolerite, Basalt
Metamorphic	Formed when rocks are subject to heat and/or pressure and have typically have directional fabric. Typically have low porosity and crystalline structure. Rock types are from coarse to fine grained	FOLIATED: Gneiss, Schist, Phyllite, Slate NON-FOLIATED: Marble, Quartzite, Serpentinite, Hornfels
Duricrust	Formed as part of a weathering profile and show evidence of being cemented in situ. Cementation is typically irregular and exhibits replacement textures.	Ferricrete (Iron oxides and hydroxides) Silicrete (Silica) Calcrete (Calcium carbonate) Gypcrete (Gypsum)

Note: ( ) denotes dominant cementing mineralogy

Grain Size

Terms describing dominate grain size in sedimentary rocks.

Term	Grain size
Coarse	Mainly 0.6 mm to 2.0 mm
Medium	Mainly 0.2 mm to 0.6 mm
Fine	Mainly 0.06 mm (just visible) to 0.2 mm

Terms describing dominate grain size in igneous and metamorphic rocks

Term	Grain size
Coarse	Mainly greater than 2 mm
Medium	0.06 mm to 2 mm
Fine	Mainly less than 0.06 mm (just visible) to 0.2 mm

Texture and Fabric

Sedimentary rocks

Thickness	Bedding Term
< 6 mm	Thinly laminated
6 – 20 mm	Laminated
20 – 60 mm	Very thinly bedded
60 – 200 mm	Thinly bedded
0.2 – 0.6 m	Medium bedding
0.6 – 2 m	Thickly bedded
> 2 m	Very thickly bedded

Igneous rocks

Term	Definition
Amorphous	Indicates that the rock has no obvious crystalline structure
Crystalline	A regular molecular structure, showing crystal structure and symmetry.
Cryptocrystalline	The texture comprises crystals that are too small to recognise under an ordinary microscope. Indistinctly crystalline.
Porphyritic	Indicates the presence of phenocrysts (relatively large crystals in a fine grained ground mass) in igneous rocks.
Flow banded	Indicates visible flow lines in volcanic rocks and some intrusive rocks
Glassy	Entirely glass like. No crystalline units and without crystalline structure.
Vesicular	A texture of volcanic rocks that indicates the presence of vesicles (small gas bubbles). Where the vesicles are filled with a mineral substance they are termed Amygdales and the texture is Amygdaloidal.

Metamorphic

Term	Definition
Foliation	The parallel arrangement of minerals due to metamorphic process, which shall be defined by the terms in weak, moderate and strongly foliated.
Porphyroblastic	A texture indicating the presence of porphyroblasts (larger crystals formed by recrystallization during metamorphism, such as garnet or staurolite in a mica schist).
Cleavage	A type of foliation developed in fine grained metamorphic rocks such as slates.

Bedding and Fabric Development

Type	Definition
Massive	No obvious development of bedding – rock appears homogeneous
Poorly Developed	Bedding is barely obvious as faint mineralogical layering or grain size banding, but bedding planes are poorly defined.
Well Developed	Bedding is apparent in outcrops or drill core as distinct layers or lines marked by mineralogical or grain size layering.
Very Well Developed	Bedding is often marked by a distinct colour banding as well as by mineralogical or grain size layering.
Indistinct Fabric	There is little effect on strength properties
Distinct Fabric	The rock may break more easily parallel to the fabric

Rock Strength

Term (Code)	UCS (MPa)	$Is_{(50)}$ (MPa)	Field Guide to Strength
Very Low (VL)	0.6 - 2	> 0.03 to ≤ 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 3 cm thick can be broken by finger pressure.
Low (L)	2 - 6	> 0.1 to ≤ 0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blow of the pick point; has dull sound under hammer. A piece of core 150 mm long 50 mm in diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium (M)	6 - 20	> 0.3 to ≤ 1.0	Readily scored with a knife; a piece of core 150 mm long by 50 mm in diameter can be broken by hand with difficulty.
High (H)	20 - 60	> 1 to ≤ 3	A piece of core 150 mm long by 50 mm in diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High (VH)	60 - 200	> 3 to ≤ 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High (EH)	> 200	> 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Rock strength is assessed by laboratory Uniaxial Compressive Strength (UCS) testing and/or Point Load Strength Index (PLT) testing to obtain the $Is_{(50)}$ the strength table implies a 20 times correlation between $Is_{(50)}$ and UCS used for classification. Note however, multiplier may range from 4 (e.g. some carbonated and low strength rocks) to 40 (e.g. some igneous rocks and/or some high strength rocks). A site specific correlation based on testing, previous investigation or literature may be used where available. These terms refer to the strength of the rock material and not to the strength of the rock mass which may be considered weaker due to the effect of rock defects.

Visual Log

A diagrammatic plot of defects showing type, spacing and orientation in relation to the core axis.

- Defects open in situ or clay sealed
- Defects closed in-situ
- Drill induced fractures or handling breaks
- Infilled seam

Rock Weathering and or Alteration Classification

Term (Code)		Definition	
Residual soil (RS)		Soil developed on extremely weathered rock. The rock mass structure and substance fabric are no longer evident but the soil has not been significantly transported.	
Extremely weathered (XW) Extremely altered (XA)		Rock is weathered to such an extent that it has 'soil' properties, i.e, it either disintegrates or can be remoulded in water, but the texture of original rock is still evident.	
Highly weathered (HW) Highly Altered (HA)	Distinctly weathered (DW)* Distinctly Altered (DA)	Whole rock material is discoloured usually by extent that iron staining or bleaching and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased or decreased compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the original rock substance is no longer recognisable	*Where is it not practical to distinguish between 'HW' and MW'. Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores
Moderately weathered (MW) Moderately Altered (MA)		Whole rock material is discoloured usually by staining that original colour of the fresh rock is no longer recognisable	
Slightly weathered (SW) Slightly altered (SA)		Rock is slightly discoloured but shows little or no change of strength from fresh rock	
Fresh rock (FR)		Rock shows no sign of decomposition or staining.	

Rock Core Recovery

TCR = Total Core Recovery (%)

$$\frac{\text{Length of Core Recovered}}{\text{Length of Core run}} \times 100$$

SCR = Solid Core Recovery (%)

$$\frac{\text{Sum Length of Cylindrical Core Recovered}}{\text{Length of Core run}} \times 100$$

RQD = Rock Quality Designation (%)

$$\frac{\text{Sum Length of Sound Core Pieces > 100mm in length}}{\text{Length of Core run}} \times 100$$

Types of Defects

Term		Code	Description
Parting		PT	A surface or crack across which the rock has little or no tensile strength. Parallel or sub-parallel to layering (e.g. bedding) or a planar anisotropy in the rock material (i.e. cleavage). May be opened or closed.
Joint		JT	A surface or crack with no apparent shear displacement and across which the rock has little or no tensile strength, but which is not parallel or sub-parallel to layering or to planar anisotropy in the rock material. May be open or closed.
Sheared Surface		SR	A near planar, curved or undulating surface which is usually smooth, polished or slickensided and which shows evidence of shear displacement.
Sheared Zone		SZ	Zone of rock material with roughly parallel, near planar, curved, or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks.
Crushed Zone [a]		CZ	A zone of broken and disturbed ground containing more than one identifiable Crushed Seam.
Fracture Zone [a]		FZ	A zone of broken ground with parallel to opposing boundaries dominated by abundant, extremely closely to closely spaced defects, which may be intact or open, and planar, curved, undulating, irregular, or stepped, resulting in a dissected rock mass of angular trapezoidal, triangular or rectangular fragments.
Seam (SE)	Sheared Seam	SS	Seam of soil material with roughly parallel almost planar boundaries, composed of soil materials with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge-shaped blocks.
	Crushed Seam	CS	Seam of soil material with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock material which may be more weathered than the host rock. The seam has soil properties.
	Infilled Seam	IS	Seam of soil material usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1 mm thick may be described as a veneer or coating on a joint surface.
	Extremely Weathered Seam	XS	Seam of soil material, often with gradational boundaries. Formed by weathering of the rock material in place.
Fault [b]		FT	A fracture (defect) or fracture zone along which there has been an observable amount of displacement.
Vein [c]		VE	Any fracture that contains mineralized material. Veins can display either crack-normal extension or shear displacement coupled with crack-normal extension.
Vugh [a]		VG	An open void with secondary crystallisation which may be coated, partly or nearly completely filled.
Void [a]		VO	An open space created through natural or anthropogenic processes, including, but not limited to, caves, kettles, tunnels, mines, pipes, piping, landslides, faulting, shearing, dissolution, & erosion.
Mechanical Break		MB	A fracture or break induced or created by the sampling process (i.e. drilling (DB) handling (HB), drill lift (DL), excavation, or blasting).

All definitions as per AS1726-2017, except:

[a] SMEC Field Manual,
[b] British Standard BS 5930:2015, and
[c] Glossary of Geology (Fifth Edition - revised) (2011), American Geosciences Institute.

Defect Planarity

Code	Description
CR	Curved – A defect with a gradual change in orientation
IR	Irregular – A defect with many sharp changes in orientation
PL	Planar – Defect forms a continuous plane without variation in orientation
ST	Stepped – A defect with distinct sharp steps or step
UN	Undulose – A defect with undulations

Defect Roughness

Code	Description
RO	Rough – Many small surface irregularities generally related to the grain size of the parent rock
SM	Smooth – Few or no surface irregularities related to the grain size of the parent rock
PO	Polished – Planes have a distinct sheen or a smoothness
SL	Slickensided – Planes have a polished, grooved or striated surface consistent with differential movement of the parent rock along the plane
VR	Very rough – many large surface irregularities, amplitude generally more than 1mm

Type of Structures

Term	Code	Description
Bedding	BD	A layered arrangement of minerals parallel to the surface of deposition which has caused planar anisotropy in the rock substance.
Cleavage	CV	An alignment of fine grained minerals caused by deformation.
Schistosity	SH	A layered arrangement of minerals to each other
Foliation	FO	A planar alignment of minerals caused by deformation.
Void	VO	A completely empty space
Dyke	DK	Sheet-like bodies of igneous rock that cut across sedimentary bedding or foliations in rocks. They may be single or multiple in nature
Sill	SL	A sill is an intrusion of magma that spreads underground between the layers of another kind of rock
Contact	CX	A contact between intrusive and stratigraphic units.
Boundary	BN	A distinct boundary between two stratigraphic units
Vugh	VG	An open void with crystalisation

Note: Drill breaks (DB) and handling breaks (HB) are not included as natural discontinuity.

Discontinuity Spacing

Spacing (mm)	Description
> 6000	Extremely Widely Spaced
2000 - 6000	Very Widely Spaced
600 - 2000	Widely Spaced
200 - 600	Medium Spaced
60 - 200	Closely Spaced
20 - 60	Very Closely Spaced
< 20	Extremely Closely Spaced

Infill Material

Code	Name	Code	Name
Ap	Apatite	Ga	Galena
Ca	Calcite	Gp	Gypsum
Ch	Chlorite	Mn	Manganese
Cl	Clay	MnO	Manganese Oxide
Co	Coal	MS	Secondary mineral
Ep	Epidote	Py	Pyrite
Fe	Limonite/ Ironstone/ Goethite	Um	Unidentified mineral
FeO	Iron oxide	Qz	Quartz
Fs	Feldspar	X	Carbonaceous
		Ze	Zeolite

Discontinuity Observation

Term	Code	Description
Clean	CN	No visible coating or infill
Stain	SN	No visible coating or infill but surfaces are discoloured by mineral staining
Veneer < 1 mm	VN	A visible coating or soil or mineral substance but usually unable to be measured. If discontinuous over the plane, patchy veneer.
Coating > 1 mm to < 10 mm	CT	A visible coating or infilling of soil or mineral substance. Describe composition and thickness.
Filling (Filled) > 10 mm	FD	A visible filling of soil or mineral substance. Describe composition and thickness.

Discontinuity Orientation

Code	Description
VT	Vertical
HO	Horizontal
RL	Top right to bottom left
LR	Top left to bottom right

Samples and Field Tests

Code	Description
B	Bulk disturbed sample
BLK	Block sample
C	Core sample
CBR	CBR Mould Sample
CPT_u	Cone Penetration Test (with pore pressure)
DT	Dilatometer
DS	Small disturbed sample
ES	Soil sample for environmental testing
EW	Water sample for environmental testing
FP	Pressuremeter
G	Gas sample
H	Hydraulic fracturing
HP	Hand penetrometer test
I	Impression device
$Is_{(50)}$	Point Load Index
K	Permeability
LB	Large bulk disturbed sample
N	Standard penetration test result (N* denotes SPT sample recovery)
O	Core orientation
P	Piston sample
PID	Photoionisation detector reading in ppm
PP	Penetrometer
R	Hammer bouncing / refusal
SPT	Standard Penetration Test
U	Undisturbed push in sample
UCS	Uniaxial Compressive Strength
U50	Undisturbed tube sample (50 mm diameter)
U75	Undisturbed tube sample (75 mm diameter)
U100	Undisturbed tube sample (100 mm diameter)
VS	Vane shear test
● (A)	Axial Test
○ (D)	Diametral Test
□	Irregular Lump test

Laboratory Tests

Code	Description
ACM	Asbestos Containing Material
CD	Consolidated Drained
CU	Consolidated Undrained
LL	Liquid Limit
LS	Linear Shrinkage
MC	Moisture Content
MDD	Maximum Dry Density
OMC	Optimum Moisture Content
PBT	Plate Bearing Test
PI	Plasticity Index
PL	Plastic Limit
PSD	Particle Size Distribution
ρ_b	Bulk Density
ρ_p	Particle Density
ρ_d	Dry Density
UU	Undrained Unconsolidated

Backfill / Standpipe Detail

Symbol	Description	Symbol	Description
	Cement seal		Filter pack: sand filter
	Grout backfill GP -Cement BE - Bentonite Cement		Filter pack: gravel filter
	Un-slotted pipe		Bentonite seal
	Slotted pipe		Cutting – excavated material backfill
	Surface Completion: Monument Above Ground		Surface Completion: Gatic Ground Monument

Completion Details

Type	Description
Collapse	Exploratory hole collapsed before reaching planned depth
Equipment Failure	Boring or excavator equipment operational failure
Flooding	Flooding of excavation
Machine Limit	Limit of machine capability reached
Obstruction	Obstruction preventing further advancement
Operator Limit	Limit of operator limit/safety reached
Possible services	Indication of possible services below
Services present	Services encountered during exploratory hole
Squeezing	Hole squeezing boring equipment
Target Depth	Depth reached as planned
Target Depth (Instrumentation Installed)	Depth reached as planned instrumentation installed
Target Depth (Standpipe Installed)	Depth reached as planned open standpipe constructed
Material Refusal	Material preventing further advancement

Status

Code	Description
-2	Historic
-1	For information
0	Preliminary
1	Checked
2	Draft
3	Final

Geological & Engineering Log

Project	Vopak Site Investigations
Client	Vopak
Site	Vopak Darwin Terminal
Job No	30080099

East	706387.298 m	Start Date	04/04/2022
North	8619648.048 m	End Date	08/04/2022
Elevation	6.464 m		
Datum	MGA94 Zone 52/AHD		

Contractor	Proactive Drilling Services	Inclination	90°
Rig Type	Comacchio GEO305	Azimuth	
Mounting	Trailer	North	
		Survey	

SMEC
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Borehole Identifier: **EMB17**

Method	Penetration Resistance	Casing	Support	Water (Gain/Loss)	Run (TCR)	Sampling	Testing: SPT	Testing: PP (kPa) VS (kPa) Peak / Remoulded PID (ppm)	Testing: DCP	Water Level & Inflow	Depth (m) Elevation	Graphic Log	Soil Code	Depth RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Origin, Stratigraphic Unit & General Observations	Installation
NDD	F					ES					0.0 6.5			6.41	FILL GRAVEL: fine to coarse grained, sub-angular, grey, dark grey, brown (50mm).	D	L				FILL (ROADBASE)	
															FILL SILT: red, with fine to coarse grained, sub-angular gravel, trace fine to coarse grained sand.		MD				FILL 0.05: gradually increased proportion of gravel and cobbles with depth	
SFA						ES					1.0 5.5			1.00 5.46	FILL Cobbly BOULDERS (SILTSTONE): red, trace silt.		D - VD					
														1.30 5.16	SILTSTONE: red-brown.		VD				WEATHERED MATERIAL 1.30: assumed natural material, difficult to determine interface between natural and fill material as material is similar	
RAB	H										2.0 4.5											
											3.0 3.5					W						
											4.0 2.5											
											5.0 1.5			5.90								
											6.0 0.5				Hole Terminated at 5.90 m Target Depth (standpipe installed)							

Installation: EMB17 — 0.2, 1.2, 1.4, 2.0, 3.0, 4.0, 5.0, 5.9, 6.0

Observations and Comments

Standpipe constructed with Torque Cap and End Cap, surface completed with flush steel cover
No odour observed

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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SMEC 2.10.13 LIB_PR.GLB Log

Geological & Engineering Log

Project	Vopak Site Investigations	East	706472.002 m	Start Date	04/04/2022	Contractor	Proactive Drilling Services
Client	Vopak	North	8619788.071 m	End Date	04/04/2022	Rig Type	Comacchio GEO305
Site	Vopak Darwin Terminal	Elevation	6.858 m			Mounting	Trailer
Job No	30080099	Datum	MGA94 Zone 52/AHD				

Inclination	90°
Azimuth	North
Survey	

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Borehole Identifier: **EMB18**

Method	Penetration Resistance	Casing	Support	Water (Gain/Loss)	Run (TCR)	Sampling	Testing: SPT	Testing: PP (kPa) VS (kPa) Peak / Remoulded PID (ppm)	Testing: DCP	Water Level & Inflow	Depth (m) Elevation	Graphic Log	Soil Code	Depth RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Origin, Stratigraphic Unit & General Observations	Installation
NDD	F					ES					0.0 6.9			6.81	FILL GRAVEL: coarse grained, sub-angular, grey (50mm).	D	L				FILL (ROADBASE) FILL 0.05: organics (roots)	0.2 EMB18
															FILL SILT: red-brown, with fine to medium grained, sub-rounded to sub-angular gravel, trace fine to medium grained sand.		MD					
														0.50 6.36	FILL SILT: red, with cobbles and boulders (siltstone).		D - VD				0.50: gravel and cobbles getting bigger and more predominant with depth	
	F-H										1.0 5.9			1.20 5.66	SILTSTONE: red, with coarse grained, sub-angular gravel.		VD				WEATHERED MATERIAL 1.20: assumed natural material, difficult to determine interface between natural and fill material as material is similar 2.00: less gravel with depth	1.3 1.6 2.0
SFA						ES					2.0 4.9											
	H										3.0 3.9											3.0
										▶	4.0 2.9				4.00: becoming red-brown	M - W						4.0
											5.0 1.9				5.50: becoming red							5.0
											6.0 0.9			6.20								6.1 6.2 6.0
															Hole Terminated at 6.20 m Target Depth (standpipe installed)							

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SMEC 2.10.13 LIB_PR.GLB Log

Observations and Comments

Standpipe constructed with Torque Cap and End Cap, surface completed with flush steel cover
No odour observed

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Vopak Site Investigations	East	706247.264 m	Start Date	05/02/2022	Contractor	Proactive Drilling Services
Client	Vopak	North	8619736.510 m	End Date	05/02/2022	Rig Type	Comacchio GEO305
Site	Vopak Darwin Terminal	Elevation	6.323 m			Mounting	Trailer
Job No	30080099	Datum	MGA94 Zone 52/AHD				

Inclination	90°
Azimuth	North
Survey	

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Borehole Identifier: **EMB19**

Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Origin, Stratigraphic Unit & General Observations
0.0 / 6.3			6.24	FILL GRAVEL: coarse grained, sub-rounded to sub-angular, grey, red-grey (20mm).	D	D	FILL (ROADBASE)
			0.34 / 5.98	FILL Gravelly SILT: brown, red/brown, fine to coarse grained, sub-angular to sub-rounded gravel, trace fine grained sand (60mm).		MD - D	FILL 0.02: gravel and cobbles size increasing with depth
			0.60 / 5.72	FILL Cobbly GRAVEL: medium to coarse grained, sub-angular to sub-rounded, red-brown, trace silt.		VD	
				FILL COBBLES (SILTSTONE): red-brown, with coarse grained, sub-angular to sub-rounded gravel, trace silt.			
1.0 / 5.3				SILTSTONE: red-brown.			WEATHERED MATERIAL 0.60: assumed natural material, difficult to determine interface between natural and fill material as material is similar 1.10: colour transition through siltstone profile, same rock material
				1.10: becoming purple-grey 1.20: becoming red-brown			
				1.50: becoming red-brown, brown-yellow			
2.0 / 4.3							
3.0 / 3.3							
4.0 / 2.3				4.00: becoming red-grey-brown			
5.0 / 1.3					M		
6.0 / 0.3			6.10	Hole Terminated at 6.10 m Target Depth (standpipe installed)			

Method: NDD, SFA
Penetration Resistance: F, F-H, F, H
Casing
Support
Water (Gain/Loss)
Run (TCR)
Sampling: ES, ES
Testing: SPT; PP (kPa) VS (kPa) Peak / Remoulded PID (ppm); DCP
Water Level & Inflow

Installation: EMB19 — 0.2, 1.3, 1.5, 2.0, 3.0, 4.0, 5.0, 6.0, 6.1

Observations and Comments

Standpipe constructed with Torque Cap and End Cap, surface completed with flush steel cover
No odour observed

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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SMEC 2.10.13 LIB_PR.GLB Log

Geological & Engineering Log

Project	Vopak Site Investigations
Client	Vopak
Site	Vopak Darwin Terminal
Job No	30080099

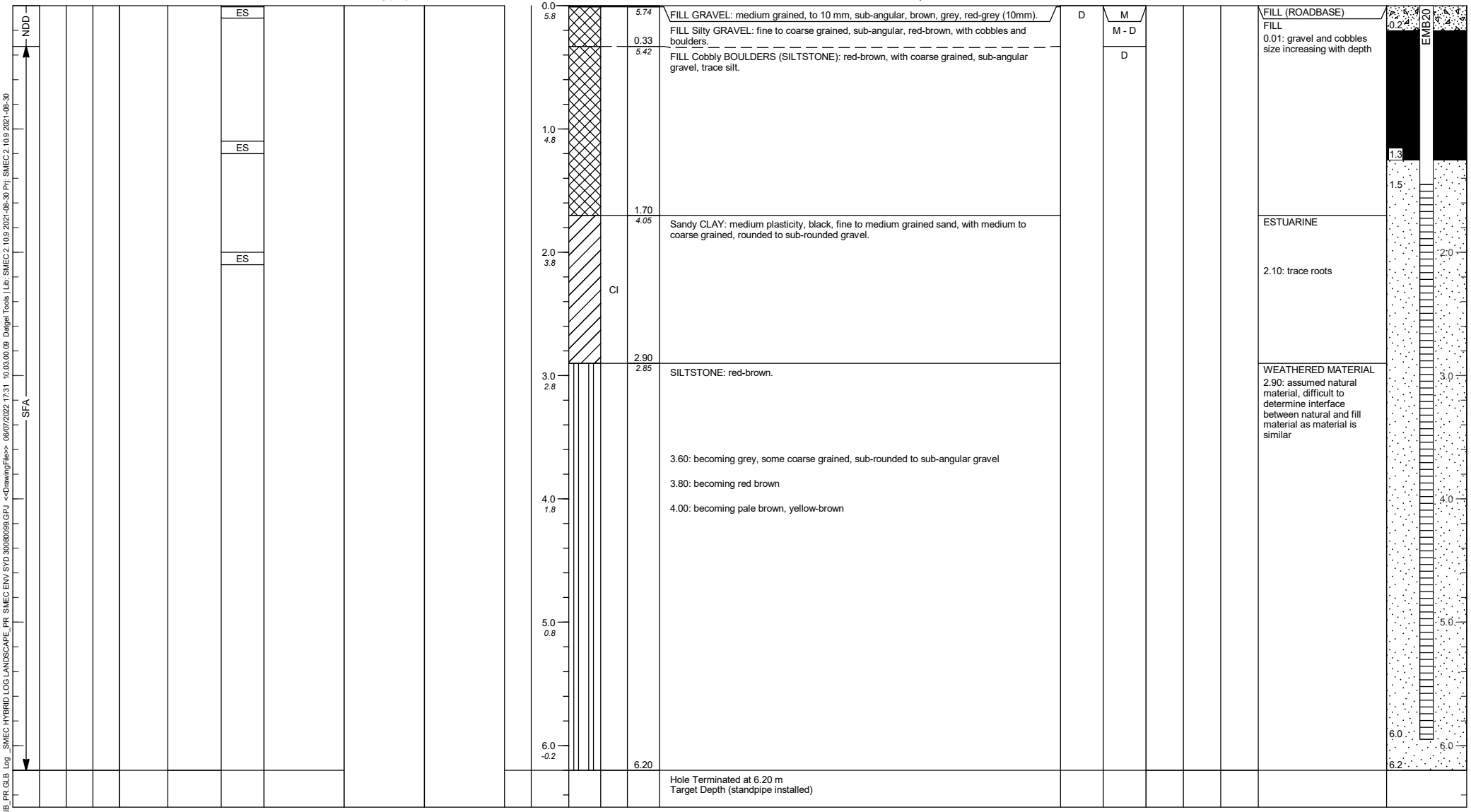
East	706243.171 m	Start Date	05/04/2022
North	8619860.507 m	End Date	05/04/2022
Elevation	5.752 m		
Datum	MGA94 Zone 52/AHD		

Contractor	Proactive Drilling Services	Inclination	90°
Rig Type	Comacchio GEO305	Azimuth	
Mounting	Trailer	North	
		Survey	

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Borehole Identifier: **EMB20**

Method	Penetration Resistance	Casing	Support	Water (Gain/Loss)	Run (TCR)	Sampling	Testing: SPT	Testing: PP (kPa) VS (kPa) Peak / Remoulded PID (ppm)	Testing: DCP	Water Level & Inflow	Depth (m) Elevation	Graphic Log	Soil Code	Depth RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Origin, Stratigraphic Unit & General Observations	Installation
NDD						ES					0.0 5.8			5.74	FILL GRAVEL: medium grained, to 10 mm, sub-angular, brown, grey, red-grey (10mm).	D	M				FILL (ROADBASE)	
															FILL Silty GRAVEL: fine to coarse grained, sub-angular, red-brown, with cobbles and boulders.		M - D				FILL 0.01: gravel and cobbles size increasing with depth	
														0.33 5.42	FILL Cobbly BOULDERS (SILTSTONE): red-brown, with coarse grained, sub-angular gravel, trace silt.		D					
						ES					1.0 4.8			1.70 4.05	Sandy CLAY: medium plasticity, black, fine to medium grained sand, with medium to coarse grained, rounded to sub-rounded gravel.						ESTUARINE 2.10: trace roots	
SFA						ES					2.0 3.8		CI	2.90 2.85	SILTSTONE: red-brown.						WEATHERED MATERIAL 2.90: assumed natural material, difficult to determine interface between natural and fill material as material is similar	
											3.0 2.8				3.60: becoming grey, some coarse grained, sub-rounded to sub-angular gravel							
											4.0 1.8				3.80: becoming red brown							
											5.0 0.8				4.00: becoming pale brown, yellow-brown							
											6.0 -0.2			6.20								
															Hole Terminated at 6.20 m Target Depth (standpipe installed)							



Observations and Comments

Standpipe constructed with Torque Cap and End Cap, surface completed with flush steel cover
No odour observed

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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SMEC 2.10.13 LIB_PR.GLB Log

Geological & Engineering Log

Project	Vopak Site Investigations	East		Start Date	05/04/2022	Contractor	Proactive Drilling Services
Client	Vopak	North		End Date	05/04/2022	Rig Type	Comacchio GEO305
Site	Vopak Darwin Terminal	Elevation				Mounting	Trailer
Job No	30080099	Datum	MGA94 Zone 52/AHD				

Inclination 90°
Azimuth
North
Survey

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Borehole Identifier: **EMB20-A**

Method	Penetration Resistance	Casing	Support	Water (Gain/Loss)	Run (TCR)	Sampling	Testing: SPT	Testing: PP (kPa) VS (kPa) Peak / Remoulded PID (ppm)	Testing: DCP	Water Level & Inflow	Depth (m) *Elevation*	Graphic Log	Soil Code	Depth *RL*	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Origin, Stratigraphic Unit & General Observations	Installation
NDD	F										0.0				FILL GRAVEL: medium grained, to 10 mm, sub-angular, brown, grey, red-grey (10mm). Hole Terminated at 0.01 m NDD Refusal	D	M - D				FILL (ROADBASE)	

1.0 2.0 3.0 4.0 5.0 6.0

Observations and Comments

No odour observed

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Vopak Site Investigations	East	706329.237 m	Start Date	05/04/2022	Contractor	Proactive Drilling Services
Client	Vopak	North	8619983.523 m	End Date	09/04/2022	Rig Type	Comacchio GEO305
Site	Vopak Darwin Terminal	Elevation	5.679 m			Mounting	Trailer
Job No	30080099	Datum	MGA94 Zone 52/AHD				

Inclination 90°
Azimuth North
Survey

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Borehole Identifier: **EMB21**

Method	Penetration Resistance	Casing	Support	Water (Gain/Loss)	Run (TCR)	Sampling	Testing: SPT	Testing: PP (kPa) VS (kPa) Peak / Remoulded PID (ppm)	Testing: DCP	Water Level & Inflow	Depth (m) Elevation	Graphic Log	Soil Code	Depth RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Origin, Stratigraphic Unit & General Observations	Installation
NDD						ES					0.0 5.7			0.18 5.50	FILL GRAVEL: medium grained, to 10 mm, sub-angular, brown, grey, red-grey (10mm).	D	MD - D				FILL (ROADBASE) FILL WEATHERED MATERIAL 0.18: assumed natural material, difficult to determine interface between natural and fill material as material is similar	0.2 1.3 1.5 EMB21
SFA															FILL Gravelly SILT: red, red-brown, fine to coarse grained, sub-angular gravel, trace fine to coarse grained sand.		VD					
															SILTSTONE: red-brown.							
H											1.0 4.7											2.0
											2.0 3.7											
																W						3.0
RAB											3.0 2.7											
																						4.0
											4.0 1.7											
																						5.0
											5.0 0.7											
														6.00								6.0
											6.0 -0.3				Hole Terminated at 6.00 m Target Depth (standpipe installed)							

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SMEC 2.10.13 LIB_PR.GLB Log

Observations and Comments

Standpipe constructed with Torque Cap and End Cap, surface completed with flush steel cover
No odour observed

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

Logged By	PV	Date	09/04/2022
Approved By	MF	Date	06/07/2022
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Geological & Engineering Log

Project	Vopak Site Investigations
Client	Vopak
Site	Vopak Darwin Terminal
Job No	30080099

East	706291.781 m	Start Date	05/04/2022
North	8619877.777 m	End Date	05/04/2022
Elevation	5.779 m		
Datum	MGA94 Zone 52/AHD		

Contractor	Proactive Drilling Services	Inclination	90°
Rig Type	Comacchio GEO305	Azimuth	
Mounting	Trailer	North	
		Survey	

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **EMB22**

Method	Penetration Resistance	Casing	Support	Water (Gain/Loss)	Run (TCR)	Sampling	Testing: SPT	Testing: PP (kPa) VS (kPa) Peak / Remoulded PID (ppm)	Testing: DCP	Water Level & Inflow	Depth (m) Elevation	Graphic Log	Soil Code	Depth RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Origin, Stratigraphic Unit & General Observations	Installation
NDD	F					ES					0.0 5.8			5.76	FILL GRAVEL: medium grained, to 10 mm, sub-angular, brown, grey, red-grey (20mm).	D	MD				FILL (ROADBASE) FILL 0.02: gravel and cobbles size increasing with depth	0.2 EMB22 1.3
SFA	H													0.30 5.48	FILL Silty GRAVEL: fine to coarse grained, sub-angular, red-brown, trace cobbles, trace fine to medium grained sand.						WEATHERED MATERIAL 0.30: assumed natural material, difficult to determine interface between natural and fill material as material is similar	1.5
						ES					1.0 4.8				SILTSTONE: red-brown.		VD					2.0
											2.0 3.8					W						
						ES					3.0 2.8			3.10								3.1 3.0
															Hole Terminated at 3.10 m Refusal (standpipe installed)							
											4.0 1.8											4.0
											5.0 0.8											5.0
											6.0 -0.2											6.0

Observations and Comments

Standpipe constructed with Torque Cap and End Cap, surface completed with flush steel cover
No odour observed

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Approved By	MF	Date	06/07/2022
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Geological & Engineering Log

Project	Vopak Site Investigations	East	706407.915 m	Start Date	07/04/2022	Contractor	Proactive Drilling Services
Client	Vopak	North	8619821.061 m	End Date	08/04/2022	Rig Type	Comacchio GEO305
Site	Vopak Darwin Terminal	Elevation	6.162 m			Mounting	Trailer
Job No	30080099	Datum	MGA94 Zone 52/AHD				

Inclination 90°
Azimuth North
Survey

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **EMB23**

Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Origin, Stratigraphic Unit & General Observations
0.0 / 6.2				FILL CONCRETE PAVERS: (80mm).	D	VD	FILL (PAVERS)
			0.21 / 5.95	FILL Silty SAND: fine to coarse grained, red-brown, with fine to coarse grained, sub-rounded to sub-angular gravel.		L - M	FILL 0.08: gravel and cobbles size increasing with depth
				FILL Sandy Silty GRAVEL (SILTSTONE) with cobbles: fine to coarse grained, sub-rounded to sub-angular, medium to coarse grained sand.		M - D	
			0.73				
			0.90 / 5.26	FILL BOULDERS (SILTSTONE): red-brown, with cobbles, trace sub-rounded gravel.		VD	
1.0 / 5.2				SILTSTONE: red-brown, orange.			WEATHERED MATERIAL 0.90: assumed natural material, difficult to determine interface between natural and fill material as material is similar
2.0 / 4.2				2.00: becoming red-brown	M		
					W		2.80-3.50: very wet, bands of softer material
3.0 / 3.2							
4.0 / 2.2							
5.0 / 1.2							
6.0 / 0.2			6.00	Hole Terminated at 6.00 m Target Depth (standpipe installed)			

Method: SFA, NDD, RAB
Penetration Resistance: H, F, F-H, F-H, H
Sampling: ES, ES, ES
Water Level & Inflow: ▶ at 2.0 / 4.2

Installation: EMB23 — 0.2, 1.3, 1.5, 2.0, 3.0, 4.0, 5.0, 6.0

Observations and Comments

Standpipe constructed with Torque Cap and End Cap, surface completed with flush steel cover
No odour observed

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

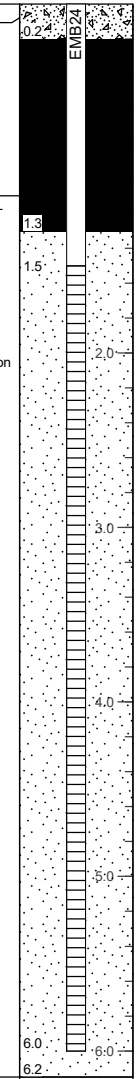
Project	Vopak Site Investigations	East	706410.748 m	Start Date	08/04/2022	Contractor	Proactive Drilling Services
Client	Vopak	North	8619790.869 m	End Date	08/04/2022	Rig Type	Comacchio GEO305
Site	Vopak Darwin Terminal	Elevation	6.499 m			Mounting	Trailer
Job No	30080099	Datum	MGA94 Zone 52/AHD				

Inclination 90°
Azimuth North
Survey

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **EMB24**

Method	Penetration Resistance	Casing	Support	Water (Gain/Loss)	Run (TCR)	Sampling	Testing: SPT	Testing: PP (kPa) VS (kPa) Peak / Remoulded PID (ppm)	Testing: DCP	Water Level & Inflow	Depth (m) Elevation	Graphic Log	Soil Code	Depth RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Origin, Stratigraphic Unit & General Observations	Installation
SFA	H					ES					0.0 6.5				FILL CONCRETE PAVERS: (80mm).	D	VD				FILL (PAVERS)	
NDD	F													0.25 6.25	FILL Silty Gravelly SAND: fine to coarse grained, red-brown, fine to coarse grained, sub-rounded to sub-angular gravel.		L - M				FILL 0.08: gravel and cobbles size increasing with depth	
															FILL Gravelly COBBLES (SILTSTONE): medium to coarse grained, red-brown, fine to coarse grained, sub-rounded to sub-angular gravel, trace red silt.		D					
						ES								0.63 5.87	FILL BOULDERS (SILTSTONE): red-brown.		VD					
											1.0 5.5			1.10 5.40	SILTSTONE: pale yellow, red-brown. 1.20: becoming red-brown						WEATHERED MATERIAL 1.10: assumed natural material, difficult to determine interface between natural and fill material as material is similar	
						ES									1.60: becoming brown, grey-brown							
											2.0 4.5				2.00: becoming red-brown						2.00: lots of colour variation through siltstone layer	
						ES									2.60: becoming red-brown, grey-brown							
											3.0 3.5				3.00: becoming red-brown	M						
											4.0 2.5											
											5.0 1.5											
											6.0 0.5			6.15	Hole Terminated at 6.15 m Target Depth (standpipe installed)							



Observations and Comments

Standpipe constructed with Torque Cap and End Cap, surface completed with flush steel cover
No odour observed

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Vopak Site Investigations	East	706381.639 m	Start Date	06/04/2022	Contractor	Proactive Drilling Services
Client	Vopak	North	8619785.002 m	End Date	08/04/2022	Rig Type	Comacchio GEO305
Site	Vopak Darwin Terminal	Elevation	6.103 m			Mounting	Trailer
Job No	30080099	Datum	MGA94 Zone 52/AHD				

Inclination 90°
Azimuth North
Survey

SMEC
Member of the Surbana Jurong Group

Borehole Identifier: **EMB25**

Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Origin, Stratigraphic Unit & General Observations
0.0 / 6.1			0.20 / 5.90	FILL CONCRETE PAVERS: (80mm).	D	VD	FILL (PAVERS)
				FILL Silty Gravelly SAND: fine to coarse grained, brown, red-brown, fine to medium, sub-angular gravel.		L	FILL 0.08: gravel and cobbles size increasing with depth
				FILL Silty Sandy GRAVEL: medium to coarse grained, sub-rounded to sub-angular, brown, fine to coarse grained sand, with cobbles.		M	
			0.80 / 5.30	FILL Cobbly BOULDERS (SILTSTONE): brown, red-brown, trace gravel, trace silt.		M - D	
1.0 / 5.1			1.20 / 4.90	SILTSTONE: red-orange.		VD	WEATHERED MATERIAL 1.20: assumed natural material, difficult to determine interface between natural and fill material as material is similar
2.0 / 4.1					M		
					W		
3.0 / 3.1							
4.0 / 2.1							
5.0 / 1.1							
6.0 / 0.1			6.00	Hole Terminated at 6.00 m Target Depth (standpipe installed)			

Method: NDD, SFA, RAB
Penetration Resistance: H, F, F-H, H, H
Sampling: ES, ES
Testing: SPT, PP (kPa), VS (kPa), Peak / Remoulded PID (ppm), DCP
Water Level & Inflow
Casing, Support, Water (Gain/Loss), Run (TCR)
Alteration, Weathering, Rock Strength

Installation: EMB25 — 0.2, 1.3, 1.5, 2.0, 3.0, 4.0, 5.0, 6.0

Observations and Comments

Standpipe constructed with Torque Cap and End Cap, surface completed with flush steel cover
No odour observed

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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SMEC 2.10.13 LIB_PR.GLB Log

Geological & Engineering Log

Project	Vopak Site Investigations	East	706390.453 m	Start Date	06/04/2022	Contractor	Proactive Drilling Services
Client	Vopak	North	8619797.461 m	End Date	06/04/2022	Rig Type	Comacchio GEO305
Site	Vopak Darwin Terminal	Elevation	6.072 m			Mounting	Trailer
Job No	30080099	Datum	MGA94 Zone 52/AHD				

Inclination 90°
Azimuth North
Survey

SMEC
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Borehole Identifier: **SBH01**

Method	Penetration Resistance	Casing	Support	Water (Gain/Loss)	Run (TCR)	Sampling	Testing: SPT	Testing: PP (kPa) VS (kPa) Peak / Remoulded PID (ppm)	Testing: DCP	Water Level & Inflow	Depth (m) Elevation	Graphic Log	Soil Code	Depth RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Origin, Stratigraphic Unit & General Observations	Installation
NDD, SFA	F, H					ES					0.0 6.1				FILL CONCRETE PAVERS: (80mm).		VD				FILL (PAVERS)	
														5.92	FILL Gravelly Silty SAND: fine to coarse grained, brown, fine to medium grained, sub-rounded to sub-angular gravel (70mm).		L				FILL 0.08: gravel and cobbles size increasing with depth	
															FILL Gravelly COBBLES (SILTSTONE): fine to coarse grained, sub-rounded to sub-angular, brown, with medium to coarse grained sand.		M - D					
														0.80 5.27	SILTSTONE: red-brown, trace white silty clay.		VD				WEATHERED MATERIAL 0.80: assumed natural material, difficult to determine interface between natural and fill material as material is similar	
						ES					1.0 5.1			1.20 4.87	SILTSTONE: red-brown.							1.0
						ES					2.0 4.1			2.00	Hole Terminated at 2.00 m Target Depth reached in natural/rock material							2.0
											3.0 3.1											3.0
											4.0 2.1											4.0
											5.0 1.1											5.0
											6.0 0.1											6.0

Observations and Comments
No odour observed

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Vopak Site Investigations	East	706393.787 m	Start Date	06/04/2022	Contractor	Proactive Drilling Services
Client	Vopak	North	8619801.352 m	End Date	07/04/2022	Rig Type	Comacchio GEO305
Site	Vopak Darwin Terminal	Elevation	6.121 m			Mounting	Trailer
Job No	30080099	Datum	MGA94 Zone 52/AHD				

Inclination 90°
Azimuth North
Survey

SMEC
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Borehole Identifier: **SBH02**

Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Origin, Stratigraphic Unit & General Observations	Installation
0.0 / 6.1				FILL CONCRETE PAVERS: (80mm).	D	VD				FILL (PAVERS)	
			5.97	FILL Gravelly Silty SAND: fine to coarse grained, brown, red-brown, fine to coarse grained, sub-rounded to sub-angular gravel (70mm).		L - M				FILL 0.08: gravel and cobbles size increasing with depth	
			0.50 / 5.62	FILL Gravelly COBBLES (SILTSTONE): medium to coarse grained, sub-rounded to sub-angular, brown, red-brown, trace silt.		M					
				FILL BOULDERS (SILTSTONE): red-brown, with cobbles.							
1.0 / 5.1			1.40 / 4.72	SILTSTONE: red-brown.	M					WEATHERED MATERIAL 1.40: assumed natural material, difficult to determine interface between natural and fill material as material is similar	1.0
2.0 / 4.1			2.10	Hole Terminated at 2.10 m Target Depth reached in natural/rock material							2.0
3.0 / 3.1											3.0
4.0 / 2.1											4.0
5.0 / 1.1											5.0
6.0 / 0.1											6.0

Method: SFA, NDD
Penetration Resistance: F, F-H, H
Casing
Support
Water (Gain/Loss)
Run (TCR)
Sampling: ES
Testing: SPT; PP (kPa) VS (kPa) Peak / Remoulded PID (ppm); DCP
Water Level & Inflow

Observations and Comments

No odour observed

Notes

Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Vopak Site Investigations	East	706395.628 m	Start Date	07/04/2022	Contractor	Proactive Drilling Services
Client	Vopak	North	8619804.940 m	End Date	07/04/2022	Rig Type	Comacchio GEO305
Site	Vopak Darwin Terminal	Elevation	5.285 m			Mounting	Trailer
Job No	30080099	Datum	MGA94 Zone 52/AHD				

Inclination	90°
Azimuth	North
Survey	

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Borehole Identifier: **SBH03**

Method	Penetration Resistance	Casing	Support	Water (Gain/Loss)	Run (TCR)	Sampling	Testing: SPT	Testing: PP (kPa) VS (kPa) Peak / Remoulded PID (ppm)	Testing: DCP	Water Level & Inflow	Depth (m) Elevation	Graphic Log	Soil Code	Depth RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Origin, Stratigraphic Unit & General Observations	Installation
NDD, SFA	F, H					ES					0.0 5.3			0.19 5.10	FILL CONCRETE PAVERS: (80mm).	D	VD				FILL (PAVERS)	
															FILL Silty Gravelly SAND: fine to coarse grained, brown, red-brown, fine to medium grained, sub-rounded to sub-angular gravel.		L - M				FILL 0.08: gravel and cobbles size increasing with depth	
														0.52 4.77	FILL Silty Sandy GRAVEL: fine to coarse grained, sub-angular to sub-rounded, brown, red-brown, fine to coarse grained sand, with cobbles.		M - D					
						ES									FILL Cobbly BOULDERS (SILTSTONE): red-brown, trace gravel.		VD					
														1.00								
SFA	H					ES					1.0 4.3			4.29	SILTSTONE: red-brown, pale brown.						WEATHERED MATERIAL 1.00: assumed natural material, difficult to determine interface between natural and fill material as material is similar	1.0
															1.30: becoming orange-yellow-brown							
															1.70: becoming orange-red-brown							
						ES								1.90								
											2.0 3.3				Hole Terminated at 1.90 m Target Depth reached in natural/rock material							2.0
											3.0 2.3											3.0
											4.0 1.3											4.0
											5.0 0.3											5.0
											6.0 -0.7											6.0

Observations and Comments
No odour observed

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Vopak Site Investigations	East	706404.791 m	Start Date	07/04/2022	Contractor	Proactive Drilling Services
Client	Vopak	North	8619816.995 m	End Date	07/04/2022	Rig Type	Comacchio GEO305
Site	Vopak Darwin Terminal	Elevation	6.016 m			Mounting	Trailer
Job No	30080099	Datum	MGA94 Zone 52/AHD				

Inclination	90°
Azimuth	North
Survey	

SMEC
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Borehole Identifier: **SBH04**

Depth (m) / Elevation	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Origin, Stratigraphic Unit & General Observations	Installation
0.0 / 6.0	5.94	FILL CONCRETE PAVERS: (80mm).	D	VD	FILL (PAVERS)	
	0.27 / 5.75	FILL Silty Gravelly SAND: fine to coarse grained, red-brown, fine to medium grained, sub-rounded to sub-angular gravel.		L - M	FILL	
		FILL Silty Gravelly COBBLES (SILTSTONE): fine to coarse grained, sub-angular to sub-rounded, brown, red-brown, with coarse grained sand.		M - D	0.08: gravel and cobbles size increasing with depth	
	0.74 / 5.28	FILL BOULDERS (SILTSTONE): brown, red-brown, with coarse grained sand.		D		
1.0 / 5.0	1.00 / 5.02	SILTSTONE: red-orange-brown.		VD	WEATHERED MATERIAL 1.00: assumed natural material, difficult to determine interface between natural and fill material as material is similar	1.0
	1.80	Hole Terminated at 1.80 m Target Depth reached in natural/rock material				
2.0 / 4.0						2.0
3.0 / 3.0						3.0
4.0 / 2.0						4.0
5.0 / 1.0						5.0
6.0 / 0.0						6.0

Method: SFA, NDD — Penetration Resistance: H, F, H — Sampling: ES, ES, ES — Testing: SPT, PP (kPa) VS (kPa) Peak / Remoulded PID (ppm), DCP — Casing, Support, Water (Gain/Loss), Run (TCR), Water Level & Inflow, Graphic Log, Soil Code, Rock Strength, Alteration, Weathering

Observations and Comments
No odour observed

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Vopak Site Investigations	East	706394.883 m	Start Date	07/04/2022	Contractor	Proactive Drilling Services
Client	Vopak	North	8619803.049 m	End Date	07/04/2022	Rig Type	Comacchio GEO305
Site	Vopak Darwin Terminal	Elevation	6.103 m			Mounting	Trailer
Job No	30080099	Datum	MGA94 Zone 52/AHD				

Inclination 90°
Azimuth North
Survey

SMEC
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Borehole Identifier: **SBH05**

Depth (m) / Elevation	Graphic Log	Soil Code	Depth / RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Origin, Stratigraphic Unit & General Observations	Installation
0.0 / 6.1			0.20 / 5.90	FILL CONCRETE PAVERS: (80mm).	D	VD	FILL (PAVERS)	
				FILL Gravelly Silty SAND: fine to coarse grained, brown, red-brown, fine to coarse grained, sub-angular gravel.		L - M	FILL	
			0.55 / 5.55	FILL Silty Sandy GRAVEL: fine to coarse grained, sub-rounded to sub-angular, red-brown, brown, fine to coarse grained sand.		M - D	0.08: gravel and cobbles size increasing with depth	
			0.90 / 5.20	FILL Gravelly COBBLES (SILTSTONE): medium to coarse grained, brown, red-brown, trace silt.				
1.0 / 5.1			1.40 / 4.70	FILL Cobbly BOULDERS (SILTSTONE): orange brown, red-brown, trace silt, trace coarse grained gravel.		VD	WEATHERED MATERIAL	1.0
2.0 / 4.1			2.80	SILTSTONE: red-brown-orange.	M		1.40: assumed natural material, difficult to determine interface between natural and fill material as material is similar	2.0
3.0 / 3.1				Hole Terminated at 2.80 m Target Depth reached in natural/rock material				3.0
4.0 / 2.1								4.0
5.0 / 1.1								5.0
6.0 / 0.1								6.0

Method: SFA, NDD
Penetration Resistance: H, F, H
Sampling: ES, ES, ES, ES
Testing: SPT, PP (kPa) VS (kPa) Peak / Remoulded PID (ppm), DCP
Water Level & Inflow
Casing
Support
Water (Gain/Loss)
Run (TCR)
Rock Strength
Alteration
Weathering

Observations and Comments
No odour observed

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Geological & Engineering Log

Project	Vopak Site Investigations
Client	Vopak
Site	Vopak Darwin Terminal
Job No	30080099

East	706398.816 m	Start Date	07/04/2022
North	8619799.963 m	End Date	07/04/2022
Elevation	6.253 m		
Datum	MGA94 Zone 52/AHD		

Contractor	Proactive Drilling Services	Inclination	90°
Rig Type	Comacchio GEO305	Azimuth	
Mounting	Trailer	North	
		Survey	

SMEC
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Borehole Identifier: **SBH06**

Method	Penetration Resistance	Casing	Support	Water (Gain/Loss)	Run (TCR)	Sampling	Testing: SPT	Testing: PP (kPa) VS (kPa) Peak / Remoulded PID (ppm)	Testing: DCP	Water Level & Inflow	Depth (m) Elevation	Graphic Log	Soil Code	Depth RL	Soil / Rock Material Description	Moisture Condition	Consistency Density	Alteration	Weathering	Rock Strength	Origin, Stratigraphic Unit & General Observations	Installation
NDD	H					ES					0.0 6.3				FILL CONCRETE PAVERS: (80mm).	2.9	VD				FILL (PAVERS)	
														0.23 6.02	FILL Silty Gravelly SAND: fine to coarse grained, red-brown, fine to coarse grained, sub-angular to sub-rounded gravel.		L - MD				FILL 0.08: gravel and cobbles size increasing with depth	
															FILL Sandy Silty GRAVEL: fine to coarse grained, sub-angular to sub-rounded, red-brown, fine to coarse grained sand.		MD - D					
														0.59 0.72 5.53	FILL Gravelly COBBLES (SILTSTONE): medium to coarse grained, red-brown, trace silt. FILL BOULDERS (SILTSTONE): red-brown, with cobbles, with coarse grained gravel.		VD					
						ES					1.0 5.3											1.0
SFA	F													1.40 4.85	SILTSTONE: red-brown, with gravel inclusions, grey-red, coarse grained, sub-rounded.						WEATHERED MATERIAL 1.40: assumed natural material, difficult to determine interface between natural and fill material as material is similar	
						ES					2.0 4.3											2.0
						ES								2.90	Hole Terminated at 2.90 m Target Depth reached in natural/rock material							
											3.0 3.3											3.0
											4.0 2.3											4.0
											5.0 1.3											5.0
											6.0 0.3											6.0

Observations and Comments
No odour observed

Notes
Classifications compliant with AS1726-2017: Geotechnical Site Investigations unless otherwise noted.
Defect Log Abridged. Additional detail in digital dataset. Lugeon: BS5930:1999
For Inclined Holes: Angles reported in defects are apparent dip from core horizontal unless as α or β.
Refer to explanatory notes for SMEC logs for details of abbreviations or basis of description.

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Approved By	MF	Date	06/07/2022
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SMEC 2.10.13 LIB_PR.GLB Log SMEC HYBRID LOG LANDSCAPE_PR SMEC ENV SYD 30080099.GPJ <<DrawingFile>> 06/07/2022 17:32 10.03.00.09 Datgel Tools | Lib: SMEC 2.10.9 2021-08-30 Prj: SMEC 2.10.9 2021-08-30

Appendix J **Field Monitoring Results**

J1. PID Record Sheet

J2. Groundwater Monitoring Records

J3. Water Level Gauging Records

SMEC Australia Pty Ltd
20 Berry St, North Sydney NSW 2060
Phone: (02) 9925 5555 Fax: (02) 9925 5566

Member of the Surbana Jurong Group

PHOTOIONISATION DETECTOR

Project:	Vopak Site Investigations	**Project No:**	30080099
Location:	Vopak Darwin Terminal	**Date:**	04/04/2022 - 06/04/2022
Feature:	-	**Tested By:**	PV

Equipment: Photoionisation Detector
Equip. ID: SN/ 592-915461 **Calibrated on:** 18/03/2022 by AES
Is calibration certificate attached?: Yes
Method: Place portion of sample in separate ziplock bag and allowing to sit for 15 minutes. Pierce and record maximum PID result (ppmv) on fieldnotes. Discard sample onsite.

Borehole ID	Depth (m)	PID Screen Date	PID result (ppmv)	Comments (ie. Odours, staining, fill)
EMB18	0.1-0.2	04/04/2022	0.0	Nil odour, nil staining
EMB18	1.4-1.5	04/04/2022	19.2	Nil odour, nil staining
EMB17	0.05-0.15	04/04/2022	0.6	Nil odour, nil staining
EMB17	1.2-1.3	04/04/2022	0.0	Nil odour, nil staining
EMB19	0.02-0.05	05/04/2022	0.3	Nil odour, nil staining
EMB19	0.9-1.0	05/04/2022	1.0	Nil odour, nil staining
EMB21	0.01-0.10	05/04/2022	0.3	Nil odour, nil staining
EMB20	0.01-0.10	05/04/2022	0.6	Nil odour, nil staining
EMB20	1.1-1.2	05/04/2022	0.1	Nil odour, nil staining
EMB20	2.0-2.1	05/04/2022	0.4	Nil odour, nil staining
EMB22	0.02-0.1	05/04/2022	0.3	Nil odour, nil staining
SBH02	0.08-0.15	06/04/2022	0.1	Nil odour, nil staining

Comments:

Abbreviations:
ppmv parts per million (volume)
PID Photoionisation detector

GROUNDWATER SAMPLING RECORD SHEET

DATE: 12/04/2022 LOCATION: Vopak PROJECT: 300800901

Bore Name	EWB19	**Stickup (m)**	-0.12
Standing Water Level	1.82	**Ref Point** mTOC / mTOM / mBMP	
Sampling Method	Bailer / Pump / Other		

24.66

NOTE: Include UNITS on meter for each field.

Volume (L)	Time	pH tod	EC SEC	EC S	EC Units	Temp (°C)	DO (1)	EH tio	TDS mg/L	Observation/Comments (e.g. colour, clarity, odour)
1	1010	5.36	1956	2280	mS/cm	33.7	235	116.2	1234.00	M-HT, med-brown, n/o
20	1020	5.34	4937	5768		33.8	39.0	127.4	3211.00	
23	1025	5.29	4911	5751		34.0	39.3	121.6	3101.50	
26	1030	5.28	4998	5850	↓	34.0	40.5	120.6	3250.00	

Sample ID	EWB19	**Duplicate ID**		**Triplicate ID**		**Lab Sent To**	ALS

*mTOC = meters Top Of Casing, mTOM = meters Top Of Monument, mBMP = meters Below Measuring Point

* Stickup is the height of the top of monument / top of casing / measuring point above ground level

SMEC

GROUNDWATER SAMPLING RECORD SHEET

DATE: 12/04/22 LOCATION: Vopak Darwin PROJECT: 30080099

Bore Name	EMB25	**Stickup (m)**	-0.11
Standing Water Level	1.06	**Ref Point** mTOC / mTOM / mBMP	
Sampling Method	Bailer / Pump / Other		

ORP mV 27.6L

NOTE: Include UNITS on meter for each field.

Volume (L)	Time	pH ±0.05	EC 37 TDS	EC 37 C	EC Units	Temp (°C)	DO 101 (%)	EH ±10	TDS mg/L	Observation/Comments (e.g. colour, clarity, odour)
1	0917	6.01	231.4	266.4	ms/cm	33.2	36.8	104.7	148.85	L-MT, pale red-brown, n/o
20	0926	6.28	277.2	327.2		34.4	43.4	100.9	180.70	" "
23	0928	6.25	270.8	318.7		34.4	42.7	98.6	175.50	" "
26	0932	5.64	202.2	239.7		34.8	44.6	101.4	128.05	" "
29	0934	5.59	195.4	227.5		35.0	41.4	107.4	114.40	" "
33	0938	5.84	208.9	239.6		35.0	40.8	108.0	134.56	" "

Sample ID	EMB25	**Duplicate ID**	/	**Triplicate ID**	/

Lab Sent To ALS

*mTOC = meters Top Of Casing, mTOM = meters Top Of Monument, mBMP = meters Below Measuring Point

* Stickup is the height of the top of monument / top of casing / measuring point above ground level

GROUNDWATER SAMPLING RECORD SHEET

DATE: 12/04/22 LOCATION: Vopak Darwin PROJECT: 30080099

Bore Name	EMB24	**Stickup (m)**	-0.16
Standing Water Level	1.44	**Ref Point** mTOC / mTOM / mBMP	
Sampling Method	Bailer / Pump / Other		

21.724

NOTE: Include UNITS on meter for each field.

Volume (L)	Time	pH ±0.05	EC (µS/cm) ±1	EC Units	Temp (°C)	DO (%) ±1	EH (mV) ±10	TPS (mV)	Observation/Comments (e.g. colour, clarity, odour)
1	0830	5.21	221.9 / 155.3	mS/cm	32.9	18.2	114.3		MT, mod-brown, n/o
16	0847	4.87	135.6 / 103.5		33.3	31.4	124.5	112.75	" "
19	0849	4.82	175.7 / 208.4		33.3	22.0	130.2	113.10	" "
22	0856	4.84	190.9 / 210.1	↓	33.3	21.6	139.3	118.95	" "

Sample ID	EMB24	**Duplicate ID**		**Triplicate ID**		**Lab Sent To**	ALS

*mTOC = meters Top Of Casing, mTOM = meters Top Of Monument, mBMP = meters Below Measuring Point

* Stickup is the height of the top of monument / top of casing / measuring point above ground level

SMEC

GROUNDWATER SAMPLING RECORD SHEET

DATE: 12/04/2022 LOCATION: Vopak PROJECT: 30080099

Bore Name	EWB18	**Stickup (m)**	~0.20
Standing Water Level	1.84	**Ref Point** mTOC / mTOM / mBMP	
Sampling Method	Bailer / Pump / Other		

22.02

NOTE: Include UNITS on meter for each field.

Volume (L)	Time	pH	EC	EC Units	Temp (ºC)	DO	EH	Observation/Comments (e.g. colour, clarity, odour)
1	0805	6.22	362.8 / 419.0	µS/cm	33.9	74.2	99.2	23970 M-H T ...
15	0810	6.20	238.2 / 276.2		32.6	44.2	102.5	9820 ...
19	0815	6.65	150.8 / 127.0		32.3	24.4	110.8	9815 ...
22	0817	4.67	154.1 / 126.0		32.3	23.8	120.7	100.10 ...
25	0819	4.72	159.8 / 182.9	↓	32.2	23.8	1338	110.60 ...

Sample ID	EWB18	**Duplicate ID**	/	**Triplicate ID**	/	**Lab Sent To**	ALS

*mTOC = meters Top Of Casing, mTOM = meters Top Of Monument, mBMP = meters Below Measuring Point

* Stickup is the height of the top of monument / top of casing / measuring point above ground level

GROUNDWATER SAMPLING RECORD SHEET

DATE: 12/04/2022 LOCATION: Vapour PROJECT: 30080099

Bore Name	EMB17	**Stickup (m)**	-0.08
Standing Water Level	1.43	**Ref Point** mTOC / mTOM / mBMP	
Sampling Method	Bailer / Pump / Other		

NOTE: Include UNITS on meter for each field.

Volume (L)	Time	pH	EC	EC Units	Temp (°C)	DO (%)	EH	TDS mg/L	Observation/Comments (e.g. colour, clarity, odour)
1	0700	5.64	965.1	µS/cm	30.3	15.7	45.9		colourless, LT, v/o, some v. fine sed. in bottle
21	0718	5.50	291.7		32.0	20.7	25.6	1496	red-brown, v/o, MT
29	0724	5.28	274.7		32.1	20.9	57.0	1775	" "
30	0726	5.40	267.2		32.2	21.7	55.9	1720	" "
33	0730	5.45	261.2		32.7	23.4	28.3	1680	" "
36	0734	5.42	254.7		32.7	23.0	25.6		
39	0736	5.47	251.1	↓	32.5	21.0	25.8	1595	" "

Sample ID	EMB17	**Duplicate ID**		**Triplicate ID**		**Lab Sent To**	ALS

*mTOC = meters Top Of Casing, mTOM = meters Top Of Monument, mBMP = meters Below Measuring Point

* Stickup is the height of the top of monument / top of casing / measuring point above ground level

GROUNDWATER SAMPLING RECORD SHEET

DATE: 11/04/2022 LOCATION: Vopak Darwin PROJECT: 30080099

Bore Name	EMB23	**Stickup (m)**	-0.11
Standing Water Level	1.06	**Ref Point** mTOC / mTOM / mBMP	
Sampling Method	Bailer / Pump / Other		

NOTE: Include UNITS on meter for each field.

10.1 ✓ ORP mV ✓

Volume (L)	Time	pH ±0.05	EC µS/cm	EC °C	EC Units	Temp (°C)	DO (L)	EH ±10	TPS mg/L	Observation/Comments (e.g. colour, clarity, odour)
1	1620	5.81	655	279	µS/cm	34.9	13.6	80.3	429.00	L-MT, pale red-brown, NIO
25	1630	5.75	377.7	446.3		33.8	14.5	82.7	244.50	" "
28	1635	5.71	367.7	381.6		33.6	13.9	90.6	200.35	" "
31	1638	5.74	365.0	426.0	↓	33.6	14.6	95.2	158.60	" "

Sample ID	EMB23	**Duplicate ID**	—	**Triplicate ID**		**Lab Sent To**	ALS

*mTOC = meters Top Of Casing, mTOM = meters Top Of Monument, mBMP = meters Below Measuring Point

* Stickup is the height of the top of monument / top of casing / measuring point above ground level

29.1L

GROUNDWATER SAMPLING RECORD SHEET

DATE: 11/04/2022 LOCATION: Kopale PROJECT: 30080099

Bore Name	ENB20	**Stickup (m)**	
Standing Water Level		**Ref Point** mTOC / mTOM / mBMP	
Sampling Method	Bailer / Pump / Other		

NOTE: Include UNITS on meter for each field.

Volume (L)	Time	pH ±0.05	EC		EC Units	Temp (°C)	DO (-/-)	EH	TDS	Observation/Comments (e.g. colour, clarity, odour)
1	1525	5.98	9430	11100	ms/cm	35.1	10.6	-79.2	6135.00	colourless, cl, n/o
19	1542	5.81	11209	13529		34.9	8.5	-70.2	7280.00	M-HT, red-brown, sp
21	1547	5.86	11823	14024		34.7	29.4	-11.8	7689.50	" "
24	1549	6.00	10107	12273		34.8	23.0	-8.8	6740.50	" "
27	1552	6.09	9464	11249		34.9	22.4	-5.3	6149.00	" "
30	1554	6.11	9834	11672	↓	34.9	23.9	-5.9	6389.50	" "

Sample ID	ENB20	**Duplicate ID**		**Triplicate ID**		**Lab Sent To**	ALS

*mTOC = meters Top Of Casing, mTOM = meters Top Of Monument, mBMP = meters Below Measuring Point

* Stickup is the height of the top of monument / top of casing / measuring point above ground level

45.80 − 1.78 = 3.72 m × 2 L/m = 7.44 L/well casing

7.44 L/well casing × 3 well casings = 22.32 L

GROUNDWATER SAMPLING RECORD SHEET

DATE: 11/04/2022 LOCATION: Vopak Darwin PROJECT: 30080099

Bore Name	ENB22	**Stickup (m)**	-0.10
Standing Water Level	1.11	**Ref Point** mTOC / mTOM / mBMP	
Sampling Method	Bailer / Pump / Other		

NOTE: Include UNITS on meter for each field.

±10 mV

ORP mV

Volume (L)	Time	pH	EC		EC Units	Temp (°C)	DO	EH	TDS	Observation/Comments (e.g. colour, clarity, odour)
1	1420	6.06	505	622	mS/cm	37.3	10.9	64.0		LMT, n/o, pale red-brown
7	1443	5.96	535	652		36.4	16.7	57.6		" "
11	1446	5.89	423	516		36.5	21.4	59.8		pale grey-red, LT, n/o
14	1448	5.82	316.9	393.3		36.7	33.4	72.4	197.60	" "
17	1452	5.87	289.1	460.9		36.5	29.7	66.7	150.75	red-brown LMT, n/o
20	1454	5.86	395.4	486.8		36.4	29.5	68.7	260.30	" "
25	1457	5.81	392.5	470.6		36.5	29.4	68.9	207.80	" "
							2.8			

Sample ID	ENB22	**Duplicate ID**	–	**Triplicate ID**	–	**Lab Sent To**	ALS

*mTOC = meters Top Of Casing, mTOM = meters Top Of Monument, mBMP = meters Below Measuring Point

* Stickup is the height of the top of monument / top of casing / measuring point above ground level

† LAB MS/LD collected

SWL 1.91 m
x 2 L/m
= 3.82 L
x 3 well vols
= 11.46 L

GROUNDWATER SAMPLING RECORD SHEET

DATE: 11/04/2012 LOCATION: Vopak PROJECT: 30080099

Bore Name	EMB71	**Stickup (m)**	
Standing Water Level	1.10	**Ref Point**	mTOC / mTOM / mBMP
Sampling Method	Bailer / Pump / Other		

NOTE: Include UNITS on meter for each field.

Volume (L)	Time	pH	EC (µS/cm)	EC Units	Temp (°C)	DO (%)	EH (mV)	TDS (g/L)	Observation/Comments (e.g. colour, clarity, odour)
1	0900	3.81	1164 1391		35.1	15.0	122.7	767	colourless, LT + m/o.
20	0910	3.59	1012 1201		28.0	24.0	161.7	656.50	pale yellow-NIT, m/o
24	0915	3.57	1017 1218		25.3	20.5	180.9	663	" "
28	0920	3.87	967 1164		35.6	18.7	168.1	630.50	" "
31	0922	3.59	968 1155		35.7	20.0	179.4	585.0	" "
34	0924	3.54	969 1017		35.2	21.8	178.7	611.0	" "

Sample ID	EMB71	**Duplicate ID**	DA06	**Triplicate ID**	QA06A	**Lab Sent To**	ALS

*mTOC = meters Top Of Casing, mTOM = meters Top Of Monument, mBMP = meters Below Measuring Point

* Stickup is the height of the top of monument / top of casing / measuring point above ground level

Water Level Measurement Record

Date:	11/04/2022
Project:	Darwin terminal
Project No.:	30080099
Field Staff:	PV
Weather:	hot, sunny, humid

Borehole ID	Time	Water Level (*mbTOC*)	Standpipe Height (*mbTOC*)	SWL (*m*)	EOW (*mbTOC*)	Comments
EMB3	1213	2.19	-0.07	5.58	7.77	-
EMB6	1205	1.25	-0.06	8.48	9.73	-
EMB8	1227	2.11	-0.08	6.88	8.99	-
EMB18	1159	1.84	-0.20	3.67	5.51	- 22.02L
EMB17	1125	1.43	-0.08	4.52	5.95	- 27.12L
EMB23	1154	1.06	-0.11	4.85	5.91	- 21.1L
EMB24	1150	1.44	-0.16	3.62	5.06	- 21.72L
EMB25	1145	1.06	-0.11	4.60	5.66	- 27.6L
EMB5	1140	1.13	-0.06	6.60	7.73	well cap broken, gatic olc
EMB7	1130	1.27	-0.08	7.92	9.19	-
EMB13	1243	2.82	0.65	6.89	9.71	standpipe, in resource recovery centre
EMB14	1247	2.77	0.75	7.31	10.08	standpipe, in resource recovery centre
EMB15	1122	0.93	-0.07	7.30	8.23	-
EMB12	1025	1.33	-0.12	2.91	4.24	-
EMB4	1056	1.23	-0.07	8.43	9.66	-
EMB19	1017	1.82	-0.12	4.11	5.93	- 24.66L
EMB16	1111	2.25	-0.08	7.13	9.38	-
EMB11	1105	2.05	-0.09	5.81	7.86	-
EMB1	1010	1.46	-0.06	4.04	9.67	- 24.24L
EMB20	1015	1.78	-0.10	3.72	5.50	-
EMB22	1000	1.11	-0.10	1.91	3.02	-
EMB2	1005	0.99	-0.08		8.93	-
EMB21	0900	1.10	-0.09	4.80	5.90	-
EMB21	1455	1.11	-0.09		5.90	-

Appendix K **Analytical Summary Tables**

					BTEXN							Metals							
				Moisture Content	Naphthalene (VOC)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	Total BTEX	Arsenic	Cadmium	Chromium (III+VI)	Copper	Lead	Mercury	Nickel	Zinc
				%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.1	0.5	0.1	0.1	0.1	0.2	0.1	0.3	0.2	2	0.4	2	5	5	0.1	2	5
2011 CRC Care HSL-D Commercial / Industrial					11,000	430	99,000	27,000			81,000									
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=0m, <1m)						3					230									
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=1m, <2m)						3														
2020 NEPM Schedule B1 Table 1A(1) HILs Comm/Ind D Soil													3,000	900	3,600	240,000	1,500	730	6,000	400,000
2020 PFAS NEMP HEPA Industrial/ Commercial (HIL D)																				
EnRisks (2022) HHERA - screening criteria (human health - industrial)																				
Lab Report Number	Sample ID	Matrix	Sample Date																	
ES2212085	QA01	Soil	4/04/2022	9.2	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	35	<1	21	8	12	<0.1	4	11
878534	QA01A	Soil	4/04/2022	11	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	52	<0.4	56	12	18	<0.1	<5	15
ES2212085	QA02	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
878534	QA02A	Soil	5/04/2022	7.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	QA04	Soil	7/04/2022	8.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
882408	QA04A	Soil	7/04/2022	9.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB17/0.05-0.15	Soil	4/04/2022	8.0	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	26	<1	31	7	11	<0.1	4	14
ES2212085	EMB17/1.2-1.3	Soil	4/04/2022	1.1	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	32	<1	16	7	<5	<0.1	<2	<5
ES2212085	EMB18/0.1-0.2	Soil	4/04/2022	9.8	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	20	<1	18	6	8	<0.1	2	8
ES2212085	EMB18/1.4-1.5	Soil	4/04/2022	7.7	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	36	<1	18	14	<5	<0.1	7	16
ES2212085	EMB19/0.02-0.05	Soil	5/04/2022	8.5	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	10	<1	24	7	13	<0.1	5	11
ES2212085	EMB19/0.9-1.0	Soil	5/04/2022	9.4	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	91	<1	24	9	9	<0.1	3	6
ES2212085	EMB20/0.01-0.1	Soil	5/04/2022	9.4	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	96	<1	26	9	10	<0.1	2	10
ES2212085	EMB20/1.1-1.2	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB20/2.0-2.1	Soil	5/04/2022	12.6	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	51	<1	19	<5	8	<0.1	2	<5
ES2212085	EMB21/0.01-0.10	Soil	5/04/2022	5.4	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	63	<1	10	<5	21	<0.1	<2	10
ES2212085	EMB22/0.02-0.1	Soil	5/04/2022	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB22/1.1-1.2	Soil	5/04/2022	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	EMB23/0.08-0.15	Soil	7/04/2022	7.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	EMB23/0.75-0.85	Soil	7/04/2022	6.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	EMB24/0.7-0.8	Soil	8/04/2022	6.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	EMB24/0.08-0.15	Soil	8/04/2022	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	EMB25/0.08-0.15	Soil	6/04/2022	7.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	EMB25/1.0-1.1	Soil	6/04/2022	6.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH01/0.08-0.15	Soil	6/04/2022	6.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH01/1.0-1.1	Soil	6/04/2022	7.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH02/0.08-0.15	Soil	6/04/2022	6.2	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	20	<1	93	<5	10	<0.1	2	<5
ES2212731	SBH02/1.1-1.2	Soil	7/04/2022	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH03/0.08-0.15	Soil	7/04/2022	8.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH03/1.0-1.1	Soil	7/04/2022	5.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH04/0.8-0.9	Soil	7/04/2022	13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH04/0.08-0.15	Soil	7/04/2022	6.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH05/0.08-0.15	Soil	7/04/2022	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH05/0.9-1.0	Soil	7/04/2022	6.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH06/0.8-0.9	Soil	7/04/2022	10.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH06/0.08-0.15	Soil	7/04/2022	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	TRIP BLANK	Soil	4/04/2022	-	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	-	-	-	-	-	-	-	-

LOR Limit of reporting

				PAH																	
				Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b+j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	Benzo(a)pyrene TEQ calc (Half)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ calc (Zero)	PAHs (Sum of total)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
2011 CRC Care HSL-D Commercial / Industrial																	11,000						
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=0m, <1m)																							
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=1m, <2m)																							
2020 NEPM Schedule B1 Table 1A(1) HILs Comm/Ind D Soil																				40	40	40	4,000
2020 PFAS NEMP HEPA Industrial/ Commercial (HIL D)																							
EnRisks (2022) HHERA - screening criteria (human health - industrial)																							
Lab Report Number	Sample ID	Matrix	Sample Date																				
ES2212085	QA01	Soil	4/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
878534	QA01A	Soil	4/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	QA02	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
878534	QA02A	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	QA04	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
882408	QA04A	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB17/0.05-0.15	Soil	4/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB17/1.2-1.3	Soil	4/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB18/0.1-0.2	Soil	4/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB18/1.4-1.5	Soil	4/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB19/0.02-0.05	Soil	5/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB19/0.9-1.0	Soil	5/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB20/0.01-0.1	Soil	5/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB20/1.1-1.2	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB20/2.0-2.1	Soil	5/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB21/0.01-0.10	Soil	5/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB22/0.02-0.1	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB22/1.1-1.2	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	EMB23/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	EMB23/0.75-0.85	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	EMB24/0.7-0.8	Soil	8/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	EMB24/0.08-0.15	Soil	8/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	EMB25/0.08-0.15	Soil	6/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	EMB25/1.0-1.1	Soil	6/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH01/0.08-0.15	Soil	6/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH01/1.0-1.1	Soil	6/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH02/0.08-0.15	Soil	6/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212731	SBH02/1.1-1.2	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH03/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH03/1.0-1.1	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH04/0.8-0.9	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH04/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH05/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH05/0.9-1.0	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH06/0.8-0.9	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH06/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	TRIP BLANK	Soil	4/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-

LOR Limit of reporting

				Perfluoroalkane Carboxylic Acids										(n:2) Fluorotelomer Sulfonic Acids			
				Perfluorobutanoic acid (PFBA)	Perfluorohexanoic acid (PFHxA)	Perfluoropentanoic acid (PFPeA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorodecanoic acid (PFDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorononanoic acid (PFNA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUnDA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005
2011 CRC Care HSL-D Commercial / Industrial																		
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=0m, <1m)																		
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=1m, <2m)																		
2020 NEPM Schedule B1 Table 1A(1) HILs Comm/Ind D Soil																		
2020 PFAS NEMP HEPA Industrial/ Commercial (HIL D)								50										
EnRisks (2022) HHERA - screening criteria (human health - industrial)				50	50	50	50	50	50	50	50	50	50	50	20	20	20	20
Lab Report Number	Sample ID	Matrix	Sample Date															
ES2212085	QA01	Soil	4/04/2022	<0.001	0.0004	0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
878534	QA01A	Soil	4/04/2022	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.005
ES2212085	QA02	Soil	5/04/2022	0.004	0.0148	0.0157	0.0017	0.0011	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0812	0.0023	<0.0005
878534	QA02A	Soil	5/04/2022	<0.005	0.0096	0.014	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.055	<0.005	<0.005
ES2212731	QA04	Soil	7/04/2022	<0.001	0.0005	0.0003	0.0004	0.0004	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0164	0.0042	<0.0005
882408	QA04A	Soil	7/04/2022	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.028	<0.005	<0.005
ES2212085	EMB17/0.05-0.15	Soil	4/04/2022	<0.001	0.0006	0.0006	0.0004	0.0074	0.0008	<0.0002	0.0086	<0.0005	<0.0002	<0.0002	<0.0005	0.246	0.253	0.0031
ES2212085	EMB17/1.2-1.3	Soil	4/04/2022	<0.001	0.0012	0.0007	0.0005	0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0095	0.0039	<0.0005
ES2212085	EMB18/0.1-0.2	Soil	4/04/2022	<0.001	0.0004	0.0004	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
ES2212085	EMB18/1.4-1.5	Soil	4/04/2022	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
ES2212085	EMB19/0.02-0.05	Soil	5/04/2022	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
ES2212085	EMB19/0.9-1.0	Soil	5/04/2022	<0.001	0.0004	0.0004	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
ES2212085	EMB20/0.01-0.1	Soil	5/04/2022	<0.001	0.0006	0.0014	0.0002	0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0369	<0.0005	<0.0005
ES2212085	EMB20/1.1-1.2	Soil	5/04/2022	<0.001	0.001	0.0008	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
ES2212085	EMB20/2.0-2.1	Soil	5/04/2022	<0.001	0.0013	0.0012	0.0005	<0.0002	<0.0002	<0.0002	0.0007	<0.0005	0.0003	0.0006	<0.0005	0.0041	<0.0005	<0.0005
ES2212085	EMB21/0.01-0.10	Soil	5/04/2022	0.001	0.0159	0.0085	0.0025	0.0013	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0197	0.0017	<0.0005
ES2212085	EMB22/0.02-0.1	Soil	5/04/2022	0.003	0.0106	0.014	0.001	0.0008	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0527	0.0024	<0.0005
ES2212085	EMB22/1.1-1.2	Soil	5/04/2022	<0.001	0.001	0.0008	0.0005	0.0003	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0061	0.0011	<0.0005
ES2212731	EMB23/0.08-0.15	Soil	7/04/2022	<0.001	0.0008	0.0006	0.0008	0.0007	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0134	0.0313	<0.0005
ES2212731	EMB23/0.75-0.85	Soil	7/04/2022	<0.001	0.0039	0.0045	0.0012	0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0038	0.0029	<0.0005
ES2213150	EMB24/0.7-0.8	Soil	8/04/2022	<0.001	0.0002	0.0002	0.0004	0.0002	<0.0002	<0.0002	0.0006	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	0.002	<0.0005
ES2213150	EMB24/0.08-0.15	Soil	8/04/2022	<0.001	0.0002	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0077	0.0033	<0.0005
ES2212247	EMB25/0.08-0.15	Soil	6/04/2022	<0.001	0.0003	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
ES2212247	EMB25/1.0-1.1	Soil	6/04/2022	<0.001	0.0004	0.0005	<0.0002	0.0003	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	0.0075	<0.0005
ES2212247	SBH01/0.08-0.15	Soil	6/04/2022	<0.001	0.0023	0.0009	0.0007	0.0013	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0603	0.0113	<0.0005
ES2212247	SBH01/1.0-1.1	Soil	6/04/2022	0.001	0.0053	0.0058	0.0013	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
ES2212247	SBH02/0.08-0.15	Soil	6/04/2022	<0.001	0.0006	0.0003	0.0003	0.0006	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.028	0.0092	<0.0005
ES2212731	SBH02/1.1-1.2	Soil	7/04/2022	<0.001	0.0029	0.0034	0.0009	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0039	<0.0005	<0.0005
ES2212731	SBH03/0.08-0.15	Soil	7/04/2022	<0.001	0.0004	0.0004	0.0004	0.0003	0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0096	0.017	0.0036
ES2212731	SBH03/1.0-1.1	Soil	7/04/2022	<0.001	0.0008	0.001	0.0006	0.0004	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0006	0.0026	<0.0005
ES2212731	SBH04/0.8-0.9	Soil	7/04/2022	0.001	0.0054	0.007	0.0021	0.0004	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0058	0.0016	<0.0005
ES2212731	SBH04/0.08-0.15	Soil	7/04/2022	<0.001	0.0026	0.0018	0.0014	0.0016	0.0011	<0.0002	0.0003	<0.0005	<0.0002	<0.0002	<0.0005	0.0678	0.11	0.0094
ES2212731	SBH05/0.08-0.15	Soil	7/04/2022	<0.001	0.0011	0.0004	0.0006	0.0008	<0.0002	<0.0002	0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0358	0.0351	0.0008
ES2212731	SBH05/0.9-1.0	Soil	7/04/2022	<0.001	0.0018	0.0019	0.0014	0.0004	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0021	0.004	<0.0005
ES2212731	SBH06/0.8-0.9	Soil	7/04/2022	<0.001	0.0008	0.0006	0.001	0.0014	<0.0002	<0.0002	0.0007	<0.0005	<0.0002	<0.0002	<0.0005	0.0131	0.0143	<0.0005
ES2212731	SBH06/0.08-0.15	Soil	7/04/2022	<0.001	0.0006	0.0004	0.0005	0.0004	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0182	0.0046	<0.0005
ES2213150	TRIP BLANK	Soil	4/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

LOR Limit of reporting

				Perfluoroalkyl Sulfonic Acids							Perfluoroalkyl Sulfonamides							PFAS							
				Perfluoropropanesulfonic acid (PFPrS)	Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecane sulfonic acid (PFDS)	Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-methyl perfluorooctane sulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	Perfluorononanesulfonic acid (PFNS)	Sum of PFHxS and PFOS	Sum of PFOS related compounds	Sum of PFOA related compounds	Sum of PFAS	Sum of PFAS (WA DER List)	Sum of enHealth PFAS (PFHxS + PFOS + PFOA)	Sum of PFAS (PFOS + PFOA)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.005	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0002	0.0005	0.0005	0.0002	0.0005	0.005	0.0002	0.0002	-	-	0.0002	0.005	0.005
2011 CRC Care HSL-D Commercial / Industrial																									
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=0m, <1m)																									
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=1m, <2m)																									
2020 NEPM Schedule B1 Table 1A(1) HILs Comm/Ind D Soil																									
2020 PFAS NEMP HEPA Industrial/ Commercial (HIL D)																		20							
EnRisks (2022) HHERA - screening criteria (human health - industrial)				20	20	20	20	20	20	20	50	50	50	50	50	50	50		20	20	50				
Lab Report Number	Sample ID	Matrix	Sample Date																						
ES2212085	QA01	Soil	4/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	0.0004	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	0.0004	0.0004	0.0009	0.0013	0.0013	-	-
878534	QA01A	Soil	4/04/2022	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.005	<0.01	<0.005	<0.005	<0.005	<LOR	<LOR	<0.05	<0.01	<0.005	<0.005
ES2212085	QA02	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0835	0.0373	0.121	0.121	-	-
878534	QA02A	Soil	5/04/2022	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.005	<0.01	<0.005	<0.005	<0.005	0.0550	0.0236	0.0786	0.0786	<0.005	<0.005
ES2212731	QA04	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0206	0.0016	0.0222	0.0222	-	-
882408	QA04A	Soil	7/04/2022	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.005	<0.01	<0.005	<0.005	<0.005	0.0280	<LOR	<0.05	0.028	<0.005	<0.005
ES2212085	EMB17/0.05-0.15	Soil	4/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.5021	0.0184	0.52	0.508	-	-
ES2212085	EMB17/1.2-1.3	Soil	4/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0134	0.0029	0.0163	0.0163	-	-
ES2212085	EMB18/0.1-0.2	Soil	4/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	0.0003	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	0.0003	0.0003	0.0008	0.0011	0.0011	-	-
ES2212085	EMB18/1.4-1.5	Soil	4/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	<LOR	<LOR	<0.0002	<0.0002	-	-
ES2212085	EMB19/0.02-0.05	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	0.0006	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	0.0006	0.0006	<LOR	0.0006	0.0006	-	-
ES2212085	EMB19/0.9-1.0	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	<LOR	0.0008	0.0008	0.0008	-	-
ES2212085	EMB20/0.01-0.1	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0369	0.0027	0.0396	0.0396	-	-
ES2212085	EMB20/1.1-1.2	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	0.0004	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	0.0004	0.0004	0.0018	0.0022	0.0022	-	-
ES2212085	EMB20/2.0-2.1	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0041	0.0046	0.0087	0.0071	-	-
ES2212085	EMB21/0.01-0.10	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0214	0.0292	0.0506	0.0506	-	-
ES2212085	EMB22/0.02-0.1	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0551	0.0294	0.0845	0.0845	-	-
ES2212085	EMB22/1.1-1.2	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0072	0.0026	0.0098	0.0098	-	-
ES2212731	EMB23/0.08-0.15	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0447	0.0029	0.0476	0.0476	-	-
ES2212731	EMB23/0.75-0.85	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0067	0.0098	0.0165	0.0165	-	-
ES2213150	EMB24/0.7-0.8	Soil	8/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0020	0.0016	0.0036	0.003	-	-
ES2213150	EMB24/0.08-0.15	Soil	8/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0110	0.0004	0.0114	0.0114	-	-
ES2212247	EMB25/0.08-0.15	Soil	6/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0000	0.0005	0.0005	0.0005	-	-
ES2212247	EMB25/1.0-1.1	Soil	6/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0075	0.0012	0.0087	0.0087	-	-
ES2212247	SBH01/0.08-0.15	Soil	6/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0716	0.0052	0.0768	0.0768	-	-
ES2212247	SBH01/1.0-1.1	Soil	6/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	<LOR	0.0134	0.0134	0.0134	-	-
ES2212247	SBH02/0.08-0.15	Soil	6/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0372	0.0018	0.039	0.039	-	-
ES2212731	SBH02/1.1-1.2	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0039	0.0072	0.0111	0.0111	-	-
ES2212731	SBH03/0.08-0.15	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0302	0.0017	0.0319	0.0281	-	-
ES2212731	SBH03/1.0-1.1	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0032	0.0028	0.006	0.006	-	-
ES2212731	SBH04/0.8-0.9	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0074	0.0159	0.0233	0.0233	-	-
ES2212731	SBH04/0.08-0.15	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.1872	0.0088	0.196	0.185	-	-
ES2212731	SBH05/0.08-0.15	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0717	0.0031	0.0748	0.0738	-	-
ES2212731	SBH05/0.9-1.0	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0061	0.0055	0.0116	0.0116	-	-
ES2212731	SBH06/0.8-0.9	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0274	0.0045	0.0319	0.0312	-	-
ES2212731	SBH06/0.08-0.15	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0228	0.0019	0.0247	0.0247	-	-
ES2213150	TRIP BLANK	Soil	4/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

LOR Limit of reporting

				TPH					TRH							
				C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Sum)	C6-C10 Fraction (F1)	C6-C10 (F1 minus BTEX)	>C10-C16 Fraction (F2)	>C10-C16 Fraction (F2 minus Naphthalene)	>C16-C34 Fraction (F3)	>C34-C40 Fraction (F4)	>C10-C40 Fraction (Sum)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				10	20	50	50	50	10	10	50	50	100	100	50
2011 CRC Care HSL-D Commercial / Industrial									26,000		20,000		27,000	38,000	
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=0m, <1m)										260					
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=1m, <2m)										370					
2020 NEPM Schedule B1 Table 1A(1) HILs Comm/Ind D Soil															
2020 PFAS NEMP HEPA Industrial/ Commercial (HIL D)															
EnRisks (2022) HHERA - screening criteria (human health - industrial)															
Lab Report Number	Sample ID	Matrix	Sample Date												
ES2212085	QA01	Soil	4/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
878534	QA01A	Soil	4/04/2022	<20	<20	<50	<50	<50	<20	<20	<50	<50	<100	<100	<100
ES2212085	QA02	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
878534	QA02A	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	QA04	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
882408	QA04A	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB17/0.05-0.15	Soil	4/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB17/1.2-1.3	Soil	4/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB18/0.1-0.2	Soil	4/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB18/1.4-1.5	Soil	4/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB19/0.02-0.05	Soil	5/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB19/0.9-1.0	Soil	5/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB20/0.01-0.1	Soil	5/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB20/1.1-1.2	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB20/2.0-2.1	Soil	5/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB21/0.01-0.10	Soil	5/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB22/0.02-0.1	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB22/1.1-1.2	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	EMB23/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	EMB23/0.75-0.85	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	EMB24/0.7-0.8	Soil	8/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	EMB24/0.08-0.15	Soil	8/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	EMB25/0.08-0.15	Soil	6/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	EMB25/1.0-1.1	Soil	6/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH01/0.08-0.15	Soil	6/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH01/1.0-1.1	Soil	6/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH02/0.08-0.15	Soil	6/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212731	SBH02/1.1-1.2	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH03/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH03/1.0-1.1	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH04/0.8-0.9	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH04/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH05/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH05/0.9-1.0	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH06/0.8-0.9	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH06/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	TRIP BLANK	Soil	4/04/2022	<10	-	-	-	-	<10	<10	-	-	-	-	-

LOR Limit of reporting

				BTEX								Metals							
				Naphthalene (VOC)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	Total BTEX	Arsenic	Cadmium	Chromium (III+VI)	Copper	Lead	Mercury	Nickel	Zinc
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.5	0.1	0.1	0.1	0.2	0.1	0.3	0.2	2	0.4	2	5	5	0.1	2	5
Lab Report Number	**Field ID**	**Matrix Type**	**Date**																
ES2212085	**EMB18/0.1-0.2**	**Soil**	**4/04/2022**	-	*<0.2*	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.2*	20	*<1*	18	6	8	*<0.1*	2	8
	QA01	**Soil**	**4/04/2022**	-	*<0.2*	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.2*	35	*<1*	21	8	12	*<0.1*	4	11
RPD				-	0	0	0	0	0	0	0	55	0	15	29	40	0	67	32
ES2212085	**EMB18/0.1-0.2**	**Soil**	**4/04/2022**	-	*<0.2*	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.2*	20	*<1*	18	6	8	*<0.1*	2	8
878534	**QA01A**	**Soil**	**4/04/2022**	*<0.5*	*<0.1*	*<0.1*	*<0.1*	*<0.2*	*<0.1*	*<0.3*	-	52	*<0.4*	56	12	18	*<0.1*	*<5*	15
RPD				-	0	0	0	0	0	0	-	89	0	103	67	77	0	0	61
ES2212085	**EMB22/0.02-0.1**	**Soil**	**5/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA02	**Soil**	**5/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RPD				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	**EMB22/0.02-0.1**	**Soil**	**5/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
878534	**QA02A**	**Soil**	**5/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RPD				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	**SBH02/0.08-0.15**	**Soil**	**6/04/2022**	-	*<0.2*	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.2*	20	*<1*	93	*<5*	10	*<0.1*	2	*<5*
882408	**QA04A**	**Soil**	**7/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RPD				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	**SBH06/0.08-0.15**	**Soil**	**7/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA04	**Soil**	**7/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RPD				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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

****Field duplicates had relative percentage difference (RPD) control limits: Less than 50%, where result is greater than 10 times limit of reporting (LOR). No limit where result is less than 10 times LOR.**

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

				PAH																			
				Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b+j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	Benzo(a)pyrene TEQ calc (Half)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ calc (Zero)	PAHs (Sum of total)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lab Report Number	**Field ID**	**Matrix Type**	**Date**																				
ES2212085	EMB18/0.1-0.2	Soil	4/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
	QA01	Soil	4/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
RPD				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ES2212085	EMB18/0.1-0.2	Soil	4/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
878534	QA01A	Soil	4/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
RPD				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ES2212085	EMB22/0.02-0.1	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA02	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RPD				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB22/0.02-0.1	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
878534	QA02A	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RPD				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH02/0.08-0.15	Soil	6/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
882408	QA04A	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RPD				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH06/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA04	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RPD				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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

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				(n:2) Fluorotelomer Sulfonic Acids				Perfluoroalkane Carboxylic Acids										Perfluoroalkane Sulfonic Acids						
				4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	Perfluorobutanoic acid (PFBA)	Perfluorohexanoic acid (PFHxA)	Perfluoropentanoic acid (PFPeA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorodecanoic acid (PFDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorononanoic acid (PFNA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluoropropanesulfonic acid (PFPrS)	Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecane sulfonic acid (PFDS)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.0005	0.0005	0.0005	0.0005	0.001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0002	0.0002	0.005	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Lab Report Number	**Field ID**	**Matrix Type**	**Date**																						
ES2212085	**EMB18/0.1-0.2**	**Soil**	**4/04/2022**	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	0.0004	0.0004	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	-	<0.0002	<0.0002	<0.0002	<0.0002	0.0003	<0.0002
	QA01	**Soil**	**4/04/2022**	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	0.0004	0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0004	<0.0002
RPD				0	0	0	0	0	0	22	0	0	0	0	0	0	0	0	-	0	0	0	0	0	29	0
ES2212085	**EMB18/0.1-0.2**	**Soil**	**4/04/2022**	<0.0005	<0.0005	<0.0005	<0.0005	<0.001	0.0004	0.0004	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	-	<0.0002	<0.0002	<0.0002	<0.0002	0.0003	<0.0002
878534	**QA01A**	**Soil**	**4/04/2022**	<0.005	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
RPD				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0
ES2212085	**EMB22/0.02-0.1**	**Soil**	**5/04/2022**	<0.0005	0.0527	0.0024	<0.0005	0.003	0.0106	0.0140	0.0010	0.0008	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
	QA02	**Soil**	**5/04/2022**	<0.0005	0.0812	0.0023	<0.0005	0.004	0.0148	0.0157	0.0017	0.0011	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
RPD				0	43	4	0	29	33	11	52	32	0	0	0	0	0	0	-	0	0	0	0	0	0	0
ES2212085	**EMB22/0.02-0.1**	**Soil**	**5/04/2022**	<0.0005	0.0527	0.0024	<0.0005	0.003	0.0106	0.0140	0.0010	0.0008	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
878534	**QA02A**	**Soil**	**5/04/2022**	<0.005	0.055	<0.005	<0.005	<0.005	0.0096	0.014	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
RPD				0	4	0	0	0	10	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0
ES2212247	**SBH02/0.08-0.15**	**Soil**	**6/04/2022**	<0.0005	0.0280	0.0092	<0.0005	<0.001	0.0006	0.0003	0.0003	0.0006	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
882408	**QA04A**	**Soil**	**7/04/2022**	<0.005	0.028	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
RPD				0	0	59	0	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0
ES2212731	**SBH06/0.08-0.15**	**Soil**	**7/04/2022**	<0.0005	0.0182	0.0046	<0.0005	<0.001	0.0006	0.0004	0.0005	0.0004	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
	QA04	**Soil**	**7/04/2022**	<0.0005	0.0164	0.0042	<0.0005	<0.001	0.0005	0.0003	0.0004	0.0004	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
RPD				0	10	9	0	0	18	29	22	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0

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				Perfluoroalkyl Sulfonamides							PFAS						TPH					TRH						
				Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-methyl perfluorooctane sulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	Perfluorononanesulfonic acid (PFNS)	Sum of PFHxS and PFOS	Sum of PFAS	Sum of PFAS (WA DER List)	Sum of enHealth PFAS (PFHxS + PFOS + PFOA)	Sum of PFAS (PFOS + PFOA)	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Sum)	C6-C10 Fraction (F1)	C6-C10 (F1 minus BTEX)	>C10-C16 Fraction (F2)	>C10-C16 Fraction (F2 minus Naphthalene)	>C16-C34 Fraction (F3)	>C34-C40 Fraction (F4)	>C10-C40 Fraction (Sum)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.0002	0.0005	0.0002	0.0005	0.0005	0.0002	0.0005	5	0.0002	0.0002	0.0002	0.005	0.005	10	20	50	50	50	10	10	50	50	100	100	50
Lab Report Number	**Field ID**	**Matrix Type**	**Date**																									
ES2212085	**EMB18/0.1-0.2**	**Soil**	**4/04/2022**	*<0.0002*	*<0.0005*	*<0.0002*	*<0.0005*	*<0.0005*	*<0.0002*	*<0.0005*	-	0.0003	0.0011	0.0011	-	-	*<10*	*<50*	*<100*	*<100*	*<50*	*<10*	*<10*	*<50*	*<50*	*<100*	*<100*	*<50*
	QA01	**Soil**	**4/04/2022**	*<0.0002*	*<0.0005*	*<0.0002*	*<0.0005*	*<0.0005*	*<0.0002*	*<0.0005*	-	0.0004	0.0013	0.0013	-	-	*<10*	*<50*	*<100*	*<100*	*<50*	*<10*	*<10*	*<50*	*<50*	*<100*	*<100*	*<50*
RPD				0	0	0	0	0	0	0	-	29	17	17	-	-	0	0	0	0	0	0	0	0	0	0	0	0
ES2212085	**EMB18/0.1-0.2**	**Soil**	**4/04/2022**	*<0.0002*	*<0.0005*	*<0.0002*	*<0.0005*	*<0.0005*	*<0.0002*	*<0.0005*	-	0.0003	0.0011	0.0011	-	-	*<10*	*<50*	*<100*	*<100*	*<50*	*<10*	*<10*	*<50*	*<50*	*<100*	*<100*	*<50*
878534	**QA01A**	**Soil**	**4/04/2022**	*<0.005*	*<0.005*	*<0.01*	*<0.005*	*<0.005*	*<0.01*	*<0.005*	*<5*	*<0.005*	*<0.05*	*<0.01*	*<0.005*	*<0.005*	*<20*	*<20*	*<50*	*<50*	*<50*	*<20*	*<20*	*<50*	*<50*	*<100*	*<100*	*<100*
RPD				0	0	0	0	0	0	0	-	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	0	0
ES2212085	**EMB22/0.02-0.1**	**Soil**	**5/04/2022**	*<0.0002*	*<0.0005*	*<0.0002*	*<0.0005*	*<0.0005*	*<0.0002*	*<0.0005*	-	*<0.0002*	0.0845	0.0845	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA02	**Soil**	**5/04/2022**	*<0.0002*	*<0.0005*	*<0.0002*	*<0.0005*	*<0.0005*	*<0.0002*	*<0.0005*	-	*<0.0002*	0.121	0.121	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RPD				0	0	0	0	0	0	0	-	0	36	36	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	**EMB22/0.02-0.1**	**Soil**	**5/04/2022**	*<0.0002*	*<0.0005*	*<0.0002*	*<0.0005*	*<0.0005*	*<0.0002*	*<0.0005*	-	*<0.0002*	0.0845	0.0845	-	-	-	-	-	-	-	-	-	-	-	-	-	-
878534	**QA02A**	**Soil**	**5/04/2022**	*<0.005*	*<0.005*	*<0.01*	*<0.005*	*<0.005*	*<0.01*	*<0.005*	*<5*	*<0.005*	0.0786	0.0786	*<0.005*	*<0.005*	-	-	-	-	-	-	-	-	-	-	-	-
RPD				0	0	0	0	0	0	0	-	0	7	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	**SBH02/0.08-0.15**	**Soil**	**6/04/2022**	*<0.0002*	*<0.0005*	*<0.0002*	*<0.0005*	*<0.0005*	*<0.0002*	*<0.0005*	-	*<0.0002*	0.0390	0.0390	-	-	*<10*	*<50*	*<100*	*<100*	*<50*	*<10*	*<10*	*<50*	*<50*	*<100*	*<100*	*<50*
882408	**QA04A**	**Soil**	**7/04/2022**	*<0.005*	*<0.005*	*<0.01*	*<0.005*	*<0.005*	*<0.01*	*<0.005*	*<5*	*<0.005*	*<0.05*	0.028	*<0.005*	*<0.005*	-	-	-	-	-	-	-	-	-	-	-	-
RPD				0	0	0	0	0	0	0	-	0	0	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	**SBH06/0.08-0.15**	**Soil**	**7/04/2022**	*<0.0002*	*<0.0005*	*<0.0002*	*<0.0005*	*<0.0005*	*<0.0002*	*<0.0005*	-	*<0.0002*	0.0247	0.0247	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	QA04	**Soil**	**7/04/2022**	*<0.0002*	*<0.0005*	*<0.0002*	*<0.0005*	*<0.0005*	*<0.0002*	*<0.0005*	-	*<0.0002*	0.0222	0.0222	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RPD				0	0	0	0	0	0	0	-	0	11	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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

****Field duplicates had relative percentage difference (RPD) control limits: Less than 50%, where result is greater than 10 times limit of reporting (LOR). No limit where result is less than 10 times LOR.**

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

	Field Parameters					BTEXN								Inorganics
	pH	Specific Conductivity (Ec @ 25oC)	Temperature	Dissolved Oxygen	Redox Potential	Naphthalene (VOC)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	Total BTEX	Ammonia as N
	pH units	µS/cm	°C	%	mV	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL						10	1	1	1	2	1	2	1	10
ANZG (2018) Marine Water 95% LOSP Toxicant DGVs						70	700	180	80	75				910
ANZG (2018) Marine Water 99% LOSP Toxicant DGVs						50	500	110	50	50				500
NEPM (2013) Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand (>=2m, <4m)						NL	5,000	NL						
NEMP (2020) PFAS Human Health Recreational														
NEMP (2020) PFAS Interim Marine 95%														
NEMP (2020) PFAS Interim Marine 99%														
NT Government (2010) WQO for Darwin Harbour	6 - 8.5													20
Lab Report Number	Sample ID	Matrix	Sample Date											
ES2213154	EMB17	Water	12/04/2022	5.47	251.6	32.5	21.0	75.8	-	<1	<2	<2	<2	<2	<2	<1	60
ES2213154	EMB18	Water	12/04/2022	4.72	159.8	32.2	23.8	133.8	-	<1	<2	<2	<2	<2	<2	<1	190
ES2213154	EMB19	Water	12/04/2022	5.28	4998	34.0	40.5	120.6	<5	<1	<2	<2	<2	<2	<2	<1	610
ES2213154	EMB20	Water	11/04/2022	6.11	9834	34.9	23.9	-53.9	<5	<1	<2	<2	<2	<2	<2	<1	6,850
ES2213154	EMB22	Water	11/04/2022	5.81	392.5	36.5	29.4	68.9	<5	<1	<2	<2	<2	<2	<2	<1	50
ES2213154	EMB23	Water	11/04/2022	5.74	365.0	33.6	14.6	95.2	<5	<1	<2	<2	<2	<2	<2	<1	30
ES2213154	EMB24	Water	12/04/2022	4.84	180.8	33.3	21.6	139.3	-	<1	<2	<2	<2	<2	<2	<1	20
ES2213154	EMB25	Water	12/04/2022	5.64	208.9	35.0	40.8	108.0	-	<1	<2	<2	<2	<2	<2	<1	40
ES2213154	EMB21	Water	11/04/2022						-	<1	<2	<2	<2	<2	<2	<1	<10
ES2213154	QA06[1]	Water	11/04/2022		964	35.2	21.8	178.7	-	<1	<2	<2	<2	<2	<2	<1	100
882131	QA06A[2]	Water	11/04/2022	3.54					<10	<1	<1	<1	<2	<1	<3	-	<10

[1]Intralab duplicate of sample EMB21.
[2]Interlab duplicate of sample EMB21.

				Metals								PAH									
				Arsenic (filtered)	Cadmium (filtered)	Chromium (III+VI) (filtered)	Copper (filtered)	Lead (filtered)	Mercury (filtered)	Nickel (filtered)	Zinc (filtered)	Sum of 16 USEPA Priority PAHs	2-methylnaphthalene	3-methylcholanthrene	7,12-dimethylbenz(a)anthracene	Acenaphthene	Acenaphthylene	Anthracene	Coronene	Benz(a)anthracene	Benzo(a) pyrene
				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				1	0.1	1	1	1	0.1	1	5	0.001	0.002	0.004	0.001	0.002	0.002	0.001	0.002	0.002	0.001
ANZG (2018) Marine Water 95% LOSP Toxicant DGVs				2.3	5.5	4.4	1.3	4.4	0.4	70	8							0.4			0.2
ANZG (2018) Marine Water 99% LOSP Toxicant DGVs					0.7				0.1									0.01			0.1
NEPM (2013) Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand (>=2m, <4m)																					
NEMP (2020) PFAS Human Health Recreational																					
NEMP (2020) PFAS Interim Marine 95%																					
NEMP (2020) PFAS Interim Marine 99%																					
NT Government (2010) WQO for Darwin Harbour																					
Lab Report Number	Sample ID	Matrix	Sample Date																		
ES2213154	EMB17	Water	12/04/2022	<1	<0.1	<1	<1	<1	<0.1	1	<5	0.026	<0.002	<0.004	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001
ES2213154	EMB18	Water	12/04/2022	<1	<0.1	<1	<1	<1	<0.1	1	<5	0.018	<0.002	<0.004	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001
ES2213154	EMB19	Water	12/04/2022	10	<0.1	<1	<1	<1	<0.1	9	12	0.047	<0.002	<0.004	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001
ES2213154	EMB20	Water	11/04/2022	12	<0.1	<1	<1	<1	<0.1	<1	<5	0.041	<0.002	<0.004	<0.001	0.003	<0.002	<0.001	<0.002	<0.002	<0.001
ES2213154	EMB22	Water	11/04/2022	<1	<0.1	<1	<1	<1	<0.1	<1	<5	0.030	<0.002	<0.004	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001
ES2213154	EMB23	Water	11/04/2022	<1	<0.1	<1	<1	<1	<0.1	<1	7	0.034	<0.002	<0.004	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001
ES2213154	EMB24	Water	12/04/2022	<1	<0.1	<1	1	<1	<0.1	2	8	0.017	<0.002	<0.004	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001
ES2213154	EMB25	Water	12/04/2022	<1	<0.1	<1	<1	<1	<0.1	<1	5	0.037	<0.002	<0.004	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001
ES2213154	EMB21	Water	11/04/2022	<1	<0.1	<1	5	3	<0.1	3	22	0.027	<0.002	<0.004	<0.001	<0.002	0.005	<0.001	<0.002	<0.002	<0.001
ES2213154	QA06[1]	Water	11/04/2022	<1	<0.1	<1	4	3	<0.1	3	22	0.029	<0.002	<0.004	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001
882131	QA06A[2]	Water	11/04/2022	2	<0.2	1	3	3	<0.1	2	18	-	-	-	-	<0.01	<0.01	<0.01	-	<0.01	<0.01

[1]Intralab duplicate of sample EMB21.
[2]Interlab duplicate of sample EMB21.

				PAH																
				Benzo(b+j)fluoranthene	Benzo(e)pyrene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Benzo(b+j+K)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Perylene	Pyrene	Benzo(a)pyrene TEQ calc (Half)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ calc (Zero)	PAHs (Sum of total)
				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				0.004	0.001	0.002	0.004	0.004	0.001	0.001	0.001	0.002	0.002	0.004	0.002	0.002	0.001	0.001	0.001	0.001	0.01
ANZG (2018) Marine Water 95% LOSP Toxicant DGVs											1.4			70	2						
ANZG (2018) Marine Water 99% LOSP Toxicant DGVs											1				0.6						
NEPM (2013) Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand (>=2m, <4m)														NL							
NEMP (2020) PFAS Human Health Recreational																					
NEMP (2020) PFAS Interim Marine 95%																					
NEMP (2020) PFAS Interim Marine 99%																					
NT Government (2010) WQO for Darwin Harbour																					
Lab Report Number	Sample ID	Matrix	Sample Date																		
ES2213154	EMB17	Water	12/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.005	0.005	<0.002	<0.004	0.012	<0.002	0.004	<0.001	<0.001	<0.001	-
ES2213154	EMB18	Water	12/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.003	0.005	<0.002	<0.004	0.007	<0.002	0.003	<0.001	<0.001	<0.001	-
ES2213154	EMB19	Water	12/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.008	0.009	<0.002	0.012	0.012	<0.002	0.006	<0.001	<0.001	<0.001	-
ES2213154	EMB20	Water	11/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.006	0.005	<0.002	0.011	0.011	<0.002	0.005	<0.001	<0.001	<0.001	-
ES2213154	EMB22	Water	11/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.005	0.005	<0.002	0.005	0.010	<0.002	0.005	<0.001	<0.001	<0.001	-
ES2213154	EMB23	Water	11/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.009	0.003	<0.002	0.004	0.009	<0.002	0.009	<0.001	<0.001	<0.001	-
ES2213154	EMB24	Water	12/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.004	0.003	<0.002	<0.004	0.007	<0.002	0.003	<0.001	<0.001	<0.001	-
ES2213154	EMB25	Water	12/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.014	0.004	<0.002	<0.004	0.009	<0.002	0.010	<0.001	<0.001	<0.001	-
ES2213154	EMB21	Water	11/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.004	0.005	<0.002	<0.004	0.008	<0.002	0.005	<0.001	<0.001	<0.001	-
ES2213154	QA06[1]	Water	11/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.004	0.008	<0.002	<0.004	0.013	<0.002	0.004	<0.001	<0.001	<0.001	-
882131	QA06A[2]	Water	11/04/2022	<0.01	-	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	-	<0.01	-	-	-	<0.02

[1]Intralab duplicate of sample EMB21.
[2]Interlab duplicate of sample EMB21.

				Perfluoroalkane Carboxylic Acids										
				Perfluorobutanoic acid (PFBA)	Perfluorohexanoic acid (PFHxA)	Perfluoropentanoic acid (PFPeA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorodecanoic acid (PFDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorononanoic acid (PFNA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUnDA)
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL				0.002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
ANZG (2018) Marine Water 95% LOSP Toxicant DGVs														
ANZG (2018) Marine Water 99% LOSP Toxicant DGVs														
NEPM (2013) Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand (>=2m, <4m)														
NEMP (2020) PFAS Human Health Recreational				10	10	10	10	10	10	10	10	10	10	10
NEMP (2020) PFAS Interim Marine 95%				220	220	220	220	220	220	220	220	220	220	220
NEMP (2020) PFAS Interim Marine 99%				19	19	19	19	19	19	19	19	19	19	19
NT Government (2010) WQO for Darwin Harbour														
Lab Report Number	Sample ID	Matrix	Sample Date											
ES2213154	EMB17	Water	12/04/2022	1	6.97	5.57	1.98	2.33	0.0558	<0.0005	0.149	<0.0005	<0.0005	0.0019
ES2213154	EMB18	Water	12/04/2022	0.0563	0.174	0.184	0.112	0.0324	0.001	<0.0005	0.0149	<0.0005	<0.0005	<0.0005
ES2213154	EMB19	Water	12/04/2022	0.567	3.42	2.35	0.526	0.265	0.0051	<0.0005	0.0141	<0.0005	<0.0005	<0.0005
ES2213154	EMB20	Water	11/04/2022	1.33	6.43	5.36	1.67	0.305	<0.0005	<0.0005	0.0442	<0.0005	<0.0005	0.0008
ES2213154	EMB22	Water	11/04/2022	1.65	8.39	7.49	2.88	2.18	0.069	0.004	0.138	<0.0005	<0.0005	0.011
ES2213154	EMB23	Water	11/04/2022	1.96	6.6	7.11	3.33	1.71	0.0595	0.0014	0.218	<0.0005	<0.0005	0.0073
ES2213154	EMB24	Water	12/04/2022	2	6.22	7.05	4.8	1.11	0.0014	<0.0005	0.0442	<0.0005	<0.0005	<0.0005
ES2213154	EMB25	Water	12/04/2022	1.12	4.62	5.24	2.16	1.32	0.031	<0.0005	0.184	<0.0005	<0.0005	0.0015
ES2213154	EMB21	Water	11/04/2022	1.86	6.67	6.27	2.98	1.03	0.0212	<0.0005	0.0936	<0.0005	<0.0005	<0.0005
ES2213154	QA06[1]	Water	11/04/2022	1.97	6.85	6.24	3.06	1.04	0.0187	<0.0005	0.0926	<0.0005	<0.0005	<0.0005
882131	QA06A[2]	Water	11/04/2022	-	-	-	-	-	-	-	-	-	-	-

[1]Intralab duplicate of sample EMB21.
[2]Interlab duplicate of sample EMB21.

				Perfluoroalkyl Sulfonamides							Perfluoroalkane Sulfonic Acids						(n:2) Fluorotelomer Sulfonic Acids				PFAS		
				Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-methyl perfluorooctane sulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecane sulfonic acid (PFDS)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	Sum of PFHxS and PFOS	Sum of PFAS	Sum of PFOS related compounds
				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				0.0005	0.001	0.0005	0.001	0.001	0.0005	0.001	0.0005	0.0005	0.0005	0.0005	0.0002	0.0005	0.001	0.001	0.001	0.001	0.0002	0.0002	-
ANZG (2018) Marine Water 95% LOSP Toxicant DGVs																							
ANZG (2018) Marine Water 99% LOSP Toxicant DGVs																							
NEPM (2013) Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand (>=2m, <4m)																							
NEMP (2020) PFAS Human Health Recreational				10	10	10	10	10	10	10	2	2	2	2	2	2	2	2	2	2			2
NEMP (2020) PFAS Interim Marine 95%				220	220	220	220	220	220	220	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13			0.13
NEMP (2020) PFAS Interim Marine 99%				19	19	19	19	19	19	19	0.00023	0.00023	0.00023	0.00023	0.00023	0.00023	0.00023	0.00023	0.00023	0.00023			0.00023
NT Government (2010) WQO for Darwin Harbour																							
Lab Report Number	Sample ID	Matrix	Sample Date																				
ES2213154	EMB17	Water	12/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.0011	<0.0005	0.0034	<0.0005	0.0031	<0.0005	0.058	54.5	7.29	<0.001	0.0065	79.9	61.86
ES2213154	EMB18	Water	12/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.0005	<0.0005	0.0032	<0.0005	0.0054	<0.0005	<0.001	0.019	0.009	<0.001	0.0086	0.611	0.04
ES2213154	EMB19	Water	12/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.0005	<0.0005	0.0009	<0.0005	0.0004	<0.0005	0.06	23.9	0.234	<0.001	0.0013	31.3	24.20
ES2213154	EMB20	Water	11/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.0006	<0.0005	0.0027	<0.0005	0.0015	<0.0005	0.022	19.3	0.013	<0.001	0.0042	34.5	19.34
ES2213154	EMB22	Water	11/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.0005	<0.0005	0.0034	<0.0005	0.0052	<0.0005	0.034	51.2	7.2	0.074	0.0086	81.3	58.52
ES2213154	EMB23	Water	11/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.0014	<0.0005	0.008	<0.0005	0.0085	<0.0005	0.04	30.1	9.48	0.037	0.0165	60.7	39.67
ES2213154	EMB24	Water	12/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.0018	0.0007	0.0037	<0.0005	0.0021	<0.0005	0.005	1.92	0.121	<0.001	0.0058	23.3	2.05
ES2213154	EMB25	Water	12/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.0028	0.0017	0.0169	0.001	0.0203	<0.0005	0.012	8.36	5.81	0.004	0.0372	28.9	14.23
ES2213154	EMB21	Water	11/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.0007	<0.0005	0.0048	<0.0005	0.0012	<0.0005	0.018	19.9	2.56	<0.001	0.006	41.4	22.48
ES2213154	QA06[1]	Water	11/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.0008	<0.0005	0.0052	<0.0005	0.0013	<0.0005	0.02	21	2.61	<0.001	0.0065	42.9	23.64
882131	QA06A[2]	Water	11/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[1]Intralab duplicate of sample EMB21.
[2]Interlab duplicate of sample EMB21.

			TPH	TPH - (Silica Gel Cleanup)				TRH		TRH - (Silica Gel Cleanup)				
	Sum of PFOA related compounds	Sum of PFAS (WA DER List)	C6-C9 Fraction	C10-C14 Fraction (SG)	C10-C36 Fraction (Sum)(SG)	C15-C28 Fraction (SG)	C29-C36 Fraction (SG)	C6-C10 Fraction (F1)	C6-C10 (F1 minus BTEX)	>C10-C16 Fraction (SG)	>C10-C16 (F2 minus Naphthalene) (SG)	>C16-C34 Fraction (SG)	>C34-C40 Fraction (SG)	>C10-C40 Fraction (SG)
	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	20	50	50	100	50	20	20	50	100	100	100	100
ANZG (2018) Marine Water 95% LOSP Toxicant DGVs														
ANZG (2018) Marine Water 99% LOSP Toxicant DGVs														
NEPM (2013) Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand (>=2m, <4m)									6,000	NL				
NEMP (2020) PFAS Human Health Recreational	10													
NEMP (2020) PFAS Interim Marine 95%	220													
NEMP (2020) PFAS Interim Marine 99%	19													
NT Government (2010) WQO for Darwin Harbour														
Lab Report Number	Sample ID	Matrix	Sample Date											
ES2213154	EMB17	Water	12/04/2022	18.06	79.6	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	EMB18	Water	12/04/2022	0.57	0.595	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	EMB19	Water	12/04/2022	7.15	31.3	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	EMB20	Water	11/04/2022	15.14	34.4	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	EMB22	Water	11/04/2022	22.81	81	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	EMB23	Water	11/04/2022	21.00	60.3	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	EMB24	Water	12/04/2022	21.23	23.2	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	EMB25	Water	12/04/2022	14.68	28.7	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	EMB21	Water	11/04/2022	18.92	41.3	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	QA06[1]	Water	11/04/2022	19.27	42.8	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
882131	QA06A[2]	Water	11/04/2022	-	-	-	<50	<100	<100	<100	-	-	<50	-	<100	<100	<100

[1]Intralab duplicate of sample EMB21.
[2]Interlab duplicate of sample EMB21.

				BTEX								Inorganics	Metals								
				Naphthalene (VOC)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	Total BTEX	Ammonia as N	Arsenic (filtered)	Cadmium (filtered)	Chromium (III+VI) (filtered)	Copper (filtered)	Lead (filtered)	Mercury (filtered)	Nickel (filtered)	Zinc (filtered)
				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				10	1	1	1	2	1	2	1	10	1	0.1	1	1	1	0.1	1	5
Lab Report Number	**Sample ID**	**Matrix**	**Sample Date**																	
ES2213154	EMB21	Water	11/04/2022	-	<1	<2	<2	<2	<2	<2	<1	<10	<1	<0.1	<1	5	3	<0.1	3	22
	QA06	Water	11/04/2022	-	<1	<2	<2	<2	<2	<2	<1	100	<1	<0.1	<1	4	3	<0.1	3	22
RPD				-	0	0	0	0	0	0	0	164	0	0	0	22	0	0	0	0
ES2213154	EMB21	Water	11/04/2022	-	<1	<2	<2	<2	<2	<2	<1	<10	<1	<0.1	<1	5	3	<0.1	3	22
882131	QA06A	Water	11/04/2022	<10	<1	<1	<1	<2	<1	<3	-	<10	2	<0.2	1	3	3	<0.1	2	18
RPD				-	0	0	0	0	0	0	-	0	67	0	0	50	0	0	40	20

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

****Field duplicates had relative percentage difference (RPD) control limits: Less than 50%, where result is greater than 10 times limit of reporting (LOR). No limit where result is less than 10 times LOR.**

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

				PAH																										
				Sum of 16 USEPA Priority PAHs	Benzo(b+j+k)fluoranthene	2-methylnaphthalene	3-methylcholanthrene	7,12-dimethylbenz(a)anthracene	Acenaphthene	Acenaphthylene	Anthracene	Coronene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b+j)fluoranthene	Benzo(e)pyrene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Perylene	Pyrene	Benzo(a)pyrene TEQ calc (Half)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ calc (Zero)	PAHs (Sum of total)
				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				0.001	0.004	0.002	0.004	0.001	0.002	0.002	0.001	0.002	0.002	0.001	0.004	0.001	0.002	0.004	0.001	0.001	0.001	0.002	0.002	0.004	0.002	0.002	0.001	0.001	0.001	0.001	0.01
Lab Report Number	**Sample ID**	**Matrix**	**Sample Date**																												
ES2213154	**EMB21**	**Water**	**11/04/2022**	0.027	*<0.004*	*<0.002*	*<0.004*	*<0.001*	*<0.002*	0.005	*<0.001*	*<0.002*	*<0.002*	*<0.001*	*<0.004*	*<0.001*	*<0.002*	*<0.004*	*<0.001*	*<0.001*	0.004	0.005	*<0.002*	*<0.004*	0.008	*<0.002*	0.005	*<0.001*	*<0.001*	*<0.001*	-
	QA06	**Water**	**11/04/2022**	0.029	*<0.004*	*<0.002*	*<0.004*	*<0.001*	*<0.002*	*<0.002*	*<0.001*	*<0.002*	*<0.002*	*<0.001*	*<0.004*	*<0.001*	*<0.002*	*<0.004*	*<0.001*	*<0.001*	0.004	0.008	*<0.002*	*<0.004*	0.013	*<0.002*	0.004	*<0.001*	*<0.001*	*<0.001*	-
RPD				7	0	0	0	0	0	86	0	0	0	0	0	0	0	0	0	0	0	46	0	0	48	0	22	0	0	0	-
ES2213154	**EMB21**	**Water**	**11/04/2022**	0.027	*<0.004*	*<0.002*	*<0.004*	*<0.001*	*<0.002*	0.005	*<0.001*	*<0.002*	*<0.002*	*<0.001*	*<0.004*	*<0.001*	*<0.002*	*<0.004*	*<0.001*	*<0.001*	0.004	0.005	*<0.002*	*<0.004*	0.008	*<0.002*	0.005	*<0.001*	*<0.001*	*<0.001*	-
882131	**QA06A**	**Water**	**11/04/2022**	-	-	-	-	-	*<0.01*	*<0.01*	*<0.01*	-	*<0.01*	*<0.01*	*<0.01*	-	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.02*	*<0.01*	-	*<0.01*	-	-	-	*<0.02*
RPD				-	-	-	-	-	0	0	0	-	0	0	0	-	0	0	0	0	0	0	0	0	0	-	0	-	-	-	-

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

****Field duplicates had relative percentage difference (RPD) control limits: Less than 50%, where result is greater than 10 times limit of reporting (LOR). No limit where result is less than 10 times LOR.**

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

				Perfluoroalkane Carboxylic Acids											Perfluoroalkane Sulfonic Acids						Perfluoroalkyl Sulfonamides							(n:2) Fluorotelomer Sulfonic Acids			
				Perfluorobutanoic acid (PFBA)	Perfluorohexanoic acid (PFHxA)	Perfluoropentanoic acid (PFPeA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorodecanoic acid (PFDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorononanoic acid (PFNA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecane sulfonic acid (PFDS)	Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-methyl perfluorooctane sulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)
				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				0.002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0002	0.0005	0.0005	0.001	0.0005	0.001	0.001	0.0005	0.001	0.001	0.001	0.001	0.001
Lab Report Number	**Sample ID**	**Matrix**	**Sample Date**																													
ES2213154	**EMB21**	**Water**	**11/04/2022**	1.86	6.67	6.27	2.98	1.03	0.0212	*<0.0005*	0.0936	*<0.0005*	*<0.0005*	*<0.0005*	0.0007	*<0.0005*	0.0048	*<0.0005*	0.0012	*<0.0005*	*<0.0005*	*<0.001*	*<0.0005*	*<0.001*	*<0.001*	*<0.0005*	*<0.001*	0.018	19.9	2.56	*<0.001*
	QA06	**Water**	**11/04/2022**	1.97	6.85	6.24	3.06	1.04	0.0187	*<0.0005*	0.0926	*<0.0005*	*<0.0005*	*<0.0005*	0.0008	*<0.0005*	0.0052	*<0.0005*	0.0013	*<0.0005*	*<0.0005*	*<0.001*	*<0.0005*	*<0.001*	*<0.001*	*<0.0005*	*<0.001*	0.020	21.0	2.61	*<0.001*
RPD				6	3	0	3	1	13	0	1	0	0	0	13	0	8	0	8	0	0	0	0	0	0	0	0	11	5	2	0
ES2213154	**EMB21**	**Water**	**11/04/2022**	1.86	6.67	6.27	2.98	1.03	0.0212	*<0.0005*	0.0936	*<0.0005*	*<0.0005*	*<0.0005*	0.0007	*<0.0005*	0.0048	*<0.0005*	0.0012	*<0.0005*	*<0.0005*	*<0.001*	*<0.0005*	*<0.001*	*<0.001*	*<0.0005*	*<0.001*	0.018	19.9	2.56	*<0.001*
882131	**QA06A**	**Water**	**11/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RPD				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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

****Field duplicates had relative percentage difference (RPD) control limits: Less than 50%, where result is greater than 10 times limit of reporting (LOR). No limit where result is less than 10 times LOR.**

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

				PFAS			TPH					TRH		TRH - (Silica Gel Cleanup)				
				Sum of PFHxS and PFOS	Sum of PFAS	Sum of PFAS (WA DER List)	C10-C14 Fraction (SG)	C10-C36 Fraction (Sum)(SG)	C15-C28 Fraction (SG)	C29-C36 Fraction (SG)	C6-C9 Fraction	C6-C10 Fraction (F1)	C6-C10 (F1 minus BTEX)	>C10-C16 Fraction (SG)	>C10-C16 (F2 minus Naphthalene) (SG)	>C16-C34 Fraction (SG)	>C34-C40 Fraction (SG)	>C10-C40 Fraction (SG)
				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	0.0002	0.0002	50	50	100	50	20	20	20	50	100	100	100	100
Lab Report Number	**Sample ID**	**Matrix**	**Sample Date**															
ES2213154	**EMB21**	**Water**	**11/04/2022**	0.0060	41.4	41.3	*<50*	*<50*	*<100*	*<50*	*<20*	*<20*	*<20*	*<100*	*<100*	*<100*	*<100*	*<100*
	QA06	**Water**	**11/04/2022**	0.0065	42.9	42.8	*<50*	*<50*	*<100*	*<50*	*<20*	*<20*	*<20*	*<100*	*<100*	*<100*	*<100*	*<100*
RPD				8	4	4	0	0	0	0	0	0	0	0	0	0	0	0
ES2213154	**EMB21**	**Water**	**11/04/2022**	0.0060	41.4	41.3	*<50*	*<50*	*<100*	*<50*	*<20*	*<20*	*<20*	*<100*	*<100*	*<100*	*<100*	*<100*
882131	**QA06A**	**Water**	**11/04/2022**	-	-	-	*<50*	*<100*	*<100*	*<100*	-	-	-	*<50*	-	*<100*	*<100*	*<100*
RPD				-	-	-	0	0	0	0	-	-	-	0	-	0	0	0

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

****Field duplicates had relative percentage difference (RPD) control limits: Less than 50%, where result is greater than 10 times limit of reporting (LOR). No limit where result is less than 10 times LOR.**

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

				BTEXN								Metals							
				Naphthalene (VOC)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	Total BTEX	Arsenic (filtered)	Cadmium (filtered)	Chromium (III+VI) (filtered)	Copper (filtered)	Lead (filtered)	Mercury (filtered)	Nickel (filtered)	Zinc (filtered)
				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				10	1	1	1	2	1	2	1	1	0.1	1	1	1	0.1	1	5
Lab Report Number	**Sample ID**	**Matrix**	**Sample Date**																
ES2212085	**BLANK01**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	**RINSATE 01**	**Water**	**04/04/2022**	-	*<1*	*<2*	*<2*	*<2*	*<2*	*<2*	*<1*	*<1*	*<0.1*	*<1*	*<1*	*<1*	*<0.1*	*<1*	*<5*
ES2212085	**RINSATE 02**	**Water**	**05/04/2022**	-	*<1*	*<2*	*<2*	*<2*	*<2*	*<2*	*<1*	*<1*	*<0.1*	*<1*	*<1*	*<1*	*<0.1*	*<1*	*<5*
ES2212085	**TRIP BLANK**	**Water**	**04/04/2022**	-	*<1*	*<2*	*<2*	*<2*	*<2*	*<2*	*<1*	-	-	-	-	-	-	-	-
ES2212247	**BLANK 02**	**Water**	**06/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	**RINSATE 03**	**Water**	**06/04/2022**	-	*<1*	*<2*	*<2*	*<2*	*<2*	*<2*	*<1*	*<1*	*<0.1*	*<1*	*<1*	*<1*	*<0.1*	*<1*	*<5*
ES2212731	**BLANK03**	**Water**	**07/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	**RINSATE04**	**Water**	**07/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	**BLANK 04**	**Water**	**08/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	**RINSATE 05**	**Water**	**08/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	**TRIP BLANK**	**Water**	**04/04/2022**	*<1*	*<0.2*	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.5*	*<0.2*	-	-	-	-	-	-	-	-
ES2213150	**TRIP SPIKE 2**	**Water**	**04/04/2022**	100%	100%	89%	87%	90%	95%	92%	90%	-	-	-	-	-	-	-	-
ES2213154	**TRIP SPIKE 1**	**Water**	**04/04/2022**	95%	105%	95%	95%	90%	95%	185%	120%	-	-	-	-	-	-	-	-
ES2213154	**BLANK 05**	**Water**	**11/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213154	**TRIP BLANK**	**Water**	**04/04/2022**	*<5*	*<1*	*<2*	*<2*	*<2*	*<2*	*<2*	*<1*	-	-	-	-	-	-	-	-

				PAH																	
				Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b+j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Benzo(b+j+K)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	Benzo(a)pyrene TEQ calc (Zero)	PAHs (Sum of total)
				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				0.002	0.002	0.001	0.002	0.001	0.004	0.002	0.004	0.004	0.001	0.001	0.001	0.002	0.002	0.004	0.002	0.001	0.001	0.01
Lab Report Number	**Sample ID**	**Matrix**	**Sample Date**																		
ES2212085	**BLANK01**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	**RINSATE 01**	**Water**	**04/04/2022**	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<0.5*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<0.5*	*<0.5*
ES2212085	**RINSATE 02**	**Water**	**05/04/2022**	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<0.5*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<0.5*	*<0.5*
ES2212085	**TRIP BLANK**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*<5*	-	-	-	-
ES2212247	**BLANK 02**	**Water**	**06/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	**RINSATE 03**	**Water**	**06/04/2022**	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<0.5*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<1.0*	*<0.5*	*<0.5*
ES2212731	**BLANK03**	**Water**	**07/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	**RINSATE04**	**Water**	**07/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	**BLANK 04**	**Water**	**08/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	**RINSATE 05**	**Water**	**08/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	**TRIP BLANK**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*<5*	-	-	-	-
ES2213150	**TRIP SPIKE 2**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213154	**TRIP SPIKE 1**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213154	**BLANK 05**	**Water**	**11/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213154	**TRIP BLANK**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

				Perfluoroalkane Carboxylic Acids											Perfluoroalkane Sulfonic Acids					
				Perfluorobutanoic acid (PFBA)	Perfluorohexanoic acid (PFHxA)	Perfluoropentanoic acid (PFPeA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorodecanoic acid (PFDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorononanoic acid (PFNA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecane sulfonic acid (PFDS)
				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				0.002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0002	0.0005
Lab Report Number	**Sample ID**	**Matrix**	**Sample Date**																		
ES2212085	**BLANK01**	**Water**	**04/04/2022**	*<0.1*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.02*	*<0.02*	*<0.05*	*<0.02*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.01*	*<0.02*
ES2212085	**RINSATE 01**	**Water**	**04/04/2022**	*<0.1*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.02*	*<0.02*	*<0.05*	*<0.02*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.01*	*<0.02*
ES2212085	**RINSATE 02**	**Water**	**05/04/2022**	*<0.1*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.02*	*<0.02*	*<0.05*	*<0.02*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.01*	*<0.02*
ES2212085	**TRIP BLANK**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	**BLANK 02**	**Water**	**06/04/2022**	*<0.1*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.02*	*<0.02*	*<0.05*	*<0.02*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.01*	*<0.02*
ES2212247	**RINSATE 03**	**Water**	**06/04/2022**	*<0.1*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.02*	*<0.02*	*<0.05*	*<0.02*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.01*	*<0.02*
ES2212731	**BLANK03**	**Water**	**07/04/2022**	*<0.1*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.02*	*<0.02*	*<0.05*	*<0.02*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.01*	*<0.02*
ES2212731	**RINSATE04**	**Water**	**07/04/2022**	*<0.1*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.02*	*<0.02*	*<0.05*	*<0.02*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.01*	*<0.02*
ES2213150	**BLANK 04**	**Water**	**08/04/2022**	*<0.1*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.02*	*<0.02*	*<0.05*	*<0.02*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.01*	*<0.02*
ES2213150	**RINSATE 05**	**Water**	**08/04/2022**	*<0.1*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.02*	*<0.02*	*<0.05*	*<0.02*	*<0.02*	*<0.02*	*<0.02*	*<0.01*	*<0.02*	*<0.01*	*<0.02*
ES2213150	**TRIP BLANK**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	**TRIP SPIKE 2**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213154	**TRIP SPIKE 1**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213154	**BLANK 05**	**Water**	**11/04/2022**	*<0.0020*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0002*	*<0.0005*
ES2213154	**TRIP BLANK**	**Water**	**04/04/2022**	*<0.01*	*<0.002*	*<0.002*	*<0.002*	*<0.002*	-	-	-	-	-	-	*<0.002*	-	*<0.002*	-	*<0.002*	-

				Perfluoroalkyl Sulfonamides							PFAS			(n:2) Fluorotelomer Sulfonic Acids			
				Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-methyl perfluorooctane sulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	Sum of PFHxS and PFOS	Sum of PFAS	Sum of PFAS (WA DER List)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)
				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				0.0005	0.001	0.0005	0.001	0.001	0.0005	0.001	0.0002	0.0002	0.0002	0.001	0.001	0.001	0.001
Lab Report Number	**Sample ID**	**Matrix**	**Sample Date**														
ES2212085	**BLANK01**	**Water**	**04/04/2022**	*<0.02*	*<0.05*	*<0.02*	*<0.05*	*<0.05*	*<0.02*	*<0.05*	*<0.01*	*<0.01*	*<0.01*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
ES2212085	**RINSATE 01**	**Water**	**04/04/2022**	*<0.02*	*<0.05*	*<0.02*	*<0.05*	*<0.05*	*<0.02*	*<0.05*	*<0.01*	*<0.01*	*<0.01*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
ES2212085	**RINSATE 02**	**Water**	**05/04/2022**	*<0.02*	*<0.05*	*<0.02*	*<0.05*	*<0.05*	*<0.02*	*<0.05*	*<0.01*	*<0.01*	*<0.01*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
ES2212085	**TRIP BLANK**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	**BLANK 02**	**Water**	**06/04/2022**	*<0.02*	*<0.05*	*<0.02*	*<0.05*	*<0.05*	*<0.02*	*<0.05*	*<0.01*	*<0.01*	*<0.01*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
ES2212247	**RINSATE 03**	**Water**	**06/04/2022**	*<0.02*	*<0.05*	*<0.02*	*<0.05*	*<0.05*	*<0.02*	*<0.05*	*<0.01*	*<0.01*	*<0.01*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
ES2212731	**BLANK03**	**Water**	**07/04/2022**	*<0.02*	*<0.05*	*<0.02*	*<0.05*	*<0.05*	*<0.02*	*<0.05*	*<0.01*	*<0.01*	*<0.01*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
ES2212731	**RINSATE04**	**Water**	**07/04/2022**	*<0.02*	*<0.05*	*<0.02*	*<0.05*	*<0.05*	*<0.02*	*<0.05*	*<0.01*	*<0.01*	*<0.01*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
ES2213150	**BLANK 04**	**Water**	**08/04/2022**	*<0.02*	*<0.05*	*<0.02*	*<0.05*	*<0.05*	*<0.02*	*<0.05*	*<0.01*	*<0.01*	*<0.01*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
ES2213150	**RINSATE 05**	**Water**	**08/04/2022**	*<0.02*	*<0.05*	*<0.02*	*<0.05*	*<0.05*	*<0.02*	*<0.05*	*<0.01*	*<0.01*	*<0.01*	*<0.05*	*<0.05*	*<0.05*	*<0.05*
ES2213150	**TRIP BLANK**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	**TRIP SPIKE 2**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213154	**TRIP SPIKE 1**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213154	**BLANK 05**	**Water**	**11/04/2022**	*<0.0005*	*<0.001*	*<0.0005*	*<0.001*	*<0.001*	*<0.0005*	*<0.001*	*<0.0002*	*<0.0002*	*<0.0002*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
ES2213154	**TRIP BLANK**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	*<0.002*	-	*<0.002*	*<0.005*	*<0.005*	*<0.005*	*<0.005*

				TPH					TRH							
				C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Sum)	C6-C10 Fraction (F1)	C6-C10 (F1 minus BTEX)	>C10-C16 Fraction (F2)	>C10-C16 Fraction (F2 minus Naphthalene)	>C16-C34 Fraction (F3)	>C34-C40 Fraction (F4)	>C10-C40 Fraction (Sum)
				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				20	50	100	50	50	20	20	100	100	100	100	100
Lab Report Number	**Sample ID**	**Matrix**	**Sample Date**												
ES2212085	**BLANK01**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	**RINSATE 01**	**Water**	**04/04/2022**	*<20*	*<50*	*<100*	*<50*	*<50*	*<20*	*<20*	130	130	*<100*	*<100*	130
ES2212085	**RINSATE 02**	**Water**	**05/04/2022**	*<20*	*<50*	*<100*	*<50*	*<50*	*<20*	*<20*	*<100*	*<100*	*<100*	*<100*	*<100*
ES2212085	**TRIP BLANK**	**Water**	**04/04/2022**	*<20*	-	-	-	-	*<20*	*<20*	-	-	-	-	-
ES2212247	**BLANK 02**	**Water**	**06/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	**RINSATE 03**	**Water**	**06/04/2022**	*<20*	*<50*	*<100*	*<50*	*<50*	*<20*	*<20*	*<100*	*<100*	*<100*	*<100*	*<100*
ES2212731	**BLANK03**	**Water**	**07/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	**RINSATE04**	**Water**	**07/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	**BLANK 04**	**Water**	**08/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	**RINSATE 05**	**Water**	**08/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	**TRIP BLANK**	**Water**	**04/04/2022**	*<10*	-	-	-	-	*<10*	*<10*	-	-	-	-	-
ES2213150	**TRIP SPIKE 2**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-
ES2213154	**TRIP SPIKE 1**	**Water**	**04/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-
ES2213154	**BLANK 05**	**Water**	**11/04/2022**	-	-	-	-	-	-	-	-	-	-	-	-
ES2213154	**TRIP BLANK**	**Water**	**04/04/2022**	*<20*	-	-	-	-	*<20*	*<20*	-	-	-	-	-

					Leaching Preparation	(n:2) Fluorotelomer Sulfonic Acids				Perfluoroalkane Carboxylic Acids											
					pH (Final)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	Perfluorobutanoic acid (PFBA)	Perfluorohexanoic acid (PFHxA)	Perfluoropentanoic acid (PFPeA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorodecanoic acid (PFDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorononanoic acid (PFNA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorobutane sulfonic acid (PFBS)
					-	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					0.1	0.001	0.001	0.001	0.001	0.002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
ANZG (2018) Marine Water 95% LOSP Toxicant DGVs																					
ANZG (2018) Marine Water 99% LOSP Toxicant DGVs																					
NEPM (2013) Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand (>=2m, <4m)																					
NEMP (2020) PFAS Recreational						2	2	2	2	10	10	10	10	10	10	10	10	10	10	10	2
NEMP (2020) PFAS Interim Marine 95%						0.13	0.13	0.13	0.13	220	220	220	220	220	220	220	220	220	220	220	0.13
NEMP (2020) PFAS Interim Marine 99%						0.00023	0.00023	0.00023	0.00023	19	19	19	19	19	19	19	19	19	19	19	0.00023
NT Government (2010) WQO for Darwin Harbour																					
Lab Report Number	Field ID	Matrix Type	Date																		
ES2215138	EMB17/0.05-0.15	Water	4/04/2022		9	*<0.001*	6.04	6.05	0.031	0.0051	0.0186	0.0299	0.0105	0.204	0.0313	0.003	0.28	*<0.0008*	*<0.0005*	0.0033	*<0.0005*
ES2215138	EMB18/0.1-0.2	Water	4/04/2022		7.5	*<0.001*	0.001	0.002	*<0.001*	0.0059	0.015	0.0261	0.0063	0.0033	*<0.0005*	*<0.0005*	0.0011	*<0.0008*	*<0.0005*	*<0.0005*	*<0.0005*
ES2215138	EMB19/0.02-0.05	Water	5/04/2022		6.9	*<0.001*	*<0.001*	*<0.001*	*<0.001*	0.0035	0.0049	0.006	0.0009	0.002	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0008*	*<0.0005*	*<0.0005*	0.0012
ES2215138	EMB20/1.1-1.2	Water	5/04/2022		5.1	*<0.001*	0.003	*<0.001*	*<0.001*	0.0076	0.0335	0.0408	0.0063	0.0008	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0008*	*<0.0005*	*<0.0005*	*<0.0005*
ES2215138	SBH04/0.08-0.15	Water	7/04/2022		11	0.002	2.74	3.84	0.065	0.014	0.0936	0.0774	0.05	0.0545	0.0386	0.0033	0.0112	*<0.0008*	*<0.0005*	0.0033	*<0.0005*

				Perfluoroalkane Sulfonic Acids					Perfluoroalkyl Sulfonamides							PFAS				
				Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecane sulfonic acid (PFDS)	Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-methyl perfluorooctane sulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	Sum of PFHxS and PFOS	Sum of PFAS	Sum of PFOS related compounds	Sum of PFOA related compounds	Sum of PFAS (WA DER List)
				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				0.0005	0.0005	0.0005	0.0002	0.0005	0.0005	0.001	0.0005	0.001	0.001	0.0005	0.001	0.0002	0.0002	-	-	0.0002
ANZG (2018) Marine Water 95% LOSP Toxicant DGVs																				
ANZG (2018) Marine Water 99% LOSP Toxicant DGVs																				
NEPM (2013) Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand (>=2m, <4m)																				
NEMP (2020) PFAS Recreational				2	2	2	2	2	10	10	10	10	10	10	10			2	10	
NEMP (2020) PFAS Interim Marine 95%				0.13	0.13	0.13	0.13	0.13	220	220	220	220	220	220	220			0.13	220	
NEMP (2020) PFAS Interim Marine 99%				0.00023	0.00023	0.00023	0.00023	0.00023	19	19	19	19	19	19	19			0.00023	19	
NT Government (2010) WQO for Darwin Harbour																				
Lab Report Number	Field ID	Matrix Type	Date																	
ES2215138	EMB17/0.05-0.15	Water	4/04/2022	*<0.0005*	*<0.0005*	*<0.0005*	0.0024	*<0.0005*	*<0.0005*	*<0.001*	*<0.0005*	*<0.001*	*<0.001*	*<0.0005*	*<0.001*	0.0024	12.7	12.1234	0.5857	12.4
ES2215138	EMB18/0.1-0.2	Water	4/04/2022	*<0.0005*	0.0034	*<0.0005*	0.0081	*<0.0005*	*<0.0005*	*<0.001*	*<0.0005*	*<0.001*	*<0.001*	*<0.0005*	*<0.001*	0.0115	0.0722	0.0145	0.0577	0.0711
ES2215138	EMB19/0.02-0.05	Water	5/04/2022	0.0011	0.0086	*<0.0005*	0.0214	*<0.0005*	*<0.0005*	*<0.001*	*<0.0005*	*<0.001*	*<0.001*	*<0.0005*	*<0.001*	0.03	0.0496	0.0323	0.0173	0.0485
ES2215138	EMB20/1.1-1.2	Water	5/04/2022	*<0.0005*	*<0.0005*	*<0.0005*	0.0004	*<0.0005*	*<0.0005*	*<0.001*	*<0.0005*	*<0.001*	*<0.001*	*<0.0005*	*<0.001*	0.0004	0.0924	0.0034	0.0890	0.0924
ES2215138	SBH04/0.08-0.15	Water	7/04/2022	*<0.0005*	*<0.0005*	*<0.0005*	0.0003	*<0.0005*	*<0.0005*	*<0.001*	*<0.0005*	*<0.001*	*<0.001*	*<0.0005*	*<0.001*	*<0.0003*	6.99	6.6473	0.3459	6.87

Appendix L **Laboratory Reports**

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www.eurofins.com.au EnviroSales@eurofins.com

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Melbourne
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Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

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Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

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Mayfield East NSW 2304
PO Box 60 Wickham 2293
Phone : +61 2 4968 8448
NATA # 1261 Site # 25079

Eurofins ARL Pty Ltd
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Phone : +61 8 6253 4444
NATA # 2377 Site # 2370

Eurofins Environment Testing NZ Limited
NZBN: 9429046024954

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Phone : +64 9 526 45 51
IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Sample Receipt Advice

Company name:	SMEC Australia Pty Ltd (SYD)
Contact name:	Manuel Fernandez
Project name:	VOPAK SITE INVESTIGATION
Project ID:	30080099
Turnaround time:	5 Day
Date/Time received	Apr 7, 2022 4:30 PM
Eurofins reference	878534

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	Sample Temperature of chilled sample on the batch as recorded by Eurofins Sample Receipt : 13.4 degrees Celsius.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
X	Split sample sent to requested external lab.
X	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Emma Beesley on phone : or by email: EmmaBeesley@eurofins.com

Results will be delivered electronically via email to Manuel Fernandez - manuel.fernandez@smec.com.

Note: A copy of these results will also be delivered to the general SMEC Australia Pty Ltd (SYD) email address.

eurofins | Environment Testing

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

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Phone : 0800 856 450
IANZ # 1290

Company Name: SMEC Australia Pty Ltd (SYD)
Address: Level 6, 76 Berry Street
North Sydney
NSW 2060

Project Name: VOPAK SITE INVESTIGATION
Project ID: 30080099

Order No.:
Report #: 878534
Phone: 02 9925 5555
Fax: 02 9925 5566

Received: Apr 7, 2022 4:30 PM
Due: Apr 14, 2022
Priority: 5 Day
Contact Name: Manuel Fernandez

Eurofins Analytical Services Manager : Emma Beesley

Sample Detail						Moisture Set	Eurofins Suite B7	Per- and Polyfluoroalkyl Substances (PFASs)
Melbourne Laboratory - NATA # 1261 Site # 1254								
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X
Brisbane Laboratory - NATA # 1261 Site # 20794								
Mayfield Laboratory - NATA # 1261 Site # 25079								
Perth Laboratory - NATA # 2377 Site # 2370								
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	QA01A	Apr 04, 2022		Soil	S22-Ap0017906	X	X	X
2	QA02A	Apr 05, 2022		Soil	S22-Ap0017907	X		X
Test Counts						2	1	2

SMEC Australia Pty Ltd
Level 6, 76 Berry Street
North Sydney
NSW 2060

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Manuel Fernandez**

Report **878534-S**
Project name VOPAK SITE INVESTIGATION
Project ID 30080099
Received Date Apr 07, 2022

Client Sample ID			**QA01A**	**QA02A**
Sample Matrix			**Soil**	**Soil**
Eurofins Sample No.			**S22-Ap0017906**	**S22-Ap0017907**
Date Sampled			**Apr 04, 2022**	**Apr 05, 2022**
Test/Reference	LOR	Unit		
Total Recoverable Hydrocarbons				
TRH C6-C9	20	mg/kg	< 20	-
TRH C10-C14	20	mg/kg	< 20	-
TRH C15-C28	50	mg/kg	< 50	-
TRH C29-C36	50	mg/kg	< 50	-
TRH C10-C36 (Total)	50	mg/kg	< 50	-
Naphthalene[N02]	0.5	mg/kg	< 0.5	-
TRH C6-C10	20	mg/kg	< 20	-
TRH C6-C10 less BTEX (F1)[N04]	20	mg/kg	< 20	-
TRH >C10-C16	50	mg/kg	< 50	-
TRH >C10-C16 less Naphthalene (F2)[N01]	50	mg/kg	< 50	-
TRH >C16-C34	100	mg/kg	< 100	-
TRH >C34-C40	100	mg/kg	< 100	-
TRH >C10-C40 (total)*	100	mg/kg	< 100	-
BTEX				
Benzene	0.1	mg/kg	< 0.1	-
Toluene	0.1	mg/kg	< 0.1	-
Ethylbenzene	0.1	mg/kg	< 0.1	-
m&p-Xylenes	0.2	mg/kg	< 0.2	-
o-Xylene	0.1	mg/kg	< 0.1	-
Xylenes - Total*	0.3	mg/kg	< 0.3	-
4-Bromofluorobenzene (surr.)	1	%	120	-
Polycyclic Aromatic Hydrocarbons				
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5	-
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6	-
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2	-
Acenaphthene	0.5	mg/kg	< 0.5	-
Acenaphthylene	0.5	mg/kg	< 0.5	-
Anthracene	0.5	mg/kg	< 0.5	-
Benz(a)anthracene	0.5	mg/kg	< 0.5	-
Benzo(a)pyrene	0.5	mg/kg	< 0.5	-
Benzo(b&j)fluoranthene[N07]	0.5	mg/kg	< 0.5	-
Benzo(g.h.i)perylene	0.5	mg/kg	< 0.5	-
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	-
Chrysene	0.5	mg/kg	< 0.5	-
Dibenz(a.h)anthracene	0.5	mg/kg	< 0.5	-

Client Sample ID			QA01A	QA02A
Sample Matrix			Soil	Soil
Eurofins Sample No.			S22-Ap0017906	S22-Ap0017907
Date Sampled			Apr 04, 2022	Apr 05, 2022
Test/Reference	LOR	Unit		
Polycyclic Aromatic Hydrocarbons				
Fluoranthene	0.5	mg/kg	< 0.5	-
Fluorene	0.5	mg/kg	< 0.5	-
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5	-
Naphthalene	0.5	mg/kg	< 0.5	-
Phenanthrene	0.5	mg/kg	< 0.5	-
Pyrene	0.5	mg/kg	< 0.5	-
Total PAH*	0.5	mg/kg	< 0.5	-
2-Fluorobiphenyl (surr.)	1	%	97	-
p-Terphenyl-d14 (surr.)	1	%	106	-
Heavy Metals				
Arsenic	2	mg/kg	52	-
Cadmium	0.4	mg/kg	< 0.4	-
Chromium	5	mg/kg	56	-
Copper	5	mg/kg	12	-
Lead	5	mg/kg	18	-
Mercury	0.1	mg/kg	< 0.1	-
Nickel	5	mg/kg	< 5	-
Zinc	5	mg/kg	15	-
% Moisture	1	%	11	7.9
Perfluoroalkyl carboxylic acids (PFCAs)				
Perfluorobutanoic acid (PFBA)[N11]	5	ug/kg	< 5	< 5
Perfluoropentanoic acid (PFPeA)[N11]	5	ug/kg	< 5	14
Perfluorohexanoic acid (PFHxA)[N11]	5	ug/kg	< 5	9.6
Perfluoroheptanoic acid (PFHpA)[N11]	5	ug/kg	< 5	< 5
Perfluorooctanoic acid (PFOA)[N11]	5	ug/kg	< 5	< 5
Perfluorononanoic acid (PFNA)[N11]	5	ug/kg	< 5	< 5
Perfluorodecanoic acid (PFDA)[N11]	5	ug/kg	< 5	< 5
Perfluoroundecanoic acid (PFUnDA)[N11]	5	ug/kg	< 5	< 5
Perfluorododecanoic acid (PFDoDA)[N11]	5	ug/kg	< 5	< 5
Perfluorotridecanoic acid (PFTrDA)[N15]	5	ug/kg	< 5	< 5
Perfluorotetradecanoic acid (PFTeDA)[N11]	5	ug/kg	< 5	< 5
13C4-PFBA (surr.)	1	%	85	80
13C5-PFPeA (surr.)	1	%	92	86
13C5-PFHxA (surr.)	1	%	90	87
13C4-PFHpA (surr.)	1	%	81	82
13C8-PFOA (surr.)	1	%	85	79
13C5-PFNA (surr.)	1	%	82	85
13C6-PFDA (surr.)	1	%	87	83
13C2-PFUnDA (surr.)	1	%	84	86
13C2-PFDoDA (surr.)	1	%	86	85
13C2-PFTeDA (surr.)	1	%	84	67

Client Sample ID			QA01A	QA02A
Sample Matrix			Soil	Soil
Eurofins Sample No.			S22-Ap0017906	S22-Ap0017907
Date Sampled			Apr 04, 2022	Apr 05, 2022
Test/Reference	LOR	Unit		
Perfluoroalkyl sulfonamido substances				
Perfluorooctane sulfonamide (FOSA)[N11]	5	ug/kg	< 5	< 5
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)[N11]	5	ug/kg	< 5	< 5
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)[N11]	5	ug/kg	< 5	< 5
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)[N11]	5	ug/kg	< 5	< 5
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)[N11]	5	ug/kg	< 5	< 5
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)[N11]	10	ug/kg	< 10	< 10
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)[N11]	10	ug/kg	< 10	< 10
13C8-FOSA (surr.)	1	%	78	73
D3-N-MeFOSA (surr.)	1	%	98	88
D5-N-EtFOSA (surr.)	1	%	105	91
D7-N-MeFOSE (surr.)	1	%	76	69
D9-N-EtFOSE (surr.)	1	%	70	64
D5-N-EtFOSAA (surr.)	1	%	88	96
D3-N-MeFOSAA (surr.)	1	%	76	72
Perfluoroalkyl sulfonic acids (PFSAs)				
Perfluorobutanesulfonic acid (PFBS)[N11]	5	ug/kg	< 5	< 5
Perfluorononanesulfonic acid (PFNS)[N15]	5	ug/kg	< 5	< 5
Perfluoropropanesulfonic acid (PFPrS)[N15]	5	ug/kg	< 5	< 5
Perfluoropentanesulfonic acid (PFPeS)[N15]	5	ug/kg	< 5	< 5
Perfluorohexanesulfonic acid (PFHxS)[N11]	5	ug/kg	< 5	< 5
Perfluoroheptanesulfonic acid (PFHpS)[N15]	5	ug/kg	< 5	< 5
Perfluorooctanesulfonic acid (PFOS)[N11]	5	ug/kg	< 5	< 5
Perfluorodecanesulfonic acid (PFDS)[N15]	5	ug/kg	< 5	< 5
13C3-PFBS (surr.)	1	%	88	83
18O2-PFHxS (surr.)	1	%	88	81
13C8-PFOS (surr.)	1	%	93	83
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)				
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)[N11]	5	ug/kg	< 5	< 5
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)[N11]	10	ug/kg	< 10	55
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)[N11]	5	ug/kg	< 5	< 5
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)[N11]	5	ug/kg	< 5	< 5
13C2-4:2 FTSA (surr.)	1	%	84	93
13C2-6:2 FTSA (surr.)	1	%	81	82
13C2-8:2 FTSA (surr.)	1	%	77	109
13C2-10:2 FTSA (surr.)	1	%	90	106
PFASs Summations				
Sum (PFHxS + PFOS)*	5	ug/kg	< 5	< 5
Sum of US EPA PFAS (PFOS + PFOA)*	5	ug/kg	< 5	< 5
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	5	ug/kg	< 5	< 5
Sum of WA DWER PFAS (n=10)*	10	ug/kg	< 10	78.6
Sum of PFASs (n=30)*	50	ug/kg	< 50	78.6

Sample History

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

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
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Sydney	Apr 12, 2022	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Sydney	Apr 12, 2022	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Sydney	Apr 12, 2022	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Sydney	Apr 12, 2022	14 Days
- Method: LTM-ORG-2010 BTEX and Volatile TRH			
Polycyclic Aromatic Hydrocarbons	Sydney	Apr 12, 2022	14 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Metals M8	Sydney	Apr 12, 2022	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
% Moisture	Sydney	Apr 08, 2022	14 Days
- Method: LTM-GEN-7080 Moisture			
Per- and Polyfluoroalkyl Substances (PFASs)			
Perfluoroalkyl carboxylic acids (PFCAs)	Sydney	Apr 12, 2022	28 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluoroalkyl sulfonamido substances	Sydney	Apr 12, 2022	28 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluoroalkyl sulfonic acids (PFSAs)	Sydney	Apr 12, 2022	28 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)	Sydney	Apr 12, 2022	28 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
PFASs Summations	Sydney	Apr 08, 2022	
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			

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Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: SMEC Australia Pty Ltd (SYD)
Address: Level 6, 76 Berry Street
North Sydney
NSW 2060

Project Name: VOPAK SITE INVESTIGATION
Project ID: 30080099

Order No.:
Report #: 878534
Phone: 02 9925 5555
Fax: 02 9925 5566

Received: Apr 7, 2022 4:30 PM
Due: Apr 14, 2022
Priority: 5 Day
Contact Name: Manuel Fernandez

Eurofins Analytical Services Manager : Emma Beesley

Sample Detail						Moisture Set	Eurofins Suite B7	Per- and Polyfluoroalkyl Substances (PFASs)
Melbourne Laboratory - NATA # 1261 Site # 1254								
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X
Brisbane Laboratory - NATA # 1261 Site # 20794								
Mayfield Laboratory - NATA # 1261 Site # 25079								
Perth Laboratory - NATA # 2377 Site # 2370								
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	QA01A	Apr 04, 2022		Soil	S22-Ap0017906	X	X	X
2	QA02A	Apr 05, 2022		Soil	S22-Ap0017907	X		X
Test Counts						2	1	2

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid 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. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. 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.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	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.
NCP	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.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

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%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

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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. 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.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. 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
Method Blank							
Total Recoverable Hydrocarbons							
TRH C6-C9	mg/kg	< 20			20	Pass	
TRH C10-C14	mg/kg	< 20			20	Pass	
TRH C15-C28	mg/kg	< 50			50	Pass	
TRH C29-C36	mg/kg	< 50			50	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
TRH C6-C10	mg/kg	< 20			20	Pass	
TRH >C10-C16	mg/kg	< 50			50	Pass	
TRH >C16-C34	mg/kg	< 100			100	Pass	
TRH >C34-C40	mg/kg	< 100			100	Pass	
Method Blank							
BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total*	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g.h.i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a.h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1.2.3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
Heavy Metals							
Arsenic	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Chromium	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.1			0.1	Pass	
Nickel	mg/kg	< 5			5	Pass	
Zinc	mg/kg	< 5			5	Pass	
Method Blank							
Perfluoroalkyl carboxylic acids (PFCAs)							
Perfluorobutanoic acid (PFBA)	ug/kg	< 5			5	Pass	
Perfluoropentanoic acid (PFPeA)	ug/kg	< 5			5	Pass	
Perfluorohexanoic acid (PFHxA)	ug/kg	< 5			5	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Perfluoroheptanoic acid (PFHpA)	ug/kg	< 5			5	Pass	
Perfluorooctanoic 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	
Method Blank							
Perfluoroalkyl sulfonamido substances							
Perfluorooctane 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-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ug/kg	< 10			10	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ug/kg	< 10			10	Pass	
Method Blank							
Perfluoroalkyl sulfonic acids (PFSAs)							
Perfluorobutanesulfonic acid (PFBS)	ug/kg	< 5			5	Pass	
Perfluorononanesulfonic acid (PFNS)	ug/kg	< 5			5	Pass	
Perfluoropropanesulfonic acid (PFPrS)	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	
Perfluorooctanesulfonic acid (PFOS)	ug/kg	< 5			5	Pass	
Perfluorodecanesulfonic acid (PFDS)	ug/kg	< 5			5	Pass	
Method Blank							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)							
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	
LCS - % Recovery							
Total Recoverable Hydrocarbons							
TRH C6-C9	%	108			70-130	Pass	
TRH C10-C14	%	75			70-130	Pass	
Naphthalene	%	93			70-130	Pass	
TRH C6-C10	%	101			70-130	Pass	
TRH >C10-C16	%	72			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	120			70-130	Pass	
Toluene	%	104			70-130	Pass	
Ethylbenzene	%	102			70-130	Pass	
m&p-Xylenes	%	102			70-130	Pass	
o-Xylene	%	101			70-130	Pass	
Xylenes - Total*	%	101			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	80			70-130	Pass	
Acenaphthylene	%	81			70-130	Pass	
Anthracene	%	82			70-130	Pass	
Benz(a)anthracene	%	72			70-130	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Benzo(a)pyrene	%	78			70-130	Pass	
Benzo(b&j)fluoranthene	%	75			70-130	Pass	
Benzo(g.h.i)perylene	%	80			70-130	Pass	
Benzo(k)fluoranthene	%	85			70-130	Pass	
Chrysene	%	78			70-130	Pass	
Dibenz(a.h)anthracene	%	76			70-130	Pass	
Fluoranthene	%	76			70-130	Pass	
Fluorene	%	83			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	78			70-130	Pass	
Naphthalene	%	80			70-130	Pass	
Phenanthrene	%	79			70-130	Pass	
Pyrene	%	75			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Arsenic	%	110			80-120	Pass	
Cadmium	%	107			80-120	Pass	
Chromium	%	110			80-120	Pass	
Copper	%	109			80-120	Pass	
Lead	%	104			80-120	Pass	
Mercury	%	104			80-120	Pass	
Nickel	%	90			80-120	Pass	
Zinc	%	105			80-120	Pass	
LCS - % Recovery							
Perfluoroalkyl carboxylic acids (PFCAs)							
Perfluorobutanoic acid (PFBA)	%	102			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	%	107			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	%	103			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	%	108			50-150	Pass	
Perfluorooctanoic acid (PFOA)	%	107			50-150	Pass	
Perfluorononanoic acid (PFNA)	%	109			50-150	Pass	
Perfluorodecanoic acid (PFDA)	%	107			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	%	109			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	%	112			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	%	114			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	%	108			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonamido substances							
Perfluorooctane sulfonamide (FOSA)	%	101			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	%	107			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	%	106			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	%	108			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	%	111			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	%	100			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	%	112			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonic acids (PFSAs)							
Perfluorobutanesulfonic acid (PFBS)	%	96			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)	%	101			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)	%	95			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)	%	92			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	%	93			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	%	97			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	%	103			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	%	95			50-150	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery									
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)									
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)			%	97			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)			%	96			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)			%	101			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)			%	100			50-150	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Spike - % Recovery									
Total Recoverable Hydrocarbons				Result 1					
TRH C6-C9	N22-Ap0016556	NCP	%	94			70-130	Pass	
TRH C10-C14	S22-Ap0024375	NCP	%	84			70-130	Pass	
Naphthalene	N22-Ap0016556	NCP	%	75			70-130	Pass	
TRH C6-C10	N22-Ap0016556	NCP	%	90			70-130	Pass	
TRH >C10-C16	S22-Ap0024375	NCP	%	81			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	N22-Ap0016556	NCP	%	105			70-130	Pass	
Toluene	N22-Ap0016556	NCP	%	90			70-130	Pass	
Ethylbenzene	N22-Ap0016556	NCP	%	88			70-130	Pass	
m&p-Xylenes	N22-Ap0016556	NCP	%	90			70-130	Pass	
o-Xylene	N22-Ap0016556	NCP	%	88			70-130	Pass	
Xylenes - Total*	N22-Ap0016556	NCP	%	89			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	S22-Ap0024383	NCP	%	86			70-130	Pass	
Acenaphthylene	S22-Ap0024383	NCP	%	88			70-130	Pass	
Anthracene	S22-Ap0024383	NCP	%	86			70-130	Pass	
Benz(a)anthracene	S22-Ap0024383	NCP	%	80			70-130	Pass	
Benzo(a)pyrene	S22-Ap0024383	NCP	%	84			70-130	Pass	
Benzo(b&j)fluoranthene	S22-Ap0024383	NCP	%	82			70-130	Pass	
Benzo(g.h.i)perylene	S22-Ap0024383	NCP	%	78			70-130	Pass	
Benzo(k)fluoranthene	S22-Ap0024383	NCP	%	93			70-130	Pass	
Chrysene	S22-Ap0024383	NCP	%	84			70-130	Pass	
Dibenz(a.h)anthracene	S22-Ap0024383	NCP	%	78			70-130	Pass	
Fluoranthene	S22-Ap0024383	NCP	%	82			70-130	Pass	
Fluorene	S22-Ap0024383	NCP	%	90			70-130	Pass	
Indeno(1.2.3-cd)pyrene	S22-Ap0024383	NCP	%	79			70-130	Pass	
Naphthalene	S22-Ap0024383	NCP	%	87			70-130	Pass	
Phenanthrene	S22-Ap0024383	NCP	%	86			70-130	Pass	
Pyrene	S22-Ap0024383	NCP	%	82			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	S22-Ap0021171	NCP	%	112			75-125	Pass	
Cadmium	S22-Ap0021171	NCP	%	112			75-125	Pass	
Chromium	S22-Ap0021171	NCP	%	116			75-125	Pass	
Copper	S22-Ap0021171	NCP	%	119			75-125	Pass	
Lead	S22-Ap0021261	NCP	%	112			75-125	Pass	
Mercury	S22-Ap0021171	NCP	%	112			75-125	Pass	
Nickel	S22-Ap0021171	NCP	%	109			75-125	Pass	
Zinc	S22-Ap0021261	NCP	%	95			75-125	Pass	
Spike - % Recovery									
Perfluoroalkyl carboxylic acids (PFCAs)				Result 1					
Perfluorobutanoic acid (PFBA)	S22-Ap0017925	NCP	%	101			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	S22-Ap0017925	NCP	%	106			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Perfluorohexanoic acid (PFHxA)	S22-Ap0017925	NCP	%	107			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	S22-Ap0017925	NCP	%	103			50-150	Pass	
Perfluorooctanoic acid (PFOA)	S22-Ap0017925	NCP	%	101			50-150	Pass	
Perfluorononanoic acid (PFNA)	S22-Ap0017925	NCP	%	109			50-150	Pass	
Perfluorodecanoic acid (PFDA)	S22-Ap0017925	NCP	%	106			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	S22-Ap0017925	NCP	%	106			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	S22-Ap0017925	NCP	%	109			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	S22-Ap0017925	NCP	%	121			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	S22-Ap0017925	NCP	%	108			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl sulfonamido substances				Result 1					
Perfluorooctane sulfonamide (FOSA)	S22-Ap0017925	NCP	%	103			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	S22-Ap0017925	NCP	%	107			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	S22-Ap0017925	NCP	%	103			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	S22-Ap0017925	NCP	%	104			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	S22-Ap0017925	NCP	%	109			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	S22-Ap0017925	NCP	%	103			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	S22-Ap0017925	NCP	%	96			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl sulfonic acids (PFSAs)				Result 1					
Perfluorobutanesulfonic acid (PFBS)	S22-Ap0017925	NCP	%	94			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)	S22-Ap0017925	NCP	%	98			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)	S22-Ap0017925	NCP	%	91			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)	S22-Ap0017925	NCP	%	91			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	S22-Ap0017925	NCP	%	90			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	S22-Ap0017925	NCP	%	94			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	S22-Ap0017925	NCP	%	96			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	S22-Ap0017925	NCP	%	95			50-150	Pass	
Spike - % Recovery									
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)				Result 1					
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	S22-Ap0017925	NCP	%	102			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	S22-Ap0017925	NCP	%	96			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	S22-Ap0017925	NCP	%	107			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	S22-Ap0017925	NCP	%	93			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Total Recoverable Hydrocarbons				Result 1	Result 2	RPD			
TRH C6-C9	S22-Ap0023339	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C10-C14	S22-Ap0029369	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH C15-C28	S22-Ap0029369	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH C29-C36	S22-Ap0029369	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
Naphthalene	S22-Ap0023339	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
TRH C6-C10	S22-Ap0023339	NCP	mg/kg	< 20	< 20	<1	30%	Pass	
TRH >C10-C16	S22-Ap0029369	NCP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34	S22-Ap0029369	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
TRH >C34-C40	S22-Ap0029369	NCP	mg/kg	< 100	< 100	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	S22-Ap0023339	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	S22-Ap0023339	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	S22-Ap0023339	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	S22-Ap0023339	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	S22-Ap0023339	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total*	S22-Ap0023339	NCP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	S22-Ap0021169	NCP	mg/kg	11	7.4	40	30%	Fail	Q15
Cadmium	S22-Ap0021169	NCP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	S22-Ap0021169	NCP	mg/kg	30	30	2.0	30%	Pass	
Copper	S22-Ap0021169	NCP	mg/kg	11	9.8	9.0	30%	Pass	
Lead	S22-Ap0021169	NCP	mg/kg	25	22	10	30%	Pass	
Mercury	S22-Ap0021169	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	S22-Ap0021169	NCP	mg/kg	< 5	< 5	<1	30%	Pass	
Zinc	S22-Ap0021169	NCP	mg/kg	31	27	14	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	S22-Ap0020592	NCP	%	13	12	6.0	30%	Pass	
Duplicate									
Perfluoroalkyl carboxylic acids (PFCAs)				Result 1	Result 2	RPD			
Perfluorobutanoic acid (PFBA)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoropentanoic acid (PFPeA)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorohexanoic acid (PFHxA)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoroheptanoic acid (PFHpA)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorooctanoic acid (PFOA)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorononanoic acid (PFNA)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorodecanoic acid (PFDA)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoroundecanoic acid (PFUnDA)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorododecanoic acid (PFDoDA)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorotridecanoic acid (PFTrDA)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorotetradecanoic acid (PFTeDA)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	

Duplicate									
Perfluoroalkyl sulfonamido substances				Result 1	Result 2	RPD			
Perfluorooctane sulfonamide (FOSA)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	S22-Ap0017924	NCP	ug/kg	< 10	< 10	<1	30%	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	S22-Ap0017924	NCP	ug/kg	< 10	< 10	<1	30%	Pass	
Duplicate									
Perfluoroalkyl sulfonic acids (PFSAs)				Result 1	Result 2	RPD			
Perfluorobutanesulfonic acid (PFBS)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorononanesulfonic acid (PFNS)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoropropanesulfonic acid (PFPrS)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoropentanesulfonic acid (PFPeS)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorohexanesulfonic acid (PFHxS)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorooctanesulfonic acid (PFOS)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorodecanesulfonic acid (PFDS)	S22-Ap0017924	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)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	S22-Ap0017924	NCP	ug/kg	< 10	< 10	<1	30%	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	S22-Ap0017924	NCP	ug/kg	< 5	< 5	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Temperature of Chilled samples on receipt	13.4°C
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
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
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).
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised by:

Emma Beesley	Analytical Services Manager
Gabriele Cordero	Senior Analyst (NSW)
Roopesh Rangarajan	Senior Analyst (NSW)
Charl Du Preez	Senior Analyst (NSW)



Glenn Jackson
General 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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SMEC

CHAIN OF CUSTODY FORM

SMEC OFFICE: SMEC North Sydney

PROJECT: Vopak Site Investigation

TURNAROUND REQUIREMENTS : ☐ Standard - 5 day TAT

LAB:
ALS Darwin
Unit 4/16 Charlton Court
Woolner, NT, 0820

ALS Sydney
277-289 Woodpark Road
Smithfield NSW 2164

ATTENTION:
Adrian Degenaar / Sepan Mahamad
DISPATCH TO (ADDRESS & PHONE NO.):

PROJECT NUMBER: 30080099

LAB QUOTE NO.: SY/285/21

COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

PROJECT MANAGER: Manuel Fernandez

CONTACT PH: 0422 159 256 (Pauline)

SAMPLED BY: Pauline Voukidis

DATE SAMPLED: 4&5 April 2022

(1st) RELINQUISHED BY: Pauline Voukidis
DATE/TIME: 4&5/4/2022

RECEIVED BY:
DATE/TIME:

(2nd) RELINQUISHED BY:
DATE/TIME:

RECEIVED BY:
DATE/TIME:

(3rd) RELINQUISHED BY:
DATE/TIME:

RECEIVED BY:
DATE/TIME:

Email Reports to (will default to PM if blank): manuel.fernandez@smec.com, pauline.voukidis@smec.com

Email Invoice to (will default to PM if blank): manuel.fernandez@smec.com

Special Laboratory Instructions:
Please forward results to smec@esdat.com.au
ESDAT format results

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	PFAS - Full Suite (28 analytes)	S-28 (TRH (C6-C40) / BTEXN / PAH / 6 Metals)	BTEX/TRH(C6-9)	BTEX				HOLD	
1	EMB17/0.05-0.15	4/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
2	EMB17/1.2-1.3	4/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
3	EMB18/0.1-0.2	4/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
4	EMB18/1.4-1.5	4/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
5	EMB19/0.02-0.05	5/04/2022	Soil	glass jar, 1 PFAS jar	2	X	X							
6	EMB19/0.9-1.0	5/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
7	EMB20/0.01-0.1	5/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
8	EMB20/1.1-1.2	5/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X								
9	EMB20/2.0-2.1	5/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
10	EMB21/0.01-0.10	5/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
11	EMB22/0.02-0.1	5/04/2022	Soil	1 glass jar, 1 PFAS jar	1	X								
12	EMB22/1.1-1.2	5/04/2022		1 PFAS jar	1	X								
13	EMB22/2.5-2.6	5/04/2022	Soil	1 PFAS jar	1								X	
14	QA01	4/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
1	QA01A	4/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							Send to Eurofins for Analysis
15	QA02	5/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X								
—	QA02A	5/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X								Send to Eurofins for Analysis
16	BLANK01	4/05/2022	Water	2 PFAS Bottles	2	X								
17	TRIP BLANK		Water	2 PFAS bottles	2								X	
18	TRIP BLANK		Water	1 vial	1			X						
19	TRIP SPIKE 28/3/22	28/03/2022	Water	1 vial	1				X					
20	RINSATE 01	4/04/2022	Water	1 metals, 2 PFAS, 2 vials	5	X	X							
21	RINSATE 02	5/04/2022	Water	2 metals, 2 amb, 2 PFAS, 2 vials	8	X	X							
				TOTAL		19	13	1	1				1	

Notes: Hold all remaining sample volume for possible future leachability analysis

LAB OF ORIGIN: DARWIN

Environmental Division
Sydney
Work Order Reference
ES2212085

Telephone : + 61-2-8784 8555

Subcon / Forward Lab / Split WO
Lab / Analysis: EUROFINS → QA01A QA02A
Organised By / Date:
Relinquished By / Date:
Connote / Courier:
WO No: ES2212085
Attached By PO / Internal Sheet:

4:30 pm 12/8

8785534

CHAIN OF CUSTODY FORM

SMEC

SMEC OFFICE: SMEC North Sydney **PROJECT:** Vopak Site Investigation	**TURNAROUND REQUIREMENTS :** ◻ Standard - 5 day TAT	**LAB:** ALS Darwin, Unit 4/16 Charlton Court, Woolner, NT, 0820 ALS Sydney, 277-289 Woodpark Road, Smithfield NSW 2164 **ATTENTION:** Adrian Degenaar / Sepan Mahamad DISPATCH TO (ADDRESS & PHONE NO.):
PROJECT NUMBER: 30080099	**LAB QUOTE NO.:** SY/285/21 (being updated by Sepan Mahamad)	**COC SEQUENCE NUMBER (Circle)**
PROJECT MANAGER: Manuel Fernandez	**CONTACT PH:** 0422 156 256 (Pauline)	**COC: PAGE 1**
SAMPLED BY: Pauline Voukidis		**OF: 2**
DATE SAMPLED: 11 to 12 April 2022	**(1st) RELINQUISHED BY:** Pauline Voukidis **DATE/TIME:** 12/4/2022	**(2nd) RELINQUISHED BY:** **DATE/TIME:**	**(3rd) RELINQUISHED BY:** **DATE/TIME:**
Email Reports to: manuel.fernandez@smec.com, pauline.voukidis@smec.com	RECEIVED BY:	RECEIVED BY:	RECEIVED BY:
Email Invoice to: manuel.fernandez@smec.com			

Special Laboratory Instructions:
Please forward results to smec@esdat.com.au

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	PFAS - Super Ultra Trace Waters Long Suite (29	TRH / BTEX (with silica gel)*	PAH (ultra trace)*	Metals (8)*	Ammonia*	BTEX/TRH(C6-9)	BTEX		
6	EMB17	12/04/2022	Water	see note 1	10	X	X	X	X	X				
4	EMB18	12/04/2022	Water	see note 1	10	X	X	X	X	X				
5	EMB19	12/04/2022	Water	see note 1	10	X	X	X	X	X				
2	EMB20	11/04/2022	Water	see note 1	10	X	X	X	X	X				
1	EMB21	11/04/2022	Water	see note 1	10	X	X	X	X	X				
3	EMB22	11/04/2022	Water	see note 1	10	X	X	X	X	X				
	EMB23	11/04/2022	Water	see note 1	10	X	X	X	X	X				
	EMB24	12/04/2022	Water	see note 1	10	X	X	X	X	X				
	EMB25	12/04/2022	Water	see note 1	10	X	X	X	X	X				
	QA06	11/04/2022	Water	see note 1	10	X	X	X	X	X				
	QA06A	11/04/2022	Water	see note 1	10	X	X	X	X	X				Send sample to Eurofins for analysis
7	BLANK05	11/04/2022	Water	see note 1	10	X								
8	MS/LD LAB	11/04/2022	Water	see note 1	10									For lab use as matrix spike and lab duplicate
10	TRIP BLANK	4/04/2022	Water	2 PFAS bottles	2	X								
11	TRIP SPIKE 1	4/04/2022	Water	1 Vial	1							X		
12	TRIP BLANK	4/04/2022	Water	4 vials	4						X			
				TOTAL		13	11			11	1	1		

Notes: 1) - 2xPFAS, 4 vials, 2 amber, 1 metals, 1 purple bottles
*** LORs must meet minimum LORs as per attached table***

Received Eurofins
BP 20/04/22 13.9°c
#882 131

Sub-cont / Forward Lab / Split WO
Lab Analysis: Eurofins → QA06A
Organised By / Date:
Relinquished By / Date:
Connote / Courier:
WO No: ES2213154
Attach By PO / Internal Sheet:

ES2213154

eurofins | Environment Testing

www.eurofins.com.au EnviroSales@eurofins.com

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Rolleston, Christchurch 7675
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IANZ # 1290

Sample Receipt Advice

Company name:	SMEC Australia Pty Ltd (SYD)
Contact name:	Manuel Fernandez
Project name:	Not provided
Project ID:	3008009
Turnaround time:	5 Day
Date/Time received	Apr 20, 2022 2:00 PM
Eurofins reference	882131

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	Sample Temperature of chilled sample on the batch as recorded by Eurofins Sample Receipt : 13.1 degrees Celsius.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
X	Split sample sent to requested external lab.
X	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

PFAS sample for QA06a not received, other analysis will proceed as per COC.

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Emma Beesley on phone : or by email: EmmaBeesley@eurofins.com

Results will be delivered electronically via email to Manuel Fernandez - manuel.fernandez@smec.com.

Note: A copy of these results will also be delivered to the general SMEC Australia Pty Ltd (SYD) email address.

eurofins | Environment Testing

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

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ABN: 50 005 085 521

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Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: SMEC Australia Pty Ltd (SYD)
Address: Level 6, 76 Berry Street
North Sydney
NSW 2060

Project Name:
Project ID: 3008009

Order No.:
Report #: 882131
Phone: 02 9925 5555
Fax: 02 9925 5566

Received: Apr 20, 2022 2:00 PM
Due: Apr 28, 2022
Priority: 5 Day
Contact Name: Manuel Fernandez

Eurofins Analytical Services Manager : Emma Beesley

Sample Detail						Ammonia (as N)	Metals M8	Eurofins Suite B1SG: TRH (With Silica Gel Clean up), BTEXN	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA # 1261 Site # 1254									X
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	
Brisbane Laboratory - NATA # 1261 Site # 20794									
Mayfield Laboratory - NATA # 1261 Site # 25079									
Perth Laboratory - NATA # 2377 Site # 2370									
External Laboratory									
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**				
1	QA06A	Apr 11, 2022		Water	S22-Ap0045963	X	X	X	X
Test Counts						1	1	1	1

SMEC Australia Pty Ltd
Level 6, 76 Berry Street
North Sydney
NSW 2060

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Manuel Fernandez**

Report **882131-W**
Project name
Project ID 3008009
Received Date Apr 20, 2022

Client Sample ID			[G01]**QA06A**
Sample Matrix			**Water**
Eurofins Sample No.			**S22-Ap0045963**
Date Sampled			**Apr 11, 2022**
Test/Reference	LOR	Unit	
Total Recoverable Hydrocarbons			
Naphthalene[N02]	0.01	mg/L	< 0.01
BTEX			
Benzene	0.001	mg/L	< 0.001
Toluene	0.001	mg/L	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002
o-Xylene	0.001	mg/L	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003
4-Bromofluorobenzene (surr.)	1	%	114
TRH - 2013 NEPM Fractions (after silica gel clean-up)			
TRH >C10-C16 (after silica gel clean-up)	0.05	mg/L	< 0.05
TRH >C16-C34 (after silica gel clean-up)	0.1	mg/L	< 0.1
TRH >C34-C40 (after silica gel clean-up)	0.1	mg/L	< 0.1
TRH >C10-C40 (total) (after silica-gel clean up)*	0.1	mg/L	< 0.1
TRH - 1999 NEPM Fractions (after silica gel clean-up)			
TRH C10-C14 (after silica gel clean-up)	0.05	mg/L	< 0.05
TRH C15-C28 (after silica gel clean-up)	0.1	mg/L	< 0.1
TRH C29-C36 (after silica gel clean-up)	0.1	mg/L	< 0.1
TRH C10-C36 (Total) (after silica gel clean-up)	0.1	mg/L	< 0.1
Polycyclic Aromatic Hydrocarbons (Trace level)			
Acenaphthene	0.00001	mg/L	< 0.00001
Acenaphthylene	0.00001	mg/L	< 0.00001
Anthracene	0.00001	mg/L	< 0.00001
Benz(a)anthracene	0.00001	mg/L	< 0.00001
Benzo(a)pyrene	0.00001	mg/L	< 0.00001
Benzo(b&j)fluoranthene	0.00001	mg/L	< 0.00001
Benzo(g.h.i)perylene	0.00001	mg/L	< 0.00001
Benzo(k)fluoranthene	0.00001	mg/L	< 0.00001
Chrysene	0.00001	mg/L	< 0.00001
Dibenz(a.h)anthracene	0.00001	mg/L	< 0.00001
Fluoranthene	0.00001	mg/L	< 0.00001
Fluorene	0.00001	mg/L	< 0.00001
Indeno(1.2.3-cd)pyrene	0.00001	mg/L	< 0.00001
Naphthalene	0.00001	mg/L	< 0.00002

Client Sample ID			[G01]QA06A
Sample Matrix			**Water**
Eurofins Sample No.			**S22-Ap0045963**
Date Sampled			**Apr 11, 2022**
Test/Reference	LOR	Unit	
Polycyclic Aromatic Hydrocarbons (Trace level)			
Phenanthrene	0.00001	mg/L	< 0.00001
Pyrene	0.00001	mg/L	< 0.00001
Total PAH*	0.00001	mg/L	< 0.00002
2-Fluorobiphenyl (surr.)	1	%	102
p-Terphenyl-d14 (surr.)	1	%	98
Ammonia (as N)	0.01	mg/L	< 0.01
Heavy Metals			
Arsenic	0.001	mg/L	0.002
Cadmium	0.0002	mg/L	< 0.0002
Chromium	0.001	mg/L	0.001
Copper	0.001	mg/L	0.003
Lead	0.001	mg/L	0.003
Mercury	0.0001	mg/L	< 0.0001
Nickel	0.001	mg/L	0.002
Zinc	0.005	mg/L	0.018

Sample History

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

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
Eurofins Suite B1SG: TRH (With Silica Gel Clean up), BTEXN			
BTEX	Sydney	Apr 27, 2022	14 Days
- Method: LTM-ORG-2010 BTEX and Volatile TRH			
TRH - 2013 NEPM Fractions (after silica gel clean-up)	Sydney	Apr 27, 2022	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
TRH - 1999 NEPM Fractions (after silica gel clean-up)	Sydney	Apr 27, 2022	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Polycyclic Aromatic Hydrocarbons (Trace level)	Melbourne	Apr 27, 2022	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water (trace)			
Ammonia (as N)	Sydney	Apr 27, 2022	28 Days
- Method: LTM-INO-4200 Ammonia by Discrete Analyser			
Metals M8	Sydney	Apr 28, 2022	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			

eurofins | Environment Testing

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IANZ # 1290

Company Name: SMEC Australia Pty Ltd (SYD)
Address: Level 6, 76 Berry Street
North Sydney
NSW 2060

Project Name:
Project ID: 3008009

Order No.:
Report #: 882131
Phone: 02 9925 5555
Fax: 02 9925 5566

Received: Apr 20, 2022 2:00 PM
Due: Apr 28, 2022
Priority: 5 Day
Contact Name: Manuel Fernandez

Eurofins Analytical Services Manager : Emma Beesley

Sample Detail						Ammonia (as N)	Metals M8	Eurofins Suite B1SG: TRH (With Silica Gel Clean up), BTEXN	Polycyclic Aromatic Hydrocarbons (Trace level)
Melbourne Laboratory - NATA # 1261 Site # 1254								X	X
Sydney Laboratory - NATA # 1261 Site # 18217						X	X	X	
Brisbane Laboratory - NATA # 1261 Site # 20794									
Mayfield Laboratory - NATA # 1261 Site # 25079									
Perth Laboratory - NATA # 2377 Site # 2370									
External Laboratory									
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**				
1	QA06A	Apr 11, 2022		Water	S22-Ap0045963	X	X	X	X
Test Counts						1	1	1	1

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid 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. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. 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.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	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.
NCP	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.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

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%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

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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. 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.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. 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
Method Blank							
Total Recoverable Hydrocarbons							
Naphthalene	mg/L	< 0.01			0.01	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							
TRH - 2013 NEPM Fractions (after silica gel clean-up)							
TRH >C10-C16 (after silica gel clean-up)	mg/L	< 0.05			0.05	Pass	
TRH >C16-C34 (after silica gel clean-up)	mg/L	< 0.1			0.1	Pass	
TRH >C34-C40 (after silica gel clean-up)	mg/L	< 0.1			0.1	Pass	
Method Blank							
TRH - 1999 NEPM Fractions (after silica gel clean-up)							
TRH C10-C14 (after silica gel clean-up)	mg/L	< 0.05			0.05	Pass	
TRH C15-C28 (after silica gel clean-up)	mg/L	< 0.1			0.1	Pass	
TRH C29-C36 (after silica gel clean-up)	mg/L	< 0.1			0.1	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons (Trace level)							
Acenaphthene	mg/L	< 0.00001			0.00001	Pass	
Acenaphthylene	mg/L	< 0.00001			0.00001	Pass	
Anthracene	mg/L	< 0.00001			0.00001	Pass	
Benz(a)anthracene	mg/L	< 0.00001			0.00001	Pass	
Benzo(a)pyrene	mg/L	< 0.00001			0.00001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Benzo(g.h.i)perylene	mg/L	< 0.00001			0.00001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Chrysene	mg/L	< 0.00001			0.00001	Pass	
Dibenz(a.h)anthracene	mg/L	< 0.00001			0.00001	Pass	
Fluoranthene	mg/L	< 0.00001			0.00001	Pass	
Fluorene	mg/L	< 0.00001			0.00001	Pass	
Indeno(1.2.3-cd)pyrene	mg/L	< 0.00001			0.00001	Pass	
Naphthalene	mg/L	< 0.00001			0.00001	Pass	
Phenanthrene	mg/L	< 0.00001			0.00001	Pass	
Pyrene	mg/L	< 0.00001			0.00001	Pass	
Total PAH*	mg/L	< 0.00001			0.00001	Pass	
Method Blank							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Method Blank							
Heavy Metals							
Arsenic	mg/L	< 0.001			0.001	Pass	
Cadmium	mg/L	< 0.0002			0.0002	Pass	
Chromium	mg/L	< 0.001			0.001	Pass	
Copper	mg/L	< 0.001			0.001	Pass	
Lead	mg/L	< 0.001			0.001	Pass	
Mercury	mg/L	< 0.0001			0.0001	Pass	
Nickel	mg/L	< 0.001			0.001	Pass	
Zinc	mg/L	< 0.005			0.005	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery							
Total Recoverable Hydrocarbons							
Naphthalene	%	71			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	85			70-130	Pass	
Toluene	%	84			70-130	Pass	
Ethylbenzene	%	85			70-130	Pass	
m&p-Xylenes	%	87			70-130	Pass	
o-Xylene	%	87			70-130	Pass	
Xylenes - Total*	%	87			70-130	Pass	
LCS - % Recovery							
TRH - 2013 NEPM Fractions (after silica gel clean-up)							
TRH >C10-C16 (after silica gel clean-up)	%	91			70-130	Pass	
LCS - % Recovery							
TRH - 1999 NEPM Fractions (after silica gel clean-up)							
TRH C10-C14 (after silica gel clean-up)	%	98			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons (Trace level)							
Acenaphthene	%	78			70-130	Pass	
Acenaphthylene	%	82			70-130	Pass	
Anthracene	%	82			70-130	Pass	
Benz(a)anthracene	%	86			70-130	Pass	
Benzo(a)pyrene	%	82			70-130	Pass	
Benzo(b&j)fluoranthene	%	82			70-130	Pass	
Benzo(g.h.i)perylene	%	81			70-130	Pass	
Benzo(k)fluoranthene	%	77			70-130	Pass	
Chrysene	%	83			70-130	Pass	
Dibenz(a.h)anthracene	%	84			70-130	Pass	
Fluoranthene	%	79			70-130	Pass	
Fluorene	%	74			70-130	Pass	
Indeno(1.2.3-cd)pyrene	%	77			70-130	Pass	
Naphthalene	%	80			70-130	Pass	
Phenanthrene	%	83			70-130	Pass	
Pyrene	%	79			70-130	Pass	
LCS - % Recovery							
Ammonia (as N)	%	91			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons				Result 1					
Naphthalene	S22-Ap0042784	NCP	%	79			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	S22-Ap0042784	NCP	%	94			70-130	Pass	
Toluene	S22-Ap0042784	NCP	%	90			70-130	Pass	
Ethylbenzene	S22-Ap0042784	NCP	%	89			70-130	Pass	
m&p-Xylenes	S22-Ap0042784	NCP	%	90			70-130	Pass	
o-Xylene	S22-Ap0042784	NCP	%	91			70-130	Pass	
Xylenes - Total*	S22-Ap0042784	NCP	%	90			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons (Trace level)				Result 1					
Benzo(a)pyrene	M22-Ap0016516	NCP	%	76			70-130	Pass	
Spike - % Recovery									
				Result 1					
Ammonia (as N)	S22-Ap0045963	CP	%	94			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Total Recoverable Hydrocarbons				Result 1	Result 2	RPD			
Naphthalene	S22-Ap0042682	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	S22-Ap0042682	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	S22-Ap0042682	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	S22-Ap0042682	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
m&p-Xylenes	S22-Ap0042682	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
o-Xylene	S22-Ap0042682	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes - Total*	S22-Ap0042682	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons (Trace level)				Result 1	Result 2	RPD			
Acenaphthene	B22-Ap0049736	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Acenaphthylene	B22-Ap0049736	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Anthracene	B22-Ap0049736	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benz(a)anthracene	B22-Ap0049736	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(a)pyrene	B22-Ap0049736	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(b&j)fluoranthene	B22-Ap0049736	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(g.h.i)perylene	B22-Ap0049736	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Benzo(k)fluoranthene	B22-Ap0049736	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Chrysene	B22-Ap0049736	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Dibenz(a.h)anthracene	B22-Ap0049736	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Fluoranthene	B22-Ap0049736	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Fluorene	B22-Ap0049736	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Indeno(1.2.3-cd)pyrene	B22-Ap0049736	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Naphthalene	B22-Ap0049736	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Phenanthrene	B22-Ap0049736	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Pyrene	B22-Ap0049736	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	S22-Ap0045963	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	S22-Ap0052119	NCP	mg/L	0.002	0.002	1.0	30%	Pass	
Cadmium	S22-Ap0052119	NCP	mg/L	< 0.0002	< 0.0002	<1	30%	Pass	
Chromium	S22-Ap0052119	NCP	mg/L	0.005	0.005	10	30%	Pass	
Copper	S22-Ap0052119	NCP	mg/L	0.004	0.004	<1	30%	Pass	
Lead	S22-Ap0052119	NCP	mg/L	0.002	0.002	2.0	30%	Pass	
Mercury	S22-Ap0052119	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel	S22-Ap0052119	NCP	mg/L	0.004	0.003	39	30%	Fail	Q15
Zinc	S22-Ap0052119	NCP	mg/L	0.015	0.015	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Temperature of Chilled samples on receipt	13.1°C
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
G01	The LORs have been raised due to matrix interference
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised by:

Emma Beesley	Analytical Services Manager
Joseph Edouard	Senior Analyst (VIC)
Ryan Phillips	Senior Analyst (NSW)
Gabriele Cordero	Senior Analyst (NSW)
Roopesh Rangarajan	Senior Analyst (NSW)

Glenn Jackson
General 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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updated COC 12.04.22 12.37pm

Environmental Division
Sydney
Work Order Reference
ES2212731

Telephone : +61-2-8784 8555

CHAIN OF CUSTODY FORM

SMEC

SMEC OFFICE: SMEC North Sydney PROJECT: Vopak Site Investigation	TURNAROUND REQUIREMENTS : ☐ Standard - 5 day TAT	LAB: ALS Darwin Unit 4/16 Charlton Court Woolner, NT, 0820 ALS Sydney 277-289 Woodpark Road Smithfield NSW 2164
PROJECT NUMBER: 30080099	LAB QUOTE NO.: SY/285/21	COC SEQUENCE NUMBER (Circle)
PROJECT MANAGER: Manuel Fernandez	CONTACT PH: 0422 156 256 (Pauline)	COC: PAGE 2
SAMPLED BY: Pauline Voukidis		OF: 2
DATE SAMPLED: 7 April 2022	(1st) RELINQUISHED BY: Pauline Voukidis DATE/TIME: 7/4/2022	(2nd) RELINQUISHED BY: DATE/TIME:	(3rd) RELINQUISHED BY: DATE/TIME:
Email Reports to: manuel.fernandez@smec.com, pauline.voukidis@smec.com	RECEIVED BY:	RECEIVED BY:	RECEIVED BY:
Email Invoice to: manuel.fernandez@smec.com			

Special Laboratory Instructions:
Please forward results to smec@esdat.com.au

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	PFAS - Full Suite (28 analytes)	S-26 (TRH (C6-C40) / BTEXN / PAH / 8 Metals)	BTEX/TRH(C6-9)	BTEX				HOLD	
1	SBH02/1.1-1.2	7/04/2022	Soil	1 PFAS jar	1	X								
2	SBH02/2.0-2.1	7/04/2022	Soil	1 PFAS jar	1								X	
3	SBH03/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
4	SBH05/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
5	SBH05/0.9-1.0	7/04/2022	Soil	1 PFAS jar	1	X								
6	SBH05/1.9-2.0	7/04/2022	Soil	1 PFAS jar	1								X	
7	SBH05/2.7-2.8	7/04/2022	Soil	1 PFAS jar	1								X	
8	SBH03/0.7-0.8	7/04/2022	Soil	1 PFAS jar	1								X	
9	SBH03/1.0-1.1	7/04/2022	Soil	1 PFAS jar	1	X								
10	SBH03/1.8-1.9	7/04/2022	Soil	1 PFAS jar	1								X	
11	SBH06/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
12	SBH06/0.8-0.9	7/04/2022	Soil	1 PFAS jar	1	X								
13	SBH06/1.8-1.9	7/04/2022	Soil	1 PFAS jar	1								X	
14	RINSATE04	7/04/2022	Water	2 PFAS bottles	2	X								
15	BLANK03	7/04/2022	Water	2 PFAS bottles	2	X								
16	QA04	7/04/2022	Soil	1 PFAS jar	1	X								
17	QA04A	7/04/2022	Soil	1 PFAS jar	1	X								Send to Eurofins for Analysis
18	SBH06/2.8-2.9	7/04/2022	Soil	1 PFAS jar	1								X	
19	SBH04/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
20	SBH04/0.8-0.9	7/04/2022	Soil	1 PFAS jar	1	X								
21	SBH04/1.7-1.8	7/04/2022	Soil	1 PFAS jar	1								X	
				Total:		13							8	

Notes: Hold all remaining sample volume for possible future leachability analysis

Split WO: ES2212731 Sub-Batch 1 Eurofins QA04A
Organised By:
Relinquished:
Connote / Courier:
WO No: ES2212731
Attach By PC

S-833/834

Received Eurofins 22/04/22 6:34pm BP
882408

Updated COC 12.04.22 12.37 pm

CHAIN OF CUSTODY FORM

SMEC

SMEC OFFICE: SMEC North Sydney **PROJECT:** Vopak Site Investigation	**TURNAROUND REQUIREMENTS :** ☐ Standard - 5 day TAT	**LAB:** ALS Darwin Unit 4/16 Charlton Court Woolner, NT, 0820 ALS Sydney 277-289 Woodpark Road Smithfield NSW 2164
PROJECT NUMBER: 30080099	**LAB QUOTE NO.:** SY/285/21	**COC SEQUENCE NUMBER (Circle)**
PROJECT MANAGER: Manuel Fernandez	**CONTACT PH:** 0422 156 256 (Pauline)	COC: PAGE 1
SAMPLED BY: Pauline Voukidis		OF: 2

DATE SAMPLED: 6 to 8 April 2022	**(1st) RELINQUISHED BY:** Pauline Voukidis DATE/TIME: 6 and 8/4/2022	**(2nd) RELINQUISHED BY:** DATE/TIME:	**(3rd) RELINQUISHED BY:** DATE/TIME:
Email Reports to: manuel.fernandez@smec.com, pauline.voukidis@smec.com			
Email Invoice to: manuel.fernandez@smec.com	RECEIVED BY:	RECEIVED BY:	RECEIVED BY:

Special Laboratory Instructions:
Please forward results to smec@esdat.com.au

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	PFAS - Full Suite (28 analytes)	S-26 (TRH (C6-C40) / BTEXN / PAH / 8 Metals)	BTEX/TRH(C6-9)	BTEX				HOLD	
	EMB26/0.08-0.15	6/04/2022	Soil	1 PFAS jar	1	X								
	EMB25/1/0-1.1	6/04/2022	Soil	1 PFAS jar	1	X								
	SBH01/0.08-0.15	6/04/2022	Soil	1 PFAS jar	1	X								
	SBH01/1.1-1.1	6/04/2022	Soil	1 PFAS jar	1	X								
	SBH01/1.9-2.0	6/04/2022	Soil	1 PFAS jar	1								X	
	SBH02/0.08-0.15	6/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
	RINSATE03	6/04/2022	Water	2 metals, 2 vials, 2 amber , 2 PFAS bottles	8	X	X							
	BLANK02	6/04/2022	Water	2 PFAS bottles	2	X								
	QA03	6/04/2022	Soil	1 glass jar, 1 PFAS jar	2								X	
	QA03A	6/04/2022	Soil	1 glass jar, 1 PFAS jar	2								X	
22	EMB23/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
23	EMB23/0.75-0.85	7/04/2022	Soil	1 PFAS jar	1	X								
24	EMB25/1.8-1.9 *	7/04/2022	Soil	1 PFAS jar	1								X	
	EMB24/0.08-0.15	8/04/2022	Soil	1 PFAS jar	1	X								
	EMB24/0.7-0.8	8/04/2022	Soil	1 PFAS jar	1	X								
	EMB24/1.7-1.8	8/04/2022	Soil	1 PFAS jar	1								X	
	EMB24/2.7-2.8	8/04/2022	Soil	1 PFAS jar	1								X	
	QA05	8/04/2022	Soil	1 PFAS jar	1								X	
	QA05A	8/04/2022	Soil	1 PFAS jar	1								X	
	RINSATE05	8/04/2022	Water	2 PFAS bottles	2	X								
	TRIP SPIKE 2	4/04/2022	Soil	1 glass jar	1				X					
	TRIP BLANK	4/04/2022	Soil	1 glass jar	1			X						
	BLANK04	8/04/2022	Water	2 PFAS bottles	2	X								
						13	2	1	1				8	

Notes: Hold all remaining sample volume for possible future leachability analysis

Received EuroFins 22/04/22 6:34 pm BP
#882405

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Sample Receipt Advice

Company name:	SMEC Australia Pty Ltd (SYD)
Contact name:	Manuel Fernandez
Project name:	VOPAK SITE INVESTIGATION
Project ID:	30080099
Turnaround time:	5 Day
Date/Time received	Apr 22, 2022 6:34 PM
Eurofins reference	882408

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	Sample Temperature of chilled sample on the batch as recorded by Eurofins Sample Receipt : 16.2 degrees Celsius.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
X	Split sample sent to requested external lab.
X	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

Samples received by the laboratory after 5.30pm are deemed to have been received the following working day.

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Emma Beesley on phone : or by email: EmmaBeesley@eurofins.com

Results will be delivered electronically via email to Manuel Fernandez - manuel.fernandez@smec.com.

Note: A copy of these results will also be delivered to the general SMEC Australia Pty Ltd (SYD) email address.

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web: www.eurofins.com.au
email: EnviroSales@eurofins.com

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Company Name: SMEC Australia Pty Ltd (SYD)
Address: Level 6, 76 Berry Street
North Sydney
NSW 2060

Project Name: VOPAK SITE INVESTIGATION
Project ID: 30080099

Order No.:
Report #: 882408
Phone: 02 9925 5555
Fax: 02 9925 5566

Received: Apr 22, 2022 6:34 PM
Due: May 3, 2022
Priority: 5 Day
Contact Name: Manuel Fernandez

Eurofins Analytical Services Manager : Emma Beesley

Sample Detail						Moisture Set	Per- and Polyfluoroalkyl Substances (PFASs)
Melbourne Laboratory - NATA # 1261 Site # 1254							
Sydney Laboratory - NATA # 1261 Site # 18217							
Brisbane Laboratory - NATA # 1261 Site # 20794						X	X
Mayfield Laboratory - NATA # 1261 Site # 25079							
Perth Laboratory - NATA # 2377 Site # 2370							
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	QA04A	Apr 07, 2022		Soil	S22-Ap0048415	X	X
Test Counts						1	1

SMEC Australia Pty Ltd
Level 6, 76 Berry Street
North Sydney
NSW 2060

NATA Accredited
Accreditation Number 1261
Site Number 20794

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Manuel Fernandez**

Report **882408-S**
Project name VOPAK SITE INVESTIGATION
Project ID 30080099
Received Date Apr 22, 2022

Client Sample ID			**QA04A**
Sample Matrix			**Soil**
Eurofins Sample No.			**S22-Ap0048415**
Date Sampled			**Apr 07, 2022**
Test/Reference	LOR	Unit	
% Moisture	1	%	9.4
Perfluoroalkyl carboxylic acids (PFCAs)			
Perfluorobutanoic acid (PFBA)[N11]	5	ug/kg	< 5
Perfluoropentanoic acid (PFPeA)[N11]	5	ug/kg	< 5
Perfluorohexanoic acid (PFHxA)[N11]	5	ug/kg	< 5
Perfluoroheptanoic acid (PFHpA)[N11]	5	ug/kg	< 5
Perfluorooctanoic acid (PFOA)[N11]	5	ug/kg	< 5
Perfluorononanoic acid (PFNA)[N11]	5	ug/kg	< 5
Perfluorodecanoic acid (PFDA)[N11]	5	ug/kg	< 5
Perfluoroundecanoic acid (PFUnDA)[N11]	5	ug/kg	< 5
Perfluorododecanoic acid (PFDoDA)[N11]	5	ug/kg	< 5
Perfluorotridecanoic acid (PFTrDA)[N15]	5	ug/kg	< 5
Perfluorotetradecanoic acid (PFTeDA)[N11]	5	ug/kg	< 5
13C4-PFBA (surr.)	1	%	107
13C5-PFPeA (surr.)	1	%	118
13C5-PFHxA (surr.)	1	%	97
13C4-PFHpA (surr.)	1	%	115
13C8-PFOA (surr.)	1	%	112
13C5-PFNA (surr.)	1	%	149
13C6-PFDA (surr.)	1	%	142
13C2-PFUnDA (surr.)	1	%	139
13C2-PFDoDA (surr.)	1	%	123
13C2-PFTeDA (surr.)	1	%	79
Perfluoroalkyl sulfonamido substances			
Perfluorooctane sulfonamide (FOSA)[N11]	5	ug/kg	< 5
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)[N11]	5	ug/kg	< 5
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)[N11]	5	ug/kg	< 5
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)[N11]	5	ug/kg	< 5
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)[N11]	5	ug/kg	< 5
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)[N11]	10	ug/kg	< 10
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)[N11]	10	ug/kg	< 10

Client Sample ID			QA04A
Sample Matrix			Soil
Eurofins Sample No.			S22-Ap0048415
Date Sampled			Apr 07, 2022
Test/Reference	LOR	Unit	
Perfluoroalkyl sulfonamido substances			
13C8-FOSA (surr.)	1	%	93
D3-N-MeFOSA (surr.)	1	%	120
D5-N-EtFOSA (surr.)	1	%	99
D7-N-MeFOSE (surr.)	1	%	110
D9-N-EtFOSE (surr.)	1	%	101
D5-N-EtFOSAA (surr.)	1	%	97
D3-N-MeFOSAA (surr.)	1	%	97
Perfluoroalkyl sulfonic acids (PFSAs)			
Perfluorobutanesulfonic acid (PFBS)[N11]	5	ug/kg	< 5
Perfluorononanesulfonic acid (PFNS)[N15]	5	ug/kg	< 5
Perfluoropropanesulfonic acid (PFPrS)[N15]	5	ug/kg	< 5
Perfluoropentanesulfonic acid (PFPeS)[N15]	5	ug/kg	< 5
Perfluorohexanesulfonic acid (PFHxS)[N11]	5	ug/kg	< 5
Perfluoroheptanesulfonic acid (PFHpS)[N15]	5	ug/kg	< 5
Perfluorooctanesulfonic acid (PFOS)[N11]	5	ug/kg	< 5
Perfluorodecanesulfonic acid (PFDS)[N15]	5	ug/kg	< 5
13C3-PFBS (surr.)	1	%	111
18O2-PFHxS (surr.)	1	%	125
13C8-PFOS (surr.)	1	%	117
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)			
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)[N11]	5	ug/kg	< 5
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)[N11]	10	ug/kg	28
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)[N11]	5	ug/kg	< 5
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)[N11]	5	ug/kg	< 5
13C2-4:2 FTSA (surr.)	1	%	138
13C2-6:2 FTSA (surr.)	1	%	189
13C2-8:2 FTSA (surr.)	1	%	101
13C2-10:2 FTSA (surr.)	1	%	77
PFASs Summations			
Sum (PFHxS + PFOS)*	5	ug/kg	< 5
Sum of US EPA PFAS (PFOS + PFOA)*	5	ug/kg	< 5
Sum of enHealth PFAS (PFHxS + PFOS + PFOA)*	5	ug/kg	< 5
Sum of WA DWER PFAS (n=10)*	10	ug/kg	28
Sum of PFASs (n=30)*	50	ug/kg	< 50

Sample History

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

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
% Moisture	Brisbane	Apr 26, 2022	14 Days
- Method: LTM-GEN-7080 Moisture			
Per- and Polyfluoroalkyl Substances (PFASs)			
Perfluoroalkyl carboxylic acids (PFCAs)	Brisbane	May 03, 2022	28 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluoroalkyl sulfonamido substances	Brisbane	May 03, 2022	28 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
Perfluoroalkyl sulfonic acids (PFSAs)	Brisbane	May 03, 2022	28 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)	Brisbane	May 03, 2022	28 Days
- Method: LTM-ORG-2100 Per- and Polyfluoroalkyl Substances (PFAS)			

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NSW 2060

Project Name: VOPAK SITE INVESTIGATION
Project ID: 30080099

Order No.:
Report #: 882408
Phone: 02 9925 5555
Fax: 02 9925 5566

Received: Apr 22, 2022 6:34 PM
Due: May 3, 2022
Priority: 5 Day
Contact Name: Manuel Fernandez

Eurofins Analytical Services Manager : Emma Beesley

Sample Detail						Moisture Set	Per- and Polyfluoroalkyl Substances (PFASs)
Melbourne Laboratory - NATA # 1261 Site # 1254							
Sydney Laboratory - NATA # 1261 Site # 18217							
Brisbane Laboratory - NATA # 1261 Site # 20794						X	X
Mayfield Laboratory - NATA # 1261 Site # 25079							
Perth Laboratory - NATA # 2377 Site # 2370							
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	QA04A	Apr 07, 2022		Soil	S22-Ap0048415	X	X
Test Counts						1	1

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid 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. Information identified on this report with blue colour, indicates data provided by customer that may have an impact on the results.
9. 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.

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
µg/L: micrograms per litre
ppm: parts per million
ppb: parts per billion
%: Percentage
org/100 mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100 mL: Most Probable Number of organisms per 100 millilitres

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	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.
NCP	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.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

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%

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 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. 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.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. 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
Method Blank							
Perfluoroalkyl carboxylic acids (PFCAs)							
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	
Perfluorooctanoic 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	
Method Blank							
Perfluoroalkyl sulfonamido substances							
Perfluorooctane 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-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	ug/kg	< 10			10	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	ug/kg	< 10			10	Pass	
Method Blank							
Perfluoroalkyl sulfonic acids (PFSAs)							
Perfluorobutanesulfonic acid (PFBS)	ug/kg	< 5			5	Pass	
Perfluorononanesulfonic acid (PFNS)	ug/kg	< 5			5	Pass	
Perfluoropropanesulfonic acid (PFPrS)	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	
Perfluorooctanesulfonic acid (PFOS)	ug/kg	< 5			5	Pass	
Perfluorodecanesulfonic acid (PFDS)	ug/kg	< 5			5	Pass	
Method Blank							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)							
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	
LCS - % Recovery							
Perfluoroalkyl carboxylic acids (PFCAs)							
Perfluorobutanoic acid (PFBA)	%	95			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	%	99			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	%	98			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	%	99			50-150	Pass	
Perfluorooctanoic acid (PFOA)	%	102			50-150	Pass	
Perfluorononanoic acid (PFNA)	%	101			50-150	Pass	
Perfluorodecanoic acid (PFDA)	%	108			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	%	102			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	%	100			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	%	78			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	%	100			50-150	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery							
Perfluoroalkyl sulfonamido substances							
Perfluorooctane sulfonamide (FOSA)	%	97			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	%	105			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	%	106			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	%	108			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	%	66			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	%	101			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	%	100			50-150	Pass	
LCS - % Recovery							
Perfluoroalkyl sulfonic acids (PFSAs)							
Perfluorobutanesulfonic acid (PFBS)	%	92			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)	%	116			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)	%	111			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)	%	99			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	%	97			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	%	96			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	%	100			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	%	131			50-150	Pass	
LCS - % Recovery							
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)							
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	%	113			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	%	96			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	%	96			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	%	99			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Perfluoroalkyl carboxylic acids (PFCAs)				Result 1					
Perfluorobutanoic acid (PFBA)	S22-Ap0058313	NCP	%	95			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	S22-Ap0058313	NCP	%	98			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	S22-Ap0058313	NCP	%	95			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	S22-Ap0058313	NCP	%	95			50-150	Pass	
Perfluorooctanoic acid (PFOA)	S22-Ap0058313	NCP	%	110			50-150	Pass	
Perfluorononanoic acid (PFNA)	S22-Ap0058313	NCP	%	99			50-150	Pass	
Perfluorodecanoic acid (PFDA)	S22-Ap0058313	NCP	%	93			50-150	Pass	
Perfluoroundecanoic acid (PFUnDA)	S22-Ap0058313	NCP	%	111			50-150	Pass	
Perfluorododecanoic acid (PFDoDA)	S22-Ap0058313	NCP	%	105			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	S22-Ap0058313	NCP	%	96			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	S22-Ap0058313	NCP	%	99			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl sulfonamido substances				Result 1					
Perfluorooctane sulfonamide (FOSA)	S22-Ap0058313	NCP	%	94			50-150	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	S22-Ap0058313	NCP	%	113			50-150	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	S22-Ap0058313	NCP	%	103			50-150	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	S22-Ap0058313	NCP	%	105			50-150	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	S22-Ap0058313	NCP	%	69			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	S22-Ap0058313	NCP	%	110			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	S22-Ap0058313	NCP	%	87			50-150	Pass	
Spike - % Recovery									
Perfluoroalkyl sulfonic acids (PFSAs)				Result 1					
Perfluorobutanesulfonic acid (PFBS)	S22-Ap0058313	NCP	%	91			50-150	Pass	
Perfluorononanesulfonic acid (PFNS)	S22-Ap0058313	NCP	%	70			50-150	Pass	
Perfluoropropanesulfonic acid (PFPrS)	S22-Ap0058313	NCP	%	107			50-150	Pass	
Perfluoropentanesulfonic acid (PFPeS)	S22-Ap0058313	NCP	%	101			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	S22-Ap0058313	NCP	%	94			50-150	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	S22-Ap0058313	NCP	%	94			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	S22-Ap0058313	NCP	%	100			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	S22-Ap0058313	NCP	%	88			50-150	Pass	
Spike - % Recovery									
n:2 Fluorotelomer sulfonic acids (n:2 FTSAs)				Result 1					
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTSA)	S22-Ap0058313	NCP	%	98			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	S22-Ap0058313	NCP	%	100			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	S22-Ap0058313	NCP	%	102			50-150	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	S22-Ap0058313	NCP	%	97			50-150	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	B22-Ap0057382	NCP	%	33	39	15	30%	Pass	
Duplicate									
Perfluoroalkyl carboxylic acids (PFCAs)				Result 1	Result 2	RPD			
Perfluorobutanoic acid (PFBA)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoropentanoic acid (PFPeA)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorohexanoic acid (PFHxA)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoroheptanoic acid (PFHpA)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorooctanoic acid (PFOA)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorononanoic acid (PFNA)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorodecanoic acid (PFDA)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoroundecanoic acid (PFUnDA)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorododecanoic acid (PFDoDA)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorotridecanoic acid (PFTrDA)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorotetradecanoic acid (PFTeDA)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	

Duplicate									
Perfluoroalkyl sulfonamido substances				Result 1	Result 2	RPD			
Perfluorooctane sulfonamide (FOSA)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
N-methylperfluoro-1-octane sulfonamide (N-MeFOSA)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
N-ethylperfluoro-1-octane sulfonamide (N-EtFOSA)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
2-(N-methylperfluoro-1-octane sulfonamido)-ethanol (N-MeFOSE)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
2-(N-ethylperfluoro-1-octane sulfonamido)-ethanol (N-EtFOSE)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	S22-Ap0058280	NCP	ug/kg	< 10	< 10	<1	30%	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	S22-Ap0058280	NCP	ug/kg	< 10	< 10	<1	30%	Pass	
Duplicate									
Perfluoroalkyl sulfonic acids (PFSAs)				Result 1	Result 2	RPD			
Perfluorobutanesulfonic acid (PFBS)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorononanesulfonic acid (PFNS)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoropropanesulfonic acid (PFPrS)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoropentanesulfonic acid (PFPeS)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorohexanesulfonic acid (PFHxS)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluoroheptanesulfonic acid (PFHpS)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorooctanesulfonic acid (PFOS)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
Perfluorodecanesulfonic acid (PFDS)	S22-Ap0058280	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)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTSA)	S22-Ap0058280	NCP	ug/kg	< 10	< 10	<1	30%	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTSA)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	
1H.1H.2H.2H-perfluorododecanesulfonic acid (10:2 FTSA)	S22-Ap0058280	NCP	ug/kg	< 5	< 5	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Temperature of Chilled samples on receipt	16.2°C
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
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:

Robert Biviano	Analytical Services Manager
Jonathon Angell	Senior Analyst (NSW)
Sarah McCallion	Senior Analyst (NSW)



Glenn Jackson
General 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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ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2212085**	Page	: 1 of 19
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Contact	: Brenda Hong
Address	: Level 5, 20 Berry Street, North Sydney, NSW 2060 North Sydney 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 30080099 - Vopak Site Investigation	Date Samples Received	: 07-Apr-2022 08:10
Order number	: ----	Date Analysis Commenced	: 08-Apr-2022
C-O-C number	: ----	Issue Date	: 14-Apr-2022 16:18
Sampler	: Pauline Voukidis		
Site	: ----		
Quote number	: SY/285/21 V2		
No. of samples received	: 22		
No. of samples analysed	: 19		

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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

- EP075 (SIM): Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EP231X - Per- and Polyfluoroalkyl Substances (PFAS): Samples received in 20ml or 125ml bottles have been tested in accordance with the QSM5.3 compliant, NATA accredited method. 60mL or 250mL bottles have been tested to the legacy QSM 5.1 aligned, NATA accredited method.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EP080: Sample TRIP SPIKE contains volatile compounds spiked into the sample containers prior to dispatch from the laboratory. BTEXN compounds spiked at 20 ug/L.
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. 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. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	EMB17/0.05-0.15	EMB17/1.2-1.3	EMB18/0.1-0.2	EMB18/1.4-1.5	EMB19/0.02-0.05
				Sampling date / time	04-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	05-Apr-2022 00:00
					ES2212085-001	ES2212085-002	ES2212085-003	ES2212085-004	ES2212085-005
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		**8.0**	**1.1**	**9.8**	**7.7**	**8.5**
EG005(ED093)T: Total Metals by ICP-AES									
Arsenic	7440-38-2	5	mg/kg		**26**	**32**	**20**	**36**	**10**
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		**31**	**16**	**18**	**18**	**24**
Copper	7440-50-8	5	mg/kg		**7**	**7**	**6**	**14**	**7**
Lead	7439-92-1	5	mg/kg		**11**	<5	**8**	<5	**13**
Nickel	7440-02-0	2	mg/kg		**4**	<2	**2**	**7**	**5**
Zinc	7440-66-6	5	mg/kg		**14**	<5	**8**	**16**	**11**
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	EMB17/0.05-0.15	EMB17/1.2-1.3	EMB18/0.1-0.2	EMB18/1.4-1.5	EMB19/0.02-0.05
			Sampling date / time	04-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	05-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2212085-001	ES2212085-002	ES2212085-003	ES2212085-004	ES2212085-005
				Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons - Continued								
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	<50	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	<50	<50	<50	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<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	<0.0002	<0.0002	**0.0003**	<0.0002	**0.0006**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	EMB17/0.05-0.15	EMB17/1.2-1.3	EMB18/0.1-0.2	EMB18/1.4-1.5	EMB19/0.02-0.05
			Sampling date / time	04-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	05-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2212085-001	ES2212085-002	ES2212085-003	ES2212085-004	ES2212085-005
				Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids - Continued								
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	**0.0006**	**0.0007**	**0.0004**	<0.0002	<0.0002
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	**0.0006**	**0.0012**	**0.0004**	<0.0002	<0.0002
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	**0.0004**	**0.0005**	<0.0002	<0.0002	<0.0002
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	**0.0074**	**0.0005**	<0.0002	<0.0002	<0.0002
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	**0.0086**	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	**0.0008**	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<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
EP231D: (n:2) Fluorotelomer Sulfonic Acids								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	EMB17/0.05-0.15	EMB17/1.2-1.3	EMB18/0.1-0.2	EMB18/1.4-1.5	EMB19/0.02-0.05
				Sampling date / time	04-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	05-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2212085-001	ES2212085-002	ES2212085-003	ES2212085-004	ES2212085-005
					Result	Result	Result	Result	Result
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued									
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		**0.246**	**0.0095**	<0.0005	<0.0005	<0.0005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		**0.253**	**0.0039**	<0.0005	<0.0005	<0.0005
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		**0.0031**	<0.0005	<0.0005	<0.0005	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.520**	**0.0163**	**0.0011**	<0.0002	**0.0006**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		<0.0002	<0.0002	**0.0003**	<0.0002	**0.0006**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.508**	**0.0163**	**0.0011**	<0.0002	**0.0006**
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		**90.8**	**90.7**	**90.5**	**88.0**	**90.3**
2-Chlorophenol-D4	93951-73-6	0.5	%		**105**	**103**	**104**	**102**	**99.4**
2.4.6-Tribromophenol	118-79-6	0.5	%		**86.1**	**72.8**	**81.0**	**68.9**	**79.5**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		**104**	**101**	**103**	**104**	**99.4**
Anthracene-d10	1719-06-8	0.5	%		**108**	**108**	**107**	**106**	**112**
4-Terphenyl-d14	1718-51-0	0.5	%		**94.7**	**95.3**	**94.5**	**93.7**	**100**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		**87.2**	**114**	**94.6**	**78.7**	**93.0**
Toluene-D8	2037-26-5	0.2	%		**93.1**	**110**	**105**	**81.8**	**101**
4-Bromofluorobenzene	460-00-4	0.2	%		**101**	**118**	**113**	**89.7**	**110**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**90.0**	**96.5**	**103**	**106**	**98.0**
13C8-PFOA	----	0.0002	%		**102**	**110**	**105**	**102**	**108**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	EMB19/0.9-1.0	EMB20/0.01-0.1	EMB20/1.1-1.2	EMB20/2.0-2.1	EMB21/0.01-0.10
			Sampling date / time	05-Apr-2022 00:00	05-Apr-2022 00:00	05-Apr-2022 00:00	05-Apr-2022 00:00	05-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2212085-006	ES2212085-007	ES2212085-008	ES2212085-009	ES2212085-010
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	9.4	9.4	----	12.6	5.4
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	91	96	----	51	63
Cadmium	7440-43-9	1	mg/kg	<1	<1	----	<1	<1
Chromium	7440-47-3	2	mg/kg	24	26	----	19	10
Copper	7440-50-8	5	mg/kg	9	9	----	<5	<5
Lead	7439-92-1	5	mg/kg	9	10	----	8	21
Nickel	7440-02-0	2	mg/kg	3	2	----	2	<2
Zinc	7440-66-6	5	mg/kg	6	10	----	<5	10
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	----	<0.1	<0.1
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	0.6	0.6	----	0.6	0.6
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	1.2	1.2	----	1.2	1.2
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	----	<10	<10

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	EMB19/0.9-1.0	EMB20/0.01-0.1	EMB20/1.1-1.2	EMB20/2.0-2.1	EMB21/0.01-0.10
			Sampling date / time	05-Apr-2022 00:00	05-Apr-2022 00:00	05-Apr-2022 00:00	05-Apr-2022 00:00	05-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2212085-006	ES2212085-007	ES2212085-008	ES2212085-009	ES2212085-010
				Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons - Continued								
C10 - C14 Fraction	----	50	mg/kg	<50	<50	----	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	<100	----	<100	<100
C29 - C36 Fraction	----	100	mg/kg	<100	<100	----	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	<50	<50	----	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	----	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	<10	<10	----	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	----	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	----	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	----	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	<50	----	<50	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	<50	<50	----	<50	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	----	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg	<0.2	<0.2	----	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg	<0.5	<0.5	----	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	----	<1	<1
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<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	<0.0002	<0.0002	**0.0004**	<0.0002	<0.0002

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	EMB19/0.9-1.0	EMB20/0.01-0.1	EMB20/1.1-1.2	EMB20/2.0-2.1	EMB21/0.01-0.10
				Sampling date / time	05-Apr-2022 00:00	05-Apr-2022 00:00	05-Apr-2022 00:00	05-Apr-2022 00:00	05-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2212085-006	ES2212085-007	ES2212085-008	ES2212085-009	ES2212085-010
					Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids - Continued									
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		<0.001	<0.001	<0.001	<0.001	**0.001**
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		**0.0004**	**0.0014**	**0.0008**	**0.0012**	**0.0085**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		**0.0004**	**0.0006**	**0.0010**	**0.0013**	**0.0159**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		<0.0002	**0.0002**	<0.0002	**0.0005**	**0.0025**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		<0.0002	**0.0005**	<0.0002	<0.0002	**0.0013**
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0007**	<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	**0.0006**	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0003**	<0.0002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231D: (n:2) Fluorotelomer Sulfonic Acids									

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	EMB19/0.9-1.0	EMB20/0.01-0.1	EMB20/1.1-1.2	EMB20/2.0-2.1	EMB21/0.01-0.10
				Sampling date / time	05-Apr-2022 00:00	05-Apr-2022 00:00	05-Apr-2022 00:00	05-Apr-2022 00:00	05-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2212085-006	ES2212085-007	ES2212085-008	ES2212085-009	ES2212085-010
					Result	Result	Result	Result	Result
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued									
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	**0.0369**	<0.0005	**0.0041**	**0.0197**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	**0.0017**
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0008**	**0.0396**	**0.0022**	**0.0087**	**0.0506**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		<0.0002	<0.0002	**0.0004**	<0.0002	<0.0002
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0008**	**0.0396**	**0.0022**	**0.0071**	**0.0506**
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		**94.8**	**88.2**	----	**88.6**	**90.3**
2-Chlorophenol-D4	93951-73-6	0.5	%		**100**	**95.8**	----	**99.6**	**103**
2.4.6-Tribromophenol	118-79-6	0.5	%		**82.4**	**75.6**	----	**79.9**	**80.7**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		**95.0**	**101**	----	**104**	**100**
Anthracene-d10	1719-06-8	0.5	%		**111**	**104**	----	**109**	**110**
4-Terphenyl-d14	1718-51-0	0.5	%		**98.7**	**90.0**	----	**95.5**	**98.8**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		**83.2**	**80.8**	----	**84.6**	**91.5**
Toluene-D8	2037-26-5	0.2	%		**90.4**	**88.1**	----	**89.7**	**99.3**
4-Bromofluorobenzene	460-00-4	0.2	%		**97.9**	**95.9**	----	**97.8**	**104**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**83.0**	**82.0**	**91.5**	**86.5**	**104**
13C8-PFOA	----	0.0002	%		**110**	**111**	**116**	**99.5**	**110**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	EMB22/0.02-0.1	EMB22/1.1-1.2	QA01	QA02	----
			Sampling date / time	05-Apr-2022 00:00	05-Apr-2022 00:00	04-Apr-2022 00:00	05-Apr-2022 00:00	----
Compound	CAS Number	LOR	Unit	ES2212085-011	ES2212085-012	ES2212085-014	ES2212085-015	--------
				Result	Result	Result	Result	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	8.2	4.6	9.2	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	----	----	35	----	----
Cadmium	7440-43-9	1	mg/kg	----	----	<1	----	----
Chromium	7440-47-3	2	mg/kg	----	----	21	----	----
Copper	7440-50-8	5	mg/kg	----	----	8	----	----
Lead	7439-92-1	5	mg/kg	----	----	12	----	----
Nickel	7440-02-0	2	mg/kg	----	----	4	----	----
Zinc	7440-66-6	5	mg/kg	----	----	11	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	----	----	<0.1	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	----	----	<0.5	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	----	----	<0.5	----	----
Acenaphthene	83-32-9	0.5	mg/kg	----	----	<0.5	----	----
Fluorene	86-73-7	0.5	mg/kg	----	----	<0.5	----	----
Phenanthrene	85-01-8	0.5	mg/kg	----	----	<0.5	----	----
Anthracene	120-12-7	0.5	mg/kg	----	----	<0.5	----	----
Fluoranthene	206-44-0	0.5	mg/kg	----	----	<0.5	----	----
Pyrene	129-00-0	0.5	mg/kg	----	----	<0.5	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	----	----	<0.5	----	----
Chrysene	218-01-9	0.5	mg/kg	----	----	<0.5	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	----	----	<0.5	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	----	----	<0.5	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	----	----	<0.5	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	----	----	<0.5	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	----	----	<0.5	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	----	----	<0.5	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	----	----	<0.5	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	----	----	<0.5	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	----	----	0.6	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	----	----	1.2	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	----	----	<10	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	EMB22/0.02-0.1	EMB22/1.1-1.2	QA01	QA02	----
			Sampling date / time	05-Apr-2022 00:00	05-Apr-2022 00:00	04-Apr-2022 00:00	05-Apr-2022 00:00	----
Compound	CAS Number	LOR	Unit	ES2212085-011	ES2212085-012	ES2212085-014	ES2212085-015	--------
				Result	Result	Result	Result	----
EP080/071: Total Petroleum Hydrocarbons - Continued								
C10 - C14 Fraction	----	50	mg/kg	----	----	<50	----	----
C15 - C28 Fraction	----	100	mg/kg	----	----	<100	----	----
C29 - C36 Fraction	----	100	mg/kg	----	----	<100	----	----
^ **C10 - C36 Fraction (sum)**	----	50	mg/kg	----	----	<50	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	----	----	<10	----	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	10	mg/kg	----	----	<10	----	----
>C10 - C16 Fraction	----	50	mg/kg	----	----	<50	----	----
>C16 - C34 Fraction	----	100	mg/kg	----	----	<100	----	----
>C34 - C40 Fraction	----	100	mg/kg	----	----	<100	----	----
^ **>C10 - C40 Fraction (sum)**	----	50	mg/kg	----	----	<50	----	----
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	50	mg/kg	----	----	<50	----	----
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	----	----	<0.2	----	----
Toluene	108-88-3	0.5	mg/kg	----	----	<0.5	----	----
Ethylbenzene	100-41-4	0.5	mg/kg	----	----	<0.5	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	----	----	<0.5	----	----
ortho-Xylene	95-47-6	0.5	mg/kg	----	----	<0.5	----	----
^ **Sum of BTEX**	----	0.2	mg/kg	----	----	<0.2	----	----
^ **Total Xylenes**	----	0.5	mg/kg	----	----	<0.5	----	----
Naphthalene	91-20-3	1	mg/kg	----	----	<1	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<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	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<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	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	**0.0004**	<0.0002	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	EMB22/0.02-0.1	EMB22/1.1-1.2	QA01	QA02	----
			Sampling date / time	05-Apr-2022 00:00	05-Apr-2022 00:00	04-Apr-2022 00:00	05-Apr-2022 00:00	----
Compound	CAS Number	LOR	Unit	ES2212085-011	ES2212085-012	ES2212085-014	ES2212085-015	--------
				Result	Result	Result	Result	----
EP231A: Perfluoroalkyl Sulfonic Acids - Continued								
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	**0.003**	<0.001	<0.001	**0.004**	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	**0.0140**	**0.0008**	**0.0005**	**0.0157**	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	**0.0106**	**0.0010**	**0.0004**	**0.0148**	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	**0.0010**	**0.0005**	<0.0002	**0.0017**	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	**0.0008**	**0.0003**	<0.0002	**0.0011**	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<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	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<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	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<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	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<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	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<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	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids								

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	EMB22/0.02-0.1	EMB22/1.1-1.2	QA01	QA02	----
				Sampling date / time	05-Apr-2022 00:00	05-Apr-2022 00:00	04-Apr-2022 00:00	05-Apr-2022 00:00	----
Compound	CAS Number	LOR	Unit		ES2212085-011	ES2212085-012	ES2212085-014	ES2212085-015	--------
					Result	Result	Result	Result	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		**0.0527**	**0.0061**	<0.0005	**0.0812**	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		**0.0024**	**0.0011**	<0.0005	**0.0023**	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0845**	**0.0098**	**0.0013**	**0.121**	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		<0.0002	<0.0002	**0.0004**	<0.0002	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0845**	**0.0098**	**0.0013**	**0.121**	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		----	----	**88.8**	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%		----	----	**98.9**	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%		----	----	**79.5**	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		----	----	**97.8**	----	----
Anthracene-d10	1719-06-8	0.5	%		----	----	**108**	----	----
4-Terphenyl-d14	1718-51-0	0.5	%		----	----	**96.7**	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		----	----	**94.5**	----	----
Toluene-D8	2037-26-5	0.2	%		----	----	**97.2**	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		----	----	**104**	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**100**	**101**	**100**	**99.5**	----
13C8-PFOA	----	0.0002	%		**108**	**107**	**104**	**108**	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	BLANK01	TRIP BLANK	TRIP SPIKE 28/3/22	RINSATE 01	RINSATE 02
			Sampling date / time	04-Apr-2022 00:00	04-Apr-2022 00:00	28-Mar-2022 00:00	04-Apr-2022 00:00	05-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2212085-016	ES2212085-018	ES2212085-019	ES2212085-020	ES2212085-021
				Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	----	----	----	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	----	----	----	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	----	----	----	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	----	----	----	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L	----	----	----	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	----	----	----	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	----	----	----	<0.005	<0.005
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	----	----	----	<0.0001	<0.0001
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1.0	µg/L	----	----	----	<1.0	<1.0
Acenaphthylene	208-96-8	1.0	µg/L	----	----	----	<1.0	<1.0
Acenaphthene	83-32-9	1.0	µg/L	----	----	----	<1.0	<1.0
Fluorene	86-73-7	1.0	µg/L	----	----	----	<1.0	<1.0
Phenanthrene	85-01-8	1.0	µg/L	----	----	----	<1.0	<1.0
Anthracene	120-12-7	1.0	µg/L	----	----	----	<1.0	<1.0
Fluoranthene	206-44-0	1.0	µg/L	----	----	----	<1.0	<1.0
Pyrene	129-00-0	1.0	µg/L	----	----	----	<1.0	<1.0
Benz(a)anthracene	56-55-3	1.0	µg/L	----	----	----	<1.0	<1.0
Chrysene	218-01-9	1.0	µg/L	----	----	----	<1.0	<1.0
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	----	----	----	<1.0	<1.0
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	----	----	----	<1.0	<1.0
Benzo(a)pyrene	50-32-8	0.5	µg/L	----	----	----	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	----	----	----	<1.0	<1.0
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	----	----	----	<1.0	<1.0
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	----	----	----	<1.0	<1.0
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	----	----	----	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	----	----	----	<0.5	<0.5
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	----	<20	----	<20	<20
C10 - C14 Fraction	----	50	µg/L	----	----	----	<50	<50
C15 - C28 Fraction	----	100	µg/L	----	----	----	<100	<100
C29 - C36 Fraction	----	50	µg/L	----	----	----	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L	----	----	----	<50	<50

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	BLANK01	TRIP BLANK	TRIP SPIKE 28/3/22	RINSATE 01	RINSATE 02
				Sampling date / time	04-Apr-2022 00:00	04-Apr-2022 00:00	28-Mar-2022 00:00	04-Apr-2022 00:00	05-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2212085-016	ES2212085-018	ES2212085-019	ES2212085-020	ES2212085-021
					Result	Result	Result	Result	Result
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		----	<20	----	<20	<20
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		----	<20	----	<20	<20
>C10 - C16 Fraction	----	100	µg/L		----	----	----	**130**	<100
>C16 - C34 Fraction	----	100	µg/L		----	----	----	<100	<100
>C34 - C40 Fraction	----	100	µg/L		----	----	----	<100	<100
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		----	----	----	**130**	<100
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		----	----	----	**130**	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		----	<1	**16**	<1	<1
Toluene	108-88-3	2	µg/L		----	<2	**16**	<2	<2
Ethylbenzene	100-41-4	2	µg/L		----	<2	**16**	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		----	<2	**16**	<2	<2
ortho-Xylene	95-47-6	2	µg/L		----	<2	**17**	<2	<2
^ **Total Xylenes**	----	2	µg/L		----	<2	**33**	<2	<2
^ **Sum of BTEX**	----	1	µg/L		----	<1	**81**	<1	<1
Naphthalene	91-20-3	5	µg/L		----	<5	**20**	<5	<5
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		<0.02	----	----	<0.02	<0.02
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		<0.02	----	----	<0.02	<0.02
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L		<0.01	----	----	<0.01	<0.01
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		<0.02	----	----	<0.02	<0.02
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		<0.01	----	----	<0.01	<0.01
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	----	----	<0.02	<0.02
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	----	----	<0.1	<0.1
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		<0.02	----	----	<0.02	<0.02
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		<0.02	----	----	<0.02	<0.02

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	BLANK01	TRIP BLANK	TRIP SPIKE 28/3/22	RINSATE 01	RINSATE 02
			Sampling date / time	04-Apr-2022 00:00	04-Apr-2022 00:00	28-Mar-2022 00:00	04-Apr-2022 00:00	05-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2212085-016	ES2212085-018	ES2212085-019	ES2212085-020	ES2212085-021
				Result	Result	Result	Result	Result
EP231B: Perfluoroalkyl Carboxylic Acids - Continued								
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	----	----	<0.02	<0.02
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	----	----	<0.01	<0.01
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	----	----	<0.02	<0.02
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	----	----	<0.02	<0.02
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	----	----	<0.02	<0.02
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	----	----	<0.02	<0.02
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	----	----	<0.02	<0.02
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	----	----	<0.05	<0.05
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	----	----	<0.02	<0.02
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	----	----	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	----	----	<0.05	<0.05
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	----	----	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	----	----	<0.05	<0.05
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	----	----	<0.02	<0.02
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	----	----	<0.02	<0.02
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<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
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	----	----	<0.05	<0.05

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	BLANK01	TRIP BLANK	TRIP SPIKE 28/3/22	RINSATE 01	RINSATE 02
			Sampling date / time	04-Apr-2022 00:00	04-Apr-2022 00:00	28-Mar-2022 00:00	04-Apr-2022 00:00	05-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2212085-016	ES2212085-018	ES2212085-019	ES2212085-020	ES2212085-021
				Result	Result	Result	Result	Result
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued								
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	----	----	<0.05	<0.05
EP231P: PFAS Sums								
Sum of PFAS	----	0.01	µg/L	<0.01	----	----	<0.01	<0.01
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	<0.01	----	----	<0.01	<0.01
Sum of PFAS (WA DER List)	----	0.01	µg/L	<0.01	----	----	<0.01	<0.01
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	1.0	%	----	----	----	**29.4**	**21.4**
2-Chlorophenol-D4	93951-73-6	1.0	%	----	----	----	**52.8**	**36.7**
2.4.6-Tribromophenol	118-79-6	1.0	%	----	----	----	**56.0**	**33.9**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	1.0	%	----	----	----	**60.6**	**62.4**
Anthracene-d10	1719-06-8	1.0	%	----	----	----	**64.9**	**80.8**
4-Terphenyl-d14	1718-51-0	1.0	%	----	----	----	**79.0**	**69.2**
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	2	%	----	**102**	**112**	**107**	**105**
Toluene-D8	2037-26-5	2	%	----	**96.0**	**109**	**96.9**	**99.4**
4-Bromofluorobenzene	460-00-4	2	%	----	**99.4**	**111**	**99.1**	**99.0**
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.02	%	**93.3**	----	----	**103**	**103**
13C8-PFOA	----	0.02	%	**101**	----	----	**98.3**	**104**

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2212085**

Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Contact	: Brenda Hong
Address	: Level 5, 20 Berry Street, North Sydney, NSW 2060 North Sydney 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: manuel.fernandez@smec.com	E-mail	: Brenda.Hong@ALSGlobal.com
Telephone	: ----	Telephone	: +61 2 8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 30080099 - Vopak Site Investigation	Page	: 1 of 3
Order number	: ----	Quote number	: ES2021SMEAUS0007 (SY/285/21)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Pauline Voukidis		

Dates

Date Samples Received	: 07-Apr-2022 08:10	Issue Date	: 08-Apr-2022
Client Requested Due Date	: 14-Apr-2022	Scheduled Reporting Date	: **14-Apr-2022**

Delivery Details

Mode of Delivery	: Undefined	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: 12.1
Receipt Detail	:	No. of samples received / analysed	: 22 / 19

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Samples QA01A and QA02A forwarded to Eurofins.**
- **Sample EMB17/0.1-0.2 (ALS#22) received extra, placed on hold.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

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

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

Any sample identifications that cannot be displayed entirely in the analysis summary table will be listed below.

ES2212085-014 : [04-Apr-2022] : QA0 - Received as QA01

Summary of Sample(s) and Requested Analysis

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

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	(On Hold) SOIL No analysis requested	SOIL - EA055-103 Moisture Content	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)	SOIL - S-26 8 metals/TRH/BTEXN/PAH
ES2212085-001	04-Apr-2022 00:00	EMB17/0.05-0.15		✓	✓	✓
ES2212085-002	04-Apr-2022 00:00	EMB17/1.2-1.3		✓	✓	✓
ES2212085-003	04-Apr-2022 00:00	EMB18/0.1-0.2		✓	✓	✓
ES2212085-004	04-Apr-2022 00:00	EMB18/1.4-1.5		✓	✓	✓
ES2212085-005	05-Apr-2022 00:00	EMB19/0.02-0.05		✓	✓	✓
ES2212085-006	05-Apr-2022 00:00	EMB19/0.9-1.0		✓	✓	✓
ES2212085-007	05-Apr-2022 00:00	EMB20/0.01-0.1		✓	✓	✓
ES2212085-008	05-Apr-2022 00:00	EMB20/1.1-1.2		✓	✓	
ES2212085-009	05-Apr-2022 00:00	EMB20/2.0-2.1		✓	✓	✓
ES2212085-010	05-Apr-2022 00:00	EMB21/0.01-0.10		✓	✓	✓
ES2212085-011	05-Apr-2022 00:00	EMB22/0.02-0.1		✓	✓	
ES2212085-012	05-Apr-2022 00:00	EMB22/1.1-1.2		✓	✓	
ES2212085-013	05-Apr-2022 00:00	EMB22/2.5-2.6	✓			
ES2212085-014	04-Apr-2022 00:00	QA0 Received as QA01		✓	✓	✓
ES2212085-015	05-Apr-2022 00:00	QA02		✓	✓	
ES2212085-022	04-Apr-2022 00:00	EMB17/0.1-0.2	✓			

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	(On Hold) WATER No analysis requested	WATER - EP231X PFAS - Full Suite (28 analytes)	WATER - W-18 TRH(C6 - C9)/BTEXN
ES2212085-016	04-Apr-2022 00:00	BLANK01		✓	
ES2212085-017	04-Apr-2022 00:00	TRIP BLANK	✓		
ES2212085-018	04-Apr-2022 00:00	TRIP BLANK			✓
ES2212085-020	04-Apr-2022 00:00	RINSATE 01		✓	
ES2212085-021	05-Apr-2022 00:00	RINSATE 02		✓	

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EP080 BTEXN	WATER - W-26 TRH/BTEXN/PAH/8 Metals
ES2212085-019	28-Mar-2022 00:00	TRIP SPIKE 28/3/22	✓	
ES2212085-020	04-Apr-2022 00:00	RINSATE 01		✓
ES2212085-021	05-Apr-2022 00:00	RINSATE 02		✓

Proactive Holding Time Report

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

Requested Deliverables

ACCOUNTS INVOICES

- A4 - AU Tax Invoice (INV)	Email	accounts.payable@smec.com

ESDAT REPORTS

- *AU Certificate of Analysis - NATA (COA)	Email	smec@esdat.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	smec@esdat.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	smec@esdat.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	smec@esdat.com.au
- Chain of Custody (CoC) (COC)	Email	smec@esdat.com.au
- EDI Format - ENMRG (ENMRG)	Email	smec@esdat.com.au
- EDI Format - ESDAT (ESDAT)	Email	smec@esdat.com.au

MANUEL FERNANDEZ

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

Pauline Voukidis

- *AU Certificate of Analysis - NATA (COA)	Email	pauline.voukidis@smec.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	pauline.voukidis@smec.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	pauline.voukidis@smec.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	pauline.voukidis@smec.com
- Chain of Custody (CoC) (COC)	Email	pauline.voukidis@smec.com
- EDI Format - ENMRG (ENMRG)	Email	pauline.voukidis@smec.com
- EDI Format - ESDAT (ESDAT)	Email	pauline.voukidis@smec.com

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES2212085**	Page	: 1 of 18
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Contact	: Brenda Hong
Address	: Level 5, 20 Berry Street, North Sydney, NSW 2060 North Sydney 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 30080099 - Vopak Site Investigation	Date Samples Received	: 07-Apr-2022
Order number	: ----	Date Analysis Commenced	: 08-Apr-2022
C-O-C number	: ----	Issue Date	: 14-Apr-2022
Sampler	: Pauline Voukidis		
Site	: ----		
Quote number	: SY/285/21 V2		
No. of samples received	: 22		
No. of samples analysed	: 19		

ilac-MRA NATA
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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 4281232)									
ES2211677-061	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	37	36	0.0	0% - 50%
		EG005T: Nickel	7440-02-0	2	mg/kg	4	3	33.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	8	13	44.2	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	12	8	38.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	21	14	40.6	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	42	21	65.2	No Limit
ES2212085-014	QA01	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	21	15	32.9	0% - 50%
		EG005T: Nickel	7440-02-0	2	mg/kg	4	3	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	35	28	21.3	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	8	8	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	12	11	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	11	10	11.3	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 4281239)									
ES2212085-002	EMB17/1.2-1.3	EA055: Moisture Content	----	0.1	%	1.1	1.2	9.4	0% - 50%
ES2212298-005	Anonymous	EA055: Moisture Content	----	0.1	%	23.7	22.2	6.4	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 4281241)									
EP2204052-010	Anonymous	EA055: Moisture Content	----	0.1	%	21.2	21.8	2.8	0% - 20%
ES2212085-012	EMB22/1.1-1.2	EA055: Moisture Content	----	0.1	%	4.6	4.5	0.0	0% - 20%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 4281233)									
ES2211677-061	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
ES2212085-014	QA01	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 4278967)									
ES2212085-001	EMB17/0.05-0.15	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4278968)									
ES2212085-001	EMB17/0.05-0.15	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4279211)									
ES2212085-001	EMB17/0.05-0.15	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
ES2212085-005	EMB19/0.02-0.05	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4278968)									
ES2212085-001	EMB17/0.05-0.15	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4279211)									
ES2212085-001	EMB17/0.05-0.15	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
ES2212085-005	EMB19/0.02-0.05	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP080: BTEXN (QC Lot: 4279211)									
ES2212085-001	EMB17/0.05-0.15	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP080: BTEXN (QC Lot: 4279211) - continued									
ES2212085-001	EMB17/0.05-0.15	EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
ES2212085-005	EMB19/0.02-0.05	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4277372)									
EP2204052-008	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	0.0008	0.0009	17.3	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	0.0008	0.0010	16.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0736	0.0731	0.7	0% - 20%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	0.0005	0.0008	43.3	No Limit
ES2212085-005	EMB19/0.02-0.05	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.0002	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0006	0.0008	22.4	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4277372)									
EP2204052-008	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0006	0.0006	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.0035	0.0038	6.9	0% - 50%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0016	0.0018	12.2	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0049	0.0056	13.4	0% - 20%
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	0.0042	0.0043	2.4	0% - 20%
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	0.0006	0.0007	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
ES2212085-005	EMB19/0.02-0.05	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4277372) - continued									
ES2212085-005	EMB19/0.02-0.05	EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4277372)									
EP2204052-008	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	0.0004	0.0003	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
ES2212085-005	EMB19/0.02-0.05	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 4277372)									
EP2204052-008	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	0.0645	0.0642	0.6	0% - 20%
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	0.0600	0.0513	15.6	0% - 20%

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 4277372) - continued									
EP2204052-008	Anonymous	EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	0.0031	0.0043	31.7	No Limit
ES2212085-005	EMB19/0.02-0.05	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4281520)									
ES2212275-013	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
ES2212255-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.003	0.003	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.066	0.066	0.0	0% - 20%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.100	0.099	0.0	0% - 50%
EG035F: Dissolved Mercury by FIMS (QC Lot: 4281521)									
ES2212085-021	RINSATE 02	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
ES2212275-019	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4277308)									
ES2212270-001	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
ES2212273-001	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4277308)									
ES2212270-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
ES2212273-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP080: BTEXN (QC Lot: 4277308)									
ES2212270-001	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP080: BTEXN (QC Lot: 4277308) - continued									
ES2212270-001	Anonymous	EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
ES2212273-001	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4277179)									
ES2212085-016	BLANK01	EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
ES2212085-021	RINSATE 02	EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4277179)									
ES2212085-016	BLANK01	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
ES2212085-021	RINSATE 02	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4277179) - continued									
ES2212085-021	RINSATE 02	EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4277179)									
ES2212085-016	BLANK01	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
ES2212085-021	RINSATE 02	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 4277179)									
ES2212085-016	BLANK01	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 4277179) - continued									
ES2212085-016	BLANK01	EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
ES2212085-021	RINSATE 02	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231P: PFAS Sums (QC Lot: 4277179)									
ES2212085-016	BLANK01	EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	<0.01	0.0	No Limit
ES2212085-021	RINSATE 02	EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	<0.01	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (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 Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4281232)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	121.1 mg/kg	103	88.0	113
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	0.74 mg/kg	95.1	70.0	130
EG005T: Chromium	7440-47-3	2	mg/kg	<2	19.6 mg/kg	114	68.0	132
EG005T: Copper	7440-50-8	5	mg/kg	<5	52.9 mg/kg	109	89.0	111
EG005T: Lead	7439-92-1	5	mg/kg	<5	60.8 mg/kg	105	82.0	119
EG005T: Nickel	7440-02-0	2	mg/kg	<2	15.3 mg/kg	108	80.0	120
EG005T: Zinc	7440-66-6	5	mg/kg	<5	139.3 mg/kg	96.7	66.0	133
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4281233)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.087 mg/kg	94.2	70.0	125
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 4278967)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	6 mg/kg	97.3	77.0	125
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	6 mg/kg	100	72.0	124
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	6 mg/kg	98.3	73.0	127
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	6 mg/kg	101	72.0	126
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	6 mg/kg	101	75.0	127
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	6 mg/kg	103	77.0	127
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	6 mg/kg	103	73.0	127
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	6 mg/kg	100	74.0	128
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	6 mg/kg	93.8	69.0	123
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	6 mg/kg	93.3	75.0	127
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	6 mg/kg	92.8	68.0	116
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	6 mg/kg	94.9	74.0	126
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	6 mg/kg	100	70.0	126
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	6 mg/kg	76.2	61.0	121
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	6 mg/kg	79.6	62.0	118
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	6 mg/kg	73.4	63.0	121
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4278968)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	300 mg/kg	95.0	75.0	129
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	450 mg/kg	98.4	77.0	131
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	300 mg/kg	99.2	71.0	129
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4279211)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	90.1	68.4	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4278968)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4278968) - continued								
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	375 mg/kg	99.9	77.0	125
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	525 mg/kg	98.3	74.0	138
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	225 mg/kg	84.3	63.0	131
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4279211)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	92.2	68.4	128
EP080: BTEXN (QCLot: 4279211)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	108	62.0	116
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	108	67.0	121
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	107	65.0	117
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	109	66.0	118
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	111	68.0	120
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	95.9	63.0	119
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4277372)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	89.2	72.0	128
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	79.6	73.0	123
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	78.8	67.0	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	91.6	70.0	132
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	83.2	68.0	136
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	88.0	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4277372)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	79.6	71.0	135
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	88.4	69.0	132
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	112	70.0	132
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	89.6	71.0	131
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	104	69.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	88.0	72.0	129
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	95.6	69.0	133
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	95.2	64.0	136
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	99.6	69.0	135
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	99.6	66.0	139
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	85.1	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4277372)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	88.8	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	97.6	71.6	129
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	78.7	69.8	131
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	113	68.7	130

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4277372) - continued								
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	105	65.1	134
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	98.4	63.0	144
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	69.2	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4277372)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	98.0	62.0	145
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	84.4	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	87.2	65.0	137
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	96.8	69.2	143

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4281520)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	98.9	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	97.0	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	97.9	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	97.1	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	96.0	83.0	111
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	95.8	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	95.2	81.0	117
EG035F: Dissolved Mercury by FIMS (QCLot: 4281521)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	91.4	83.0	105
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 4277462)								
EP075(SIM): Naphthalene	91-20-3	1	µg/L	<1.0	5 µg/L	66.5	50.0	94.0
EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<1.0	5 µg/L	72.2	63.6	114
EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<1.0	5 µg/L	75.5	62.2	113
EP075(SIM): Fluorene	86-73-7	1	µg/L	<1.0	5 µg/L	72.8	63.9	115
EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<1.0	5 µg/L	73.1	62.6	116
EP075(SIM): Anthracene	120-12-7	1	µg/L	<1.0	5 µg/L	75.7	64.3	116
EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<1.0	5 µg/L	85.8	63.6	118
EP075(SIM): Pyrene	129-00-0	1	µg/L	<1.0	5 µg/L	85.2	63.1	118
EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<1.0	5 µg/L	81.0	64.1	117
EP075(SIM): Chrysene	218-01-9	1	µg/L	<1.0	5 µg/L	82.1	62.5	116
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<1.0	5 µg/L	71.0	61.7	119
EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<1.0	5 µg/L	75.5	63.0	115

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 4277462) - continued								
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	5 µg/L	83.2	63.3	117
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<1.0	5 µg/L	83.4	59.9	118
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	1	µg/L	<1.0	5 µg/L	82.7	61.2	117
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	1	µg/L	<1.0	5 µg/L	82.2	59.1	118
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4277308)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	91.7	75.0	127
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4277463)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	400 µg/L	79.0	55.8	112
EP071: C15 - C28 Fraction	----	100	µg/L	<100	600 µg/L	76.8	71.6	113
EP071: C29 - C36 Fraction	----	50	µg/L	<50	400 µg/L	110	56.0	121
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4277308)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	100	75.0	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4277463)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	500 µg/L	72.8	57.9	119
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	700 µg/L	78.5	62.5	110
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	300 µg/L	102	61.5	121
EP080: BTEXN (QCLot: 4277308)								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	91.6	70.0	122
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	93.8	69.0	123
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	95.8	70.0	120
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	95.0	69.0	121
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	97.0	72.0	122
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	97.9	70.0	120
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4277179)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.25 µg/L	104	72.0	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.25 µg/L	89.0	71.0	127
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	0.25 µg/L	92.0	68.0	131
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.25 µg/L	98.0	69.0	134
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.25 µg/L	85.8	65.0	140
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.25 µg/L	88.6	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4277179)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	88.1	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	89.4	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	113	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	90.8	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	99.4	71.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.25 µg/L	93.2	69.0	130

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4277179) - continued								
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.25 µg/L	95.6	71.0	129
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.25 µg/L	87.6	69.0	133
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.25 µg/L	98.0	72.0	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.25 µg/L	94.8	65.0	144
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	0.625 µg/L	94.0	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4277179)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.25 µg/L	97.4	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	0.625 µg/L	108	68.0	141
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	0.625 µg/L	92.5	62.6	147
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	0.625 µg/L	92.5	66.0	145
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	0.625 µg/L	91.5	57.6	145
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.25 µg/L	92.8	65.0	136
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.25 µg/L	85.4	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4277179)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.25 µg/L	99.0	63.0	143
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.25 µg/L	94.6	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.25 µg/L	106	67.0	138
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.25 µg/L	102	71.4	144

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	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4281232)							
ES2211677-061	Anonymous	EG005T: Arsenic	7440-38-2	50 mg/kg	96.2	70.0	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	98.5	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	82.1	68.0	132
		EG005T: Copper	7440-50-8	250 mg/kg	98.6	70.0	130
		EG005T: Lead	7439-92-1	250 mg/kg	97.4	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	96.0	70.0	130
		EG005T: Zinc	7440-66-6	250 mg/kg	91.2	66.0	133

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4281233)							
ES2211677-061	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	93.7	70.0	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 4278967)							
ES2212085-001	EMB17/0.05-0.15	EP075(SIM): Acenaphthene	83-32-9	10 mg/kg	90.0	70.0	130
		EP075(SIM): Pyrene	129-00-0	10 mg/kg	107	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4278968)							
ES2212085-001	EMB17/0.05-0.15	EP071: C10 - C14 Fraction	----	480 mg/kg	112	73.0	137
		EP071: C15 - C28 Fraction	----	3100 mg/kg	115	53.0	131
		EP071: C29 - C36 Fraction	----	2060 mg/kg	119	52.0	132
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4279211)							
ES2212085-001	EMB17/0.05-0.15	EP080: C6 - C9 Fraction	----	32.5 mg/kg	95.7	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4278968)							
ES2212085-001	EMB17/0.05-0.15	EP071: >C10 - C16 Fraction	----	860 mg/kg	107	73.0	137
		EP071: >C16 - C34 Fraction	----	4320 mg/kg	118	53.0	131
		EP071: >C34 - C40 Fraction	----	890 mg/kg	114	52.0	132
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4279211)							
ES2212085-001	EMB17/0.05-0.15	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	106	70.0	130
EP080: BTEXN (QCLot: 4279211)							
ES2212085-001	EMB17/0.05-0.15	EP080: Benzene	71-43-2	2.5 mg/kg	97.2	70.0	130
		EP080: Toluene	108-88-3	2.5 mg/kg	96.6	70.0	130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	98.0	70.0	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	97.7	70.0	130
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	99.4	70.0	130
		EP080: Naphthalene	91-20-3	2.5 mg/kg	88.8	70.0	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4277372)							
EP2204052-008	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	78.4	72.0	128
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	76.0	73.0	123
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	82.0	67.0	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	130	70.0	132
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	# Not Determined	68.0	136
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	103	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4277372)							
EP2204052-008	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	91.4	71.0	135
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	90.8	69.0	132
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	123	70.0	132

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Matrix Spike (MS) Report: Acceptable Limits (%) Low	Matrix Spike (MS) Report: Acceptable Limits (%) High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4277372) - continued							
EP2204052-008	Anonymous	EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	107	71.0	131
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	90.4	69.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	80.4	72.0	129
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	92.8	69.0	133
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	82.8	64.0	136
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	91.2	69.0	135
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	86.8	66.0	139
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	90.7	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4277372)							
EP2204052-008	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	85.6	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	84.3	71.6	129
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	81.1	69.8	131
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	97.1	68.7	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	102	65.1	134
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	88.8	63.0	144
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	71.2	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4277372)							
EP2204052-008	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	88.4	62.0	145
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	# Not Determined	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	# Not Determined	65.0	137
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	140	69.2	143

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Matrix Spike (MS) Report: Acceptable Limits (%) Low	Matrix Spike (MS) Report: Acceptable Limits (%) High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4281520)							
ES2212085-021	RINSATE 02	EG020A-F: Arsenic	7440-38-2	1 mg/L	128	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	102	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	114	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	120	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	94.7	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	129	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4281520) - continued							
ES2212085-021	RINSATE 02	EG020A-F: Zinc	7440-66-6	1 mg/L	128	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 4281521)							
ES2212085-020	RINSATE 01	EG035F: Mercury	7439-97-6	0.01 mg/L	92.8	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4277308)							
ES2212270-001	Anonymous	EP080: C6 - C9 Fraction	----	325 µg/L	117	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4277308)							
ES2212270-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	116	70.0	130
EP080: BTEXN (QCLot: 4277308)							
ES2212270-001	Anonymous	EP080: Benzene	71-43-2	25 µg/L	100	70.0	130
		EP080: Toluene	108-88-3	25 µg/L	101	70.0	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	102	70.0	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	25 µg/L	104	70.0	130
		EP080: ortho-Xylene	95-47-6	25 µg/L	104	70.0	130
		EP080: Naphthalene	91-20-3	25 µg/L	99.5	70.0	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4277179)							
ES2212085-020	RINSATE 01	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.25 µg/L	95.4	72.0	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.25 µg/L	86.0	71.0	127
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.25 µg/L	85.0	68.0	131
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.25 µg/L	94.2	69.0	134
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.25 µg/L	77.2	65.0	140
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.25 µg/L	84.8	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4277179)							
ES2212085-020	RINSATE 01	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	1.25 µg/L	84.3	73.0	129
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.25 µg/L	83.2	72.0	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.25 µg/L	110	72.0	129
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.25 µg/L	86.4	72.0	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.25 µg/L	85.8	71.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.25 µg/L	87.0	69.0	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.25 µg/L	90.4	71.0	129
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.25 µg/L	88.2	69.0	133
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.25 µg/L	92.2	72.0	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.25 µg/L	92.0	65.0	144
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.625 µg/L	96.0	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4277179)							
ES2212085-020	RINSATE 01	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.25 µg/L	86.0	67.0	137

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4277179) - continued							
ES2212085-020	RINSATE 01	EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.625 µg/L	93.4	68.0	141
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.625 µg/L	81.0	62.6	147
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.625 µg/L	79.6	66.0	145
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.625 µg/L	104	57.6	145
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.25 µg/L	89.2	65.0	136
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.25 µg/L	94.0	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4277179)							
ES2212085-020	RINSATE 01	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.25 µg/L	87.8	63.0	143
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.25 µg/L	81.4	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.25 µg/L	88.8	67.0	138
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.25 µg/L	84.6	71.4	144

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2212085**	Page	: 1 of 12
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Telephone	: +61 2 8784 8555
Project	: 30080099 - Vopak Site Investigation	Date Samples Received	: 07-Apr-2022
Site	: ----	Issue Date	: 14-Apr-2022
Sampler	: Pauline Voukidis	No. of samples received	: 22
Order number	: ----	No. of samples analysed	: 19

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

- **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
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	EP2204052--008	Anonymous	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EP2204052--008	Anonymous	**6:2 Fluorotelomer sulfonic acid (6:2 FTS)**	27619-97-2	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EP2204052--008	Anonymous	**8:2 Fluorotelomer sulfonic acid (8:2 FTS)**	39108-34-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
PAH/Phenols (GC/MS - SIM)	0	4	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	4	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
PAH/Phenols (GC/MS - SIM)	0	4	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	4	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: **SOIL**

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

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

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
HDPE Soil Jar (EA055)							
EMB22/1.1-1.2	**05-Apr-2022**	**----**	----	----	**11-Apr-2022**	19-Apr-2022	✓
Soil Glass Jar - Unpreserved (EA055)							
EMB17/0.05-0.15, EMB17/1.2-1.3, EMB18/0.1-0.2, EMB18/1.4-1.5, QA01	**04-Apr-2022**	**----**	----	----	**11-Apr-2022**	18-Apr-2022	✓
Soil Glass Jar - Unpreserved (EA055)							
EMB19/0.02-0.05, EMB19/0.9-1.0, EMB20/0.01-0.1, EMB20/2.0-2.1, EMB21/0.01-0.10, EMB22/0.02-0.1	**05-Apr-2022**	**----**	----	----	**11-Apr-2022**	19-Apr-2022	✓
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
EMB17/0.05-0.15, EMB17/1.2-1.3, EMB18/0.1-0.2, EMB18/1.4-1.5, QA01	**04-Apr-2022**	**12-Apr-2022**	01-Oct-2022	✓	**13-Apr-2022**	01-Oct-2022	✓
Soil Glass Jar - Unpreserved (EG005T)							
EMB19/0.02-0.05, EMB19/0.9-1.0, EMB20/0.01-0.1, EMB20/2.0-2.1, EMB21/0.01-0.10	**05-Apr-2022**	**12-Apr-2022**	02-Oct-2022	✓	**13-Apr-2022**	02-Oct-2022	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
EMB17/0.05-0.15, EMB17/1.2-1.3, EMB18/0.1-0.2, EMB18/1.4-1.5, QA01	**04-Apr-2022**	**12-Apr-2022**	02-May-2022	✓	**13-Apr-2022**	02-May-2022	✓
Soil Glass Jar - Unpreserved (EG035T)							
EMB19/0.02-0.05, EMB19/0.9-1.0, EMB20/0.01-0.1, EMB20/2.0-2.1, EMB21/0.01-0.10	**05-Apr-2022**	**12-Apr-2022**	03-May-2022	✓	**13-Apr-2022**	03-May-2022	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
EMB17/0.05-0.15, EMB17/1.2-1.3, EMB18/0.1-0.2, EMB18/1.4-1.5, QA01	**04-Apr-2022**	**11-Apr-2022**	18-Apr-2022	✓	**12-Apr-2022**	21-May-2022	✓
Soil Glass Jar - Unpreserved (EP075(SIM))							
EMB19/0.02-0.05, EMB19/0.9-1.0, EMB20/0.01-0.1, EMB20/2.0-2.1, EMB21/0.01-0.10	**05-Apr-2022**	**11-Apr-2022**	19-Apr-2022	✓	**12-Apr-2022**	21-May-2022	✓

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
EP080/071: Total Petroleum Hydrocarbons								
Soil Glass Jar - Unpreserved (EP080)								
EMB17/0.05-0.15, EMB18/0.1-0.2, QA01	EMB17/1.2-1.3, EMB18/1.4-1.5,	**04-Apr-2022**	**11-Apr-2022**	18-Apr-2022	✓	**11-Apr-2022**	18-Apr-2022	✓
Soil Glass Jar - Unpreserved (EP071)								
EMB17/0.05-0.15, EMB18/0.1-0.2, QA01	EMB17/1.2-1.3, EMB18/1.4-1.5,	**04-Apr-2022**	**11-Apr-2022**	18-Apr-2022	✓	**12-Apr-2022**	21-May-2022	✓
Soil Glass Jar - Unpreserved (EP080)								
EMB19/0.02-0.05, EMB20/0.01-0.1, EMB21/0.01-0.10	EMB19/0.9-1.0, EMB20/2.0-2.1,	**05-Apr-2022**	**11-Apr-2022**	19-Apr-2022	✓	**11-Apr-2022**	19-Apr-2022	✓
Soil Glass Jar - Unpreserved (EP071)								
EMB19/0.02-0.05, EMB20/0.01-0.1, EMB21/0.01-0.10	EMB19/0.9-1.0, EMB20/2.0-2.1,	**05-Apr-2022**	**11-Apr-2022**	19-Apr-2022	✓	**12-Apr-2022**	21-May-2022	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
Soil Glass Jar - Unpreserved (EP080)								
EMB17/0.05-0.15, EMB18/0.1-0.2, QA01	EMB17/1.2-1.3, EMB18/1.4-1.5,	**04-Apr-2022**	**11-Apr-2022**	18-Apr-2022	✓	**11-Apr-2022**	18-Apr-2022	✓
Soil Glass Jar - Unpreserved (EP071)								
EMB17/0.05-0.15, EMB18/0.1-0.2, QA01	EMB17/1.2-1.3, EMB18/1.4-1.5,	**04-Apr-2022**	**11-Apr-2022**	18-Apr-2022	✓	**12-Apr-2022**	21-May-2022	✓
Soil Glass Jar - Unpreserved (EP080)								
EMB19/0.02-0.05, EMB20/0.01-0.1, EMB21/0.01-0.10	EMB19/0.9-1.0, EMB20/2.0-2.1,	**05-Apr-2022**	**11-Apr-2022**	19-Apr-2022	✓	**11-Apr-2022**	19-Apr-2022	✓
Soil Glass Jar - Unpreserved (EP071)								
EMB19/0.02-0.05, EMB20/0.01-0.1, EMB21/0.01-0.10	EMB19/0.9-1.0, EMB20/2.0-2.1,	**05-Apr-2022**	**11-Apr-2022**	19-Apr-2022	✓	**12-Apr-2022**	21-May-2022	✓
EP080: BTEXN								
Soil Glass Jar - Unpreserved (EP080)								
EMB17/0.05-0.15, EMB18/0.1-0.2, QA01	EMB17/1.2-1.3, EMB18/1.4-1.5,	**04-Apr-2022**	**11-Apr-2022**	18-Apr-2022	✓	**11-Apr-2022**	18-Apr-2022	✓
Soil Glass Jar - Unpreserved (EP080)								
EMB19/0.02-0.05, EMB20/0.01-0.1, EMB21/0.01-0.10	EMB19/0.9-1.0, EMB20/2.0-2.1,	**05-Apr-2022**	**11-Apr-2022**	19-Apr-2022	✓	**11-Apr-2022**	19-Apr-2022	✓

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X) EMB17/1.2-1.3, EMB18/0.1-0.2, EMB18/1.4-1.5, QA01	**04-Apr-2022**	**08-Apr-2022**	01-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
HDPE Soil Jar (EP231X) EMB19/0.02-0.05, EMB19/0.9-1.0, EMB20/0.01-0.1, EMB20/1.1-1.2, EMB21/0.01-0.10, EMB22/1.1-1.2, QA02	**05-Apr-2022**	**08-Apr-2022**	02-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
Soil Glass Jar - Unpreserved (EP231X) EMB17/0.05-0.15	**04-Apr-2022**	**08-Apr-2022**	01-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
Soil Glass Jar - Unpreserved (EP231X) EMB20/2.0-2.1, EMB22/0.02-0.1	**05-Apr-2022**	**08-Apr-2022**	02-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X) EMB17/1.2-1.3, EMB18/0.1-0.2, EMB18/1.4-1.5, QA01	**04-Apr-2022**	**08-Apr-2022**	01-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
HDPE Soil Jar (EP231X) EMB19/0.02-0.05, EMB19/0.9-1.0, EMB20/0.01-0.1, EMB20/1.1-1.2, EMB21/0.01-0.10, EMB22/1.1-1.2, QA02	**05-Apr-2022**	**08-Apr-2022**	02-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
Soil Glass Jar - Unpreserved (EP231X) EMB17/0.05-0.15	**04-Apr-2022**	**08-Apr-2022**	01-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
Soil Glass Jar - Unpreserved (EP231X) EMB20/2.0-2.1, EMB22/0.02-0.1	**05-Apr-2022**	**08-Apr-2022**	02-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X) EMB17/1.2-1.3, EMB18/0.1-0.2, EMB18/1.4-1.5, QA01	**04-Apr-2022**	**08-Apr-2022**	01-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
HDPE Soil Jar (EP231X) EMB19/0.02-0.05, EMB19/0.9-1.0, EMB20/0.01-0.1, EMB20/1.1-1.2, EMB21/0.01-0.10, EMB22/1.1-1.2, QA02	**05-Apr-2022**	**08-Apr-2022**	02-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
Soil Glass Jar - Unpreserved (EP231X) EMB17/0.05-0.15	**04-Apr-2022**	**08-Apr-2022**	01-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
Soil Glass Jar - Unpreserved (EP231X) EMB20/2.0-2.1, EMB22/0.02-0.1	**05-Apr-2022**	**08-Apr-2022**	02-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓

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
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X) EMB17/1.2-1.3, EMB18/0.1-0.2, EMB18/1.4-1.5, QA01	**04-Apr-2022**	**08-Apr-2022**	01-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
HDPE Soil Jar (EP231X) EMB19/0.02-0.05, EMB19/0.9-1.0, EMB20/0.01-0.1, EMB20/1.1-1.2, EMB21/0.01-0.10, EMB22/1.1-1.2, QA02	**05-Apr-2022**	**08-Apr-2022**	02-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
Soil Glass Jar - Unpreserved (EP231X) EMB17/0.05-0.15	**04-Apr-2022**	**08-Apr-2022**	01-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
Soil Glass Jar - Unpreserved (EP231X) EMB20/2.0-2.1, EMB22/0.02-0.1	**05-Apr-2022**	**08-Apr-2022**	02-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X) EMB17/1.2-1.3, EMB18/0.1-0.2, EMB18/1.4-1.5, QA01	**04-Apr-2022**	**08-Apr-2022**	01-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
HDPE Soil Jar (EP231X) EMB19/0.02-0.05, EMB19/0.9-1.0, EMB20/0.01-0.1, EMB20/1.1-1.2, EMB21/0.01-0.10, EMB22/1.1-1.2, QA02	**05-Apr-2022**	**08-Apr-2022**	02-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
Soil Glass Jar - Unpreserved (EP231X) EMB17/0.05-0.15	**04-Apr-2022**	**08-Apr-2022**	01-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓
Soil Glass Jar - Unpreserved (EP231X) EMB20/2.0-2.1, EMB22/0.02-0.1	**05-Apr-2022**	**08-Apr-2022**	02-Oct-2022	✓	**11-Apr-2022**	18-May-2022	✓

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
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F) RINSATE 01	**04-Apr-2022**	**----**	----	----	**12-Apr-2022**	01-Oct-2022	✓
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F) RINSATE 02	**05-Apr-2022**	**----**	----	----	**12-Apr-2022**	02-Oct-2022	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F) RINSATE 01	**04-Apr-2022**	**----**	----	----	**12-Apr-2022**	02-May-2022	✓
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F) RINSATE 02	**05-Apr-2022**	**----**	----	----	**12-Apr-2022**	03-May-2022	✓

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
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Amber Glass Bottle - Unpreserved (EP075(SIM))								
RINSATE 02		**05-Apr-2022**	**11-Apr-2022**	12-Apr-2022	✓	**12-Apr-2022**	21-May-2022	✓
Amber VOC Vial - Sulfuric Acid (EP075(SIM))								
RINSATE 01		**04-Apr-2022**	**11-Apr-2022**	11-Apr-2022	✓	**14-Apr-2022**	21-May-2022	✓
EP080/071: Total Petroleum Hydrocarbons								
Amber Glass Bottle - Unpreserved (EP071)								
RINSATE 02		**05-Apr-2022**	**11-Apr-2022**	12-Apr-2022	✓	**12-Apr-2022**	21-May-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080)								
TRIP BLANK,	RINSATE 01	**04-Apr-2022**	**11-Apr-2022**	18-Apr-2022	✓	**11-Apr-2022**	18-Apr-2022	✓
Amber VOC Vial - Sulfuric Acid (EP071)								
RINSATE 01		**04-Apr-2022**	**11-Apr-2022**	11-Apr-2022	✓	**14-Apr-2022**	21-May-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080)								
RINSATE 02		**05-Apr-2022**	**11-Apr-2022**	19-Apr-2022	✓	**11-Apr-2022**	19-Apr-2022	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
Amber Glass Bottle - Unpreserved (EP071)								
RINSATE 02		**05-Apr-2022**	**11-Apr-2022**	12-Apr-2022	✓	**12-Apr-2022**	21-May-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080)								
TRIP BLANK,	RINSATE 01	**04-Apr-2022**	**11-Apr-2022**	18-Apr-2022	✓	**11-Apr-2022**	18-Apr-2022	✓
Amber VOC Vial - Sulfuric Acid (EP071)								
RINSATE 01		**04-Apr-2022**	**11-Apr-2022**	11-Apr-2022	✓	**14-Apr-2022**	21-May-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080)								
RINSATE 02		**05-Apr-2022**	**11-Apr-2022**	19-Apr-2022	✓	**11-Apr-2022**	19-Apr-2022	✓
EP080: BTEXN								
Amber VOC Vial - Sulfuric Acid (EP080)								
TRIP BLANK,	RINSATE 01	**04-Apr-2022**	**11-Apr-2022**	18-Apr-2022	✓	**11-Apr-2022**	18-Apr-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080)								
RINSATE 02		**05-Apr-2022**	**11-Apr-2022**	19-Apr-2022	✓	**11-Apr-2022**	19-Apr-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080)								
TRIP SPIKE 28/3/22		**28-Mar-2022**	**11-Apr-2022**	11-Apr-2022	✓	**11-Apr-2022**	11-Apr-2022	✓
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE (no PTFE) (EP231X)								
BLANK01,	RINSATE 01	**04-Apr-2022**	**11-Apr-2022**	01-Oct-2022	✓	**12-Apr-2022**	01-Oct-2022	✓
HDPE (no PTFE) (EP231X)								
RINSATE 02		**05-Apr-2022**	**11-Apr-2022**	02-Oct-2022	✓	**12-Apr-2022**	02-Oct-2022	✓
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X)								
BLANK01,	RINSATE 01	**04-Apr-2022**	**11-Apr-2022**	01-Oct-2022	✓	**12-Apr-2022**	01-Oct-2022	✓
HDPE (no PTFE) (EP231X)								
RINSATE 02		**05-Apr-2022**	**11-Apr-2022**	02-Oct-2022	✓	**12-Apr-2022**	02-Oct-2022	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X) BLANK01,	RINSATE 01	**04-Apr-2022**	**11-Apr-2022**	01-Oct-2022	✓	**12-Apr-2022**	01-Oct-2022	✓
HDPE (no PTFE) (EP231X) RINSATE 02		**05-Apr-2022**	**11-Apr-2022**	02-Oct-2022	✓	**12-Apr-2022**	02-Oct-2022	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X) BLANK01,	RINSATE 01	**04-Apr-2022**	**11-Apr-2022**	01-Oct-2022	✓	**12-Apr-2022**	01-Oct-2022	✓
HDPE (no PTFE) (EP231X) RINSATE 02		**05-Apr-2022**	**11-Apr-2022**	02-Oct-2022	✓	**12-Apr-2022**	02-Oct-2022	✓
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X) BLANK01,	RINSATE 01	**04-Apr-2022**	**11-Apr-2022**	01-Oct-2022	✓	**12-Apr-2022**	01-Oct-2022	✓
HDPE (no PTFE) (EP231X) RINSATE 02		**05-Apr-2022**	**11-Apr-2022**	02-Oct-2022	✓	**12-Apr-2022**	02-Oct-2022	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	4	33	12.12	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	1	10	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	10	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	10	10.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Dissolved Mercury by FIMS	EG035F	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	4	0.00	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*	
Laboratory Duplicates (DUP) - Continued							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	4	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Mercury by FIMS	EG035F	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	4	**25.00**	**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
TRH - Semivolatile Fraction	EP071	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Mercury by FIMS	EG035F	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	4	**25.00**	**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
TRH - Semivolatile Fraction	EP071	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Mercury by FIMS	EG035F	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	4	**0.00**	**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
TRH - Semivolatile Fraction	EP071	0	4	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015 Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM Schedule B(3).
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-house: Analysis of soils by solvent extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM using internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).

Analytical Methods	Method	Matrix	Method Descriptions
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
QuECheRS Extraction of Solids	ORG71	SOIL	In house: Sequential extractions with Acetonitrile/Methanol by shaking. Extraction efficiency aided by the addition of salts under acidic conditions. Where relevant, interferences from co-extracted organics are removed with dispersive clean-up media (dSPE). The extract is either diluted or concentrated and exchanged into the analytical solvent.
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.
Solid Phase Extraction (SPE) for PFAS in water	ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

14-4-22

CHAIN OF CUSTODY FORM

SMEC

Subcon / ~~Forward Lab~~ / Split WO
Lab / Analysis:
Organised By / Date: Eurofins
Relinquished By / Date: QA01A / QA02A
Connote / Courier:
WO No: ES2212085
Attach By PO / Internal Sheet:

SMEC OFFICE: SMEC North Sydney
PROJECT: Vopak Site Investigation

TURNAROUND REQUIREMENTS : Standard - 5 day TAT

LAB:
ALS Darwin
Unit 4/16 Charlton Court
Woolner, NT, 0820

ALS Sydney
277-289 Woodpark Road
Smithfield NSW 2164

ATTENTION:
Adrian Degenaar / Sepan Mahamad
DISPATCH TO (ADDRESS & PHONE NO.):

PROJECT NUMBER: 30060099
LAB QUOTE NO.: SY/285/21
COC SEQUENCE NUMBER (Circle)
COC: 1 2 3 4 5 6 7
OF: 1 2 3 4 5 6 7

PROJECT MANAGER: Manuel Fernandez
CONTACT PH: 0422 150 250 (Pauline)

SAMPLED BY: Pauline Voulidis

DATE SAMPLED: 4&5 April 2022

(1st) RELINQUISHED BY: Pauline Voulidis
DATE/TIME: 4&5/4/2022
RECEIVED BY:
DATE/TIME:

(2nd) RELINQUISHED BY:
DATE/TIME:
RECEIVED BY:
DATE/TIME:

(3rd) RELINQUISHED BY:
DATE/TIME
RECEIVED BY: Kim - ALS
DATE/TIME: 07.04.22 7.40am

Email Reports to (will default to PM if blank): manuel.fernandez@smec.com, pauline.voulidis@smec.com
Email Invoice to (will default to PM if blank): manuel.fernandez@smec.com

Special Laboratory Instructions:
Please forward results to smec@esdat.com.au
ESDAT format results

LAB OF ORIGIN: DARWIN

Environmental Division Sydney
Work Order Reference
ES2212085

Telephone : + 61-2-8784 8555

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	PFAS - Full Suite (28 analytes)	5-26 (TRH (C6-C40) / BTEXN / PAH / 6 Metals)	BTEX/TRH(C6-9)	BTEX				HOLD	
1	EMB17/0.05-0.15	4/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
2	EMB17/1.2-1.3	4/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
3	EMB18/0.1-0.2	4/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
4	EMB18/1.4-1.5	4/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
5	EMB19/0.02-0.05	5/04/2022	Soil	glass jar, 1 PFAS jar	2	X	X							
6	EMB19/0.9-1.0	5/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
7	EMB20/0.01-0.1	5/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
8	EMB20/1.1-1.2	5/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X								
9	EMB20/2.0-2.1	5/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
10	EMB21/0.01-0.10	5/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
11	EMB22/0.02-0.1	5/04/2022	Soil	1 glass jar, 1 PFAS jar	1	X								
12	EMB22/1.1-1.2	5/04/2022		1 PFAS jar	1	X								
13	EMB22/2.5-2.6	5/04/2022	Soil	1 PFAS jar	1								X	
14	QA01	4/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
—	QA01A	4/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							Send to Eurofins for Analysis
15	QA02	5/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X								
—	QA02A	5/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X								Send to Eurofins for Analysis
16	BLANK01	4/05/2022	Water	2 PFAS Bottles	2	X								
17	TRIP BLANK		Water	2 PFAS bottles	2								X	
18	TRIP BLANK		Water	1 vial	1			X						
19	TRIP SPIKE 28/3/22	28/03/2022	Water	1 vial	1				X					
20	RINSATE 01	4/04/2022	Water	1 metals, 2 PFAS, 2 vials	5	X	X							
21	RINSATE 02	5/04/2022	Water	2 metals, 2 ambr, 2 PFAS, 2 vials	8	X	X							
				TOTAL		19	13	1	1				1	

Notes: Hold all remaining sample volume for possible future leachability analysis

Extra - 22 EMB17/0.1-02 . 4.4.22

CHAIN OF CUSTODY FORM

SMEC

SMEC OFFICE: SMEC North Sydney PROJECT: Vopak Site Investigation	TURNAROUND REQUIREMENTS : o Standard - 5 day TAT	LAB: ALS Darwin Unit 4/16 Charlton Court Woolner, NT, 0820 ALS Sydney 277-289 Woodpark Road Smithfield NSW 2164
PROJECT NUMBER: 30080099	LAB QUOTE NO.: SY/285/21	COC SEQUENCE NUMBER (Circle) COC: 0 2 3 4 5 6 7
PROJECT MANAGER: Manuel Fernandez	CONTACT PH: 0422 156 256 (Pauline)	OF: 1 2 3 4 5 6 7
SAMPLED BY: Pauline Voukidis		ATTENTION: Adrian Degenaar / Sepan Mahamad DISPATCH TO (ADDRESS & PHONE NO.):
DATE SAMPLED: 06/04/2022	(1st) RELINQUISHED BY: PV DATE/TIME: 06/04/2022 1750	(2nd) RELINQUISHED BY: DATE/TIME:	(3rd) RELINQUISHED BY: DATE/TIME:
Email Reports to (will default to PM if blank): manuel.fernandez@smec.com, pauline.voukidis@smec.com	RECEIVED BY: DATE/TIME: 07/04/22 1:00pm	RECEIVED BY: DATE/TIME:	RECEIVED BY: Kim ALS 08.04.22 7.40 Am
Email Invoice to (will default to PM if blank): manuel.fernandez@smec.com			

Special Laboratory Instructions:
Please forward results to smec@esdat.com.au
ESDAT format results

015 8/4°C

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	HOLD - Please deliver to ALS Smithfield NSW								
1	EW02/0.0-0.2	06/04/22 0920	S	1 PFAS	1	X								
2	BH05/1.0-1.1	06/04/22 1010	S	1 PFAS	1	X								
3	BH01/0.0-0.1	06/04/22 1515	S	1 PFAS	1	X								
4	BH01/1.0-1.1	06/04/22 1545	S	1 PFAS	1	X								
5	BH01/1.9-2.0	06/04/22 1600	S	1 PFAS	1	X								
6	BH02/0.0-0.1	06/04/22 1610	S	1PFAS, 1JAR, 1BAG	3	X								
7	RINSATE02	06/04/2022	W	2metals, 2vols, 2amber, 2PFAS	8	X								1metal UPUF; 1metalURB
8	BLANK 02	06/04/2022	W	2 PFAS	2	X								
9	QA03	06/04/2022	S	1 PFAS, 1JAR	2	X								
10	QA03A	06/04/2022	S	1 PFAS, 1JAR	2	X								
				Total										

Notes: Low Reporting limits required for groundwater as specified by SMEC Australia Pty Ltd. Copies: WHITE: send to lab, YELLOW: to be placed in project file, PINK: to be retained in CoC book

Environmental Division
Sydney
Work Order Reference
ES2212247

Telephone : 61-2-8784 8555

LAB OF ORIGIN:
DARWIN

updated COC 12.04.22 12.37 pm

CHAIN OF CUSTODY FORM

SMEC

SMEC OFFICE: SMEC North Sydney **PROJECT:** Vopak Site Investigation	**TURNAROUND REQUIREMENTS :** ☐ Standard - 5 day TAT		**LAB:** ALS Darwin Unit 4/16 Charlton Court Woolner, NT, 0820 ALS Sydney 277-289 Woodpark Road Smithfield NSW 2164
PROJECT NUMBER: 30080099	**LAB QUOTE NO.:** SY/285/21	**COC SEQUENCE NUMBER (Circle)**	
PROJECT MANAGER: Manuel Fernandez	**CONTACT PH:** 0422 156 256 (Pauline)	**COC:** PAGE 1	
SAMPLED BY: Pauline Voukidis		**OF:** 2	
DATE SAMPLED: 6 to 8 April 2022	**(1st) RELINQUISHED BY:** Pauline Voukidis **DATE/TIME:** 6 and 8/4/2022	**(2nd) RELINQUISHED BY:** **DATE/TIME:**	**(3rd) RELINQUISHED BY:** **DATE/TIME:**
Email Reports to: manuel.fernandez@smec.com, pauline.voukidis@smec.com			
Email Invoice to: manuel.fernandez@smec.com	**RECEIVED BY:**	**RECEIVED BY:**	**RECEIVED BY:**

Special Laboratory Instructions:
Please forward results to smec@esdat.com.au

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	PFAS - Full Suite (28 analytes)	S-26 (TRH (C6-C40) / BTEXN / PAH / 8 Metals)	BTEX/TRH(C6-9)	BTEX				HOLD	
1	EMB25/0.08-0.15	6/04/2022	Soil	1 PFAS jar	1	X								
2	EMB25/1/0-1.1	6/04/2022	Soil	1 PFAS jar	1	X								
3	SBH01/0.08-0.15	6/04/2022	Soil	1 PFAS jar	1	X								
4	SBH01/1.1-1.1	6/04/2022	Soil	1 PFAS jar	1	X								
5	SBH01/1.9-2.0	6/04/2022	Soil	1 PFAS jar	1								X	
6	SBH02/0.08-0.15	6/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
7	RINSATE03	6/04/2022	Water	2 metals, 2 vials, 2 amber , 2 PFAS bottles	8	X	X							
8	BLANK02	6/04/2022	Water	2 PFAS bottles	2	X								
9	QA03	6/04/2022	Soil	1 glass jar, 1 PFAS jar	2								X	
10	QA03A	6/04/2022	Soil	1 glass jar, 1 PFAS jar	2								X	
SD	EMB23/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
	EMB23/0.75-0.85	7/04/2022	Soil	1 PFAS jar	1	X								
	EMB25/1.8-1.9	7/04/2022	Soil	1 PFAS jar	1								X	
	EMB24/0.08-0.15	8/04/2022	Soil	1 PFAS jar	1	X								
	EMB24/0.7-0.8	8/04/2022	Soil	1 PFAS jar	1	X								
	EMB24/1.7-1.8	8/04/2022	Soil	1 PFAS jar	1								X	
	EMB24/2.7-2.8	8/04/2022	Soil	1 PFAS jar	1								X	
	QA05	8/04/2022	Soil	1 PFAS jar	1								X	
	QA05A	8/04/2022	Soil	1 PFAS jar	1								X	
	RINSATE05	8/04/2022	Water	2 PFAS bottles	2	X								
	TRIP SPIKE 2	4/04/2022	Soil	1 glass jar	1				X					
	TRIP BLANK	4/04/2022	Soil	1 glass jar	1			X						
	BLANK04	8/04/2022	Water	2 PFAS bottles	2	X								
				TOTAL		13	2	1	1				8	

Notes: Hold all remaining sample volume for possible future leachability analysis

Environmental Division
Sydney
Work Order Reference
ES2212247

Telephone : +61-2-8784 8555

CHAIN OF CUSTODY FORM

SMEC

SMEC OFFICE: SMEC North Sydney **PROJECT:** Vopak Site Investigation	**TURNAROUND REQUIREMENTS :** ☐ Standard - 5 day TAT	**LAB:** ALS Darwin Unit 4/16 Charlton Court Woolner, NT, 0820 ALS Sydney 277-289 Woodpark Road Smithfield NSW 2164
PROJECT NUMBER: 30080099	**LAB QUOTE NO.:** SY/285/21	**COC SEQUENCE NUMBER (Circle)**
PROJECT MANAGER: Manuel Fernandez	**CONTACT PH:** 0422 156 256 (Pauline)	**COC:** PAGE 2
SAMPLED BY: Pauline Voukidis		**OF:** 2

DATE SAMPLED: 7 April 2022	**(1st) RELINQUISHED BY:** Pauline Voukidis **DATE/TIME:** 7/4/2022	**(2nd) RELINQUISHED BY:** **DATE/TIME:**	**(3rd) RELINQUISHED BY:** **DATE/TIME:**
Email Reports to: manuel.fernandez@smec.com, pauline.voukidis@smec.com			
Email Invoice to: manuel.fernandez@smec.com	**RECEIVED BY:**	**RECEIVED BY:**	**RECEIVED BY:**

Special Laboratory Instructions:
Please forward results to smec@esdat.com.au

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	PFAS - Full Suite (28 analytes)	S-26 (TRH (C6-C40) / BTEXN / PAH / 8 Metals)	BTEX/TRH(C6-9)	BTEX				HOLD	
SVR	SBH02/1.1-1.2	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH02/2.0-2.1	7/04/2022	Soil	1 PFAS jar	1								X	
	SBH03/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH05/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH05/0.9-1.0	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH05/1.9-2.0	7/04/2022	Soil	1 PFAS jar	1								X	
	SBH05/2.7-2.8	7/04/2022	Soil	1 PFAS jar	1								X	
	SBH03/0.7-0.8	7/04/2022	Soil	1 PFAS jar	1								X	
	SBH03/1.0-1.1	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH03/1.8-1.9	7/04/2022	Soil	1 PFAS jar	1								X	
	SBH06/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH06/0.8-0.9	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH06/1.8-1.9	7/04/2022	Soil	1 PFAS jar	1								X	
	RINSATE04	7/04/2022	Water	2 PFAS bottles	2	X								
	BLANK03	7/04/2022	Water	2 PFAS bottles	2	X								
	QA04	7/04/2022	Soil	1 PFAS jar	1	X								
	QA04A	7/04/2022	Soil	1 PFAS jar	1	X								Send to Eurofins for Analysis
	SBH06/2.8-2.9	7/04/2022	Soil	1 PFAS jar	1								X	
	SBH04/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH04/0.8-0.9	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH04/1.7-1.8	7/04/2022	Soil	1 PFAS jar	1								X	
				TOTAL		13							8	

Notes: Hold all remaining sample volume for possible future leachability analysis

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2212247**

Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Contact	: Brenda Hong
Address	: Level 5, 20 Berry Street, North Sydney, NSW 2060 North Sydney 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: manuel.fernandez@smec.com	E-mail	: Brenda.Hong@ALSGlobal.com
Telephone	: ----	Telephone	: +61 2 8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 30080099 - Vopak Site Investigation	Page	: 1 of 3
Order number	: ----	Quote number	: ES2021SMEAUS0007 (SY/285/21)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Pauline Voukidis		

Dates

Date Samples Received	: 08-Apr-2022 07:40	Issue Date	: 13-Apr-2022
Client Requested Due Date	: 22-Apr-2022	Scheduled Reporting Date	: **22-Apr-2022**

Delivery Details

Mode of Delivery	: Pickup	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: 8.4' C
Receipt Detail	:	No. of samples received / analysed	: 10 / 7

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

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

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

Summary of Sample(s) and Requested Analysis

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

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	(On Hold) SOIL No analysis requested	SOIL - EA055-103 Moisture Content	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)	SOIL - S-26 8 metals/TRH/BTEXN/PAH
ES2212247-001	06-Apr-2022 08:50	EMB25/0.08-0.15		✓	✓	
ES2212247-002	06-Apr-2022 09:40	EMB25/1.0-1.1		✓	✓	
ES2212247-003	06-Apr-2022 14:45	SBH01/0.08-0.15		✓	✓	
ES2212247-004	06-Apr-2022 15:15	SBH01/1.0-1.1		✓	✓	
ES2212247-005	06-Apr-2022 15:30	SBH01/1.9-2.0	✓			
ES2212247-006	06-Apr-2022 16:10	SBH02/0.08-0.15		✓	✓	✓
ES2212247-009	06-Apr-2022 08:50	QA03	✓			
ES2212247-010	06-Apr-2022 08:50	QA03A	✓			

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EP231X PFAS - Full Suite (28 analytes)	WATER - W-26 TRH/BTEXN/PAH/8 Metals
ES2212247-007	06-Apr-2022 00:00	RINSATE 03	✓	✓
ES2212247-008	06-Apr-2022 00:00	BLANK 02	✓	

Proactive Holding Time Report

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

Requested Deliverables

ACCOUNTS INVOICES

- A4 - AU Tax Invoice (INV)	Email	accounts.payable@smec.com

MANUEL FERNANDEZ

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

Pauline Voukidis

- *AU Certificate of Analysis - NATA (COA)	Email	pauline.voukidis@smec.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	pauline.voukidis@smec.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	pauline.voukidis@smec.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	pauline.voukidis@smec.com
- Chain of Custody (CoC) (COC)	Email	pauline.voukidis@smec.com
- EDI Format - ENMRG (ENMRG)	Email	pauline.voukidis@smec.com
- EDI Format - ESDAT (ESDAT)	Email	pauline.voukidis@smec.com

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES2212247**	Page	: 1 of 21
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Contact	: Brenda Hong
Address	: Level 5, 20 Berry Street, North Sydney, NSW 2060 North Sydney 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 30080099 - Vopak Site Investigation	Date Samples Received	: 08-Apr-2022
Order number	: 30080099	Date Analysis Commenced	: 13-Apr-2022
C-O-C number	: ----	Issue Date	: 22-Apr-2022
Sampler	: Pauline Voukidis		
Site	: ----		
Quote number	: SY/285/21 V2		
No. of samples received	: 10		
No. of samples analysed	: 7		

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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Inorganics, Smithfield, NSW
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 4288277)									
ES2212247-006	SBH02/0.08-0.15	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	93	78	17.8	0% - 20%
		EG005T: Nickel	7440-02-0	2	mg/kg	2	2	0.0	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	20	22	8.9	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	10	10	0.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	<5	<5	0.0	No Limit
ES2212898-010	Anonymous	EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.0	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	16	22	33.2	0% - 50%
		EG005T: Nickel	7440-02-0	2	mg/kg	47	46	3.5	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	<5	<5	0.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	44	58	27.5	0% - 50%
		EG005T: Lead	7439-92-1	5	mg/kg	28	33	16.2	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	162	188	15.4	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 4287935)									
ES2212247-003	SBH01/0.08-0.15	EA055: Moisture Content	----	0.1	%	6.7	7.2	6.9	0% - 20%
ES2212442-052	Anonymous	EA055: Moisture Content	----	0.1	%	56.4	62.1	9.6	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 4288288)									
ES2212505-001	Anonymous	EA055: Moisture Content	----	0.1	%	24.2	27.0	10.9	0% - 20%
ES2212898-018	Anonymous	EA055: Moisture Content	----	0.1	%	12.0	11.6	3.2	0% - 50%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 4288276)									
ES2212247-006	SBH02/0.08-0.15	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
ES2212898-010	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	1.0	0.8	24.5	0% - 50%

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 4286000)									
ES2211922-001	Anonymous	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
ES2211922-031	Anonymous	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4286001)									
ES2211922-001	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
ES2211922-031	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4287789)									
ES2213060-001	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4286001)									
ES2211922-001	Anonymous	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
ES2211922-031	Anonymous	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.0	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4287789)									
ES2213060-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP080: BTEXN (QC Lot: 4287789)									
ES2213060-001	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4291006)									
EP2204292-007	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
EP2204292-095	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.0003	51.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4291007)									

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4291007) - continued									
ES2212247-006	SBH02/0.08-0.15	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
ES2212899-010	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4291006)									
EP2204292-007	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
EP2204292-095	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4291007)									
ES2212247-006	SBH02/0.08-0.15	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0003	0.0003	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.0006	0.0006	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0003	0.0003	0.0	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0006	0.0007	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4291007) - continued									
ES2212247-006	SBH02/0.08-0.15	EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
ES2212899-010	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0003	0.0003	0.0	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.0002	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4291006)									
EP2204292-007	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP2204292-095	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4291006) - continued									
EP2204292-095	Anonymous	EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4291007)									
ES2212247-006	SBH02/0.08-0.15	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
ES2212899-010	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 4291006)									
EP2204292-007	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 4291006) - continued									
EP2204292-095	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 4291007)									
ES2212247-006	SBH02/0.08-0.15	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	0.0280	0.0340	19.2	0% - 20%
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	0.0092	0.0099	7.4	0% - 50%
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
ES2212899-010	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4293109)									
ES2213113-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
ES2213404-002	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4293109) - continued									
ES2213404-002	Anonymous	EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 4293110)									
ES2212568-001	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.1 µg/L	<0.0001	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4291454)									
CA2202541-001	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
ES2212982-004	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4291454)									
CA2202541-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
ES2212982-004	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP080: BTEXN (QC Lot: 4291454)									
CA2202541-001	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
ES2212982-004	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4294624)									
ES2212247-007	RINSATE 03	EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4294624)									
ES2212247-007	RINSATE 03	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4294624) - continued									
ES2212247-007	RINSATE 03	EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4294624)									
ES2212247-007	RINSATE 03	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 4294624)									
ES2212247-007	RINSATE 03	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231P: PFAS Sums (QC Lot: 4294624)									
ES2212247-007	RINSATE 03	EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	<0.01	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (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 Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4288277)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	121.1 mg/kg	103	88.0	113
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	0.74 mg/kg	110	70.0	130
EG005T: Chromium	7440-47-3	2	mg/kg	<2	19.6 mg/kg	114	68.0	132
EG005T: Copper	7440-50-8	5	mg/kg	<5	52.9 mg/kg	105	89.0	111
EG005T: Lead	7439-92-1	5	mg/kg	<5	60.8 mg/kg	108	82.0	119
EG005T: Nickel	7440-02-0	2	mg/kg	<2	15.3 mg/kg	106	80.0	120
EG005T: Zinc	7440-66-6	5	mg/kg	<5	139.3 mg/kg	96.7	66.0	133
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4288276)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.087 mg/kg	124	70.0	125
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 4286000)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	6 mg/kg	101	77.0	125
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	6 mg/kg	107	72.0	124
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	6 mg/kg	93.6	73.0	127
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	6 mg/kg	106	72.0	126
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	6 mg/kg	99.7	75.0	127
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	6 mg/kg	99.6	77.0	127
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	6 mg/kg	108	73.0	127
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	6 mg/kg	104	74.0	128
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	6 mg/kg	96.5	69.0	123
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	6 mg/kg	98.2	75.0	127
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	6 mg/kg	90.6	68.0	116
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	6 mg/kg	104	74.0	126
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	6 mg/kg	94.4	70.0	126
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	6 mg/kg	91.2	61.0	121
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	6 mg/kg	87.0	62.0	118
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	6 mg/kg	92.6	63.0	121
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4286001)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	300 mg/kg	87.6	75.0	129
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	450 mg/kg	90.0	77.0	131
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	300 mg/kg	93.5	71.0	129
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4287789)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	98.8	68.4	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4286001)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4286001) - continued								
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	375 mg/kg	86.7	77.0	125
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	525 mg/kg	89.0	74.0	138
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	225 mg/kg	92.1	63.0	131
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4287789)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	95.2	68.4	128
EP080: BTEXN (QCLot: 4287789)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	99.6	62.0	116
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	101	67.0	121
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	106	65.0	117
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	104	66.0	118
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	108	68.0	120
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	107	63.0	119
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4291006)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	104	72.0	128
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	90.8	73.0	123
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.8	67.0	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	79.2	70.0	132
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	83.6	68.0	136
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	119	59.0	134
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4291007)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	121	72.0	128
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	98.8	73.0	123
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	91.6	67.0	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	96.8	70.0	132
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.0	68.0	136
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	98.8	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4291006)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	83.5	71.0	135
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	98.0	69.0	132
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	118	70.0	132
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	93.2	71.0	131
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	100	69.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	102	72.0	129
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	107	69.0	133
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	96.4	64.0	136
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	99.2	69.0	135
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	74.4	66.0	139

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4291006) - continued								
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	86.5	69.0	133
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4291007)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	76.7	71.0	135
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	102	69.0	132
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	121	70.0	132
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	81.2	71.0	131
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	107	69.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	112	72.0	129
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	106	69.0	133
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	95.6	64.0	136
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	113	69.0	135
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	110	66.0	139
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	102	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4291006)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	97.2	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	83.2	71.6	129
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	98.7	69.8	131
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	91.7	68.7	130
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	108	65.1	134
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	95.2	63.0	144
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	96.8	61.0	139
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4291007)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	121	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	115	71.6	129
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	109	69.8	131
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	108	68.7	130
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	125	65.1	134
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	120	63.0	144
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	110	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4291006)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	91.6	62.0	145

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4291006) - continued								
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	87.6	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	107	65.0	137
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	119	69.2	143
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4291007)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	112	62.0	145
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	107	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	109	65.0	137
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	98.8	69.2	143

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4293109)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	97.7	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	94.6	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	94.1	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	94.4	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	91.5	83.0	111
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	94.3	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	97.6	81.0	117
EG035F: Dissolved Mercury by FIMS (QCLot: 4293110)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	96.0	83.0	105
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 4285692)								
EP075(SIM): Naphthalene	91-20-3	1	µg/L	<1.0	5 µg/L	73.9	50.0	94.0
EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<1.0	5 µg/L	91.4	63.6	114
EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<1.0	5 µg/L	85.7	62.2	113
EP075(SIM): Fluorene	86-73-7	1	µg/L	<1.0	5 µg/L	87.3	63.9	115
EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<1.0	5 µg/L	80.1	62.6	116
EP075(SIM): Anthracene	120-12-7	1	µg/L	<1.0	5 µg/L	85.6	64.3	116
EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<1.0	5 µg/L	87.6	63.6	118
EP075(SIM): Pyrene	129-00-0	1	µg/L	<1.0	5 µg/L	87.1	63.1	118
EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<1.0	5 µg/L	83.6	64.1	117
EP075(SIM): Chrysene	218-01-9	1	µg/L	<1.0	5 µg/L	81.6	62.5	116
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<1.0	5 µg/L	85.6	61.7	119
EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<1.0	5 µg/L	85.9	63.0	115
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	5 µg/L	82.5	63.3	117
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<1.0	5 µg/L	85.3	59.9	118
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	1	µg/L	<1.0	5 µg/L	84.8	61.2	117

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 4285692) - continued								
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	1	µg/L	<1.0	5 µg/L	85.5	59.1	118
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4285693)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	400 µg/L	67.0	55.8	112
EP071: C15 - C28 Fraction	----	100	µg/L	<100	600 µg/L	95.3	71.6	113
EP071: C29 - C36 Fraction	----	50	µg/L	<50	400 µg/L	98.3	56.0	121
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4291454)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	95.1	75.0	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4285693)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	500 µg/L	73.6	57.9	119
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	700 µg/L	72.1	62.5	110
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	300 µg/L	69.3	61.5	121
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4291454)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	102	75.0	127
EP080: BTEXN (QCLot: 4291454)								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	97.7	70.0	122
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	101	69.0	123
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	104	70.0	120
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	99.7	69.0	121
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	100	72.0	122
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	107	70.0	120
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4294624)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.25 µg/L	124	72.0	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.25 µg/L	92.2	71.0	127
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	0.25 µg/L	91.8	68.0	131
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.25 µg/L	89.0	69.0	134
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.25 µg/L	88.8	65.0	140
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.25 µg/L	95.4	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4294624)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	93.1	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	81.6	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	113	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	83.2	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	95.2	71.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.25 µg/L	101	69.0	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.25 µg/L	102	71.0	129
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.25 µg/L	102	69.0	133
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.25 µg/L	120	72.0	134

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4294624) - continued								
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.25 µg/L	91.8	65.0	144
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	0.625 µg/L	122	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4294624)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.25 µg/L	119	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	0.625 µg/L	92.3	68.0	141
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	0.625 µg/L	97.4	62.6	147
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	0.625 µg/L	109	66.0	145
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	0.625 µg/L	111	57.6	145
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.25 µg/L	121	65.0	136
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.25 µg/L	105	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4294624)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.25 µg/L	108	63.0	143
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.25 µg/L	101	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.25 µg/L	109	67.0	138
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.25 µg/L	92.0	71.4	144

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	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4288277)							
ES2212247-006	SBH02/0.08-0.15	EG005T: Arsenic	7440-38-2	50 mg/kg	90.4	70.0	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	102	70.0	130
		EG005T: Chromium	7440-47-3	50 mg/kg	112	68.0	132
		EG005T: Copper	7440-50-8	250 mg/kg	101	70.0	130
		EG005T: Lead	7439-92-1	250 mg/kg	104	70.0	130
		EG005T: Nickel	7440-02-0	50 mg/kg	102	70.0	130
		EG005T: Zinc	7440-66-6	250 mg/kg	101	66.0	133
EG035T: Total Recoverable Mercury by FIMS (QCLot: 4288276)							
ES2212308-001	Anonymous	EG035T: Mercury	7439-97-6	5 mg/kg	92.7	70.0	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 4286000)							

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 4286000) - continued							
ES2211922-001	Anonymous	EP075(SIM): Acenaphthene	83-32-9	10 mg/kg	79.8	70.0	130
		EP075(SIM): Pyrene	129-00-0	10 mg/kg	96.4	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4286001)							
ES2211922-001	Anonymous	EP071: C10 - C14 Fraction	----	480 mg/kg	85.6	73.0	137
		EP071: C15 - C28 Fraction	----	3100 mg/kg	91.5	53.0	131
		EP071: C29 - C36 Fraction	----	2060 mg/kg	99.4	52.0	132
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4287789)							
ES2213060-001	Anonymous	EP080: C6 - C9 Fraction	----	32.5 mg/kg	111	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4286001)							
ES2211922-001	Anonymous	EP071: >C10 - C16 Fraction	----	860 mg/kg	84.7	73.0	137
		EP071: >C16 - C34 Fraction	----	4320 mg/kg	96.3	53.0	131
		EP071: >C34 - C40 Fraction	----	890 mg/kg	103	52.0	132
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4287789)							
ES2213060-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	118	70.0	130
EP080: BTEXN (QCLot: 4287789)							
ES2213060-001	Anonymous	EP080: Benzene	71-43-2	2.5 mg/kg	103	70.0	130
		EP080: Toluene	108-88-3	2.5 mg/kg	105	70.0	130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	112	70.0	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	109	70.0	130
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	109	70.0	130
		EP080: Naphthalene	91-20-3	2.5 mg/kg	105	70.0	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4291006)							
EP2204292-007	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	122	72.0	128
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	97.2	73.0	123
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	79.6	67.0	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	106	70.0	132
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	102	68.0	136
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	108	59.0	134
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4291007)							
ES2212247-006	SBH02/0.08-0.15	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	123	72.0	128
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	101	73.0	123
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	96.4	67.0	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	102	70.0	132
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	91.6	68.0	136
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	103	59.0	134

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4291006)							
EP2204292-007	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	93.4	71.0	135
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	101	69.0	132
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	118	70.0	132
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	108	71.0	131
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	112	69.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	106	72.0	129
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	120	69.0	133
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	116	64.0	136
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	109	69.0	135
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	95.2	66.0	139
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	118	69.0	133
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4291007)							
ES2212247-006	SBH02/0.08-0.15	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	83.4	71.0	135
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	116	69.0	132
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	121	70.0	132
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	94.4	71.0	131
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	111	69.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	110	72.0	129
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	116	69.0	133
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	102	64.0	136
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	110	69.0	135
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	110	66.0	139
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	108	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4291006)							
EP2204292-007	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	116	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	104	71.6	129
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	109	69.8	131
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	94.1	68.7	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	110	65.1	134
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	98.8	63.0	144
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	105	61.0	139
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4291007)							
ES2212247-006	SBH02/0.08-0.15	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	120	67.0	137

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4291007) - continued							
ES2212247-006	SBH02/0.08-0.15	EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	118	71.6	129
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	106	69.8	131
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	98.1	68.7	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	126	65.1	134
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	121	63.0	144
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	112	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4291006)							
EP2204292-007	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	94.4	62.0	145
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	99.6	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	112	65.0	137
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	86.0	69.2	143
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4291007)							
ES2212247-006	SBH02/0.08-0.15	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	107	62.0	145
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	# Not Determined	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	# Not Determined	65.0	137
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	110	69.2	143

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4293109)							
ES2212725-013	Anonymous	EG020A-F: Arsenic	7440-38-2	1 mg/L	104	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	105	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	104	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	104	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	124	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	103	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	104	70.0	130
EG035F: Dissolved Mercury by FIMS (QCLot: 4293110)							
ES2212247-007	RINSATE 03	EG035F: Mercury	7439-97-6	0.01 mg/L	88.3	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4291454)							
CA2202541-001	Anonymous						

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4291454) - continued							
CA2202541-001	Anonymous	EP080: C6 - C9 Fraction	----	325 µg/L	82.7	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4291454)							
CA2202541-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	85.3	70.0	130
EP080: BTEXN (QCLot: 4291454)							
CA2202541-001	Anonymous	EP080: Benzene	71-43-2	25 µg/L	82.3	70.0	130
		EP080: Toluene	108-88-3	25 µg/L	81.0	70.0	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	83.0	70.0	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	25 µg/L	83.0	70.0	130
		EP080: ortho-Xylene	95-47-6	25 µg/L	83.9	70.0	130
		EP080: Naphthalene	91-20-3	25 µg/L	84.1	70.0	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4294624)							
ES2212247-008	BLANK 02	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.25 µg/L	130	72.0	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.25 µg/L	99.0	71.0	127
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.25 µg/L	97.2	68.0	131
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.25 µg/L	95.4	69.0	134
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.25 µg/L	86.4	65.0	140
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.25 µg/L	96.0	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4294624)							
ES2212247-008	BLANK 02	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	1.25 µg/L	101	73.0	129
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.25 µg/L	89.4	72.0	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.25 µg/L	114	72.0	129
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.25 µg/L	93.0	72.0	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.25 µg/L	96.4	71.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.25 µg/L	111	69.0	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.25 µg/L	107	71.0	129
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.25 µg/L	107	69.0	133
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.25 µg/L	116	72.0	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.25 µg/L	85.2	65.0	144
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.625 µg/L	127	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4294624)							
ES2212247-008	BLANK 02	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.25 µg/L	118	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.625 µg/L	88.8	68.0	141
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.625 µg/L	91.4	62.6	147
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.625 µg/L	104	66.0	145

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4294624) - continued							
ES2212247-008	BLANK 02	EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.625 µg/L	116	57.6	145
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.25 µg/L	123	65.0	136
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.25 µg/L	106	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4294624)							
ES2212247-008	BLANK 02	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.25 µg/L	106	63.0	143
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.25 µg/L	110	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.25 µg/L	99.6	67.0	138
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.25 µg/L	106	71.4	144

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2212247**	Page	: 1 of 9
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Telephone	: +61 2 8784 8555
Project	: 30080099 - Vopak Site Investigation	Date Samples Received	: 08-Apr-2022
Site	: ----	Issue Date	: 22-Apr-2022
Sampler	: Pauline Voukidis	No. of samples received	: 10
Order number	: 30080099	No. of samples analysed	: 7

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

- **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
Matrix Spike (MS) Recoveries							
EP231D: (n:2) Fluorotelomer Sulfonic Acids	ES2212247--006	SBH02/0.08-0.15	**6:2 Fluorotelomer sulfonic acid (6:2 FTS)**	27619-97-2	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	ES2212247--006	SBH02/0.08-0.15	**8:2 Fluorotelomer sulfonic acid (8:2 FTS)**	39108-34-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count QC	Count Regular	Rate (%) Actual	Rate (%) Expected	Quality Control Specification
Laboratory Duplicates (DUP)					
PAH/Phenols (GC/MS - SIM)	0	3	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	1	17	5.88	10.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	6	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
PAH/Phenols (GC/MS - SIM)	0	3	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	6	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: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Evaluation	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
HDPE Soil Jar (EA055)							
EMB25/0.08-0.15, EMB25/1.0-1.1, SBH01/0.08-0.15, SBH01/1.0-1.1	**06-Apr-2022**	**----**	----	----	**14-Apr-2022**	20-Apr-2022	✓
Soil Glass Jar - Unpreserved (EA055)							
SBH02/0.08-0.15	**06-Apr-2022**	**----**	----	----	**14-Apr-2022**	20-Apr-2022	✓
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
SBH02/0.08-0.15	**06-Apr-2022**	**14-Apr-2022**	03-Oct-2022	✓	**20-Apr-2022**	03-Oct-2022	✓

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
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
SBH02/0.08-0.15	**06-Apr-2022**	**14-Apr-2022**	04-May-2022	✓	**20-Apr-2022**	04-May-2022	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
SBH02/0.08-0.15	**06-Apr-2022**	**19-Apr-2022**	20-Apr-2022	✓	**19-Apr-2022**	29-May-2022	✓
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080)							
SBH02/0.08-0.15	**06-Apr-2022**	**14-Apr-2022**	20-Apr-2022	✓	**14-Apr-2022**	20-Apr-2022	✓
Soil Glass Jar - Unpreserved (EP071)							
SBH02/0.08-0.15	**06-Apr-2022**	**19-Apr-2022**	20-Apr-2022	✓	**19-Apr-2022**	29-May-2022	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP080)							
SBH02/0.08-0.15	**06-Apr-2022**	**14-Apr-2022**	20-Apr-2022	✓	**14-Apr-2022**	20-Apr-2022	✓
Soil Glass Jar - Unpreserved (EP071)							
SBH02/0.08-0.15	**06-Apr-2022**	**19-Apr-2022**	20-Apr-2022	✓	**19-Apr-2022**	29-May-2022	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080)							
SBH02/0.08-0.15	**06-Apr-2022**	**14-Apr-2022**	20-Apr-2022	✓	**14-Apr-2022**	20-Apr-2022	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X)							
EMB25/0.08-0.15, EMB25/1.0-1.1, SBH01/0.08-0.15, SBH01/1.0-1.1	**06-Apr-2022**	**19-Apr-2022**	03-Oct-2022	✓	**19-Apr-2022**	29-May-2022	✓
HDPE Soil Jar (EP231X)							
SBH02/0.08-0.15	**06-Apr-2022**	**19-Apr-2022**	03-Oct-2022	✓	**20-Apr-2022**	29-May-2022	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X)							
EMB25/0.08-0.15, EMB25/1.0-1.1, SBH01/0.08-0.15, SBH01/1.0-1.1	**06-Apr-2022**	**19-Apr-2022**	03-Oct-2022	✓	**19-Apr-2022**	29-May-2022	✓
HDPE Soil Jar (EP231X)							
SBH02/0.08-0.15	**06-Apr-2022**	**19-Apr-2022**	03-Oct-2022	✓	**20-Apr-2022**	29-May-2022	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X)							
EMB25/0.08-0.15, EMB25/1.0-1.1, SBH01/0.08-0.15, SBH01/1.0-1.1	**06-Apr-2022**	**19-Apr-2022**	03-Oct-2022	✓	**19-Apr-2022**	29-May-2022	✓
HDPE Soil Jar (EP231X)							
SBH02/0.08-0.15	**06-Apr-2022**	**19-Apr-2022**	03-Oct-2022	✓	**20-Apr-2022**	29-May-2022	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X)							
EMB25/0.08-0.15, EMB25/1.0-1.1, SBH01/0.08-0.15, SBH01/1.0-1.1	**06-Apr-2022**	**19-Apr-2022**	03-Oct-2022	✓	**19-Apr-2022**	29-May-2022	✓
HDPE Soil Jar (EP231X)							
SBH02/0.08-0.15	**06-Apr-2022**	**19-Apr-2022**	03-Oct-2022	✓	**20-Apr-2022**	29-May-2022	✓

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X)							
EMB25/0.08-0.15, EMB25/1.0-1.1, SBH01/0.08-0.15, SBH01/1.0-1.1	**06-Apr-2022**	**19-Apr-2022**	03-Oct-2022	✓	**19-Apr-2022**	29-May-2022	✓
HDPE Soil Jar (EP231X)							
SBH02/0.08-0.15	**06-Apr-2022**	**19-Apr-2022**	03-Oct-2022	✓	**20-Apr-2022**	29-May-2022	✓

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
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)							
RINSATE 03	**06-Apr-2022**	**----**	----	----	**20-Apr-2022**	03-Oct-2022	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F)							
RINSATE 03	**06-Apr-2022**	**----**	----	----	**21-Apr-2022**	04-May-2022	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075(SIM))							
RINSATE 03	**06-Apr-2022**	**13-Apr-2022**	13-Apr-2022	✓	**20-Apr-2022**	23-May-2022	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP071)							
RINSATE 03	**06-Apr-2022**	**13-Apr-2022**	13-Apr-2022	✓	**20-Apr-2022**	23-May-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080)							
RINSATE 03	**06-Apr-2022**	**20-Apr-2022**	20-Apr-2022	✓	**20-Apr-2022**	20-Apr-2022	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Amber Glass Bottle - Unpreserved (EP071)							
RINSATE 03	**06-Apr-2022**	**13-Apr-2022**	13-Apr-2022	✓	**20-Apr-2022**	23-May-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080)							
RINSATE 03	**06-Apr-2022**	**20-Apr-2022**	20-Apr-2022	✓	**20-Apr-2022**	20-Apr-2022	✓
EP080: BTEXN							
Amber VOC Vial - Sulfuric Acid (EP080)							
RINSATE 03	**06-Apr-2022**	**20-Apr-2022**	20-Apr-2022	✓	**20-Apr-2022**	20-Apr-2022	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
RINSATE 03, BLANK 02	**06-Apr-2022**	**21-Apr-2022**	03-Oct-2022	✓	**21-Apr-2022**	03-Oct-2022	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X)							
RINSATE 03, BLANK 02	**06-Apr-2022**	**21-Apr-2022**	03-Oct-2022	✓	**21-Apr-2022**	03-Oct-2022	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X)							
RINSATE 03, BLANK 02	**06-Apr-2022**	**21-Apr-2022**	03-Oct-2022	✓	**21-Apr-2022**	03-Oct-2022	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
RINSATE 03, BLANK 02	**06-Apr-2022**	**21-Apr-2022**	03-Oct-2022	✓	**21-Apr-2022**	03-Oct-2022	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X)							
RINSATE 03, BLANK 02	**06-Apr-2022**	**21-Apr-2022**	03-Oct-2022	✓	**21-Apr-2022**	03-Oct-2022	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	4	39	10.26	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	2	14	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	4	40	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	14	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	9	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	40	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	40	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	40	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	19	5.26	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	14	7.14	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	9	11.11	5.00	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Dissolved Mercury by FIMS	EG035F	1	6	16.67	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	7	28.57	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	3	0.00	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*	
Laboratory Duplicates (DUP) - Continued							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	17	**5.88**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	6	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Dissolved Mercury by FIMS	EG035F	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Mercury by FIMS	EG035F	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Mercury by FIMS	EG035F	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	7	**14.29**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	3	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	6	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3)
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015 Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM Schedule B(3).
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-house: Analysis of soils by solvent extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM using internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).

Analytical Methods	Method	Matrix	Method Descriptions
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015 The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM Schedule B(3)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	In house: Referenced to USEPA SW 846 - 8270 Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
QuECheRS Extraction of Solids	ORG71	SOIL	In house: Sequential extractions with Acetonitrile/Methanol by shaking. Extraction efficiency aided by the addition of salts under acidic conditions. Where relevant, interferences from co-extracted organics are removed with dispersive clean-up media (dSPE). The extract is either diluted or concentrated and exchanged into the analytical solvent.
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.
Solid Phase Extraction (SPE) for PFAS in water	ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2212247**	Page	: 1 of 11
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Contact	: Brenda Hong
Address	: Level 5, 20 Berry Street, North Sydney, NSW 2060 North Sydney 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 30080099 - Vopak Site Investigation	Date Samples Received	: 08-Apr-2022 07:40
Order number	: 30080099	Date Analysis Commenced	: 13-Apr-2022
C-O-C number	: ----	Issue Date	: 22-Apr-2022 11:30
Sampler	: Pauline Voukidis		
Site	: ----		
Quote number	: SY/285/21 V2		
No. of samples received	: 10		
No. of samples analysed	: 7		

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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Inorganics, Smithfield, NSW
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

- EP075 (SIM): Where reported, Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EP231X - Per- and Polyfluoroalkyl Substances (PFAS): Samples received in 20ml or 125ml bottles have been tested in accordance with the QSM5.3 compliant, NATA accredited method. 60mL or 250mL bottles have been tested to the legacy QSM 5.1 aligned, NATA accredited method.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP075(SIM): Where reported, Total Cresol is the sum of the reported concentrations of 2-Methylphenol and 3- & 4-Methylphenol at or above the LOR.
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. 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. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	EMB25/0.08-0.15	EMB25/1.0-1.1	SBH01/0.08-0.15	SBH01/1.0-1.1	SBH02/0.08-0.15
			Sampling date / time	06-Apr-2022 08:50	06-Apr-2022 09:40	06-Apr-2022 14:45	06-Apr-2022 15:15	06-Apr-2022 16:10
Compound	CAS Number	LOR	Unit	ES2212247-001	ES2212247-002	ES2212247-003	ES2212247-004	ES2212247-006
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	7.7	6.6	6.7	7.9	6.2
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	----	----	----	----	20
Cadmium	7440-43-9	1	mg/kg	----	----	----	----	<1
Chromium	7440-47-3	2	mg/kg	----	----	----	----	93
Copper	7440-50-8	5	mg/kg	----	----	----	----	<5
Lead	7439-92-1	5	mg/kg	----	----	----	----	10
Nickel	7440-02-0	2	mg/kg	----	----	----	----	2
Zinc	7440-66-6	5	mg/kg	----	----	----	----	<5
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	----	----	----	----	<0.1
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	----	----	----	----	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	----	----	----	----	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	----	----	----	----	<0.5
Fluorene	86-73-7	0.5	mg/kg	----	----	----	----	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	----	----	----	----	<0.5
Anthracene	120-12-7	0.5	mg/kg	----	----	----	----	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	----	----	----	----	<0.5
Pyrene	129-00-0	0.5	mg/kg	----	----	----	----	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	----	----	----	----	<0.5
Chrysene	218-01-9	0.5	mg/kg	----	----	----	----	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	----	----	----	----	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	----	----	----	----	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	----	----	----	----	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	----	----	----	----	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	----	----	----	----	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	----	----	----	----	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	----	----	----	----	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	----	----	----	----	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg	----	----	----	----	0.6
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg	----	----	----	----	1.2
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	----	----	----	----	<10

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	EMB25/0.08-0.15	EMB25/1.0-1.1	SBH01/0.08-0.15	SBH01/1.0-1.1	SBH02/0.08-0.15
			Sampling date / time	06-Apr-2022 08:50	06-Apr-2022 09:40	06-Apr-2022 14:45	06-Apr-2022 15:15	06-Apr-2022 16:10
Compound	CAS Number	LOR	Unit	ES2212247-001	ES2212247-002	ES2212247-003	ES2212247-004	ES2212247-006
				Result	Result	Result	Result	Result
EP080/071: Total Petroleum Hydrocarbons - Continued								
C10 - C14 Fraction	----	50	mg/kg	----	----	----	----	<50
C15 - C28 Fraction	----	100	mg/kg	----	----	----	----	<100
C29 - C36 Fraction	----	100	mg/kg	----	----	----	----	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg	----	----	----	----	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	----	----	----	----	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg	----	----	----	----	<10
>C10 - C16 Fraction	----	50	mg/kg	----	----	----	----	<50
>C16 - C34 Fraction	----	100	mg/kg	----	----	----	----	<100
>C34 - C40 Fraction	----	100	mg/kg	----	----	----	----	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg	----	----	----	----	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg	----	----	----	----	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	----	----	----	----	<0.2
Toluene	108-88-3	0.5	mg/kg	----	----	----	----	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	----	----	----	----	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	----	----	----	----	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	----	----	----	----	<0.5
^ Sum of BTEX	----	0.2	mg/kg	----	----	----	----	<0.2
^ Total Xylenes	----	0.5	mg/kg	----	----	----	----	<0.5
Naphthalene	91-20-3	1	mg/kg	----	----	----	----	<1
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<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	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	EMB25/0.08-0.15	EMB25/1.0-1.1	SBH01/0.08-0.15	SBH01/1.0-1.1	SBH02/0.08-0.15
				Sampling date / time	06-Apr-2022 08:50	06-Apr-2022 09:40	06-Apr-2022 14:45	06-Apr-2022 15:15	06-Apr-2022 16:10
Compound	CAS Number	LOR	Unit		ES2212247-001	ES2212247-002	ES2212247-003	ES2212247-004	ES2212247-006
					Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids - Continued									
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		<0.001	<0.001	<0.001	**0.001**	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		**0.0002**	**0.0005**	**0.0009**	**0.0058**	**0.0003**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		**0.0003**	**0.0004**	**0.0023**	**0.0053**	**0.0006**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		<0.0002	<0.0002	**0.0007**	**0.0013**	**0.0003**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		<0.0002	**0.0003**	**0.0013**	<0.0002	**0.0006**
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<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
EP231D: (n:2) Fluorotelomer Sulfonic Acids									

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	EMB25/0.08-0.15	EMB25/1.0-1.1	SBH01/0.08-0.15	SBH01/1.0-1.1	SBH02/0.08-0.15
				Sampling date / time	06-Apr-2022 08:50	06-Apr-2022 09:40	06-Apr-2022 14:45	06-Apr-2022 15:15	06-Apr-2022 16:10
Compound	CAS Number	LOR	Unit		ES2212247-001	ES2212247-002	ES2212247-003	ES2212247-004	ES2212247-006
					Result	Result	Result	Result	Result
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued									
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	**0.0603**	<0.0005	**0.0280**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	**0.0075**	**0.0113**	<0.0005	**0.0092**
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0005**	**0.0087**	**0.0768**	**0.0134**	**0.0390**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0005**	**0.0087**	**0.0768**	**0.0134**	**0.0390**
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		----	----	----	----	**82.6**
2-Chlorophenol-D4	93951-73-6	0.5	%		----	----	----	----	**87.8**
2.4.6-Tribromophenol	118-79-6	0.5	%		----	----	----	----	**80.2**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		----	----	----	----	**117**
Anthracene-d10	1719-06-8	0.5	%		----	----	----	----	**101**
4-Terphenyl-d14	1718-51-0	0.5	%		----	----	----	----	**90.4**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		----	----	----	----	**119**
Toluene-D8	2037-26-5	0.2	%		----	----	----	----	**122**
4-Bromofluorobenzene	460-00-4	0.2	%		----	----	----	----	**130**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**98.0**	**95.0**	**99.0**	**94.0**	**87.5**
13C8-PFOA	----	0.0002	%		**95.0**	**97.5**	**94.0**	**98.5**	**117**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	RINSATE 03	BLANK 02	----	----	----
			Sampling date / time	06-Apr-2022 00:00	06-Apr-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit	ES2212247-007	ES2212247-008	--------	--------	--------
				Result	Result	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1.0	µg/L	<1.0	----	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	----	----	----	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	----	----	----	----
Fluorene	86-73-7	1.0	µg/L	<1.0	----	----	----	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	----	----	----	----
Anthracene	120-12-7	1.0	µg/L	<1.0	----	----	----	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	----	----	----	----
Pyrene	129-00-0	1.0	µg/L	<1.0	----	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	----	----	----	----
Chrysene	218-01-9	1.0	µg/L	<1.0	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	<1.0	----	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	----	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	----	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	----	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	----	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	----	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RINSATE 03	BLANK 02	----	----	----
				Sampling date / time	06-Apr-2022 00:00	06-Apr-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES2212247-007	ES2212247-008	--------	--------	--------
					Result	Result	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	----	----	----	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		<20	----	----	----	----
>C10 - C16 Fraction	----	100	µg/L		<100	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	----	----	----	----
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		<100	----	----	----	----
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	----	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	----	----	----	----
Toluene	108-88-3	2	µg/L		<2	----	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	----	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	----	----	----	----
^ **Total Xylenes**	----	2	µg/L		<2	----	----	----	----
^ **Sum of BTEX**	----	1	µg/L		<1	----	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L		<0.01	<0.01	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		<0.01	<0.01	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	<0.02	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	<0.1	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		<0.02	<0.02	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	RINSATE 03	BLANK 02	----	----	----
				Sampling date / time	06-Apr-2022 00:00	06-Apr-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES2212247-007	ES2212247-008	--------	--------	--------
					Result	Result	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids - Continued									
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		<0.01	<0.01	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	<0.02	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	<0.05	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.02	<0.02	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.05	<0.05	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	<0.05	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	<0.05	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	<0.05	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	<0.02	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	<0.02	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	<0.05	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	<0.05	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	<0.05	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	RINSATE 03	BLANK 02	----	----	----
			Sampling date / time	06-Apr-2022 00:00	06-Apr-2022 00:00	----	----	----
Compound	CAS Number	LOR	Unit	ES2212247-007	ES2212247-008	--------	--------	--------
				Result	Result	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued								
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	----	----	----
EP231P: PFAS Sums								
Sum of PFAS	----	0.01	µg/L	<0.01	<0.01	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L	<0.01	<0.01	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L	<0.01	<0.01	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	1.0	%	**18.7**	----	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%	**38.8**	----	----	----	----
2.4.6-Tribromophenol	118-79-6	1.0	%	**44.4**	----	----	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	1.0	%	**50.1**	----	----	----	----
Anthracene-d10	1719-06-8	1.0	%	**63.2**	----	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%	**61.2**	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	2	%	**97.7**	----	----	----	----
Toluene-D8	2037-26-5	2	%	**101**	----	----	----	----
4-Bromofluorobenzene	460-00-4	2	%	**97.3**	----	----	----	----
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.02	%	**105**	**100**	----	----	----
13C8-PFOA	----	0.02	%	**103**	**103**	----	----	----

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

updated COC 12.04.22 12.37pm

Environmental Division
Sydney
Work Order Reference
ES2212731

Telephone : + 61-2-8784 8555

CHAIN OF CUSTODY FORM

SMEC

SMEC OFFICE: SMEC North Sydney PROJECT: Vopak Site Investigation	TURNAROUND REQUIREMENTS : ☐ Standard - 5 day TAT	LAB: ALS Darwin Unit 4/16 Charlton Court Woolner, NT, 0820
PROJECT NUMBER: 30080099	LAB QUOTE NO.: SY/265/21	COC SEQUENCE NUMBER (Circle) COC: PAGE 2 OF: 2
PROJECT MANAGER: Manuel Fernandez	CONTACT PH: 0422 156 256 (Pauline)	ALS Sydney 277-289 Woodpark Road Smithfield NSW 2164
SAMPLED BY: Pauline Voukidis		

DATE SAMPLED: 7 April 2022	(1st) RELINQUISHED BY: Pauline Voukidis DATE/TIME: 7/4/2022	(2nd) RELINQUISHED BY: DATE/TIME:	(3rd) RELINQUISHED BY: DATE/TIME:
Email Reports to: manuel.fernandez@smec.com, pauline.voukidis@smec.com			
Email Invoice to: manuel.fernandez@smec.com	RECEIVED BY:	RECEIVED BY:	RECEIVED BY:

Special Laboratory Instructions:
Please forward results to smec@esdat.com.au

	SAMPLE DETAILS					ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	PFAS - Full Suite (28 analytes)	S-26 (TRH (C6-C40) / BTEXN / PAH / 8 Metals)	BTEX/TRH(C6-9)	BTEX				HOLD	
1	SBH02/1.1-1.2	7/04/2022	Soil	1 PFAS jar	1	X								
2	SBH02/2.0-2.1	7/04/2022	Soil	1 PFAS jar	1								X	
3	SBH03/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
4	SBH05/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
5	SBH05/0.9-1.0	7/04/2022	Soil	1 PFAS jar	1	X								
6	SBH05/1.9-2.0	7/04/2022	Soil	1 PFAS jar	1								X	
7	SBH05/2.7-2.8	7/04/2022	Soil	1 PFAS jar	1								X	
8	SBH03/0.7-0.8	7/04/2022	Soil	1 PFAS jar	1								X	
9	SBH03/1.0-1.1	7/04/2022	Soil	1 PFAS jar	1	X								
10	SBH03/1.8-1.9	7/04/2022	Soil	1 PFAS jar	1								X	
11	SBH06/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
12	SBH06/0.8-0.9	7/04/2022	Soil	1 PFAS jar	1	X								
13	SBH06/1.8-1.9	7/04/2022	Soil	1 PFAS jar	1								X	
14	RINSATE04	7/04/2022	Water	2 PFAS bottles	2	X								
15	BLANK03	7/04/2022	Water	2 PFAS bottles	2	X								
16	QA04	7/04/2022	Soil	1 PFAS jar	1	X								
17	QA04A	7/04/2022	Soil	1 PFAS jar	1	X								Send to Eurofins for Analysis
18	SBH06/2.8-2.9	7/04/2022	Soil	1 PFAS jar	1								X	
19	SBH04/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
20	SBH04/0.8-0.9	7/04/2022	Soil	1 PFAS jar	1	X								
21	SBH04/1.7-1.8	7/04/2022	Soil	1 PFAS jar	1								X	
				TOTAL		13							8	

Notes: Hold all remaining sample volume for possible future leachability analysis

Split WO
Lab / Analyst
Organised By
Relinquished
Connote / Courier
WO No: ES2212731
Attach By PC

updated COC 12.04.22 12.37 pm

CHAIN OF CUSTODY FORM

SMEC

SMEC OFFICE: SMEC North Sydney PROJECT: Vopak Site Investigation	TURNAROUND REQUIREMENTS : ☐ Standard - 5 day TAT	LAB: ALS Darwin Unit 4/16 Charlton Court Woolner, NT, 0820
PROJECT NUMBER: 30080099	LAB QUOTE NO.: SY/285/21	COC SEQUENCE NUMBER (Circle) COC: PAGE 1 OF: 2
PROJECT MANAGER: Manuel Fernandez	CONTACT PH: 0422 156 256 (Pauline)	ALS Sydney 277-289 Woodpark Road Smithfield NSW 2164
SAMPLED BY: Pauline Voukidis		

DATE SAMPLED: 6 to 8 April 2022	(1st) RELINQUISHED BY: Pauline Voukidis DATE/TIME: 6 and 8/4/2022	(2nd) RELINQUISHED BY: DATE/TIME:	(3rd) RELINQUISHED BY: DATE/TIME:
Email Reports to: manuel.fernandez@smec.com, pauline.voukidis@smec.com			
Email Invoice to: manuel.fernandez@smec.com	RECEIVED BY:	RECEIVED BY:	RECEIVED BY:

Special Laboratory Instructions:
Please forward results to smec@esdat.com.au

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	PFAS - Full Suite (28 analytes)	S-26 (TRH (C6-C40) / BTEXN / PAH / 8 Metals)	BTEX/TRH(C6-9)	BTEX				HOLD	
	EMB25/0.08-0.15	6/04/2022	Soil	1 PFAS jar	1	X								
	EMB25/1/0-1.1	6/04/2022	Soil	1 PFAS jar	1	X								
	SBH01/0.08-0.15	6/04/2022	Soil	1 PFAS jar	1	X								
	SBH01/1.1-1.1	6/04/2022	Soil	1 PFAS jar	1	X								
	SBH01/1.9-2.0	6/04/2022	Soil	1 PFAS jar	1								X	
	SBH02/0.08-0.15	6/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
	RINSATE03	6/04/2022	Water	2 metals, 2 vials, 2 amber , 2 PFAS bottles	8	X	X							
	BLANK02	6/04/2022	Water	2 PFAS bottles	2	X							X	
	QA03	6/04/2022	Soil	1 glass jar, 1 PFAS jar	2								X	
	QA03A	6/04/2022	Soil	1 glass jar, 1 PFAS jar	2									
22	EMB23/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
23	EMB23/0.75-0.85	7/04/2022	Soil	1 PFAS jar	1	X								
24	EMB25/1.8-1.9	7/04/2022	Soil	1 PFAS jar	1								X	
	EMB24/0.08-0.15	8/04/2022	Soil	1 PFAS jar	1	X								
	EMB24/0.7-0.8	8/04/2022	Soil	1 PFAS jar	1	X								
	EMB24/1.7-1.8	8/04/2022	Soil	1 PFAS jar	1								X	
	EMB24/2.7-2.8	8/04/2022	Soil	1 PFAS jar	1								X	
	QA05	8/04/2022	Soil	1 PFAS jar	1								X	
	QA05A	8/04/2022	Soil	1 PFAS jar	1								X	
	RINSATE05	8/04/2022	Water	2 PFAS bottles	2	X								
	TRIP SPIKE 2	4/04/2022	Soil	1 glass jar	1				X					
	TRIP BLANK	4/04/2022	Soil	1 glass jar	1			X						
	BLANK04	8/04/2022	Water	2 PFAS bottles	2	X								
				TOTALS		13	2	1	1				8	

Notes: Hold all remaining sample volume for possible future leachability analysis

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2212731**

Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Contact	: Brenda Hong
Address	: Level 5, 20 Berry Street, North Sydney, NSW 2060 North Sydney 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: manuel.fernandez@smec.com	E-mail	: Brenda.Hong@ALSGlobal.com
Telephone	: ----	Telephone	: +61 2 8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 30080099 - Vopak Site Investigation	Page	: 1 of 3
Order number	: ----	Quote number	: ES2021SMEAUS0007 (SY/285/21 V2)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Pauline Voukidis		

Dates

Date Samples Received	: 14-Apr-2022 07:00	Issue Date	: 22-Apr-2022
Client Requested Due Date	: 27-Apr-2022	Scheduled Reporting Date	: **27-Apr-2022**

Delivery Details

Mode of Delivery	: Client Drop Off	Security Seal	: Not Available
No. of coolers/boxes	: 5	Temperature	: 21.8'C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 23 / 14

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Sample QA04 forwarded to Eurofins.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

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

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

Summary of Sample(s) and Requested Analysis

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

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	(On Hold) SOIL No analysis requested	SOIL - EA055-103 Moisture Content	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)
ES2212731-001	07-Apr-2022 07:10	SBH02/1.1-1.2		✓	✓
ES2212731-002	07-Apr-2022 07:25	SBH02/2.0-2.1	✓		
ES2212731-003	07-Apr-2022 07:55	SBH03/0.08-0.15		✓	✓
ES2212731-004	07-Apr-2022 08:05	SBH05/0.08-0.15		✓	✓
ES2212731-005	07-Apr-2022 08:25	SBH05/0.9-1.0		✓	✓
ES2212731-006	07-Apr-2022 08:40	SBH05/1.9-2.0	✓		
ES2212731-007	07-Apr-2022 08:50	SBH05/2.7-2.8	✓		
ES2212731-008	07-Apr-2022 09:15	SBH03/0.7-0.8	✓		
ES2212731-009	07-Apr-2022 09:20	SBH03/1.0-1.1		✓	✓
ES2212731-010	07-Apr-2022 09:25	SBH03/1.8-1.9	✓		
ES2212731-011	07-Apr-2022 10:20	SBH06/0.08-0.15		✓	✓
ES2212731-012	07-Apr-2022 10:55	SBH06/0.8-0.9		✓	✓
ES2212731-013	07-Apr-2022 11:10	SBH06/1.8-1.9	✓		
ES2212731-016	07-Apr-2022 00:00	QA04		✓	✓
ES2212731-018	07-Apr-2022 11:20	SBH06/2.8-2.9	✓		
ES2212731-019	07-Apr-2022 12:10	SBH04/0.08-0.15		✓	✓
ES2212731-020	07-Apr-2022 12:50	SBH04/0.8-0.9		✓	✓
ES2212731-021	07-Apr-2022 13:05	SBH04/1.7-1.8	✓		
ES2212731-022	07-Apr-2022 14:20	EMB23/0.08-0.15		✓	✓
ES2212731-023	07-Apr-2022 15:00	EMB23/0.75-0.85		✓	✓
ES2212731-024	07-Apr-2022 15:25	EMB25/1.8-1.9	✓		

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EP231X PFAS - Full Suite (28 analytes)
ES2212731-014	07-Apr-2022 00:00	RINSATE04	✓
ES2212731-015	07-Apr-2022 00:00	Blank03	✓

Proactive Holding Time Report

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

Requested Deliverables

ACCOUNTS INVOICES

- A4 - AU Tax Invoice (INV)	Email	accounts.payable@smec.com

ESDAT REPORTS

- *AU Certificate of Analysis - NATA (COA)	Email	smec@esdat.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	smec@esdat.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	smec@esdat.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	smec@esdat.com.au
- Chain of Custody (CoC) (COC)	Email	smec@esdat.com.au
- EDI Format - ENMRG (ENMRG)	Email	smec@esdat.com.au
- EDI Format - ESDAT (ESDAT)	Email	smec@esdat.com.au

MANUEL FERNANDEZ

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

Pauline Voukidis

- *AU Certificate of Analysis - NATA (COA)	Email	pauline.voukidis@smec.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	pauline.voukidis@smec.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	pauline.voukidis@smec.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	pauline.voukidis@smec.com
- Chain of Custody (CoC) (COC)	Email	pauline.voukidis@smec.com
- EDI Format - ENMRG (ENMRG)	Email	pauline.voukidis@smec.com
- EDI Format - ESDAT (ESDAT)	Email	pauline.voukidis@smec.com

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES2212731**	Page	: 1 of 11
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Contact	: Brenda Hong
Address	: Level 5, 20 Berry Street, North Sydney, NSW 2060 North Sydney 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 30080099 - Vopak Site Investigation	Date Samples Received	: 14-Apr-2022
Order number	: 30080099	Date Analysis Commenced	: 22-Apr-2022
C-O-C number	: ----	Issue Date	: 27-Apr-2022
Sampler	: Pauline Voukidis		
Site	: ----		
Quote number	: SY/285/21 V2		
No. of samples received	: 23		
No. of samples analysed	: 14		

ilac-MRA NATA
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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 4299923)									
ES2212731-004	SBH05/0.08-0.15	EA055: Moisture Content	----	0.1	%	8.5	8.3	2.3	0% - 20%
ES2213150-002	Anonymous	EA055: Moisture Content	----	0.1	%	6.4	6.0	7.3	0% - 20%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4302373)									
ES2212731-001	SBH02/1.1-1.2	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
ES2212731-022	EMB23/0.08-0.15	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4302373)									
ES2212731-001	SBH02/1.1-1.2	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0034	0.0030	12.8	0% - 50%
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.0029	0.0026	11.4	0% - 50%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0009	0.0008	0.0	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4302373) - continued									
ES2212731-001	SBH02/1.1-1.2	EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
ES2212731-022	EMB23/0.08-0.15	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0006	0.0005	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.0008	0.0008	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0008	0.0007	0.0	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0007	0.0006	16.2	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4302373)									
ES2212731-001	SBH02/1.1-1.2	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
ES2212731-022	EMB23/0.08-0.15	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 4302373)									
ES2212731-001	SBH02/1.1-1.2	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	0.0039	0.0033	16.6	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
ES2212731-022	EMB23/0.08-0.15	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	0.0134	0.0140	4.5	0% - 20%
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	0.0313	0.0273	13.9	0% - 20%
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4304146)									
ES2212731-014	RINSATE04	EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
ES2213745-002	Anonymous	EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4304146)									
ES2212731-014	RINSATE04	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4304146) - continued									
ES2212731-014	RINSATE04	EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
ES2213745-002	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4304146)									
ES2212731-014	RINSATE04	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
ES2213745-002	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 4304146)									
ES2212731-014	RINSATE04	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
ES2213745-002	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231P: PFAS Sums (QC Lot: 4304146)									
ES2212731-014	RINSATE04	EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	<0.01	0.0	No Limit
ES2213745-002	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	<0.01	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (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 Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4302373)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	111	72.0	128
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	96.8	73.0	123
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	102	67.0	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	87.6	70.0	132
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.8	68.0	136
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	110	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4302373)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	85.8	71.0	135
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	108	69.0	132
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	122	70.0	132
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	116	71.0	131
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	106	69.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	100	72.0	129
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	107	69.0	133
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	111	64.0	136
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	112	69.0	135
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	75.2	66.0	139
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	94.1	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4302373)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	119	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	113	71.6	129
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	97.6	69.8	131
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	90.7	68.7	130
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	108	65.1	134
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	99.2	63.0	144
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	114	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4302373)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	108	62.0	145
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	111	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	115	65.0	137

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4302373) - continued								
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	124	69.2	143

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4304146)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.25 µg/L	117	72.0	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.25 µg/L	103	71.0	127
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	0.25 µg/L	106	68.0	131
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.25 µg/L	94.2	69.0	134
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.25 µg/L	93.6	65.0	140
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.25 µg/L	93.2	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4304146)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	86.4	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	104	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	125	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	103	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	104	71.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.25 µg/L	108	69.0	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.25 µg/L	102	71.0	129
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.25 µg/L	104	69.0	133
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.25 µg/L	103	72.0	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.25 µg/L	103	65.0	144
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	0.625 µg/L	110	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4304146)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.25 µg/L	105	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	0.625 µg/L	99.4	68.0	141
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	0.625 µg/L	97.6	62.6	147
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	0.625 µg/L	101	66.0	145
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	0.625 µg/L	91.5	57.6	145
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.25 µg/L	92.2	65.0	136
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.25 µg/L	118	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4304146)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.25 µg/L	103	63.0	143
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.25 µg/L	101	64.0	140

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4304146) - continued								
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.25 µg/L	114	67.0	138
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.25 µg/L	100	71.4	144

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	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4302373)							
ES2212731-001	SBH02/1.1-1.2	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	113	72.0	128
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	98.4	73.0	123
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	112	67.0	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	96.0	70.0	132
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	103	68.0	136
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	119	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4302373)							
ES2212731-001	SBH02/1.1-1.2	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	96.9	71.0	135
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	75.2	69.0	132
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	86.8	70.0	132
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	112	71.0	131
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	114	69.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	101	72.0	129
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	104	69.0	133
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	110	64.0	136
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	109	69.0	135
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	71.2	66.0	139
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	96.3	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4302373)							
ES2212731-001	SBH02/1.1-1.2	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	115	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	120	71.6	129
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	113	69.8	131
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	100	68.7	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	118	65.1	134

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Acceptable Limits (%) Low	Acceptable Limits (%) High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4302373) - continued							
ES2212731-001	SBH02/1.1-1.2	EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	99.6	63.0	144
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	119	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4302373)							
ES2212731-001	SBH02/1.1-1.2	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	109	62.0	145
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	84.8	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	120	65.0	137
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	118	69.2	143

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Acceptable Limits (%) Low	Acceptable Limits (%) High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4304146)							
ES2212731-015	Blank03	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.25 µg/L	127	72.0	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.25 µg/L	91.8	71.0	127
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.25 µg/L	93.8	68.0	131
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.25 µg/L	89.4	69.0	134
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.25 µg/L	91.0	65.0	140
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.25 µg/L	84.8	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4304146)							
ES2212731-015	Blank03	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	1.25 µg/L	86.4	73.0	129
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.25 µg/L	102	72.0	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.25 µg/L	128	72.0	129
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.25 µg/L	100	72.0	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.25 µg/L	101	71.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.25 µg/L	109	69.0	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.25 µg/L	104	71.0	129
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.25 µg/L	103	69.0	133
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.25 µg/L	107	72.0	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.25 µg/L	113	65.0	144
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.625 µg/L	104	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4304146)							
ES2212731-015	Blank03	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.25 µg/L	103	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.625 µg/L	86.2	68.0	141
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.625 µg/L	90.8	62.6	147
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.625 µg/L	101	66.0	145

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4304146) - continued							
ES2212731-015	Blank03	EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.625 µg/L	85.2	57.6	145
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.25 µg/L	102	65.0	136
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.25 µg/L	114	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4304146)							
ES2212731-015	Blank03	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.25 µg/L	117	63.0	143
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.25 µg/L	96.8	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.25 µg/L	121	67.0	138
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.25 µg/L	117	71.4	144

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2212731**	Page	: 1 of 6
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Telephone	: +61 2 8784 8555
Project	: 30080099 - Vopak Site Investigation	Date Samples Received	: 14-Apr-2022
Site	: ----	Issue Date	: 27-Apr-2022
Sampler	: Pauline Voukidis	No. of samples received	: 23
Order number	: 30080099	No. of samples analysed	: 14

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method / Container / Client Sample ID(s)		Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA055: Moisture Content (Dried @ 105-110°C)							
HDPE Soil Jar							
SBH02/1.1-1.2,	SBH03/0.08-0.15,	----	----	----	22-Apr-2022	21-Apr-2022	**1**
SBH05/0.08-0.15,	SBH05/0.9-1.0,						
SBH03/1.0-1.1,	SBH06/0.08-0.15,						
SBH06/0.8-0.9,	QA04,						
SBH04/0.08-0.15,	SBH04/0.8-0.9,						
EMB23/0.08-0.15,	EMB23/0.75-0.85						

Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)								
HDPE Soil Jar (EA055)								
SBH02/1.1-1.2,	SBH03/0.08-0.15,	**07-Apr-2022**	**----**	----	----	**22-Apr-2022**	21-Apr-2022	×
SBH05/0.08-0.15,	SBH05/0.9-1.0,							
SBH03/1.0-1.1,	SBH06/0.08-0.15,							
SBH06/0.8-0.9,	QA04,							
SBH04/0.08-0.15,	SBH04/0.8-0.9,							
EMB23/0.08-0.15,	EMB23/0.75-0.85							
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE Soil Jar (EP231X)								
SBH02/1.1-1.2,	SBH03/0.08-0.15,	**07-Apr-2022**	**26-Apr-2022**	04-Oct-2022	✓	**26-Apr-2022**	05-Jun-2022	✓
SBH05/0.08-0.15,	SBH05/0.9-1.0,							
SBH03/1.0-1.1,	SBH06/0.08-0.15,							
SBH06/0.8-0.9,	QA04,							
SBH04/0.08-0.15,	SBH04/0.8-0.9,							
EMB23/0.08-0.15,	EMB23/0.75-0.85							

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
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE Soil Jar (EP231X)								
SBH02/1.1-1.2,	SBH03/0.08-0.15,	**07-Apr-2022**	**26-Apr-2022**	04-Oct-2022	✓	**26-Apr-2022**	05-Jun-2022	✓
SBH05/0.08-0.15,	SBH05/0.9-1.0,							
SBH03/1.0-1.1,	SBH06/0.08-0.15,							
SBH06/0.8-0.9,	QA04,							
SBH04/0.08-0.15,	SBH04/0.8-0.9,							
EMB23/0.08-0.15,	EMB23/0.75-0.85							
EP231C: Perfluoroalkyl Sulfonamides								
HDPE Soil Jar (EP231X)								
SBH02/1.1-1.2,	SBH03/0.08-0.15,	**07-Apr-2022**	**26-Apr-2022**	04-Oct-2022	✓	**26-Apr-2022**	05-Jun-2022	✓
SBH05/0.08-0.15,	SBH05/0.9-1.0,							
SBH03/1.0-1.1,	SBH06/0.08-0.15,							
SBH06/0.8-0.9,	QA04,							
SBH04/0.08-0.15,	SBH04/0.8-0.9,							
EMB23/0.08-0.15,	EMB23/0.75-0.85							
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE Soil Jar (EP231X)								
SBH02/1.1-1.2,	SBH03/0.08-0.15,	**07-Apr-2022**	**26-Apr-2022**	04-Oct-2022	✓	**26-Apr-2022**	05-Jun-2022	✓
SBH05/0.08-0.15,	SBH05/0.9-1.0,							
SBH03/1.0-1.1,	SBH06/0.08-0.15,							
SBH06/0.8-0.9,	QA04,							
SBH04/0.08-0.15,	SBH04/0.8-0.9,							
EMB23/0.08-0.15,	EMB23/0.75-0.85							
EP231P: PFAS Sums								
HDPE Soil Jar (EP231X)								
SBH02/1.1-1.2,	SBH03/0.08-0.15,	**07-Apr-2022**	**26-Apr-2022**	04-Oct-2022	✓	**26-Apr-2022**	05-Jun-2022	✓
SBH05/0.08-0.15,	SBH05/0.9-1.0,							
SBH03/1.0-1.1,	SBH06/0.08-0.15,							
SBH06/0.8-0.9,	QA04,							
SBH04/0.08-0.15,	SBH04/0.8-0.9,							
EMB23/0.08-0.15,	EMB23/0.75-0.85							

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE (no PTFE) (EP231X)								
RINSATE04,	Blank03	**07-Apr-2022**	**27-Apr-2022**	04-Oct-2022	✓	**27-Apr-2022**	04-Oct-2022	✓
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X)								
RINSATE04,	Blank03	**07-Apr-2022**	**27-Apr-2022**	04-Oct-2022	✓	**27-Apr-2022**	04-Oct-2022	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X)								
RINSATE04,	Blank03	**07-Apr-2022**	**27-Apr-2022**	04-Oct-2022	✓	**27-Apr-2022**	04-Oct-2022	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X)								
RINSATE04,	Blank03	**07-Apr-2022**	**27-Apr-2022**	04-Oct-2022	✓	**27-Apr-2022**	04-Oct-2022	✓
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X)								
RINSATE04,	Blank03	**07-Apr-2022**	**27-Apr-2022**	04-Oct-2022	✓	**27-Apr-2022**	04-Oct-2022	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-house: Analysis of soils by solvent extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM using internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	Method	Matrix	Method Descriptions
QuECheRS Extraction of Solids	ORG71	SOIL	In house: Sequential extractions with Acetonitrile/Methanol by shaking. Extraction efficiency aided by the addition of salts under acidic conditions. Where relevant, interferences from co-extracted organics are removed with dispersive clean-up media (dSPE). The extract is either diluted or concentrated and exchanged into the analytical solvent.
Solid Phase Extraction (SPE) for PFAS in water	ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2212731**	Page	: 1 of 13
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Contact	: Brenda Hong
Address	: Level 5, 20 Berry Street, North Sydney, NSW 2060 North Sydney 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 30080099 - Vopak Site Investigation	Date Samples Received	: 14-Apr-2022 07:00
Order number	: 30080099	Date Analysis Commenced	: 22-Apr-2022
C-O-C number	: ----	Issue Date	: 27-Apr-2022 17:42
Sampler	: Pauline Voukidis		
Site	: ----		
Quote number	: SY/285/21 V2		
No. of samples received	: 23		
No. of samples analysed	: 14		

ilac-MRA NATA
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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Inorganics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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 - Per- and Polyfluoroalkyl Substances (PFAS): Samples received in 20ml or 125ml bottles have been tested in accordance with the QSM5.3 compliant, NATA accredited method. 60mL or 250mL bottles have been tested to the legacy QSM 5.1 aligned, NATA accredited method.
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. 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. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.

Analytical Results

Sub-Matrix: RINSATE (Matrix: WATER)				Sample ID	RINSATE04	----	----	----	----
				Sampling date / time	07-Apr-2022 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2212731-014	--------	--------	--------	--------
					Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		<0.02	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L		<0.01	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		<0.01	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		<0.02	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		<0.01	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<0.02	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.02	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	----	----	----	----

Analytical Results

Sub-Matrix: RINSATE (Matrix: WATER)				Sample ID	RINSATE04	----	----	----	----
				Sampling date / time	07-Apr-2022 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2212731-014	--------	--------	--------	--------
					Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	----	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		<0.01	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		<0.01	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		<0.01	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**104**	----	----	----	----
13C8-PFOA	----	0.02	%		**101**	----	----	----	----

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	SBH02/1.1-1.2	SBH03/0.08-0.15	SBH05/0.08-0.15	SBH05/0.9-1.0	SBH03/1.0-1.1
				Sampling date / time	07-Apr-2022 07:10	07-Apr-2022 07:55	07-Apr-2022 08:05	07-Apr-2022 08:25	07-Apr-2022 09:20
					ES2212731-001	ES2212731-003	ES2212731-004	ES2212731-005	ES2212731-009
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	0.1	%		**5.2**	**8.7**	**8.5**	**6.2**	**5.7**
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<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		<0.0002	<0.0002	<0.0002	<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
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		<0.001	<0.001	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		**0.0034**	**0.0004**	**0.0004**	**0.0019**	**0.0010**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		**0.0029**	**0.0004**	**0.0011**	**0.0018**	**0.0008**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		**0.0009**	**0.0004**	**0.0006**	**0.0014**	**0.0006**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		<0.0002	**0.0003**	**0.0008**	**0.0004**	**0.0004**
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		<0.0002	<0.0002	**0.0002**	<0.0002	<0.0002
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		<0.0002	**0.0002**	<0.0002	<0.0002	<0.0002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	SBH02/1.1-1.2	SBH03/0.08-0.15	SBH05/0.08-0.15	SBH05/0.9-1.0	SBH03/1.0-1.1
				Sampling date / time	07-Apr-2022 07:10	07-Apr-2022 07:55	07-Apr-2022 08:05	07-Apr-2022 08:25	07-Apr-2022 09:20
Compound	CAS Number	LOR	Unit		ES2212731-001	ES2212731-003	ES2212731-004	ES2212731-005	ES2212731-009
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		**0.0039**	**0.0096**	**0.0358**	**0.0021**	**0.0006**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	**0.0170**	**0.0351**	**0.0040**	**0.0026**
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	**0.0036**	**0.0008**	<0.0005	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0111**	**0.0319**	**0.0748**	**0.0116**	**0.0060**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0111**	**0.0281**	**0.0738**	**0.0116**	**0.0060**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**92.5**	**104**	**112**	**100**	**94.0**
13C8-PFOA	----	0.0002	%		**102**	**93.0**	**88.5**	**99.5**	**87.0**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	SBH06/0.08-0.15	SBH06/0.8-0.9	QA04	SBH04/0.08-0.15	SBH04/0.8-0.9
			Sampling date / time	07-Apr-2022 10:20	07-Apr-2022 10:55	07-Apr-2022 00:00	07-Apr-2022 12:10	07-Apr-2022 12:50
Compound	CAS Number	LOR	Unit	ES2212731-011	ES2212731-012	ES2212731-016	ES2212731-019	ES2212731-020
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**8.5**	**10.1**	**8.4**	**6.5**	**13.4**
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<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	<0.0002	<0.0002	<0.0002	<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
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	<0.001	<0.001	**0.001**
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	**0.0004**	**0.0006**	**0.0003**	**0.0018**	**0.0070**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	**0.0006**	**0.0008**	**0.0005**	**0.0026**	**0.0054**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	**0.0005**	**0.0010**	**0.0004**	**0.0014**	**0.0021**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	**0.0004**	**0.0014**	**0.0004**	**0.0016**	**0.0004**
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	**0.0007**	<0.0002	**0.0003**	<0.0002
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	**0.0011**	<0.0002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	SBH06/0.08-0.15	SBH06/0.8-0.9	QA04	SBH04/0.08-0.15	SBH04/0.8-0.9
			Sampling date / time	07-Apr-2022 10:20	07-Apr-2022 10:55	07-Apr-2022 00:00	07-Apr-2022 12:10	07-Apr-2022 12:50
Compound	CAS Number	LOR	Unit	ES2212731-011	ES2212731-012	ES2212731-016	ES2212731-019	ES2212731-020
				Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued								
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	**0.0182**	**0.0131**	**0.0164**	**0.0678**	**0.0058**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	**0.0046**	**0.0143**	**0.0042**	**0.110**	**0.0016**
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	**0.0094**	<0.0005
EP231P: PFAS Sums								
Sum of PFAS	----	0.0002	mg/kg	**0.0247**	**0.0319**	**0.0222**	**0.196**	**0.0233**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	**0.0247**	**0.0312**	**0.0222**	**0.185**	**0.0233**
EP231S: PFAS Surrogate								
13C4-PFOS	----	0.0002	%	**102**	**117**	**100**	**99.0**	**106**
13C8-PFOA	----	0.0002	%	**91.5**	**90.5**	**84.0**	**89.0**	**91.0**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	EMB23/0.08-0.15	EMB23/0.75-0.85	----	----	----
			Sampling date / time	07-Apr-2022 14:20	07-Apr-2022 15:00	----	----	----
Compound	CAS Number	LOR	Unit	ES2212731-022	ES2212731-023	--------	--------	--------
				Result	Result	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**7.0**	**6.9**	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
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	<0.0002	<0.0002	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	**0.0006**	**0.0045**	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	**0.0008**	**0.0039**	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	**0.0008**	**0.0012**	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	**0.0007**	**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 (PFDoDA)	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	----	----	----
EP231C: Perfluoroalkyl Sulfonamides								
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	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	EMB23/0.08-0.15	EMB23/0.75-0.85	----	----	----
				Sampling date / time	07-Apr-2022 14:20	07-Apr-2022 15:00	----	----	----
Compound	CAS Number	LOR	Unit		ES2212731-022	ES2212731-023	--------	--------	--------
					Result	Result	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	<0.0005	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg		<0.0005	<0.0005	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	<0.0005	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg		<0.0002	<0.0002	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	<0.0002	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg		<0.0005	<0.0005	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		**0.0134**	**0.0038**	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		**0.0313**	**0.0029**	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	<0.0005	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0476**	**0.0165**	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		<0.0002	<0.0002	----	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0476**	**0.0165**	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**96.0**	**114**	----	----	----
13C8-PFOA	----	0.0002	%		**90.0**	**94.0**	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Blank03	----	----	----	----
				Sampling date / time	07-Apr-2022 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2212731-015	--------	--------	--------	--------
					Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		<0.02	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L		<0.01	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		<0.01	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		<0.02	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		<0.01	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<0.02	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.02	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	Blank03	----	----	----	----
				Sampling date / time	07-Apr-2022 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2212731-015	--------	--------	--------	--------
					Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	----	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		<0.01	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		<0.01	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		<0.01	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**98.0**	----	----	----	----
13C8-PFOA	----	0.02	%		**100**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **RINSATE**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

Sub-Matrix: **SOIL**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

Updated COC 12.04.22 12.37 pm

CHAIN OF CUSTODY FORM

SMEC

SMEC OFFICE: SMEC North Sydney PROJECT: Vopak Site Investigation	TURNAROUND REQUIREMENTS : ☐ Standard - 5 day TAT	LAB: ALS Darwin Unit 4/16 Charlton Court Woolner, NT, 0820 ALS Sydney 277-289 Woodpark Road Smithfield NSW 2164
PROJECT NUMBER: 30080099	LAB QUOTE NO.: SY/285/21	COC SEQUENCE NUMBER (Circle) COC: PAGE 1 OF: 2
PROJECT MANAGER: Manuel Fernandez	CONTACT PH: 0422 156 256 (Pauline)	
SAMPLED BY: Pauline Voukidis		
DATE SAMPLED: 6 to 8 April 2022	(1st) RELINQUISHED BY: Pauline Voukidis DATE/TIME: 6 and 8/4/2022 RECEIVED BY:	(2nd) RELINQUISHED BY: DATE/TIME: RECEIVED BY:	(3rd) RELINQUISHED BY: DATE/TIME: RECEIVED BY:
Email Reports to: manuel.fernandez@smec.com, pauline.voukidis@smec.com			
Email Invoice to: manuel.fernandez@smec.com			

Special Laboratory Instructions:
Please forward results to smec@esdat.com.au

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	PFAS - Full Suite (28 analytes)	S-28 (TRH (C6-C40) / BTEXN / PAH / 6 Metals)	BTEX/TRH(C6-9)	BTEX				HOLD	
	EMB25/0.08-0.15	6/04/2022	Soil	1 PFAS jar	1	X								
	EMB25/1/0-1.1	6/04/2022	Soil	1 PFAS jar	1	X								
	SBH01/0.08-0.15	6/04/2022	Soil	1 PFAS jar	1	X								
	SBH01/1.1-1.1	6/04/2022	Soil	1 PFAS jar	1	X								
	SBH01/1.9-2.0	6/04/2022	Soil	1 PFAS jar	1								X	
	SBH02/0.08-0.15	6/04/2022	Soil	1 glass jar, 1 PFAS jar	2	X	X							
	RINSATE03	6/04/2022	Water	2 metals, 2 vials, 2 amber , 2 PFAS bottles	8	X	X							
	BLANK02	6/04/2022	Water	2 PFAS bottles	2	X								
	QA03	6/04/2022	Soil	1 glass jar, 1 PFAS jar	2								X	
	QA03A	6/04/2022	Soil	1 glass jar, 1 PFAS jar	2								X	
	EMB23/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
	EMB23/0.75-0.85	7/04/2022	Soil	1 PFAS jar	1	X								
	EMB25/1.8-1.9	7/04/2022	Soil	1 PFAS jar	1								X	
1	EMB24/0.08-0.15	8/04/2022	Soil	1 PFAS jar	1	X								
2	EMB24/0.7-0.8	8/04/2022	Soil	1 PFAS jar	1	X								
3	EMB24/1.7-1.8	8/04/2022	Soil	1 PFAS jar	1								X	
4	EMB24/2.7-2.8	8/04/2022	Soil	1 PFAS jar	1								X	
5	QA05	8/04/2022	Soil	1 PFAS jar	1								X	
6	QA05A	8/04/2022	Soil	1 PFAS jar	1								X	
7	RINSATE05	8/04/2022	Water	2 PFAS bottles	2	X								
8	TRIP SPIKE 2	4/04/2022	Soil	1 glass jar	1				X					
9	TRIP BLANK	4/04/2022	Soil	1 glass jar	1			X						
10	BLANK04	8/04/2022	Water	2 PFAS bottles	2	X								
				TOTAL		13	2	1	1				8	

Notes: Hold all remaining sample volume for possible future leachability analysis

Environmental Division
Sydney
Work Order Reference
ES2213150

Telephone : + 61-2-8784 8555

11 TSC_2 4.4.22

CHAIN OF CUSTODY FORM

SMEC

SMEC OFFICE: SMEC North Sydney PROJECT: Vopak Site Investigation	TURNAROUND REQUIREMENTS : ☐ Standard - 5 day TAT	LAB: ALS Darwin Unit 4/16 Charlton Court Woolner, NT, 0820
PROJECT NUMBER: 30080099	LAB QUOTE NO.: SY/285/21	COC SEQUENCE NUMBER (Circle) COC: PAGE 2 OF: 2
PROJECT MANAGER: Manuel Fernandez	CONTACT PH: 0422 156 256 (Pauline)	ALS Sydney 277-289 Woodpark Road Smithfield NSW 2164
SAMPLED BY: Pauline Voukidis		

DATE SAMPLED: 7 April 2022	(1st) RELINQUISHED BY: Pauline Voukidis DATE/TIME: 7/4/2022	(2nd) RELINQUISHED BY: DATE/TIME:	(3rd) RELINQUISHED BY: DATE/TIME:
Email Reports to: manuel.fernandez@smec.com, pauline.voukidis@smec.com			
Email Invoice to: manuel.fernandez@smec.com	RECEIVED BY:	RECEIVED BY:	RECEIVED BY:

Special Laboratory Instructions:
Please forward results to smec@esdat.com.au

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	PFAS - Full Suite (28 analytes)	S-26 (TRH (C6-C40) / BTEXN / PAH / 8 Metals)	BTEX/TRH(C6-9)	BTEX				HOLD	
	SBH02/1.1-1.2	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH02/2.0-2.1	7/04/2022	Soil	1 PFAS jar	1								X	
	SBH03/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH05/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH05/0.9-1.0	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH05/1.9-2.0	7/04/2022	Soil	1 PFAS jar	1								X	
	SBH05/2.7-2.8	7/04/2022	Soil	1 PFAS jar	1								X	
	SBH03/0.7-0.8	7/04/2022	Soil	1 PFAS jar	1								X	
	SBH03/1.0-1.1	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH03/1.8-1.9	7/04/2022	Soil	1 PFAS jar	1								X	
	SBH06/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH06/0.8-0.9	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH06/1.8-1.9	7/04/2022	Soil	1 PFAS jar	1								X	
	RINSATE04	7/04/2022	Water	2 PFAS bottles	2	X								
	BLANK03	7/04/2022	Water	2 PFAS bottles	2	X								
	QA04	7/04/2022	Soil	1 PFAS jar	1	X								
	QA04A	7/04/2022	Soil	1 PFAS jar	1	X								Send to Eurofins for Analysis
	SBH06/2.8-2.9	7/04/2022	Soil	1 PFAS jar	1								X	
	SBH04/0.08-0.15	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH04/0.8-0.9	7/04/2022	Soil	1 PFAS jar	1	X								
	SBH04/1.7-1.8	7/04/2022	Soil	1 PFAS jar	1								X	
				TOTALS		13							8	

Notes: Hold all remaining sample volume for possible future leachability analysis

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2213150**

Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Contact	: Brenda Hong
Address	: Level 5, 20 Berry Street, North Sydney, NSW 2060 North Sydney 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: manuel.fernandez@smec.com	E-mail	: Brenda.Hong@ALSGlobal.com
Telephone	: ----	Telephone	: +61 2 8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 30080099 - Vopak Site Investigation	Page	: 1 of 3
Order number	: ----	Quote number	: ES2021SMEAUS0007 (SY/285/21 V2)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Pauline Voukidis		

Dates

Date Samples Received	: 14-Apr-2022 07:30	Issue Date	: 22-Apr-2022
Client Requested Due Date	: 27-Apr-2022	Scheduled Reporting Date	: **27-Apr-2022**

Delivery Details

Mode of Delivery	: Undefined	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: 16.1' C - Ice present
Receipt Detail	:	No. of samples received / analysed	: 11 / 7

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

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

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

Summary of Sample(s) and Requested Analysis

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

Matrix: **SOIL**

Laboratory sample ID	Sampling date / time	Sample ID	(On Hold) SOIL No analysis requested	SOIL - EA055-103 Moisture Content	SOIL - EP080 BTEXN	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)	SOIL - S-18 (NO MOIST) TRH(C6-C9)/BTEXN with No Moisture for TBs
ES2213150-001	08-Apr-2022 10:00	EMB24/0.08-0.15		✓		✓	
ES2213150-002	08-Apr-2022 10:30	EMB24/0.7-0.8		✓		✓	
ES2213150-003	08-Apr-2022 10:45	EMB24/1.7-1.8	✓				
ES2213150-004	08-Apr-2022 10:50	EMB24/2.7-2.8	✓				
ES2213150-005	08-Apr-2022 00:00	QA05	✓				
ES2213150-006	08-Apr-2022 00:00	QA05A	✓				
ES2213150-008	04-Apr-2022 00:00	TRIP SPIKE - 2			✓		
ES2213150-009	04-Apr-2022 00:00	TRIP BLANK					✓
ES2213150-011	04-Apr-2022 00:00	TCS - 2			✓		

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EP231X PFAS - Full Suite (28 analytes)
ES2213150-007	08-Apr-2022 00:00	RINSATE 05	✓
ES2213150-010	08-Apr-2022 00:00	BLANK 04	✓

Proactive Holding Time Report

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

Requested Deliverables

ACCOUNTS INVOICES		
- A4 - AU Tax Invoice (INV)	Email	accounts.payable@smec.com
ESDAT REPORTS		
- *AU Certificate of Analysis - NATA (COA)	Email	smec@esdat.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	smec@esdat.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	smec@esdat.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	smec@esdat.com.au
- Chain of Custody (CoC) (COC)	Email	smec@esdat.com.au
- EDI Format - ENMRG (ENMRG)	Email	smec@esdat.com.au
- EDI Format - ESDAT (ESDAT)	Email	smec@esdat.com.au
MANUEL FERNANDEZ		
- *AU Certificate of Analysis - NATA (COA)	Email	manuel.fernandez@smec.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	manuel.fernandez@smec.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	manuel.fernandez@smec.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	manuel.fernandez@smec.com
- A4 - AU Tax Invoice (INV)	Email	manuel.fernandez@smec.com
- Chain of Custody (CoC) (COC)	Email	manuel.fernandez@smec.com
- EDI Format - ENMRG (ENMRG)	Email	manuel.fernandez@smec.com
- EDI Format - ESDAT (ESDAT)	Email	manuel.fernandez@smec.com
Pauline Voukidis		
- *AU Certificate of Analysis - NATA (COA)	Email	pauline.voukidis@smec.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	pauline.voukidis@smec.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	pauline.voukidis@smec.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	pauline.voukidis@smec.com
- Chain of Custody (CoC) (COC)	Email	pauline.voukidis@smec.com
- EDI Format - ENMRG (ENMRG)	Email	pauline.voukidis@smec.com
- EDI Format - ESDAT (ESDAT)	Email	pauline.voukidis@smec.com

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2213150**	Page	: 1 of 5
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Telephone	: +61 2 8784 8555
Project	: 30080099 - Vopak Site Investigation	Date Samples Received	: 14-Apr-2022
Site	: ----	Issue Date	: 27-Apr-2022
Sampler	: Pauline Voukidis	No. of samples received	: 11
Order number	: 30080099	No. of samples analysed	: 7

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EP080/071: Total Petroleum Hydrocarbons						
Soil Glass Jar - Unpreserved						
TRIP BLANK	22-Apr-2022	18-Apr-2022	**4**	22-Apr-2022	18-Apr-2022	**4**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions						
Soil Glass Jar - Unpreserved						
TRIP BLANK	22-Apr-2022	18-Apr-2022	**4**	22-Apr-2022	18-Apr-2022	**4**
EP080: BTEXN						
Soil Glass Jar - Unpreserved						
TRIP SPIKE - 2, TRIP BLANK, TCS - 2	22-Apr-2022	18-Apr-2022	**4**	22-Apr-2022	18-Apr-2022	**4**

Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
HDPE Soil Jar (EA055)							
EMB24/0.08-0.15, EMB24/0.7-0.8	**08-Apr-2022**	**----**	----	----	**22-Apr-2022**	22-Apr-2022	✓
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP080)							
TRIP BLANK	**04-Apr-2022**	**22-Apr-2022**	18-Apr-2022	×	**22-Apr-2022**	18-Apr-2022	×
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP080)							
TRIP BLANK	**04-Apr-2022**	**22-Apr-2022**	18-Apr-2022	×	**22-Apr-2022**	18-Apr-2022	×
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080)							
TRIP SPIKE - 2, TRIP BLANK, TCS - 2	**04-Apr-2022**	**22-Apr-2022**	18-Apr-2022	×	**22-Apr-2022**	18-Apr-2022	×
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X)							
EMB24/0.08-0.15, EMB24/0.7-0.8	**08-Apr-2022**	**26-Apr-2022**	05-Oct-2022	✓	**26-Apr-2022**	05-Jun-2022	✓

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
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE Soil Jar (EP231X)								
EMB24/0.08-0.15,	EMB24/0.7-0.8	**08-Apr-2022**	**26-Apr-2022**	05-Oct-2022	✓	**26-Apr-2022**	05-Jun-2022	✓
EP231C: Perfluoroalkyl Sulfonamides								
HDPE Soil Jar (EP231X)								
EMB24/0.08-0.15,	EMB24/0.7-0.8	**08-Apr-2022**	**26-Apr-2022**	05-Oct-2022	✓	**26-Apr-2022**	05-Jun-2022	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE Soil Jar (EP231X)								
EMB24/0.08-0.15,	EMB24/0.7-0.8	**08-Apr-2022**	**26-Apr-2022**	05-Oct-2022	✓	**26-Apr-2022**	05-Jun-2022	✓
EP231P: PFAS Sums								
HDPE Soil Jar (EP231X)								
EMB24/0.08-0.15,	EMB24/0.7-0.8	**08-Apr-2022**	**26-Apr-2022**	05-Oct-2022	✓	**26-Apr-2022**	05-Jun-2022	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE (no PTFE) (EP231X)								
RINSATE 05,	BLANK 04	**08-Apr-2022**	**27-Apr-2022**	05-Oct-2022	✓	**27-Apr-2022**	05-Oct-2022	✓
EP231B: Perfluoroalkyl Carboxylic Acids								
HDPE (no PTFE) (EP231X)								
RINSATE 05,	BLANK 04	**08-Apr-2022**	**27-Apr-2022**	05-Oct-2022	✓	**27-Apr-2022**	05-Oct-2022	✓
EP231C: Perfluoroalkyl Sulfonamides								
HDPE (no PTFE) (EP231X)								
RINSATE 05,	BLANK 04	**08-Apr-2022**	**27-Apr-2022**	05-Oct-2022	✓	**27-Apr-2022**	05-Oct-2022	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE (no PTFE) (EP231X)								
RINSATE 05,	BLANK 04	**08-Apr-2022**	**27-Apr-2022**	05-Oct-2022	✓	**27-Apr-2022**	05-Oct-2022	✓
EP231P: PFAS Sums								
HDPE (no PTFE) (EP231X)								
RINSATE 05,	BLANK 04	**08-Apr-2022**	**27-Apr-2022**	05-Oct-2022	✓	**27-Apr-2022**	05-Oct-2022	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	4	**25.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM Schedule B(3) amended.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-house: Analysis of soils by solvent extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM using internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	Method	Matrix	Method Descriptions
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
QuECheRS Extraction of Solids	ORG71	SOIL	In house: Sequential extractions with Acetonitrile/Methanol by shaking. Extraction efficiency aided by the addition of salts under acidic conditions. Where relevant, interferences from co-extracted organics are removed with dispersive clean-up media (dSPE). The extract is either diluted or concentrated and exchanged into the analytical solvent.
Solid Phase Extraction (SPE) for PFAS in water	ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

QUALITY CONTROL REPORT

Work Order	: **ES2213150**	Page	: 1 of 11
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Contact	: Brenda Hong
Address	: Level 5, 20 Berry Street, North Sydney, NSW 2060 North Sydney 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 30080099 - Vopak Site Investigation	Date Samples Received	: 14-Apr-2022
Order number	: 30080099	Date Analysis Commenced	: 22-Apr-2022
C-O-C number	: ----	Issue Date	: 27-Apr-2022
Sampler	: Pauline Voukidis		
Site	: ----		
Quote number	: SY/285/21 V2		
No. of samples received	: 11		
No. of samples analysed	: 7		

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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 4299923)									
ES2212731-004	Anonymous	EA055: Moisture Content	----	0.1	%	8.5	8.3	2.3	0% - 20%
ES2213150-002	EMB24/0.7-0.8	EA055: Moisture Content	----	0.1	%	6.4	6.0	7.3	0% - 20%
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4300261)									
ES2213153-019	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4300261)									
ES2213153-019	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.0	No Limit
EP080: BTEXN (QC Lot: 4300261)									
ES2213153-019	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.0	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.0	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.0	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4302373)									
ES2212731-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
ES2212731-022	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4302373) - continued									
ES2212731-022	Anonymous	EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4302373)									
ES2212731-001	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0034	0.0030	12.8	0% - 50%
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.0029	0.0026	11.4	0% - 50%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0009	0.0008	0.0	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
ES2212731-022	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0006	0.0005	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.0008	0.0008	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0008	0.0007	0.0	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0007	0.0006	16.2	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4302373)									
ES2212731-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4302373) - continued									
ES2212731-001	Anonymous	EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
ES2212731-022	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 4302373)									
ES2212731-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	0.0039	0.0033	16.6	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
ES2212731-022	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	0.0134	0.0140	4.5	0% - 20%
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	0.0313	0.0273	13.9	0% - 20%
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4304146)									
ES2212731-014	Anonymous	EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4304146) - continued									
ES2213745-002	Anonymous	EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4304146)									
ES2212731-014	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
ES2213745-002	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.0	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4304146)									
ES2212731-014	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4304146) - continued									
ES2212731-014	Anonymous	EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
ES2213745-002	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 4304146)									
ES2212731-014	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
ES2213745-002	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.0	No Limit
EP231P: PFAS Sums (QC Lot: 4304146)									
ES2212731-014	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	<0.01	0.0	No Limit
ES2213745-002	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	<0.01	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (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 Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4300261)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	83.1	68.4	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4300261)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	79.0	68.4	128
EP080: BTEXN (QCLot: 4300261)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	104	62.0	116
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	108	67.0	121
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	110	65.0	117
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	103	66.0	118
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	105	68.0	120
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	72.6	63.0	119
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4302373)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	111	72.0	128
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	96.8	73.0	123
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	102	67.0	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	87.6	70.0	132
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.8	68.0	136
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	110	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4302373)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	85.8	71.0	135
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	108	69.0	132
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	122	70.0	132
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	116	71.0	131
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	106	69.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	100	72.0	129
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	107	69.0	133
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	111	64.0	136
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	112	69.0	135
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	75.2	66.0	139
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	94.1	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4302373)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	119	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	113	71.6	129
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	97.6	69.8	131

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4302373) - continued								
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	90.7	68.7	130
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	108	65.1	134
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	99.2	63.0	144
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	114	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4302373)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	108	62.0	145
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	111	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	115	65.0	137
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	124	69.2	143

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4304146)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.25 µg/L	117	72.0	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.25 µg/L	103	71.0	127
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L	<0.01	0.25 µg/L	106	68.0	131
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.25 µg/L	94.2	69.0	134
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.25 µg/L	93.6	65.0	140
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.25 µg/L	93.2	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4304146)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	1.25 µg/L	86.4	73.0	129
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.25 µg/L	104	72.0	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.25 µg/L	125	72.0	129
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.25 µg/L	103	72.0	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.25 µg/L	104	71.0	133
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.25 µg/L	108	69.0	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.25 µg/L	102	71.0	129
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.25 µg/L	104	69.0	133
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.25 µg/L	103	72.0	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.25 µg/L	103	65.0	144
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	0.625 µg/L	110	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4304146)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.25 µg/L	105	67.0	137
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	0.625 µg/L	99.4	68.0	141

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4304146) - continued								
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	0.625 µg/L	97.6	62.6	147
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L	<0.05	0.625 µg/L	101	66.0	145
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	0.625 µg/L	91.5	57.6	145
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.25 µg/L	92.2	65.0	136
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.25 µg/L	118	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4304146)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.25 µg/L	103	63.0	143
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.25 µg/L	101	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.25 µg/L	114	67.0	138
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.25 µg/L	100	71.4	144

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	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Acceptable Limits (%): Low	Acceptable Limits (%): High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4300261)							
ES2213153-019	Anonymous	EP080: C6 - C9 Fraction	----	32.5 mg/kg	89.9	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4300261)							
ES2213153-019	Anonymous	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	100	70.0	130
EP080: BTEXN (QCLot: 4300261)							
ES2213153-019	Anonymous	EP080: Benzene	71-43-2	2.5 mg/kg	83.8	70.0	130
		EP080: Toluene	108-88-3	2.5 mg/kg	86.9	70.0	130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	90.8	70.0	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	90.0	70.0	130
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	95.9	70.0	130
		EP080: Naphthalene	91-20-3	2.5 mg/kg	88.8	70.0	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4302373)							
ES2212731-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	113	72.0	128
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	98.4	73.0	123
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	112	67.0	130

Sub-Matrix: **SOIL**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Matrix Spike (MS) Report: Acceptable Limits (%) Low	Matrix Spike (MS) Report: Acceptable Limits (%) High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4302373) - continued							
ES2212731-001	Anonymous	EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	96.0	70.0	132
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	103	68.0	136
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	119	59.0	134
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4302373)							
ES2212731-001	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	96.9	71.0	135
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	75.2	69.0	132
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	86.8	70.0	132
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	112	71.0	131
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	114	69.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	101	72.0	129
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	104	69.0	133
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	110	64.0	136
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	109	69.0	135
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	71.2	66.0	139
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	96.3	69.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4302373)							
ES2212731-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	115	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	120	71.6	129
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	113	69.8	131
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.00312 mg/kg	100	68.7	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	118	65.1	134
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	99.6	63.0	144
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	119	61.0	139
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4302373)							
ES2212731-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	109	62.0	145
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	84.8	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	120	65.0	137
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	118	69.2	143

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Matrix Spike (MS) Report: Acceptable Limits (%) Low	Matrix Spike (MS) Report: Acceptable Limits (%) High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4304146)							
ES2212731-015	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.25 µg/L	127	72.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4304146) - continued							
ES2212731-015	Anonymous	EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.25 µg/L	91.8	71.0	127
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.25 µg/L	93.8	68.0	131
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.25 µg/L	89.4	69.0	134
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.25 µg/L	91.0	65.0	140
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.25 µg/L	84.8	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4304146)							
ES2212731-015	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	1.25 µg/L	86.4	73.0	129
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.25 µg/L	102	72.0	129
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.25 µg/L	128	72.0	129
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.25 µg/L	100	72.0	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.25 µg/L	101	71.0	133
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.25 µg/L	109	69.0	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.25 µg/L	104	71.0	129
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.25 µg/L	103	69.0	133
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.25 µg/L	107	72.0	134
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.25 µg/L	113	65.0	144
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.625 µg/L	104	71.0	132
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4304146)							
ES2212731-015	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.25 µg/L	103	67.0	137
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.625 µg/L	86.2	68.0	141
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.625 µg/L	90.8	62.6	147
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.625 µg/L	101	66.0	145
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.625 µg/L	85.2	57.6	145
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.25 µg/L	102	65.0	136
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.25 µg/L	114	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4304146)							
ES2212731-015	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.25 µg/L	117	63.0	143
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.25 µg/L	96.8	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.25 µg/L	121	67.0	138
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.25 µg/L	117	71.4	144

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2213150**	Page	: 1 of 10
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Contact	: Brenda Hong
Address	: Level 5, 20 Berry Street, North Sydney, NSW 2060 North Sydney 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 30080099 - Vopak Site Investigation	Date Samples Received	: 14-Apr-2022 07:30
Order number	: 30080099	Date Analysis Commenced	: 22-Apr-2022
C-O-C number	: ----	Issue Date	: 27-Apr-2022 18:17
Sampler	: Pauline Voukidis		
Site	: ----		
Quote number	: SY/285/21 V2		
No. of samples received	: 11		
No. of samples analysed	: 7		

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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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 - Per- and Polyfluoroalkyl Substances (PFAS): Samples received in 20ml or 125ml bottles have been tested in accordance with the QSM5.3 compliant, NATA accredited method. 60mL or 250mL bottles have been tested to the legacy QSM 5.1 aligned, NATA accredited method.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP080: The trip spike and its control have been analysed for volatile TPH and BTEXN only. The trip spike and control were prepared in the lab using reagent grade sand spiked with petrol. The spike was dispatched from the lab and the control retained.
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. 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. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.

Analytical Results

Sub-Matrix: RINSATE (Matrix: WATER)				Sample ID	RINSATE 05	----	----	----	----
				Sampling date / time	08-Apr-2022 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2213150-007	--------	--------	--------	--------
					Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		<0.02	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L		<0.01	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		<0.01	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		<0.02	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		<0.01	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<0.02	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.02	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	----	----	----	----

Analytical Results

Sub-Matrix: RINSATE (Matrix: WATER)				Sample ID	RINSATE 05	----	----	----	----
				Sampling date / time	08-Apr-2022 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2213150-007	--------	--------	--------	--------
					Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	----	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		<0.01	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		<0.01	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		<0.01	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		101	----	----	----	----
13C8-PFOA	----	0.02	%		100	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	EMB24/0.08-0.15	EMB24/0.7-0.8	TRIP SPIKE - 2	TRIP BLANK	TCS - 2
			Sampling date / time	08-Apr-2022 10:00	08-Apr-2022 10:30	04-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00
Compound	CAS Number	LOR	Unit	ES2213150-001	ES2213150-002	ES2213150-008	ES2213150-009	ES2213150-011
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**7.5**	**6.4**	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	----	----	----	<10	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	----	----	----	<10	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	10	mg/kg	----	----	----	<10	----
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	----	----	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	----	----	**5.4**	<0.5	**6.1**
Ethylbenzene	100-41-4	0.5	mg/kg	----	----	**1.3**	<0.5	**1.5**
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	----	----	**7.6**	<0.5	**8.4**
ortho-Xylene	95-47-6	0.5	mg/kg	----	----	**3.7**	<0.5	**3.9**
^ **Total Xylenes**	----	0.5	mg/kg	----	----	**11.3**	<0.5	**12.3**
^ **Sum of BTEX**	----	0.2	mg/kg	----	----	**18.0**	<0.2	**19.9**
Naphthalene	91-20-3	1	mg/kg	----	----	<1	<1	<1
EP231A: Perfluoroalkyl Sulfonic Acids								
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	<0.0002	<0.0002	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
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	**0.0004**	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	**0.0002**	**0.0002**	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	EMB24/0.08-0.15	EMB24/0.7-0.8	TRIP SPIKE - 2	TRIP BLANK	TCS - 2
				Sampling date / time	08-Apr-2022 10:00	08-Apr-2022 10:30	04-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2213150-001	ES2213150-002	ES2213150-008	ES2213150-009	ES2213150-011
					Result	Result	Result	Result	Result
EP231B: Perfluoroalkyl Carboxylic Acids - Continued									
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		<0.0002	**0.0006**	----	----	----
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 (PFDoDA)	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	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
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	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.0005	mg/kg		<0.0005	<0.0005	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	<0.0005	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg		<0.0002	<0.0002	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	<0.0002	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg		<0.0005	<0.0005	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		**0.0077**	<0.0005	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		**0.0033**	**0.0020**	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	<0.0005	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	EMB24/0.08-0.15	EMB24/0.7-0.8	TRIP SPIKE - 2	TRIP BLANK	TCS - 2
				Sampling date / time	08-Apr-2022 10:00	08-Apr-2022 10:30	04-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2213150-001	ES2213150-002	ES2213150-008	ES2213150-009	ES2213150-011
					Result	Result	Result	Result	Result
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0114**	**0.0036**	**----**	**----**	**----**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		<0.0002	<0.0002	**----**	**----**	**----**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0114**	**0.0030**	**----**	**----**	**----**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		**----**	**----**	**79.2**	**81.0**	**84.5**
Toluene-D8	2037-26-5	0.2	%		**----**	**----**	**78.9**	**81.5**	**85.7**
4-Bromofluorobenzene	460-00-4	0.2	%		**----**	**----**	**82.0**	**83.5**	**85.1**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**106**	**109**	**----**	**----**	**----**
13C8-PFOA	----	0.0002	%		**99.5**	**96.0**	**----**	**----**	**----**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	BLANK 04	----	----	----	----
				Sampling date / time	08-Apr-2022 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2213150-010	--------	--------	--------	--------
					Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		<0.02	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.01	µg/L		<0.01	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		<0.01	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		<0.02	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		<0.01	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<0.02	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.02	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	BLANK 04	----	----	----	----
				Sampling date / time	08-Apr-2022 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2213150-010	--------	--------	--------	--------
					Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	----	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		<0.01	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		<0.01	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		<0.01	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**100**	----	----	----	----
13C8-PFOA	----	0.02	%		**102**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **RINSATE**

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

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

Sub-Matrix: **WATER**

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

Updated CoC 14.04.22 @ 11.12 AM

Environmental Division Sydney
Work Order Reference
ES2213154

Telephone : +61-2-8784 8555

CHAIN OF CUSTODY FORM

SMEC

SMEC OFFICE: SMEC North Sydney	TURNAROUND REQUIREMENTS : o Standard - 5 day TAT		LAB: ALS Darwin, Unit 4/16 Charlton Court, Woolner, NT, 0820
PROJECT: Vopak Site Investigation			ALS Sydney, 277-289 Woodpark Road, Smithfield NSW 2164
PROJECT NUMBER: 30080099	LAB QUOTE NO.: SY/285/21 (being updated by Sepan Mahamad)	COC SEQUENCE NUMBER (Circle)	ATTENTION: Adrian Degenaar / Sepan Mahamad
PROJECT MANAGER: Manuel Fernandez	CONTACT PH: 0422 156 256 (Pauline)	COC: PAGE 1	
SAMPLED BY: Pauline Voukidis		OF: 2	DISPATCH TO (ADDRESS & PHONE NO.):
DATE SAMPLED: 11 to 12 April 2022	(1st) RELINQUISHED BY: Pauline Voukidis DATE/TIME: 12/4/2022	(2nd) RELINQUISHED BY: DATE/TIME:	(3rd) RELINQUISHED BY: DATE/TIME:
Email Reports to: manuel.fernandez@smec.com, pauline.voukidis@smec.com	RECEIVED BY:	RECEIVED BY:	RECEIVED BY:
Email Invoice to: manuel.fernandez@smec.com			

Special Laboratory Instructions:
Please forward results to smec@esdat.com.au

SAMPLE DETAILS						ANALYSIS REQUIRED								COMMENTS
LAB ID	SAMPLE ID	DATE / TIME	SAMPLE MATRIX	CONTAINER TYPE & PRESERVATIVE	TOTAL NO. CONTAINERS	PFAS - Super Ultra Trace Waters Long Suite (29	TRH / BTEX (with silica gel)*	PAH (ultra trace)*	Metals (8)*	Ammonia*	BTEX/TRH(C6-9)	BTEX		
15	EMB17	12/04/2022	Water	see note 1	10	X	X	X	X	X				
14	EMB18	12/04/2022	Water	see note 1	10	X	X	X	X	X				
15	EMB19	12/04/2022	Water	see note 1	10	X	X	X	X	X				
3	EMB20	11/04/2022	Water	see note 1	10	X	X	X	X	X				
1	EMB21	11/04/2022	Water	see note 1	10	X	X	X	X	X				
2	EMB22	11/04/2022	Water	see note 1	10	X	X	X	X	X				
4	EMB23	11/04/2022	Water	see note 1	10	X	X	X	X	X				
16	EMB24	12/04/2022	Water	see note 1	10	X	X	X	X	X				
17	EMB25	12/04/2022	Water	see note 1	10	X	X	X	X	X				
5	QA06	11/04/2022	Water	see note 1	10	X	X	X	X	X				
6	QA06A	11/04/2022	Water	see note 1	10	X	X	X	X	X				Send sample to Eurofins for analysis
7	BLANK05	11/04/2022	Water	see note 1	10	X								
8	MS/LD LAB	11/04/2022	Water	see note 1	10									For lab use as matrix spike and lab duplicate
10	TRIP BLANK	4/04/2022	Water	2 PFAS bottles	2	X								
11	TRIP SPIKE 1	4/04/2022	Water	1 Vial	1							X		
12	TRIP BLANK	4/04/2022	Water	4 vials	4						X			
				Total		13	11			11	1	1		

Notes: 1) - 2xPFAS, 4 vials, 2 amber, 1 metals, 1 purple bottles

*** LORs must meet minimum LORs as per attached table***

Subcon / Forward Lab / Split WO
Lab / Analysis: Eurofins → QA06A
Organised By / Date:
Relinquished By / Date:
Connote / Courier:
WO No: ES2213154
Attach By PO / Internal Sheet:

ES2213154

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2213154**

Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Contact	: Brenda Hong
Address	: Level 5, 20 Berry Street, North Sydney, NSW 2060 North Sydney 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: manuel.fernandez@smec.com	E-mail	: Brenda.Hong@ALSGlobal.com
Telephone	: ----	Telephone	: +61 2 8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 30080099 - Vopak Site Investigation	Page	: 1 of 3
Order number	: ----	Quote number	: ES2021SMEAUS0007 (SY/285/21 V2)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Pauline Voukidis		

Dates

Date Samples Received	: 14-Apr-2022 09:00	Issue Date	: 19-Apr-2022
Client Requested Due Date	: 26-Apr-2022	Scheduled Reporting Date	: **26-Apr-2022**

Delivery Details

Mode of Delivery	: Undefined	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: 16.1' C SYD - Ice present
Receipt Detail	:	No. of samples received / analysed	: 15 / 14
		No. of samples NOT collected	1

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Sample QA06A forwarded to Eurofins.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- Sample TRIP SPIKE SNR was not received due to the following reason: was not received
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

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

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

Summary of Sample(s) and Requested Analysis

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

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	(On Hold) WATER No analysis requested	WATER - EK055G Ammonia as N By Discrete Analyser	WATER - EP132-ST Super Trace PAHs	WATER - EP231X PFAS - Full Suite (28 analytes)	WATER - EP231X-SUT PFAS - Super Ultra Trace Waters Long Suite (29	WATER - W-02 8 Metals	WATER - W-04 SG TRH/BTEXN inc Silica Gel Clean Up
ES2213154-001	[11-Apr-2022]	EMB21		✓	✓		✓	✓	✓
ES2213154-002	[11-Apr-2022]	EMB22		✓	✓		✓	✓	✓
ES2213154-003	[11-Apr-2022]	EMB20		✓	✓		✓	✓	✓
ES2213154-004	[11-Apr-2022]	EMB23		✓	✓		✓	✓	✓
ES2213154-005	11-Apr-2022 00:00	QA06		✓	✓		✓	✓	✓
ES2213154-007	11-Apr-2022 00:00	BLANK 05					✓		
ES2213154-008	11-Apr-2022 00:00	MS/LD LAB	✓						
ES2213154-010	04-Apr-2022 00:00	TRIP BLANK				✓			
ES2213154-013	[12-Apr-2022]	EMB17		✓	✓		✓	✓	✓
ES2213154-014	[12-Apr-2022]	EMB18		✓	✓		✓	✓	✓
ES2213154-015	[12-Apr-2022]	EMB19		✓	✓		✓	✓	✓
ES2213154-016	[12-Apr-2022]	EMB24		✓	✓		✓	✓	✓
ES2213154-017	[12-Apr-2022]	EMB25		✓	✓		✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EP080 BTEXN	WATER - W-18 TRH(C6 - C9)/BTEXN
ES2213154-011	04-Apr-2022 00:00	TRIP SPIKE 1	✓	
ES2213154-012	04-Apr-2022 00:00	TRIP BLANK		✓

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

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

Method / Client Sample ID(s)	Container	Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation

EP071SG: TRH - Total Recoverable Hydrocarbons - Silica Gel Cleanup							
EMB20	Amber Glass Bottle - Unpreserve	18-Apr-2022	28-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
EMB21	Amber Glass Bottle - Unpreserve	18-Apr-2022	28-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
EMB22	Amber Glass Bottle - Unpreserve	18-Apr-2022	28-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
EMB23	Amber Glass Bottle - Unpreserve	18-Apr-2022	28-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
QA06	Amber Glass Bottle - Unpreserve	18-Apr-2022	28-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
EP080: TRH Volatiles/BTEX							
TRIP BLANK	Amber VOC Vial - Sulfuric Acid	18-Apr-2022	18-Apr-2022	14-Apr-2022	✓	19-Apr-2022	✗
TRIP SPIKE 1	Amber VOC Vial - Sulfuric Acid	18-Apr-2022	18-Apr-2022	14-Apr-2022	✓	19-Apr-2022	✗
EP132-ST: PAH Compounds in Water							
EMB20	Amber Glass Bottle - Unpreserve	18-Apr-2022	28-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
EMB21	Amber Glass Bottle - Unpreserve	18-Apr-2022	28-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
EMB22	Amber Glass Bottle - Unpreserve	18-Apr-2022	28-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
EMB23	Amber Glass Bottle - Unpreserve	18-Apr-2022	28-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
QA06	Amber Glass Bottle - Unpreserve	18-Apr-2022	28-May-2022	14-Apr-2022	✓	19-Apr-2022	✗

Requested Deliverables

ACCOUNTS INVOICES

- A4 - AU Tax Invoice (INV)	Email	accounts.payable@smec.com

ESDAT REPORTS

- *AU Certificate of Analysis - NATA (COA)	Email	smec@esdat.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	smec@esdat.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	smec@esdat.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	smec@esdat.com.au
- Chain of Custody (CoC) (COC)	Email	smec@esdat.com.au
- EDI Format - ENMRG (ENMRG)	Email	smec@esdat.com.au
- EDI Format - ESDAT (ESDAT)	Email	smec@esdat.com.au

MANUEL FERNANDEZ

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

Pauline Voukidis

- *AU Certificate of Analysis - NATA (COA)	Email	pauline.voukidis@smec.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	pauline.voukidis@smec.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	pauline.voukidis@smec.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	pauline.voukidis@smec.com
- Chain of Custody (CoC) (COC)	Email	pauline.voukidis@smec.com
- EDI Format - ENMRG (ENMRG)	Email	pauline.voukidis@smec.com
- EDI Format - ESDAT (ESDAT)	Email	pauline.voukidis@smec.com

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES2213154**

Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Contact	: Brenda Hong
Address	: Level 5, 20 Berry Street, North Sydney, NSW 2060 North Sydney 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: manuel.fernandez@smec.com	E-mail	: Brenda.Hong@ALSGlobal.com
Telephone	: ----	Telephone	: +61 2 8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 30080099 - Vopak Site Investigation	Page	: 1 of 3
Order number	: 30080099	Quote number	: ES2021SMEAUS0007 (SY/285/21 V2)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: Pauline Voukidis		

Dates

Date Samples Received	: 14-Apr-2022 09:00	Issue Date	: 26-Apr-2022
Client Requested Due Date	: 26-Apr-2022	Scheduled Reporting Date	: **26-Apr-2022**

Delivery Details

Mode of Delivery	: Undefined	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: 16.1' C SYD - Ice present
Receipt Detail	:	No. of samples received / analysed	: 15 / 14
		No. of samples NOT collected	1

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Sample QA06A forwarded to Eurofins.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The laboratory will process these samples unless instructions are received from you indicating you do not wish to proceed. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- Sample TRIP SPIKE SNR was not received due to the following reason: was not received
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Sample Container(s)/Preservation Non-Compliances

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

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

Summary of Sample(s) and Requested Analysis

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

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	(On Hold) WATER No analysis requested	WATER - EK055G Ammonia as N By Discrete Analyser	WATER - EP132-ST Super Trace PAHs	WATER - EP231-LL PFAS - Short Suite Low Level (12 analytes)	WATER - EP231X-SUT PFAS - Super Ultra Trace Waters Long Suite (29	WATER - W-02 8 Metals	WATER - W-04 SG TRH/BTEXN inc Silica Gel Clean Up
ES2213154-001	[11-Apr-2022]	EMB21		✓	✓		✓	✓	✓
ES2213154-002	[11-Apr-2022]	EMB22		✓	✓		✓	✓	✓
ES2213154-003	[11-Apr-2022]	EMB20		✓	✓		✓	✓	✓
ES2213154-004	[11-Apr-2022]	EMB23		✓	✓		✓	✓	✓
ES2213154-005	11-Apr-2022 00:00	QA06		✓	✓		✓	✓	✓
ES2213154-007	11-Apr-2022 00:00	BLANK 05					✓		
ES2213154-008	11-Apr-2022 00:00	MS/LD LAB	✓						
ES2213154-010	04-Apr-2022 00:00	TRIP BLANK				✓			
ES2213154-013	[12-Apr-2022]	EMB17		✓	✓		✓	✓	✓
ES2213154-014	[12-Apr-2022]	EMB18		✓	✓		✓	✓	✓
ES2213154-015	[12-Apr-2022]	EMB19		✓	✓		✓	✓	✓
ES2213154-016	[12-Apr-2022]	EMB24		✓	✓		✓	✓	✓
ES2213154-017	[12-Apr-2022]	EMB25		✓	✓		✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Sampling date / time	Sample ID	WATER - EP080 BTEXN	WATER - W-18 TRH(C6 - C9)/BTEXN
ES2213154-011	04-Apr-2022 00:00	TRIP SPIKE 1	✓	
ES2213154-012	04-Apr-2022 00:00	TRIP BLANK		✓

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

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

Method / Client Sample ID(s)	Container	Due for extraction	Due for analysis	Samples Received		Instructions Received	
				Date	Evaluation	Date	Evaluation

EP071SG: TRH - Total Recoverable Hydrocarbons - Silica Gel Cleanup							
EMB20	Amber Glass Bottle - Unpreserve	18-Apr-2022	30-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
EMB21	Amber Glass Bottle - Unpreserve	18-Apr-2022	30-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
EMB22	Amber Glass Bottle - Unpreserve	18-Apr-2022	30-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
EMB23	Amber Glass Bottle - Unpreserve	18-Apr-2022	30-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
QA06	Amber Glass Bottle - Unpreserve	18-Apr-2022	30-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
EP080: TRH Volatiles/BTEX							
TRIP BLANK	Amber VOC Vial - Sulfuric Acid	18-Apr-2022	18-Apr-2022	14-Apr-2022	✓	19-Apr-2022	✗
TRIP SPIKE 1	Amber VOC Vial - Sulfuric Acid	18-Apr-2022	18-Apr-2022	14-Apr-2022	✓	19-Apr-2022	✗
EP132-ST: PAH Compounds in Water							
EMB20	Amber Glass Bottle - Unpreserve	18-Apr-2022	30-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
EMB21	Amber Glass Bottle - Unpreserve	18-Apr-2022	30-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
EMB22	Amber Glass Bottle - Unpreserve	18-Apr-2022	30-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
EMB23	Amber Glass Bottle - Unpreserve	18-Apr-2022	30-May-2022	14-Apr-2022	✓	19-Apr-2022	✗
QA06	Amber Glass Bottle - Unpreserve	18-Apr-2022	30-May-2022	14-Apr-2022	✓	19-Apr-2022	✗

Requested Deliverables

ACCOUNTS INVOICES

- A4 - AU Tax Invoice (INV)	Email	accounts.payable@smec.com

ESDAT REPORTS

- *AU Certificate of Analysis - NATA (COA)	Email	smec@esdat.com.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	smec@esdat.com.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	smec@esdat.com.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	smec@esdat.com.au
- Chain of Custody (CoC) (COC)	Email	smec@esdat.com.au
- EDI Format - ENMRG (ENMRG)	Email	smec@esdat.com.au
- EDI Format - ESDAT (ESDAT)	Email	smec@esdat.com.au

MANUEL FERNANDEZ

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

Pauline Voukidis

- *AU Certificate of Analysis - NATA (COA)	Email	pauline.voukidis@smec.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	pauline.voukidis@smec.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	pauline.voukidis@smec.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	pauline.voukidis@smec.com
- Chain of Custody (CoC) (COC)	Email	pauline.voukidis@smec.com
- EDI Format - ENMRG (ENMRG)	Email	pauline.voukidis@smec.com
- EDI Format - ESDAT (ESDAT)	Email	pauline.voukidis@smec.com

QUALITY CONTROL REPORT

Work Order	: **ES2213154**	Page	: 1 of 11
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Contact	: Brenda Hong
Address	: Level 5, 20 Berry Street, North Sydney, NSW 2060 North Sydney 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 30080099 - Vopak Site Investigation	Date Samples Received	: 14-Apr-2022
Order number	: 30080099	Date Analysis Commenced	: 20-Apr-2022
C-O-C number	: ----	Issue Date	: 28-Apr-2022
Sampler	: Pauline Voukidis		
Site	: ----		
Quote number	: SY/285/21 V2		
No. of samples received	: 16		
No. of samples analysed	: 14		

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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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.

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4295794)									
ES2212961-001	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.003	0.003	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.003	0.003	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.020	0.020	0.0	No Limit
ES2212961-011	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0010	<0.0010	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.010	<0.010	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.010	<0.010	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.010	<0.010	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.010	<0.010	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.010	<0.010	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.050	<0.050	0.0	No Limit
EG020F: Dissolved Metals by ICP-MS (QC Lot: 4295797)									
ES2213154-016	EMB24	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.1 µg/L	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<1 µg/L	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<1 µg/L	<0.001	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	1 µg/L	0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<1 µg/L	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	2 µg/L	0.002	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	8 µg/L	0.008	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 4295796)									
ES2212961-004	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EG035F: Dissolved Mercury by FIMS (QC Lot: 4295796) - continued									
ES2212961-013	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 4298400)									
ES2213052-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.03	0.04	0.0	No Limit
ES2213052-010	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.51	0.53	3.8	0% - 20%
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 4298402)									
ES2213154-003	EMB20	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	6850 µg/L	6.90	0.7	0% - 20%
ES2213207-002	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	7.10	7.20	1.4	0% - 20%
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 4294196)									
ES2213154-001	EMB21	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
ES2213154-016	EMB24	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 4294196)									
ES2213154-001	EMB21	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
ES2213154-016	EMB24	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.0	No Limit
EP080: BTEXN (QC Lot: 4294196)									
ES2213154-001	EMB21	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
ES2213154-016	EMB24	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4300187)									
EP2204562-005	Anonymous	EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	<0.0002	<0.0002	0.0	No Limit
		EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 4300187) - continued									
EP2204562-005	Anonymous	EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 4300187)									
EP2204562-005	Anonymous	EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.0020	<0.0020	0.0	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 4300187)									
EP2204562-005	Anonymous	EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	<0.0005	0.0	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 4300187)									
EP2204562-005	Anonymous	EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	<0.001	0.0	No Limit
		EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	<0.001	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EP231P: PFAS Sums (QC Lot: 4300187)									
EP2204562-005	Anonymous	EP231X-SUT: Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L	<0.0002	<0.0002	0.0	No Limit
		EP231X-SUT: Sum of PFAS (WA DER List)	----	0.0002	µg/L	<0.0002	<0.0002	0.0	No Limit
		EP231X-SUT: Sum of PFAS	----	0.0002	µg/L	<0.0002	<0.0002	0.0	No Limit

Method Blank (MB) and Laboratory Control Sample (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 Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4295794)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	93.6	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	96.1	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	95.8	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	93.9	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	91.8	83.0	111
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	94.0	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	93.4	81.0	117
EG020F: Dissolved Metals by ICP-MS (QCLot: 4295797)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	98.2	85.0	114
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	95.9	84.0	110
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	93.9	85.0	111
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	95.2	81.0	111
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	93.3	83.0	111
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	95.6	82.0	112
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	97.2	81.0	117
EG035F: Dissolved Mercury by FIMS (QCLot: 4295796)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	89.5	83.0	105
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4298400)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	102	90.0	114
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4298402)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	1 mg/L	100	90.0	114
EP071 SG: Total Petroleum Hydrocarbons - Silica gel cleanup (QCLot: 4293250)								
EP071SG: C10 - C14 Fraction	----	50	µg/L	<50	400 µg/L	74.6	55.8	112
EP071SG: C15 - C28 Fraction	----	100	µg/L	<100	600 µg/L	88.4	71.6	113
EP071SG: C29 - C36 Fraction	----	50	µg/L	<50	400 µg/L	80.0	56.0	121
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup (QCLot: 4293250)								
EP071SG: >C10 - C16 Fraction	----	100	µg/L	<100	500 µg/L	71.6	57.9	119
EP071SG: >C16 - C34 Fraction	----	100	µg/L	<100	700 µg/L	80.6	62.5	110
EP071SG: >C34 - C40 Fraction	----	100	µg/L	<100	300 µg/L	75.4	61.5	121
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4294196)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	260 µg/L	101	75.0	127
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4294196)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	310 µg/L	104	75.0	127

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP080: BTEXN (QCLot: 4294196)								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	109	70.0	122
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	101	69.0	123
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	103	70.0	120
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	10 µg/L	103	69.0	121
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	106	72.0	122
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	104	70.0	120
EP132B: Polynuclear Aromatic Hydrocarbons (super trace) (QCLot: 4296295)								
EP132-ST: Acenaphthene	83-32-9	0.002	µg/L	<0.002	0.01 µg/L	104	70.0	130
EP132-ST: Acenaphthylene	208-96-8	0.002	µg/L	<0.002	0.01 µg/L	109	70.0	130
EP132-ST: Anthracene	120-12-7	0.001	µg/L	<0.001	0.01 µg/L	107	70.0	130
EP132-ST: Benz(a)anthracene	56-55-3	0.002	µg/L	<0.002	0.01 µg/L	119	70.0	130
EP132-ST: Benzo(a)pyrene	50-32-8	0.001	µg/L	<0.001	0.01 µg/L	113	70.0	130
EP132-ST: Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.004	µg/L	<0.004	0.01 µg/L	95.7	70.0	130
EP132-ST: Benzo(e)pyrene	192-97-2	0.001	µg/L	<0.001	0.01 µg/L	92.5	70.0	130
EP132-ST: Benzo(g.h.i)perylene	191-24-2	0.002	µg/L	<0.002	0.01 µg/L	105	70.0	130
EP132-ST: Benzo(k)fluoranthene	207-08-9	0.004	µg/L	<0.004	0.01 µg/L	119	70.0	130
EP132-ST: Chrysene	218-01-9	0.001	µg/L	<0.001	0.01 µg/L	107	70.0	130
EP132-ST: Coronene	191-07-1	0.002	µg/L	<0.002	0.01 µg/L	99.2	70.0	130
EP132-ST: Dibenz(a.h)anthracene	53-70-3	0.001	µg/L	<0.001	0.01 µg/L	96.7	70.0	130
EP132-ST: 7.12-Dimethylbenz(a)anthracene	57-97-6	0.002	µg/L	<0.002	0.01 µg/L	107	70.0	130
EP132-ST: Fluoranthene	206-44-0	0.001	µg/L	<0.001	0.01 µg/L	107	70.0	130
EP132-ST: Fluorene	86-73-7	0.002	µg/L	<0.002	0.01 µg/L	102	70.0	130
EP132-ST: Indeno(1.2.3.cd)pyrene	193-39-5	0.002	µg/L	<0.002	0.01 µg/L	103	70.0	130
EP132-ST: 3-Methylcholanthrene	56-49-5	0.004	µg/L	<0.004	0.01 µg/L	98.0	70.0	130
EP132-ST: 2-Methylnaphthalene	91-57-6	0.002	µg/L	<0.002	0.01 µg/L	103	70.0	130
EP132-ST: Naphthalene	91-20-3	0.004	µg/L	<0.004	0.01 µg/L	124	70.0	130
EP132-ST: Phenanthrene	85-01-8	0.002	µg/L	<0.002	0.01 µg/L	110	70.0	130
EP132-ST: Perylene	198-55-0	0.002	µg/L	<0.002	0.01 µg/L	97.7	70.0	130
EP132-ST: Pyrene	129-00-0	0.001	µg/L	<0.001	0.01 µg/L	110	70.0	130
EP132-ST: Sum of 16 US EPA Priority PAHs	----	0.001	µg/L	<0.001	----	----	----	----
EP132-ST: Benzo(a)pyrene TEQ (zero)	----	0.001	µg/L	<0.001	----	----	----	----
EP132-ST: Benzo(a)pyrene TEQ (half LOR)	----	0.001	µg/L	<0.001	----	----	----	----
EP132-ST: Benzo(a)pyrene TEQ (LOR)	----	0.001	µg/L	<0.001	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4300187)								
EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	0.004 µg/L	108	72.0	130
EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	0.004 µg/L	98.8	71.0	127
EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	0.004 µg/L	104	68.0	131

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4300187) - continued								
EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	0.004 µg/L	104	69.0	134
EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	<0.0002	0.004 µg/L	101	65.0	140
EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	0.004 µg/L	92.4	53.0	142
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4303986)								
EP231X-LL: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	<0.002	0.025 µg/L	99.2	72.0	130
EP231X-LL: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	<0.002	0.025 µg/L	106	68.0	131
EP231X-LL: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	<0.002	0.025 µg/L	102	65.0	140
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4300187)								
EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.002	µg/L	<0.0020	0.02 µg/L	83.6	73.0	129
EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	0.004 µg/L	100	72.0	129
EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	0.004 µg/L	123	72.0	129
EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	0.004 µg/L	100	72.0	130
EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	0.004 µg/L	100	71.0	133
EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	0.004 µg/L	112	69.0	130
EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	0.004 µg/L	122	71.0	129
EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	0.004 µg/L	101	69.0	133
EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	0.004 µg/L	109	72.0	134
EP231X-SUT: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	0.004 µg/L	90.4	65.0	144
EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	0.01 µg/L	84.6	71.0	132
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4303986)								
EP231X-LL: Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	<0.01	0.125 µg/L	84.8	73.0	129
EP231X-LL: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	<0.002	0.025 µg/L	116	72.0	129
EP231X-LL: Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	<0.002	0.025 µg/L	114	72.0	129
EP231X-LL: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	<0.002	0.025 µg/L	105	72.0	130
EP231X-LL: Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	<0.002	0.025 µg/L	107	71.0	133
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4300187)								
EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	0.004 µg/L	109	67.0	137
EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	0.01 µg/L	110	68.0	141
EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	0.01 µg/L	99.2	56.6	136
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	0.01 µg/L	115	61.9	129
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	0.01 µg/L	81.1	52.8	135
EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	0.004 µg/L	117	65.0	136
EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	0.004 µg/L	92.8	61.0	135

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
				Result	Concentration	LCS	Low	High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4300187)								
EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	0.004 µg/L	107	63.0	143
EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	0.004 µg/L	119	64.0	140
EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	0.004 µg/L	112	67.0	138
EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L	<0.001	0.004 µg/L	112	60.9	136
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4303986)								
EP231X-LL: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	<0.005	0.025 µg/L	95.2	63.0	143
EP231X-LL: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	<0.005	0.025 µg/L	105	64.0	140
EP231X-LL: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	<0.005	0.025 µg/L	123	67.0	138
EP231X-LL: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	<0.005	0.025 µg/L	85.6	75.2	137
EP231P: PFAS Sums (QCLot: 4300187)								
EP231X-SUT: Sum of PFHxS and PFOS	355-46-4/17 63-23-1	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS (WA DER List)	----	0.0002	µg/L	<0.0002	----	----	----	----
EP231X-SUT: Sum of PFAS	----	0.0002	µg/L	<0.0002	----	----	----	----

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: **WATER**

Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
				Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 4295794)							
ES2212961-002	Anonymous	EG020A-F: Arsenic	7440-38-2	1 mg/L	95.3	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	95.3	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	93.3	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	98.7	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	110	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	96.7	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	96.5	70.0	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 4295797)							
ES2213154-017	EMB25	EG020A-F: Arsenic	7440-38-2	1 mg/L	94.4	70.0	130
		EG020A-F: Cadmium	7440-43-9	0.25 mg/L	95.6	70.0	130
		EG020A-F: Chromium	7440-47-3	1 mg/L	93.9	70.0	130
		EG020A-F: Copper	7440-50-8	1 mg/L	97.2	70.0	130
		EG020A-F: Lead	7439-92-1	1 mg/L	111	70.0	130
		EG020A-F: Nickel	7440-02-0	1 mg/L	95.5	70.0	130
		EG020A-F: Zinc	7440-66-6	1 mg/L	96.4	70.0	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG035F: Dissolved Mercury by FIMS (QCLot: 4295796)							
ES2212961-003	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	76.3	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4298400)							
ES2213052-001	Anonymous	EK055G: Ammonia as N	7664-41-7	1 mg/L	101	70.0	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 4298402)							
ES2213154-003	EMB20	EK055G: Ammonia as N	7664-41-7	1 mg/L	# Not Determined	70.0	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 4294196)							
ES2213154-001	EMB21	EP080: C6 - C9 Fraction	----	325 µg/L	104	70.0	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 4294196)							
ES2213154-001	EMB21	EP080: C6 - C10 Fraction	C6_C10	375 µg/L	103	70.0	130
EP080: BTEXN (QCLot: 4294196)							
ES2213154-001	EMB21	EP080: Benzene	71-43-2	25 µg/L	114	70.0	130
		EP080: Toluene	108-88-3	25 µg/L	102	70.0	130
		EP080: Ethylbenzene	100-41-4	25 µg/L	105	70.0	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	25 µg/L	100	70.0	130
		EP080: ortho-Xylene	95-47-6	25 µg/L	105	70.0	130
		EP080: Naphthalene	91-20-3	25 µg/L	96.6	70.0	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 4300187)							
EP2204562-005	Anonymous	EP231X-SUT: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.004 µg/L	114	72.0	130
		EP231X-SUT: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.004 µg/L	93.2	71.0	127
		EP231X-SUT: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.004 µg/L	106	68.0	131
		EP231X-SUT: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.004 µg/L	94.4	69.0	134
		EP231X-SUT: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.004 µg/L	90.0	65.0	140
		EP231X-SUT: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.004 µg/L	124	53.0	142
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 4300187)							
EP2204562-005	Anonymous	EP231X-SUT: Perfluorobutanoic acid (PFBA)	375-22-4	0.02 µg/L	87.6	73.0	129
		EP231X-SUT: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.004 µg/L	128	72.0	129
		EP231X-SUT: Perfluorohexanoic acid (PFHxA)	307-24-4	0.004 µg/L	127	72.0	129
		EP231X-SUT: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.004 µg/L	101	72.0	130
		EP231X-SUT: Perfluorooctanoic acid (PFOA)	335-67-1	0.004 µg/L	105	71.0	133
		EP231X-SUT: Perfluorononanoic acid (PFNA)	375-95-1	0.004 µg/L	114	69.0	130
		EP231X-SUT: Perfluorodecanoic acid (PFDA)	335-76-2	0.004 µg/L	118	71.0	129
		EP231X-SUT: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.004 µg/L	112	69.0	133
		EP231X-SUT: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.004 µg/L	92.8	72.0	134
		EP231X-SUT: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.004 µg/L	126	65.0	144
		EP231X-SUT: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.01 µg/L	93.4	71.0	132

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Acceptable Limits (%)	
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 4300187)							
EP2204562-005	Anonymous	EP231X-SUT: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.004 µg/L	113	67.0	137
		EP231X-SUT: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.01 µg/L	113	68.0	141
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.01 µg/L	92.5	56.6	136
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.01 µg/L	112	61.9	129
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.01 µg/L	97.9	52.8	135
		EP231X-SUT: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.004 µg/L	114	65.0	136
		EP231X-SUT: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.004 µg/L	106	61.0	135
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 4300187)							
EP2204562-005	Anonymous	EP231X-SUT: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.004 µg/L	102	63.0	143
		EP231X-SUT: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.004 µg/L	93.6	64.0	140
		EP231X-SUT: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.004 µg/L	121	67.0	138
		EP231X-SUT: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.004 µg/L	111	60.9	136

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES2213154**	Page	: 1 of 11
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Telephone	: +61 2 8784 8555
Project	: 30080099 - Vopak Site Investigation	Date Samples Received	: 14-Apr-2022
Site	: ----	Issue Date	: 28-Apr-2022
Sampler	: Pauline Voukidis	No. of samples received	: 16
Order number	: 30080099	No. of samples analysed	: 14

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

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: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EK055G: Ammonia as N by Discrete Analyser	ES2213154--003	EMB20	**Ammonia as N**	7664-41-7	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EP071 SG: Total Petroleum Hydrocarbons - Silica gel cleanup						
Amber Glass Bottle - Unpreserved EMB21, EMB22, EMB20, EMB23, QA06	20-Apr-2022	18-Apr-2022	**2**	----	----	----
Amber Glass Bottle - Unpreserved EMB17, EMB18, EMB19, EMB24, EMB25	20-Apr-2022	19-Apr-2022	**1**	----	----	----
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup						
Amber Glass Bottle - Unpreserved EMB21, EMB22, EMB20, EMB23, QA06	20-Apr-2022	18-Apr-2022	**2**	----	----	----
Amber Glass Bottle - Unpreserved EMB17, EMB18, EMB19, EMB24, EMB25	20-Apr-2022	19-Apr-2022	**1**	----	----	----
EP080/071: Total Petroleum Hydrocarbons						
Amber VOC Vial - Sulfuric Acid TRIP BLANK	20-Apr-2022	18-Apr-2022	**2**	20-Apr-2022	18-Apr-2022	**2**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions						
Amber VOC Vial - Sulfuric Acid TRIP BLANK	20-Apr-2022	18-Apr-2022	**2**	20-Apr-2022	18-Apr-2022	**2**
EP080: BTEXN						
Amber VOC Vial - Sulfuric Acid TRIP SPIKE 1, TRIP BLANK	20-Apr-2022	18-Apr-2022	**2**	20-Apr-2022	18-Apr-2022	**2**
EP132B: Polynuclear Aromatic Hydrocarbons						

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Days overdue	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Days overdue
EP132B: Polynuclear Aromatic Hydrocarbons - Analysis Holding Time Compliance						
Amber Glass Bottle - Unpreserved EMB21, EMB22, EMB20, EMB23, QA06	20-Apr-2022	18-Apr-2022	**2**	----	----	----
Amber Glass Bottle - Unpreserved EMB17, EMB18, EMB19, EMB24, EMB25	20-Apr-2022	19-Apr-2022	**1**	----	----	----
EP132B: Polynuclear Aromatic Hydrocarbons (super trace)						
Amber Glass Bottle - Unpreserved EMB21, EMB22, EMB20, EMB23, QA06	20-Apr-2022	18-Apr-2022	**2**	----	----	----
Amber Glass Bottle - Unpreserved EMB17, EMB18, EMB19, EMB24, EMB25	20-Apr-2022	19-Apr-2022	**1**	----	----	----

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count: QC	Count: Regular	Rate (%): Actual	Rate (%): Expected	Quality Control Specification
Laboratory Duplicates (DUP)					
PAH Compounds in Water	0	10	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	0	1	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	1	17	5.88	10.00	NEPM 2013 B3 & ALS QC Standard
TRH - Total Recoverable Hydrocarbons - Silica Gel Cleanup	0	10	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
PAH Compounds in Water	0	10	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	0	1	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
TRH - Total Recoverable Hydrocarbons - Silica Gel Cleanup	0	10	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: **WATER** Evaluation: × = Holding time breach ; ✓ = Within holding time.

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
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)							
EMB21, EMB22, EMB20, EMB23, QA06	**11-Apr-2022**	**----**	----	----	**21-Apr-2022**	08-Oct-2022	✓
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)							
EMB17, EMB18, EMB19, EMB24, EMB25	**12-Apr-2022**	**----**	----	----	**21-Apr-2022**	09-Oct-2022	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F)							
EMB21, EMB22, EMB20, EMB23, QA06	**11-Apr-2022**	**----**	----	----	**21-Apr-2022**	09-May-2022	✓
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F)							
EMB17, EMB18, EMB19, EMB24, EMB25	**12-Apr-2022**	**----**	----	----	**21-Apr-2022**	10-May-2022	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
EMB21, EMB22, EMB20, EMB23, QA06	**11-Apr-2022**	**----**	----	----	**22-Apr-2022**	09-May-2022	✓
Clear Plastic Bottle - Sulfuric Acid (EK055G)							
EMB17, EMB18, EMB19, EMB24, EMB25	**12-Apr-2022**	**----**	----	----	**22-Apr-2022**	10-May-2022	✓
EP071 SG: Total Petroleum Hydrocarbons - Silica gel cleanup							
Amber Glass Bottle - Unpreserved (EP071SG)							
EMB21, EMB22, EMB20, EMB23, QA06	**11-Apr-2022**	**20-Apr-2022**	18-Apr-2022	×	**22-Apr-2022**	30-May-2022	✓
Amber Glass Bottle - Unpreserved (EP071SG)							
EMB17, EMB18, EMB19, EMB24, EMB25	**12-Apr-2022**	**20-Apr-2022**	19-Apr-2022	×	**22-Apr-2022**	30-May-2022	✓

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
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup							
Amber Glass Bottle - Unpreserved (EP071SG) EMB21, EMB22, EMB20, EMB23, QA06	**11-Apr-2022**	**20-Apr-2022**	18-Apr-2022	×	**22-Apr-2022**	30-May-2022	✓
Amber Glass Bottle - Unpreserved (EP071SG) EMB17, EMB18, EMB19, EMB24, EMB25	**12-Apr-2022**	**20-Apr-2022**	19-Apr-2022	×	**22-Apr-2022**	30-May-2022	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber VOC Vial - Sulfuric Acid (EP080) TRIP BLANK	**04-Apr-2022**	**20-Apr-2022**	18-Apr-2022	×	**20-Apr-2022**	18-Apr-2022	×
Amber VOC Vial - Sulfuric Acid (EP080) EMB21, EMB22, EMB20, EMB23, QA06	**11-Apr-2022**	**20-Apr-2022**	25-Apr-2022	✓	**20-Apr-2022**	25-Apr-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080) EMB17, EMB18, EMB19, EMB24, EMB25	**12-Apr-2022**	**20-Apr-2022**	26-Apr-2022	✓	**20-Apr-2022**	26-Apr-2022	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Amber VOC Vial - Sulfuric Acid (EP080) TRIP BLANK	**04-Apr-2022**	**20-Apr-2022**	18-Apr-2022	×	**20-Apr-2022**	18-Apr-2022	×
Amber VOC Vial - Sulfuric Acid (EP080) EMB21, EMB22, EMB20, EMB23, QA06	**11-Apr-2022**	**20-Apr-2022**	25-Apr-2022	✓	**20-Apr-2022**	25-Apr-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080) EMB17, EMB18, EMB19, EMB24, EMB25	**12-Apr-2022**	**20-Apr-2022**	26-Apr-2022	✓	**20-Apr-2022**	26-Apr-2022	✓
EP080: BTEXN							
Amber VOC Vial - Sulfuric Acid (EP080) TRIP SPIKE 1, TRIP BLANK	**04-Apr-2022**	**20-Apr-2022**	18-Apr-2022	×	**20-Apr-2022**	18-Apr-2022	×
Amber VOC Vial - Sulfuric Acid (EP080) EMB21, EMB22, EMB20, EMB23, QA06	**11-Apr-2022**	**20-Apr-2022**	25-Apr-2022	✓	**20-Apr-2022**	25-Apr-2022	✓
Amber VOC Vial - Sulfuric Acid (EP080) EMB17, EMB18, EMB19, EMB24, EMB25	**12-Apr-2022**	**20-Apr-2022**	26-Apr-2022	✓	**20-Apr-2022**	26-Apr-2022	✓

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
EP132B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP132-ST)							
EMB21, EMB22, EMB20, EMB23, QA06	**11-Apr-2022**	**20-Apr-2022**	18-Apr-2022	×	**22-Apr-2022**	30-May-2022	✓
Amber Glass Bottle - Unpreserved (EP132-ST)							
EMB17, EMB18, EMB19, EMB24, EMB25	**12-Apr-2022**	**20-Apr-2022**	19-Apr-2022	×	**22-Apr-2022**	30-May-2022	✓
EP132B: Polynuclear Aromatic Hydrocarbons (super trace)							
Amber Glass Bottle - Unpreserved (EP132-ST)							
EMB21, EMB22, EMB20, EMB23, QA06	**11-Apr-2022**	**20-Apr-2022**	18-Apr-2022	×	**22-Apr-2022**	30-May-2022	✓
Amber Glass Bottle - Unpreserved (EP132-ST)							
EMB17, EMB18, EMB19, EMB24, EMB25	**12-Apr-2022**	**20-Apr-2022**	19-Apr-2022	×	**22-Apr-2022**	30-May-2022	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL)							
TRIP BLANK	**04-Apr-2022**	**27-Apr-2022**	01-Oct-2022	✓	**27-Apr-2022**	01-Oct-2022	✓
HDPE (no PTFE) (EP231X-SUT)							
EMB21, EMB22, EMB20, EMB23, QA06, BLANK 05	**11-Apr-2022**	**22-Apr-2022**	08-Oct-2022	✓	**22-Apr-2022**	08-Oct-2022	✓
HDPE (no PTFE) (EP231X-SUT)							
EMB17, EMB18, EMB19, EMB24, EMB25	**12-Apr-2022**	**22-Apr-2022**	09-Oct-2022	✓	**22-Apr-2022**	09-Oct-2022	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X-LL)							
TRIP BLANK	**04-Apr-2022**	**27-Apr-2022**	01-Oct-2022	✓	**27-Apr-2022**	01-Oct-2022	✓
HDPE (no PTFE) (EP231X-SUT)							
EMB21, EMB22, EMB20, EMB23, QA06, BLANK 05	**11-Apr-2022**	**22-Apr-2022**	08-Oct-2022	✓	**22-Apr-2022**	08-Oct-2022	✓
HDPE (no PTFE) (EP231X-SUT)							
EMB17, EMB18, EMB19, EMB24, EMB25	**12-Apr-2022**	**22-Apr-2022**	09-Oct-2022	✓	**22-Apr-2022**	09-Oct-2022	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X-SUT) EMB21, EMB22, EMB20, EMB23, QA06, BLANK 05	**11-Apr-2022**	**22-Apr-2022**	08-Oct-2022	✓	**22-Apr-2022**	08-Oct-2022	✓
HDPE (no PTFE) (EP231X-SUT) EMB17, EMB18, EMB19, EMB24, EMB25	**12-Apr-2022**	**22-Apr-2022**	09-Oct-2022	✓	**22-Apr-2022**	09-Oct-2022	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X-LL) TRIP BLANK	**04-Apr-2022**	**27-Apr-2022**	01-Oct-2022	✓	**27-Apr-2022**	01-Oct-2022	✓
HDPE (no PTFE) (EP231X-SUT) EMB21, EMB22, EMB20, EMB23, QA06, BLANK 05	**11-Apr-2022**	**22-Apr-2022**	08-Oct-2022	✓	**22-Apr-2022**	08-Oct-2022	✓
HDPE (no PTFE) (EP231X-SUT) EMB17, EMB18, EMB19, EMB24, EMB25	**12-Apr-2022**	**22-Apr-2022**	09-Oct-2022	✓	**22-Apr-2022**	09-Oct-2022	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X-LL) TRIP BLANK	**04-Apr-2022**	**27-Apr-2022**	01-Oct-2022	✓	**27-Apr-2022**	01-Oct-2022	✓
HDPE (no PTFE) (EP231X-SUT) EMB21, EMB22, EMB20, EMB23, QA06, BLANK 05	**11-Apr-2022**	**22-Apr-2022**	08-Oct-2022	✓	**22-Apr-2022**	08-Oct-2022	✓
HDPE (no PTFE) (EP231X-SUT) EMB17, EMB18, EMB19, EMB24, EMB25	**12-Apr-2022**	**22-Apr-2022**	09-Oct-2022	✓	**22-Apr-2022**	09-Oct-2022	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Ammonia as N by Discrete analyser	EK055G	4	39	**10.26**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	3	22	**13.64**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH Compounds in Water	EP132-ST	0	10	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	0	1	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	17	**5.88**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH - Total Recoverable Hydrocarbons - Silica Gel Cleanup	EP071SG	0	10	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Ammonia as N by Discrete analyser	EK055G	2	39	**5.13**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH Compounds in Water	EP132-ST	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Total Recoverable Hydrocarbons - Silica Gel Cleanup	EP071SG	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	2	39	**5.13**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH Compounds in Water	EP132-ST	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	1	1	**100.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Total Recoverable Hydrocarbons - Silica Gel Cleanup	EP071SG	1	10	**10.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	2	39	**5.13**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Mercury by FIMS	EG035F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH Compounds in Water	EP132-ST	0	10	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	0	1	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Matrix Spikes (MS) - Continued							
TRH - Total Recoverable Hydrocarbons - Silica Gel Cleanup	EP071SG	0	10	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM Schedule B(3).
Ammonia as N by Discrete analyser	EK055G	WATER	In house: Referenced to APHA 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM Schedule B(3)
TRH - Total Recoverable Hydrocarbons - Silica Gel Cleanup	EP071SG	WATER	In house: Referenced to USEPA SW 846 - 8015 Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C36. This method is compliant with NEPM Schedule B(3).
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260 Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM Schedule B(3)
PAH Compounds in Water	EP132-ST	WATER	In house, Samples are extracted into solvent in original containers. Determination by large volume injection GCMS in selected ion monitoring (SIM) mode.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.
Per- and Polyfluoroalkyl Substances (PFAS by LCMSMS	EP231X-LL	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is concentrated, combined with an equal volume of reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Analytical Methods	Method	Matrix	Method Descriptions
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X-SUT	WATER	In-house: Analysis of fresh and saline waters by Solid Phase Extraction (SPE) followed by LC-Electrospray-MS-MS, Negative Mode using MRM and internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is concentrated, combined with an equal volume of reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.3, table B-15 requirements.

Preparation Methods	Method	Matrix	Method Descriptions
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Liquid Liquid Extraction (in-bottle - trace) -	ORG14-IB-ST	WATER	In house: A 50 mL of representative portion of a 500 mL sample is discarded. A portion of solvent (less dense than water) is used to extract the sample (horizontal shaker for 30 minutes) and a portion of the extract analysed directly.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for purging.
Solid Phase Extraction (SPE) for PFAS in water	ORG72	WATER	In-house: Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to the sample container. The entire contents are transferred to a solid phase extraction (SPE) cartridge. The sample container is successively rinsed with aliquots of the elution solvent. The eluted extract is combined with an equal volume of reagent water and a portion is filtered for analysis. Method procedures conform to US DoD QSM 5.3, table B-15 requirements.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2213154**	Page	: 1 of 16
Client	: **SMEC AUSTRALIA PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MANUEL FERNANDEZ	Contact	: Brenda Hong
Address	: Level 5, 20 Berry Street, North Sydney, NSW 2060 North Sydney 2060	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61 2 8784 8555
Project	: 30080099 - Vopak Site Investigation	Date Samples Received	: 14-Apr-2022 09:00
Order number	: 30080099	Date Analysis Commenced	: 20-Apr-2022
C-O-C number	: ----	Issue Date	: 28-Apr-2022 09:36
Sampler	: Pauline Voukidis		
Site	: ----		
Quote number	: SY/285/21 V2		
No. of samples received	: 16		
No. of samples analysed	: 14		

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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Senior Chemist - Inorganics	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Franco Lentini	LCMS Coordinator	Sydney Organics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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 - Per- and Polyfluoroalkyl Substances (PFAS): Samples received in 20ml or 125ml bottles have been tested in accordance with the QSM5.3 compliant, NATA accredited method. 60mL or 250mL bottles have been tested to the legacy QSM 5.1 aligned, NATA accredited method.
- EP080: Where reported, Total Xylenes is the sum of the reported concentrations of m&p-Xylene and o-Xylene at or above the LOR.
- EP080: Sample TRIP SPIKE contains volatile compounds spiked into the sample containers prior to dispatch from the laboratory. BTEXN compounds spiked at 20 ug/L.
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. 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. These practices are in line with recommendations in the National Environmental Management Plan for PFAS (Australian HEPA) and also conform to QSM 5.3 (US DoD) requirements.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB21	EMB22	EMB20	EMB23	QA06
				Sampling date / time	[11-Apr-2022]	[11-Apr-2022]	[11-Apr-2022]	[11-Apr-2022]	11-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2213154-001	ES2213154-002	ES2213154-003	ES2213154-004	ES2213154-005
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	1	µg/L		<1	<1	**12**	<1	<1
Cadmium	7440-43-9	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	1	µg/L		<1	<1	<1	<1	<1
Copper	7440-50-8	1	µg/L		**5**	<1	<1	<1	**4**
Nickel	7440-02-0	1	µg/L		**3**	<1	<1	<1	**3**
Lead	7439-92-1	1	µg/L		**3**	<1	<1	<1	**3**
Zinc	7440-66-6	5	µg/L		**22**	<5	<5	**7**	**22**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	10	µg/L		<10	**50**	**6850**	**30**	**100**
EP071 SG: Total Petroleum Hydrocarbons - Silica gel cleanup									
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	<50	<50	<50	<50
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup									
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	<100	<100	<100
>C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L		<100	<100	<100	<100	<100
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	<20
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	<2

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB21	EMB22	EMB20	EMB23	QA06
				Sampling date / time	[11-Apr-2022]	[11-Apr-2022]	[11-Apr-2022]	[11-Apr-2022]	11-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2213154-001	ES2213154-002	ES2213154-003	ES2213154-004	ES2213154-005
					Result	Result	Result	Result	Result
EP080: BTEXN - Continued									
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	<2
^ Total Xylenes	----	2	µg/L		<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L		<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5
EP132B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.004	µg/L		<0.004	**0.005**	**0.011**	**0.004**	<0.004
2-Methylnaphthalene	91-57-6	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	<0.002
Acenaphthylene	208-96-8	0.002	µg/L		**0.005**	<0.002	<0.002	<0.002	<0.002
Acenaphthene	83-32-9	0.002	µg/L		<0.002	<0.002	**0.003**	<0.002	<0.002
Fluorene	86-73-7	0.002	µg/L		**0.005**	**0.005**	**0.005**	**0.003**	**0.008**
Phenanthrene	85-01-8	0.002	µg/L		**0.008**	**0.010**	**0.011**	**0.009**	**0.013**
Anthracene	120-12-7	0.001	µg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Fluoranthene	206-44-0	0.001	µg/L		**0.004**	**0.005**	**0.006**	**0.009**	**0.004**
Pyrene	129-00-0	0.001	µg/L		**0.005**	**0.005**	**0.005**	**0.009**	**0.004**
Benz(a)anthracene	56-55-3	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	<0.002
Chrysene	218-01-9	0.001	µg/L		<0.001	<0.001	<0.001	<0.001	<0.001
7.12-Dimethylbenz(a)anthracene	57-97-6	0.001	µg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.004	µg/L		<0.004	<0.004	<0.004	<0.004	<0.004
Benzo(k)fluoranthene	207-08-9	0.004	µg/L		<0.004	<0.004	<0.004	<0.004	<0.004
Benzo(e)pyrene	192-97-2	0.001	µg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Benzo(a)pyrene	50-32-8	0.001	µg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Perylene	198-55-0	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	<0.002
3-Methylcholanthrene	56-49-5	0.004	µg/L		<0.004	<0.004	<0.004	<0.004	<0.004
Indeno(1.2.3.cd)pyrene	193-39-5	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	<0.002
Dibenz(a.h)anthracene	53-70-3	0.001	µg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Benzo(g.h.i)perylene	191-24-2	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	<0.002
Coronene	191-07-1	0.002	µg/L		<0.002	<0.002	<0.002	<0.002	<0.002
^ Sum of 16 US EPA Priority PAHs	----	0.001	µg/L		**0.027**	**0.030**	**0.041**	**0.034**	**0.029**
^ Benzo(a)pyrene TEQ (zero)	----	0.001	µg/L		<0.001	<0.001	<0.001	<0.001	<0.001
^ Benzo(a)pyrene TEQ (half LOR)	----	0.001	µg/L		<0.001	<0.001	<0.001	<0.001	<0.001
^ Benzo(a)pyrene TEQ (LOR)	----	0.001	µg/L		<0.001	<0.001	<0.001	<0.001	<0.001
EP132B: Polynuclear Aromatic Hydrocarbons (super trace)									
^ Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	0.004	µg/L		<0.004	<0.004	<0.004	<0.004	<0.004

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB21	EMB22	EMB20	EMB23	QA06
				Sampling date / time	[11-Apr-2022]	[11-Apr-2022]	[11-Apr-2022]	[11-Apr-2022]	11-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2213154-001	ES2213154-002	ES2213154-003	ES2213154-004	ES2213154-005
					Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L		**0.0007**	<0.0005	**0.0006**	**0.0014**	**0.0008**
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L		**0.0048**	**0.0034**	**0.0027**	**0.0080**	**0.0052**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L		**0.0012**	**0.0052**	**0.0015**	**0.0085**	**0.0013**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.0020	µg/L		**1.86**	**1.65**	**1.33**	**1.96**	**1.97**
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L		**6.27**	**7.49**	**5.36**	**7.11**	**6.24**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L		**2.98**	**2.88**	**1.67**	**3.33**	**3.06**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L		**6.67**	**8.39**	**6.43**	**6.60**	**6.85**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L		**1.03**	**2.18**	**0.305**	**1.71**	**1.04**
Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L		**0.0936**	**0.138**	**0.0442**	**0.218**	**0.0926**
Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L		**0.0212**	**0.0690**	<0.0005	**0.0595**	**0.0187**
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L		<0.0005	**0.0110**	**0.0008**	**0.0073**	<0.0005
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L		<0.0005	**0.0040**	<0.0005	**0.0014**	<0.0005
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L		<0.001	<0.001	<0.001	<0.001	<0.001
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L		<0.001	<0.001	<0.001	<0.001	<0.001

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB21	EMB22	EMB20	EMB23	QA06
				Sampling date / time	[11-Apr-2022]	[11-Apr-2022]	[11-Apr-2022]	[11-Apr-2022]	11-Apr-2022 00:00
Compound	CAS Number	LOR	Unit		ES2213154-001	ES2213154-002	ES2213154-003	ES2213154-004	ES2213154-005
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L		<0.001	<0.001	<0.001	<0.001	<0.001
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L		<0.001	<0.001	<0.001	<0.001	<0.001
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L		**0.018**	**0.034**	**0.022**	**0.040**	**0.020**
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L		**19.9**	**51.2**	**19.3**	**30.1**	**21.0**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L		**2.56**	**7.20**	**0.013**	**9.48**	**2.61**
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L		<0.001	**0.074**	<0.001	**0.037**	<0.001
EP231P: PFAS Sums									
^ Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L		**0.0060**	**0.0086**	**0.0042**	**0.0165**	**0.0065**
^ Sum of PFAS (WA DER List)	----	0.0002	µg/L		**41.3**	**81.0**	**34.4**	**60.3**	**42.8**
^ Sum of PFAS	----	0.0002	µg/L		**41.4**	**81.3**	**34.5**	**60.7**	**42.9**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**121**	**118**	**118**	**124**	**122**
Toluene-D8	2037-26-5	2	%		**106**	**98.6**	**124**	**103**	**112**
4-Bromofluorobenzene	460-00-4	2	%		**99.5**	**99.7**	**116**	**102**	**108**
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	0.002	%		**108**	**106**	**96.4**	**103**	**94.2**
Anthracene-d10	1719-06-8	0.002	%		**114**	**108**	**108**	**94.3**	**108**
4-Terphenyl-d14	1718-51-0	0.002	%		**98.1**	**96.4**	**100**	**97.1**	**81.1**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0005	%		**96.5**	**99.4**	**118**	**106**	**100**
13C8-PFOA	----	0.0005	%		**90.4**	**84.7**	**62.7**	**85.5**	**78.9**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	BLANK 05	TRIP BLANK	TRIP SPIKE 1	TRIP BLANK	EMB17
			Sampling date / time	11-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	[12-Apr-2022]
Compound	CAS Number	LOR	Unit	ES2213154-007	ES2213154-010	ES2213154-011	ES2213154-012	ES2213154-013
				Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	1	µg/L	----	----	----	----	<1
Cadmium	7440-43-9	0.1	µg/L	----	----	----	----	<0.1
Chromium	7440-47-3	1	µg/L	----	----	----	----	<1
Copper	7440-50-8	1	µg/L	----	----	----	----	<1
Nickel	7440-02-0	1	µg/L	----	----	----	----	1
Lead	7439-92-1	1	µg/L	----	----	----	----	<1
Zinc	7440-66-6	5	µg/L	----	----	----	----	<5
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.1	µg/L	----	----	----	----	<0.1
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	10	µg/L	----	----	----	----	60
EP071 SG: Total Petroleum Hydrocarbons - Silica gel cleanup								
C10 - C14 Fraction	----	50	µg/L	----	----	----	----	<50
C15 - C28 Fraction	----	100	µg/L	----	----	----	----	<100
C29 - C36 Fraction	----	50	µg/L	----	----	----	----	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L	----	----	----	----	<50
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup								
>C10 - C16 Fraction	----	100	µg/L	----	----	----	----	<100
>C16 - C34 Fraction	----	100	µg/L	----	----	----	----	<100
>C34 - C40 Fraction	----	100	µg/L	----	----	----	----	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L	----	----	----	----	<100
>C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	----	----	----	----	<100
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	----	----	----	<20	<20
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	----	----	----	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	----	----	----	<20	<20
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	----	----	21	<1	<1
Toluene	108-88-3	2	µg/L	----	----	19	<2	<2
Ethylbenzene	100-41-4	2	µg/L	----	----	19	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	----	----	18	<2	<2

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	BLANK 05	TRIP BLANK	TRIP SPIKE 1	TRIP BLANK	EMB17
			Sampling date / time	11-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	[12-Apr-2022]
Compound	CAS Number	LOR	Unit	ES2213154-007	ES2213154-010	ES2213154-011	ES2213154-012	ES2213154-013
				Result	Result	Result	Result	Result
EP080: BTEXN - Continued								
ortho-Xylene	95-47-6	2	µg/L	----	----	**19**	<2	<2
^ Total Xylenes	----	2	µg/L	----	----	**37**	<2	<2
^ Sum of BTEX	----	1	µg/L	----	----	**96**	<1	<1
Naphthalene	91-20-3	5	µg/L	----	----	**19**	<5	<5
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.004	µg/L	----	----	----	----	<0.004
2-Methylnaphthalene	91-57-6	0.002	µg/L	----	----	----	----	<0.002
Acenaphthylene	208-96-8	0.002	µg/L	----	----	----	----	<0.002
Acenaphthene	83-32-9	0.002	µg/L	----	----	----	----	<0.002
Fluorene	86-73-7	0.002	µg/L	----	----	----	----	**0.005**
Phenanthrene	85-01-8	0.002	µg/L	----	----	----	----	**0.012**
Anthracene	120-12-7	0.001	µg/L	----	----	----	----	<0.001
Fluoranthene	206-44-0	0.001	µg/L	----	----	----	----	**0.005**
Pyrene	129-00-0	0.001	µg/L	----	----	----	----	**0.004**
Benz(a)anthracene	56-55-3	0.002	µg/L	----	----	----	----	<0.002
Chrysene	218-01-9	0.001	µg/L	----	----	----	----	<0.001
7.12-Dimethylbenz(a)anthracene	57-97-6	0.001	µg/L	----	----	----	----	<0.001
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.004	µg/L	----	----	----	----	<0.004
Benzo(k)fluoranthene	207-08-9	0.004	µg/L	----	----	----	----	<0.004
Benzo(e)pyrene	192-97-2	0.001	µg/L	----	----	----	----	<0.001
Benzo(a)pyrene	50-32-8	0.001	µg/L	----	----	----	----	<0.001
Perylene	198-55-0	0.002	µg/L	----	----	----	----	<0.002
3-Methylcholanthrene	56-49-5	0.004	µg/L	----	----	----	----	<0.004
Indeno(1.2.3.cd)pyrene	193-39-5	0.002	µg/L	----	----	----	----	<0.002
Dibenz(a.h)anthracene	53-70-3	0.001	µg/L	----	----	----	----	<0.001
Benzo(g.h.i)perylene	191-24-2	0.002	µg/L	----	----	----	----	<0.002
Coronene	191-07-1	0.002	µg/L	----	----	----	----	<0.002
^ Sum of 16 US EPA Priority PAHs	----	0.001	µg/L	----	----	----	----	**0.026**
^ Benzo(a)pyrene TEQ (zero)	----	0.001	µg/L	----	----	----	----	<0.001
^ Benzo(a)pyrene TEQ (half LOR)	----	0.001	µg/L	----	----	----	----	<0.001
^ Benzo(a)pyrene TEQ (LOR)	----	0.001	µg/L	----	----	----	----	<0.001
EP132B: Polynuclear Aromatic Hydrocarbons (super trace)								
^ Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	0.004	µg/L	----	----	----	----	<0.004

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	BLANK 05	TRIP BLANK	TRIP SPIKE 1	TRIP BLANK	EMB17
			Sampling date / time	11-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	[12-Apr-2022]
Compound	CAS Number	LOR	Unit	ES2213154-007	ES2213154-010	ES2213154-011	ES2213154-012	ES2213154-013
				Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	----	----	----	**0.0011**
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.002	µg/L	----	<0.002	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	----	----	----	<0.0005
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	<0.0005	----	----	----	**0.0034**
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.002	µg/L	----	<0.002	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	----	----	----	<0.0005
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	<0.0002	----	----	----	**0.0031**
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.002	µg/L	----	<0.002	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	----	----	----	<0.0005
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.01	µg/L	----	<0.01	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.002	µg/L	----	<0.002	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.002	µg/L	----	<0.002	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.002	µg/L	----	<0.002	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.002	µg/L	----	<0.002	----	----	----
Perfluorobutanoic acid (PFBA)	375-22-4	0.0020	µg/L	<0.0020	----	----	----	**1.00**
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	<0.0005	----	----	----	**5.57**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	<0.0005	----	----	----	**1.98**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	<0.0005	----	----	----	**6.97**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	<0.0005	----	----	----	**2.33**
Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	<0.0005	----	----	----	**0.149**
Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	<0.0005	----	----	----	**0.0558**
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	----	----	----	**0.0019**
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	----	----	----	<0.0005

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	BLANK 05	TRIP BLANK	TRIP SPIKE 1	TRIP BLANK	EMB17
			Sampling date / time	11-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	[12-Apr-2022]
Compound	CAS Number	LOR	Unit	ES2213154-007	ES2213154-010	ES2213154-011	ES2213154-012	ES2213154-013
				Result	Result	Result	Result	Result
EP231B: Perfluoroalkyl Carboxylic Acids - Continued								
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	----	----	----	<0.0005
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	----	----	----	<0.0005
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	----	----	----	<0.0005
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	----	----	----	<0.001
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	----	----	----	<0.001
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L	<0.001	----	----	----	<0.001
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L	<0.001	----	----	----	<0.001
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L	<0.0005	----	----	----	<0.0005
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L	<0.0005	----	----	----	<0.0005
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.005	µg/L	----	<0.005	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.005	µg/L	----	<0.005	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.005	µg/L	----	<0.005	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.005	µg/L	----	<0.005	----	----	----
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L	<0.001	----	----	----	**0.058**
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L	<0.001	----	----	----	**54.5**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L	<0.001	----	----	----	**7.29**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	BLANK 05	TRIP BLANK	TRIP SPIKE 1	TRIP BLANK	EMB17
				Sampling date / time	11-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	04-Apr-2022 00:00	[12-Apr-2022]
Compound	CAS Number	LOR	Unit		ES2213154-007	ES2213154-010	ES2213154-011	ES2213154-012	ES2213154-013
					Result	Result	Result	Result	Result
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued									
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L		<0.001	----	----	----	<0.001
EP231P: PFAS Sums									
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.002	µg/L		----	<0.002	----	----	----
Sum of PFAS (WA DER List)	----	0.002	µg/L		----	<0.002	----	----	----
^ **Sum of PFHxS and PFOS**	355-46-4/1763-23-1	0.0002	µg/L		<0.0002	----	----	----	**0.0065**
^ **Sum of PFAS (WA DER List)**	----	0.0002	µg/L		<0.0002	----	----	----	**79.6**
^ **Sum of PFAS**	----	0.0002	µg/L		<0.0002	----	----	----	**79.9**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		----	----	**134**	**130**	**125**
Toluene-D8	2037-26-5	2	%		----	----	**113**	**107**	**108**
4-Bromofluorobenzene	460-00-4	2	%		----	----	**113**	**105**	**107**
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	0.002	%		----	----	----	----	**96.6**
Anthracene-d10	1719-06-8	0.002	%		----	----	----	----	**90.5**
4-Terphenyl-d14	1718-51-0	0.002	%		----	----	----	----	**87.6**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.002	%		----	**104**	----	----	----
13C8-PFOA	----	0.002	%		----	**106**	----	----	----
13C4-PFOS	----	0.0005	%		**95.1**	----	----	----	**102**
13C8-PFOA	----	0.0005	%		**94.1**	----	----	----	**89.4**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	EMB18	EMB19	EMB24	EMB25	----
			Sampling date / time	[12-Apr-2022]	[12-Apr-2022]	[12-Apr-2022]	[12-Apr-2022]	----
Compound	CAS Number	LOR	Unit	ES2213154-014	ES2213154-015	ES2213154-016	ES2213154-017	--------
				Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS								
Arsenic	7440-38-2	1	µg/L	<1	**10**	<1	<1	----
Cadmium	7440-43-9	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	----
Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	----
Copper	7440-50-8	1	µg/L	<1	<1	**1**	<1	----
Nickel	7440-02-0	1	µg/L	**1**	**9**	**2**	<1	----
Lead	7439-92-1	1	µg/L	<1	<1	<1	<1	----
Zinc	7440-66-6	5	µg/L	<5	**12**	**8**	**5**	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.1	µg/L	<0.1	<0.1	<0.1	<0.1	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	10	µg/L	**190**	**610**	**20**	**40**	----
EP071 SG: Total Petroleum Hydrocarbons - Silica gel cleanup								
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	----
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	----
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	----
EP071 SG: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Silica gel cleanup								
>C10 - C16 Fraction	----	100	µg/L	<100	<100	<100	<100	----
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	----
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	<100	<100	<100	----
>C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	<100	<100	<100	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	----
Toluene	108-88-3	2	µg/L	<2	<2	<2	<2	----
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	EMB18	EMB19	EMB24	EMB25	----
			Sampling date / time	[12-Apr-2022]	[12-Apr-2022]	[12-Apr-2022]	[12-Apr-2022]	----
Compound	CAS Number	LOR	Unit	ES2213154-014	ES2213154-015	ES2213154-016	ES2213154-017	--------
				Result	Result	Result	Result	----
EP080: BTEXN - Continued								
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	----
^ Total Xylenes	----	2	µg/L	<2	<2	<2	<2	----
^ Sum of BTEX	----	1	µg/L	<1	<1	<1	<1	----
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	----
EP132B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.004	µg/L	<0.004	**0.012**	<0.004	<0.004	----
2-Methylnaphthalene	91-57-6	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
Acenaphthylene	208-96-8	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
Acenaphthene	83-32-9	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
Fluorene	86-73-7	0.002	µg/L	**0.005**	**0.009**	**0.003**	**0.004**	----
Phenanthrene	85-01-8	0.002	µg/L	**0.007**	**0.012**	**0.007**	**0.009**	----
Anthracene	120-12-7	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	----
Fluoranthene	206-44-0	0.001	µg/L	**0.003**	**0.008**	**0.004**	**0.014**	----
Pyrene	129-00-0	0.001	µg/L	**0.003**	**0.006**	**0.003**	**0.010**	----
Benz(a)anthracene	56-55-3	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
Chrysene	218-01-9	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	----
7.12-Dimethylbenz(a)anthracene	57-97-6	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	----
Benzo(k)fluoranthene	207-08-9	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	----
Benzo(e)pyrene	192-97-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	----
Benzo(a)pyrene	50-32-8	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	----
Perylene	198-55-0	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
3-Methylcholanthrene	56-49-5	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
Dibenz(a.h)anthracene	53-70-3	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	----
Benzo(g.h.i)perylene	191-24-2	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
Coronene	191-07-1	0.002	µg/L	<0.002	<0.002	<0.002	<0.002	----
^ Sum of 16 US EPA Priority PAHs	----	0.001	µg/L	**0.018**	**0.047**	**0.017**	**0.037**	----
^ Benzo(a)pyrene TEQ (zero)	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	----
EP132B: Polynuclear Aromatic Hydrocarbons (super trace)								
^ Benzo(b+j) & Benzo(k)fluoranthene	205-99-2 207-08-9	0.004	µg/L	<0.004	<0.004	<0.004	<0.004	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	EMB18	EMB19	EMB24	EMB25	----
			Sampling date / time	[12-Apr-2022]	[12-Apr-2022]	[12-Apr-2022]	[12-Apr-2022]	----
Compound	CAS Number	LOR	Unit	ES2213154-014	ES2213154-015	ES2213154-016	ES2213154-017	--------
				Result	Result	Result	Result	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0005	µg/L	<0.0005	<0.0005	**0.0018**	**0.0028**	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0005	µg/L	<0.0005	<0.0005	**0.0007**	**0.0017**	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0005	µg/L	**0.0032**	**0.0009**	**0.0037**	**0.0169**	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0005	µg/L	<0.0005	<0.0005	<0.0005	**0.0010**	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	µg/L	**0.0054**	**0.0004**	**0.0021**	**0.0203**	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.0020	µg/L	**0.0563**	**0.567**	**2.00**	**1.12**	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0005	µg/L	**0.184**	**2.35**	**7.05**	**5.24**	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0005	µg/L	**0.112**	**0.526**	**4.80**	**2.16**	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0005	µg/L	**0.174**	**3.42**	**6.22**	**4.62**	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0005	µg/L	**0.0324**	**0.265**	**1.11**	**1.32**	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0005	µg/L	**0.0149**	**0.0141**	**0.0442**	**0.184**	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0005	µg/L	**0.0010**	**0.0051**	**0.0014**	**0.0310**	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0005	µg/L	<0.0005	<0.0005	<0.0005	**0.0015**	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0005	µg/L	<0.0005	<0.0005	<0.0005	<0.0005	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.001	µg/L	<0.001	<0.001	<0.001	<0.001	----

Analytical Results

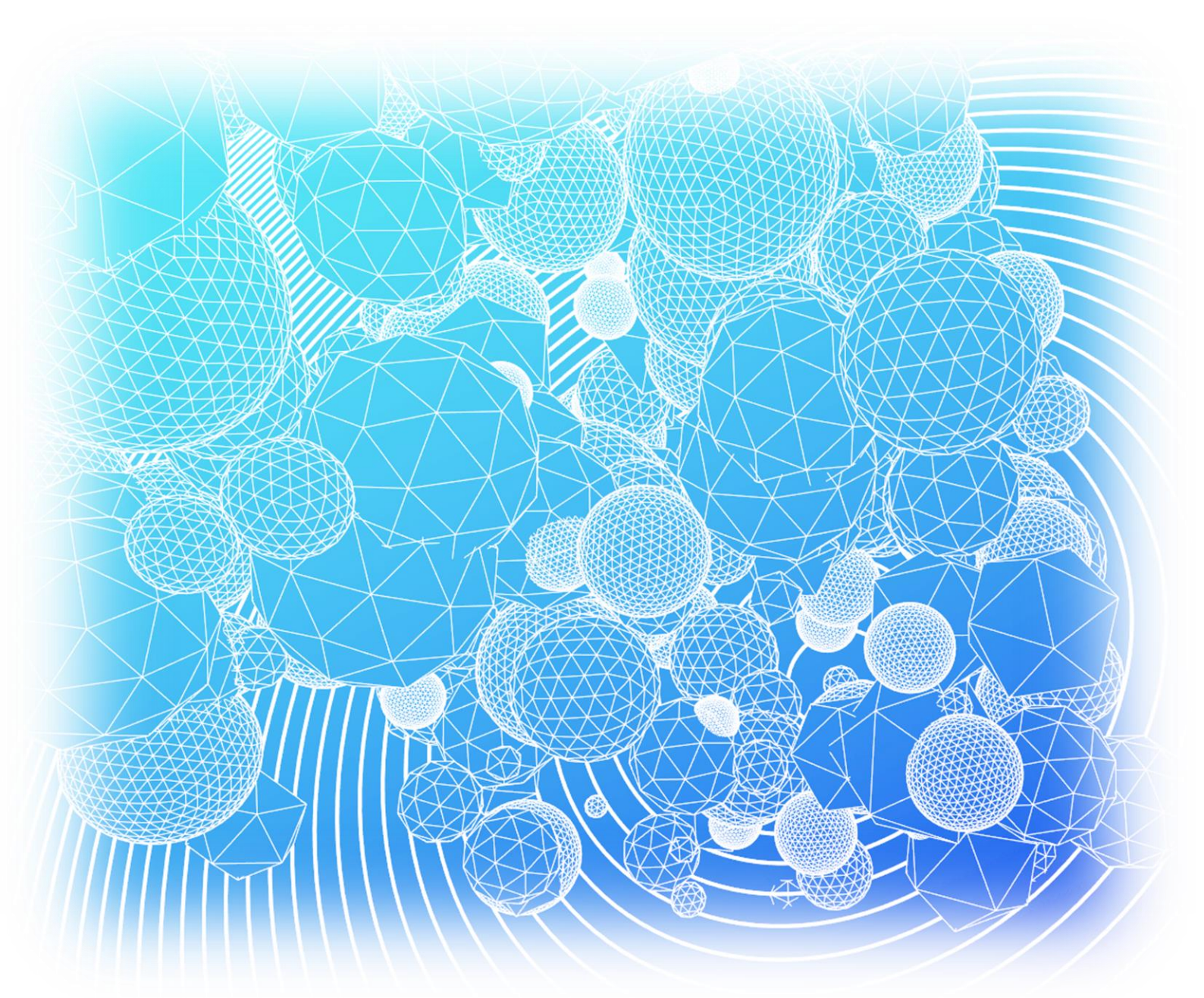
Sub-Matrix: WATER (Matrix: WATER)				Sample ID	EMB18	EMB19	EMB24	EMB25	----
				Sampling date / time	[12-Apr-2022]	[12-Apr-2022]	[12-Apr-2022]	[12-Apr-2022]	----
Compound	CAS Number	LOR	Unit		ES2213154-014	ES2213154-015	ES2213154-016	ES2213154-017	--------
					Result	Result	Result	Result	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	24448-09-7	0.001	µg/L		<0.001	<0.001	<0.001	<0.001	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.001	µg/L		<0.001	<0.001	<0.001	<0.001	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0005	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0005	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.001	µg/L		<0.001	**0.060**	**0.005**	**0.012**	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.001	µg/L		**0.019**	**23.9**	**1.92**	**8.36**	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.001	µg/L		**0.009**	**0.234**	**0.121**	**5.81**	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.001	µg/L		<0.001	<0.001	<0.001	**0.004**	----
EP231P: PFAS Sums									
^ Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	µg/L		**0.0086**	**0.0013**	**0.0058**	**0.0372**	----
^ Sum of PFAS (WA DER List)	----	0.0002	µg/L		**0.595**	**31.3**	**23.2**	**28.7**	----
^ Sum of PFAS	----	0.0002	µg/L		**0.611**	**31.3**	**23.3**	**28.9**	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**121**	**124**	**124**	**119**	----
Toluene-D8	2037-26-5	2	%		**107**	**110**	**98.2**	**98.7**	----
4-Bromofluorobenzene	460-00-4	2	%		**97.2**	**105**	**97.7**	**96.2**	----
EP132T: Base/Neutral Extractable Surrogates									
2-Fluorobiphenyl	321-60-8	0.002	%		**107**	**108**	**101**	**108**	----
Anthracene-d10	1719-06-8	0.002	%		**101**	**113**	**104**	**99.1**	----
4-Terphenyl-d14	1718-51-0	0.002	%		**92.9**	**94.4**	**85.7**	**93.6**	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0005	%		**111**	**112**	**94.3**	**103**	----
13C8-PFOA	----	0.0005	%		**92.1**	**77.0**	**89.4**	**90.0**	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128
EP132T: Base/Neutral Extractable Surrogates			
2-Fluorobiphenyl	321-60-8	70	130
Anthracene-d10	1719-06-8	70	130
4-Terphenyl-d14	1718-51-0	70	130
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120
13C4-PFOS	----	60	120
13C8-PFOA	----	60	120

Appendix M **PFAS Risk Assessment Report (EnRiskS)**



Human Health and Ecological Risk Assessment: Vopak Bulk Fuel Terminal, NT

Prepared for: SMEC Pty Ltd

18 July 2022

Document History and Status

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Limitations

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It is prepared in accordance with the scope of work and for the purpose outlined in the **Section 1** of this report.

The methodology adopted and sources of information used are outlined in this report. Environmental Risk Sciences Pty Ltd has made no independent verification of this information beyond the agreed scope of works and assumes no responsibility for any inaccuracies or omissions. No indications were found that information contained in the reports provided for use in this assessment was false.

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Glossary of Terms

Additive Effect	An additive effect is where two or more substances act together to produce a total effect that is the same as the sum of the individual effects
Absorption	The process of taking in. For a person or an animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.
Adverse Health Effect	A change in body function or cell structure that might lead to disease or health problems
ANZECC	Australia and New Zealand Environment and Conservation Council
ASC NEPM	National Environmental Protection Measure – Assessment of Site Contamination
ASLP	Australian Standard Leaching Procedure
AT	Averaging Time
Background Level	An average or expected amount of a substance or material in a specific environment, or typical amounts of substances that occur naturally in an environment.
BW	Body weight
Carcinogen	A substance that causes cancer.
CF	Unit Conversion Factor
Chronic Exposure	Contact with a substance that occurs over a long time (more than 1 year) (compare with acute exposure and intermediate duration exposure)
Dermal Contact	Contact with (touching) the skin (see route of exposure).
Detection Limit	The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.
Dose	The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An “exposure dose” is how much of a substance is encountered in the environment. An “absorbed dose” is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.
DSI	Detailed Site Investigation
ED	Exposure Duration
EF	Exposure Frequency
EFSA	European Food Safety Authority
ET	Exposure time
Exposure	Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term (acute exposure), of intermediate duration, or long-term (chronic exposure).
Exposure Assessment	The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.
Exposure Pathway	The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a source of contamination (such as chemical leakage into the subsurface); an environmental media and transport mechanism (such as movement through groundwater); a point of exposure (such as a private well); a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.
FSANZ	Food Standards Australia New Zealand

Guideline Value	Guideline value is a concentration in soil, sediment, water, biota or air (established by relevant regulatory authorities such as the National Health and Medical Research Council (NHMRC), Australia and New Zealand Environment and Conservation Council (ANZECC) and World Health Organisation (WHO)), that is used to identify conditions below which no adverse effects, nuisance or indirect health effects are expected. The derivation of a guideline value utilises relevant studies on animals or humans and relevant factors to account for inter- and intra-species variations and uncertainty factors. Separate guidelines may be identified for protection of human health and the environment. Dependent on the source, guidelines will have different names, such as investigation level, trigger value, ambient guideline etc.
HHRA	Human Health Risk Assessment
HI	Hazard Index
HIL	Health Investigation Level
Ingestion	The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way (see route of exposure).
Inhalation	The act of breathing. A hazardous substance can enter the body this way (see route of exposure).
LOAEL	Lowest-observed-adverse-effect-level: The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals
LOR	Limit of Reporting
MDH	Minnesota Department of Health
No effect level	The tested dose of a substance that does not cause adverse effects in people or animals. See also NOAEL and LOAEL
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
NNPAS	National Nutrition and Physical Activity Survey
NOAEL	No-observed-adverse-effect-level: The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals
PFAS	**Per- or Poly-fluoroalkyl Substances**
PFPrS	*Perfluoropropane sulfonate*
PFBA	*Perfluorobutanoic Acid*
PFBS	*Perfluorobutanesulfonic Acid*
PFPeA	*Perfluoropentanoic Acid*
PFPeS	*Perfluoropentane sulfonate*
PFHxA	*Perfluorohexanoic Acid*
PFHxS	*Perfluorohexanesulfonic Acid*
PFHpA	*Perfluoroheptanoic Acid*
PFHpS	*Perfluoroheptane sulfonate*
PFOA	*Perfluorooctanoic Acid*
PFOS	*Perfluorooctanesulfonic Acid*
PFNA	*Perfluorononanoic Acid*
PFNS	Perfluorononane sulfonate
PFDA	*Perfluorodecanoic Acid*
PFDS	*Perfluorodecanesulfonic Acid*
PFUnDA	*Perfluoroundecanoic Acid*
PFDoA	*Perfluorododecanoic Acid*
PFTrDA	*Perfluorotridecanoic acid*

PFTeDA	*Perfluorotetradecanoic acid*
4:2 FtS	*1H.1H.2H.2H-Perfluorohexanesulfonic Acid*
6:2 FtS	*1H.1H.2H.2H-Perfluorooctansulfonic Acid*
8:2 FtS	*1H.1H.2H.2H-Perfluorodecanesulfonic Acid*
10:2 FTS	*10:2 Fluorotelomer sulfonate*
PFOSA	*Perfluorooctanesulfonamide*
NMeFOSA	*N-Methyl perfluorooctane sulfonamide*
NEtFOSA	*N-Ethyl perfluorooctane sulfonamide*
NMeFOSE	*N-Methyl perfluorooctane sulfonamidoethanol*
NEtFOSE	*N-Ethyl perfluorooctane sulfonamidoethanol*
NEtFOSAA	*N-ethyl-perfluorooctanesulfonamidoacetic acid*
NMeFOSAA	*N-methyl-perfluorooctanesulfonamidoacetic acid*
pKa	The most widely used form of the acid dissociation constant (also known as the acidity constant) which is a quantitative measure of the strength of an acid. This value helps to predict what a molecule will do at a specific pH.
Point of Exposure	The place where someone can come into contact with a substance present in the environment (see exposure pathway).
Population	A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).
PSI	Preliminary Site Investigation
Receptor Population	People who could come into contact with hazardous substances (see exposure pathway).
Risk	The probability that something will cause injury or harm.
RME	Reasonable maximum exposure: The RME represents exposure scenario based on a set of exposure parameters that is representative of expected maximum exposure for that receptor and activity. The RME would not be expected to be exceeded except under highly specific and exceptional circumstances.
Route of Exposure	The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin (dermal contact)
SWL	Standing Water Level
TDS	Total Dissolved Solids
Toxicity	The degree of danger posed by a substance to human, animal or plant life.
Toxicity Data	Characterisation or quantitative value estimated (by recognised authorities) for each individual chemical for relevant exposure pathway (inhalation, oral or dermal), with special emphasis on dose-response characteristics. The data is based on available toxicity studies relevant to humans and/or animals and relevant safety factors.
Toxicological Profile	An assessment that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.
Toxicology	The study of the harmful effects of substances on humans or animals.
TRV	Toxicity Reference Value, e.g. an RfD, ADI, TDI, or PTWI. A guideline toxicity value that incorporates uncertainty or safety factors to identify a safe dose assuming daily lifetime exposure to a substance that is unlikely to cause harm in humans.

Uncertainty Factor	Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people (also sometimes called a safety factor).
USEPA	United States Environmental Protection Agency
WHO	World Health Organisation

Executive Summary

Environmental Risk Sciences Pty Ltd (enRiskS) has been engaged by SMEC Pty Ltd, to review available data and undertake a human health and ecological risk assessment (HHERA) in relation to the presence of per- and polyfluoroalkyl substances (PFAS) at the Vopak Bulk Fuel Terminal (operated by Vopak) in the Northern Territory (the "Site"; refer to **Figure 1.1**).

A firefighting foam solution leak occurred at the Site on 26 September 2020. Per and poly-fluoroalkyl substances (PFAS) are included in the ingredients for the foam. These chemicals are persistent organic pollutants with potential for health and environmental impacts. The incident was reported and assessed by the Northern Territory Environment Protection Authority (NT EPA) (SMEC 2022).

NT EPA issued Vopak with a notice on 25 October 2021 under Section 48(1) of the Waste Management and Pollution Control Act 1988. The notice requires Vopak to carry out an environmental audit program to evaluate the types, amount, distribution and mobility of petroleum hydrocarbons, PFAS, and other contaminants of concern (copper, lead, zinc and ammonia) present in the environment at the Site (SMEC 2022).

The site investigation report by SMEC addresses the evaluation of the types, amount, distribution and mobility of these contaminants. The assessment provided in this report relates to the presence of PFAS and the potential for the levels of PFAS found in stormwater, groundwater or soil to pose a risk to human health or the environment.

The facility has used PFAS containing AFFF in their fire management system. The fire management system was tested on a monthly basis, where foam solution may have been placed directly onto the ground. In addition, there was a leak of foam solution from an underground line in 2020. This leak was detected and repaired. There is no history of fuel fires at the site.

Vopak commissioned consultants to undertake:

- groundwater monitoring at its on-site wells
- stormwater sampling from a range of locations within the stormwater management system
- soil sampling from relevant locations across the site.

A range of PFAS were detected in at least some groundwater, stormwater and soil samples. In line with national guidance, a site-specific human health and ecological risk assessment has been undertaken to determine risks and any necessary management actions.

Based on the data available to May 2022, and with consideration of the uncertainties identified, the following can be concluded.

Soil

All soil samples were found to have PFAS concentrations in compliance with guideline values provided within the NEMP relevant for the protection of human health and ecological health for industrial sites. Leachability testing was undertaken. It indicated that PFAS were leachable from

these soils. Further assessment of potential risks due to PFAS that may leach is discussed for groundwater and stormwater.

Stormwater

Human health

Initial screening of the total PFAS concentrations in stormwater showed that some levels were in excess of the guideline values provided within the NEMP relevant for the protection of human health. These guidelines are based on health effect data for PFOS+PFHxS and PFOA. The key chemicals that were present in these samples, however, were 6:2 FTS, 8:2 FTS and PFHxA rather than PFOS, PFHxS or PFOA.

Further refinement of the assessment was undertaken by adjusting the recreational water quality guideline for PFOS to be more appropriate for the key chemicals based on the difference in toxicity between the key chemicals at this site (6:2 FTS, 8:2 FTS and PFHxA) and PFOS. All stormwater results were in compliance with these adjusted recreational guidelines.

Given that some PFAS are highly bioaccumulative, it is important to consider potential uptake into seafood. Fish and crabs collected from Bleesers Creek in Darwin Harbour were analysed for PFAS by the University of Queensland on behalf of NT Health in 2017. The results indicated that levels of PFOS and PFOA were in compliance with the Food Standards Australia and New Zealand (FSANZ) trigger points for fish that people eat. The levels were around 10 times lower than the trigger point for PFOS. The key chemicals for this site are PFAS that are not bioaccumulative and would not be expected to be present in seafood.

No data have been collected from any off-site surface water environments into which stormwater would discharge. However, given that recreational contact with stormwater was considered acceptable using data from the site, no further consideration is required in regard to human health.

Ecological

Initial screening of stormwater results also showed total PFAS concentrations in excess of the guideline values provided within the NEMP relevant for the protection of ecosystems, based on ecotoxicity data for PFOS and PFOA.

Further refinement of the assessment of stormwater results was undertaken.

There are no surface water bodies located on the site for which these guideline values are relevant, so no further consideration is required for this aspect.

Stormwater might leave the site flowing into the off-site area to the west of the site and west of the railway line via the open drain. There is no information about the concentrations of these chemicals that would be present in the off-site area, but it would be expected that the stormwater at the site would be diluted during discharge into the off-site areas.

Regardless of the potential for dilution, further refinement of the screening assessment has been undertaken assuming the concentrations measured in stormwater at the site might reach the off-site area. The key chemicals in these samples were 6:2 FTS and 8:2 FTS. The USEPA ECOTOX

database was interrogated for data relevant for these key chemicals. A single study was found for 8:2 FTS and 4 studies were found for 6:2 FTS. Using the data for 6:2 FTS and guidance from the Australian Water Quality Guidelines, an interim water quality guideline relevant for 95% species protection was determined. This value was applied to screen the results for both 6:2 FTS and 8:2 FTS.

All results in stormwater samples were in compliance with this interim water quality guideline. However, there are a number of limitations in this assessment including:

- interim water quality guideline for 6:2 FTS is based on only limited ecotoxicity data – available data would not be sufficient to calculate an official water quality guideline
- data for stormwater are limited to 3 rounds during the wet season (February, December 2021 and March 2022) and 1 round during the dry season (May 2022)
- wet season data includes 2 rounds toward the later parts of the wet (February 2021, March 2022) and 1 round toward the beginning of the wet (December 2021) and these rounds show around 10 fold variation between late and early in the wet season
- dry season data includes only data for early in the dry (May 2022), but these data are similar to the data for early in the wet (i.e. December 2021)
- based on the limited data:
    - maximum concentration reported in stormwater at this site was around 50 µg/L and this is around 25% of the proposed guideline
    - variation in stormwater concentrations appears to be around 10 fold
    - concentrations of 6:2 FTS in the existing data vary from 3% to 25% of the proposed guideline.

Therefore, additional monitoring will be important to support the conclusion that the levels of these key chemicals (6:2 FTS and 8:2 FTS) in stormwater are in compliance with the proposed guideline.

It is understood that the following monitoring program is undertaken by Vopak each year:

- Groundwater – twice a year, early wet season and late wet season, from a network of 14 bores
- Stormwater pit – three times a year, early, mid and late wet season, from 5 locations
- Sediment in drains – once every 2 years at the end of the wet season, from 12 locations

If monitoring for PFAS is included in this program for stormwater samples, that will provide appropriate data to support the conclusions of this HHERA.

It is also important to note that the key chemicals for this site are PFAS that are not bioaccumulative – i.e. 6:2 FTS, 8:2 FTS. It is expected that, if risks to aquatic organisms from direct contact with water are acceptable, then risks to higher organisms from consumption of aquatic organisms will also be acceptable.

Groundwater

Human health

Initial screening of the total PFAS concentrations in groundwater showed that some levels were in excess of the guideline values provided within the NEMP relevant for the protection of human

health, based on health effects data for PFOS+PFHxS and PFOA. The key chemicals that were present in these samples were 6:2 FTS, 8:2 FTS and PFHxA. Further refinement of the assessment was undertaken by adjusting the recreational water quality guideline for PFOS to be more appropriate for the key chemicals based on the difference in toxicity between the key chemicals for this site (6:2 FTS, 8:2 FTS and PFHxA) and PFOS. All groundwater results were in compliance with these adjusted recreational guidelines.

Given that some PFAS are highly bioaccumulative, it is important to consider potential uptake into seafood. Fish and crabs collected from Bleesers Creek in Darwin Harbour were analysed for PFAS by the University of Queensland on behalf of NT Health in 2017. The results for these samples indicate that levels of PFOS and PFOA were in compliance with the Food Standards Australia and New Zealand (FSANZ) trigger points for fish. The levels were around 10 times lower than the trigger point for PFOS. The key chemicals for this site are PFAS that are not bioaccumulative and would not be expected to be present in seafood.

No data have been collected from any off-site surface water environments into which groundwater would mix. However, given that recreational contact with groundwater was considered acceptable using data from the site, no further consideration is required in regard to human health.

Ecological

Initial screening of groundwater results also showed total PFAS concentrations in excess of the guideline values provided within the NEMP relevant for the protection of ecosystems, based on ecotoxicity data for PFOS and PFOA.

Potential ecological risks to aquatic organisms are most relevant to consider where groundwater mixes into surface water within the off-site area. There is no information about the concentrations of these chemicals that would be present in the off-site area where surface water and groundwater mix, but it would be expected that concentrations of PFAS in groundwater measured at the site would be diluted as it mixes into surface water.

There are no surface water bodies located on the site into which this groundwater might mix and for which these guideline values would be relevant, so no further consideration is required for this aspect.

Regardless of the potential for dilution, further refinement of the screening assessment has been undertaken assuming the concentrations measured in groundwater at the site (both concentrations along the western boundary and the maximum concentrations anywhere on the site) might reach the off-site area without any dilution which will be conservative.

The key chemicals in the groundwater samples were 6:2 FTS and 8:2 FTS. The interim water quality guideline determined in the stormwater assessment was also applied to groundwater. All results in the groundwater samples were in compliance with this interim water quality guideline. However, there are a number of limitations/uncertainties in this assessment including:

- interim water quality guideline for 6:2 FTS is based on only limited ecotoxicity data – available data would not be sufficient to calculate an official water quality guideline
- data for groundwater are limited to 3 rounds (April 2021, December 2021 and April 2022)

- data for April 2021 and 2022 were collected at the end of the wet season while the December round was at the beginning of the wet season
- monitoring of groundwater has not yet occurred during the dry season
- data show that there is a 2-4 fold variability across these monitoring events (i.e. within the wet season)
- differences in groundwater concentrations between the wet and dry season cannot be determined with the available data
- based on the limited data:
    - maximum concentration reported in groundwater at this site was around 140 µg/L and this is around 65% of the proposed guideline
    - variation in groundwater concentrations across the wet season appears to be around 2-4 fold
    - concentrations of 6:2 FTS in the existing data vary from 15% to 65% of the proposed guideline.

Therefore, additional monitoring will be important to support the conclusion that the levels of these key chemicals (6:2 FTS and 8:2 FTS) in groundwater are in compliance with the proposed guideline.

It is understood that the following monitoring program is undertaken by Vopak each year:

- Groundwater – twice a year, early wet season and late wet season, from a network of 14 bores
- Stormwater pit – three times a year, early, mid and late wet season, from 5 locations
- Sediment in drains – once every 2 years at the end of the wet season, from 12 locations

If monitoring for PFAS is included in this program for groundwater samples, that will provide appropriate data to support the conclusions of this HHERA.

It is also important to note that the key chemicals for this site are PFAS that are not bioaccumulative – i.e. 6:2 FTS, 8:2 FTS. It is expected that, if risks to aquatic organisms from direct contact with water are acceptable, then risks to higher organisms from consumption of aquatic organisms will also be acceptable.

Section 1. Background

1.1 Introduction

Environmental Risk Sciences Pty Ltd (enRiskS) has been engaged by SMEC Pty Ltd, to review available data and undertake a human health and ecological risk assessment (HHERA) in relation to the presence of per- and polyfluoroalkyl substances (PFAS) at the Vopak Bulk Fuel Terminal (operated by Vopak) in the Northern Territory (the "Site"; refer to **Figure 1.1**).

PFAS are a family of fluorine-containing compounds with unique properties to make materials stain- and stick-resistant. PFAS are often described as being "ubiquitous in the environment". They have been widely used in man-made products such as paints, roof treatments, hardwood floor protectant, surface protection products (e.g. carpet and clothing treatments) and coatings for cardboard and packaging. Some PFAS are, or were also historically used in fire-fighting foams. These compounds are not found in the environment from natural sources, only from anthropogenic sources (ATSDR 2015, 2018).

A firefighting foam solution leak occurred at the Site on 26 September 2020. The foam solution has a component of per and poly-fluoroalkyl substances (PFAS) which are persistent organic pollutants with potential for health and environmental impacts. The incident was reported and assessed by the Northern Territory Environment Protection Authority (NT EPA) (SMEC 2022).

NT EPA issued Vopak with a notice on 25 October 2021 under Section 48(1) of the Waste Management and Pollution Control Act 1988. The notice requires Vopak to carry out an environmental audit program to evaluate the types, amount, distribution and mobility of petroleum hydrocarbons, PFAS, and other contaminants of concern (copper, lead, zinc and ammonia) present in the environment at the Site (SMEC 2022). This assessment only relates to the presence of PFAS.

The facility has used PFAS containing AFFF in their fire management system. The fire management system was tested on a monthly basis, where foam may have been placed directly onto the ground. In addition, there was a leak of foam solution from an underground line in 2020. This leak was detected fairly quickly and repaired. There is no history of actual fuel fires at the site.

The operator has undertaken:

- groundwater monitoring at its on-site wells
- stormwater sampling from a range of locations within the stormwater management system
- soil sampling from relevant locations across the site.

A range of PFAS were detected in at least some groundwater, stormwater and soil samples.

In line with national guidance, a site-specific human health and ecological risk assessment is required to determine risks and any necessary management actions.



FIG NO. 1.1

FIGURE TITLE Site Locality

DATE 11/03/2022

0 25 50 100 150
1:4,000 Meters

PAGE SIZE A3

COORDINATE SYSTEM GDA 1994 MGA Zone 52

PROJECT NO. 30080099

PROJECT TITLE Vopak Darwin Terminal, 780 Berrimah Road

CREATED BY FA13847

SOURCES Roadnet MDS 2022
MetroMap Imagery © Aerometrex Pty Ltd

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SMEC
Member of the Surbana Jurong Group

Location: V:\Projectz\30080099\Maps\30080099_F0001_SiteLocality.mxd

Last updated by: FA13847 on 11/03/2022 at 15:32

1.2 Objectives

The objectives of the assessment presented in this HHERA are:

- Review the available data for PFAS provided by SMEC and the design information about the system.
- Undertake a HHERA to determine potential human health and ecological risks for groundwater for the following exposure scenarios:
    - Human health
        - Workers at the site who may come into contact with groundwater
        - Consumers of fish/shellfish caught in the neighbouring wetlands which may be affected by groundwater from this site
    - Ecological
        - Aquatic organisms living in wetlands and the estuarine environment adjacent to this site
        - Consumers of aquatic organisms (birds and mammals).
- Where possible, screening guidelines will be developed in line with Australian guidance for the individual PFAS relevant for this site that do not currently have such guidelines.
- If elevated risks are identified, appropriate risk management measures that may need to be implemented to mitigate the identified risks will be discussed, in general terms.

This assessment has been undertaken based on the information available up to May 2022 and as described in **Section 1.4**.

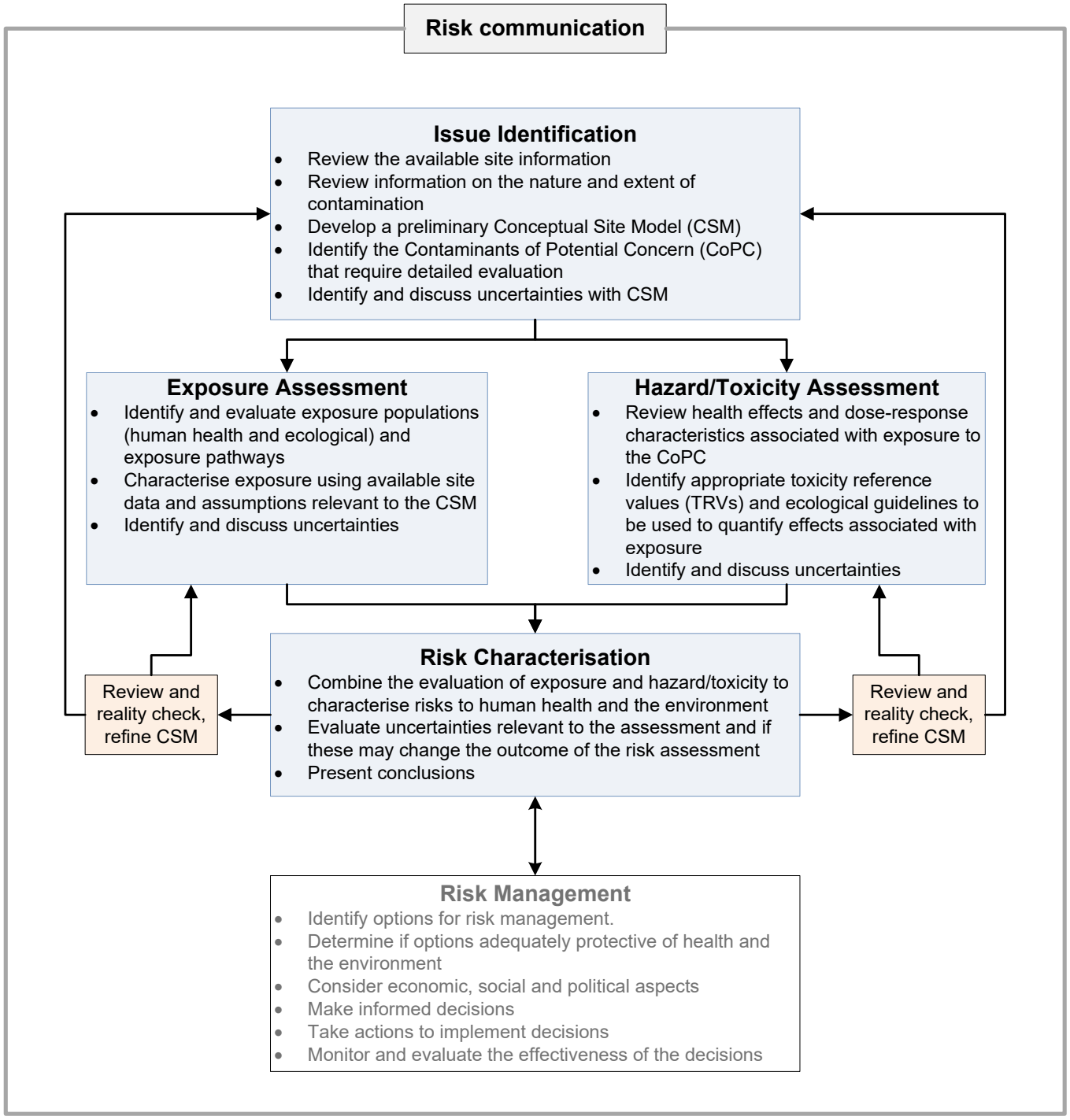
The HHERA has addressed human health and environmental risk issues relevant to PFAS. The assessment has not addressed issues associated with other chemicals.

1.3 Methodology

In general, the approach taken for the assessment of human health and ecological risks is in accordance with guidelines / protocols endorsed by Australian regulators, including:

- enHealth, Environmental Health Risk Assessment, Guidelines for Assessing Human Health Risks from Environmental Hazards (enHealth 2012b)
- enHealth, Australian Exposure Factor Guide (enHealth 2012a)
- NEPM (1999 amended 2013) National Environmental Protection Measure – Assessment of Site Contamination including (the “NEPM 2013”):
    - Schedule B1 Investigation Levels for Soil and Groundwater (NEPC 1999 amended 2013e)
    - Schedule B4 Guideline on Health Risk Assessment Methodology (NEPC 1999 amended 2013a)
    - Schedule B6 Guideline on Risk Based Assessment of Groundwater Contamination (NEPC 1999 amended 2013b)
    - Schedule B7 Guideline on Health-Based Investigation Levels (NEPC 1999 amended 2013c)

The overall approach for the HHERA is outlined in the following (modified from enHealth 2012):


Risk communication
Issue Identification
Review the available site information
Review information on the nature and extent of contamination
Develop a preliminary Conceptual Site Model (CSM)
Identify the Contaminants of Potential Concern (CoPC) that require detailed evaluation
Identify and discuss uncertainties with CSM
Exposure Assessment
Identify and evaluate exposure populations (human health and ecological) and exposure pathways
Characterise exposure using available site data and assumptions relevant to the CSM
Identify and discuss uncertainties
Hazard/Toxicity Assessment
Review health effects and dose-response characteristics associated with exposure to the CoPC
Identify appropriate toxicity reference values (TRVs) and ecological guidelines to be used to quantify effects associated with exposure
Identify and discuss uncertainties
Review and reality check, refine CSM
Risk Characterisation
Combine the evaluation of exposure and hazard/toxicity to characterise risks to human health and the environment
Evaluate uncertainties relevant to the assessment and if these may change the outcome of the risk assessment
Present conclusions
Review and reality check, refine CSM
Risk Management
Identify options for risk management.
Determine if options adequately protective of health and the environment
Consider economic, social and political aspects
Make informed decisions
Take actions to implement decisions
Monitor and evaluate the effectiveness of the decisions

More specifically, the following PFAS-specific guidance has been considered in the HHRA:

- PFAS National Environmental Management Plan (the "PFAS NEMP") Version 2, (HEPA 2020)
- Perfluorinated chemicals in food (FSANZ 2017f), and associated supporting documents:
    - Supporting Document 1 Hazard assessment report – Perfluorooctane sulfonate (PFOS), Perfluorooctanoic acid (PFOA), Perfluorohexane sulfonate (PFHxS)
        - Critical review of pharmacokinetic modelling of PFOS and PFOA to assist in establishing HBGVs for these chemicals (FSANZ 2017h)
        - Immunomodulation by PFASs: a brief literature review (ToxConsult 2017)
    - Supporting Document 2 Assessment of potential dietary exposure to PFOS, PFOA and PFHxS occurring in foods sampled from contaminated sites (FSANZ 2017a)
        - Occurrence of and dietary exposure to PFOS, PFOA and PFHxS reported in the literature (FSANZ 2017b)
        - Occurrence of PFOS, PFOA and PFHxS in foods and water sampled from contaminated sites (FSANZ 2017c)
    - Supporting Document 3 Summary of other controls for perfluorinated chemicals (FSANZ 2017d)
    - Supporting Document 4 Criteria for the establishment of maximum levels in food (FSANZ 2017e)

Existing background information and guidance from the Northern Territory EPA available at https://ntepa.nt.gov.au/your-environment/pfas has also been considered in this assessment.

The overall approach adopted in this assessment is as follows:

- Relevant background information (**Section 2**)
- Identification of an appropriate dose-response relationship and quantitative values (toxicity reference values; TRV) for the assessment of potential human health effects associated with exposures to PFAS (**Section 3**)
- Identification of an appropriate dose-response relationship and quantitative values (toxicity reference values; TRV) for the assessment of potential ecological effects associated with exposures to PFAS (**Section 4**)
- Summary of relevant site information and available data relevant to the development of a Conceptual Site Model (CSM) (**Section 5**)
- Summary of results of investigation of PFAS in soil, groundwater and stormwater (**Section 6**)
- Screening risk assessment for site data (**Section 7**)
- Discussion of uncertainties (**Section 8**)
- Conclusions (**Section 9**).

Additional guidance has been sought from international sources, and referenced within this document where relevant, however, international guidance has not been adopted where it is inconsistent with the Australian regulatory or policy setting.

1.4 Available information

This assessment has been conducted on the basis of information and data presented in the following reports:

- SMEC 2022, Vopak Darwin Terminal, Site Investigations (Dated 18 July 2022 – 30080099-3-Rev3).
- GHD 2022, Vopak Terminal Environmental Monitoring, December 2021 – April 2022, Vopak Terminal Darwin Pty Ltd (dated 20 May 2022).
- EcOz 2020, Firefighting foam leak – soil and water analysis results (dated 10 November 2020).
- EcOz 2021a, Groundwater Quality Monitoring Late Wet Season, April 2021 Vopak Terminal Darwin (dated 10 May 2021).
- EcOz 2021b, Stormwater Pit Monitoring, February 2021, Vopak Terminal Darwin (dated 15 February 2021).
- Tabulated results as per **Appendix A**.

Section 2. Background information – PFAS

2.1 Chemicals in everyday life

The fundamental building blocks for the entire planet are chemical substances. The building blocks of all matter are the chemical elements like carbon or hydrogen or copper or gold. The elements or building blocks are listed in the Periodic Table. The elements combine to form chemical substances or compounds.

Whether it is the water we drink, the air we breathe, the food we eat, the ground we walk on, the houses we live in, the things we have inside our houses or workplaces or what we ourselves are made of, everything is made of chemicals.

Some chemical substances we need to keep us alive or to let plants or other animals live – like water, oxygen and nutrients. Other chemical substances are naturally occurring, but they can kill us – like spider and snake venoms or well-known poisons like arsenic or mercury. The same applies to the chemical substances we make – some are quite benign and some are quite toxic.

A range of chemical substances are used to manufacture things we use every day like food, clothes, computers, kitchen appliances, cars, houses, roads, trains, planes, hair dyes, beauty products, toothpaste, shampoo, flea rinse for our pets and many other things.

Some examples of common activities that involve chemistry and chemical reactions include:

- Cooking – turning raw food into cooked food involves reactions that change the compounds in food which changes the look and taste of the food
- How our bodies use food to make energy within cells
- How plants take the energy of the sun and turn it into food in photosynthesis
- Making steel or aluminium or glass to use in cars or buildings
- Using petrol in our cars as fuel for the engine
- How medicines work to make us well
- How natural gas is used to fuel a BBQ or stove
- How coal is used in a power station to make electricity.

We don't often think of these as chemical reactions – being alive (using energy to power our hearts and brains), cooking, burning, running an engine, manufacturing and so many other things.

Governments have established a range of legal requirements about how chemicals are approved for use, handling, transport and disposal as well as what to do in emergency situations so that chemicals are managed well. Such requirements include consideration of the characteristics of the chemical substances, how much will be used, how they might be released into the environment and a range of other matters.

People are always exposed to chemicals so when assessing projects or activities that exposure is considered as part of the assessment process as well as the benefits and other risks the project may pose. In particular, one thing that is considered is whether exposure to a particular chemical due to a project would be any different from everyday life. These assessments target whether there

are any chemicals being used (or that remain from historic uses) in a way that might cause an impact. Management actions are then proposed to ensure those chemicals are controlled.

Governments provide guidance, such as those listed in **Section 1.3**, that indicate how these assessments for chemicals are to be undertaken. These assessments must then comply with such guidance to be acceptable.

2.2 Introduction to PFAS

Per and poly fluoroalkyl substances (PFAS) are the focus of this assessment. While these chemicals have been in use for decades, analytical methods to measure these chemicals have only been available since 2000 (initially in university research laboratories and then since around 2010 routinely in commercial analytical laboratories who do analysis for these types of investigations).

PFAS are a family of man-made fluorine-containing chemicals. They do not occur naturally in the environment. They have unique properties that make materials stain- and water-resistant because the compounds repel oil, grease and water. These unique properties also make them persistent in the environment and highly mobile in soil and water (i.e. they readily leach into groundwater).

These chemicals have been used in a wide range of products including:

- Fire fighting foams
- Packaging materials for food
- Waterproofing or stainproofing agents (e.g. scotchguard)
- Non-stick products (e.g. Teflon)
- Polishes
- Waxes
- Paints
- Cleaning products
- Surfactants used in chrome plating or electronics manufacture

Consequently, they are widespread in our environment – usually at low levels. There are some places where levels may be higher and these appear to be related to places where manufacturing occurred or locations that used fire fighting foams (like airports, defence bases and firefighting training locations). Manufacturing of fluoropolymers and other PFAS never took place in Australia but those made elsewhere have been used as raw materials in manufacture of items like furniture, textiles etc.

A lot of chemicals subject to environmental investigations are ones that break down over time. Part of such investigations is consideration of the fate of the chemical. Many of the chemicals in the PFAS family do not break down over time in the environment due to the strength of the carbon fluorine bond. As a result, investigations of situations involving PFAS chemicals are focused on where the chemicals are as well as how/where they may travel.

Not only are these chemicals extremely difficult to break into their component parts in the environment but organisms cannot metabolise them. They are readily absorbed into the body for most organisms given their water solubility. Unlike most water soluble chemicals, however, they are difficult to remove from the body once taken in, at least for some organisms including people. This

combination means that they can build up inside organisms that are exposed – i.e. they bioaccumulate. The potential for these chemicals to bioaccumulate is a characteristic of these chemicals that makes them more likely to pose a risk to human health or the environment.

These chemicals behave differently to other chemicals that bioaccumulate (build up in organisms) such as organochlorine pesticides like DDT. Chemicals such as DDT or PCBs are not water soluble and so do not easily travel from where they were used. Such chemicals also accumulate in the lipids in organisms and tend to take quite some time to accumulate to high levels (USEPA 2017).

The structure of these compounds means they are chemically and biologically stable in the environment, resisting typical environmental degradation processes (like biodegradation, photolysis and hydrolysis) making them extremely persistent. These compounds are mobile in soil and leach into groundwater. They are more water soluble than lipid soluble. Most of the individual PFAS do not readily volatilise from soil or water. These compounds are not found in the environment from natural sources, only from anthropogenic sources (ATSDR 2015, 2018).

The water solubility of the PFAS family means they can easily move from areas where they have been used into off-site areas. During rain they wash out of the soil into stormwater as it runs off overland toward surface waters. They also wash out of the soil into soil water that percolates down through the soil profile and then into groundwater. They also move easily with the groundwater as it travels away from a site toward surface water.

They accumulate in organisms quite rapidly, especially for aquatic organisms (days to weeks instead of years/decades for the other types of bioaccumulative chemicals).

Studies have investigated whether PFAS can be found in organisms (plants, animals and people). These studies have found that PFOS, PFOA and PFHxS are the PFAS chemicals most commonly reported to be present in organisms that people consume as food (fish, livestock).

Site investigations in the US, Europe and Australia have shown that the main exposure pathway for PFAS, for both people and animals, is the oral/ingestion pathway. Ingestion pathways commonly assessed during most environmental investigations include:

- consumption of water (drinking or incidental during cooking, showering, swimming, boating, cleaning, etc)
- ingestion of soil (incidental)
- consumption of food (fruit, vegetables, eggs, fish, seafood, milk, meat – where relevant).

Section 3. Toxicity of PFAS – People

3.1 Approach

This section outlines the approach used to assess the toxicity of PFAS to human health. The quantitative assessment of potential risks to human health for any chemical requires the consideration of the health end-points and, where carcinogenicity is identified, the mechanism of action needs to be understood.

For chemicals that are not carcinogenic, a threshold exists below which there are no adverse effects (for all relevant end-points) and has been termed a toxicity reference value (TRV) in this assessment. Another name for a TRV is a Health Based Guideline Value (HBGV). The TRV typically adopted in risk calculations (equal to a tolerable daily intake [TDI] or acceptable daily intake [ADI]) is based on the lowest no observed adverse effect level (NOAEL), typically from animal or human (e.g. occupational) studies, and the application of a number of safety or uncertainty factors (UF). Intakes / exposures lower than the TRV are considered safe, or not associated with an adverse health risk (NHMRC 1999). Instead of a NOAEL, an alternative Point of Departure (POD) such as a Lowest Observed Adverse Effect Level (LOAEL) or Benchmark Dose Level (BMDL) may also be used and these usually include additional uncertainty factors. A Human Equivalent Dose (HED) may also be calculated to avoid the use of a significant number of UFs, if there is sufficient understanding of the toxicokinetics or data to allow toxicokinetic modelling.

Where a chemical has the potential for carcinogenic effects, the mechanism of action needs to be understood as this defines the way that the dose-response is assessed. Carcinogenic effects are associated with multi-step and multi-mechanism processes that may include genetic damage, altering gene expression and stimulating proliferation of transformed cells. Some carcinogens have the potential to result in genetic (DNA) damage (gene mutation, gene amplification, chromosomal rearrangement) and are termed genotoxic carcinogens. For these carcinogens, it is assumed that any exposure may result in one mutation or one DNA damage event that is considered sufficient to initiate the process for the development of cancer sometime during a lifetime (NHMRC 1999). Hence no safe-dose or threshold is assumed, and assessment of exposure is based on a linear non-threshold approach using slope factors or unit risk values, which can also be termed TRVs.

For other (non-genotoxic) carcinogens, while some form of genetic damage (or altered cell growth) is still necessary for cancer to develop, it is not the primary mode of action for these compounds. For these compounds, carcinogenic effects are associated with indirect mechanisms (that do not directly interact with genetic material) and so a threshold is believed to exist and a threshold TRV can be adopted.

Dose-response values (threshold or non-threshold), i.e. TRVs, that are considered relevant to the characterisation of potential health effects associated with exposure to PFAS, have been selected from credible peer-reviewed sources using the process outlined in enHealth and NEPC (enHealth 2012b; NEPC 1999 amended 2013a).

The toxicology of PFAS is complex and not well understood despite a significant amount of research in the last 5-10 years. **Appendix B** presents a summary of the human toxicity of PFOS,

PFOA and PFHxS, with the following providing a summary of the key aspects considered in this assessment.

3.2 Toxicology of PFAS

Toxicological studies using laboratory animals for this family of chemicals have focused to date on PFOS, PFHxS and PFOA. A more detailed review is provided in **Appendix B**.

The toxicology of PFAS is complex and not well understood despite a significant amount of research in the last 5 to 10 years.

Toxicological studies using laboratory animals for this family of chemicals have focused to date on PFOS, PFHxS and PFOA. The toxicity of PFAS to humans can be inferred from animal toxicity studies as well as occupational exposure studies in accordance with the normal processes used to determine the toxicity of a chemical. This is in line with studies on the effects of many other chemicals.

Concentrations of PFAS in occupationally exposed workers are 100 to 1,000-fold higher than those in the general populations. Associations between exposure and the following health effects have been suggested in these studies:

- Changes in serum lipid levels e.g. increase total cholesterol levels
- Changes in serum liver enzymes levels
- Kidney disease
- Effects on fertility, pregnancy, lactation, and birth outcomes
- Effects on thyroid and immune function
- Endocrine effects (e.g. elevated thyroxine levels and increased risk of thyroid disease, diabetes mellitus and early onset menopause)
- Cardiovascular disease
- Cancer.

Results of studies in animals have been used to calculate tolerable daily intakes using the internationally accepted standard approaches for extrapolating from animal to human effects. This is standard practice and is the basis for tolerable daily intakes or reference doses for almost all chemicals for which such guidelines are available.

Tolerable daily intake/reference dose is the amount a person can take in every day for their lifetime that will not result in adverse effects. Such values are determined by taking the dose that did not cause any effects in the animal studies. A number of safety factors are then applied to reduce the dose to address limitations in our knowledge regarding:

- difference between animals and people
- difference between individual people
- confidence in the database (i.e. extensive toxicological studies versus limited studies etc).

The combination of the dose that did not cause any effects and the safety factors gives a tolerable daily intake or reference dose. This is the toxicity reference value used to generate guidelines like the fish tissue trigger point used in this assessment.

The TDIs or reference doses adopted by FSANZ for the assessment PFOS + PFHxS and PFOA are summarised in **Table 3.1**. This table also includes the background intakes, based on the reviews presented by ToxConsult (ToxConsult 2016b, 2016a) adopted for the characterisation of risk.

Table 3.1: Summary of toxicity reference values adopted for PFOS + PFHxS and PFOA

PFAS Compound	TDI	Background intake	Reference
PFOS + PFHxS	0.02 µg/kg/day	0.0014 µg/kg/day (7% of the TDI)	
PFOA	0.16 µg/kg/day	0.00078 µg/kg/day (negligible)	

3.3 New international assessments – 2018/2020

Since the work by FSANZ was completed in 2017, a number of international agencies have published updated toxicological reviews for these chemicals.

In June 2018, the US ATSDR published an update to their toxicological profile for PFAS. The update changed their existing draft guideline based on applying an additional safety factor to address the uncertainties in understanding the impacts these chemicals may have on the immune system. This assessment remains a draft profile and hasn't been implemented as yet (ATSDR 2018). In September 2020, the European Food Safety Authority released a toxicity profile for PFOS, PFOA, PFNA and PFHxS (EFSA Panel on Contaminants in the Food Chain et al. 2020). A tolerable weekly intake of 0.0044 µg/kg bw/week for the sum of PFOS, PFOA, PFNA and PFHxS was determined based on effects on the immune system. These newly derived guidelines are lower (i.e. more stringent) than the existing Australian TDIs listed in **Table 3.1**.

FSANZ has indicated that they are currently undertaking a review of all these documents to determine if there is any new information that would warrant a change in Australian guidance[1].

3.4 Other PFAS

Most international guidelines focus on PFOS and PFOA. Guidelines in Australia focus on PFOS, PFHxS and PFOA. There are, however, many other chemicals that may be included in the PFAS chemicals class. For most of these "other PFAS", limited data are available to evaluate their toxicity. What is available indicates that these other chemicals are likely to be less toxic than PFOS and PFOA. Given these limitations, this assessment has considered the guidelines specifically as indicated in the PFAS NEMP as well as whether there is any change in the conclusions if the sum of all PFAS detected in a sample (i.e. total PFAS) is considered.

3.5 FSANZ trigger points for different food types

In addition to these overarching toxicity reference values, other types of screening criteria have been developed for use in contaminated land investigations involving PFAS chemicals. FSANZ have established trigger points which can be used to screen measured concentrations in food where that might be relevant for a site investigation. These FSANZ trigger points are listed in **Table 3.2** (FSANZ 2017a).

[1] https://www.foodstandards.gov.au/consumer/chemicals/Pages/Perfluorinated-compounds.aspx

Table 3.2: FSANZ trigger points

Criteria Type	Screening Criteria	
	PFOS + PFHxS	PFOA
Finfish (mg/kg) [1]	0.0052	0.041
Fish liver (mg/kg) [1]	0.28	2.24
Crustaceans/Molluscs (mg/kg) [1]	0.065	0.52
Meat (mg/kg) [1]	0.0035	0.028
Milk (mg/kg) [1]	0.0004	0.0028
Honey (mg/kg) [1]	0.033	0.264
Offal (mg/kg) [1]	0.096	0.765
Eggs (mg/kg) [1]	0.011	0.085
Fruit (mg/kg) [1]	0.0006	0.0051
Vegetables (mg/kg)[1]	0.0011	0.0088

Notes:

1 FSANZ Dietary Assessment (FSANZ 2017a)

3.6 Summary of Recommendations – Human Health

For the assessment of PFAS, the TRVs recommended by FSANZ (i.e. **Table 3.1**) have been adopted in this assessment as well as the screening criteria as listed in **Table 3.2**:

- For PFOS + PFHxS (sum), the recommended TRV is 0.02 µg/kg/day ($2x10^{-5}$ mg/kg/day); and
- For PFOA, the recommended TRV is 0.16 µg/kg/day ($1.6x10^{-4}$ mg/kg/day).

Other PFAS compounds have been assessed in this HHERA using either the TRV for PFOS+PFHxS (for sulfonic acid PFAS and the fluorotelomers including 6:2 FTS or the TRV for PFOA for carboxylic acid PFAS and other PFAS (sulfonamides etc)).

3.7 Uncertainties

In general, the available scientific information is insufficient to provide a thorough understanding of all of the potential toxic properties of chemicals to which humans may be exposed. It is necessary, therefore, to extrapolate these properties from data obtained under other conditions of exposure and involving experimental laboratory animals. The majority of the toxicological knowledge of chemicals comes from experiments with laboratory animals, although there may be interspecies differences in chemical absorption, metabolism, excretion and toxic response, as is particularly the case for PFAS compounds. There may also be uncertainties concerning the relevance of animal studies using exposure routes that differ from human exposure routes. In addition, the frequent necessity to extrapolate results of short-term or sub-chronic animal studies to humans exposed over a lifetime has inherent uncertainty.

Overall, the toxicological data presented are considered to be current and adequate for the assessment of risks to human health associated with the potential exposure to PFOS, PFOA, PFHxS and PFHxA. The uncertainties inherent in the toxicological values adopted are considered likely to result in an overestimation of actual risk assessed for long-term or chronic exposures. Specifically, the use of chronic values for the assessment of short duration (acute or sub-chronic) exposures (as undertaken for construction workers) is expected to be conservative and result in an overestimate of actual risk.

Section 4. Toxicity of PFAS – Environment

4.1 General

This section outlines the approach used to assess the toxicity of PFAS to aquatic and terrestrial organisms. More detail is provided in **Appendix C**.

To determine what concentrations are likely to be protective (or concentrations likely to cause effects) national approaches for the development of water quality guidelines for aquatic systems and ecological investigation levels for soil to protect terrestrial systems have been outlined by relevant national bodies in Australia (ANZECC/ARMCANZ 2000; ANZG 2018; NEPC 1999 amended 2013d). These approaches are similar to those adopted in other countries (CCME 1995, 1998, 2005, 2006a, 2006b, 2007; USEPA 2005, 2007).

These approaches have been adopted in national guidance to determine guideline values for particular priority chemicals but the approaches can also be applied in site specific risk assessments where chemicals present at a site are not covered in national or international guidance.

These approaches involve the collection and review of information from the scientific literature on the toxicity of the specific chemical of interest to aquatic or terrestrial organisms. If toxicity information is available for a sufficient number of organism types, a species sensitivity distribution is developed showing the range of concentrations where organisms show effects. These distributions allow the calculation of a concentration that is likely to be protective of 95% of organisms (or some other percentage as specified in the guidance documents). For chemicals where toxicity information is limited, the most sensitive effect concentration is used with relevant uncertainty factors to determine a protective concentration.

It is noted that ecological guidelines are available for PFOS, with some limited guidelines available for PFOA. No ecological guidelines are available for most other PFAS.

For PFAS that have potential to bioaccumulate the potential for different/increased risk due to this characteristic must be considered but for those PFAS that are not bioaccumulative only the potential for direct toxicity effects needs to be considered.

It has been assumed for screening purposes in this assessment that:

- guidelines for PFOS are applicable to all sulfonates as well as the fluorotelomers
- guidelines for PFOA are applicable to all carboxylic acids

4.2 Terrestrial ecosystems

The PFAS NEMP provides direct and indirect exposure soil guidelines for the protection of terrestrial environments in two land use settings – a residential setting and a commercial/industrial setting (HEPA 2020). Guidelines are only available for PFOS (for direct toxicity and bioaccumulation) and PFOA (for direct toxicity only). In addition, guidelines for PFOS only in the diet of mammals and birds are provided to address bioaccumulation issues.

The guidelines adopted in the PFAS NEMP that relate to indirect exposures are derived from the review presented by Environment Canada (Environment Canada 2018). The Environment Canada review provide criteria for some additional land uses (where the residential value is adopted). These criteria are presented, along with the relevant PFAS NEMP guidelines in **Table 4.1.**

Table 4.1: Guidelines for protection of terrestrial environments

Basis of Guideline	Adopted Guideline			Notes
	PFOS	PFOA	PFHxS	
Soil: indirect exposure (mg/kg [soil])				
Agricultural land	0.01	0.01	0.01	Guideline for indirect exposure (i.e. includes some consideration of uptake into plants or animals that may be eaten by other organisms and leaching to and impacts on water quality [protection of freshwater species]) (Environment Canada 2017, 2018; HEPA 2020).
Residential	0.01 *	0.01	0.01	
Parkland and recreational	0.01	0.01	0.01	
Commercial/industrial	0.14 *	0.14	0.14	
Soil: direct toxicity (mg/kg [soil])				
Terrestrial environments – Soil	1*	10*	1	Guideline for direct exposure for public open space, which is recommended to be used for all land use scenarios (HEPA 2020).
Terrestrial biota (mg/kg [diet])				
Terrestrial species (mammals and birds)	0.0046*	0.0046	0.0046	Guideline for dietary material consumed by higher organisms (for PFAS that are bioaccumulative) as listed in NEMP. The most sensitive value listed has been chosen – i.e. concentration that can be present in food (aquatic or terrestrial) consumed by mammals. The value protective for food consumed by birds is 0.0082 mg/kg. There is no value listed for PFOA, so the value for PFOS has been adopted (HEPA 2020).

* Guideline value available from the PFAS NEMP (HEPA 2020)

The guidelines above relate to all soil products, regardless of mixing, as the various terrestrial species may only access soil or materials on the very surface of the ground.

The direct exposure guideline from the NEMP is around 10 times lower than the guideline calculated by Environment Canada (2018) guideline for the protection of organisms (including earthworms and plants) in direct contact with soil. They calculated a guideline for PFOS of 11 mg/kg for an agricultural and a residential/parkland setting, and 61 mg/kg for commercial/industrial settings (Environment Canada 2018). The Environment Canada guideline is based on studies with plants (alfalfa, flax, lettuce, onion, potato, ryegrass, soybean and tomato) and invertebrates (earthworm, springtail and mite), and includes an uncertainty factor of two due to issues associated with laboratory to field extrapolation. The NEMP chose a more conservative value, given the uncertainty in knowledge.

The guidelines for dietary material consumed by mammals and birds relate to concentrations of PFOS in an aquatic biota food item, that could be eaten by terrestrial or semi-aquatic mammal or bird. Environment Canada notes that these guidelines may not be appropriate for terrestrial consumers other than mammals and birds (e.g. reptiles such as turtles) (Environment Canada 2018).

The NEMP recommends the use of guidelines for PFOS for screening PFHxS in regard to ecological protection. Most other PFAS also do not have specific guidelines for soil, water or sediment based on ecological protection.

4.3 Aquatic ecosystems

4.3.1 Guidance for chemicals that bioaccumulate

The supporting documents for the Australian Water Quality Guidelines provide the following information on how to deal with bioaccumulative chemicals:

- *Dietary accumulation can be an important route of uptake for some chemicals, and it will need to be addressed in future revisions of the Guidelines;*
- *There is currently no formal and specific international guidance for incorporating bioaccumulation into water quality guidelines;*
- *For those chemicals that have the potential to bioaccumulate, the decision scheme provides for site-specific re-assessment of this issue, if suitable data become available. Field investigations of residue levels in appropriate organisms may provide additional evidence for whether or not bioaccumulation is an issue at the site under study; and*
- *In the absence of such local data, a higher level of protection is recommended (e.g. 99% protection for slightly–moderately disturbed systems instead of 95%).*

It is noted that the last point (i.e. use of the 99% protection trigger value) often represents the default position adopted for most contaminated land sites but it is not the only approach that can be used and, based on this guidance, is not the preferred approach.

The use of the 99% protection trigger value is a policy decision that does not include specific consideration of scientific information relating to bioaccumulation processes (i.e. does not actually assess the potential for bioaccumulation in aquatic organisms). The “step up” of a protection level is simply a trigger for more careful and detailed assessment as the chemical has been identified to be bioaccumulative.

Another option for dealing with bioaccumulative substances is the use of actual sampling of aquatic biota to determine whether organisms that may be present in an aquatic system are actually being exposed to chemicals like PFOS in a form that can get into their systems and be accumulated.

The currently preferred approach for sites where PFOS may be present is to use the 95% protection trigger value to determine if there is a potential for direct toxicity to aquatic organisms and to use field sampling of aquatic biota to assess the potential for bioaccumulation/secondary poisoning.

In this case, screening has used both 99% and 95% species protection guidelines.

4.3.2 Recommended Aquatic Guidelines

Water quality guidelines and / or toxicity information relevant to the characterisation of potential effects associated with exposure to PFAS have been selected from credible peer-reviewed sources. A summary of the key effects and aspects relevant to the identification and selection of an appropriate toxicity reference values for PFAS is provided in **Appendix C**.

Based on the review presented in **Appendix C,** guidelines relevant to this assessment are provided in **Table 4.2**.

Table 4.2: Adopted Guidelines for Protection of Aquatic Environments

Basis of Guideline	Adopted Guideline		Notes
	PFOS	PFOA	
Aquatic Organisms – Freshwater	0.00023 µg/L	19 µg/L	As listed in NEMP, interim water quality guidelines are to be used for screening at sites affected by PFAS. These values are relevant for 99% species protection. See discussion above regarding use of ANZECC guidelines for this assessment – 95% trigger value to be used to assess direct toxicity and dietary guidelines from Environment Canada to be used to assess bioaccumulation. Page et al 2019 discuss the statistical issues that caused difficulty in calculating the 99% species protection value and instead recommend a value of 0.05 µg/L (Page et al. 2019). This value has also been discussed in this assessment.
	0.13 µg/L	220 µg/L	As listed in NEMP, interim water quality guidelines are to be used for screening at sites affected by PFAS. These values are relevant for 95% species protection which addresses direct toxicity for organisms living in affected waterbodies (HEPA 2020).
Aquatic Organisms – Diet	0.0046/ 0.0082 mg/kg	0.0046/ 0.0082 mg/kg	Criteria for dietary material consumed by higher organisms as listed in NEMP. The values listed are based on the protection of birds or mammals when they consume a diet that contains PFOS. There is no value listed for PFOA so the value for PFOS has been adopted (HEPA 2020).
Aquatic organisms – sediments	0.01 mg/kg	0.01 mg/kg	There were no criteria for PFAS in sediments for ecological protection at the time of preparing the NEMP. CSIRO staff were undertaking toxicity testing with benthic organisms which was expected to allow a relevant guideline to be developed. In the meantime, the NEMP recommended the use of the criteria for indirect exposure to PFAS in soil be adopted. It is noted that the value chosen includes some consideration of uptake into plants or animals that may be eaten by other organisms. The value adopted for PFOS also adopted for PFOA (HEPA 2020).
	0.25 mg/kg (95%)	--	Since the release of the NEMP in 2020, CSIRO have published their sediment ecotoxicity data (Simpson et al. 2021). These data have been used to calculate 95% and 99% species protection values. These values have been adopted for this assessment.
	0.06 mg/kg (99%)	--	

The NEMP recommends the use of guidelines for PFOS for screening PFHxS in regard to ecological protection. Most other PFAS also do not have specific guidelines for soil, water or sediment based on ecological protection.

Where necessary other PFAS have been screened using the guidelines for PFOS or PFOA. Other PFAS compounds have been assessed in this HHERA using either:

- guidelines for PFOS have been applied to the sulfonic acid type PFAS (e.g. PFBS, PFPeS, PFHxS etc) and the fluorotelomers including 6:2 FTS (i.e. 4:2, 6:2, 8:2 and 10:2 FTS) or

- guidelines for PFOA have been applied to the carboxylic acid PFAS (i.e. PFBA, PFPeA, PFHxA etc) and other PFAS (sulfonamides including EtFOSA, EtFOSAA, EtFOSE, MeFOSA, MeFOSAA, MeFOSE and FOSA).

Section 5. Site description

5.1 Site details

The site is located next to Darwin Harbour in an industrial area approximately 7 km to the south east of Darwin CBD.

Darwin has a tropical climate with distinct wet and dry seasons. The dry season is typically from about May to September and wet season from about November to March. Darwin has an average annual rainfall of 1,723 mm (BoM) (SMEC 2022).

The site and surrounds are relatively flat forming a peninsula style formation within the broader Darwin Port. The site is at an elevation of approximately 5-8 m Australian height datum (AHD) (SMEC 2022).

The site is located between a major access road and the rail line. The areas on the eastern side of the access road and on the western side of the rail line are undeveloped and consist of a typical estuarine environment within Darwin Harbour including mudflats, tidal creeks and mangroves (SMEC 2022).

Site identification details are provided in **Table 5.1**.

Table 5.1: Site Details (SMEC 2022)

Site Details	
Facility Address	780 and 800 Berrimah Road, East Arm, Northern Territory 0822
Current Site Use	North: Bulk liquid transfer and storage facility South-east: Sub-lease to Global Resource Recovery (GRR) for liquid waste treatment management
Title Identification Details	5719 and 5783 Hundred of Bagot
Current Site Zoning	Industrial (Zone DV - Development)
Site Area	130 000 m^2 (approximately)

The land uses adjoining the site are summarised in **Table 5.2.**

Table 5.2: Surrounding Land Uses (SMEC 2022)

Direction (Relative to site)	**Description**
North	Vacant land immediately to the north of the Site, followed by the Ghan Passenger Rail Terminal.
South	Northern Cement Darwin
East	Berrima Road spans the eastern boundary of the Site, adjacent to wetland area, then Hudson Creek.
West	A railway spans the western boundary of the Site, adjacent to wetland area, then Bleesers Creek and Frances Bay/Darwin Harbour.

5.2 Geology

The history of the site prior to use as the Vopak bulk fuel terminal has not been previously documented. Aerial images available to SMEC dating back to 2001 show the general site area and

surrounds to be filled over surrounding mudflat areas prior to the terminal construction in 2005. The land use prior (if any) is unknown (SMEC 2022).

Reference to the 1:100,000 scale geology map of Darwin (Published by the Department of Mines and Energy) indicates the site is likely to be underlain by Siltstone; shale; sandstone (quarts arenite, sublitharenite); quartz pebble conglomerate; metamorphosed to lower greeschist facies (Burrell Creek Formation). Surrounding areas comprise intertidal marine alluvium. (SMEC 2022)

Site specific geology is limited. A geotechnical report for the biodiesel area (to the south-east) reported some fill material, overlying shallow weathered phyllite rock and 'coffee rock (however, logs or plans showing test locations were not available) (SMEC 2022).

Subsurface conditions were assessed during this investigation (SMEC 2022). **Table 5.3** shows the findings.

Table 5.3: Subsurface conditions (SMEC 2022)

Unit	Typical depth to top of unit (m bgl)	Indicative thickness of unit (m)	Description
Roadbase/ pavers	0	-0.08	Typically, medium to coarse gravel or concrete pavers.
FILL	0.08	0.15-1.32	General fill mixtures/layers: SILT, Gravelly SILT or silty gravelly SAND, transitioning into sandy silty GRAVEL, cobbly GRAVEL, gravelly COBBLES or COBBLES, transitioning into cobbly BOULDERS or BOULDERS (siltstone). Note: Gravel and cobble size generally increased with depth)
Estuarine	1.7	1.2	Sandy clay Note: this layer was only encountered at location EMB20.
Weathered material (rock)	0.5-1.2	--	SILTSTONE

No unusual staining or odours were observed during the sampling. No visual indicators of suspected asbestos containing material (ACM) were noted at the sampling locations. PID field screening did not suggest the presence of volatile contaminants (SMEC 2022).

5.3 Hydrology / hydrogeology

The terminal captures surface water within bunds around tanks and paved areas. Such surface water is directed into an on-site drainage/treatment system which discharges to the west into the wetland/harbour. The treatment system in the Vopak bulk fuel terminal comprises a first flush sump and oil/water separator. Flow directions may change in times of very heavy rain and surface water flows could move in multiple directions (SMEC 2022).

Detailed site-specific hydrogeology was not available prior to commencement of this investigation. Past monitoring wells installed at the site recorded groundwater depths ranging between 2.63 m and 4.57 m below ground level in October 2020 (end of dry season) and between 0.3 m and 2.18 m in April 2021 (end of wet season) (SMEC 2022).

Electrical conductivity values from both these sampling events showed a range of 117 µS/cm to 70,194 µS/cm which suggests a range between fresh to hypersaline conditions depending on the time of year and timing of sampling within the tidal cycle (SMEC 2022).

During this investigation it was found that the standing water level ranged from 0.998 m bgl to 2.315 m bgl. These levels were determined in early April 2022 and are similar to the results obtained in April 2021.

Data provided to SMEC by Vopak show that fourteen (14) groundwater monitoring wells exist at the Site (EMB1-EMB8 and EMB11-EMB16). Logs for these wells are not available, but well completion details were presented in a previous report (EcOz, 2020) and are provided in **Table 5.4**. Standing water levels from these wells have generally been recorded biannually since 2009 and the range of standing water levels from past monitoring is also presented in **Table 5.4** (SMEC 2022).

Table 5.4: Existing groundwater monitoring well details (SMEC 2022)

Bore ID	Total Depth (m)	Screen Depth (m)	Standing Water Level Range 2009-2022 (m bgl)[1]
EMB1	10	7 to 10	0.63-3.50
EMB2	10	7 to 10	0-5.33
EMB3	10	7 to 10	1.57-3.49
EMB4	10	7 to 10	1.13-7.63
EMB5	8	5 to 8	0.61-3.80
EMB6	10	7 to 10	0.64-3.89
EMB7	10	7 to 10	0.64-5.72
EMB8	10	7 to 10	1.50-4.93
EMB11	8.5	5.5 to 8.5	1.20-3.90
EMB12	9.5	6.5 to 9.5	1.16-7.04
EMB15	9.5	6.5 to 9.5	0.68-3.40
EMB16	9.5	6.5 to 9.5	2.06-5.39

Notes:

1. Data from electronic database provided to SMEC by Vopak – (m bgl = metres below ground level)

Groundwater flow directions have not been previously calculated. It may be possible that groundwater flows could move preferentially in multiple directions due to the location being a peninsula surrounded by the Harbour on 3 sides, the shallow nature of groundwater and heavy rain in wet seasons. Generally, groundwater would be expected to flow east to west (SMEC 2022).

Groundwater flow was inferred to be to the west during this sampling event. **Figure 5.1** shows groundwater contours and flow direction (SMEC 2022).

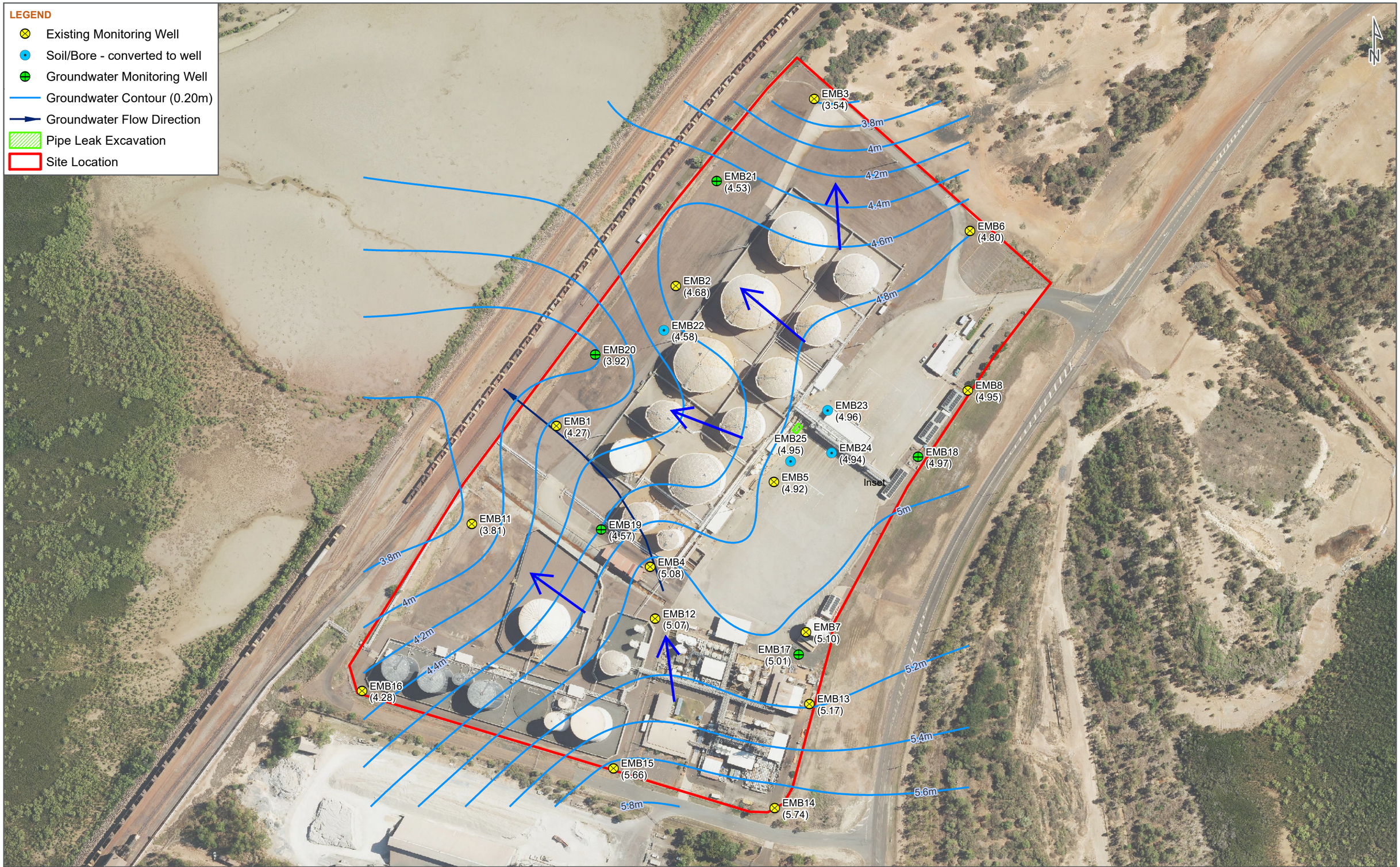


FIG NO. 5.1	**FIGURE TITLE** Groundwater Contours and Flow Direction	**DATE** 05/05/2022	0 25 50 100 Meters 1:2,500	**PAGE SIZE** A3	**COORDINATE SYSTEM** GDA 1994 MGA Zone 52
PROJECT NO. 30080099	**PROJECT TITLE** Vopak Darwin Terminal, 780 Berrimah Road	**CREATED BY** FA13847	**SOURCES** Roadnet MDS 2022 MetroMap Imagery © Aerometrex Pty Ltd		

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Last updated by: FA13847 on 5/05/2022 at 10:13

5.4 Site history

Review of aerial images dating back to 2001 show the general site area and surrounds to be filled over surrounding mudflat areas prior to the terminal construction in 2005 (SMEC 2022).

Previous reports prepared prior to the construction of the terminal indicated the following relating to the Site condition:

"The proposed site encompasses Quarantine Island and a low lying section of land previously containing mangrove vegetation and soft mangrove muds, south of East Arm Peninsula. Site preparation was undertaken by the former Department of Transport and Works Construction Agency (now part of the DIPE), and included reclamation using quality imported fill material, surcharging the mangrove muds and the construction of a bund wall to level 5.5 m AHD along the northern perimeter. The site has been cut/filled to bring it to a required elevation of RL 5.5 m AHD." (SMEC 2022).

The land use prior to development by Vopak is, therefore, inferred to have been vacant land that was subsequently filled and recontoured for the terminal construction (SMEC 2022).

5.5 Site layout and operations

5.5.1 General

The northern part of the Site is used as a bulk liquid fuel transfer and storage facility operated by Vopak. The south-eastern part of the Site is subleased to GRR for treatment and management of liquid wastes. Each area is described in the sections below. **Figure 5.2** shows the site layout.

5.5.2 Vopak bulk fuel terminal

A high-level overview of the operations at the Vopak Terminal is as follows:

- Bulk liquids are delivered to the Site from East Arm Port via a pipeline
- All bulk liquids are stored in above ground tanks around the Site
- Bulk liquids are transferred to road tankers using bottom-loading gantries for off-site movement of the bulk liquids (SMEC 2022).

The Site storage areas are divided into three main zones:

- Darwin Industry Fuel Terminal (DIFT)
- Darwin Acid Terminal (DAT)
- The 6-Series (previously the Darwin Biodiesel Terminal) (SMEC 2022).

There are two pipelines which transfer fuels from the wharf at the Port to the DIFT facility. There is one pipeline which supplies diesel from the DIFT facility to the wharf, and one pipeline which supplies sulfuric acid from the wharf to the DAT facility. There is also a pipeline to the 6-Series area from the wharf (SMEC 2022).

The DIFT zone includes:

- 12 above ground bulk fuel storage tanks
- Various smaller above ground fuel additive tanks

- Above ground fuel slops tanks
- One underground oil/water tank
- Road tanker loading gantry
- One above ground firewater tank and associated pumphouse (The pump house contains a 7,100 litre above ground storage tank to store fire extinguishing agent concentrate – Ansulite low viscosity 3x3 Alcohol Resistant Concentrate (ARC)) (SMEC 2022).

A building housing the Site office, control room and amenities is located in the north-east of the Site (SMEC 2022).

The DAT zone includes one above ground bulk fuel storage tank and associated connections and pipework. There is also a 1 m^3 pump out sump to contain spills (SMEC 2022).

The 6-Series zone contains ten (10) above ground bulk fuel storage tanks (SMEC 2022).

LEGEND

- DIFT Area
- 6-Series Area
- DAT Area
- GRR LWTF
- Approximate location of firefighting foam solution leak 2020
- Site Location

N

Sewage pump station
Office / control room
Former Septic Tank & Pump Chamber
Soakage trench
Switchroom
Pump Bay
Stormwater Separator
Wastewater treatment
Firewater pumphouse
TK3101 (Fire water tank)
Tank Farm
Filter Press
Glycol recovery processing
Recieval bay
Sludge bay
Oil processing
Packaging waste
Wharf lines
Acid road tanker loading bay
Fire Box
Refer to Figure 2A for details
TK0303
TK0203
TK0302
TK0202
TK0301
TK0201
TK0105
TK0104
TK0106
TK0103
TK0101
TK0102
TK6301
TK6203
TK6202
TK6201
TK6101
TK6102
TK6103
TK6104
TK6108
TK6107
TK6106
Berrimah Rd

FIG NO. 5.2 **FIGURE TITLE** Site Layout

DATE 05/05/2022

0 25 50 100 Meters
1:2,750

PAGE SIZE A3

COORDINATE SYSTEM GDA 1994 MGA Zone 52

PROJECT NO. 30080099 **PROJECT TITLE** Vopak Darwin Terminal, 780 Berrimah Road

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Last updated by: FA13847 on 5/05/2022 at 11:08

There are large open areas surrounding the fuel infrastructure. Areas to the east are covered with pavers and areas to the north and west are gravel surface (SMEC 2022).

Site stormwater enters subsurface drainage systems which flow to a first flush tank and water separator. Stormwater undergoes pH testing and a visual assessment prior to release to an open drain which discharges to the environment in the west (SMEC 2022). The drain is shown in **Figure 5.3**.



Figure 5.3: Open stormwater drain

If the water is assessed to be of poor quality, it is either recycled through the Site stormwater treatment system or disposed off-site at a licensed waste facility (SMEC 2022).

Tank sludge and waste oil generated from on-site processes is disposed of off-site at a licensed waste facility (SMEC 2022).

The site originally had a septic system to manage sewage, but this was upgraded in 2010 to connect the system to Power and Water Corporation infrastructure (SMEC 2022).

5.5.3 GRR Liquid waste treatment facility (GRR LWTF)

Information provided by the Vopak terminal manager indicates that the south-eastern part of the Site was initially constructed for the purposes of being a biodiesel facility, but following construction was not operated for this purpose (SMEC 2022).

The area is now licenced to GRR for treatment and management of liquid wastes. Specific details of operations were not available but details on waste types and storage amounts were sourced from a copy of the site Environmental Management Plan available online (SMEC 2022).

A summary of relevant details from this plan are provided below:

- Environment Protection Licence (EPL 229) was granted by NT EPA on 21 December 2017
- The biodiesel facility was upgraded and repurposed into the Liquid Waste Treatment Facility (LWTF) which can treat industrial liquid waste streams including:
    - Acid and alkali waste streams
    - Industrial wash waters including low level amine wash waters
    - Waste oil and Oily Water including bunker oils from shipping
    - Glycol based waste streams
    - Contaminated stormwater and ground water
    - PFAS Separation
- The facility can also consolidate hazardous wastes such as:
    - solvents
    - cyanides
    - chromic Acid
    - mercury
    - chlorinated hydrocarbons
    - pesticides
    - similar wastes requiring specialised treatment to allow for the materials to be transported to GRR's LWTF in Laverton North, Victoria or other interstate licensed facilities (SMEC 2022).

The LWTF has the capacity to treat up to:

- 20 million litres per annum of industrial wastewater
- 24 million litres per annum of Glycol
- 10 million litres per annum of used engine oil and oily-water (SMEC 2022).

Vopak indicated that the GRR LWTF utilises the same fire fighting foam system used for the Vopak Terminal (SMEC 2022).

Section 6. Relevant site conditions

6.1 Sources of Contamination

The Vopak Bulk Fuel Terminal has a fire suppression/deluge system. This system is designed to control potential for fires, given the storage of flammable liquids at the site. The site layout is shown in **Figure 5.2**.

The product that was originally used in the fire suppression/deluge system was Angus Alcoseal 3x3.

This product was used from commissioning of the site in 2005 until 2014. Safety data sheets were available online. A recent SDS indicated this product contained 2-methylpentane-2,4-diol, sodium chloride, 1,3,5-tris(2-hydroxyethyl)hexahydro-1,3,5-triazine, 1,2-benzisothiazol-3(2H)-one and 2-methyl-2H-isothiazol-3-one (see **Appendix D**). An older SDS (also provided in **Appendix D**), indicated that previous formulations of a similar product definitely included fluorosurfactants – the description was a hydrolysed protein solution containing fluorosurfactants and glycol solvent. These SDS do not indicate exactly which PFAS might be present in the product on the ingredients list – this is common for many products.

A review undertaken on fire fighting foam products used in Ireland on behalf of their EPA confirmed that Alcoseal 3x3 definitely included fluorosurfactants[2] but did not provide information on the specific PFAS likely to be present.

Spills at other sites using similar products have indicated that these foams are more likely to contain fluorotelomers than PFOS or PFOA (e.g. Qantas spill in 2017 at Brisbane Airport).

In 2014, the Alcoseal product was replaced by Ansulite low viscosity 3x3 alcohol resistant concentrate. The safety data sheet is included in SMEC 2022 (the site investigation report). This product includes a range of chemicals including 2-(2-butoxyethoxy)ethanol, 1,2-propanediol, n-butanol, glycerol, dichloromethane (methylene chloride), 1,3-dichloropropene and D-glucopyranoside oligomer. It is not known if this product contains any PFAS. The results of these investigations (as discussed in following sections) indicate that it may do. EcOz (2020) confirms that 6:2 FTS was the primary PFAS detected at the site at the time of the leak in 2020.

The sources of PFAS at the site include spills/leaks from the deluge system as well as the regular testing of the system which occurred on a monthly basis with the foam discharged directly to the ground.

A number of incidents in relation to the fire suppression/deluge system have occurred at the site:

- In 2006, during the construction of the biodiesel terminal (now the GRR LWTF), there was a water / foam pipe "separation". Vopak has no formal record of the quantity of foam solution potentially released. The leak was apparently just south of the fire water tank and the foam solution spilt out across the site boundary to the east into a low point in the adjacent grassed area. This incident would have involved the Alcoseal product.

[2] https://www.epa.ie/publications/monitoring--assessment/waste/determining-historic-and-current-pfas-levels-in-afff-in-the-republic-of-ireland.php

- In 2014 there was a foaming of a JET-A1 aviation tank event. Vopak has no record of the type and quantity of foam solution released during that event. Vopak indicated that foam from that event was released only into the inside of the tank (i.e. no foam solution was released onto the ground). This incident would have involved the Alcoseal product.
- In 2020 there was a foam solution leak as described in EcOz report (pipe failure) which involved the Ansulite product (SMEC 2022).

Fire system deluge testing has occurred monthly at the facility since commissioning. This involves testing that the fire suppression/deluge system works and foam solution is discharged via about fifteen (15) tell tails where a relatively small quantity of foam solution is released. Prior to 2016/17, the released foam solution was not captured and went to ground. Since 2016/17 the water / foam solution has been captured in IBC's and disposed of by a licensed contractor off-site (SMEC 2022).

The monthly testing and the 2 incidents where foam solution is likely to have been released onto the ground may have been the source of PFAS to soil, groundwater and stormwater at the site. The monitoring results for these chemicals in these media are described in the following section.

In addition, the GRR LWTF in the south-eastern part of the Site is licenced to accept and manage wastewater containing PFAS, but it is unclear whether this has occurred or what it is has involved.

It is also noted that these chemicals are routinely found in surface waters in urban areas from a range of diffuse sources such as runoff from around homes or leaks from sewage collection systems.

6.2 Nature and Extent of PFAS Contamination

Monitoring of groundwater, stormwater and/or soil has occurred at the site since it commenced operation at different times and with different frequencies. PFAS were not included in the monitoring program until recently (SMEC 2022).

Sampling and analysis of soil, groundwater and stormwater for PFAS has been undertaken by EcOz, GHD and SMEC (SMEC 2022, GHD 2022, EcOz 2020, EcOz 2021a, EcOz 2021b).

An assessment of data quality and quality control for each monitoring event has been undertaken and presented in the various reports of the work prepared by these consultants. These assessments have found that the data are of suitable quality for interpretation and these data have been relied on for this assessment.

6.2.1 Soil

Soil samples have been collected by SMEC around the area where the foam solution leak occurred in 2020 and in the locations of the new groundwater wells (SMEC 2022). This provided a total of 30 samples for analysis for PFAS.

The sampling locations are shown in **Figure 6.1** (red markers for the soil bores near the location of the 2020 incident and blue markers for the new groundwater wells where soil samples were also collected). Samples were analysed for the suite of PFAS available from Australian laboratories. The adopted limits of reporting (LOR) ranged between 0.0002 and 0.001 mg/kg (depending on the compound and the laboratory used).

Of the 28 individual PFAS reported in the standard suite, 15 were not detected above the limit of reporting in any sample. These included 4:2 FTS, PFDoDA, PFTeDA, PFBS, PFPeS, PFHxS, PFHpS, PFDS, EtFOSA, EtFOSAA, EtFOSE, MeFOSA, MeFOSAA, MeFOSE and FOSA.

Table 6.1 lists the summary results for soil for the individual PFAS that were identified as present above the limit of reporting in at least one sample from the soil around the area where the 2020 leak occurred or in the soil collected when installing new groundwater wells by SMEC in 2022 (SMEC 2022).

Table 6.1: Soil concentrations for detected PFAS (mg/kg) – 2022

Detected PFAS	Average	Minimum	Maximum	Detection frequency (%)
PFBA	0.0015	<0.001	0.004	13%
PFPeA	0.0022	<0.0002	0.0157	90%
PFHxA	0.0023	<0.0002	0.0159	93%
PFHpA	0.0010	<0.0002	0.0021	73%
PFOA	0.0007	<0.0002	0.0074	70%
PFNA	0.0039	<0.0002	0.0086	20%
PFDA	0.0007	<0.0002	0.0011	10%
PFUnDA	0.0006	<0.0002	0.0006	3%
PFTrDA	0.0003	<0.0002	0.0003	3%
6:2 FTS	0.0307	<0.0005	0.246	70%
8:2 FTS	0.0259	<0.0005	0.253	67%
10:2 FTS	0.0042	<0.0005	0.0094	13%
PFOS	0.0004	<0.0002	0.0006	13%
Total PFAS	0.047	<0.0002	0.52	97%

Almost every soil sample around the location of the 2020 incident and at the locations of each of the new groundwater wells contained measurable levels of at least one PFAS. Only 13% of samples contained PFOS which is as expected, given the nature of the products used at this site – ones focused on fluorotelomers and short chain carboxylic acids rather than being primarily PFOS.

PFAS results for soil samples collected immediately after the 2020 incident are listed in **Table 6.2** (EcOz 2020). These samples were collected for soil immediately within the excavations where the pipe leak was found. Photos of the locations are shown below (**Figure 6.2**).

Table 6.2: Soil concentrations for detected PFAS (mg/kg) – 2020

Detected PFAS	Minimum	Maximum
PFBA	<0.001	0.02
PFPeA	0.001	0.007
PFHxA	0.0019	0.0148
PFHpA	0.0005	0.0035
PFOA	0.0006	0.0061
6:2 FTS	0.0104	0.235
8:2 FTS	<0.0005	0.0226
10:2 FTS	<0.0005	0.0182
PFBS	<0.0002	0.0003
PFHxS	<0.0002	0.0068
PFOS	0.0002	0.0423
Total PFAS	0.03	0.29

These results are similar to the results for samples collected in 2022. 6:2 FTS was present at the highest concentration in both sampling events and at similar concentrations (0.235 vs 0.246 mg/kg).

LEGEND

- Existing Monitoring Well
- Soil Bore
- Soil/Bore - converted to well
- Groundwater Monitoring Well
- Pipe Leak Excavation
- Site Location



FIG NO. 6.1	**FIGURE TITLE** Sample Locations	**DATE** 05/05/2022	0 25 50 100 Meters 1:2,500	**PAGE SIZE** A3	**COORDINATE SYSTEM** GDA 1994 MGA Zone 52
PROJECT NO. 30080099	**PROJECT TITLE** Vopak Darwin Terminal, 780 Berrimah Road	**CREATED BY** FA13847	**SOURCES** Roadnet MDS 2022 MetroMap Imagery © Aerometrex Pty Ltd		

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Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, this map contains data from a number of sources - no warranty is given that the information contained on this map is free from error or omission. Any reliance placed on such information shall be at the sole risk of the user. Please verify the accuracy of all information prior to using it. This map is not a design document.

SMEC
Member of the Surbana Jurong Group

Location: V:\Projectz\30080099\Maps\30080099_F0003_SampleLocations.mxd

Last updated by: FA13847 on 5/05/2022 at 10:10

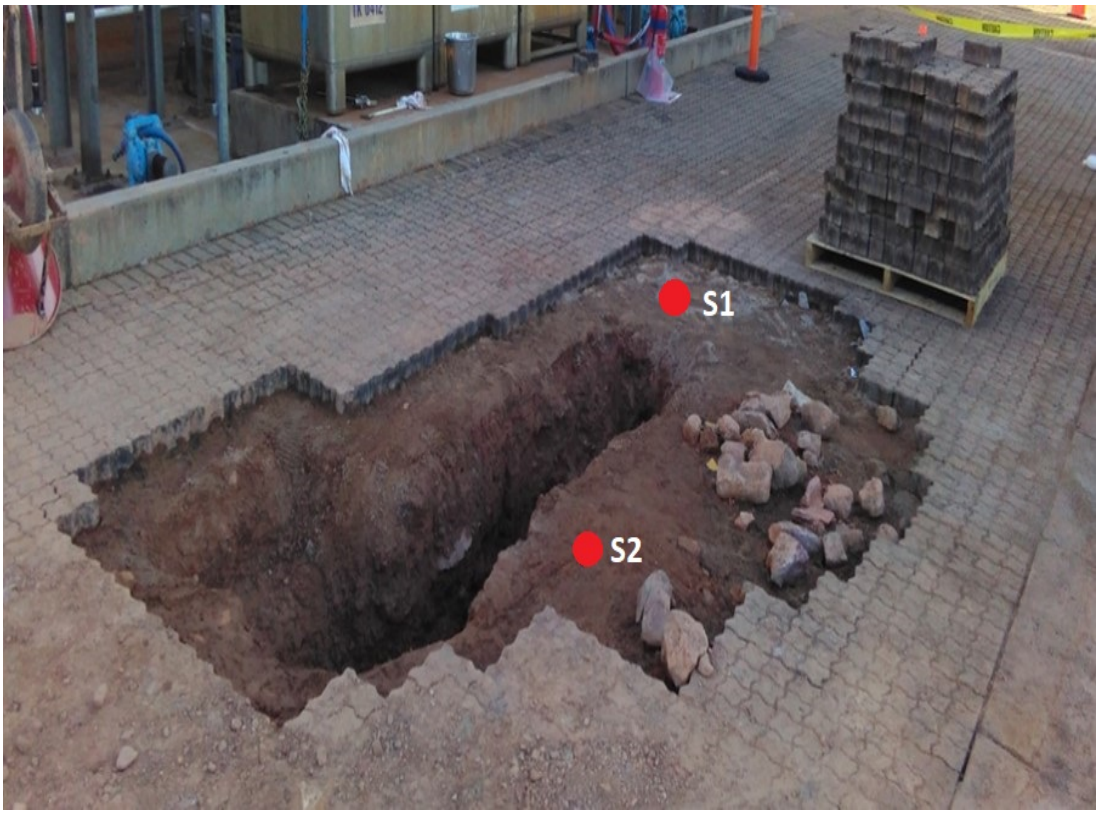


Figure 1. Excavation to expose the leaking section of pipe and location of S1 and S2 soil samples.

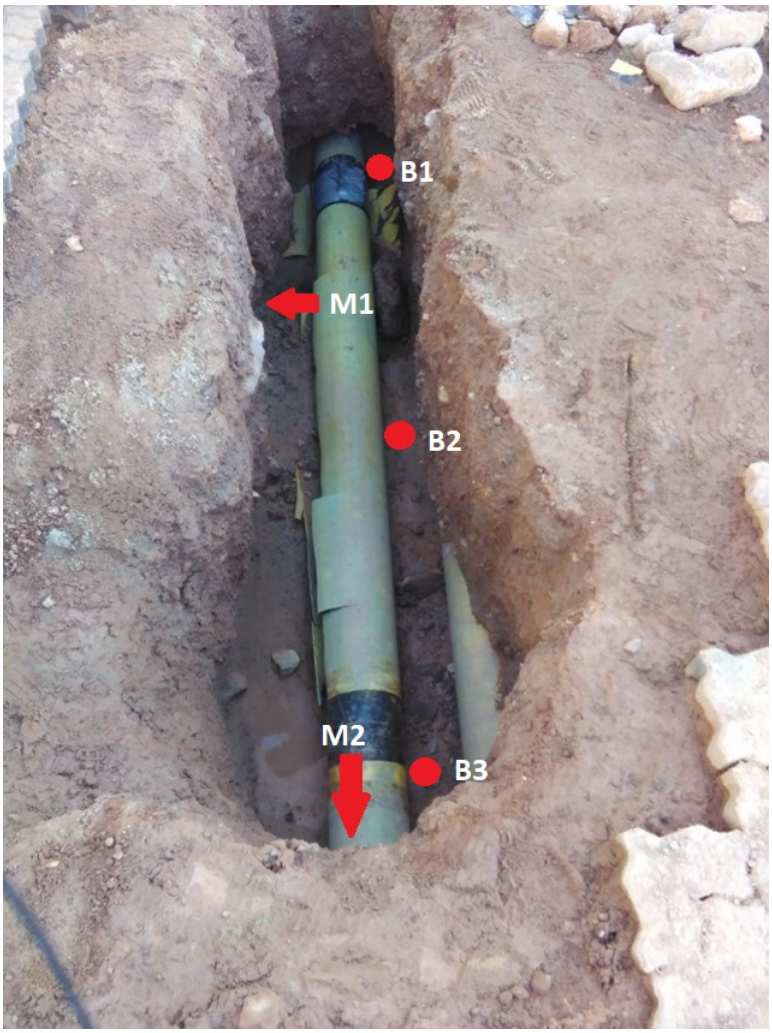


Figure 2. Leaking section of pipe and location of B1, B2, B3, M1 and M2 soil samples.

Soil samples were also assessed for the potential for PFAS to leach from soil into groundwater and/or surface water during rain events. The samples assessed in this way included EMB17(0.05-0.15), EMB18(0.1-0.2), EMB19(0.02-0.05), EMB20(1.1-1.2) and SBH04(0.08-0.15) (SMEC 2022).

Potential for chemicals to leach from soil was evaluated using the ASLP test (i.e. Australian Standard Leaching Procedure) (AS 1997). This method involves the use of a small amount of soil and a large amount of leaching fluid (i.e. water in the case of the ASLP). The test vessel containing these materials is then mixed by turning end on end for 16 hours and the presence of the chemicals in the liquid at the end of that time is measured. This method also focuses on the smaller particles in the soil – the soil is sieved prior to testing and only the fraction less than 2.4 mm is used in the test.

This test is designed to replicate what might leach from waste material inside a landfill over the lifetime of the landfill (>50 years). It is not designed to evaluate what might leach from a waste or from soil during a single rain event, nor is it common for such situations to have large volumes of water moving through small amounts of solid material – it is normally the reverse – and this will impact on how much of a chemical in the soil will actually move into the small volume of water moving through the soil profile during a rain event. It is this single rain event type information that would actually be most relevant for this type of risk assessment. It is noted that there are limited methods for evaluating leaching potential in a way that would be more relevant, but it is important to understand the limitations for the commonly used approach. This method is likely to provide significant overestimates of the amount of these chemicals that will leach from a soil during a single rain event.

The results for the samples with detections for these chemicals are provided in **Table 6.3**.

Table 6.3: Leachate concentrations for detected PFAS – ASLP (µg/L)

Location	Concentration (µg/L)															
	4:2 FTS	6:2 FTS	8:2 FTS	10:2 FTS	PFBS	PFPeS	PFHxS	PFOS	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFDoDA
EMB17 (0.05-0.15)	<0.001	6.04	6.05	0.031	<0.0005	<0.0005	<0.0005	0.0024	0.0051	0.0299	0.0186	0.0105	0.204	0.280	0.0313	0.0033	0.003
EMB18 (0.1-0.2)	<0.001	0.001	0.002	<0.001	<0.0005	<0.0005	0.0034	0.0081	0.0059	0.0261	0.0150	0.0063	0.0033	0.0011	<0.0005	<0.0005	<0.0005
EMB19 (0.02-0.05)	<0.001	<0.001	<0.001	<0.001	0.0012	0.0011	0.0086	0.0214	0.0035	0.006	0.0049	0.0009	0.002	<0.0005	<0.0005	<0.0005	<0.0005
EMB20 (1.1-1.2)	<0.001	0.003	<0.001	<0.001	<0.0005	<0.0005	<0.0005	0.0004	0.0076	0.0408	0.0335	0.0063	0.0008	<0.0005	<0.0005	<0.0005	<0.0005
SBH04 (0.08-0.15)	0.002	2.74	3.84	0.065	<0.0005	<0.0005	<0.0005	0.0003	0.014	0.0774	0.0936	0.05	0.0545	0.0112	0.0386	0.0033	0.0033

These results indicate that these chemicals are highly leachable from these soils as is expected for this group of chemicals.

Using the soil and leachate results, the leachable portion can be determined as listed in **Table 6.4** for PFOS and for 6:2 FTS, based on 1 g soil in 20 mLs leachate (i.e. 1:20 dilution).

Table 6.4: Leachability for PFOS and 6:2 FTS

Location	Concentration (solid) (mg/kg)	Leachate concentration (µg/L)	Measured proportion	Concentration in water if 100% leaching occurs (µg/L)
PFOS				
EMB17 (0.05-0.15)	<0.0002	0.0024	24%	0.01
EMB18 (0.1-0.2)	0.0003	0.0081	54%	0.015
EMB19 (0.02-0.05)	0.0006	0.0214	71%	0.03
EMB20 (1.1-1.2)	0.0004	0.0004	2%	0.02
SBH04 (0.08-0.15)	<0.0002	0.0003	3%	0.01
6:2 FTS				
EMB17 (0.05-0.15)	0.246	6.04	49%	12.3
EMB18 (0.1-0.2)	<0.0005	0.001	4%	0.025
EMB19 (0.02-0.05)	<0.0005	<0.001	4%	0.025
EMB20 (1.1-1.2)	<0.0005	0.003	12%	0.025
SBH04 (0.08-0.15)	0.0058	2.74	>100%	0.29

Notes:
Greyed values assume these chemicals are present at the limit of reporting for the purposes of these calculations.

These results indicate that PFOS is around 50% leachable for samples with detected levels. 6:2 FTS is highly leachable for samples with detected levels with one sample showing 100% leachability. For the sample with the highest levels of 6:2 FTS, leachability was around 50% - similar to the results for PFOS.

Section 7 will present the screening assessment for the soil results and discuss the leachability findings.

6.2.2 Storm Water

Sampling of stormwater at the Vopak site has been undertaken by EcOz in February 2021 (late in wet season) and by GHD in December 2021 (beginning of wet season), March 2022 (late in wet season) and May 2022 (beginning of dry season) (EcOz 2021b, GHD 2022).

Figure 6.2 shows the sampling locations. A summary of the data is included in **Appendix A**.

There are four routine monitoring sites for stormwater:

1. Darwin Industry Fuel Terminal (DIFT) 1 – Largest stormwater pit at Vopak; receives water captured within the bunds for the main tank farm (12 tanks storing unleaded fuel, diesel, Jet A1, Avgas), and from the main road tanker loading gantry. Samples are collected from the upper end of the stormwater pit.

2. DIFT 2 – Same pit as above, but samples are collected from the lower end of the pit; i.e. the final chamber from where water is released into the open drain.

3. Darwin Acid Tank (DAT) 2 – Stormwater pit receiving water captured within the acid tank bund. Note site is referred to as ‘DAT2’ to distinguish it from a different site that was previously named DAT.

4. 6-Series – Stormwater pit receiving water captured within the bund for the 6-Series tank farm (10 tanks storing diesel). This site was previously called Darwin Biodiesel Terminal (DBT) (EcOz 2021).

Samples were analysed for the full suite of PFAS available from Australian laboratories. The limits of reporting (LOR) in surface water ranged from 0.1 to 0.01 µg/L depending on the individual PFAS.

Of the 28 individual PFAS reported in the standard suite, 18 were not detected above the limit of reporting in any samples. These included 4:2 FTS, PFBS, PFPeS, PFHxS, PFHpS, PFOS, PFDS, PFDoDA, PFUnDA, PFTrDA, PFTeDA, EtFOSA, EtFOSAA, EtFOSE, MeFOSA, MeFOSAA, MeFOSE and FOSA.

Table 6.5 lists the results for surface water for the individual PFAS that were identified as present above the limit of reporting in at least one sample.

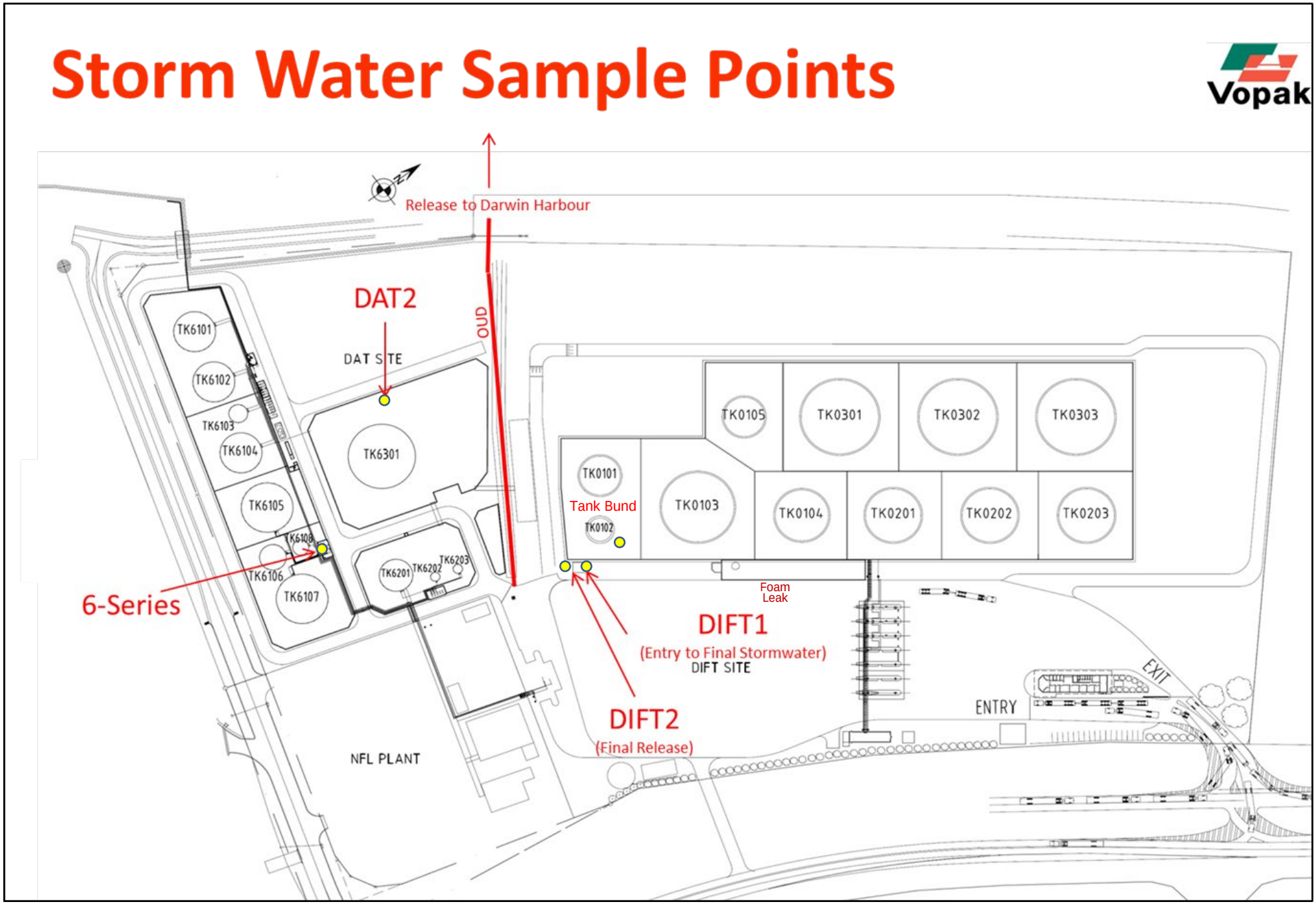


Figure 6-2. Map of stormwater pit sampling sites (yellow dots) and OUD; also location of foam product leak.

Table 6.5: Stormwater concentrations (µg/L)

Sampling location	6:2 FTS	8:2 FTS	10:2 FTS	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFUnDA	PFDoDA	PFOS	Total PFAS
February 2021														
DIFT1	21.5	3.62	0.06	0.9	4.79	3.34	1.89	2.09	0.14	0.06	<0.02	<0.02	<0.01	38.4
DIFT2	13.4	4.45	0.05	0.6	3.06	2.22	1.21	1.38	0.09	0.04	<0.02	<0.02	<0.01	26.5
DIFT2 Dup	13.2	4.81	0.06	0.6	3.09	2.20	1.2	1.36	0.1	0.04	<0.02	<0.02	<0.01	26.7
DAT2	<0.05	<0.05	<0.05	<0.1	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01
6-Series	<0.05	<0.05	<0.05	<0.1	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01
December 2021														
DIFT1	2.84	1.33	0.1	<0.1	0.39	0.44	0.16	0.17	0.02	0.02	<0.02	<0.02	0.03	5.5
DIFT1 Dup	3.23	2.42	0.2	0.1	0.63	0.62	0.34	0.16	0.05	0.07	<0.02	0.03	<0.01	7.5
DIFT2	3.24	2.54	0.22	0.2	0.67	0.66	0.36	0.17	0.05	0.07	0.02	0.03	<0.01	7.84
DAT2	<0.05	<0.05	<0.05	<0.1	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01
6-Series	<0.05	<0.05	<0.05	<0.1	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	0.02	0.02
March 2022														
DIFT1	12.8	2.41	0.06	0.2	1.05	1.41	0.42	0.64	0.04	0.02	<0.02	<0.02	0.01	19.1
DIFT2	49.2	8.9	0.12	1.2	5.4	7.1	2.48	2.68	0.18	0.08	<0.02	<0.02	<0.01	77.4
DIFT2 Dup	47.8	8.71	0.12	1.2	5.4	7.41	2.37	2.73	0.15	0.07	<0.02	<0.02	<0.01	76
DAT2	<0.05	<0.05	<0.05	<0.1	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01
6-Series	<0.05	<0.05	<0.05	<0.1	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01
May 2022														
DIFT1	7.34	2.33	0.09	0.3	1.25	1.28	0.44	0.39	0.04	0.02	<0.02	<0.02	<0.01	13.5
DIFT2	7.78	2.58	0.08	0.3	1.35	1.44	0.49	0.46	0.05	0.03	<0.02	<0.02	0.01	14.6
DIFT2 Dup	7.85	2.5	0.07	0.3	1.24	1.36	0.46	0.44	0.04	0.03	<0.02	<0.02	0.02	14.3
DAT2	0.1	0.11	<0.05	<0.1	0.04	0.03	0.02	0.01	<0.02	<0.02	<0.02	<0.02	<0.01	0.31
6-Series	<0.05	<0.05	<0.05	<0.1	<0.02	<0.02	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01

Notes:

December 2021 results in GHD report indicate DIFT1 location was where duplicate was collected but the results appear to indicate that the duplicate was taken at DIFT2 as was the case for all other sampling rounds.

The stormwater sampled within the main stormwater system for the site routinely contains PFAS.

Section 7 will present the screening assessment for the stormwater results.

6.2.3 Groundwater

Groundwater investigations with the existing monitoring network were undertaken by EcOz and GHD in 2021 and 2022. EcOz sampled EMB1-8, EMB11-12, EMB15-16 in April 2021. GHD sampled the same groundwater wells as EcOz on 2 occasions – December 2021 and April 2022 (EcOz 2021a, GHD 2022).

SMEC installed an additional nine groundwater wells as part of this investigation. These wells are EMB17-25 (SMEC 2022). Samples for analysis by SMEC were collected only from the 9 new wells as data from the existing wells was available from GHD.

Figure 6.1 shows the groundwater well locations. **Appendix A** provides a summary of data from all groundwater monitoring wells.

The wells on the eastern boundary of the site are EMB8, EMB18, EMB7, EMB17, EMB13 and EMB14 (EMB13 and 14 have not been sampled during the monitoring events reviewed for this assessment).

The wells on the western boundary are EMB3, EMB21, EMB2, EMB22, EMB20, EMB1, EMB11 and EMB16.

The wells through the centre of the site include EMB6, EMB23, EMB24, EMB25, EMB5, EMB4, EMB12, EMB19 and EMB15.

There are 23 wells in total across the site. Standing water levels were assessed across all wells in the most recent investigation.

Samples were analysed for the suite of PFAS available from Australian laboratories. The adopted limits of reporting (LOR) ranged between 0.0002 and 0.002 µg/L (depending on the compound and the laboratory used).

Of the 28 individual PFAS reported in the standard suite, 10 were not detected above the limit of reporting in any sample. These included PFDS, PFTrDA, PFTeDA, EtFOSA, Et-FOSAA, EtFOSE, MeFOSA, MeFOSAA, MeFOSE and FOSA.

Tables 6.6, 6.7 and **6.8** list the summary results for groundwater for the individual PFAS that were identified as present above the limit of reporting in at least one sample for each sampling round (i.e. April 2021 (end of wet season), December 2021 (beginning of wet season), April 2022 (end of wet season)).

Table 6.6: Groundwater concentrations for detected PFAS – April 2021 (µg/L) (Wells EMB1-8, EMB11-12, EMB15-16)

Detected PFAS	Average	Minimum	Maximum	Detection frequency (%)
PFBA	0.8	<0.1	2.1	58%
PFPeA	1.59	<0.02	4.8	92%
PFHxA	2.13	<0.02	9.02	92%
PFHpA	0.58	<0.02	1.54	83%
PFOA	0.55	<0.01	3.05	83%
PFNA	0.068	<0.02	0.11	50%
PFDA	0.03	<0.02	0.03	8%
PFUnDA	NA	<0.02	<0.02	0%
PFDoDA	NA	<0.02	<0.02	0%
PFTrDA	0.05	<0.02	0.05	8%
4:2 FTS	0.24	<0.05	0.36	16%
6:2 FTS	12.4	<0.05	52.1	67%
8:2 FTS	1.74	<0.05	3.89	33%
10:2 FTS	NA	<0.05	<0.05	0%
PFBS	NA	<0.02	<0.02	0%
PFPeS	NA	<0.02	<0.02	0%
PFHxS	0.04	<0.02	0.04	8%
PFHpS	NA	<0.02	<0.02	0%
PFOS	NA	<0.01	<0.01	0%
Total PFAS	14.1	<0.01	72.2	92%

Table 6.7: Groundwater concentrations for detected PFAS – December 2021 (µg/L) (Wells EMB1-8, EMB11-12, EMB15-16)

Detected PFAS	Average	Minimum	Maximum	Detection frequency (%)
PFBA	0.77	<0.1	2.6	75%
PFPeA	2.67	<0.02	9.36	92%
PFHxA	3.94	<0.02	22.2	92%
PFHpA	0.89	<0.02	2.88	92%
PFOA	1.09	<0.01	6.59	83%
PFNA	0.13	<0.02	0.38	67%
PFDA	0.095	<0.02	0.11	17%
PFUnDA	NA	<0.02	<0.02	0%
PFDoDA	NA	<0.02	<0.02	0%
4:2 FTS	0.34	<0.05	0.51	17%
6:2 FTS	29.4	<0.05	140	83%
8:2 FTS	2.77	<0.05	12.7	50%
10:2 FTS	0.07	<0.05	0.07	8%
PFBS	NA	<0.02	<0.02	0%
PFPeS	NA	<0.02	<0.02	0%
PFHxS	0.013	<0.01	0.02	25%
PFHpS	NA	<0.02	<0.02	0%
PFOS	0.02	<0.01	0.02	8%
Total PFAS	37.6	<0.01	184	92%

Table 6.8: Groundwater concentrations for detected PFAS – April 2022 (µg/L) (Wells EMB1-8, EMB11-12, EMB15-16, EMB17-25 – i.e. all wells)

Detected PFAS	Average	Minimum	Maximum	Detection frequency (%)
PFBA	1.0	0.056	2	81%
PFPeA	2.98	<0.02	7.49	95%
PFHxA	4.32	<0.02	14	95%
PFHpA	1.22	<0.02	4.8	95%
PFOA	0.89	<0.01	3.68	95%
PFNA	0.12	<0.02	0.54	76%
PFDA	0.041	<0.0005	0.069	48%
PFUnDA	0.0045	<0.0005	0.011	24%
PFDoDA	0.0027	<0.0005	0.004	10%
4:2 FTS	0.16	<0.001	0.35	48%
6:2 FTS	20.9	0.019	70	81%
8:2 FTS	2.60	0.009	9.48	71%
10:2 FTS	0.038	<0.001	0.074	14%
PFBS	0.0014	<0.0005	0.0028	29%
PFPeS	0.0012	<0.0005	0.0017	10%
PFHxS	0.018	0.0009	0.05	52%
PFHpS	0.001	<0.0005	0.001	5%
PFOS	0.018	0.0004	0.03	48%
Total PFAS	32.1	0.611	97	95%

The results for April in 2021 and 2022 are relatively similar, while the results for December 2021 are somewhat higher. This is as expected, given that April is at the end of the wet season so concentrations in groundwater would likely be at their most dilute, while those for December are at the end of the dry season so are likely to represent the high end of the range.

The wells with the highest concentrations in April 2022 were EMB17, EMB22, EMB23, EMB4 and EMB7. The wells with the highest concentrations in December 2021 were EMB4, EMB5 and EMB7. The wells with the highest concentrations in April 2021 were EMB4 and EMB7.

EMB4 is located near the site stormwater management system and the stormwater discharge drain. EMB5 is located somewhat near the location of the 2020 incident. EMB23, EMB24 and EMB25 are located closer to the location of the 2020 incident. EMB7 and EMB17 are located close to the eastern boundary but near a location where a foam leak may have occurred historically. EMB22 is near one of the locations where foam would be discharged during monthly testing of the deluge system and is on the downgradient side of the site/tanks.

No groundwater wells have been installed within the tank farm as this would not be appropriate, given the bunding requirements for such tanks.

Section 7 will present the screening assessment for the groundwater results.

6.2.4 Sediment

Sediment samples were collected at relevant locations across the site at one time. Results for PFAS in those samples do not appear to have been collected.

6.3 Conceptual Site Model

Investigations undertaken at this site have identified detectable concentrations of some PFAS compounds in soil, stormwater and groundwater within the site.

These chemicals are long lived and are known to be present in a range of locations including:

- contaminated sites like airports and defence bases and bulk fuel terminals where aqueous film-forming foams were used for fire fighting
- leachate/runoff from landfills due to use of products containing these chemicals around the home or in commercial/retail activities
- effluent/runoff from sewage treatment plants due to use of products containing these chemicals around the home or in commercial/retail activities
- stormwater runoff in urban areas due to use of products containing these chemicals around the home or in commercial/retail activities.

General observations for this site include:

- Site is underlain generally by shallow rock
- Groundwater sits just below or close to the surface of the rock
- Groundwater flow is estimated to the west, but flow may change in heavy sustained rain as water table is relatively shallow

A range of PFAS were reported to be present in soil, groundwater and stormwater collected at the site. Key chemicals for this site were 6:2 FTS, 8:2 FTS and PFHxA. These chemicals fit with the products used at this site – modern aqueous film forming foams sold between 2005 and 2014. This site commenced operations in 2005/6 and so older products containing high levels of PFOS were not available for use at the site.

The premises is located within the Darwin Harbour Region that is a Declared Beneficial Use Area – with beneficial uses including aquaculture, environment, culture, rural stock and domestic. The premises is located within the Darwin Harbour Site of Conservation Significance – a site of national and international conservational significance.

The characteristics of these chemicals mean that incidental ingestion is the major pathway of exposure. These compounds are not volatile at environmental pH. The most relevant ones exist as anions at environmental conditions so most do not evaporate from the water into the air people breathe or get absorbed through the skin (dermal exposure) to any significant degree.

The following receptors have been identified for this site:

Human Receptors:

- Workers at the site who may come into contact with soil, groundwater or stormwater
- Consumers of fish/shellfish caught in the neighbouring wetlands which may be affected by groundwater from this site.

Environmental Receptors:

- Aquatic organisms living in wetlands and the estuarine environment adjacent to this site
- Consumers of aquatic organisms (birds and mammals).

Section 7. Screening Assessment

7.1 General

This section presents a screening risk assessment of the data for the various media sampled for the site. The aim of this assessment is to identify whether PFAS chemicals are present at levels above national guidelines requiring more detailed evaluation of risk.

7.2 Screening – soil

The maximum soil concentrations reported in this investigation have been reviewed against the relevant screening criteria noted in **Section 3** and **Section 4**. The chemicals listed are those for which at least one sample contained concentrations above the limit of reporting.

As discussed in **Sections 3** and **4**, where necessary other PFAS have been screened using the guidelines for PFOS/PFOS+PFHxS or PFOA as follows:

- guidelines for PFOS have been applied to the sulfonic acid type PFAS (e.g. PFBS, PFPeS, PFHxS etc) and the fluorotelomers including 6:2 FTS (i.e. 4:2, 6:2, 8:2 and 10:2 FTS)
- guidelines for PFOA have been applied to the carboxylic acid PFAS (i.e. PFBA, PFPeA, PFHxA etc) and other PFAS (sulfonamides including EtFOSA, EtFOSAA, EtFOSE, MeFOSA, MeFOSAA, MeFOSE and FOSA).

7.2.1 Human health

This section of the HHERA provides a review of the concentrations of PFAS reported in soil against relevant screening guidelines for the protection of human health. The guidelines from the NEMP for industrial land use have been adopted .

The screening assessment using the maximum concentration across the site is shown in **Table 7.1**.

Table 7.1: Screening risk assessment – soil – human health

Detected PFAS	Maximum Concentration (mg/kg)	Screening criteria (mg/kg) – industrial
PFOS	0.0006	20
6:2 FTS	0.246	
8:2 FTS	0.253	
10:2 FTS	0.0094	
SUM (PFOS like)	0.509	20
PFBA	0.004	50
PFPeA	0.0157	
PFHxA	0.0159	
PFHpA	0.0021	
PFOA	0.0074	
PFNA	0.0086	
PFDA	0.0011	
PFUnDA	0.0006	
PFTrDA	0.0003	
SUM (PFOA like)	0.056	50

Notes:
Screening criteria used here are from **Table 3.2**

The screening shows the following:

- The maximum concentrations across the site were in compliance with the national guidelines for industrial sites – i.e. HIL-D.
- This guideline assumes a person is in contact with soil at their workplace on every day of the year they are at work (i.e. 240 days per year).
- This assessment also assumes the fluorotelomers have similar toxicity as PFOS and that all the carboxylic acids have similar toxicity to PFOA. As discussed, this is likely to be an overestimate, so these results are definitely in compliance with national guidelines for such a site.

In May 2022, the USEPA issued guidelines for PFBS, PFHxS and PFNA for residential and industrial soils (USEPA 2022). The ones for industrial soil were 250, 16 and 2.5 mg/kg respectively. These indicate that none of these individual PFAS are close to guidelines specific for them and that comparing the sums of these 2 subcategories to the PFOS and PFOA soil guidelines is conservative.

Ambient PFAS

In addition to noticing which sampling locations contained measurable PFAS, its also important to look at ambient concentrations regularly found in soil in areas where there are no major sources of PFAS. These chemicals are long lived so once in the environment they can accumulate and distribute throughout much of the environment. These chemicals were used in many products used around the home as well as for tasks such as fire fighting foams. Studies have reported that they are widespread at low levels throughout our environment, especially in urban areas.

EPA Victoria and other researchers in Victoria have undertaken a number of studies of PFAS levels in soils, sediments or waters in areas where no major sources of these chemicals were expected (i.e. not near facilities such as defence bases or airports) (Allinson et al. 2019; Sardiña et al. 2019; Sharp et al. 2021; Szabo et al. 2018).

In Sharp et al. (2021), soil sample results ranged from non-detect to 0.046 mg/kg (PFPeA) depending on which PFAS compound was measured. These samples were collected around wetland areas across Victoria. Detected PFAS included PFPeA, PFHxA, PFOS and 8:2 FTS. Sediment samples also reported detections ranging up to 0.016 mg/kg (PFOS). PFAS detected in sediments included PFPeA, PFHxA, PFHpA, PFOS and 8:2 FTS. Most of the sites investigated in this study were in agricultural areas.

Researchers in other countries have also looked at PFAS concentrations in soil at background locations (Brusseau et al. 2020). For example, Brusseau et al. (2020) reviewed data from the scientific literature for more than 30,000 samples from more than 2,500 sites across the globe. They noted that:

PFAS were present in soil at almost every site tested. Low but measurable concentrations were observed even in remote regions far from potential PFOS sources.

This review found there were 5,700 samples from more than 1,400 sites which could be classified as background. The concentrations of PFOS in these locations ranged from 0.000003 to 0.16 mg/kg

(median 0.0027 mg/kg). For PFOA, the concentrations ranged from 0.00001 to 0.124 mg/kg and the median was similar to that for PFOS – 0.0027 mg/kg. These sites included locations that were residential backyards, schoolyards, agricultural areas, commercial sites and parks. Measurable levels of these chemicals were reported for sites from all of these land uses. In one study, in particular, samples were collected from 28 unpopulated forested sites located hundreds of km from urban areas or relevant point sources. PFOS and PFOA were detected in these sites using trace analysis procedures (0.000003-0.00001 mg/kg). Even in Antarctica, PFOS and PFOA were detected at a single location – again using trace analysis procedures (0.000007-0.00005 mg/kg) (Brusseau et al. 2020).

Leaching

NEMP guidelines for industrial soils are based on ensuring people are protected for direct contact with the soils – i.e. incidental ingestion and dermal contact. These chemicals can also leach from soil into groundwater or stormwater due to their water solubility, but this potential pathway is not included in these soil guidelines. Leachability is dependent on the characteristics of the soil, organic matter content, cation exchange capacity, pH and soil/water interactions making it difficult to incorporate this aspect into the guidelines.

Assessment of leachability for these soils was undertaken using ASLP testing. These results indicated that PFOS and 6:2 FTS were around 50% leachable. This confirms that PFAS in the soil could have leached from the soil into water at the site (groundwater or stormwater). Further assessment of the potential for human health or ecological effects due to PFAS present in groundwater or stormwater is presented in **Sections 7.3** and **7.4**.

7.2.2 Ecological

This section of the HHERA provides a review of the concentrations of PFAS reported in soil against relevant screening guidelines for the protection of ecological health. The guidelines from the NEMP for residential land use have been adopted .

This site is an industrial site with limited environmental values based on guidance in Schedule B5 of the ASC NEPM (NEPC 1999 amended 2013d). For a site like this it is usual to consider the protection of transitory wildlife as the main ecological value of relevance. This means organisms that are only present on occasions as they travel through a site – they do not live permanently at such a site and do not get their entire diet from plants or small organisms that live at such a site. This means the most relevant national guideline for screening these soil results is the direct contact guidelines.

Canadian authorities developed a direct contact guideline for organisms living in contact with soil (plants or animals) and generated a value of 11 mg PFOS/kg for agricultural and residential land and 61 mg PFOS/kg for commercial or industrial land. These values were determined using a species sensitivity distribution with ecotoxicity data for crop species and soil organisms. The Australian authorities reviewed what Canada had found and decided a more conservative approach was required. Direct contact guidelines of 1 mg PFOS/kg and 10 mg PFOA/kg were chosen and put into the NEMP. The Australian values have been used in this assessment.

The screening assessment for soil data for this site is shown in **Table 7.2**.

Table 7.2: Screening risk assessment – soil – ecological health – direct contact

Detected PFAS	Maximum Concentration (mg/kg)	Screening criteria (mg/kg) – industrial
PFOS	0.0006	1
6:2 FTS	0.246	
8:2 FTS	0.253	
10:2 FTS	0.0094	
SUM (PFOS like)	0.509	1
PFBA	0.004	10
PFPeA	0.0157	
PFHxA	0.0159	
PFHpA	0.0021	
PFOA	0.0074	
PFNA	0.0086	
PFDA	0.0011	
PFUnDA	0.0006	
PFTrDA	0.0003	
SUM (PFOA like)	0.056	10

Notes:
Screening criteria used here are from **Table 4.1**

Screening shows:

- All concentrations for each individual PFAS at this site are well below the national guidelines protective for soil organisms and plants that directly grow or contact soil.
- Sum of all PFOS like chemicals and all PFOA like chemicals are in compliance with the national guidelines protective for organisms that eat soil organisms or plants.
- Protecting these organisms will provide larger transitory wildlife with an occasional food source as these soil organisms or plants will be able to survive on the site.

The indirect soil guideline listed in the NEMP is for use in situations where bioaccumulation may be important. Both PFOS and PFOA are bioaccumulative and so this aspect is an important consideration. However, the only chemicals at this site with maximum concentrations above the indirect soil guideline for PFOS were 6:2 FTS, 8:2 FTS, PFPeA and PFHxA. All of these PFAS are not considered to be bioaccumulative or they have much lower potential for bioaccumulation than PFOS and PFOA. Consequently, the screening assessment provided above is appropriate for this site.

No further consideration of potential risks to ecosystems due to the presence of PFAS in soil at this industrial site is required.

7.3 Screening – Storm Water

The maximum surface water concentrations reported in this investigation have been reviewed against the relevant screening criteria noted in **Section 3** and **Section 4**. The chemicals listed are those for which at least one sample contained concentrations above the limit of reporting.

As discussed in **Sections 3** and **4**, where necessary other PFAS have been screened using the guidelines for PFOS/PFOS+PFHxS or PFOA as follows:

- guidelines for PFOS have been applied to the sulfonic acid type PFAS (e.g. PFBS, PFPeS, PFHxS etc) and the fluorotelomers including 6:2 FTS (i.e. 4:2, 6:2, 8:2 and 10:2 FTS)

- guidelines for PFOA have been applied to the carboxylic acid PFAS (i.e. PFBA, PFPeA, PFHxA etc) and other PFAS (sulfonamides including EtFOSA, EtFOSAA, EtFOSE, MeFOSA, MeFOSAA, MeFOSE and FOSA).

7.3.1 Human Health

This section of the HHERA provides a review of the concentrations of PFAS reported in stormwater against relevant screening guidelines for the protection of human health. The guidelines from the NEMP for recreational use of water have been adopted (HEPA 2020).

People could come into incidental contact with stormwater system at the Vopak site. For these uses, the recreational criteria are appropriate.

The screening assessment for stormwater (human health) is shown in **Table 7.3**.

As noted in **Section 6.2.2**, sampling of stormwater at the Vopak site was undertaken by EcOz in February 2021 (late in wet season) and by GHD in December 2021 (beginning of wet season), March 2022 (late in wet season) and May 2022 (beginning of dry season). The maximum concentrations for each chemical from all of the data have been used for the screening assessment.

Table 7.3: Screening risk assessment – stormwater – human health

Detected PFAS	Maximum Concentration (µg/L)				Screening criteria (µg/L) – recreational
	DIFT1	DIFT2	DAT2	6-series	
PFOS	0.03	0.02	<0.01	0.02	2
6:2 FTS	21.5	49.2	0.1	<0.05	
8:2 FTS	3.62	8.9	0.11	<0.05	
10:2 FTS	0.1	0.22	<0.05	<0.05	
SUM (all PFOS related)	25.3	58.3	0.21	0.02	2
PFBA	0.9	1.2	<0.1	<0.1	10
PFPeA	4.79	5.4	0.04	<0.02	
PFHxA	3.34	7.41	0.03	<0.02	
PFHpA	1.89	2.48	0.02	<0.02	
PFOA	2.09	2.73	0.01	<0.01	
PFNA	0.14	0.18	<0.02	<0.02	
PFDA	0.06	0.08	<0.02	<0.02	
PFUnDA	<0.02	0.02	<0.02	<0.02	
PFDoDA	<0.02	0.03	<0.02	<0.02	
SUM (all PFOA related)	13	19.5	0.1	<0.02	10

Notes:
Screening criteria used here are from **Table 3.2**

Screening shows:

- The stormwater systems servicing DAT2 and 6-series areas have limited contamination from PFAS and most concentrations for individual PFAS are close to the limits of reporting. All concentrations for individual PFAS and for the relevant sums are in compliance with the screening criteria.
- The stormwater system servicing the DIFT area is impacted by PFAS contamination.
- The stormwater treatment system focuses on the management of oily water and is not designed to remove PFAS.
- The results over different sampling events for DIFT1 and DIFT2 show that concentrations are quite variable. At times, the concentrations in DIFT1 and DIFT2 are similar and at other

times they are different with one event showing DIFT1>DIFT2 and one event showing DIFT2>DIFT1.
- These results indicate that the levels found in stormwater are quite dependent on the nature of the rain events as well as likely variations in potential sources across the site.
- Some of the individual PFAS (or the relevant sum) were above the screening criteria.

The chemicals of most interest (i.e. present at highest levels) are 6:2 FTS, 8:2 FTS, PFHxA and PFPeA.

These specific PFAS are not ones that bioaccumulate significantly in people. This conclusion is based on international findings including:

- Biomonitoring for 6:2 FTS in serum found no detections for this chemical in any of the samples tested[3].
- Studies have also found that PFHxA is usually not detected in serum or is at levels around the limit of reporting (Danish Ministry of the Environment 2015a).
- Another study reported 6:2 FTS to not be detected in serum (Danish Ministry of the Environment 2015a).

This lack of significant bioaccumulation is an important aspect when considering the toxicology as the accumulation of PFOS and PFOA has been a major driver of the very low values for the TRVs for these 2 chemicals. Leaving bioaccumulation out of the calculation of the TRV means such values would be much smaller for these chemicals (6:2 FTS, 8:2 FTS, PFHxA and PFPeA).

The investigation of a spill at Brisbane Airport made use of a tolerable daily intake (TDI) of 0.005 mg/kg bw/day for 6:2 FTS based on liver toxicity in mice (ERM 2017). The Department of Defence investigation at RAAF Williamtown made use of a tolerable daily intake of 0.1 mg/kg bw/day for PFHxA based on impacts on kidney in rats (AECOM 2017). These values are provided for comparison with the TDI for PFOS and PFOA in **Table 7.4**.

Table 7.4: Comparison of TDIs for PFOS + PFHxS, PFOA, 6:2 FTS and PFHxA

PFAS Compound	TDI	Comparison with PFOS
PFOS	0.00002 mg/kg bw/day	1
PFOS + PFHxS	0.00002 mg/kg bw/day	1
PFOA	0.00016 mg/kg bw/day	8
6:2 FTS	0.005 mg/kg bw/day	250
PFHxA	0.1 mg/kg bw/day	5,000

This comparison shows that 6:2 FTS is around 250 times less toxic than PFOS. It also shows that PFHxA is around 5,000 times less toxic than PFOS. Using these ratios to adjust the recreational guidelines for PFOS to be more appropriate for these 2 chemicals (and 8:2 FTS by assuming it is similar to 6:2 FTS), gives the following interim guidelines for this assessment:

- 6:2 FTS and 8:2 FTS – 500 µg/L (i.e. 2 µg/L x 250)
- PFHxA – 10,000 µg/L (i.e. 2 µg/L x 5,000)

[3] https://biomonitoring.ca.gov/results/chemical/all?field_chemical_name_target_id_selective%5B0%5D=2886

These values still assume a person comes into contact with the water on 150 days per year and incidentally ingests 200 mLs on each occasion which will be conservative for workers on the site and for people in the neighbouring areas who may come into occasional direct contact with stormwater being discharged from the site via the open drain. It also assumes that only 10% of the TDI is available for this pathway.

None of the results for stormwater samples at this site are close to these values. The maximum concentration for any PFAS at the site is for 6:2 FTS with a concentration of 140 µg/L measured on one occasion. This maximum concentration is well in compliance with these adjusted guidelines.

Given the compliance with the recreational guidelines (and the adjusted recreational guidelines) which are considered conservative for stormwater in this area, no further consideration of potential human health risks due to the presence of PFAS in stormwater is required.

7.3.2 Ecological

This section of the HHERA provides a review of the concentrations of PFAS reported in stormwater against relevant screening guidelines for the protection of ecological health. The water quality guidelines from the NEMP have been adopted (HEPA 2020).

The screening assessment for stormwater (ecological) is shown in **Table 7.5**.

As noted in **Section 6.2.2**, sampling of stormwater at the Vopak site was undertaken by EcOz in February 2021 (late in wet season) and by GHD in December 2021 (beginning of wet season), March 2022 (late in wet season) and May 2022 (beginning of dry season). The maximum concentrations for each chemical from all of the data have been used for the screening assessment.

Table 7.5: Screening risk assessment – stormwater – ecological

Detected PFAS	Maximum Concentration (µg/L)				Screening Criteria – ecological (95% species protection) (µg/L)	Screening criteria – ecological (99% species protection) (µg/L)
	DIFT1	DIFT2	DAT2	6-series		
PFOS	0.03	0.01	<0.01	0.02	0.13	0.00023
6:2 FTS	21.5	49.2	0.1	<0.05		
8:2 FTS	3.62	8.9	0.11	<0.05		
10:2 FTS	0.1	0.22	<0.05	<0.05		
SUM (all PFOS related)	25.3	58.3	0.21	0.02	0.13	0.00023
PFBA	0.9	1.2	<0.1	<0.1	220	19
PFPeA	4.79	5.4	0.04	<0.02		
PFHxA	3.24	7.41	0.03	<0.02		
PFHpA	1.89	2.48	0.02	<0.02		
PFOA	2.09	2.73	0.01	<0.01		
PFNA	0.14	0.18	<0.02	<0.02		
PFDA	0.06	0.08	<0.02	<0.02		
PFUnDA	<0.02	0.02	<0.02	<0.02		
PFDoDA	<0.02	0.03	<0.02	<0.02		
SUM (all PFOA related)	13	19.5	0.1	<0.02	220	19

Notes:
Screening criteria used here are from **Table 4.2**

Screening shows:

- All stormwater samples have been taken within the site.
- There are no water bodies relevant for ecosystem protection within the site.
- Concentrations of PFOA like chemicals are all well in compliance with the relevant ecosystem protection guidelines (both 95 and 99% species protection values).
- Concentrations of PFOS are above the 99% species protection value but in compliance with the 95% species protection value
- Concentrations of some of the PFOS like chemicals (and the sum of all relevant chemicals) are above the relevant ecosystem protection guidelines (both 95 and 99% species protection values).
- 6:2 FTS and 8:2 FTS are the primary chemicals that are in excess of screening criteria.

Some aspects that are important to consider for assessing the stormwater data are:

- The major area where relevant water bodies are located is in the area to the west of the site to which the open drain discharges. This area is shown in **Figure 7.1**.
- There were no data for PFAS in water, soil or sediment collected in this off-site area available for this assessment.
- Data for sediments in a number of other areas around Darwin Harbour are available from a study undertaken on behalf of the NT Department of Health (Munksgaard et al. 2016; Vijayasarathy et al. 2017) and these are discussed in detail in **Section 7.3.3**.
- Data for fish and crabs were available for Bleesers Creek (Vijayasarathy et al. 2017) and these are discussed in detail in **Section 7.3.3**.



Figure 7.1: Drain discharge location

- There are a number of additional sources of stormwater that may impact in this area of mudflats and mangroves including the railway line and the cement supply operation to the

south of the bulk fuel terminal. Other sites to the northeast may also contribute stormwater to this area. It is possible that stormwater from these sites (or any neighbouring areas) will contain PFAS.

Further discussion of the potential risks to ecosystems is provided in **Section 7.3.3**.

7.3.3 Refined assessment

Further consideration of these results is required, given that the results are above the 99% species protection value for PFOS (and like chemicals)

It is important to note that the chemicals that are key at this site are different to PFOS. The key chemicals are 6:2 FTS and 8:2 FTS.

In particular, the conservative nature of the screening process in **Section 7.3.2** needs to be explained to put the potential for risks to ecosystems in context.

There are a range of matters that require further refinement including:

- Comparison of ecotoxicity of 6:2 FTS and 8:2 FTS with ecotoxicity of PFOS and PFOA
- Issues in relation to the 99% species protection value for PFOS
- Discussion of ambient levels of PFAS – in urban waterways around Australia
- Discussion of existing data for PFAS in Darwin Harbour (sediments and fish/crab)
- Potential for accumulation into dietary items for higher organisms.

6:2 FTS/8:2 FTS

It is possible to make use of existing ecotoxicity data from the USEPA ECOTOX database and the guidance in the Australian Water Quality Guidelines to provide interim water quality guidelines that are more relevant to the chemicals that are key for this site (USEPA 2020; Warne et al. 2018).

The assessment factor method (as discussed in Section 4 of Warne et al.) has been adopted. This approach is recommended when there are limited data for a particular chemical. It involves taking the most sensitive data point for ecologically relevant endpoints and combining that value with an assessment factor relevant for the dataset. In most cases, this is a value of 100 as per (ANZECC/ARMCANZ 2000). Warne et al. (2018) and ANZECC/ARMCANZ (2000) consider this approach to be conservative and potentially overly conservative.

The alternative (and preferred) approach to generating official national water quality guidelines in Australia is the use of a statistical method based on a species sensitivity distribution. This approach requires availability of ecotoxicity data for a range of different organism types and a detailed review of all available ecotoxicity data for each chemical. Given the limited data available for 6:2 FTS and 8:2 FTS, it was not possible to use this type of approach (Warne et al. 2018).

The ECOTOX database includes 21 entries for 6:2 FTS and only 3 for 8:2 FTS. These are quite limited datasets compared to other PFAS like PFOS and PFOA.

For 8:2 FTS, even though there were 3 entries in the database these data were taken from only 1 study. This study evaluated a particular effect on early life stage fish for 38 different PFAS and 8:2 FTS was one of those chemicals – 6:2 FTS was also included . The study was undertaken on newly fertilised eggs. This study reported no mortality or other relevant effects when the newly fertilised eggs were exposed to 26 mg/L for 8:2 FTS. For 6:2 FTS, this study reported no mortality or other

relevant effects at 21 mg/L. The results for PFOS and PFOA in this study also showed no impacts at similar concentrations (i.e. 25 and 21 mg/L respectively), so this paper is limited in its usefulness.

For 6:2 FTS, 4 different studies were available that looked at impacts on ecologically relevant endpoints including survival, growth and reproduction (Dasgupta et al. 2020; Hoke et al. 2015; Matsubara et al. 2006; Menger et al. 2020). The Dasgupta et al. study has already been discussed.

The other studies found the following:

Hoke et al. 2015

- No impacts on algae were observed when exposed to 125 mg/L (maximum concentration used in the study).
- For waterfleas, no effects were observed for exposure to 112 mg/L (maximum concentration used in the study).
- For rainbow trout, no effects were observed at 108 mg/L (maximum concentration used in the study) (Hoke et al. 2015).

Menger et al. 2020

- zebrafish embryos were exposed to a range of PFAS including 6:2 FTS to assess changes in swimming behaviour
- embryos were exposed to concentrations ranging from 0.0001 to 100 mg/L.
- embryos exposed to PFOS, PFHxS and PFNA did show changes in mortality and development
- other PFAS including 6:2 FTS did not show any such impacts
- changes in swimming behaviour that were statistically different from the control were observed in the highest concentration for 6:2 FTS in the dark treatments – the fish swam further in the 100 mg/L treatment
- no such effects were seen in the 30 mg/L treatment
- a no observed effect concentration (NOEC) of 13 mg/L was determined for this effect for use in the USEPA database
- this study also evaluated bioaccumulation directly from water
- bioconcentration of 6:2 FTS was much lower than for PFOA, PFHxS or PFOS
- a bioconcentration factor of 35 was calculated for 6:2 FTS
- international guidance indicates that if a chemical has a BCF of less than 500 it does not have the potential for significant bioaccumulation (Annex 9 of Globally Harmonised System for labelling[4]) (Menger et al. 2020).

Matsubara et al. 2006

- this study investigated the impact of exposure to various PFAS on swimming for a single celled organism (*Paramecium caudatum*)
- minimal effects from exposure to 6:2 FTS (referred to as THPFOS in this paper) were observed

[4] https://unece.org/transport/standards/transport/dangerous-goods/ghs-rev9-2021

- maximum concentration of 6:2 FTS used in this study was 100 µM or 42 mg/L and this value was used as a NOEC (Matsubara et al. 2006).

In addition to these specific scientific studies, the Danish EPA provided a review of potential effects for short chain PFAS including 6:2 FTS. They found such chemicals were generally less toxic than PFOS and PFOA (Danish Ministry of the Environment 2015a).

Using these data, an interim water quality guideline can be generated for 6:2 FTS and this value can then be applied to all of the fluorotelomers (8:2 FTS, in particular).

Effects from PFOS exposure can be seen in fish at concentrations around 0.01 mg/L in multi-generation studies (see **Appendix C**). This concentration is around 1,000 times lower than the NOEC determined in any of the studies discussed above for 6:2 FTS.

The development of a guideline for 6:2 FTS can take the NOECs discussed above and apply an assessment factor of 100 to cover the uncertainties in such a small dataset.

Using this approach the calculation can be undertaken in 2 ways:

- adopting a NOEC of 13 mg/L – the smallest of all the values discussed above. However, this endpoint is a small change in swimming behaviour and this type of behavioural effect is not commonly used to generate water quality guidelines. If this value is used, then the interim water quality guideline would be 13 mg/L divided by 100 = 0.13 mg/L or 130 µg/L
- an endpoint that is more in line with standard approaches to guideline development is the NOEC fof 21 mg/L which gives an interim guideline of 210 µg/L.

Given that most of the results for 6:2 FTS showed no effects at exposures of >100 mg/L, either of these values is a conservative approach. The guideline to be used for this assessment is 210 µg/L and this value is to be used for each fluorotelomer and for the sum of all of the fluorotelomers that require more detailed assessment.

Robustness of 99% species protection guideline for PFOS

The water quality guidelines recommended for use in the NEMP are draft guidelines determined around 2016 for inclusion in the Australian Water Quality Guidelines (ANZG 2018). They have never been finalised and there has been much discussion of the appropriateness of the data used in this evaluation especially given that the 99% species protection value is around 1000 times lower than the 95% species protection value. The difference in these 2 values is much larger than for most other bioaccumulative chemicals for which water quality guidelines exist. For chemicals like the organochlorine pesticides, a difference of 10 fold has been more common. This large difference points to an issue in the dataset.

More recently, CSIRO scientists have undertaken a number of recalculations of the 99% species protection value for a number of reasons including:

- Difficult nature of the available ecotoxicity data which included some studies that did not follow standard guidance about treatment concentrations nor provided appropriate dose-response relationships to indicate the most relevant endpoint for use in a water quality guideline calculation
- Differences in toxicity to plants versus animals for these chemicals – plants are less susceptible to impacts when exposed to these chemicals which may have required the

calculations to focus on the animal data only (or at least for this potential for a bimodal distribution to be considered)
- Availability of more appropriate software to calculate the species sensitivity distribution for guideline development (Environment Canada developed more robust software that undertook these calculations more effectively https://bcgov-env.shinyapps.io/ssdtools/)

The recalculations resulted in 99% species protection values around 0.05 µg/L (Batley et al. 2018; Page et al. 2019). These recalculations as well as those by the original authors are currently being considered by the technical committee who oversee the development of water quality guidelines in Australia.

In addition to these recalculations, additional ecotoxicity studies have been undertaken since the draft guideline was developed more than 5 years ago.

One particular study was designed to replicate the study that provided the data that has proven most difficult to interpret for use in guideline development (https://acs.digitellinc.com/acs/sessions/135358/view). This work has been completed but is not yet published. An indication of the results has been reported in a number of conference presentations. The study included more treatment concentrations (0, 0.1, 0.6, 3.2, 20 and 100 µg/L) than the original version of this experiment (0, 0.6, 10 and 100 µg/L). The results reported to date indicate that effects at 0.6 µg/L, which were seen in the original study, have not been able to be replicated. CSIRO scientists have been keeping in touch with this work and these data will be used in the recalculation of the PFOS water quality guideline. This study is likely to support a change in the PFOS water quality guideline from 0.00023 to around 0.01-0.05 µg/L.

Ambient PFAS concentrations

In any assessment of PFAS within urban environments, it is important to remember that PFAS are commonly detected in urban surface waters in Australia.

Concentrations for PFOS in urban areas are mostly within the range of 0.01 to 0.05 µg/L where there is no specific contamination source such as an airport or defence base. The PFAS present in urban waterways come from a range of diffuse and point sources including, for example:

- runoff from around homes where products containing these chemicals have been used (waterproof clothing, furniture etc)
- leaks from sewage collection systems
- discharges from sewage treatment plants
- discharges/runoff from landfills
- use of recycled water for irrigation
- emissions/runoff from contaminated sites upstream of a location of interest.

A range of studies have been undertaken in Australia specifically looking at ambient levels of these chemicals (Allinson et al. 2019; Baddiley et al. 2020; Coggan et al. 2019; Sardiña et al. 2019; Sharp et al. 2021; Szabo et al. 2018; Thompson et al. 2011).

These studies indicate that these chemicals are routinely detected in urban surface waters but may only be occasionally present in water away from urban areas (i.e. more remote areas). They also indicate that a wide range of PFAS may be found in urban waters.

Victoria

Victorian studies of PFAS concentrations in surface waters have included sampling in freshwaters, estuarine areas and in rivers and streams in urban or agricultural areas. PFOS concentrations ranged up to 0.0452 µg/L in a study of a number of freshwater locations, up to 0.0749 µg/L in some estuarine locations and up to 0.1 µg/L in the larger study on rivers and streams in urban or agricultural areas. Many of the PFAS that were detected in these samples were detected in 100% of the samples. PFAS detected included PFOS, PFOA as well as PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnDA, PFDoDA, PFTeDA, PFBS, PFPeS, PFHxS, PFHpS, PFDS, 6:2 and 10:2 FTS as well as FOSA, N-EtFOSA and N-EtFOSAA with concentrations ranging up to 0.04 µg/L (Allinson et al. 2019; Baddiley et al. 2020; Sardiña et al. 2019).

Groundwater around the Werribee sewage treatment plant was assessed to determine the potential for PFAS to be present in recycled water used for irrigation at this site (Szabo et al. 2018). This study found that PFAS were present in 100% of the samples tested. PFOS ranged from <0.00003 to 0.034 µg/L and total PFAS ranged from <0.00003 to 0.074 µg/L. The highest groundwater concentrations were found in the centre of the area being irrigated.

NSW

Levels of PFAS have been measured in surface waters collected in Homebush Bay/Parramatta River (i.e within Sydney Harbour). PFOS concentrations ranged up to 0.021 µg/L. Other PFAS detected in these samples included PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnDA, PFDoDA, PFBS and PFHxS. Concentrations for these other PFAS ranged up to 0.0064 µg/L (Baddiley et al. 2020; Thompson et al. 2011).

Queensland

The largest study of ambient PFAS concentrations in surface waters, sediments and fish (and other aquatic biota) in Australia has been undertaken in Queensland by the Department of Environment and Science. The goal of this work was to establish an understanding of baseline levels of PFAS in surface waters across Queensland (Baddiley et al. 2020).

Samples were collected at 55 locations along the Queensland coast on 6 occasions over a 1 year period (May 2019 – March 2020) (Baddiley et al. 2020).

The results from this study for locations within South East Queensland are presented here for comparison with the results for this site. Sampling was undertaken in the following waterways:

- Noosa River
- Maroochy River
- Bells Creek
- Back/Coochin Creek
- Pumicestone Passage
- Caboolture River
- Bremer River

- Warrill Creek
- Brisbane River
- Oxley Creek
- Tingalpa Creek
- Logan River
- Moreton Bay
- Gold Coast Broadwater.

A total of 24 locations were taken from one or more locations within these waterways.

Surface water concentrations in locations relevant to South East Queensland are reported in **Tables 7.6, 7.7** and **7.8.**

Table 7.6: Surface water PFAS concentrations – Noosa to Caboolture

Location	Median Concentration (range) (µg/L)								
	PFPeA	PFHxA	PFHpA	PFOA	PFBS	PFHxS	PFOS	PFNS	PFDS
Lake Cootharaba	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0002 (<0.0001-0.0006)	<0.001	0.0005 (<0.001-0.001)
Cooroibah	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0001 (<0.0001-0.0002)	<0.001	<0.001
Noosaville	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0001 (<0.0001-0.0003)	<0.001	<0.001
Maroochy River	<0.001	0.0005 (<0.001-0.001)	<0.001	0.0005 (<0.001-0.001)	<0.001	<0.001	0.0005 (<0.0001-0.0013)	<0.001	<0.001
Bells Creek	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0005 (<0.0001-0.0011)	<0.001	<0.001
Coochin Creek	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0004 (<0.0001-0.0008)	<0.001	<0.001
Back Creek	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0005 (<0.0001-0.0008)	<0.001	<0.001
Pumicestone Passage	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0005 (<0.0001-0.0011)	<0.001	<0.001
Caboolture River	0.0025 (<0.001-0.006)	0.003 (<0.001-0.008)	0.0005 (<0.001-0.001)	0.0018 (<0.001-0.004)	0.0005 (<0.001-0.001)	0.0005 (<0.001-0.001)	0.0017 (<0.0001-0.0033)	0.0005 (<0.001-0.001)	<0.001
Upper Caboolture River	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0003 (<0.0001-0.0003)	<0.001	<0.001

Table 7.7: Surface water PFAS concentrations – Greater Brisbane and Moreton Bay

Location	Median Concentration (range) (µg/L)													
	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFPrS	PFBS	PFPeS	PFHxS	PFHpS	PFOS	8:2 FTS
Warrill Creek	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0003 (<0.0001-0.0006)	<0.001
Bremer River	0.01 (<0.001-0.012)	0.0005 (<0.001-0.001)	0.002 (<0.001-0.002)	0.0005 (<0.001-0.001)	0.0005 (<0.001-0.001)	<0.001	<0.001	<0.001	<0.001	<0.001	0.0005 (<0.001-0.001)	<0.001	0.0026 (0.0011-0.0035)	<0.001
Karana Downs	0.0025 (<0.001-0.006)	0.0055 (0.002-0.009)	0.006 (0.002-0.01)	0.002 (<0.001-0.003)	0.003 (0.001-0.005)	<0.001	<0.001	<0.001	0.002 (<0.001-0.004)	0.0005 (<0.001-0.001)	0.011 (0.005-0.019)	<0.001	0.0125 (0.009-0.018)	<0.001

Location	Median Concentration (range) (µg/L)													
	PFBA	PFPeA	PFHxA	PFHpA	PFOA	PFNA	PFDA	PFPrS	PFBS	PFPeS	PFHxS	PFHpS	PFOS	8:2 FTS
Oxley Creek	0.0038 (<0.001-0.006)	0.0075 (0.006-0.012)	0.009 (0.008-0.01)	0.003 (<0.001-0.004)	0.005 (0.004-0.006)	0.0005 (<0.001-0.001)	0.0008 (<0.001-0.002)	0.0005 (<0.001-0.002)	0.002 (0.002-0.004)	0.0005 (<0.001-0.001)	0.0105 (0.008-0.017)	0.0005 (<0.001-0.003)	0.0165 (0.012-0.03)	<0.001
Indooroopilly	0.0038 (<0.001-0.006)	0.0065 (0.004-0.01)	0.01 (0.008-0.012)	0.003 (<0.001-0.004)	0.006 (0.004-0.006)	<0.001	0.001 (<0.001-0.002)	0.0005 (<0.001-0.001)	0.002 (0.001-0.003)	0.0005 (<0.001-0.001)	0.009 (0.008-0.018)	0.0005 (<0.001-0.003)	0.017 (0.01-0.037)	<0.001
Lytton	<0.001	0.001 (<0.001-0.002)	0.001 (<0.001-0.002)	<0.001	0.0005 (<0.001-0.001)	<0.001	<0.001	<0.001	<0.001	<0.001	0.0015 (<0.001-0.004)	<0.001	0.0024 (0.0012-0.0062)	<0.001
Tingalpa Creek	<0.001	0.0035 (<0.001-0.01)	0.005 (<0.001-0.009)	0.002 (<0.001-0.003)	0.005 (<0.001-0.006)	<0.001	0.0005 (<0.001-0.001)	<0.001	0.001 (<0.001-0.002)	<0.001	0.003 (<0.001-0.004)	<0.001	0.0047 (0.0004-0.0095)	0.0005 (<0.001-0.004)
Bramble Bay	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0012 (0.0003-0.0018)	<0.001
Near Moreton Island	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0001 (<0.0001-0.0002)	<0.001
North of Russell Island	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0001 (<0.0001-0.0003)	<0.001

Table 7.8: Surface water PFAS concentrations – Gold Coast

Location	Median Concentration (range) (µg/L)					
	PFPeA	PFHxA	PFHpA	PFOA	PFHxS	PFOS
Glenlogan	<0.001	<0.001	<0.001	<0.001	<0.001	0.0001 (<0.0001-0.0002)
Edens Landing	0.004 (<0.001-0.005)	0.003 (<0.001-0.006)	0.001 (<0.001-0.001)	0.003 (<0.001-0.004)	0.002 (<0.001-0.002)	0.0032 (<0.0001-0.0059)
Couran Cove	<0.001	<0.001	<0.001	<0.001	<0.001	0.0003 (<0.0001-0.0006)
Southport	<0.001	<0.001	<0.001	<0.001	<0.001	0.0001 (<0.0001-0.0005)

In most of these waterways, PFOS was detected at every location sampled although not necessarily on every occasion a location was sampled. A wide range of other PFAS were also reported to be present, particularly in urban areas, even at locations that were not close to known sources of these chemicals.

Outside urban areas, the concentrations of PFOS in water were less than or around the limit of reporting.

Data for Darwin Harbour

Seafood

Fish and crab samples caught around Bleesers Creek were collected and analysed for PFAS in 2017 . Organisms collected in this location included golden snapper, catfish and mudcrab.

Bleesers Creek is located to the north of this site in the mudflats/mangroves to the west of the Vopak site as shown in **Figure 7.2**.

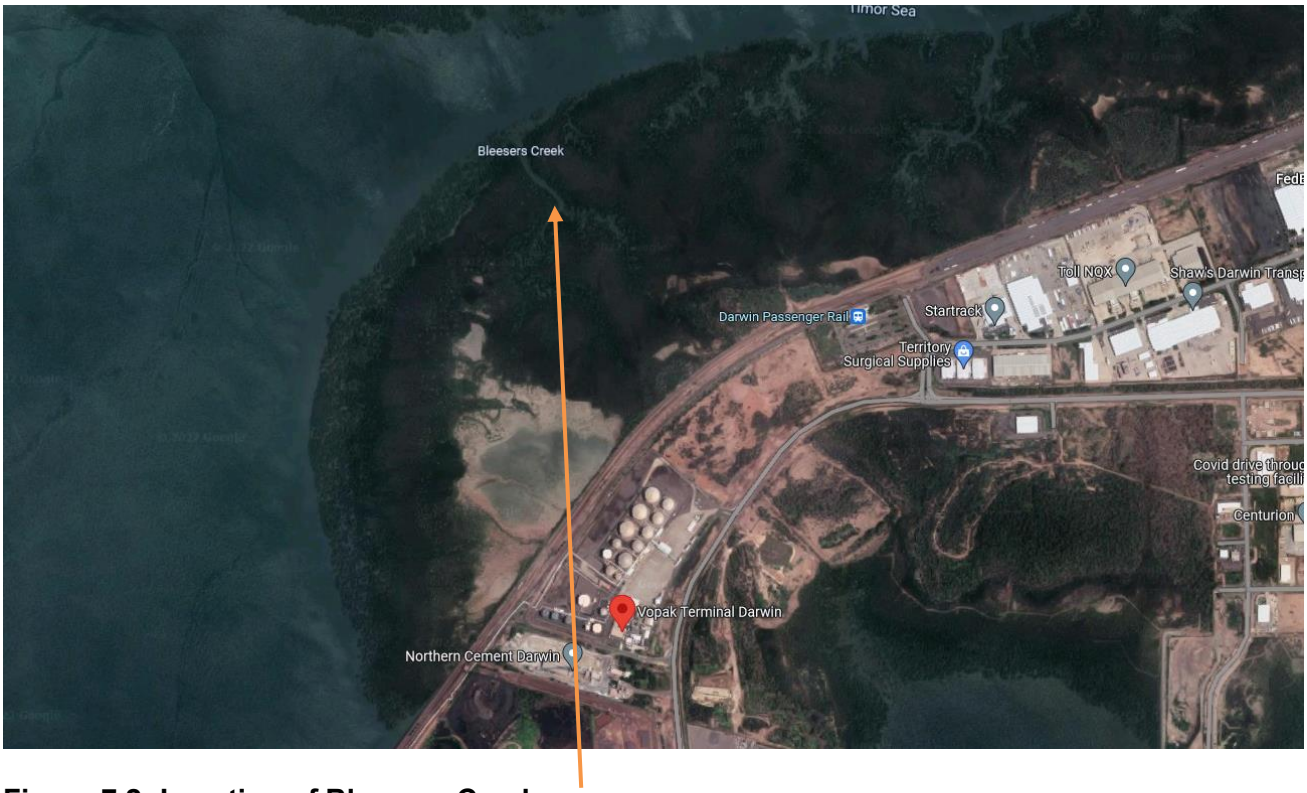


Figure 7.2: Location of Bleesers Creek

The data from this study did not include assessment of 6:2 FTS or 8:2 FTS. The chemicals measured were PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFBS, PFHxS, PFOS, PFDS, PFUnDA, PFDoDA.

The results for muscle tissue in golden snapper were 0.2 µg PFOS+PFHxS/kg wet weight (maximum) and 0.16 µg PFOS+PFHxS/kg wet weight (mean) and 0.063 µg PFOA/kg wet weight (maximum) and 0.048 µg PFOA/kg wet weight (mean). The results for muscle tissue in catfish were 0.42 µg PFOS+PFHxS/kg wet weight (maximum) and 0.37 µg PFOS+PFHxS/kg wet weight (mean)

and 0.052 µg PFOA/kg wet weight (maximum) and 0.037 µg PFOA/kg wet weight (mean). The results for muscle tissue in mudcrab were 0.13 µg PFOS+PFHxS/kg wet weight (single result) and 0.08 µg PFOA/kg wet weight (single result).

These biota samples did not report any detections of PFBA, PFPeA, PFHxA, PFHpA, PFBS, PFDS.

As discussed in **Section 3**, FSANZ undertook a dietary assessment to determine a trigger point for PFOS+PFHxS of 5.2 µg/kg wet weight and 41 µg/kg wet weight for PFOA in fish and other aquatic organisms.

All of these results are well in compliance with the trigger points developed by Food Standards Australia and New Zealand (FSANZ).

The maximum concentration reported for Bleesers Creek for PFOA was 0.2% of the relevant FSANZ trigger point. The maximum concentration reported for Bleesers Creek for PFOS+PFHxS was 8% of the relevant FSANZ trigger point.

These organisms will travel around this embayment, so these results will be relevant for potential impacts from this site as well as other areas in Darwin Harbour.

Sediments

Sediments were collected in various locations around Darwin Harbour in 2016 (Munksgaard et al. 2016). The locations were not close to this site, but they do include 2 samples in urban areas (Ludmilla Creek and Rapid Creek) of the harbour and one in a more remote location (Fright Point).

The results for Fright Point reported detections of PFOS and PFOA only. The concentrations for PFOA were 0.00004-0.00005 mg/kg and, for PFOS, the concentrations were 0.00004-0.0001 mg/kg. These values are around the limits of reporting used in the study.

For Rapid Creek, the results for the upper samples are as follows:

- PFBA – <0.0001-0.00014 mg/kg
- PFPeA – <0.00007-0.00008 mg/kg
- PFHxA – <0.00006-0.00026 mg/kg
- PFHpA – <0.00003-0.00006 mg/kg
- PFOA – 0.00005-0.00018 mg/kg
- PFNA – <0.00005-0.0002 mg/kg
- PFHxS – 0.00022-0.0007 mg/kg
- PFOS – 0.0017-0.0058 mg/kg

For Ludmilla Creek, the results for the upper samples are as follows:

- PFBA – 0.00018-0.00042 mg/kg
- PFHxA – <0.00006-0.00021 mg/kg
- PFHpA – <0.00003-0.00007 mg/kg
- PFOA – 0.00007-0.00046 mg/kg
- PFNA – <0.00005-0.00009 mg/kg
- PFDA – 0.00002-0.0001 mg/kg

- PFUnDA – <0.00007-0.00009 mg/kg
- PFHxS – <0.00009-0.0011 mg/kg
- PFOS – 0.00078-0.028 mg/kg

These results are quite similar to each other.

CSIRO researchers have undertaken ecotoxicity testing for sediment dwelling organisms (Simpson et al. 2021). The sediment quality guidelines they developed are 0.25 mg PFOS/kg for 95% species protection and 0.06 mg PFOS/kg for 99% species protection. All the results for these 2 creeks are in compliance with these guideline values, so no impacts would be expected.

If samples in the area close to this site are similar, no impacts would be expected.

Accumulation into dietary items for higher organisms

The key chemicals for this site – namely 6:2 FTS and 8:2 FTS – do not bioaccumulate to the same extent as PFOS and PFOA. In fact, as noted above, the bioconcentration factor measured for 6:2 FTS in one study was well below the criteria specified in the Globally Harmonised System for labelling to indicate bioaccumulation (the value was 35 compared to the GHS criteria of >500) (Menger et al. 2020).

The PFAS NEMP provides guidelines for PFAS levels in dietary items consumed by higher organisms to ensure such organisms are not exposed to excess amounts of these chemicals (HEPA 2020). Because the key chemicals at this site do not bioaccumulate, the need to consider such exposures is more limited. This also means consideration of the 99% species protection value is less relevant for this site. Guidelines designed to protect 95% of species are most relevant for 6:2 FTS and 8:2 FTS. These chemicals will not accumulate in fish and other aquatic organisms, so higher organisms could be exposed when they come into contact with the water but exposure via their diet will be low.

For chemicals that do not bioaccumulate, it is usual for risks to aquatic organisms to be more important to consider than risks to higher organisms simply because their exposure is higher – they live in the impacted water at all times rather than having occasional contact with the water during wading or drinking etc. Therefore, this assessment has focused on risks to aquatic organisms.

Summary

In regard to potential for ecological effects from PFAS in stormwater, the following are relevant:

- There are no water bodies on the site that are relevant for ecosystem protection.
- It is possible that PFAS may be present in stormwater released from the site, but the concentrations present in the off-site area have not been assessed.
- The levels of most PFAS within stormwater are in compliance with the current draft national water quality guidelines for PFOS or PFOA (depending on the individual chemical).
- The levels of 6:2 FTS and 8:2 FTS are above the water quality guidelines that are relevant for PFOS – the chemical they are assumed to be similar too in a screening assessment.
- Making use of the USEPA ECOTOX database and Australian guidance for water quality guideline development, it is possible to generate a guideline more appropriate for 6:2 FTS.

- This value is 210 µg/L.
- This value has been developed using an approach relevant for 95% species protection.
- A 95% species protection value is relevant for these chemicals as they are not bioaccumulative unlike PFOS and PFOA.
- All concentrations for 6:2 FTS and 8:2 FTS in stormwater are in compliance with this interim water quality guideline.
- The concentrations of PFOS are similar to ambient PFOS concentrations in urban areas of Australia, so no further assessment is required for this specific PFAS.

While this assessment indicates that the potential ecological impacts due to the presence of 6:2 FTS and 8:2 FTS are likely to be low, there are important aspects that are somewhat uncertain including:

- interim water quality guideline for 6:2 FTS is based on only limited ecotoxicity data – available data would not be sufficient to calculate an official water quality guideline
- data for PFAS in stormwater are limited to 3 rounds during the wet season (February, December 2021 and March 2022) and 1 round during the dry season (May 2022)
- wet season data includes 2 rounds toward the later parts of the wet (February 2021, March 2022) and 1 round toward the beginning of the wet (December 2021) and these rounds show around 10 fold variation between late and early in the wet season
- dry season data includes only data for early in the dry (May 2022), but these data are similar to the data for early in the wet (i.e. December 2021)
- based on the limited data:
    - maximum concentration reported in stormwater at this site was around 50 µg/L and this is around 25% of the proposed guideline
    - variation in stormwater concentrations appears to be around 10 fold
    - concentrations of 6:2 FTS in the existing data vary from 3% to 25% of the proposed guideline.

Therefore, additional monitoring will be important to support the conclusion that the levels of these key chemicals (6:2 FTS and 8:2 FTS) in stormwater are in compliance with the proposed guideline.

It is understood that the following monitoring program is undertaken by Vopak each year:

- Groundwater – twice a year, early wet season and late wet season, from a network of 14 bores
- Stormwater pit – three times a year, early, mid and late wet season, from 5 locations
- Sediment in drains – once every 2 years at the end of the wet season, from 12 locations

If monitoring for PFAS is included in this program for stormwater samples, that will provide appropriate data to support the conclusions of this HHERA.

7.4 Screening – Groundwater

The maximum groundwater concentrations reported in this investigation have been reviewed against the relevant screening criteria noted in **Section 3** and **Section 4**. The chemicals listed are those for which at least one sample contained concentrations above the limit of reporting.

As discussed in **Sections 3** and **4**, where necessary other PFAS have been screened using the guidelines for PFOS/PFOS+PFHxS or PFOA as follows:

- guidelines for PFOS have been applied to the sulfonic acid type PFAS (e.g. PFBS, PFPeS, PFHxS etc) and the fluorotelomers including 6:2 FTS (i.e. 4:2, 6:2, 8:2 and 10:2 FTS)
- guidelines for PFOA have been applied to the carboxylic acid PFAS (i.e. PFBA, PFPeA, PFHxA etc) and other PFAS (sulfonamides including EtFOSA, EtFOSAA, EtFOSE, MeFOSA, MeFOSAA, MeFOSE and FOSA).

7.4.1 Human Health

Groundwater at the site has high salinity in many locations making it unpalatable to drink. In addition, this area has been developed into a port and is surrounded by sites used for industrial purposes. Consequently, groundwater is not extracted for drinking water in this area. This means the relevant screening criteria for human health are those for recreational water use.

The screening assessment has been undertaken by grouping the wells into a number of groups depending on where they are located. The groupings are as follows:

- Upgradient wells away from areas where leaks have been identified (i.e. EMB3, EMB6, EMB8, EMB18)
- Wells around the location of the 2020 incident (i.e. EMB5, EMB23, EMB24, EMB25)
- Wells around the historic incident in the south east part of the site (i.e. EMB7 and EMB17)
- Wells along the western boundary (i.e. EMB21, EMB2, EMB22, EMB20, EMB1, EMB11)
- Wells along the southern boundary (i.e. EMB15, EMB16)
- Wells around stormwater management system and drain (EMB4, EMB12, EMB19)

The screening assessment is shown in **Table 7.9** (end of wet season results) and **Table 7.10** (end of dry season results).

Table 7.9: Screening risk assessment – groundwater – human health (April 2021/April 2022) – end of wet season

Detected PFAS	Maximum Concentration (µg/L)						Screening criteria (µg/L) – recreational
	Upgradient	2020 leak (middle of site)	Historic leak (SE Corner)	Western boundary	Southern boundary	Centre of site near stormwater drain	
PFBS	<0.0005	0.0028	0.0011	0.0007	<0.02	<0.0005	2
PFPeS	<0.0005	0.0017	<0.0005	<0.0005	<0.02	<0.0005	
PFHxS	0.05	0.0169	0.0034	0.0048	<0.02	0.0009	
PFHpS	<0.0005	0.001	<0.0005	<0.0005	<0.02	<0.0005	
PFOS	0.0054	0.03	0.0031	0.0052	<0.01	0.0004	
PFOS+PFHxS	0.0554	0.0469	0.0065	0.01	<0.01	0.0013	
4:2 FTS	<0.001	0.04	0.35	0.034	<0.05	0.22	
6:2 FTS	4.23	30.1	70	51.2	<0.05	52.4	
8:2 FTS	0.2	9.48	7.29	7.2	<0.05	2.52	
10:2FTS	<0.001	0.037	<0.001	0.074	<0.05	<0.001	
SUM (PFOS like)	4.5	39.7	77.6	58.5	Not detected	55.1	2
PFBA	1.2	2	1.6	1.86	<0.1	1	10
PFPeA	4.8	7.11	5.57	7.49	0.11	4.35	
PFHxA	4.82	6.6	14	8.39	0.08	6.52	
PFHpA	1.54	4.8	1.98	2.98	0.07	1.17	
PFOA	0.55	1.71	3.68	2.18	0.01	1.52	
PFNA	0.54	0.218	0.149	0.3	<0.02	0.11	
PFDA	0.001	0.0595	0.0558	<0.0005	<0.02	0.06	
PFUnDA	<0.0005	0.0073	0.0019	<0.0005	<0.02	<0.02	
PFDoDA	<0.0005	0.0014	<0.0005	<0.0005	<0.02	<0.02	
PFTrDA	<0.0005	<0.0005	<0.0005	<0.0005	<0.02	<0.02	
SUM (PFOA like)	13.5	22.5	27	23.2	0.27	14.7	10

Notes:
Screening criteria used here are from **Table 3.2**

Table 7.10: Screening risk assessment – groundwater – human health (December 2021) – end of dry season

Detected PFAS	Maximum Concentration (µg/L)						Screening criteria (µg/L) – recreational
	Upgradient	2020 leak	Historic leak	Western boundary	Southern boundary	Centre of site near stormwater drain	
PFBS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	2
PFPeS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
PFHxS	0.02	<0.01	0.01	<0.02	<0.02	0.01	
PFHpS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
PFOS	<0.02	0.02	<0.02	<0.01	<0.01	<0.01	
PFOS+PFHxS	0.02	0.02	0.01	<0.01	<0.01	0.01	
4:2 FTS	<0.05	<0.05	0.51	<0.05	<0.05	0.17	
6:2 FTS	1.89	67.2	140	4.45	<0.05	102	
8:2 FTS	0.2	12.7	0.3	0.17	<0.05	3.11	
10:2FTS	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	
SUM (PFOS like)	2.11	80	140.8	4.62	Not detected	105.3	2
PFBA	0.4	1.4	2.6	0.7	<0.1	1.1	10
PFPeA	1.88	6.76	9.36	2.94	0.06	4.56	
PFHxA	1.75	7.2	22.2	2.75	0.05	6.57	
PFHpA	0.6	2.88	2.63	1.11	0.03	1.27	
PFOA	0.17	2.33	6.59	0.2	<0.01	2.12	
PFNA	0.3	0.38	0.1	0.03	<0.02	0.15	
PFDA	<0.02	0.11	<0.02	<0.02	<0.02	0.08	
PFUnDA	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
PFDoDA	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
PFTrDA	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
SUM (PFOA like)	5.1	21.1	43.5	7.7	0.14	15.9	10

Notes:
Screening criteria used here are from **Table 3.2**

Screening shows:

- Upgradient groundwater has detectable PFAS present indicating that there likely to be other sources of these chemicals on the peninsula.
- Concentrations of PFAS in groundwater along the southern site boundary are very low.
- Concentrations of PFAS are highest near the locations where incidents have occurred historically or near the stormwater treatment system.
- Groundwater along the western boundary has concentrations similar to those measured in the most upgradient wells.
- All groundwater samples have been taken within the site.
- The only chemicals present at concentrations in excess of screening guidelines (based on PFOS and PFOA only) were 6:2 FTS, 8:2 FTS and PFHxA.
- Concentrations in groundwater are generally higher at the end of the dry season.
- The recreational guidelines assume a person comes into contact with the water on 150 days per year and incidentally ingests 200 mLs on each occasion. This is extremely conservative for this site as it would appear the only way a person might come into contact with groundwater is when taking samples for environmental monitoring. Such sampling only occurs on 3-4 occasions per year and incidental ingestion during sampling would be of the order of 1-5 mLs per occasion (a splash). Groundwater is not accessed at the site for use in any of the processes undertaken at the site (industrial use, irrigation etc).
- The adjusted guidelines for 6:2 FTS, 8:2 FTS and PFHxA discussed in regard to stormwater in **Section 7.3.1** are relevant for use in screening these data for groundwater.
- All concentrations in groundwater for these 3 key chemicals are in compliance with the adjusted guidelines.

Given the compliance with the recreational guidelines (and the adjusted recreational guidelines) which are considered conservative for groundwater in this area, no further consideration of potential human health risks due to the presence of PFAS in groundwater is required.

7.4.2 Ecological

This section of the HHERA provides a review of the concentrations of PFAS reported in water against relevant screening guidelines for the protection of ecological health. The water quality guidelines from the NEMP have been adopted (HEPA 2020).

The screening assessment for ecological risks is shown in **Table 7.11** (end of wet season results) and **Table 7.12** (end of dry season results).

Table 7.11: Screening risk assessment – groundwater – ecological (April 2021/April 2022) – end of wet season

Detected PFAS	Maximum Concentration (µg/L)						Screening Criteria – ecological (95% species protection) (µg/L)	Screening criteria – ecological (99% species protection) (µg/L)
	Upgradient	2020 leak (middle of site)	Historic leak (SE Corner)	Western boundary	Southern boundary	Centre of site near stormwater drain		
PFBS	<0.0005	0.0028	0.0011	0.0007	<0.02	<0.0005	0.13	0.00023
PFPeS	<0.0005	0.0017	<0.0005	<0.0005	<0.02	<0.0005		
PFHxS	0.05	0.0169	0.0034	0.0048	<0.02	0.0009		
PFHpS	<0.0005	0.001	<0.0005	<0.0005	<0.02	<0.0005		
PFOS	0.0054	0.03	0.0031	0.0052	<0.01	0.0004		
4:2 FTS	<0.001	0.04	0.35	0.034	<0.05	0.22		
6:2 FTS	4.23	30.1	70	51.2	<0.05	52.4		
8:2 FTS	0.2	9.48	7.29	7.2	<0.05	2.52		
10:2FTS	<0.001	0.037	<0.001	0.074	<0.05	<0.001		
SUM (PFOS like)	4.5	39.7	77.6	58.5	Not detected	55.1	0.13	0.00023
PFBA	1.2	2	1.6	1.86	<0.1	1	220	19
PFPeA	4.8	7.11	5.57	7.49	0.11	4.35		
PFHxA	4.82	6.6	14	8.39	0.08	6.52		
PFHpA	1.54	4.8	1.98	2.98	0.07	1.17		
PFOA	0.55	1.71	3.68	2.18	0.01	1.52		
PFNA	0.54	0.218	0.149	0.3	<0.02	0.11		
PFDA	0.001	0.0595	0.0558	<0.0005	<0.02	0.06		
PFUnDA	<0.0005	0.0073	0.0019	<0.0005	<0.02	<0.02		
PFDoDA	<0.0005	0.0014	<0.0005	<0.0005	<0.02	<0.02		
PFTrDA	<0.0005	<0.0005	<0.0005	<0.0005	<0.02	<0.02		
SUM (PFOA like)	13.5	22.5	27	23.2	0.27	14.7	220	19

Notes:
Screening criteria used here are from **Table 4.2**

Table 7.12: Screening risk assessment – groundwater – ecological (December 2021) – end of dry season

Detected PFAS	Maximum Concentration (µg/L)						Screening Criteria – ecological (95% species protection) (µg/L)	Screening criteria – ecological (99% species protection) (µg/L)
	Upgradient	2020 leak	Historic leak	Western boundary	Southern boundary	Centre of site near stormwater drain		
PFBS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.13	0.00023
PFPeS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		
PFHxS	0.02	<0.01	0.01	<0.02	<0.02	0.01		
PFHpS	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		
PFOS	<0.02	0.02	<0.02	<0.01	<0.01	<0.01		
4:2 FTS	<0.05	<0.05	0.51	<0.05	<0.05	0.17		
6:2 FTS	1.89	67.2	140	4.45	<0.05	102		
8:2 FTS	0.2	12.7	0.3	0.17	<0.05	3.11		
10:2FTS	<0.05	0.07	<0.05	<0.05	<0.05	<0.05		
SUM (PFOS like)	2.11	80	140.8	4.62	Not detected	105.3	0.13	0.00023
PFBA	0.4	1.4	2.6	0.7	<0.1	1.1	220	19
PFPeA	1.88	6.76	9.36	2.94	0.06	4.56		
PFHxA	1.75	7.2	22.2	2.75	0.05	6.57		
PFHpA	0.6	2.88	2.63	1.11	0.03	1.27		
PFOA	0.17	2.33	6.59	0.2	<0.01	2.12		
PFNA	0.3	0.38	0.1	0.03	<0.02	0.15		
PFDA	<0.02	0.11	<0.02	<0.02	<0.02	0.08		
PFUnDA	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		
PFDoDA	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		
PFTrDA	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		
SUM (PFOA like)	5.1	21.1	43.5	7.7	0.14	15.9	220	19

Notes:
Screening criteria used here are from **Table 4.2**

Screening shows:

- Upgradient groundwater has detectable PFAS present.
- Concentrations of PFAS in groundwater along the southern boundary are very low.
- Concentrations of PFAS are highest near the locations where leaks/spills have occurred historically and near the stormwater treatment system.
- Groundwater along the western boundary has concentrations similar to those measured in the most upgradient wells.
- All groundwater samples have been taken within the site.
- Potential for impacts on ecosystems from groundwater is relevant in areas where the groundwater discharges into surface water bodies which would occur in the off-site area to the west of the site.
- When groundwater seeps into surface water, it mixes and is diluted.
- It is not possible to determine the level of dilution without data obtained at the off-site area to the west of the site.
- Given the available information, the concentrations reported for wells along the western boundary are the most relevant for the assessment of potential risks to ecosystems.
- Just as was the case for stormwater, 6:2 FTS and 8:2 FTS are the key chemicals present in groundwater along the western boundary.
- The concentrations of these 2 chemicals in wells along the western boundary are in compliance with the interim water quality guidelines developed in **Section 7.3.3**.
- In addition, the concentrations of these 2 chemicals in all wells at the site, even the most impacted wells, are in compliance with the interim water quality guidelines developed for this assessment.
- PFOS concentrations are generally similar to those for urban waterways throughout Australia.

The maximum concentrations at the site are generally in compliance with relevant water quality guidelines (i.e. 6:2 FTS) and/or ambient levels (i.e. PFOS).

While this assessment indicates that the potential ecological impacts due to the presence of 6:2 FTS in groundwater are likely to be low, there are important aspects that are somewhat uncertain including:

- interim water quality guideline for 6:2 FTS is based on only limited ecotoxicity data – available data would not be sufficient to calculate an official water quality guideline
- data for groundwater are limited to 3 rounds (April 2021, December 2021 and April 2022)
- data for April 2021 and 2022 were collected at the end of the wet season while the December round was at the beginning of the wet season
- monitoring of groundwater has not yet occurred during the dry season
- data show that there is a 2-4 fold variability across these monitoring events (i.e. within the wet season)
- differences in groundwater concentrations between the wet and dry season cannot be determined with the available data
- based on the limited data:
    - maximum concentration reported in groundwater at this site was around 140 µg/L and this is around 65% of the proposed guideline

- variation in groundwater concentrations across the wet season appears to be around 2-4 fold
- concentrations of 6:2 FTS in the existing data vary from 15% to 65% of the proposed guideline.

Therefore, additional monitoring will be important to support the conclusion that the levels of these key chemicals (6:2 FTS and 8:2 FTS) in groundwater are in compliance with the proposed guideline.

It is understood that the following monitoring program is undertaken by Vopak each year:

- Groundwater – twice a year, early wet season and late wet season, from a network of 14 bores
- Stormwater pit – three times a year, early, mid and late wet season, from 5 locations
- Sediment in drains – once every 2 years at the end of the wet season, from 12 locations

If monitoring for PFAS is included in this program for groundwater samples, that will provide appropriate data to support the conclusions of this HHERA.

Section 8. Uncertainties

8.1 General

The ASC NEPM requires risk assessments to include consideration of the uncertainties present in any such assessment. Uncertainties are present because not every aspect of interest can be measured in an investigation or because the state of knowledge is limited (NEPC 1999 amended 2013a).

Uncertainty in any assessment refers to a lack of knowledge (that could be better refined through the collection of additional data or conduct of additional studies) and is an important aspect of the risk assessment process.

An assessment of uncertainty is usually a qualitative process relating to the selection and rejection of specific data, estimates or scenarios within the risk assessment. In general, to compensate for uncertainty, conservative assumptions are made that result in an overestimate rather than an underestimate of risk.

For sophisticated risk assessments which include detailed exposure assessment modelling, the ASC NEPM notes that quantitative sensitivity analysis may be an important aspect of evaluating the uncertainties. Such an assessment includes checking whether conclusions change if assumptions included in the modelling are varied. For this assessment, such detailed exposure assessment modelling has not been undertaken so a quantitative sensitivity analysis is not relevant.

In general, the uncertainties and limitations of any risk assessment can be classified into the following categories, where uncertainties relevant to each have been addressed within the report (as noted):

- Sampling and analysis
- Toxicological assessment
- Exposure assessment

8.2 Sampling and analysis

The sampling and analysis of environmental samples from any site results in some level of error and/or variability that is inherent in the data reported. In addition, sampling involves the collection of samples from discrete locations and using that data to infer the level of contamination between these sampling points. The actual concentration between the sample points cannot be guaranteed.

National guidance has been used as a basis for the sampling design. For this assessment, more targeted sampling (which is permitted within national guidance) was undertaken to ensure the locations where leaks/spills had occurred were appropriately assessed.

The sampling and analysis of environmental media from any site results in some level of error that is inherent in the data reported. In addition, sampling involves the collection of samples from discrete locations and inferring the level of contamination between these sampling points. The actual concentration between the sample points cannot be guaranteed.

The stormwater and groundwater data show a higher level of variability than might be seen in non-tropical locations. In addition, the available data do not provide a detailed understanding of the

variability in PFAS concentrations through time in stormwater or groundwater. The available data do indicate that concentrations in stormwater vary around 10 fold and, for groundwater, maximum concentrations vary around 2-4 fold.

This HHERA has considered the available site assessment data on face value and assumed that the data are representative of the PFAS contamination at the site and are suitable for interpretative use. However, it is noted that stormwater and groundwater concentrations are quite variable and have only been assessed over the last 1-2 years, so there is not an extensive understanding of the concentrations present nor the drivers for the variability.

8.3 Toxicological assessment

In general, the available scientific information is insufficient to provide a thorough understanding of all the potential toxic properties of chemicals to which humans may be exposed. It is necessary, therefore, to extrapolate these properties from data obtained under other conditions of exposure and involving experimental laboratory animals. Most the toxicological knowledge of chemicals comes from experiments with laboratory animals, although there may be interspecies differences in chemical absorption, metabolism, excretion and toxic response, as is particularly the case for PFAS compounds. There may also be uncertainties concerning the relevance of animal studies using exposure routes that differ from human exposure routes. In addition, the frequent necessity to extrapolate results of short-term or sub-chronic animal studies to humans exposed over a lifetime has inherent uncertainty. The uncertainties inherent in the toxicological values adopted are considered likely to result in an overestimation of actual risk assessed for long-term or chronic exposures.

The use of toxicity data from laboratory experiments with animals is the recognised approach in Australia and overseas for the assessment of toxicity to humans in the absence of more relevant experimental data for humans (i.e. epidemiological studies). This is because the use of these animal toxicity data (and the overall approach) is established and precautionary. This applies equally to PFAS, as it does to any other chemical where it is suspected that exposure may lead to adverse health effects.

Toxicity reference values relevant for people like the ones used in this assessment (those for PFAS and for many other chemicals) are determined from animal toxicity data. The calculation starts by finding the lowest (i.e. most sensitive) dose that does not cause any effects. Uncertainty factors are then applied to that dose to account for extrapolating from animals to people and across different people with different sensitivities. Other uncertainty factors can be included if there is a small set of data to use etc. These uncertainty factors result in the dose that caused no effects being divided by 100-10,000 depending on the combination of uncertainty factors. For PFAS, some of the uncertainty factors were replaced with detailed modelling of how the chemicals move around the body of the animals used in testing and then in people. This modelling resulted in the no effects dose being adjusted by more than 10,000 fold. The toxicity reference value is the value that this assessment assumes a person can be exposed to for their lifetime with no effects. This value is likely to be at least 100 times lower than the dose in test animals that caused no effects for most chemicals. For PFAS, this value is at least 10,000 times lower than the dose that caused no effects. There is a significant margin in this assessment to account for what is unknown about the toxicology of these chemicals.

Ecotoxicity reference values have been adopted from national guidance or generated based on data from the USEPA ECOTOX database and Australian guidance. The interim value generated for 6:2 FTS is based on the highest concentration used in a study for an ecologically relevant endpoint that resulted in no effects in the organisms. This value was then divided by 100 to account for uncertainties, given the limited amount of available data. It is noted that there is insufficient data available for the development of an official water quality guideline to be promulgated by ANZECC.

8.4 Exposure Assessment

The quantification of exposure in this assessment has been based on the exposure scenarios built into the PFAS NEMP guidelines and FSANZ trigger points.

These scenarios are designed to be conservative to allow generation of generic national guidelines.

Conservative approaches/ assumptions built into this assessment include:

- Soil guidelines for PFAS assume 80% of the tolerable daily intake is not available for consideration at this site as background exposures (or exposures via other pathways) may be important – i.e. only 20% of the tolerable intake can result from exposure to soil at the site. The measured background levels of PFOS and PFOA in serum in the Australian population are around 10%.
- Recreational and drinking guidelines also assume that only 10% of the tolerable daily intake can come from exposure to water – i.e. only 10% of the tolerable intake can come from contact with stormwater or groundwater at this site.

8.5 Source control

PFAS are persistent, bioaccumulative chemicals. Key PFAS like PFOS, PFOA and PFHxS are listed on the Stockholm Convention for persistent organic pollutants [5]. This convention was developed to ensure appropriate protection of human health and the environment from these types of chemicals. While some of the key chemicals at this site are not listed on this convention nor are they bioaccumulative, chemicals like 6:2 FTS are persistent.

The convention includes requirements for countries that are signatories to appropriately manage the movement of these chemicals. This means that best practice measures are important to consider whenever there is potential for these chemicals to move into off-site areas around a facility using products containing them. Where possible and practical, methods to reduce levels in discharges are important to implement. An approach that may be relevant for this site is an investigation of how PFAS are entering the stormwater system. If, for example, there are minor leaks in the infrastructure that could be easily repaired, then this would be appropriate to determine and implement.

Understanding the sources of PFAS to groundwater and stormwater at this site would be useful in addressing some of the uncertainties present due to the limitations of the data.

[5] http://pops.int/

Section 9. Conclusions

Environmental Risk Sciences Pty Ltd (enRiskS) has been engaged by SMEC Pty Ltd, to review available data and undertake a human health and ecological risk assessment (HHERA) in relation to the presence of per- and polyfluoroalkyl substances (PFAS) at the Vopak Bulk Fuel Terminal (operated by Vopak) in the Northern Territory (the "Site"; refer to **Figure 1.1**).

A firefighting foam solution leak occurred at the Site on 26 September 2020. Per and poly-fluoroalkyl substances (PFAS) are included in the ingredients for the foam. These chemicals are persistent organic pollutants with potential for health and environmental impacts. The incident was reported and assessed by the Northern Territory Environment Protection Authority (NT EPA) (SMEC 2022).

NT EPA issued Vopak with a notice on 25 October 2021 under Section 48(1) of the Waste Management and Pollution Control Act 1988. The notice requires Vopak to carry out an environmental audit program to evaluate the types, amount, distribution and mobility of petroleum hydrocarbons, PFAS, and other contaminants of concern (copper, lead, zinc and ammonia) present in the environment at the Site (SMEC 2022).

The site investigation report by SMEC addresses the evaluation of the types, amount, distribution and mobility of these contaminants. The assessment provided in this report relates to the presence of PFAS and the potential for the levels of PFAS found in stormwater, groundwater or soil to pose a risk to human health or the environment.

The facility has used PFAS containing AFFF in their fire management system. The fire management system was tested on a monthly basis, where foam solution may have been placed directly onto the ground. In addition, there was a leak of foam solution from an underground line in 2020. This leak was detected and repaired. There is no history of fuel fires at the site.

Vopak commissioned consultants to undertake:

- groundwater monitoring at its on-site wells
- stormwater sampling from a range of locations within the stormwater management system
- soil sampling from relevant locations across the site.

A range of PFAS were detected in at least some groundwater, stormwater and soil samples. In line with national guidance, a site-specific human health and ecological risk assessment has been undertaken to determine risks and any necessary management actions.

Based on the data available to May 2022, and with consideration of the uncertainties identified, the following can be concluded.

Soil

All soil samples were found to have PFAS concentrations in compliance with guideline values provided within the NEMP relevant for the protection of human health and ecological health for industrial sites. Leachability testing was undertaken. It indicated that PFAS were leachable from these soils. Further assessment of potential risks due to PFAS that may leach is discussed for groundwater and stormwater.

Stormwater

Human health

Initial screening of the total PFAS concentrations in stormwater showed that some levels were in excess of the guideline values provided within the NEMP relevant for the protection of human health. These guidelines are based on health effect data for PFOS+PFHxS and PFOA. The key chemicals that were present in these samples, however, were 6:2 FTS, 8:2 FTS and PFHxA rather than PFOS, PFHxS or PFOA.

Further refinement of the assessment was undertaken by adjusting the recreational water quality guideline for PFOS to be more appropriate for the key chemicals based on the difference in toxicity between the key chemicals at this site (6:2 FTS, 8:2 FTS and PFHxA) and PFOS. All stormwater results were in compliance with these adjusted recreational guidelines.

Given that some PFAS are highly bioaccumulative, it is important to consider potential uptake into seafood. Fish and crabs collected from Bleesers Creek in Darwin Harbour were analysed for PFAS by the University of Queensland on behalf of NT Health in 2017. The results indicated that levels of PFOS and PFOA were in compliance with the Food Standards Australia and New Zealand (FSANZ) trigger points for fish that people eat. The levels were around 10 times lower than the trigger point for PFOS. The key chemicals for this site are PFAS that are not bioaccumulative and would not be expected to be present in seafood.

No data have been collected from any off-site surface water environments into which stormwater would discharge. However, given that recreational contact with stormwater was considered acceptable using data from the site, no further consideration is required in regard to human health.

Ecological

Initial screening of stormwater results also showed total PFAS concentrations in excess of the guideline values provided within the NEMP relevant for the protection of ecosystems, based on ecotoxicity data for PFOS and PFOA.

Further refinement of the assessment of stormwater results was undertaken.

There are no surface water bodies located on the site for which these guideline values are relevant, so no further consideration is required for this aspect.

Stormwater might leave the site flowing into the off-site area to the west of the site and west of the railway line via the open drain. There is no information about the concentrations of these chemicals that would be present in the off-site area, but it would be expected that the stormwater at the site would be diluted during discharge into the off-site areas.

Regardless of the potential for dilution, further refinement of the screening assessment has been undertaken assuming the concentrations measured in stormwater at the site might reach the off-site area. The key chemicals in these samples were 6:2 FTS and 8:2 FTS. The USEPA ECOTOX database was interrogated for data relevant for these key chemicals. A single study was found for 8:2 FTS and 4 studies were found for 6:2 FTS. Using the data for 6:2 FTS and guidance from the Australian Water Quality Guidelines, an interim water quality guideline relevant for 95% species

protection was determined. This value was applied to screen the results for both 6:2 FTS and 8:2 FTS.

All results in stormwater samples were in compliance with this interim water quality guideline. However, there are a number of limitations in this assessment including:

- interim water quality guideline for 6:2 FTS is based on only limited ecotoxicity data – available data would not be sufficient to calculate an official water quality guideline
- data for stormwater are limited to 3 rounds during the wet season (February, December 2021 and March 2022) and 1 round during the dry season (May 2022)
- wet season data includes 2 rounds toward the later parts of the wet (February 2021, March 2022) and 1 round toward the beginning of the wet (December 2021) and these rounds show around 10 fold variation between late and early in the wet season
- dry season data includes only data for early in the dry (May 2022), but these data are similar to the data for early in the wet (i.e. December 2021)
- based on the limited data:
    - maximum concentration reported in stormwater at this site was around 50 µg/L and this is around 25% of the proposed guideline
    - variation in stormwater concentrations appears to be around 10 fold
    - concentrations of 6:2 FTS in the existing data vary from 3% to 25% of the proposed guideline.

Therefore, additional monitoring will be important to support the conclusion that the levels of these key chemicals (6:2 FTS and 8:2 FTS) in stormwater are in compliance with the proposed guideline.

It is understood that the following monitoring program is undertaken by Vopak each year:

- Groundwater – twice a year, early wet season and late wet season, from a network of 14 bores
- Stormwater pit – three times a year, early, mid and late wet season, from 5 locations
- Sediment in drains – once every 2 years at the end of the wet season, from 12 locations

If monitoring for PFAS is included in this program for stormwater samples, that will provide appropriate data to support the conclusions of this HHERA.

It is also important to note that the key chemicals for this site are PFAS that are not bioaccumulative – i.e. 6:2 FTS, 8:2 FTS. It is expected that, if risks to aquatic organisms from direct contact with water are acceptable, then risks to higher organisms from consumption of aquatic organisms will also be acceptable.

Groundwater

Human health

Initial screening of the total PFAS concentrations in groundwater showed that some levels were in excess of the guideline values provided within the NEMP relevant for the protection of human health, based on health effects data for PFOS+PFHxS and PFOA. The key chemicals that were present in these samples were 6:2 FTS, 8:2 FTS and PFHxA. Further refinement of the assessment was undertaken by adjusting the recreational water quality guideline for PFOS to be more

appropriate for the key chemicals based on the difference in toxicity between the key chemicals for this site (6:2 FTS, 8:2 FTS and PFHxA) and PFOS. All groundwater results were in compliance with these adjusted recreational guidelines.

Given that some PFAS are highly bioaccumulative, it is important to consider potential uptake into seafood. Fish and crabs collected from Bleesers Creek in Darwin Harbour were analysed for PFAS by the University of Queensland on behalf of NT Health in 2017. The results for these samples indicate that levels of PFOS and PFOA were in compliance with the Food Standards Australia and New Zealand (FSANZ) trigger points for fish. The levels were around 10 times lower than the trigger point for PFOS. The key chemicals for this site are PFAS that are not bioaccumulative and would not be expected to be present in seafood.

No data have been collected from any off-site surface water environments into which groundwater would mix. However, given that recreational contact with groundwater was considered acceptable using data from the site, no further consideration is required in regard to human health.

Ecological

Initial screening of groundwater results also showed total PFAS concentrations in excess of the guideline values provided within the NEMP relevant for the protection of ecosystems, based on ecotoxicity data for PFOS and PFOA.

Potential ecological risks to aquatic organisms are most relevant to consider where groundwater mixes into surface water within the off-site area. There is no information about the concentrations of these chemicals that would be present in the off-site area where surface water and groundwater mix, but it would be expected that concentrations of PFAS in groundwater measured at the site would be diluted as it mixes into surface water.

There are no surface water bodies located on the site into which this groundwater might mix and for which these guideline values would be relevant, so no further consideration is required for this aspect.

Regardless of the potential for dilution, further refinement of the screening assessment has been undertaken assuming the concentrations measured in groundwater at the site (both concentrations along the western boundary and the maximum concentrations anywhere on the site) might reach the off-site area without any dilution which will be conservative.

The key chemicals in the groundwater samples were 6:2 FTS and 8:2 FTS. The interim water quality guideline determined in the stormwater assessment was also applied to groundwater. All results in the groundwater samples were in compliance with this interim water quality guideline. However, there are a number of limitations/uncertainties in this assessment including:

- interim water quality guideline for 6:2 FTS is based on only limited ecotoxicity data – available data would not be sufficient to calculate an official water quality guideline
- data for groundwater are limited to 3 rounds (April 2021, December 2021 and April 2022)
- data for April 2021 and 2022 were collected at the end of the wet season while the December round was at the beginning of the wet season
- monitoring of groundwater has not yet occurred during the dry season

- data show that there is a 2-4 fold variability across these monitoring events (i.e. within the wet season)
- differences in groundwater concentrations between the wet and dry season cannot be determined with the available data
- based on the limited data:
    - maximum concentration reported in groundwater at this site was around 140 µg/L and this is around 65% of the proposed guideline
    - variation in groundwater concentrations across the wet season appears to be around 2-4 fold
    - concentrations of 6:2 FTS in the existing data vary from 15% to 65% of the proposed guideline.

Therefore, additional monitoring will be important to support the conclusion that the levels of these key chemicals (6:2 FTS and 8:2 FTS) in groundwater are in compliance with the proposed guideline.

It is understood that the following monitoring program is undertaken by Vopak each year:

- Groundwater – twice a year, early wet season and late wet season, from a network of 14 bores
- Stormwater pit – three times a year, early, mid and late wet season, from 5 locations
- Sediment in drains – once every 2 years at the end of the wet season, from 12 locations

If monitoring for PFAS is included in this program for groundwater samples, that will provide appropriate data to support the conclusions of this HHERA.

It is also important to note that the key chemicals for this site are PFAS that are not bioaccumulative – i.e. 6:2 FTS, 8:2 FTS. It is expected that, if risks to aquatic organisms from direct contact with water are acceptable, then risks to higher organisms from consumption of aquatic organisms will also be acceptable.

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Appendix A Site data

					BTEXN							Metals							
				Moisture Content	Naphthalene (VOC)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	Total BTEX	Arsenic	Cadmium	Chromium (III+VI)	Copper	Lead	Mercury	Nickel	Zinc
				%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.1	0.5	0.1	0.1	0.1	0.2	0.1	0.3	0.2	2	0.4	2	5	5	0.1	2	5
2011 CRC Care HSL-D Commercial / Industrial					11,000	430	99,000	27,000			81,000									
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=0m, <1m)						3					230									
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=1m, <2m)						3														
2020 NEPM Schedule B1 Table 1A(1) HILs Comm/Ind D Soil													3,000	900	3,600	240,000	1,500	730	6,000	400,000
2020 PFAS NEMP HEPA Industrial/ Commercial (HIL D)																				
EnRisks (2022) HHERA - screening criteria (human health - industrial)																				
Lab Report Number	Sample ID	Matrix	Sample Date																	
ES2212085	QA01	Soil	4/04/2022	9.2	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	35	<1	21	8	12	<0.1	4	11
878534	QA01A	Soil	4/04/2022	11	<0.5	<0.1	<0.1	<0.1	<0.2	<0.1	<0.3	-	52	<0.4	56	12	18	<0.1	<5	15
ES2212085	QA02	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
878534	QA02A	Soil	5/04/2022	7.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	QA04	Soil	7/04/2022	8.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
882408	QA04A	Soil	7/04/2022	9.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB17/0.05-0.15	Soil	4/04/2022	8.0	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	26	<1	31	7	11	<0.1	4	14
ES2212085	EMB17/1.2-1.3	Soil	4/04/2022	1.1	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	32	<1	16	7	<5	<0.1	<2	<5
ES2212085	EMB18/0.1-0.2	Soil	4/04/2022	9.8	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	20	<1	18	6	8	<0.1	2	8
ES2212085	EMB18/1.4-1.5	Soil	4/04/2022	7.7	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	36	<1	18	14	<5	<0.1	7	16
ES2212085	EMB19/0.02-0.05	Soil	5/04/2022	8.5	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	10	<1	24	7	13	<0.1	5	11
ES2212085	EMB19/0.9-1.0	Soil	5/04/2022	9.4	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	91	<1	24	9	9	<0.1	3	6
ES2212085	EMB20/0.01-0.1	Soil	5/04/2022	9.4	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	96	<1	26	9	10	<0.1	2	10
ES2212085	EMB20/1.1-1.2	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB20/2.0-2.1	Soil	5/04/2022	12.6	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	51	<1	19	<5	8	<0.1	2	<5
ES2212085	EMB21/0.01-0.10	Soil	5/04/2022	5.4	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	63	<1	10	<5	21	<0.1	<2	10
ES2212085	EMB22/0.02-0.1	Soil	5/04/2022	8.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB22/1.1-1.2	Soil	5/04/2022	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	EMB23/0.08-0.15	Soil	7/04/2022	7.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	EMB23/0.75-0.85	Soil	7/04/2022	6.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	EMB24/0.7-0.8	Soil	8/04/2022	6.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	EMB24/0.08-0.15	Soil	8/04/2022	7.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	EMB25/0.08-0.15	Soil	6/04/2022	7.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	EMB25/1.0-1.1	Soil	6/04/2022	6.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH01/0.08-0.15	Soil	6/04/2022	6.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH01/1.0-1.1	Soil	6/04/2022	7.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH02/0.08-0.15	Soil	6/04/2022	6.2	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	20	<1	93	<5	10	<0.1	2	<5
ES2212731	SBH02/1.1-1.2	Soil	7/04/2022	5.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH03/0.08-0.15	Soil	7/04/2022	8.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH03/1.0-1.1	Soil	7/04/2022	5.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH04/0.8-0.9	Soil	7/04/2022	13.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH04/0.08-0.15	Soil	7/04/2022	6.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH05/0.08-0.15	Soil	7/04/2022	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH05/0.9-1.0	Soil	7/04/2022	6.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH06/0.8-0.9	Soil	7/04/2022	10.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH06/0.08-0.15	Soil	7/04/2022	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	TRIP BLANK	Soil	4/04/2022	-	-	<0.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.2	-	-	-	-	-	-	-	-

LOR Limit of reporting

				PAH																	
				Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b+j)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	Benzo(a)pyrene TEQ calc (Half)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ calc (Zero)	PAHs (Sum of total)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
2011 CRC Care HSL-D Commercial / Industrial																	11,000						
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=0m, <1m)																							
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=1m, <2m)																							
2020 NEPM Schedule B1 Table 1A(1) HILs Comm/Ind D Soil																				40	40	40	4,000
2020 PFAS NEMP HEPA Industrial/ Commercial (HIL D)																							
EnRisks (2022) HHERA - screening criteria (human health - industrial)																							
Lab Report Number	Sample ID	Matrix	Sample Date																				
ES2212085	QA01	Soil	4/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
878534	QA01A	Soil	4/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	QA02	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
878534	QA02A	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	QA04	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
882408	QA04A	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB17/0.05-0.15	Soil	4/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB17/1.2-1.3	Soil	4/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB18/0.1-0.2	Soil	4/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB18/1.4-1.5	Soil	4/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB19/0.02-0.05	Soil	5/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB19/0.9-1.0	Soil	5/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB20/0.01-0.1	Soil	5/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB20/1.1-1.2	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB20/2.0-2.1	Soil	5/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB21/0.01-0.10	Soil	5/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212085	EMB22/0.02-0.1	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB22/1.1-1.2	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	EMB23/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	EMB23/0.75-0.85	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	EMB24/0.7-0.8	Soil	8/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	EMB24/0.08-0.15	Soil	8/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	EMB25/0.08-0.15	Soil	6/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	EMB25/1.0-1.1	Soil	6/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH01/0.08-0.15	Soil	6/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH01/1.0-1.1	Soil	6/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH02/0.08-0.15	Soil	6/04/2022	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	1.2	<0.5	<0.5
ES2212731	SBH02/1.1-1.2	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH03/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH03/1.0-1.1	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH04/0.8-0.9	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH04/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH05/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH05/0.9-1.0	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH06/0.8-0.9	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH06/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	TRIP BLANK	Soil	4/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	<1	-	-	-	-	-	-

LOR Limit of reporting

				Perfluoroalkane Carboxylic Acids										(n:2) Fluorotelomer Sulfonic Acids			
				Perfluorobutanoic acid (PFBA)	Perfluorohexanoic acid (PFHxA)	Perfluoropentanoic acid (PFPeA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorodecanoic acid (PFDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorononanoic acid (PFNA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUnDA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005
2011 CRC Care HSL-D Commercial / Industrial																		
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=0m, <1m)																		
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=1m, <2m)																		
2020 NEPM Schedule B1 Table 1A(1) HILs Comm/Ind D Soil																		
2020 PFAS NEMP HEPA Industrial/ Commercial (HIL D)								50										
EnRisks (2022) HHERA - screening criteria (human health - industrial)				50	50	50	50	50	50	50	50	50	50	50	20	20	20	20
Lab Report Number	Sample ID	Matrix	Sample Date															
ES2212085	QA01	Soil	4/04/2022	<0.001	0.0004	0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
878534	QA01A	Soil	4/04/2022	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.005
ES2212085	QA02	Soil	5/04/2022	0.004	0.0148	0.0157	0.0017	0.0011	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0812	0.0023	<0.0005
878534	QA02A	Soil	5/04/2022	<0.005	0.0096	0.014	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.055	<0.005	<0.005
ES2212731	QA04	Soil	7/04/2022	<0.001	0.0005	0.0003	0.0004	0.0004	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0164	0.0042	<0.0005
882408	QA04A	Soil	7/04/2022	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.028	<0.005	<0.005
ES2212085	EMB17/0.05-0.15	Soil	4/04/2022	<0.001	0.0006	0.0006	0.0004	0.0074	0.0008	<0.0002	0.0086	<0.0005	<0.0002	<0.0002	<0.0005	0.246	0.253	0.0031
ES2212085	EMB17/1.2-1.3	Soil	4/04/2022	<0.001	0.0012	0.0007	0.0005	0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0095	0.0039	<0.0005
ES2212085	EMB18/0.1-0.2	Soil	4/04/2022	<0.001	0.0004	0.0004	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
ES2212085	EMB18/1.4-1.5	Soil	4/04/2022	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
ES2212085	EMB19/0.02-0.05	Soil	5/04/2022	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
ES2212085	EMB19/0.9-1.0	Soil	5/04/2022	<0.001	0.0004	0.0004	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
ES2212085	EMB20/0.01-0.1	Soil	5/04/2022	<0.001	0.0006	0.0014	0.0002	0.0005	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0369	<0.0005	<0.0005
ES2212085	EMB20/1.1-1.2	Soil	5/04/2022	<0.001	0.001	0.0008	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
ES2212085	EMB20/2.0-2.1	Soil	5/04/2022	<0.001	0.0013	0.0012	0.0005	<0.0002	<0.0002	<0.0002	0.0007	<0.0005	0.0003	0.0006	<0.0005	0.0041	<0.0005	<0.0005
ES2212085	EMB21/0.01-0.10	Soil	5/04/2022	0.001	0.0159	0.0085	0.0025	0.0013	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0197	0.0017	<0.0005
ES2212085	EMB22/0.02-0.1	Soil	5/04/2022	0.003	0.0106	0.014	0.001	0.0008	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0527	0.0024	<0.0005
ES2212085	EMB22/1.1-1.2	Soil	5/04/2022	<0.001	0.001	0.0008	0.0005	0.0003	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0061	0.0011	<0.0005
ES2212731	EMB23/0.08-0.15	Soil	7/04/2022	<0.001	0.0008	0.0006	0.0008	0.0007	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0134	0.0313	<0.0005
ES2212731	EMB23/0.75-0.85	Soil	7/04/2022	<0.001	0.0039	0.0045	0.0012	0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0038	0.0029	<0.0005
ES2213150	EMB24/0.7-0.8	Soil	8/04/2022	<0.001	0.0002	0.0002	0.0004	0.0002	<0.0002	<0.0002	0.0006	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	0.002	<0.0005
ES2213150	EMB24/0.08-0.15	Soil	8/04/2022	<0.001	0.0002	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0077	0.0033	<0.0005
ES2212247	EMB25/0.08-0.15	Soil	6/04/2022	<0.001	0.0003	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
ES2212247	EMB25/1.0-1.1	Soil	6/04/2022	<0.001	0.0004	0.0005	<0.0002	0.0003	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	0.0075	<0.0005
ES2212247	SBH01/0.08-0.15	Soil	6/04/2022	<0.001	0.0023	0.0009	0.0007	0.0013	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0603	0.0113	<0.0005
ES2212247	SBH01/1.0-1.1	Soil	6/04/2022	0.001	0.0053	0.0058	0.0013	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005
ES2212247	SBH02/0.08-0.15	Soil	6/04/2022	<0.001	0.0006	0.0003	0.0003	0.0006	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.028	0.0092	<0.0005
ES2212731	SBH02/1.1-1.2	Soil	7/04/2022	<0.001	0.0029	0.0034	0.0009	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0039	<0.0005	<0.0005
ES2212731	SBH03/0.08-0.15	Soil	7/04/2022	<0.001	0.0004	0.0004	0.0004	0.0003	0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0096	0.017	0.0036
ES2212731	SBH03/1.0-1.1	Soil	7/04/2022	<0.001	0.0008	0.001	0.0006	0.0004	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0006	0.0026	<0.0005
ES2212731	SBH04/0.8-0.9	Soil	7/04/2022	0.001	0.0054	0.007	0.0021	0.0004	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0058	0.0016	<0.0005
ES2212731	SBH04/0.08-0.15	Soil	7/04/2022	<0.001	0.0026	0.0018	0.0014	0.0016	0.0011	<0.0002	0.0003	<0.0005	<0.0002	<0.0002	<0.0005	0.0678	0.11	0.0094
ES2212731	SBH05/0.08-0.15	Soil	7/04/2022	<0.001	0.0011	0.0004	0.0006	0.0008	<0.0002	<0.0002	0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0358	0.0351	0.0008
ES2212731	SBH05/0.9-1.0	Soil	7/04/2022	<0.001	0.0018	0.0019	0.0014	0.0004	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0021	0.004	<0.0005
ES2212731	SBH06/0.8-0.9	Soil	7/04/2022	<0.001	0.0008	0.0006	0.001	0.0014	<0.0002	<0.0002	0.0007	<0.0005	<0.0002	<0.0002	<0.0005	0.0131	0.0143	<0.0005
ES2212731	SBH06/0.08-0.15	Soil	7/04/2022	<0.001	0.0006	0.0004	0.0005	0.0004	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0005	0.0182	0.0046	<0.0005
ES2213150	TRIP BLANK	Soil	4/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

LOR Limit of reporting

				Perfluoroalkyl Sulfonic Acids							Perfluoroalkyl Sulfonamides							PFAS							
				Perfluoropropanesulfonic acid (PFPrS)	Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecane sulfonic acid (PFDS)	Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-methyl perfluorooctane sulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	Perfluorononanesulfonic acid (PFNS)	Sum of PFHxS and PFOS	Sum of PFOS related compounds	Sum of PFOA related compounds	Sum of PFAS	Sum of PFAS (WA DER List)	Sum of enHealth PFAS (PFHxS + PFOS + PFOA)	Sum of PFAS (PFOS + PFOA)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.005	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0002	0.0005	0.0005	0.0002	0.0005	0.005	0.0002	0.0002	-	-	0.0002	0.005	0.005
2011 CRC Care HSL-D Commercial / Industrial																									
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=0m, <1m)																									
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=1m, <2m)																									
2020 NEPM Schedule B1 Table 1A(1) HILs Comm/Ind D Soil																									
2020 PFAS NEMP HEPA Industrial/ Commercial (HIL D)																		20							
EnRisks (2022) HHERA - screening criteria (human health - industrial)				20	20	20	20	20	20	20	50	50	50	50	50	50	50		20	20	50				
Lab Report Number	Sample ID	Matrix	Sample Date																						
ES2212085	QA01	Soil	4/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	0.0004	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	0.0004	0.0004	0.0009	0.0013	0.0013	-	-
878534	QA01A	Soil	4/04/2022	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.005	<0.01	<0.005	<0.005	<0.005	<LOR	<LOR	<0.05	<0.01	<0.005	<0.005
ES2212085	QA02	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0835	0.0373	0.121	0.121	-	-
878534	QA02A	Soil	5/04/2022	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.005	<0.01	<0.005	<0.005	<0.005	0.0550	0.0236	0.0786	0.0786	<0.005	<0.005
ES2212731	QA04	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0206	0.0016	0.0222	0.0222	-	-
882408	QA04A	Soil	7/04/2022	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01	<0.005	<0.005	<0.01	<0.005	<0.005	<0.005	0.0280	<LOR	<0.05	0.028	<0.005	<0.005
ES2212085	EMB17/0.05-0.15	Soil	4/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.5021	0.0184	0.52	0.508	-	-
ES2212085	EMB17/1.2-1.3	Soil	4/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0134	0.0029	0.0163	0.0163	-	-
ES2212085	EMB18/0.1-0.2	Soil	4/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	0.0003	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	0.0003	0.0003	0.0008	0.0011	0.0011	-	-
ES2212085	EMB18/1.4-1.5	Soil	4/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	<LOR	<LOR	<0.0002	<0.0002	-	-
ES2212085	EMB19/0.02-0.05	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	0.0006	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	0.0006	0.0006	<LOR	0.0006	0.0006	-	-
ES2212085	EMB19/0.9-1.0	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	<LOR	0.0008	0.0008	0.0008	-	-
ES2212085	EMB20/0.01-0.1	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0369	0.0027	0.0396	0.0396	-	-
ES2212085	EMB20/1.1-1.2	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	0.0004	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	0.0004	0.0004	0.0018	0.0022	0.0022	-	-
ES2212085	EMB20/2.0-2.1	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0041	0.0046	0.0087	0.0071	-	-
ES2212085	EMB21/0.01-0.10	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0214	0.0292	0.0506	0.0506	-	-
ES2212085	EMB22/0.02-0.1	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0551	0.0294	0.0845	0.0845	-	-
ES2212085	EMB22/1.1-1.2	Soil	5/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0072	0.0026	0.0098	0.0098	-	-
ES2212731	EMB23/0.08-0.15	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0447	0.0029	0.0476	0.0476	-	-
ES2212731	EMB23/0.75-0.85	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0067	0.0098	0.0165	0.0165	-	-
ES2213150	EMB24/0.7-0.8	Soil	8/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0020	0.0016	0.0036	0.003	-	-
ES2213150	EMB24/0.08-0.15	Soil	8/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0110	0.0004	0.0114	0.0114	-	-
ES2212247	EMB25/0.08-0.15	Soil	6/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0000	0.0005	0.0005	0.0005	-	-
ES2212247	EMB25/1.0-1.1	Soil	6/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0075	0.0012	0.0087	0.0087	-	-
ES2212247	SBH01/0.08-0.15	Soil	6/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0716	0.0052	0.0768	0.0768	-	-
ES2212247	SBH01/1.0-1.1	Soil	6/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	<LOR	0.0134	0.0134	0.0134	-	-
ES2212247	SBH02/0.08-0.15	Soil	6/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0372	0.0018	0.039	0.039	-	-
ES2212731	SBH02/1.1-1.2	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0039	0.0072	0.0111	0.0111	-	-
ES2212731	SBH03/0.08-0.15	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0302	0.0017	0.0319	0.0281	-	-
ES2212731	SBH03/1.0-1.1	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0032	0.0028	0.006	0.006	-	-
ES2212731	SBH04/0.8-0.9	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0074	0.0159	0.0233	0.0233	-	-
ES2212731	SBH04/0.08-0.15	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.1872	0.0088	0.196	0.185	-	-
ES2212731	SBH05/0.08-0.15	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0717	0.0031	0.0748	0.0738	-	-
ES2212731	SBH05/0.9-1.0	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0061	0.0055	0.0116	0.0116	-	-
ES2212731	SBH06/0.8-0.9	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0274	0.0045	0.0319	0.0312	-	-
ES2212731	SBH06/0.08-0.15	Soil	7/04/2022	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0005	<0.0005	<0.0002	<0.0005	-	<0.0002	0.0228	0.0019	0.0247	0.0247	-	-
ES2213150	TRIP BLANK	Soil	4/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

LOR Limit of reporting

				TPH					TRH							
				C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Sum)	C6-C10 Fraction (F1)	C6-C10 (F1 minus BTEX)	>C10-C16 Fraction (F2)	>C10-C16 Fraction (F2 minus Naphthalene)	>C16-C34 Fraction (F3)	>C34-C40 Fraction (F4)	>C10-C40 Fraction (Sum)
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				10	20	50	50	50	10	10	50	50	100	100	50
2011 CRC Care HSL-D Commercial / Industrial									26,000		20,000		27,000	38,000	
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=0m, <1m)										260					
2013 NEPM Table 1A(3) Comm/Ind D Soil HSL for Vapour Intrusion, Sand (>=1m, <2m)										370					
2020 NEPM Schedule B1 Table 1A(1) HILs Comm/Ind D Soil															
2020 PFAS NEMP HEPA Industrial/ Commercial (HIL D)															
EnRisks (2022) HHERA - screening criteria (human health - industrial)															
Lab Report Number	Sample ID	Matrix	Sample Date												
ES2212085	QA01	Soil	4/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
878534	QA01A	Soil	4/04/2022	<20	<20	<50	<50	<50	<20	<20	<50	<50	<100	<100	<100
ES2212085	QA02	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
878534	QA02A	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	QA04	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
882408	QA04A	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB17/0.05-0.15	Soil	4/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB17/1.2-1.3	Soil	4/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB18/0.1-0.2	Soil	4/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB18/1.4-1.5	Soil	4/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB19/0.02-0.05	Soil	5/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB19/0.9-1.0	Soil	5/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB20/0.01-0.1	Soil	5/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB20/1.1-1.2	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB20/2.0-2.1	Soil	5/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB21/0.01-0.10	Soil	5/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212085	EMB22/0.02-0.1	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212085	EMB22/1.1-1.2	Soil	5/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	EMB23/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	EMB23/0.75-0.85	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	EMB24/0.7-0.8	Soil	8/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	EMB24/0.08-0.15	Soil	8/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	EMB25/0.08-0.15	Soil	6/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	EMB25/1.0-1.1	Soil	6/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH01/0.08-0.15	Soil	6/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH01/1.0-1.1	Soil	6/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212247	SBH02/0.08-0.15	Soil	6/04/2022	<10	<50	<100	<100	<50	<10	<10	<50	<50	<100	<100	<50
ES2212731	SBH02/1.1-1.2	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH03/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH03/1.0-1.1	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH04/0.8-0.9	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH04/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH05/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH05/0.9-1.0	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH06/0.8-0.9	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2212731	SBH06/0.08-0.15	Soil	7/04/2022	-	-	-	-	-	-	-	-	-	-	-	-
ES2213150	TRIP BLANK	Soil	4/04/2022	<10	-	-	-	-	<10	<10	-	-	-	-	-

LOR Limit of reporting

					Leaching Preparation	(n:2) Fluorotelomer Sulfonic Acids				Perfluoroalkane Carboxylic Acids											
					pH (Final)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	Perfluorobutanoic acid (PFBA)	Perfluorohexanoic acid (PFHxA)	Perfluoropentanoic acid (PFPeA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorodecanoic acid (PFDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorononanoic acid (PFNA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorobutane sulfonic acid (PFBS)
					-	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					0.1	0.001	0.001	0.001	0.001	0.002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
ANZG (2018) Marine Water 95% LOSP Toxicant DGVs																					
ANZG (2018) Marine Water 99% LOSP Toxicant DGVs																					
NEPM (2013) Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand (>=2m, <4m)																					
NEMP (2020) PFAS Recreational						2	2	2	2	10	10	10	10	10	10	10	10	10	10	10	2
NEMP (2020) PFAS Interim Marine 95%						0.13	0.13	0.13	0.13	220	220	220	220	220	220	220	220	220	220	220	0.13
NEMP (2020) PFAS Interim Marine 99%						0.00023	0.00023	0.00023	0.00023	19	19	19	19	19	19	19	19	19	19	19	0.00023
NT Government (2010) WQO for Darwin Harbour																					
Lab Report Number	Field ID	Matrix Type	Date																		
ES2215138	EMB17/0.05-0.15	Water	4/04/2022		9	*<0.001*	6.04	6.05	0.031	0.0051	0.0186	0.0299	0.0105	0.204	0.0313	0.003	0.28	*<0.0008*	*<0.0005*	0.0033	*<0.0005*
ES2215138	EMB18/0.1-0.2	Water	4/04/2022		7.5	*<0.001*	0.001	0.002	*<0.001*	0.0059	0.015	0.0261	0.0063	0.0033	*<0.0005*	*<0.0005*	0.0011	*<0.0008*	*<0.0005*	*<0.0005*	*<0.0005*
ES2215138	EMB19/0.02-0.05	Water	5/04/2022		6.9	*<0.001*	*<0.001*	*<0.001*	*<0.001*	0.0035	0.0049	0.006	0.0009	0.002	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0008*	*<0.0005*	*<0.0005*	0.0012
ES2215138	EMB20/1.1-1.2	Water	5/04/2022		5.1	*<0.001*	0.003	*<0.001*	*<0.001*	0.0076	0.0335	0.0408	0.0063	0.0008	*<0.0005*	*<0.0005*	*<0.0005*	*<0.0008*	*<0.0005*	*<0.0005*	*<0.0005*
ES2215138	SBH04/0.08-0.15	Water	7/04/2022		11	0.002	2.74	3.84	0.065	0.014	0.0936	0.0774	0.05	0.0545	0.0386	0.0033	0.0112	*<0.0008*	*<0.0005*	0.0033	*<0.0005*

				Perfluoroalkane Sulfonic Acids					Perfluoroalkyl Sulfonamides							PFAS				
				Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecane sulfonic acid (PFDS)	Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-methyl perfluorooctane sulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	Sum of PFHxS and PFOS	Sum of PFAS	Sum of PFOS related compounds	Sum of PFOA related compounds	Sum of PFAS (WA DER List)
				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				0.0005	0.0005	0.0005	0.0002	0.0005	0.0005	0.001	0.0005	0.001	0.001	0.0005	0.001	0.0002	0.0002	-	-	0.0002
ANZG (2018) Marine Water 95% LOSP Toxicant DGVs																				
ANZG (2018) Marine Water 99% LOSP Toxicant DGVs																				
NEPM (2013) Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand (>=2m, <4m)																				
NEMP (2020) PFAS Recreational				2	2	2	2	2	10	10	10	10	10	10	10			2	10	
NEMP (2020) PFAS Interim Marine 95%				0.13	0.13	0.13	0.13	0.13	220	220	220	220	220	220	220			0.13	220	
NEMP (2020) PFAS Interim Marine 99%				0.00023	0.00023	0.00023	0.00023	0.00023	19	19	19	19	19	19	19			0.00023	19	
NT Government (2010) WQO for Darwin Harbour																				
Lab Report Number	Field ID	Matrix Type	Date																	
ES2215138	EMB17/0.05-0.15	Water	4/04/2022	*<0.0005*	*<0.0005*	*<0.0005*	0.0024	*<0.0005*	*<0.0005*	*<0.001*	*<0.0005*	*<0.001*	*<0.001*	*<0.0005*	*<0.001*	0.0024	12.7	12.1234	0.5857	12.4
ES2215138	EMB18/0.1-0.2	Water	4/04/2022	*<0.0005*	0.0034	*<0.0005*	0.0081	*<0.0005*	*<0.0005*	*<0.001*	*<0.0005*	*<0.001*	*<0.001*	*<0.0005*	*<0.001*	0.0115	0.0722	0.0145	0.0577	0.0711
ES2215138	EMB19/0.02-0.05	Water	5/04/2022	0.0011	0.0086	*<0.0005*	0.0214	*<0.0005*	*<0.0005*	*<0.001*	*<0.0005*	*<0.001*	*<0.001*	*<0.0005*	*<0.001*	0.03	0.0496	0.0323	0.0173	0.0485
ES2215138	EMB20/1.1-1.2	Water	5/04/2022	*<0.0005*	*<0.0005*	*<0.0005*	0.0004	*<0.0005*	*<0.0005*	*<0.001*	*<0.0005*	*<0.001*	*<0.001*	*<0.0005*	*<0.001*	0.0004	0.0924	0.0034	0.0890	0.0924
ES2215138	SBH04/0.08-0.15	Water	7/04/2022	*<0.0005*	*<0.0005*	*<0.0005*	0.0003	*<0.0005*	*<0.0005*	*<0.001*	*<0.0005*	*<0.001*	*<0.001*	*<0.0005*	*<0.001*	*<0.0003*	6.99	6.6473	0.3459	6.87

	Field Parameters					BTEXN								Inorganics
	pH	Specific Conductivity (Ec @ 25oC)	Temperature	Dissolved Oxygen	Redox Potential	Naphthalene (VOC)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	Total BTEX	Ammonia as N
	pH units	µS/cm	°C	%	mV	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL						10	1	1	1	2	1	2	1	10
ANZG (2018) Marine Water 95% LOSP Toxicant DGVs						70	700	180	80	75				910
ANZG (2018) Marine Water 99% LOSP Toxicant DGVs						50	500	110	50	50				500
NEPM (2013) Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand (>=2m, <4m)						NL	5,000	NL						
NEMP (2020) PFAS Human Health Recreational														
NEMP (2020) PFAS Interim Marine 95%														
NEMP (2020) PFAS Interim Marine 99%														
NT Government (2010) WQO for Darwin Harbour	6 - 8.5													20
Lab Report Number	Sample ID	Matrix	Sample Date											
ES2213154	EMB17	Water	12/04/2022	5.47	251.6	32.5	21.0	75.8	-	<1	<2	<2	<2	<2	<2	<1	60
ES2213154	EMB18	Water	12/04/2022	4.72	159.8	32.2	23.8	133.8	-	<1	<2	<2	<2	<2	<2	<1	190
ES2213154	EMB19	Water	12/04/2022	5.28	4998	34.0	40.5	120.6	<5	<1	<2	<2	<2	<2	<2	<1	610
ES2213154	EMB20	Water	11/04/2022	6.11	9834	34.9	23.9	-53.9	<5	<1	<2	<2	<2	<2	<2	<1	6,850
ES2213154	EMB22	Water	11/04/2022	5.81	392.5	36.5	29.4	68.9	<5	<1	<2	<2	<2	<2	<2	<1	50
ES2213154	EMB23	Water	11/04/2022	5.74	365.0	33.6	14.6	95.2	<5	<1	<2	<2	<2	<2	<2	<1	30
ES2213154	EMB24	Water	12/04/2022	4.84	180.8	33.3	21.6	139.3	-	<1	<2	<2	<2	<2	<2	<1	20
ES2213154	EMB25	Water	12/04/2022	5.64	208.9	35.0	40.8	108.0	-	<1	<2	<2	<2	<2	<2	<1	40
ES2213154	EMB21	Water	11/04/2022						-	<1	<2	<2	<2	<2	<2	<1	<10
ES2213154	QA06[1]	Water	11/04/2022		964	35.2	21.8	178.7	-	<1	<2	<2	<2	<2	<2	<1	100
882131	QA06A[2]	Water	11/04/2022	3.54					<10	<1	<1	<1	<2	<1	<3	-	<10

[1]Intralab duplicate of sample EMB21.
[2]Interlab duplicate of sample EMB21.

				Metals								PAH									
				Arsenic (filtered)	Cadmium (filtered)	Chromium (III+VI) (filtered)	Copper (filtered)	Lead (filtered)	Mercury (filtered)	Nickel (filtered)	Zinc (filtered)	Sum of 16 USEPA Priority PAHs	2-methylnaphthalene	3-methylcholanthrene	7,12-dimethylbenz(a)anthracene	Acenaphthene	Acenaphthylene	Anthracene	Coronene	Benz(a)anthracene	Benzo(a) pyrene
				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				1	0.1	1	1	1	0.1	1	5	0.001	0.002	0.004	0.001	0.002	0.002	0.001	0.002	0.002	0.001
ANZG (2018) Marine Water 95% LOSP Toxicant DGVs				2.3	5.5	4.4	1.3	4.4	0.4	70	8							0.4			0.2
ANZG (2018) Marine Water 99% LOSP Toxicant DGVs					0.7				0.1									0.01			0.1
NEPM (2013) Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand (>=2m, <4m)																					
NEMP (2020) PFAS Human Health Recreational																					
NEMP (2020) PFAS Interim Marine 95%																					
NEMP (2020) PFAS Interim Marine 99%																					
NT Government (2010) WQO for Darwin Harbour																					
Lab Report Number	Sample ID	Matrix	Sample Date																		
ES2213154	EMB17	Water	12/04/2022	<1	<0.1	<1	<1	<1	<0.1	1	<5	0.026	<0.002	<0.004	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001
ES2213154	EMB18	Water	12/04/2022	<1	<0.1	<1	<1	<1	<0.1	1	<5	0.018	<0.002	<0.004	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001
ES2213154	EMB19	Water	12/04/2022	10	<0.1	<1	<1	<1	<0.1	9	12	0.047	<0.002	<0.004	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001
ES2213154	EMB20	Water	11/04/2022	12	<0.1	<1	<1	<1	<0.1	<1	<5	0.041	<0.002	<0.004	<0.001	0.003	<0.002	<0.001	<0.002	<0.002	<0.001
ES2213154	EMB22	Water	11/04/2022	<1	<0.1	<1	<1	<1	<0.1	<1	<5	0.030	<0.002	<0.004	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001
ES2213154	EMB23	Water	11/04/2022	<1	<0.1	<1	<1	<1	<0.1	<1	7	0.034	<0.002	<0.004	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001
ES2213154	EMB24	Water	12/04/2022	<1	<0.1	<1	1	<1	<0.1	2	8	0.017	<0.002	<0.004	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001
ES2213154	EMB25	Water	12/04/2022	<1	<0.1	<1	<1	<1	<0.1	<1	5	0.037	<0.002	<0.004	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001
ES2213154	EMB21	Water	11/04/2022	<1	<0.1	<1	5	3	<0.1	3	22	0.027	<0.002	<0.004	<0.001	<0.002	0.005	<0.001	<0.002	<0.002	<0.001
ES2213154	QA06[1]	Water	11/04/2022	<1	<0.1	<1	4	3	<0.1	3	22	0.029	<0.002	<0.004	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001
882131	QA06A[2]	Water	11/04/2022	2	<0.2	1	3	3	<0.1	2	18	-	-	-	-	<0.01	<0.01	<0.01	-	<0.01	<0.01

[1]Intralab duplicate of sample EMB21.
[2]Interlab duplicate of sample EMB21.

				PAH																
				Benzo(b+j)fluoranthene	Benzo(e)pyrene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Benzo(b+j+K)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Perylene	Pyrene	Benzo(a)pyrene TEQ calc (Half)	Benzo(a)pyrene TEQ (LOR)	Benzo(a)pyrene TEQ calc (Zero)	PAHs (Sum of total)
				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				0.004	0.001	0.002	0.004	0.004	0.001	0.001	0.001	0.002	0.002	0.004	0.002	0.002	0.001	0.001	0.001	0.001	0.01
ANZG (2018) Marine Water 95% LOSP Toxicant DGVs											1.4			70	2						
ANZG (2018) Marine Water 99% LOSP Toxicant DGVs											1				0.6						
NEPM (2013) Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand (>=2m, <4m)														NL							
NEMP (2020) PFAS Human Health Recreational																					
NEMP (2020) PFAS Interim Marine 95%																					
NEMP (2020) PFAS Interim Marine 99%																					
NT Government (2010) WQO for Darwin Harbour																					
Lab Report Number	Sample ID	Matrix	Sample Date																		
ES2213154	EMB17	Water	12/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.005	0.005	<0.002	<0.004	0.012	<0.002	0.004	<0.001	<0.001	<0.001	-
ES2213154	EMB18	Water	12/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.003	0.005	<0.002	<0.004	0.007	<0.002	0.003	<0.001	<0.001	<0.001	-
ES2213154	EMB19	Water	12/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.008	0.009	<0.002	0.012	0.012	<0.002	0.006	<0.001	<0.001	<0.001	-
ES2213154	EMB20	Water	11/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.006	0.005	<0.002	0.011	0.011	<0.002	0.005	<0.001	<0.001	<0.001	-
ES2213154	EMB22	Water	11/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.005	0.005	<0.002	0.005	0.010	<0.002	0.005	<0.001	<0.001	<0.001	-
ES2213154	EMB23	Water	11/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.009	0.003	<0.002	0.004	0.009	<0.002	0.009	<0.001	<0.001	<0.001	-
ES2213154	EMB24	Water	12/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.004	0.003	<0.002	<0.004	0.007	<0.002	0.003	<0.001	<0.001	<0.001	-
ES2213154	EMB25	Water	12/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.014	0.004	<0.002	<0.004	0.009	<0.002	0.010	<0.001	<0.001	<0.001	-
ES2213154	EMB21	Water	11/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.004	0.005	<0.002	<0.004	0.008	<0.002	0.005	<0.001	<0.001	<0.001	-
ES2213154	QA06[1]	Water	11/04/2022	<0.004	<0.001	<0.002	<0.004	<0.004	<0.001	<0.001	0.004	0.008	<0.002	<0.004	0.013	<0.002	0.004	<0.001	<0.001	<0.001	-
882131	QA06A[2]	Water	11/04/2022	<0.01	-	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	-	<0.01	-	-	-	<0.02

[1]Intralab duplicate of sample EMB21.
[2]Interlab duplicate of sample EMB21.

				Perfluoroalkane Carboxylic Acids										
				Perfluorobutanoic acid (PFBA)	Perfluorohexanoic acid (PFHxA)	Perfluoropentanoic acid (PFPeA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorodecanoic acid (PFDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorononanoic acid (PFNA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluoroundecanoic acid (PFUnDA)
				µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL				0.002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
ANZG (2018) Marine Water 95% LOSP Toxicant DGVs														
ANZG (2018) Marine Water 99% LOSP Toxicant DGVs														
NEPM (2013) Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand (>=2m, <4m)														
NEMP (2020) PFAS Human Health Recreational				10	10	10	10	10	10	10	10	10	10	10
NEMP (2020) PFAS Interim Marine 95%				220	220	220	220	220	220	220	220	220	220	220
NEMP (2020) PFAS Interim Marine 99%				19	19	19	19	19	19	19	19	19	19	19
NT Government (2010) WQO for Darwin Harbour														
Lab Report Number	Sample ID	Matrix	Sample Date											
ES2213154	EMB17	Water	12/04/2022	1	6.97	5.57	1.98	2.33	0.0558	<0.0005	0.149	<0.0005	<0.0005	0.0019
ES2213154	EMB18	Water	12/04/2022	0.0563	0.174	0.184	0.112	0.0324	0.001	<0.0005	0.0149	<0.0005	<0.0005	<0.0005
ES2213154	EMB19	Water	12/04/2022	0.567	3.42	2.35	0.526	0.265	0.0051	<0.0005	0.0141	<0.0005	<0.0005	<0.0005
ES2213154	EMB20	Water	11/04/2022	1.33	6.43	5.36	1.67	0.305	<0.0005	<0.0005	0.0442	<0.0005	<0.0005	0.0008
ES2213154	EMB22	Water	11/04/2022	1.65	8.39	7.49	2.88	2.18	0.069	0.004	0.138	<0.0005	<0.0005	0.011
ES2213154	EMB23	Water	11/04/2022	1.96	6.6	7.11	3.33	1.71	0.0595	0.0014	0.218	<0.0005	<0.0005	0.0073
ES2213154	EMB24	Water	12/04/2022	2	6.22	7.05	4.8	1.11	0.0014	<0.0005	0.0442	<0.0005	<0.0005	<0.0005
ES2213154	EMB25	Water	12/04/2022	1.12	4.62	5.24	2.16	1.32	0.031	<0.0005	0.184	<0.0005	<0.0005	0.0015
ES2213154	EMB21	Water	11/04/2022	1.86	6.67	6.27	2.98	1.03	0.0212	<0.0005	0.0936	<0.0005	<0.0005	<0.0005
ES2213154	QA06[1]	Water	11/04/2022	1.97	6.85	6.24	3.06	1.04	0.0187	<0.0005	0.0926	<0.0005	<0.0005	<0.0005
882131	QA06A[2]	Water	11/04/2022	-	-	-	-	-	-	-	-	-	-	-

[1]Intralab duplicate of sample EMB21.
[2]Interlab duplicate of sample EMB21.

				Perfluoroalkyl Sulfonamides							Perfluoroalkane Sulfonic Acids						(n:2) Fluorotelomer Sulfonic Acids				PFAS		
				Perfluorooctane sulfonamide (FOSA)	N-Methyl perfluorooctane sulfonamide (MeFOSA)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-methyl perfluorooctane sulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonic acid (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecane sulfonic acid (PFDS)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	Sum of PFHxS and PFOS	Sum of PFAS	Sum of PFOS related compounds
				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				0.0005	0.001	0.0005	0.001	0.001	0.0005	0.001	0.0005	0.0005	0.0005	0.0005	0.0002	0.0005	0.001	0.001	0.001	0.001	0.0002	0.0002	-
ANZG (2018) Marine Water 95% LOSP Toxicant DGVs																							
ANZG (2018) Marine Water 99% LOSP Toxicant DGVs																							
NEPM (2013) Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand (>=2m, <4m)																							
NEMP (2020) PFAS Human Health Recreational				10	10	10	10	10	10	10	2	2	2	2	2	2	2	2	2	2			2
NEMP (2020) PFAS Interim Marine 95%				220	220	220	220	220	220	220	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13			0.13
NEMP (2020) PFAS Interim Marine 99%				19	19	19	19	19	19	19	0.00023	0.00023	0.00023	0.00023	0.00023	0.00023	0.00023	0.00023	0.00023	0.00023			0.00023
NT Government (2010) WQO for Darwin Harbour																							
Lab Report Number	Sample ID	Matrix	Sample Date																				
ES2213154	EMB17	Water	12/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.0011	<0.0005	0.0034	<0.0005	0.0031	<0.0005	0.058	54.5	7.29	<0.001	0.0065	79.9	61.86
ES2213154	EMB18	Water	12/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.0005	<0.0005	0.0032	<0.0005	0.0054	<0.0005	<0.001	0.019	0.009	<0.001	0.0086	0.611	0.04
ES2213154	EMB19	Water	12/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.0005	<0.0005	0.0009	<0.0005	0.0004	<0.0005	0.06	23.9	0.234	<0.001	0.0013	31.3	24.20
ES2213154	EMB20	Water	11/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.0006	<0.0005	0.0027	<0.0005	0.0015	<0.0005	0.022	19.3	0.013	<0.001	0.0042	34.5	19.34
ES2213154	EMB22	Water	11/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	<0.0005	<0.0005	0.0034	<0.0005	0.0052	<0.0005	0.034	51.2	7.2	0.074	0.0086	81.3	58.52
ES2213154	EMB23	Water	11/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.0014	<0.0005	0.008	<0.0005	0.0085	<0.0005	0.04	30.1	9.48	0.037	0.0165	60.7	39.67
ES2213154	EMB24	Water	12/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.0018	0.0007	0.0037	<0.0005	0.0021	<0.0005	0.005	1.92	0.121	<0.001	0.0058	23.3	2.05
ES2213154	EMB25	Water	12/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.0028	0.0017	0.0169	0.001	0.0203	<0.0005	0.012	8.36	5.81	0.004	0.0372	28.9	14.23
ES2213154	EMB21	Water	11/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.0007	<0.0005	0.0048	<0.0005	0.0012	<0.0005	0.018	19.9	2.56	<0.001	0.006	41.4	22.48
ES2213154	QA06[1]	Water	11/04/2022	<0.0005	<0.001	<0.0005	<0.001	<0.001	<0.0005	<0.001	0.0008	<0.0005	0.0052	<0.0005	0.0013	<0.0005	0.02	21	2.61	<0.001	0.0065	42.9	23.64
882131	QA06A[2]	Water	11/04/2022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[1]Intralab duplicate of sample EMB21.
[2]Interlab duplicate of sample EMB21.

			TPH	TPH - (Silica Gel Cleanup)				TRH		TRH - (Silica Gel Cleanup)				
	Sum of PFOA related compounds	Sum of PFAS (WA DER List)	C6-C9 Fraction	C10-C14 Fraction (SG)	C10-C36 Fraction (Sum)(SG)	C15-C28 Fraction (SG)	C29-C36 Fraction (SG)	C6-C10 Fraction (F1)	C6-C10 (F1 minus BTEX)	>C10-C16 Fraction (SG)	>C10-C16 (F2 minus Naphthalene) (SG)	>C16-C34 Fraction (SG)	>C34-C40 Fraction (SG)	>C10-C40 Fraction (SG)
	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	20	50	50	100	50	20	20	50	100	100	100	100
ANZG (2018) Marine Water 95% LOSP Toxicant DGVs														
ANZG (2018) Marine Water 99% LOSP Toxicant DGVs														
NEPM (2013) Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand (>=2m, <4m)									6,000	NL				
NEMP (2020) PFAS Human Health Recreational	10													
NEMP (2020) PFAS Interim Marine 95%	220													
NEMP (2020) PFAS Interim Marine 99%	19													
NT Government (2010) WQO for Darwin Harbour														
Lab Report Number	Sample ID	Matrix	Sample Date											
ES2213154	EMB17	Water	12/04/2022	18.06	79.6	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	EMB18	Water	12/04/2022	0.57	0.595	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	EMB19	Water	12/04/2022	7.15	31.3	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	EMB20	Water	11/04/2022	15.14	34.4	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	EMB22	Water	11/04/2022	22.81	81	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	EMB23	Water	11/04/2022	21.00	60.3	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	EMB24	Water	12/04/2022	21.23	23.2	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	EMB25	Water	12/04/2022	14.68	28.7	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	EMB21	Water	11/04/2022	18.92	41.3	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
ES2213154	QA06[1]	Water	11/04/2022	19.27	42.8	<20	<50	<50	<100	<50	<20	<20	<100	<100	<100	<100	<100
882131	QA06A[2]	Water	11/04/2022	-	-	-	<50	<100	<100	<100	-	-	<50	-	<100	<100	<100

[1]Intralab duplicate of sample EMB21.
[2]Interlab duplicate of sample EMB21.

Appendix B Toxicity Summary: PFAS Compounds

B1 PFOS and PFOA

Properties and Uses

PFAS are a family of man-made fluorine-containing chemicals that do not occur naturally in the environment. The have unique properties to make materials stain- and stick-resistant because they repel oil, grease and water. PFAS are often described as being “ubiquitous in the environment”. They have been widely used in man-made products such as surface protection products (e.g. carpet and clothing treatments) and coatings for cardboard and packaging. Some PFAS are, or were also historically used in fire-fighting foams (ATSDR 2015).

There are hundreds of different PFAS; the most common and well-studied compounds are PFOS and PFOA as these PFAS were manufactured at the highest rate. PFOS is a completely fluorinated compound with eight carbons and a sulfonate group. PFOA is a completely fluorinated compound with seven carbons and a carboxyl functional group. Both PFOS and PFOA are metabolically and environmentally stable (i.e. persistent), bioaccumulative and toxic (PBT). Perfluoroalkyl carboxylates and sulfonates are made up of a long perfluorocarbon tail that is both hydrophobic and oleophobic, and a charged end that is hydrophilic (ATSDR 2015).

In addition, many of the PFAS compounds break down to give PFOS or PFOA when released into the environment. Degradation stops at PFOS and PFOA which is why these compounds are commonly found to have accumulated in organisms. These compounds are mobile in soil and leach into groundwater (ATSDR 2015).

Exposure

Oral

PFOS and PFOA are readily absorbed via the oral route of exposure. The bioavailability of both PFAS is estimated to be >93% within 24 hours (based on studies with rats).

Dermal

When a receptor comes into direct contact with impacted soil or water, exposure is often assumed to occur via incidental ingestion and dermal contact. However, there is scientific evidence to suggest that the dermal absorption of PFOS and PFOA is limited in comparison to the ingestion pathway.

The dermal absorption of a chemical depends on the area of skin in contact with the impacted media/chemical, the concentration of chemical in the media, the duration of contact with the media, how tightly the chemical is bound into the media and the ability of the chemical to penetrate the skin. Anionic surfactants (e.g. PFOS/PFOA), are generally thought to penetrate the whole skin poorly. Experimental values confirm that even at the highest surfactant concentrations studied (0.03 M or 1%), non-detectable concentrations of ionic surfactants passed through the skin in the first two hours of exposure. Diffusion curves were observed to be non–linear (exponential), with surfactant able to be measured on the underside of the skin four hours following exposure.

Dermal exposures of rats to ammonium PFOA has been shown to produce systemic (e.g., liver, immunotoxicity) effects in animals confirming that the absorption of PFOA by animal skin is possible however estimates of the amount or rates of dermal absorption in humans or animals have not been

reported. In addition, experimental studies with rat, mouse and human skin indicate that rat and mouse skin may be more permeable to PFOA than human skin. As would be expected given the physicochemical properties of PFOS and PFOA, dermal permeability was sensitive to pH and was higher when the skin was buffered at pH 2.5 ($5.5x10^{-2}$ cm/hour) compared to pH 5.5 ($4.4x10^{-5}$ cm/hour), well above the pKa for the terminal carboxylic acid of PFOA. This suggests that permeability of the unionized acid is greater than that of the dissociated anion (ATSDR 2015) (noting that at environmental pH, PFOS, PFOA and PFHxS will be in the ionised form)

Following application of the ammonium salt of PFOA to isolated human or rat epidermis, approximately 0.048% of the dose was absorbed across human epidermis and 1.44% was absorbed across rat epidermis. When applied at the same dose and for the same time frame, 1.44% of the applied dose of PFOA was absorbed across the isolated rat skin however only 0.048% of the dose was absorbed across the isolated human skin. The estimated dermal penetration coefficient was $9.49x10^{-7}$ cm/hour in the isolated human epidermis and $3.25x10^{-5}$ cm/hour in the isolated rat epidermis (ATSDR 2015).

Default dermal permeability co-efficients for PFOS and PFOA are not available (RAIS). This may be because the measurement of the n-octanol / water partition (a critical parameter for estimating the dermal permeability co-efficient) is not practicable via the standard methodology for PFOS and PFOA as these chemicals form a separate layer when mixed with hydrocarbons and water (ATSDR 2015).

In summary, the existing evidence in the scientific literature indicates that the dermal absorption of PFAS following direct contact is limited in comparison to the ingestion pathway.

Vapour Inhalation

PFOS and PFOA are not volatile at environmental pH (it exists as an anion), hence vapour inhalation exposures have not been considered further in this HHRA. The potential health risks associated with the inhalation of dust have however been considered.

Distribution

Unlike other compounds that have PBT characteristics (e.g. organochlorine pesticides, PCBs or dioxins), PFOS and PFOA are highly water soluble and bioaccumulate by attaching to proteins in the blood rather than accumulating in lipids (USEPA 2014). It has been shown that 99.7% of these chemicals in humans and 97.3% of these chemicals in rats and monkeys is bound to the albumin. Following oral exposure in rats, PFOS is found mainly in the blood, liver, lungs and kidneys. PFOA is found mainly in the blood, liver, testis, spleen, lungs, kidney and brain. In post mortem human studies, most of the PFOS is found in the lungs, kidneys, liver and blood. Most of the PFOA has been found in the lungs, kidneys, liver, blood and bone

Both PFOS and PFOA bind to the fatty acid binding protein in the liver (although PFOS is more strongly bound than PFOA). Both chemicals also have a medium to high binding affinity for other proteins including the human serum thyroid hormone transport protein, transthyretin, low density lipoproteins and / or alpha-globulins. Transporters, including organic anion transporters, and likely to be involved in the absorption, distribution and excretion of PFOS and PFOA. PFOS and PFOA are able to cross the placenta and have been found in breast milk.

Metabolism and Excretion

There is no evidence (from studies with rats and monkeys) that PFOS and PFOA are metabolised in the body.

Excretion primarily occurs via the kidneys (in the urine) in rats. PFOA is also excreted in the bile and may be subject to extensive enterohepatic recirculation. Lactation and menstruation are also relevant routes of excretion in women and mice.

The elimination half-life for PFOS is 5.4 years in humans and 121, 48 and 37 days in monkeys, rats and mice respectively. Half-lives are generally consistent between males and females.

The elimination half-life for PFOA is 2.3 to 3.8 years in humans and 20.8, 11.5 and 15.6 days in monkeys, rats and mice respectively. A marked sex difference is observed for PFOA in rats with males showing slower eliminating which may be linked to difference in expression of organic anion transporters in the kidneys. Significant sex related differences have not been demonstrated in monkeys or humans, however it is noted that this may be due to study design.

Health Effects - PFOS

The database relating to the toxicity of PFOS in animals includes acute and short term studies with mice, rats and monkeys, sub-chronic studies with rats and monkeys, chronic studies with rats and reproductive / developmental studies with mice, rats and rabbits. The critical effects identified from these studies and used by international agencies to develop TRVs include the following:

- Rats: mortality, increased liver weights, decreased body weight, decreased body weight gain, decreased serum cholesterol, increased alanine aminotransferase, hepatocellular hypertrophy and hepatocellular vacuolation, delayed eye-opening, reduced pup viability and weight / weight gain, reduced gestation length;
- Monkeys: mortality, reduced body weight gain, increased liver weight and liver histopathological changes and reduced serum cholesterol;
- Rabbits: lower maternal body weight gain (with no corresponding effect on food ingestion rate), lower foetal weight and abortions; and
- Mice: increased relative liver weight, reduced serum triglycerides, increased foetal liver weight, delayed eye-opening; reduced SBRC plaque forming cell response, impaired learning and memory and increased apoptosis in hippocampal cells.

Data from epidemiological studies with occupationally exposed workers at 3M manufacturing facilities (Alabama, USA and Belgium), communities exposed to contaminated drinking water (USA) and general populations (USA, UK and Scandinavia) are also available. It is noted that concentrations of PFAS in occupationally exposed workers are 100 to 1,000-fold higher than those in the general populations. Despite this, epidemiology studies have generally failed to draw conclusive links between exposure to PFOS and adverse health effects. Associations between exposure to PFOS and the following health effects have been suggested:

- Changes in serum lipid levels e.g. increase total cholesterol levels;
- Changes in serum liver enzymes levels;
- Kidney disease;
- Effects on fertility, pregnancy and birth outcomes; and

- Effects on thyroid and immune function

Overall, the evidence for adverse effects on humans following PFOS exposure from the epidemiological studies is inconsistent. In addition, the biological significance of some of the observed effects has been questioned (i.e. just because an effect is observed it does not mean it is, or will lead to, an adverse effect) and there is the potential that observed effects may be due to confounding factors e.g. exposure to other contaminants or diet.

Due to the above factors, it has been concluded by all regulatory agencies and bodies (including FSANZ) that the available epidemiological data is unsuitable for use in establishing a TRV for PFOS.

Health Effects - PFOA

The database relating to the toxicity of PFOA in animals includes acute and short term studies with mice, rats and monkeys, sub-chronic studies with monkeys, chronic studies with mice, rats and monkeys and reproductive / developmental studies with mice and rats. The critical effects identified from these studies and used by international agencies to develop TRVs include the following:

- Rats: increased liver weights, decreased body weight, decreased body weight gain, significant increases in Leydig cell adenomas, hepatocellular adenomas and pancreatic acinar cell tumours, decreased sexual maturation in offspring;
- Monkeys: decreased heart and brain weights, mortality, liver toxicity, body weight effects; and
- Mice: decreased maternal weight gain, increased late foetal mortality, decreased pup weight, increase in developmental defects and neonatal mortality, decreased preweaning growth rate, delayed eye-opening, stunted mammary development in pups and immunotoxicity.

Similar to PFOS, data is available from epidemiological studies with occupationally exposed workers at 3M manufacturing facilities, communities exposed to contaminated drinking water and the general population. It is noted that concentrations of PFAS in occupationally exposed workers are 100 to 1,000-fold higher than those in the general populations. Despite this, epidemiology studies have generally failed to draw conclusive links between exposure to PFOA and adverse health effects. Associations between exposure to PFOA and the following health effects have been suggested:

- Endocrine effects (e.g. elevated thyroxine levels and increased risk of thyroid disease, diabetes mellitus and early onset menopause);
- Changes in serum lipid levels;
- Effects on fertility, pregnancy, lactation and decreased birthweight;
- Effects on immune function;
- Cardiovascular disease; and
- Cancer.

Similar to the information for PFOS, the evidence for adverse effects on humans following PFOA exposure from the epidemiological studies is inconsistent. However, the epidemiology does suggest that PFOA may be positively associated with levels of cholesterol, low-density lipoprotein and triglycerides in the serum. The actual toxic mechanisms for these effects in humans has not been determined. Interestingly, the positive association between PFOA and elevated levels of cholesterol

and triglycerides in human blood is inconsistent with the findings from animal toxicity studies. These effects are also the reverse of what would be expected for a chemical that activates PPARα (which PFOA has been shown to do) and induces peroxisome proliferation.

There are two main complicating factors with attempting to correlate PFOA toxicity in animals with toxicity in humans:

- The large interspecies variation in toxicokinetics (specifically elimination half-life), which is estimated to be years in a human but only hours to days in rats, mice and monkeys; and
- The activation of PPARα by PFOA, and the difference in the potential for activation of this receptor in rats and humans. i.e. this receptor is present in both rats and humans however is thought to be more active in rats than humans. This may be the reason some effects (e.g. liver cancer) are seen in rats but not humans.

Due to the above factors, it has been concluded by all regulatory agencies and bodies (including FSANZ) that the available epidemiological data is unsuitable for use in establishing a TRV for PFOA.

Classification - PFOS

EFSA and the USEPA (2016) have concluded that PFOS is not genotoxic based on negative findings *in in vitro* and *in vivo* tests (FSANZ 2017f).

The carcinogenic risk of PFOS has also been recently reviewed . The review considered the available animal and human toxicity studies in the context of the process adopted by the International Agency for Research on Cancer (IARC). The review concluded that there was inadequate evidence of carcinogenicity in human and animal studies and PFOS should be classified as *not classifiable as to its carcinogenicity to humans (Group 3)*.

With respect to the overall information available relating to the potential for exposure to PFAS to cause cancer:

- The literature evidence is often contradictory (or vague), even within the same reference;
- Associations with kidney, testicular, liver and bladder cancers have been reported for workers in epidemiological studies, however these studies may include a small number of participants, high occupational exposure and confounding factors (e.g. the study may not be controlled for other cancer causing exposures such as smoking); and
- Some observed effects attributed to causing cancer are reversible, hence are not necessarily adverse. In addition, associations are not causations.

As noted above, there are two general groups of carcinogens (NEPC 1999 amended 2013a):

- Genotoxic carcinogens for which, in theory, any level of exposure could result in a response as the chemical has the ability to interact directly with DNA; and
- Non-genotoxic carcinogens, for which there is a threshold below which exposure is not expected to result in adverse health effects.

PFAS do not possess the chemical / physical properties typically associated with direct genotoxicity and this is supported by an understanding of the mode of action for tumour formation in humans, and differences between humans and animals.

Overall, the weight of evidence is that, if they are carcinogenic, PFOS is a non-genotoxic threshold "carcinogen" .

Classification - PFOA

In July 2016, IARC classified PFOA as Group 2B: *Possibly carcinogenic to humans* (IARC 2016). The following is a summary of the information is provided in the IARC monograph:

- The epidemiological literature for cancer and PFOA is relatively small and considers three different types of populations – workers exposed in chemical plants producing or using PFOA, high exposure communities (e.g. where contamination of water supplies has occurred) and the general population (i.e. background exposures);
- Two studies have found an increased risk of cancer of the testis. The evidence in these studies was considered credible and unlikely to be explained by bias or confounding, however the numbers were small;
- Four studies have investigated the potential for PFOA to cause kidney cancer. The evidence for kidney cancer was considered credible however chance, bias and confounding could not be ruled out;
- Some positive associations were observed for bladder, thyroid, prostate, liver and pancreatic cancer however the results were inconsistent and based on small numbers, and the overall evidence was concluded to be inadequate;
- PFOA was found to increase the incidence of testicular adenomas (benign tumours) in rats in two studies, and increase the incidence of hepatocellular and pancreatic adenomas in one study. PFOA was also found to promote cancer of the liver in two studies with rats and two studies with rainbow trout;
- Due to the reabsorption of PFOA in the kidney, the body burden of PFOA is much greater than that in experimental animals;
- PFOA is not DNA-reactive therefore there is strong evidence that PFOA is not a direct genotoxic carcinogen. There is moderate evidence that PFOA is not an indirect genotoxic carcinogen; and
- The liver is a well-established target for toxicity in rats and mice. Potential mechanisms include activation of PPARα and cytotoxicity. The human relevance of these findings cannot be excluded based on the available information.

IARC concluded that there is *limited evidence* in humans and experimental animals for the carcinogenicity of PFOA. Overall, PFOA is *possible carcinogenic to humans (Group 2B).*

Toxicity Reference Values

On the basis that PFOS and PFOA is not considered to be a genotoxic carcinogen, it has been assessed based on a threshold approach in this HHRA. The following threshold chronic values are available from Level 1 Australian and International sources (**Table B1**):

Table B1: Summary of Toxicity Information for PFOS and PFOA

	PFOS		PFOA	
Source	**TRV (µg/kg/d)**	**Basis / Comments**	**TRV (µg/kg/d)**	**Basis / Comments**
Australian				
ADWG (NHMRC 2011 updated 2022)	No guideline value	--	No guideline value	--
NEPM (NEPC 2004)	No guideline value	--	No guideline value	--
Food Standards Australia New Zealand (FSANZ)	0.02	HBGV based on PBPK modelling for 4 selected pivotal toxicity studies (1 with monkeys and 3 with rats). The final HBGV was derived based on a POD (HED) of 0.6 µg/kg/day associated with decreased pup body weight in a two-generation reproductive toxicity study with rats and an UF of 30 (10 for intraspecies variability and 3 for interspecies variability). HBGVs calculated for the other studies were in the range 0.02 to 0.1 µg/kg/day.	0.16	HBGV based on PBPK modelling for 3 selected pivotal toxicity studies (1 with monkeys, 1 with rats and 1 with mice). The final HBGV was derived based on a POD (HED) of 4.9 µg/kg/day associated with foetal toxicity in a reproductive/developmental toxicity study mice and an UF of 30 (10 for intraspecies variability and 3 for interspecies variability). HBGVs calculated for the other studies were in the range 0.43 to 0.92 µg/kg/day.
International				
WHO Drinking Water Guidelines	No guideline value	--	No guideline value	--
United Kingdom Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT 2006)	0.3	Provisional TDI based on a POD (NOAEL) of 30 µg/kg/day associated with decreased serum T3 levels in a 26-week study with cynomolgus monkeys and an UF of 100 for inter- and intra-species variability.	1.5	Provisional TDI based of a POD of 300 µg/kg/day associated with hepatic effects in a number of studies in rats and mice and an UF of 200 (10 for inter- and intra-species variability and 2 for uncertainties relating to internal dose kinetics).
European Food Safety Authority (EFSA 2008)	0.15	TDI based on a POD (NOAEL) of 30 µg/kg/day associated with changes in serum lipids and thyroid hormones in a 26-week study with cynomolgus monkey and a UF of 200. The UF comprised by factor of 100 adopted by the UK COT for inter- and intra-species variability as well as an additional UF of 2 to account for the	1.5	TDI based on a POD ($BMDL_{10}$) of 300 µg/kg/day associated with a 10% increase in effects on the liver from studies in rats and mice and an UF of 200 (10 for inter- and intra-species variability and 2 for uncertainties relating to internal dose kinetics).

	PFOS		PFOA	
Source	**TRV (µg/kg/d)**	**Basis / Comments**	**TRV (µg/kg/d)**	**Basis / Comments**
		relatively short duration of the key study and internal dose kinetics.		
United States Environmental Protection Agency (USEPA 2016a, 2016b) (Final)	0.02	RfD based on PBPK modelling on for data from 6 subchronic, developmental / neurodevelopmental and reproductive toxicity studies with rats for which measured serum PFOS concentrations were available. Critical effects included increased levels of alanine aminotransferase and blood urea nitrogen, decreased pup body weight and survival rate and increased motor activity / decreased habituation. The adopted UF varied depending on the study and were in the range 30 to 100. Candidate RfDs were in the range 0.02 to 0.05 µg/kg/day.	0.02	RfD based on PBPK modelling on for data from a number of studies with rats, monkeys and mice for which measured serum PFOS concentrations were available. 6 primary studies were selected and critical effects included increased liver and kidney weight (rats), decreased pup body weight (mice) and developmental and immunotoxic effects (mice). The adopted UF varied depending on the study and were in the range 30 to 300. Candidate RfDs were in the range 0.02 to 0.15 µg/kg/day.
Agency for Toxic Substances and Disease Registry (ATSDR 2015) (based on Draft 2014 USEPA Guidance)	*0.03*	*MRL based on a POD (NOAEL) of 2.52 µg/kg/day associated with increased absolute liver weight in a 26-week study with cynomolgus monkeys and a UF of 90 (3 for interspecies differences, 10 for intraspecies differences and 3 for deficiencies in the database).*	*0.02*	*MRL based on a POD (HED) of 1.54 µg/kg/day associated with increased absolute liver weight in a 26-week study with cynomolgus monkeys and a UF of 90 (3 for interspecies differences, 10 for intraspecies differences and 3 for deficiencies in the database).*
Danish Ministry for the Environment (Danish Ministry of the Environment 2015b)	0.03	TDI based on a POD ($BMDL_{10}$) of 33 µg/kg/day associated with hepatotoxicity (liver toxicity) in a chronic toxicity/carcinogenicity study with rats and an UF of 1,230 (3 for possible differences in pharmacodynamics, 41 for differences in pharmacokinetics and 10 for intraspecies differences).	0.1	TDI based on a POD ($BMDL_{10}$ converted to a HED) of 3 µg/kg/day associated with hepatotoxicity (liver toxicity) in a chronic toxicity/carcinogenicity study with rats and an UF of 30 (10 for intraspecies variation and 3 for interspecies differences).
Minnesota Department of Health (MDH 2009a, 2009b)	0.08	TRV based on a POD (HED) of 2.5 µg/kg/day associated with decreased cholesterol and changes in thyroid hormones in rats and a UF of 30.	0.08	TRV based on a POD (HED) of 2.3 µg/kg/day associated with decreased cholesterol and changes in thyroid hormones in monkeys and a UF of 30.
German Drinking Water Commission (GDWC 2006)	0.1	TRV based on a POD of 25 µg/kg/day which was the lowest POD for rats from a range of studies	0.1	TRV based on a NOAEL of 100 µg/kg/day which was the lowest POD from a range of studies reviewed by the USEPA. The adopted UF was 1,000.

	PFOS		PFOA	
Source	**TRV (µg/kg/d)**	**Basis / Comments**	**TRV (µg/kg/d)**	**Basis / Comments**
		with rats and monkeys. The adopted UF was 300.		

Notes:

Grey italics indicates TRVs that have since been superseded.

BMDL = Benchmark Dose Level, HBGV = Health Based Guideline Value, HED = Human Equivalent Dose, MRL = Minimal Risk Level, NOAEL = No Observed Adverse Effect Level, PBPK = Physiologically Based Pharmacokinetic, POD = Point of Departure, RfD = Reference Dose, TDI = Tolerable Daily Intake, UF = Uncertainty Factor.

Table B1 indicates that available TRVs for PFOS range from 0.02 to 0.15 µg/kg/day (i.e. a range of 7.5 times). Available TRVs for PFOA range from 0.02 to 1.5 µg/kg/day (i.e. a range of 75 times).

The differences between the available TRVs are mainly due to the following:

- The selection of the critical study and the point of departure (POD) from the available toxicity studies;
- The application of different uncertainty factors (UFs). The application of significantly different UFs by various agencies is largely due to the toxicokinetics related issues (i.e. clearance), as well as the application of additional UFs because the available studies were less than lifetime for the estimated POD; and
- The use (or not) of PBPK modelling.

In April 2017, FSANZ released TRVs for PFOS, PFOA and PFHxS in the form of TDIs (called HBGVs) (FSANZ 2017f). The FSANZ TRVs are the final values for use in Australia and hence the TRVs for PFOS and PFOA have been adopted in this HHRA:

- PFOS: 0.02 µg/kg/day; and
- PFOA: 0.16 µg/kg/day.

Background Intake

In the HHRA, the background intakes of PFOS and PFOA has been assumed to be 10% of the toxicity value. This is based on information available about background levels of PFOS in blood of around 0.1 µg/L compared with the threshold value of 2 µg/L (ToxConsult 2014), and rounded to 10%.

It is noted that blood levels of PFAS are reflective of all intakes from consumer products, drinking water and the environment in general, hence no further specific evaluation of other potential sources of PFAS in the environment is required as part of this HHRA. This is because PFOS accumulates in the blood serum, hence concentrations in the blood represent intakes from other sources in the environment.

In addition, one of the major source of PFOS exposure at or near a contaminated site is food. There is currently insufficient information to estimate total dietary exposure to PFOS for the general population as the majority of the available information relates to contaminated sites. However, the limited data from the 24th Australian Total Diet Survey, alongside information in the scientific literature and further research on PFOS concentrations in fish purchased from Sydney retail outlets by the NSW Food Authority, indicates that dietary exposure from the general food supply is likely to be low. Hence, the adoption of 10% background contribution is considered appropriately conservative.

B2 PFHxS

PFHxS is a completely fluorinated compound with six carbons and a sulfonate group, and is the next most well-known PFAS after PFOS and PFOA. In addition, PFHxS is considered to be structurally similar to PFOS (having the same functional group with less carbons) and as a result is often considered of similar potential toxicity as PFOS.

Like PFOS and PFOA, PFHxS is readily absorbed following oral exposure (with a bioavailability of close to 100% within 24 hours in rats) and binds strongly to serum proteins. The highest PFHxS concentrations have generally been reported in the liver and kidney, with elimination occurring primarily in the urine in experimental animals. The is evidence that PFHxS can cross the placenta and PFHxS has been detected in breast milk. The elimination half-life of PFHxS in humans in estimated to be in the range 7.3 to 8.5 years.

There is limited information available relating to the toxicity of PFHxS:

- It has been shown to be a moderate activator of PPARα;
- There was no evidence of developmental or reproductive toxicity at the highest dose tested in one study with rats; and
- A number of epidemiological studies have reported associations between PFHxS exposure and health effects including physician diagnosed asthma, cholesterol levels, sperm quality, birth weight and learning difficulties. However, the results of these epidemiological studies are complicated by the factors present in the studies for PFOS and PFOA (as discussed above).

The comparative toxicity of PFHxS (and other PFAS) was recently investigated in a cumulative health risk assessment for 17 PFAS compounds . A summary of the POD for hepatotoxicity and reproductive toxicity for the PFAS investigated in the health risk assessment are provided in **Table B2**.

Table B2: Summary of Toxicity Data for PFAS

PFAS	POD					
	Hepatotoxicity		Reproductive Toxicity		Other	
	External Dose (mg/kg/day)	Internal Dose (µg/mL serum)	External Dose (mg/kg/day)	Internal Dose (µg/mL serum)	External Dose (mg/kg/day)	Internal Dose (µg/mL serum)
PFBS	**100**	67 [1]	**300**	>45 [1]	**60** [4]	--
PFHxS	**1**	**89**	**>10**	**>60**	**0.3** [2,4]	**44** [2,4]
PFOS [6]	*0.025*	*4.04*	*0.1*	*4.9*	--	--
PFOSA	0.024 [1]	4.03 [1]	0.1 [1]	4.9 [1]	--	--
PFDS	0.029 [1]	4.85 [1]	0.1 [1]	5.9 [1]	--	--
PFBA	**6.0**	**14**	**175**	**4.4**	**3** [5]	--
PFPeA	0.04 [1]	4.5 [1]	0.55 [1]	10.0 [1]	--	--
PFHxA	**20**	5.4 [1]	**100**	11.9 [1]	--	--
PFHpA	**20**	6.2 [1]	0.76 [1]	13.8 [1]	--	--
PFOA [6]	*0.06*	*7.1*	*0.86*	*15.7*	--	--
PFNA	**0.83** [2]	**28.5**	**0.83**	**8.9**	--	--
PFDA	**1.2**	31.6 [1]	**3.0**	9.9 [1]	--	--
PFUnA	1.01 [1]	34.6 [1]	1.01 [1]	10.8 [1]	--	--
PFDoA	0.02 [1]	37.7 [1]	1.10 [1]	11.8 [1]	--	--
6:2 FTS	0.020 [1]	3.45 [1]	0.085 [1]	4.2 [1]	**15** [3]	--

Notes:

1 = Read-across on a molar basis from PFOA, PFOS or PFHxS of PFNA (for PFDA and PFUnA). Borg et. al. (2013) indicates that "f*or congeners lacking data, read-across extrapolation from the closest most conservative congener on a molar basis has been performed*". Read-across is the process where endpoint information for one chemical is used to predict the same endpoint for another chemical which is considered to be similar in some way (e.g. structurally similar). PFTriDA and PFTeDA were also evaluated on this basis

2 = Lowest Observed Adverse Effect Level (LOAEL)

3 = Critical effect is nephrotoxicity

4 = Critical effect is decrease in haemoglobin levels

5 = Critical effect decrease in serum cholesterol

6 = Based on an independent review of toxicity data by the study authors which may consider different PODs to those selected by other jurisdictions for the development of guideline values and hence, may differ to the information presented above. The information presented by the study authors has been replicated here to ensure a consistent approach is adopted for the review of the toxicity data for PFOS / PFOA as compared to other PFAS compounds.

-- = No data available

Table B2 indicates that where chemical specific information is available and evaluated on a consistent basis (values shown in bold; other values have been estimated via read across from PFOS, PFOA or PFHxS), PODs for other PFAS are 10 to 100 times higher than that for PFOS and PFOA. This means these PFAS compounds are 10 to 100 times less toxic than PFOS and PFOA.

The exceptions are:

- PFNA which has reproductive toxicity and hepatotoxicity PODs (external dose) of 0.83 mg/kg/day; and
- PFHxS which has a haematology toxicity POD (external dose) of 0.3 mg/kg/day which is similar to PFOS and PFOA.

In their recent review (FSANZ 2017g), FSANZ concluded that structure of PFOS and PFHxS are similar, and there is some evidence of similar potency in the activation of PPARα which may at least partially mediate the toxicity of some PFAS.

Given this, the TRVs for PFOS of 0.02 µg/kg/day has been adopted for PFHxS in this HHRA. In practical terms, this means that concentrations of PFOS and PFHxS are evaluated together (as a sum) in the HHRA calculations.

PFNA is discussed below.

B3 Other PFAS

There is limited information relating to the toxicity of Other PFAS. Where data is available, this is normally in the form of drinking water guidelines or precautionary guidelines for PFAS mixtures as a whole. Further discussion of toxicity information for 6:2 FTS and PFHxA is provided in the text of this report (**Section 7.3.1**).

Appendix C Ecotoxicity summary for PFAS

Background to the guidelines

The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (the "Guidelines") were first released in 1992 as one of a suite of 21 documents forming the National Water Quality Management Strategy (NWQMS). The document was updated in 2000 (based on data and relevant literature to at least 1996), and then again in 2018 with the guidelines released as an online document (ANZG 2018).

This document includes guidelines for the following uses:

- Aquatic ecosystems;
- Primary industries;
- Recreation and aesthetics (now superseded by the NHMRC Recreational Water Quality Guidelines) (NHMRC 2008); and
- Drinking Water (now superseded by the NHMRC Australian Drinking Water Guidelines) (NHMRC 2011 updated 2018).

The Guidelines are based on the concept of ecologically sustainable development and the policies and principles of the NWQMS which include an integrated approach to water quality management, community involvement, government endorsement, the high variability and complexity inherent in natural waterways and the need for ongoing research and dissemination of research findings.

The Guidelines are intended to provide government, industry, consultants and community groups with a sound set of tools that will enable the assessment and management of ambient water quality in a wide range of water resource types, and according to designated environmental values. They are the recommended limits to acceptable change in water quality that will continue to protect the associated environmental values. They are not standards under the *National Environment Protection Council Act* (1994) but rather are adopted for assessing water quality associated with runoff and contamination.

The Guidelines do not signify threshold levels of pollution above which effects will occur. There is no certainty that significant impacts will occur above these recommended limits, as might be required for prosecution in a court of law. Instead, the guidelines provide certainty that there will be no significant impact on water resource values if the guidelines are achieved (i.e. concentrations remain below the guideline value). The documentation associated with the Guidelines states that the Guidelines should not be used as mandatory standards because there is significant uncertainty associated with the derivation and application of water quality guidelines. For example, data on biological effects are not available for all local species; there is uncertainty over the behaviour of contaminants in the field; there is uncertainty in water quality measurements. However, the Guidelines should provide a framework for recognising and protecting water quality for the full range of existing environmental values.

Available guidelines

The Guidelines for the Protection of Aquatic Ecosystems (ANZG 2018) have been developed with the objective of maintaining or enhancing the "ecological integrity" of freshwater and marine ecosystems. Ecological integrity is an umbrella term that describes the health or condition of an ecosystem and its ability to support and maintain key ecological processes and a community of

organisms with a species composition, diversity and functional organisation as comparable as possible to that of natural habitats within a region.

ANZG (2018) indicates that the guidelines should be applied in the following steps:

1. Define the primary management aims. The key part of this step is to determine the environmental values to be protected and the level of protection, although it is also important to identify environmental concerns and major natural or anthropogenic factors at this stage.
2. Determine appropriate guideline trigger values for selected indicators. The key part of this step is to determine appropriate guideline trigger values which indicate low risk concentrations of contaminants / stressors.
3. Assess test site data and, where possible, refine trigger values to guidelines.
4. Define water quality objectives.
5. Establish a monitoring and assessment program.

In relation to Step 2, three ecosystem conditions, spanning four different species protection levels, are recognised by the Guidelines:

1. High conservation/ecological value systems – effectively unmodified or other highly-valued ecosystems, typically (but not always) occurring in national parks, conservation reserves or in remote and/or inaccessible locations. The 99% species protection value is designed to cover this ecosystem type.
2. Slightly to moderately disturbed systems - ecosystems in which aquatic biological diversity may have been adversely affected to a relatively small but measurable degree by human activity. The biological communities remain in a healthy condition and ecosystem integrity is largely retained. The 95% species protection value is designed to cover this ecosystem type.
3. Highly disturbed systems - measurably degraded ecosystems of lower ecological value. Examples include some shipping ports and sections of harbours serving coastal cities, urban streams receiving road and stormwater runoff, or rural streams receiving runoff from intensive horticulture. The 80% and 90% species protection values are designed to be applied to this ecosystem type. Most regulators consider these lower levels of protection to be values they apply on a temporary basis while plans to improve the ecosystem are prepared and implemented.

A precautionary approach and the concept of “continual improvement” is recommended when selecting a level of protection and it is for this reason that an ecosystem may be designated as “slightly to moderately disturbed” even when significant biological or chemical toxicants / stressors are found to be present. The Guidelines support this approach by recommending that guideline trigger values for slightly to moderately disturbed systems also be applied to highly disturbed ecosystems wherever possible.

The Guidelines also note that the decision to apply a certain protection level to a specific ecosystem is the prerogative of each state jurisdiction or catchment manager, in consultation with the community and stakeholders.

Toxicological basis for the guidelines

For contaminants, (called “toxicants” in the Guidelines), the presented guideline or trigger values represent the best currently-available estimates of what are thought to be concentrations that will

pose a low risk level for of a chemical for chronic (sustained) exposures (i.e. concentrations that should cause negligible effects even when present for extended periods).

The preferred data for deriving trigger values comes from multiple-species toxicity tests, i.e. tests that represent the complex interactions of species in the field like mesocosms. However, such data sets are very limited, and these tests are costly to undertake and difficult to interpret. Hence, most of the trigger values have been derived using data from single-species toxicity tests on a range of test species. Where able to be calculated, high reliability trigger values are derived from chronic 'no observed effect concentration' (NOEC) data. However, most trigger values are moderate reliability trigger values, derived from short-term acute toxicity data (from tests ≤96-hour duration). In addition, where a NOEC is not available, a 'lowest observed effect concentration' (LOEC) may be adopted with safety factors (called assessment factors) applied to decrease the value of the guideline as the concentration at which there are no effects is not known. This adds further uncertainty.

Results for individual species are then translated to trigger values for all species using a statistical distribution approach – the species sensitivity distribution (SSD). Once sufficient data is available for use in a species sensitivity distribution, statistical techniques can then be applied to calculate the concentration that would be protective of a pre-determined percentage of species. Where there are insufficient data to allow the determination of a species sensitivity distribution assessment factors are applied.

For most toxicants, the protection level can then be determined and the appropriate trigger level selected and applied. However, this process is less straightforward for toxicants that may bioaccumulate e.g. mercury, polychlorinated biphenyls, organochlorine pesticides and PFOS. For these toxicants, the main issue of concern is not only their direct short-term toxic effect (e.g. the toxic effect that may be due to a fish swimming in water that is impacted with the toxicant) but the indirect risks associated with their longer-term concentration in organisms and the potential for secondary poisoning as the chemical accumulates up the food chain (i.e. the toxic effect that may occur if a bird eats a fish that has been swimming in the water impacted with the toxicant and the toxicant has accumulated in the fish).

Guidelines for PFOS and PFOA

There are no trigger values for PFOS and PFOA (or any other PFAS compounds) in the guidelines available to October 2019 (ANZG 2018).

Between 2016 and 2018, various state regulatory authorities published guidelines for investigating PFAS contaminated sites included trigger values for PFOS and PFOA that were based on draft determinations by ANZECC that were released to regulators for comment (EPA Victoria 2019; NSW OEH 2017; WA DER 2017) (noting that the basis for the guidelines were never formally published). These values are listed in **Table C1**.

Table C1: Guidelines for PFOS and PFOA – Protection of freshwater ecosystems

Species Protection Value	PFOS (µg/L)	PFOA (µg/L)
High conservation value systems (99% species protection)	0.00023	19
Slightly to moderately disturbed systems (95% species protection)	0.13	220
Highly disturbed systems (90% species protection)	2.0	623
Highly disturbed systems (80% species protection)	31	1,824

These values have also been listed for screening both fresh and marine waters in the PFAS NEMP (HEPA 2020).

Following the release of the original guidance containing these values in Western Australian guidance, enRiskS went to significant effort to attempt to confirm whether the provided guidelines were representative of those that would be released as part of the updated version of the National (i.e. ANZECC/ARMCANZ) Guidelines, as this document was known to be under review, and remains under review at the time of this assessment. Based on these conversations, it was the understanding of enRiskS, that these trigger values may not be representative of those to be included in the updated version of the Guidelines. More recent conversations confirm that the trigger values for PFOS, in particular, are still a matter of much debate amongst the team working on the guidelines. These discussions are of particular relevance to the 99% protection trigger value as the current value in the NEMP is very low.

Guidance for chemicals that bioaccumulate

The ANZECC Guidelines provide the following guidance on how to deal with bioaccumulative chemicals:

- *Dietary accumulation can be an important route of uptake for some chemicals, and it will need to be addressed in future revisions of the Guidelines;*
- *There is currently no formal and specific international guidance for incorporating bioaccumulation into water quality guidelines;*
- *For those chemicals that have the potential to bioaccumulate, the decision scheme provides for site-specific re-assessment of this issue if suitable data become available. Field investigations of residue levels in appropriate organisms may provide additional evidence for whether or not bioaccumulation is an issue at the site under study; and*
- *In the absence of such local data, a higher level of protection is recommended (e.g. 99% protection for slightly–moderately disturbed systems instead of 95%).*

It is noted that the last point (i.e. use of the 99% protection trigger value) often represents the default position adopted for most contaminated land sites but it is not the only approach that can be used and, based on this guidance, is not the preferred approach recommended by ANZECC. The use of the 99% protection trigger value is a policy decision that does not include specific consideration of scientific information relating to bioaccumulation processes (i.e. does not actually assess the potential for bioaccumulation in aquatic organisms). The “step up” of a protection level is simply a trigger for more careful and detailed assessment as the chemical has been identified to be bioaccumulative. This position may also be confusing to lay people, including members of the community, as the selection of guidelines may appear somewhat arbitrary as the protection levels are not equidistant (i.e. evenly spaced).

Another option for dealing with bioaccumulative substances is the use of actual sampling of aquatic biota to determine whether organisms that may be present in an aquatic system are actually being exposed to chemicals like PFOS in a form that can get into their systems and be accumulated.

The currently preferred approach for sites where PFOS may be present is to use the 95% protection trigger value to determine if there is a potential for direct toxicity to aquatic organisms and to use field sampling of aquatic biota to assess the potential for bioaccumulation and secondary poisoning. Further discussion of the toxicological basis for this approach is provided below.

Technical context relevant to the bioaccumulation of PFOS

There is clear scientific evidence that the potential for secondary poisoning from PFOS is more important than aquatic toxicity from direct exposure to PFOS in the water in which the aquatic organisms (e.g. fish) live. This is very different to most toxicants covered by the existing Guidelines.

The calculations presented by RIVM (2010) and Giesy et. al. (2010) show that PFOS can accumulate to concentrations that might affect higher organisms at water concentrations much lower than those at which direct effects on aquatic organisms would be expected. This may be due to aquatic organisms being able to remove PFOS from their systems via the gills (i.e. depurate). However, there is no such pathway for depuration in air breathing organisms (e.g. birds), so bioaccumulation can occur to much greater levels. This means that regardless of whether the 95% or 99% species protection trigger values is adopted, the potential for secondary poisoning is still required to be addressed (where relevant).

One of the reasons there has been much focus on the draft ANZECC trigger values for PFOS and PFOA is that they were significantly lower than the range of other guidelines for the protection of freshwater ecosystems from international sources (Environment Canada 2018; Giesy et al. 2010; Qi et. al. 2011; RIVM 2010; Yang et. al. 2013). In addition, they appeared to include consideration of specific studies that showed effects on aquatic organisms at much lower concentrations which did not appear to have been considered by the international sources. This resulted in concern amongst regulators that just adopting international guidelines was not sufficiently protective.

The available ecotoxicology data indicates that of the different species studied (which includes zooplankton, algae, plants, insects, invertebrates, fish and frogs), the most sensitive species/studies are the following:

- European Damselfly (*Enallagma cyathigerum*) (Environment Canada 2015): NOEC of <0.01 mg/L (i.e. <10 µg PFOS/L);
- Freshwater Midge (invertebrate) (*Chironomus tentans)* : NOEC of <0.0023 mg/L (i.e. <2.3 µg PFOS/L); and
- The multi-generation fish studies including that with the Japanese Rice Fish or Medaka (*Oryzias latipes*) (Ankley et al. 2005; Du et al. 2009; Han & Fang 2010; Ji et al. 2008; Keiter et al. 2012; Wang et al. 2011): NOEC of <0.01 mg/L (i.e. <10 µg PFOS/L).

The data for the European Damselfly, the freshwater midge and from the multi-generation fish studies is discussed below.

European Damselfly and Freshwater Midge

Environment Canada (2015) undertook a review of the available aquatic toxicity values for chronic (long-term) exposure to PFOS, reporting that the most sensitive species was the European Damselfly, with no effects on survival reported at 10 µg/L during a 320-day exposure study.

The toxicity of PFOS to the Freshwater Midge was studied in 2004 through the use of a chronic life-cycle test using a nominal concentration range of 1 to 100 µg/L (i.e. 1, 5, 10, 20, 40, 80 and 150 µg/L). Four endpoints – survival, growth, emergence and reproduction – were assessed, with survival, growth and emergence reported to be significantly affected. Reproduction was not affected at the concentrations at which females emerged. The authors concluded that the study results

suggested that PFOS was as much as three orders of magnitude more toxic to the freshwater midge than previously reported for other aquatic organisms.

A summary of reported ecotoxicology endpoints for the Freshwater Midge is provided in **Table C2**.

Table C2: Summary of Endpoints for the Freshwater Midge

Endpoint	NOEC (µg/L)	EC10 / EC50 (µg/L)
36-day exposure		
Total emergence	<2.3	89 / 95
20-day exposure		
Growth	22	88 / 94
Survival	95	86 / 92
10-day exposure		
Growth	49	49 / 87
Survival	49	108 / >150

The most sensitive endpoint in **Table D2** is emergence and, while MacDonald et. al. (2004) reported that time to first emergence, rate of emergence and total emergence per treatment were all affected by increasing PFOS concentrations, total emergence was found to be most sensitive, as illustrated in the figure below which shows the number of larvae that failed to build tubes and remained on the surface of the sediment, and the % cumulative emergence, with increasing PFOS concentrations (refer to **Diagram 1**).

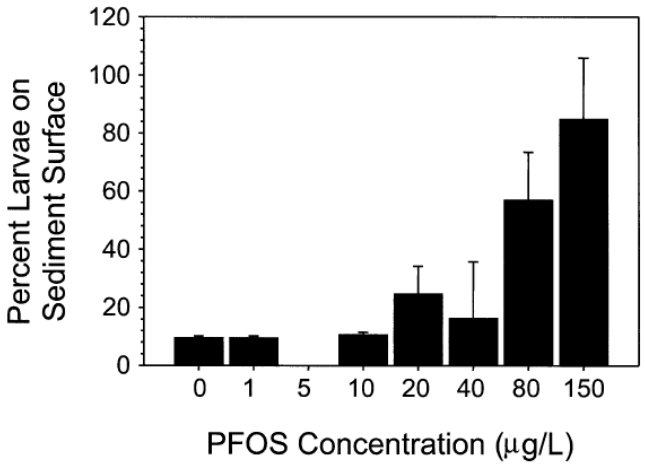


Fig. 2. Percentage of surviving larvae failing to build tubes and found residing at the sediment surface at completion of a 10-d exposure to perfluorooctane sulfonic acid (PFOS). Error bars represent the standard deviation.

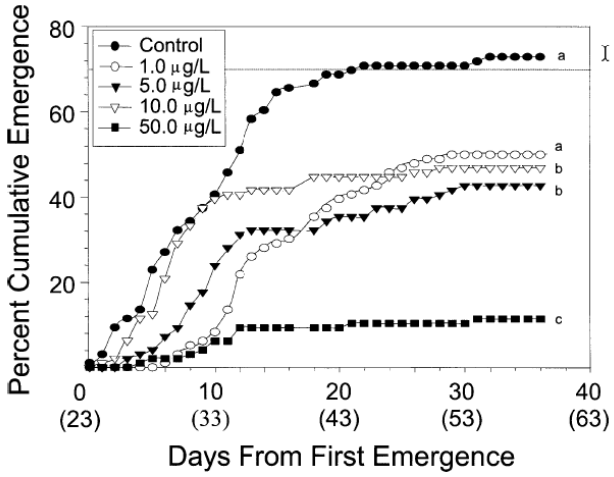


Diagram 1: Diagrams from Macdonald et al. (2004)

While the evidence for an effect on emergence with increasing PFOS concentrations is apparent from **Diagram 1**, **Table C2** indicates that the story is complex. The EC10 values (the concentration at which 10% of test organisms are affected) obtained were similar while the NOEC (the concentrations at which there is no observable effect) were variable. For example, the NOEC for the emergence endpoint is 2.3 µg/L but the EC10 for same experiment was higher at 89 µg/L. It is generally expected that an EC10 should be roughly equivalent to a NOEC which is why the difference in the results for NOEC and EC10 for emergence looks anomalous. However, and as shown by the second graph in **Diagram 1**, there is clearly a difference between the 1 µg/L treatment and the control, which confirms the presence of an effect on emergence due to PFOS concentration. What is also apparent is that there was little difference in the level of effect seen at all concentrations tested between 1 to 10 µg/L. This suggests that, based on the results of this study, there is no difference in effects on emergence within this concentration range. There is, however, a dose response across increasing concentrations as there is a significantly higher effect at 50 µg/L.

Multi-generation fish studies

Multi-generation toxicity studies in fish are important when evaluating potential effects on aquatic organisms from PFOS, given the persistent nature and widespread occurrence of the chemical.

Data from six multi-generation fish studies (Keiter et al 2012, Ji et al 2008, Ankley et al 2005, Wang et al 2011, Du et al 2009, Han and Fang 2010) were reviewed. The details of each study are presented in **Table C3**.

Table C3: Summary of multi-generation fish studies

Study	Fish Species / Solvent	Dosing Regime (µg/L)	Life Stage at Commencement of Experiment	Generations Considered by Study	Endpoints Assessed				
					Survival	Growth	Sex Ratio	Histology	Fecundity / Fertility
Keiter et al. 2012 (Keiter et al. 2012)	Zebrafish / None	0, 0.6, 100, 300	Eggs (2-4 hours post fertilisation)	F0 grew from eggs to reproducing adults; F1 eggs to reproducing adults; F2 eggs to 14-day old fry	No mortality / malformations in F0 for any treatment; no survival and definite malformations at 300 µg/L; effects at 100 µg/L at swim up stage; 42% survival at 100 µg/L for F2	Significant reduction for F0 males for all treatments (no dose response; just a difference from controls) at 90 and 180 days post fertilisation; same effect for F1	Not assessed	Vacuolisation in the liver at 100 and 300 µg/L in F0 and F1	Controls reported 190 eggs per female in F0 and 40 eggs per female in F1; no discussion provided; all PFOS related changes are within this range so effects may not be treatment related; no effect seen on fertility
Ji et al. 2008 (Ji et al. 2008)	Japanese medaka / None	0, 10, 100, 1,000	Sexually mature fish	F0 adults exposed for 14 days; F1 eggs to 100 days post hatch	No mortality effects in F0; significant mortality in F1 - any F1 from fish exposed to PFOS in F0 generation showed effects on survival regardless of exposure regime during F1	Increase in ovaries in F0 females but otherwise no effects; control fish for F1 that came from F0 exposed to each of the PFOS treatments showed significant decrease in growth at 100 days.	Not assessed	Only studied the thyroid, not the liver; significant changes noted in thyroid for all F1 from parents exposed in F0 (all doses)	Dose dependent decrease in number of eggs per spawning in F0; significant changes in hatchability and time to hatch when parents were exposed to 1,000 µg/L for all F1 treatments
Ankley et al. 2005 (Ankley et al. 2005)	Fathead minnow / None	0, 30, 100, 300, 1,000	Sexually mature fish	Adults exposed for 21 days; eggs produced in final 7 days grown out for 24 days in same treatments	1,000 µg/L was lethal within 14 days (some died others not healthy so sacrificed); no mortality in adults at any other treatment or on fry	No significant effects at up to 300 µg/L	Not assessed	Vacuolisation in the liver at 300 µg/L	Ceased spawning at 1,000 µg/L; reduced spawning at 100 and 300 µg/L; 21 d EC50 230 µg/L; reduction in fertilisation at 250 µg/L
Wang et al. 2011 (Wang et al. 2011)	Zebrafish / DMSO	0, 5, 50, 250	Eggs (8 hours post fertilisation)	F0 exposed from eggs to 5 months old; eggs produced grown out to 8 days old	No info on survival in F0; all larvae in F1 died for those mothers exposed to 250 µg/L; larvae were in clean water throughout so effects due to parental exposure; 65% survival at 50 µg/L at 8 days; all survived at 5 µg/L	Significant reduction at 250 µg/L in both sexes; significant reduction at 50 µg/L for males; growth not assessed in F1	Less males in F0 at end of 150 days at 250 µg/L	Not assessed	No significant effects on spawning for all females all treatments; reduction in fertilisation at 250 µg/L. No effect on hatching rates
Du et al. 2009 (Du et al. 2009)	Zebrafish / DMSO	0, 10, 50, 250	Fry (14 days post fertilisation)	14-day old fry exposed for 70 days with 30 days depuration/recovery following. Eggs from these adults grown out but didn't state how long for	No impacts on survival of F0 for 70 d exposure; malformations in larvae at 50 µg/L and 250 µg/L; all malformed larvae died 4-5 days post hatching	Reduction in size of female gonads at 50 and 250 µg/L; reduction was even bigger for fish after 30 d recovery time	Ratio not significantly altered but controls were 28% females; 10 µg/L 34%; 50 µg/L 36% and 250 µg/L 40%.	Vacuolisation in the liver of males at 250 µg/L after 70 d exposure, still there after 30 d recovery period	No information on spawning success; hatching success was similar for all treatments (75 to 80%)
Han and Fang 2010 (Han & Fang 2010)	Zebrafish / DMSO	0, 100, 500, 2,500	Sexually mature fish	Adults exposed for 3 weeks with 1 week recovery; pregnant female retained and larvae success checked at 14 days	No mortality in males; 33% survival in females at 2,500 µg/L; 90% survival at 100 and 500 µg/L; 43% survival for F1 larvae at 500 µg/L and 95% at 100 µg/L; malformations in 40% at 50 µg/L and 100% in 250 µg/L	Adult females reduced food intake, emaciation and body bend at 2,500 µg/L after 5 weeks	No change obvious	Vacuolisation in the liver at 2,500 µg/L	No effect on number of offspring per group
				NOEC range	**0.6-5 µg/L**	**0.6-5 µg/L**	**0.6-10 µg/L**	**0.6-10 µg/L**	**0.6-5 µg/L**

A detailed review of **Table C3** indicates that

- The study quality and consistency varied. For example, three studies used dimethyl sulfoxide (DMSO) as a carrier solvent and three used water only. However, the three studies that used DMSO did not include a solvent control which makes the interpretation of effects that may be due to PFOS problematic (due to potential confounding from effects due to the solvent). It is a standard requirement of ecotoxicity testing to include a control with and without the carrier solvent if one is used (i.e. two types of controls). The fact that these were not included in these three studies severely limits their validity;
- Study design varied with two studies set up on a flow through basis, and four were semi-static studies with renewal intervals varying between 24 hours to every week. These studies incorporated both 50% and 100% renewal. This variation in experimentation conditions makes interpretation problematic (again due to the potential for confounding factors);
- Most studies reported effects in the 1-10 µg/L range with confidence, with one study reporting effects on growth at 0.6 µg/L (all the other endpoints for this study reported no effects at 0.6 µg/L with effects at 100 µg/L). However, the effect on growth reported by Keiter et. al. (2012) did not show increasing effect with increasing concentration (i.e. did not show a dose-response). This means that the cause of this effect cannot be determined with confidence (i.e. it cannot be determined whether this effect was due to exposure to PFOS or due to something else e.g. the study design or an unidentified confounding factor). If the potential for effects at 0.6 µg/L is disregarded, this is consistent with the other multi-generational fish studies, and with the study for the other sensitive aquatic organisms (i.e. the freshwater midge and damselfly (refer above)); and
- PFOS treatment concentrations across all the studies ranged from 0.6 to 1,000 µg/L, however, few of the studies focused on treatment concentrations below 50 to 100 µg/L i.e. one treatment concentration in this range for the first five studies and no treatment concentrations in this range for the last study. This makes it difficult to identify effects at the lower end of the treatment range.

The overall implication is that, based on the available data, it is not possible to differentiate between any effect at low PFOS concentrations, due to lack of treatment doses in this range. This is particularly important because, when deriving water quality guidelines, it is the shape of the tail end of the statistical distribution that determines the difference between the 95% and 99% species protection value. If there is insufficient (or inadequate) data to determine the shape of the distribution at these low concentrations, the statistical analysis will likely yield a large difference between the 95% and 99% protection trigger values which has occurred here.

The following is also worth noting when considering the applicability of the 99% versus the 95% species protection value:

- The Australian approach for determining water quality guidelines (i.e. the SSD approach) is based on an approach developed by RIVM. However, RIVM (2010) concluded the following with respect to the application of this approach for PFOS:
    - *"The dataset does in principal fulfil the requirements for performing a species sensitivity distribution with respect to the number and type of species tested, however, all LOECs are for species that appear to the sensitive to PFOS and for which no NOECs are available in the dataset. For this reason, the lower end of the*

species sensitivity distribution cannot be estimated. It is, therefore, not considered justified to derive a [guideline] by statistical extrapolation."

The above information suggests that Australia should proceed with caution prior to using a SSD to determine guidelines for PFOS.

Further:

- The mode of action for effects in the multi-generation fish studies (or any aquatic toxicology studies with PFAS for that matter) is not well understood. This makes it difficult to determine the relevance of effects on the overall survival of a population (i.e. some effects may be reversible or not adverse, and so do not affect the overall population health); and
- Multi-generation studies are difficult to undertake as they need to be run for extended periods, and they follow a range of effects in the organisms and sufficient animals need to be present in the treatments to allow appropriate sampling throughout the exposure period. Few laboratories have the resources (space, funding and equipment) needed as well as the ability to limit the presence of PFAS in the test space to be able to undertake this type of study appropriately. CSIRO is understood to be investigating this possibility.

Summary

In summary:

- The most sensitive aquatic species to PFOS are reported to be the European Damselfly, the Freshwater Midge, and fish species including the Zebra Fish, Japanese Medaka and Fathead Minnow in multi-generation studies;
- While some data are available with which to infer a no effect concentration from these studies (which could then be used in guideline development), the data is difficult to interpret due to differences in the way the studies have been undertaken and the presence of potential confounding factors;
- In addition, it is not possible to differentiate between any effect at low PFOS concentrations, due to lack of lower treatment doses in the relevant studies. This is particularly important because, when deriving water quality guidelines, it is the shape of the tail end of the statistical distribution that determines the difference between the 95% and 99% species protection value. If there is insufficient (or inadequate) data to determine the shape of the distribution at these low concentrations, the statistical analysis will likely yield a large difference between the 95% and 99% protection trigger values which has occurred here;
- The Australian approach for determining water quality guidelines is based on a statistical approach developed by RIVM. However, RIVM (2010) concluded that it was not appropriate to use this statistical approach to derive a guideline value for PFOS given the available dataset; and
- Unlike most toxicants covered by the Guidelines, there is clear scientific evidence that for PFOS, the potential for secondary poisoning (i.e. poisoning of higher order predators following the consumption of prey containing PFOS) is more important than toxicity due to direct exposure. This means that regardless of whether the 95% or 99% species protection is adopted, the potential for secondary poisoning is still required to be addressed (where relevant) in assessments.

Due to the issues outlined above, and other technical and logistical issues with meeting the 99% species protection guideline for PFOS which is relevant for the assessment of effects due to bioaccumulation in the absence of any site-specific information, the preferred approach for the assessment of potential effects due to direct toxicity and bioaccumulation to aquatic ecosystems is the sampling and analysis of aquatic biota for PFAS.

Selection of an appropriate guideline for 99% species protection

As outlined in the discussion above, there are a range of uncertainties and issues relevant to the selection of a 99% species protection level based on the standard methodology adopted in Australia where a SSD is used. Further consideration of this matter has, therefore, been undertaken.

It is understood that the derivation of a 99% species protection level has been undertaken using a modified method, where a bimodal distribution is used, resulting in a guideline value of around 50 ng/L (pers. comm. Graeme Batley, September 2019). This value is also consistent with a 99% species protection value that can be derived using the most current Canadian software for SSDs, based on all the data. This suggests that one of the issues with the existing 99% species protection value may be the older software used to derive the Australian guideline which does not appear to have handled the PFOS data distribution well.

Different approaches have been adopted by other organisations including use of an assessment factor approach by RIVM (RIVM 2010). This approach is also considered in Australian guidance when available data are limited. If such an approach is considered for PFOS, the following is noted:

- NOECs for the most sensitive effects, being multi-generational studies, range from 0.6 to 10 µg/L.
- The value of 50 ng/L (as noted above) could be determined based on the lowest NOEC of 600 ng/L and use of a 10 fold assessment factor (which is consistent with the factor adopted by RIVM). This is also consistent with the factor recommended within the Australian guidance where a NOEC is available (ANZG 2018).

Based on the above, it would be reasonable to adopt a 99% species protection level of 50 ng/L. However, the approach and final criteria have not yet been finally determined. Hence, an additional 5 fold assessment factor has been adopted to address this uncertainty.

Where this is adopted, a 99% species protection level of 10 ng/L (i.e. 50 divided by 5) has been adopted for the purpose of establishing site-specific guidelines in this assessment.

Appendix D Safety data sheets

SAFETY DATA SHEET

Section 1: Identification of the substance/mixture and of the company/undertaking

Product identifier

Trade name or designation of the mixture	Alcoseal 3/3
Registration number	-
Synonyms	None.
SDS number	-
Product code	80-05
Date of first issue	22-December-2011
Version number	02
Revision date	03-December-2014
Supersedes date	22-December-2011

Relevant identified uses of the substance or mixture and uses advised against

Identified uses	Firefighting foam concentrate.
Uses advised against	None known.

Details of the supplier of the safety data sheet

Supplier

Company name	Angus Fire Ltd
Address	Station Road Bentham, Lancashire, LA2 7NA
Phone number:	0044 (0)15 2426 4000
e-mail	general.enquiries@angusuk.co.uk
Contact person	EH&S Manager
Emergency telephone number	0044 (0)15 2426 4000 (Standard office hours: Monday to Friday 8:30am - 4:30pm GMT)

Section 2: Hazards identification

Classification of the substance or mixture

The mixture has been assessed and/or tested for its physical, health and environmental hazards and the following classification applies.

Classification according to Directive 67/548/EEC or 1999/45/EC as amended

Classification	R43

The full text for all R-phrases is displayed in section 16.

Classification according to Regulation (EC) No 1272/2008 as amended

Health hazards		
Skin sensitisation	Category 1	May cause an allergic skin reaction.

Hazard summary

Physical hazards	Not classified for physical hazards.
Health hazards	May cause sensitisation by skin contact. Occupational exposure to the substance or mixture may cause adverse health effects.
Environmental hazards	Not classified for hazards to the environment.
Specific hazards	May cause skin and eye irritation. May cause irritation of nose, throat and mucous membranes.
Main symptoms	Contact may cause irritation and redness. Sensitisation.

Label elements

Label according to Regulation (EC) No. 1272/2008 as amended

Contains:	1,3,5-tris(2-hydroxyethyl)hexahydro-1,3,5-triazine



Signal word Warning

Hazard statements May cause an allergic skin reaction.

Precautionary statements

Prevention Avoid breathing mist/vapours/spray. Contaminated work clothing should not be allowed out of the workplace. Wear protective gloves.

Response IF ON SKIN: Wash with plenty of soap and water. If skin irritation or rash occurs: Get medical advice/attention. Wash contaminated clothing before reuse.

Storage Store away from incompatible materials.

Disposal Dispose of contents/container in accordance with local/regional/national/international regulations.

Supplemental label information None.

Other hazards Not a PBT or vPvB substance or mixture.

Section 3: Composition/information on ingredients

Mixture

General information

Chemical name	%	CAS-No. / EC No.	REACH Registration No.	INDEX No.	Notes
2-methylpentane-2,4-diol	1 - 5	107-41-5 203-489-0	-	603-053-00-3	#
Classification: **DSD:** Xi;R36/38					
CLP: Skin Irrit. 2;H315, Eye Irrit. 2;H319					
Sodium chloride	1 - < 3	7647-14-5 231-598-3	-	-	#
Classification: **DSD:** -					
CLP: -					
1,3,5-tris(2-hydroxyethyl)hexahydro-1,3,5-triazine	0,1 - 0,5	4719-04-4 225-208-0	-	613-114-00-6	
Classification: **DSD:** Xn;R22, R43					
CLP: Acute Tox. 4;H302, Skin Sens. 1;H317					
1,2-Benzisothiazol-3(2H)-one	< 0,1	2634-33-5 220-120-9	-	613-088-00-6	#
Classification: **DSD:** Xn;R22, Xi;R38-41, R43, N;R50					
CLP: Acute Tox. 4;H302, Skin Irrit. 2;H315, Skin Sens. 1;H317, Eye Dam. 1;H318, Aquatic Acute 1;H400, Aquatic Chronic 2;H411					
2-Methyl-2H-isothiazol-3-one	< 0,1	2682-20-4 220-239-6	-	-	#
Classification: **DSD:** T;R25, C;R34, R43					
CLP: Acute Tox. 3;H301, Skin Corr. 1B;H314, Skin Sens. 1;H317, Eye Dam. 1;H318					

#: This substance has workplace exposure limit(s).
DSD: Directive 67/548/EEC.
CLP: Regulation No. 1272/2008.

Composition comments All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.
The full text for all R- and H-phrases is displayed in section 16.

Section 4: First aid measures

Description of first aid measures

Inhalation Move injured person into fresh air and keep person calm under observation. Get medical attention, if needed.

Skin contact Wash the skin immediately with soap and water. Get medical attention if irritation develops and persists. If skin rash or an allergic skin reaction develops, get medical attention.

Eye contact Immediately flush eye(s) with plenty of water. Remove any contact lenses. Get medical attention if irritation develops or persists.

Ingestion	Immediately rinse mouth and drink plenty of water. Keep person under observation. If person becomes uncomfortable take to hospital along with these instructions. Only induce vomiting at the instruction of medical personnel.
Most important symptoms and effects, both acute and delayed	Contact may cause irritation and redness. Sensitisation.
Indication of any immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically.

Section 5: Firefighting measures

General fire hazards	Product is an extinguishing medium. It does not burn or support combustion.
Extinguishing media	
Suitable extinguishing media	No specific measures are required as this product is a fire extinguishing medium.
Unsuitable extinguishing media	Not applicable.
Special hazards arising from the substance or mixture	Not a fire hazard.
Advice for firefighters	
Special protective equipment for firefighters	Self-contained breathing apparatus, operated in positive pressure mode and full protective clothing must be worn in case of fire.
Special firefighting procedures	No specific precautions.

Section 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel	Avoid contact with skin and eyes. Avoid inhalation of mists or aerosols. Provide adequate ventilation. Wear protective clothing as described in section 8 of this safety data sheet.
For emergency responders	Use personal protection recommended in Section 8 of the SDS.
Environmental precautions	Prevent entry into waterways, sewer, basements or confined areas.
Methods and material for containment and cleaning up	Absorb spillage with suitable absorbent material. Collect and dispose of spillage as indicated in Section 13.
Reference to other sections	For personal protection, see section 8. For waste disposal, see section 13.

Section 7: Handling and storage

Precautions for safe handling	Avoid contact with skin and eyes. Wear appropriate personal protective equipment. Wash hands after handling. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store in original tightly closed container. Store at temperature below 40°C. Store above freezing. Store away from incompatible materials.
Specific end use(s)	Firefighting foam concentrate.

Section 8: Exposure controls/personal protection

Control parameters

Occupational exposure limits

Austria. MAK List

Components	Type	Value
2-Methyl-2H-isothiazol-3-one (2682-20-4)	MAK	0,05 mg/m3
2-methylpentane-2,4-diol (107-41-5)	Ceiling	49 mg/m3 10 ppm
	MAK	49 mg/m3 10 ppm

Belgium. Exposure Limit Values.

Components	Type	Value
2-methylpentane-2,4-diol (107-41-5)	TWA	123 mg/m3 25 ppm

France. Threshold Limit Values (VLEP) for Occupational Exposure to Chemicals in France, INRS ED 984

Components	Type	Value
2-methylpentane-2,4-diol (107-41-5)	VLE	125 mg/m3
		25 ppm

Germany. DFG MAK List (advisory OELs). Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area (DFG)

Components	Type	Value	Form
2-Methyl-2H-isothiazol-3-one (2682-20-4)	TWA	0,2 mg/m3	Inhalable fraction.
2-methylpentane-2,4-diol (107-41-5)	TWA	49 mg/m3	
		10 ppm	

Greece. OELs (Decree No. 90/1999, as amended)

Components	Type	Value
2-methylpentane-2,4-diol (107-41-5)	STEL	125 mg/m3
		25 ppm
	TWA	125 mg/m3
		25 ppm

Italy. OELs

Components	Type	Value
2-methylpentane-2,4-diol (107-41-5)	Ceiling	25 ppm

Norway. Administrative Norms for Contaminants in the Workplace

Components	Type	Value
2-methylpentane-2,4-diol (107-41-5)	Ceiling	100 mg/m3
		20 ppm

Poland. MACs. Minister of Labour and Social Policy Regarding Maximum Allowable Concentrations and Intensities in Working Environment

Components	Type	Value
2-methylpentane-2,4-diol (107-41-5)	Ceiling	120 mg/m3

Hygiene Norm GN 2.2.5.2439-09. Maximum allowable concentration (MAC) of harmful substances in the air of working zones. Executive No. 76 of 30 april 2006. Including Appendixes No.1, 2, 3 and 4.

Components	Type	Value	Form
Sodium chloride (7647-14-5)	Ceiling	5 mg/m3	Aerosol

Spain. Occupational Exposure Limits

Components	Type	Value
2-methylpentane-2,4-diol (107-41-5)	STEL	123 mg/m3
		25 ppm

Sweden. Occupational Exposure Limit Values

Components	Type	Value
2-methylpentane-2,4-diol (107-41-5)	Ceiling	120 mg/m3
		25 ppm

Switzerland. SUVA Grenzwerte am Arbeitsplatz

Components	Type	Value	Form
2-Methyl-2H-isothiazol-3-one (2682-20-4)	STEL	0,4 mg/m3	Inhalable dust.
	TWA	0,2 mg/m3	Inhalable dust.
2-methylpentane-2,4-diol (107-41-5)	STEL	98 mg/m3	
		20 ppm	
	TWA	49 mg/m3	
		10 ppm	

UK. EH40 Workplace Exposure Limits (WELs)

Components	Type	Value
2-methylpentane-2,4-diol (107-41-5)	STEL	123 mg/m3
		25 ppm

UK. EH40 Workplace Exposure Limits (WELs)

Components	Type	Value
	TWA	123 mg/m3 25 ppm

Recommended monitoring procedures Follow standard monitoring procedures.

DNEL Not available.

PNEC Not available.

Exposure controls

Appropriate engineering controls Ensure adequate ventilation, especially in confined areas. Observe occupational exposure limits and minimise the risk of exposure.

Individual protection measures, such as personal protective equipment

General information Personal protective equipment should be chosen according to the CEN standards and in discussion with the supplier of the personal protective equipment.

Eye/face protection Wear approved safety goggles.

Skin protection

- Hand protection Wear suitable gloves. Butyl rubber gloves are recommended. Suitable gloves can be recommended by the glove supplier.

- Other Wear suitable protective clothing.

Respiratory protection In case of inadequate ventilation: Use respiratory equipment with combination filter, type A2/P2.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

Hygiene measures Handle in accordance with good industrial hygiene and safety practices. Routinely wash work clothing and protective equipment to remove contaminants.

Environmental exposure controls Contain spills and prevent releases and observe national regulations on emissions. Environmental manager must be informed of all major spillages.

Section 9: Physical and chemical properties

Information on basic physical and chemical properties

Physical state Liquid.

Form Liquid.

Colour Dark brown.

Odour Organic.

Odour threshold Not available.

pH 6,5 - 7,5 at 20°C

Melting point/freezing point -7 °C (19,4 °F)

Boiling point, initial boiling point, and boiling range 100 °C (212 °F) at 20 °C

Flash point > 54 °C (> 129,2 °F)

Auto-ignition temperature Not applicable.

Flammability (solid, gas) Not applicable.

Flammability limit - lower (%) Not applicable.

Flammability limit - upper (%) Not applicable.

Oxidising properties Not applicable.

Explosive properties Not applicable.

Explosive limit Not applicable.

Vapour pressure Not applicable.

Vapour density Not applicable.

Evaporation rate Not applicable.

Relative density 1,09

Solubility (water) Miscible with water in all proportions.

Partition coefficient (n-octanol/water) No data available.

Decomposition temperature Not available.

Viscosity	Not available.
Percent volatile	Not available.
Other data	
Flammability	Not applicable.
Other information	No relevant additional information available.

Section 10: Stability and reactivity

Reactivity	The product is stable and non reactive under normal conditions of use, storage and transport.
Chemical stability	Stable at normal conditions.
Possibility of hazardous reactions	Hazardous polymerisation does not occur.
Conditions to avoid	Contact with incompatible materials. Excessive heat. Freezing (Product properties are unaffected).
Incompatible materials	Alkali metals. Strong oxidising agents. Water reactive materials.
Hazardous decomposition products	Carbon oxides. Chlorine. Sulphur oxides. Metal oxides. Nitrogen oxides (NOx). Hydrogen fluoride.

Section 11: Toxicological information

General information The information in this section is for the individual ingredients that are expected to contribute to the potential health effects of this product.

Information on likely routes of exposure

Ingestion	May cause discomfort if swallowed.
Inhalation	Under normal conditions of intended use, this material is not expected to be an inhalation hazard.
Skin contact	May cause skin irritation. May cause an allergic skin reaction.
Eye contact	May cause eye irritation on direct contact.
Symptoms	Skin sensitization, characterized by redness, inflammation, itching and/or burning may result from prolonged or repeated contact with this material.

Information on toxicological effects

Acute toxicity May cause skin and eye irritation. May cause an allergic skin reaction.

Components	Test results
2-methylpentane-2,4-diol (107-41-5)	Acute Oral LD50 Rat: 4,79 g/kg

Skin corrosion/irritation	Prolonged skin contact may cause dermatitis.
Serious eye damage/eye irritation	May cause eye irritation.
Respiratory sensitisation	No data available.
Skin sensitisation	May cause an allergic skin reaction.
Germ cell mutagenicity	No data available.
Carcinogenicity	No data available.
Reproductive toxicity	No data available.
Specific target organ toxicity - single exposure	No data available.
Specific target organ toxicity - repeated exposure	No data available.
Aspiration hazard	No data available.
Mixture versus substance information	None known.
Other information	Persons with pre-existing skin disorders may be more susceptible to the effects of the product. May cause irritation of nose, throat and mucous membranes.

Section 12: Ecological information

Toxicity

Product	Test results
Alcoseal 3/3 (Mixture)	EC50 Daphnia magna: 35000 ppm 2 Hours EC50 Daphnia magna: 12000 ppm 24 hours EC50 Daphnia magna: 10000 ppm 48 hours

Product	Test results
	LC50 Rainbow trout,donaldson trout (Oncorhynchus mykiss): 4300 ppm 24 Hours
	LC50 Rainbow trout,donaldson trout (Oncorhynchus mykiss): 17000 ppm 3 Hours
	LC50 Rainbow trout,donaldson trout (Oncorhynchus mykiss): 2400 ppm 48 Hours
	LC50 Rainbow trout,donaldson trout (Oncorhynchus mykiss): 8500 ppm 6 Hours
	LC50 Rainbow trout,donaldson trout (Oncorhynchus mykiss): 2400 ppm 72 Hours
	LC50 Rainbow trout,donaldson trout (Oncorhynchus mykiss): 2400 ppm 96 Hours

Components	Test results
2-methylpentane-2,4-diol (107-41-5)	EC50 Water flea (Ceriodaphnia reticulata): 2400 - 3200 mg/l 48 hours
	LC50 Bleak (Alburnus alburnus): 7000 - 9100 mg/l 96 hours
1,2-Benzisothiazol-3(2H)-one (2634-33-5)	LC50 Bleak (Alburnus alburnus): 8 - 13 mg/l 96 hours
Sodium chloride (7647-14-5)	EC50 Water flea (Daphnia magna): 340,7 - 469,2 mg/l 48 hours

Persistence and degradability	The product is biodegradable.
Bioaccumulative potential	The product is not expected to bioaccumulate.
Mobility	The product is water soluble and may spread in water systems.
Environmental fate - Partition coefficient	No data available.
Mobility in soil	No data available.
Results of PBT and vPvB assessment	No data available.
Other adverse effects	An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Section 13: Disposal considerations

Waste treatment methods

Residual waste	Dispose of waste and residues in accordance with local authority requirements.
Contaminated packaging	Dispose of in accordance with local regulations. Empty containers should be taken to an approved waste handling site for recycling or disposal.
EU waste code	16 03 05* Waste codes should be assigned by the user based on the application for which the product was used.
Disposal methods/information	Dispose of waste and residues in accordance with local authority requirements.

Section 14: Transport information

ADR

The product is not covered by international regulation on the transport of dangerous goods.

RID

The product is not covered by international regulation on the transport of dangerous goods.

ADN

The product is not covered by international regulation on the transport of dangerous goods.

IATA

The product is not covered by international regulation on the transport of dangerous goods.

IMDG

The product is not covered by international regulation on the transport of dangerous goods.

Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code	No information available.

Section 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture

EU regulations

Regulation (EC) No. 2037/2000 on substances that deplete the ozone layer, Annex I

Not listed.

Regulation (EC) No. 2037/2000 on substances that deplete the ozone layer, Annex II

Not listed.

Regulation (EC) No. 850/2004 on persistent organic pollutants, Annex I

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 1

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 2

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 3

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex V

Not listed.

Directive 96/61/EC concerning integrated pollution prevention and control (IPPC): Article 15, European Pollution Emission Registery (EPER)

Sodium chloride (CAS 7647-14-5)

Regulation (EC) No. 1907/2006, REACH Article 59(1). Candidate List

Not listed.

Other regulations	The product is classified and labelled in accordance with EC directives or respective national laws. This Safety Data Sheet complies with the requirements of Regulation (EC) No 1907/2006.
National regulations	Young people under 18 years old are not allowed to work with this product according to EU Directive 94/33/EC on the protection of young people at work. Follow national regulation for work with chemical agents.
Chemical safety assessment	No Chemical Safety Assessment has been carried out.

Section 16: Other information

List of abbreviations	DNEL: Derived No-Effect Level. PNEC: Predicted No-Effect Concentration. PBT: Persistent, bioaccumulative and toxic. vPvB: Very Persistent and very Bioaccumulative.
References	HSDB® - Hazardous Substances Data Bank Registry of Toxic Effects of Chemical Substances (RTECS)
Information on evaluation method leading to the classification of mixture	The mixture is classified based on test data for physical hazards. The classification for health and environmental hazards is derived by a combination of calculation methods and test data, if available. For details, refer to Sections 9, 11 and 12.
Full text of any statements or R-phrases and H-phrases under Sections 2 to 15	R22 Harmful if swallowed. R25 Toxic if swallowed. R34 Causes burns. R36/38 Irritating to eyes and skin. R38 Irritating to skin. R41 Risk of serious damage to eyes. R43 May cause sensitisation by skin contact. R50 Very toxic to aquatic organisms. H301 - Toxic if swallowed. H302 - Harmful if swallowed. H314 - Causes severe skin burns and eye damage. H315 - Causes skin irritation. H317 - May cause an allergic skin reaction. H318 - Causes serious eye damage. H319 - Causes serious eye irritation. H400 - Very toxic to aquatic life. H411 - Toxic to aquatic life with long lasting effects.
Training information	Follow training instructions when handling this material.
Disclaimer	This information is based on our current knowledge and is believed to be correct as of the date issued. The information is intended to describe the product for the purposes of health, safety and environmental requirements only and no warranty, express or implied, is made. It should also not be construed as guaranteeing any specific property of the product. In addition, information obtained from a database is subject to change and may not be as current as the information in the MSDS available directly from Angus Fire.

MATERIAL SAFETY DATA SHEET #AMS183

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product identifier: ALCOSEAL 3/6%® AR-FFFP
Synonyms: Alcohol Resistant Film Forming Fluoroprotein (AR-FFFP)
CAS #: Mixture, no single CAS number is available
Product use: Fire fighting foam concentrate
Product description: Hydrolized protein solution containing fluorosurfactants and glycol solvent.

Supplier name and address:

Angus Fire
180 Sheree Boulevard, Suite 3900 · P.O. Box 695
Exton, PA 19341 USA
Phone: (610) 363-1400 · Fax: (610) 524-9073
www.Kidde-Fire.com

Emergency Telephone #: 1-800-334-3156

SECTION 2 - CHEMICAL COMPOSITION/HAZARDOUS INGREDIENTS

Ingredients	CAS #	% (weight)	LD50 mg/kg (rat, oral)	LC50 ppm (rat, ihl)	OSHA PEL	ACGIH TLV
Hydrolized protein	None	21-31	N/Av	N/Av	None	None
Fluorosurfactrants	N/Av	3-7	N/Av	N/Av	N/Av	N/Av
1,2 benzoisothiazelin-3-one	N/Av	1-5	N/Av	N/Av	N/Av	N/Av
Hexylene glycol	107-41-5	5-10	3700	>310 mg/m^3 /1H	N/Av	25 ppm (ceiling)
Water	7732-18-5	Balance	190 gm/kg	N/Av	None	None

SECTION 3 - HAZARD IDENTIFICATION

POTENTIAL HEALTH EFFECTS

Target organs: Lungs, skin, eyes
Signs and symptoms of short-term (acute) exposure:
Inhalation: Inhalation of vapours may cause respiratory irritation.
Skin contact: Can cause skin irritation.
Eye contact: Can cause eye irritation.
Ingestion: It is not likely that this product will be swallowed if used as intended. It may cause nausea and vomiting if swallowed.
Effects of long-term (chronic) exposure:
None known.
Other important hazards: None

SECTION 4 - FIRST AID MEASURES

Inhalation: If someone feels ill after inhaling vapours, remove them to fresh air. Call a physician if symptoms do not go away quickly.

Skin contact: If product gets on skin, wash off with large amounts of water

Eye contact: If liquid is splashed in eyes, immediately flush eyes with lots of water for 15 minutes, including under the eyelids. Call a physician right away.

Ingestion: If swallowed, call a physician or Poison Control Centre. DO NOT induce vomiting unless directed to do so by a physician. If vomiting does occur, position victim so that fluid does not drain back into lungs.

SECTION 5 - FIRE FIGHTING MEASURES

Fire hazards/conditions of flammability: Not flammable under normal conditions of use. May be combustible if heated above its flash point.

Flash point (Method): >190°F (>88°C) (Pensky Martens Closed Cup)

Lower/Upper flammable limit (% by volume): Product is not flammable under normal conditions.

Explosion data:

Sensitivity to mechanical impact: Not sensitive to mechanical impact.

Sensitivity to static discharge: Not sensitive to static discharge at temperatures below the flash point.

Oxidizing properties: Product is not an oxidizer

Auto-ignition temperature: N/Av

Suitable extinguishing media: Not applicable.

Special fire-fighting procedures/equipment: Not applicable.

Hazardous combustion products: Not applicable.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

Personal precautions: Wear appropriate protective equipment (see Section 8).

Environmental precautions: If in doubt about proper disposal, contact local, state or federal EPA (in USA) or municipal or provincial environmental authorities (in Canada).

Spill response/Cleanup: Wear appropriate protective equipment to collect spillage with an absorbent material. Flush area with water until foaming ceases, using caution as area may be slippery. Prevent discharge of concentrate into waterways. Obtain prior approval before discharge into sewer treatment systems. Disposal must be in accordance with federal, state or provincial, and local regulations.

Prohibited materials: None.

SECTION 7 - HANDLING AND STORAGE

Safe handling procedures: Product is for industrial and municipal fire department use only. Consult product literature for appropriate handling during fires.

Storage requirements: Store at 25°F - 120°F (-4°C - 49°C).

Incompatible materials: As with all aqueous solutions, ALCOSEAL should not be put in contact with any materials which react violently with water.

Special packaging materials: Use original container or store in stainless steel, fibreglass or bitumen-lined tanks.

SECTION 8 - EXPOSURE CONTROLS AND PERSONAL PROTECTION

Ventilation and engineering controls:	Provide adequate levels of ventilation to prevent a build-up of vapours from the product.
Respiratory protection:	Not normally required under normal conditions of use. If vapours reach irritating levels, wear a NIOSH-approved respirator equipped with organic vapour cartridges.
Protective gloves:	Wear impervious gloves of an approved material, for example Neoprene.
Eye protection:	Wear safety glasses, chemical goggles or a face shield of an approved type.
Other protective equipment:	Body-covering clothing is recommended.
Permissible exposure levels:	See Section 2, Hazardous Ingredients.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Physical form, color and odor: Dark brown viscous liquid, with an organic odor.
Odor threshold: Not available.
pH @ 68°F (20°C): 6.5 - 7.5
Boiling point: 212°F (100°C)
Melting/freezing point: 19°F (-7°C)
Vapour pressure: Not available.
Solubility in water: 100%
Coefficient of oil/water distribution: Not available.
Specific gravity (water = 1): 1.09
Vapour density: Not available
Volatile organic compounds (VOC's): Less than 20%
Evaporation rate: Not available

SECTION 10 - REACTIVITY AND STABILITY DATA

Stability and reactivity:	Stable. Hazardous polymerization will not occur.
Conditions to avoid:	None known.
Materials to avoid:	Contact with chemicals that react violently on contact with water, such as sodium metal.
Hazardous decomposition products:	None known.

SECTION 11 - TOXICOLOGICAL INFORMATION/HEALTH EFFECTS

LD_{50}: Not available for product.
LC_{50}: Not available for product.
Routes of exposure: Lungs, skin, eyes
Carcinogenicity: No ingredient classed as carcinogenic by OSHA, IARC, ACGIH or NTP
Teratogenicity, mutagenicity, other reproductive effects: None known.
Sensitization to material: Product is not known to cause allergies.
Conditions aggravated by exposure: None known.
Synergistic materials: None known.

SECTION 12 - ECOLOGICAL INFORMATION

Environmental effects: Readily biodegradable. Product is expected to have a relatively low risk to the environment

Important environmental characteristics: None known.

Chemical Oxygen Demand: COD 0.29 g/g

Biochemical Oxygen Demand: 5 day BOD 0.078 g/g (27%)
15 day BOD 0.23 g/g (29%)
28 day BOD 0.27 g/g (92%)

Aquatic toxicity: LC_{50} (Rainbow trout [*Ocorhynchus mykiss*], 3 hours): 8,500 ppm.
LC_{50} (Rainbow trout [*Ocorhynchus mykiss*], 24 hours): 3,700 ppm.
LC_{50} (Rainbow trout [*Ocorhynchus mykiss*], 72 hours): 3,300 ppm.

EC_{50} (Water flea [*Daphnia magna*], 24 hours): 10,700 ppm.
EC_{50} (Water flea [*Daphnia magna*], 48 hours): 9,800 ppm.

SECTION 13 - WASTE DISPOSAL

Handling for disposal: Avoid contact with eyes and skin, and excessive inhalation. Do not ingest. Rinse skin and eyes thoroughly in case of contact.

Methods of disposal: If in doubt about proper disposal, contact local, state or federal EPA (in USA) or municipal or provincial environmental authorities (in Canada).

SECTION 14 - TRANSPORT INFORMATION

Transportation of Dangerous Goods (TDG) information:

Shipping description: Not regulated as dangerous goods according to TDG Regulations.

49 CFR information:

Shipping description: Not regulated as hazardous material according to 49 CFR Hazardous Materials Regulations.

International Dangerous Goods information:

IMO: Not regulated as dangerous goods according to IMDG Code.

ICAO: Not regulated as dangerous goods according to ICAO Technical Instructions or IATA Regulations.

Other information: None.

SECTION 15 - REGULATORY INFORMATION

WHMIS information: This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and this MSDS contains all the information required by the CPR. WHMIS classification is D2B, Toxic and Infectious Substances, Toxic Material.

CEPA information: All ingredients are listed on the DSL.

SARA information: This product does not contain any SARA Title III Section 313 chemicals.

TSCA information: All ingredients are listed in TSCA

RCRA information: Not a regulated waste

CERCLA information: Under U.S. EPA CERCLA regulations, releases to air, land or water which exceed the reportable quantity must be reported to the National Response Center (1-800-424-8802). There is no reportable quantity (RQ) for this product. There are no reportable materials in this product.

California Proposition 65 Information: To the best of our knowledge, this product does not contain any California Proposition 65 designated chemicals.

SECTION 16 - OTHER INFORMATION

Prepared for: Angus Fire
Telephone number: (610) 363-1400
Preparation date/revision number: March 4, 2010

Additional notes or references:

Abbreviations:

ACGIH:	American Conference of Governmental Industrial Hygienists
CEPA:	Canadian Environmental Protection Act
CERCLA:	Comprehensive Environmental Response Compensation and Liability Act
DOT:	Department of Transport
DSL:	Domestic Substance List
IARC:	International Agency for Research on Cancer
IATA:	International Air Transport Association
ICAO:	International Civil Aviation Organization
IMDG:	International Maritime Dangerous Goods Code
OSHA:	Occupational Safety and Health Administration
N/Ap	Not applicable
N/Av:	Not available
NIOSH:	National Institute for Occupational Safety and Health
NTP:	National Toxicology Program
RCRA:	Resource Conservation and Recovery Act
TSCA:	Toxic Substances Control Act
WHMIS:	Workplace Hazardous Materials Information System

References:

1. Van Nostrand Reinhold, Dangerous Properties of Industrial Materials, Seventh Edition, N. Irving Sax.
2. Canadian Centre for Occupational Health and Safety. RTECS (Registry of Toxic Effects) and CHEMINFO databases.
3. ACGIH, Threshold Limit Values and Biological Exposure Indices for 1997.
4. International Agency for Research on Cancer Monographs.

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