Coal Services Pty Ltd

Newcastle Mines Rescue Station
PFAS Contamination Assessment

October 2017

Executive summary

GHD Pty Ltd (GHD) was engaged to assess the potential for per- and poly-fluoroalkyl substances (PFAS) contamination at the Newcastle Mines Rescue Facility located at 533 Lake Road, Argenton NSW 2284 (the Site). The objective of these investigations is to understand the extent of PFAS impact at the Site and to assess the potential risks to human health and key environmental receptors.

The Site has historically been used and owned by Mines Rescue Pty Limited (Mines Rescue), a subsidiary of Coal Services Pty Limited (Coal Services), for the training of mine personnel in emergency response and rescue procedures, including the use of aqueous film forming foams (AFFF) which may have contained PFAS. Training exercises reportedly occurred both outdoors and within purpose built training facilities such as the gallery and fire cell (igloo). Training occurred approximately once a fortnight inside and approximately once or twice a year outside. Firefighting foams were used inside the galley, the fire cell and outside in the vicinity of the fire cell in the area either to the north aiming back toward the fire cell or within the north western grassed area.

Based on the site history, there is a potential for soil, surface water and sediment collected in stormwater infrastructure pits and treatment systems and groundwater to have been impacted by PFAS both on and off site.

Objective 1: Assess whether PFAS impacted groundwater is present on-site and if it has potentially migrated off-site at concentrations which may pose a risk to human health or environmental receptors

Three groundwater wells were installed to investigate the potential for PFAS to be present in groundwater beneath the site. Key findings are summarised as follows:

- PFAS was reported in groundwater at concentrations exceeding the nominated drinking water and ecological screening criteria near the western boundary off Site (MW003) and to the south west off site (OS5).
- The inferred direction of groundwater flow was to the south west/west.
- Whilst a complete pathway for migration of PFAS to groundwater was identified, groundwater is not extracted on-site and groundwater extraction is restricted within the surrounding area. Whilst the potential for unregistered bores can not be discounted, GHD notes that the area is serviced by municipal water supply. Accordingly, the potential for use and ingestion of groundwater is low.
- In regards to the ecological screening levels, surface water receptors were identified down-gradient of the site where groundwater recharge to surface water may occur. The potential risk to ecological receptors associated with PFAS in groundwater is considered to be low

Objective 2: Assess whether PFAS impacted soils/sediments are present on-site at concentrations, which may pose a risk to human health or environmental receptors

- PFAS was reported in soil samples collected on and off site however all samples reported PFAS concentrations which were below the nominated screening criteria for human health and ecological screening levels indicating that site soils do not present a risk to either users of the site under the current land use scenario or ecological receptors.

- Leachability testing showed that PFAS within soils on and off site have limited potential to release PFAS, and based on the concentrations reported during these works, this pathway is not considered to represent a significant on-going source of PFAS to groundwater and surface water across the Site.

Objective 3: Assess the potential for off-site migration of PFAS via surface water drainage:

Surface water samples were collected from infrastructure locations which discharge to both stormwater and sewer (via trade waste agreement). Key findings are summarised as follows:

- Surface water flow is managed by an onsite drainage system which discharges to the south west into a drainage channel which flows into a creek located to the south. This creek acts as a method of surface water transport down gradient of the site. This creek discharges into Cockle Creek, which ultimately flows to Lake Macquarie.
- PFAS was reported in surface water samples collected from the on-site pit (SW Pit 01) which discharges to stormwater. Whilst concentrations were reported above the drinking water criteria, incidental contact with surface water in the drains would not be expected to present an increased risk of adverse health effects.
- PFOS concentrations were reported for surface water sample collected from on-site pit (SW Pit 01) was above the ecological investigation levels. However, the infrastructure is not considered to represent an environment suitable for aquatic ecosystems and ecological risks associated with the presences of PFOS in on-site surface water are considered to be low.
- Off-site surface water samples reported PFAS concentrations above the drinking water and recreational criteria. However, noting the nature of these sampling locations, incidental contact with surface waters in this area of the creek is considered unlikely.
- PFOS concentrations were reported in off site surface water samples above the ecological investigation levels. Further surface water sampling is required to assess the potential impacts to ecological receptors.
- GHD understands that DPI will be conducting a program of biota sampling, which will include locations around Lake Macquarie and stopping at the mouth of Cockle Creek. GHD understands that the results of these investigations will be available in 2018 and the results of these works will provide a better indication of potential PFAS impacts, if any, within surface water receptors

Based on the findings of these works, the following recommendations are made:

- Installation of additional groundwater wells down gradient of the site and an additional round of monitoring to confirm off-site PFAS concentrations and assess the potential for seasonal variation of PFAS concentrations in groundwater. All wells to be sampled for PFAS and major cations and anions.
- An additional round of surface water and sediment sampling from existing monitoring locations to assess the potential for seasonal variation in PFAS concentrations. Sampling should include a wet weather sampling event to assess PFAS concentrations in surface water and sediments during wet weather flow.

- Complete a survey of water use within the area to better characterise groundwater and surface water use in the area, including understanding of the potential for domestic users of groundwater in proximity of the site and refine the CSM with respect to migration of PFAS at concentrations above the drinking water criteria.
- Controlled removal of residual sediment from on-site infrastructure collection points.

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1. Introduction

GHD Pty Ltd (GHD) was engaged to assess the potential for per- and poly-fluoroalkyl substances (PFAS) contamination at the Newcastle Mines Rescue Facility located 533 Lake Road, Argenton NSW 2284 (the Site). The Site locations is shown on Figure 1, Appendix A.

NSW Environment Protection Authority (EPA) has established a program of sampling to investigate the extent of PFAS contamination across the state as part of a broader precautionary approach to manage the legacy of PFAS use in NSW. To date, sampling completed by the EPA has focused primarily on sites which have been identified as having the greatest potential use of PFAS containing products including airports, firefighting training facilities and some industrial sites.

The Site has historically been used by Mines Rescue Pty Limited (Mines Rescue), a subsidiary of Coal Services Pty Limited (Coal Services), for the training of mine personnel in emergency response and rescue procedures, which included the use of aqueous film forming foams (AFFF). The foams used may have contained PFASs including perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), which are potentially harmful to human health and the environment. AFFF was in general use for firefighting training at Mines Rescue facilities from the 1970's until AFFF was banned by Mines Rescue and its use discontinued by 2002.

In May 2017, Mines Rescue completed targeted environmental investigations at the Site which included a desktop review of available information, a site inspection and targeted shallow soil sampling (Senversa, 2017). The results of the preliminary sampling identified PFAS in shallow soils at the Site.

Given the history of use of AFFF at the Site and based on the testing undertaken to date, Mines Rescue required additional investigations to be completed to assess the potential extent of PFAS contamination at the Site.

This report documents the outcome of the desktop review and intrusive site investigations undertaken on the Site by GHD between June and September 2017.

1.1 Objective

The overall objective of the intrusive investigation was to further investigate the PFAS impacts identified during the previous investigations, and to assess the potential risks to human health and key environmental receptors.

To address the investigation objectives outlined above, this assessment was designed to assess:

- Groundwater on-site to confirm whether PFAS impacted groundwater is present and if it has potentially migrated off-site at concentrations which may pose a risk to human health
- Whether PFAS impacted soils are present in on-site at concentrations which may pose a risk to human health or the environment
- Sampling of off-site water bodies which may receive surface water drainage from the Site

1.2 Scope

The scope of work comprised:

- Desktop review of available information including the Senversa 2017 report and historical aerial photographs for the Site.
- Site inspection and interviews with site personnel to gain an understanding of current site conditions, ground truth information obtained during the desktop review and to understand historical training practices at the Site.
- Service location including a review of site plans (where available), dial before you dig (DBYD) plans, and scanning using ground penetrating radar to identify the presence of underground services.
- Drilling and installation of three on-site groundwater wells (MW001 to MW003) and collection and analysis of six soil samples from these boreholes.
- Collection of one sediment sample from an onsite stormwater pit and five sediment samples from the down-gradient water courses.
- Collection of one on-site water sample from the storm water collection system and two off-site surface water samples.
- Collection of groundwater samples from the three installed groundwater wells and one existing offsite groundwater well.
- Laboratory analysis of selected soil, sediment, surface water and groundwater samples for PFAS.
- Laboratory analysis of a selection of soil and sediment samples for Australian standard leaching procedure (ASLP).
- A quality control and quality assurance (QA/QC) program.
- Surveying of wells.
- Preparation of this report summarising the findings of the desktop review and intrusive investigations.

1.3 Limitations

This report is subject to the limitations provided in Section 12.

2. Site setting

The following provides a summary of the site identification and environmental setting.

A summary of the site identifications and environmental setting is provided in Table 2-1. The Site location is presented in Figure 1, Appendix A.

Table 2-1 Site identification and environmental setting summary

Information	Description
Street Address	533, Lake Road, Argenton, NSW 2527 (Part of Lot 2, DP 599235)
Site Area	Approximately 12,800 m^2 (1.28 ha), with a perimeter of approximately 455 m
Local Government Area	Lake Macquarie Council
Current Land Use	Training site for mine rescue and recovery operations as well as other commercial courses that include fire-fighting training
Zoning	Under the Lake Macquarie Local Environment Plan 2014, the site is zoned as R2 – Low Density Residential.
Ownership	Land parcel owned by Mines Rescue.
Site layout and features	The Site boundary is presented in Figure 2, Appendix A. The Site is fenced and secured for authorised access only. Key features include: • Administration buildings for Coal Services- Mines Rescue, comprising offices and training rooms, virtual reality theatre, training gallery, which cover the central southern portions of the Site. Several residential dwellings cover the northern, eastern and southern corners of the site. These residential dwellings have been converted in to offices, with the exception of the most northern residential dwelling (Residence 7) which is occupied by a Mines rescue employee and their family. • Asphalt car park located within the south western portion of the site. • Grassed areas surround the residential dwelling of the site. • Oil water separator which is connected to a sump room in the underground gallery. Outflow is understood to be to sewer. • Underground gallery and sump room used for training exercises below the southern carpark and administration buildings. On-site drainage with stormwater pits which drain water off site towards the south west corner of the Site.
Surrounding Land Uses	The surrounding land use comprises: **North:** low density residential properties, Lake Road, Waratah Golf Course, Cockle Creek and Brush Creek. North of Brush Creek lies a sewage treatment plant, low density residential dwellings agricultural land and a surface water dam. **South:** Vacant land followed by Argenton Electricity Substation, undeveloped open space – the rehabilitated Pasminco sulphide smelter – and an operational rail line. **East:** low residential housing and Kindayerra Reserve followed by, Argenton Public School, low density residential dwellings and Stockland Shopping Centre. **West:** Lake Road, Waratah Golf Course and Cockle Creek. Further west land uses comprise a sewage treatment plant, multiple surface water dams and a mine facility undergoing rehabilitation.

Information	Description
Topography	The site has an elevation of approximately 5-6.5 m above the Australian Height Datum (m AHD) This elevation data was corroborated in the survey of the elevations of the monitoring wells organised by GHD The regional topography is comprised primarily of even, flat terrain. There is a slight downward incline to the north west, approaching Cockle Creek and a slight increase in gradient beyond the southern boundary of the site.
Soil and Acid sulphate soils	According to the Newcastle 1:100 000 Soil Landscape Map, the site lies within the Cockle Creek 'CC' and Warners Bay 'wa' landscapes. The Cockle Creek landscape has the following characteristics: Narrow floodplains, alluvial fan deposits and some low level terraces on recent alluvium derived from the Carboniferous sediments and volcanics in the Paterson Mountains and 10-50 m, local relief <2 m. Partially cleared tall open-forest. Soils are deep (>200 cm), imperfectly to poorly drained yellow Soloths and Yellow Podzolic Soils on floodplains, deep (>200 cm), moderately well to poorly drained Yellow Earths and Grey Earth on delta and fan deposits, with deep (>200 cm), imperfectly drained to well-drained Yellow Podzolic Soils. Limitations include that it is a flood hazard, water erosion hazard, permanently high localised water tables, periodic to permanent water logging, high run on, acidic, infertile sodic dispersible soils of low strength. Characteristics of the Warners Bay landscape include: Undulating to rolling hills and rises on fine-grained sediments of the Newcastle Coal Measures in the Awaba Hills. Local relief 30-80 m, slope gradients 3-20%, elevation to 80 m. Crests are broad; slopes are long and gentle and drainage lines are broad. Predominantly cleared tall open-forest. Soils comprise moderately deep (110 cm) to deep (> 150 cm), imperfectly to poorly drained Gleyed Podzolic Soils, moderately well drained Yellow Podzolic Soils and yellow Soloths, with moderately deep (>60 cm), poorly drained Structured Loams in drainage lines. Limitations include that it is a high water erosion hazard, foundation hazard, steep localised slopes, mass movement hazard, Mine Subsidence District, seasonal waterlogging and high run on, moderate to high shrink-swell, plastic subsoils, strongly acidic soils of low fertility. According to the NSW OEH Acid Sulfate Soils (ASS) Risk Map for Wallsend, the site is situated in and areas whereby Acid Sulfate soils are not known or expected to occur. The NSW Planning Portal considers the site to be a Class 5 area, which states that development consent is required for carrying out work within 50mm of adjacent Class 1, 2, 3 or 4 land that is below 5 metres AHD and by which the watertable is likely to be lowered below 1 m AHD on adjacent Class 1,2,3 or 4 land. (LMCC, 2014).
Hydrology	Surface water flow is split from the northern side of the carpark in the south west. Water north of the southern carpark is believed to follow the local topography on-site to stormwater pits. The stormwater pit on the north eastern boundary (SW Pit 01) is anticipated to receive water a large portion of the eastern and northern regions of the site. Water in the car park region is expected to follow the carpark drainage and flow south west towards the stormwater pits located across the south western boundary. The stormwater is believed to discharge into a small drainage channel (location of swale samples) and creek location of Bridge 1 sample) that discharges into Cockle Creek and subsequently Lake Macquarie. During the site inspection conducted by Senversa in 2017, no surface water was present on-site. During periods of rainfall it is anticipated that surface waters would infiltrate into the soil in areas where there are no sealed or hardstand surfaces. Where sealed and hardstand surfaces are present (i.e. carpark and access driveways), the water will flow to unsealed surfaces both on-Site and off-Site or towards stormwater infrastructure located within adjacent roadways (Senversa, 2017). The closest

Information	Description
	surface water body is Cockle Creek, located approximately 220 m to the west. Dial before you dig underground utilities information indicates that sewer lines are located along the north-eastern boundary of the site, and that water pipes run adjacent to the north-western boundary of the site. Two manholes are also located along the north western boundary of the site.
Geology	A review of NSW Department of Industry, Resources and Energy geological maps indicates the Site to be underlain by the Permian Age Boolaroo Sub-Group of the Newcastle Coal Measures which overly the Adamstown sub-group. The geologies of these formations are characterised by (Senversa, 2017): • Boolaroo Formation – irregular coal seams, tuff, sandstone and shales • Adamstown Formation – conglomerate, tuff, coal and shales
Hydrogeology	A search of the NSW Office of Water Groundwater Bore database on 31 July 2017 identified 12 registered bores were located within 1 km of the site. All bores were registered as test bores or for monitoring purposes. No bores registered for stock, domestic, commercial or industrial purposes were identified within a 1 kilometre radius of the site. Groundwater borehole information is provided in Appendix B. During investigations completed by GHD in August 2017, groundwater was encountered during drilling at depths between 3 and 4.3 m bgl. Standing water levels recorded in the wells during sampling ranged from approximately 2 to 5.5 metres below top of well casing. Groundwater gauging data (measured from both top of casing and in mAHD) are presented in Table C, Appendix E. It is understood the groundwater extraction within the area is restricted.

2.1 Sensitive receptors

Based on the desktop review and site inspection, the following potential sensitive human and environmental receptors were identified for the Site and surrounding areas:

Human health receptors

- Current and future occupants of the Site (e.g. residents, workers and subcontractors)
- Visitors to the Site (e.g. workers conducting maintenance, members of the public)
- Current and future occupants of surrounding properties (e.g. residents, workers and visitors)
- Beneficial users of groundwater, including domestic groundwater resources

Environmental receptors

- Flora and fauna within the Site and surrounding land
- Surface water receptors located to the north east of the Site
- Groundwater beneath the Site

3. Site history

3.1 Review of previous information

In 2017 Senversa was commissioned by Mines Rescue to undertake a targeted environmental site assessment (ESA) to assess for the presence of PFAS associated with historical uses of AFFF at the Site.

Senversa completed a desktop review of available information, site inspection, interviews with onsite personnel and collection of 6 surface soil samples and two sediment samples to a maximum depth of 0.1 m and analysis of the samples for PFAS.

Senversa reported that AFFF training was undertaken historically in the central-eastern portion of the Site in front of the administration buildings, former fire training igloo and offsite to the south on adjacent council owned land. Waste AFFF/water was stored within onsite tanks and subsequently disposed offsite to a licenced waste receiving facility.

PFAS concentrations reported by Senversa (2017) are summarised as follows:

- Concentrations of PFHxS + PFOS ranged from 0.0039 mg/kg to 0.042 mg/kg
- Concentrations of PFOS ranged from 0.0037 mg/kg to 0.047 mg/kg

The previous investigations were completed prior to release of current PFAS guidance and as such, data was not assessed against current guidelines. Following review of the existing data, GHD notes that the concentrations of PFHxS + PFOS and PFOS reported by Senversa (2017) were below the nominated health based and ecological screening criteria for the protection of human health and ecological receptors respectively based on a commercial land use scenario. Further discussion relating the selection of investigation levels is provided in Section 7.

3.2 Historic training practices

One of the primary purposes of the site has been for the training of mine workers to respond to emergencies that may occur within the mining industry. Based on conversations with site personnel, GHD's understanding of historical training practices is summarised as follows:

- Training activities at the site have historically included simulation of fires and associated emergency response scenarios to fire using a range of methods including but not limited to the use of extinguishers and AFFF.
- PFAS containing AFFF was reported by Mines Rescue to have been in general use for firefighting training at its rescue facilities from the 1970s. In mid-2001, Mines Rescue made the decision to ban the use of PFAS containing AFFF on its sites.
- Training was predominantly performed in the fire training cell (referred to as the igloo), central-eastern portion of the site in front of the administration buildings igloo and on Council owned land adjacent to the southern boundary of the site.
- Senversa 2017 reported that approximately 600 mm of surface fill material surrounding the area used for fire training in front of the residences was removed (date not provided) due to lead contamination from the adjacent Pasminco smelter.
- The water collected from the former fire training igloo was collected on-site and passed through a separator before being collected and disposed off-site. A trade wastewater agreement (E32442) was granted in February 2006 which allows wastewater within specified water quality limits to discharge into sewer (MJM Environmental, 2016). It is understood that overflow of this water was directed through stormwater drains into the creek located south of the site (Senversa, 2017).

Interviews with staff on-site by GHD reported that the use of AFFF was limited to a few times a year. Staff also reported the underground gallery was used regularly for fire training simulations and the water and foam drains into a sump room, further underground.

3.3 Historical aerial photographs

Historical aerial photographs of the Site and surrounding areas were obtained from LotSearch for 1954, 1965, 1976, 1983, 1993, 2005, 2007, 2014 and 2016 (Lotsearch, 2017). Results of the historical aerial photograph review are summarised in Table 3-1 and the photographs are presented in Appendix B.

Table 3-1 Review of historical aerial photographs

Photograph	Photograph	Site observations
1954 Newcastle Type: B&W NSW GDA 1994 MGA Zone 56		The Mines Rescue facility was present and consisted of a number of buildings including residential houses. Lake Road and Waratah Golf Club was located to the west. Immediately north of the Site was bushland, followed by low density residential dwellings. Cleared undeveloped land was located to the east. Argenton Public School and a rail line was located further east. Undeveloped land was located to the south of the Site, which included low lying land and a creek.
1965 Newcastle Type: B&W NSW GDA 1994 MGA Zone 56		The Site is relatively unchanged since the previous photograph. Lake Road had been widened. Additional bunkers, dams and buildings had been developed at the Waratah Golf Club. Bushland to the north has been mostly cleared. Additional residential development has occurred to the north. Development of Jack Edwards oval has occurred to the east, followed by an oval track. The creek/wetland area was to the south, and commercial/industrial activity was further south. The former Sulphide Workers Club (now Club Macquarie) was present to the south west.

Photograph	Photograph	Site observations
1976 Newcastle Type: Colour NSW GDA 1994 MGA Zone 56		The Site remained relatively unchanged from the previous photograph. The area to the west remained relatively unchanged since the previous photograph. Some additional residential dwellings and infrastructure had been constructed to the north. A small shed had been constructed at the Jack Edwards Oval to the east. To the south, tracks were present to the south of the creek/wetland. The Kopex Waratah Engineering building was present to the south. The railway line and a Pasminco tailings dame were located to the south east.
1983 Newcastle Type: Colour NSW GDA 1994 MGA Zone 56		The Site remained unchanged from previous photograph, with an extension to a small building in the north. The surrounding area remained relatively unchanged.
1993 Newcastle Type: Colour NSW GDA 1994 MGA Zone 56		Additional buildings had been constructed within the south western portion of the Site. The training igloo was present to the south of the admin buildings. The southern carpark was also present. The surrounding area remained relatively unchanged with the exception of a development of a BMX track to the east, and expansion of the Waratah Golf Club clubhouse.

Photograph	Photograph	Site observations
2005 Newcastle Type: Colour NSW GDA 1994 MGA Zone 56		The Site remained relatively similar to the previous photograph. Trees were present along the northern edge of the wetland/creek. Lake Road had been widened. The shed located at the Jack Edwards sports oval had expanded and the BMX track had undergone further development.
2007 Newcastle Type: Colour NSW GDA 1994 MGA Zone 56		The Site remained relatively unchanged. Some additional infrastructure had been built at the Argenton Public School. Further south of the Site, construction of an industrial/commercial area has begun, with fill being used to develop the area.
2014 Newcastle Type: Colour NSW GDA 1994 MGA Zone 56		An additional structure had been built in the south eastern portion of the Site between two residential buildings. Vegetation growth around the wetland had increased. The Waratah Golf Club clubhouse had expanded. To the south, the construction of a commercial/industrial complex had been completed, whilst the Kopex site remained relatively unchanged. The Pasminco dams were present to the east with noticeable bright turquoise/green water.
2016 Newcastle Type: Colour NSW GDA 1994 MGA Zone 56		The Site remained relatively unchanged from previous images. To the east, Pasminco dams water were brown.

3.4 Publicly available information

The following information was obtained during a series of local and state government searches conducted on 22 August 2017.

Information	Description
Heritage	A search of the NSW Office of Environment and Heritage State and Lake Macquarie Council Local databases revealed the following state and local heritage sites within the surrounding area: • Newcastle Mines Rescue Station (the site) • Church Hall and Anglican Church located 814 m north east of the site • Cockle Creek Railway Bridge and Former Railway Underbridge located 670 m south west of the site
Naturally Occurring Asbestos Potential	A NSW EPA search revealed that there were no Naturally Occurring Asbestos Potential sites within study area.
EPA CLM Register	A search of the EPA record of notices within the Argenton area revealed: • Cockle Creek and Cockle Bay Sediments, Creek Reserve Road Argenton, located approximately 745 m south west of the site to have 3 current and 1 former notice • Pasminco Cockle Creek Smelter, Lake Road, Boolaroo, located approximately 670 m south east of the site to have 6 current and 17 former notices • Scrap Metal Yard, 21 Racecourse Rd, Teralba, located approximately 1 km south west of the site to have one current and three former notices
Sites notified to the EPA	A search of the EPA List of Contaminated Sites within the Argenton area revealed the following contaminated sites within a 1 km radius of the site: • Bunnings Site – Pasminco Cockle Creek, 13a Main Rd Boolaroo (formerly regulated under CLM Act) • Cardiff West Estate – Pasminco Cockle Creek, 13a Main Rd, Boolaroo (regulation under CLM Act not required) Pasminco Cockle Creek Smelter, Lake Road, Boolaroo (currently regulated under the CLM Act)
EPA PFAS Investigation Program	The site is listed as part of the NSW EPA PFAS investigation program.
POEO Licences	A review of the Protection of the Environment Operations (POEO) licences for the Argenton area revealed that there are no current licences within a 1 km radius of the site.
EPA Activities	No delicensed activities still regulated by the EPA within the site and designated buffer.
Mine Subsidence Districts	Following a search of Subsidence Advisory databases, it was revealed that the site lies within a mine subsidence district.
State Environment Planning Policy	A search of NSW Department of Planning and Environment data revels that there are no SEPP Protected Areas or Strategic Land Use Areas on or near the site. The following Major Projects are located within 100 m of the site: • Former Pasminco Site Remediation
RAMSAR Wetlands	There are no RAMSAR Wetland areas on or near the site.

4. Conceptual site model

A conceptual site model (CSM) was developed based on the findings of the desktop review the potential on-site sources of contamination and receptors as described below.

4.1 Source

Based on the Site history review an interviews with Mines Rescue Staff, the Site is currently and has been historically been used for the training of mining staff which included fire training exercises. Training exercises occurred both outdoors and within purpose built training facilities such as the gallery and fire cell (igloo). Training occurred approximately once a fortnight inside and approximately once or twice a year outside. Firefighting foams were used inside the galley, the fire cell and outside in the vicinity of the fire cell in the area either to the north aiming back toward the fire cell or within the north western grassed area.

Based on the site history, there is a potential for soil, surface water and sediment collected in stormwater infrastructure pits and treatment systems and groundwater to have been impacted by PFAS both on and off site.

4.2 Receptors

As outlined in Section 2.1 the following identified receptors were identified:

Human health receptors

- Current and future occupants of the Site (e.g. residents, workers and subcontractors)
- Visitors to the Site (e.g. mines workers undergoing training or health screening, workers conducting maintenance, members of the public)
- Current and future occupants of surrounding properties (e.g. residential users, workers (including intrusive maintenance workers) and visitors)
- Beneficial users of groundwater, including domestic groundwater resources

Environmental receptors

- Flora and fauna within the Site and surrounding land
- Surface water receptors located to the north east of the Site
- Groundwater beneath the Site

4.3 Pathway and exposure

On-site

The potential pathways for exposure for workers, contractors and visitors are considered to be primarily from ingestion of PFAS impacted soils, surface water and sediments. Given the depth of groundwater and that no groundwater is extracted or used on-site, the impacts from groundwater is not considered be a potential pathway. In addition, no produce is grown at the facility (gardens or fruit trees) and ingesting of PFAS impacted produce is also not considered to be a potential pathway. It should be noted risk assessments for PFAS in Australia have identified that the primary route of human health exposure (contributing in the order of 90 percent of uptake) of PFAS is via direct ingestion of water or produce that may have been exposed to PFAS contaminated water or soils.

Staff and visitors to the facility are considered to have minimal exposure to potentially impacted soils, sediments or surface water on-site during normal activities for the following reasons:

- The outdoor training areas were well grassed or paved limiting exposure to soils during normal activities. GHD understands that fire training does not involve excavation or disturbance of soils on-site.
- Staff and visitors undertaking fire training activities wear personal protective equipment (PPE) which would provide additional protection from exposure to PFAS.
- Staff are only at the facility during normal working hours.
- Fire training activities do not occur every day. Products that do not contain PFAS have been used for training activities since mid-2001.
- Staff have access to the contents of stormwater pits, waste water settlement tanks at the facility. Staff are responsible for management of sediment/ash traps within internal training system water pits to avoid majority of the fire refuse going into the settlement tanks. These traps including those in the fire cell are emptied regularly when the gallery is cleaned following training activities.

During the site works on 25 August, it was identified that one family (two adults and three children) are currently living within house No. 7 located on the north western portion of the Site. It is understood that no produce is grown at this residence and that the residents have full access to the Mines Rescue facility at all hours. There is a potential for exposure of residents to PFAS in soils, surface water and sediments at the site, through ingestion and dermal contact. As no groundwater is extracted, groundwater is not considered to be a potential pathway for exposure on-site. GHD understands that the residents have been instructed by Mines Rescue not to grow vegetables or other produce on-site.

There is a potential for maintenance and intrusive workers to be exposed to any PFAS contaminated soils, sediments and water during some types of routine maintenance works. However, this exposure is considered to be infrequent and ingestion of PFAS during maintenance works is considered unlikely.

Off site

Given the proximity of the creek and drainage line to the Site, it is considered that the potential pathways for exposure to be primarily from either surface water runoff or sediment migration from the Site. The area to the south of the Site is owned by Council and could be used by the general public for recreational purposes. No groundwater extraction bores were located in the surrounding area, however, there may be potential for unregistered bores in the area which are used for domestic or other purposes. In addition, it is understood that groundwater extraction is restricted within the Argenton area.

4.4 Source-pathway-receptor linkages

Based on the outcomes of the assessment, the potentially significant ‘source/pathway/receptor’ linkages are described in Table 4-1 and are depicted in a graphical presentation as Figure 4-1.

Table 4-1 Conceptual site model

Potential Source	Primary pathway	Receptor
Firefighting foams in the fire training areas	Incidental ingestion of PFAS impacted soils and sediments	Site staff, intrusive maintenance workers and visitors to the site.
		On-site residents, users of the public open space south of the site
	Vertical/horizontal migration of leachate through unsaturated zone	On-site ecological communities
		Groundwater – subsequent migration in groundwater (secondary source)
	Surface runoff and sediment transport	On-site surface waters (including drainage systems – secondary source)
		Off-site surface waters
Secondary source - PFAS In surface Water	Incidental ingestion of PFAS impacted surface waters	Site staff and intrusive maintenance workers.
		On-site residents, users of the public open space south of the site
		Surface water receptors down-gradient of the site including Cockle Creek located approximately 220 metres west of the site
		Ecological communities down-gradient of the site
Secondary source - PFAS in groundwater	Vertical/horizontal migration	Down gradient surface waters recharged by groundwater
		Abstraction bore (domestic, irrigation and/or stock use)

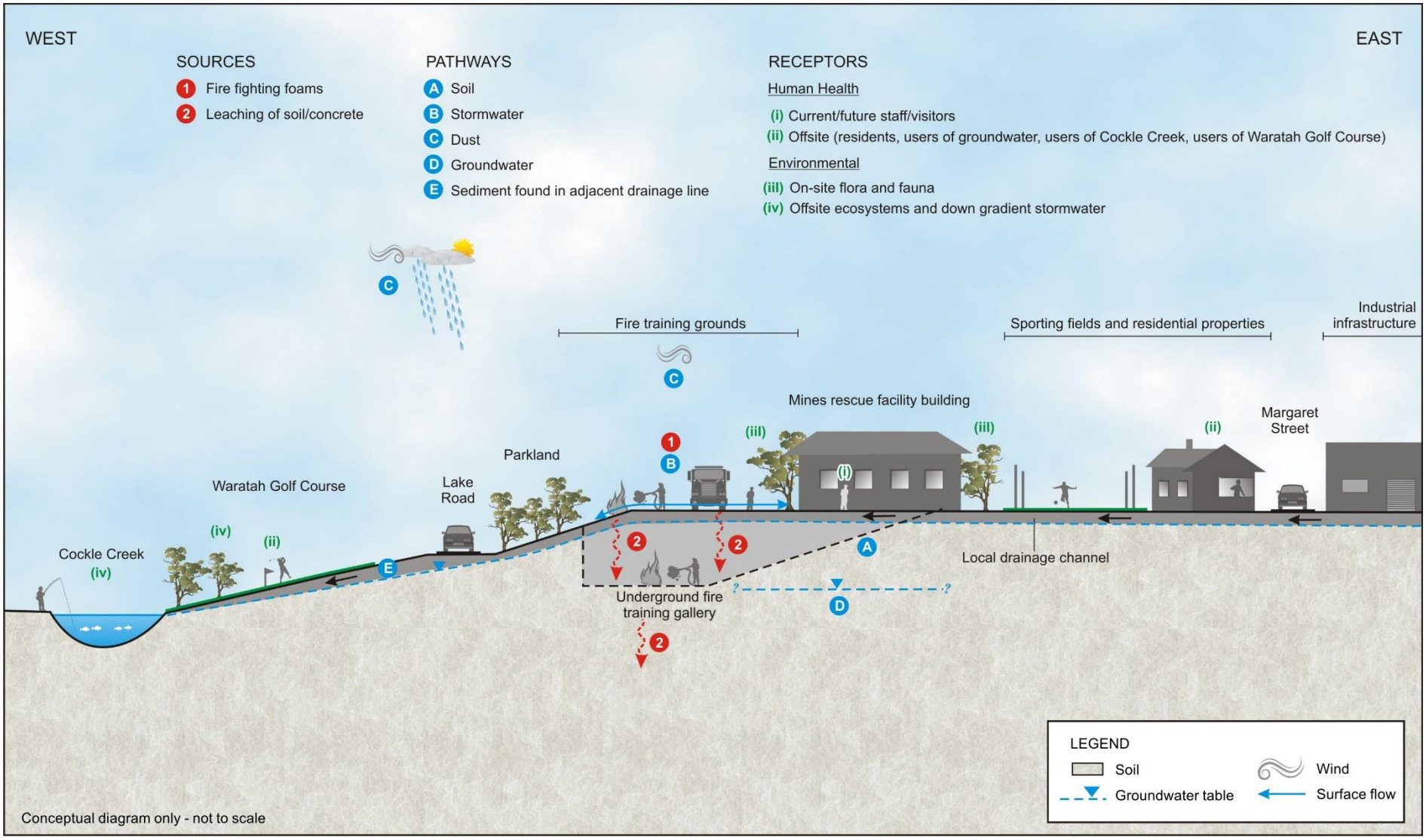

Figure 4-1 Conceptual site model

5. Data quality objectives

The Data Quality Objectives (DQOs) for the investigation are based on guidance presented in:

- NEPC (2013) *National Environmental Protection (Assessment of Site Contamination) Amended Measure (NEPM) No. 1 – Schedule B1, Guideline on Investigation Levels for Soil and Groundwater.*

The DQOs establish a framework for contamination investigations, which incorporates a seven stepped continuum that defines the problem at the site. A series of stages then optimises the design of the investigation.

An overview of the DQOs for the investigation are presented in the following steps.

Step 1: State the problem

The Site has previously been used as a mines rescue and fire training facility, which has potentially included the use of AFFF that contained PFAS including PFOS and PFOA, which are potentially harmful to human health and the environment.

The problem as it stands is that the use of AFFF containing PFAS has resulted in contamination of surface soils both on-site and off site. There is also a potential contamination of surface water, groundwater and sediments both on and off site to unknown extent.

Step 2: Identify the decision/goal of the study

The key study questions to be answered as part of the works include:

- Is PFAS present on the site at concentrations which pose a potentially unacceptable risk to human health or the environment under the current land use (training facility commercial/industrial) and down-gradient land-uses (including residential and recreational land and water uses) based on new screening criteria?
- Is PFAS present in surface water down-gradient of the Site?
- Is the data obtained of an acceptable quality to enable appropriate conclusions to be made in relation to the overall risks to human health and/or the environment?
- Is the extent of the impact adequately delineated off-site?
- Is further assessment or remediation/management required?

Step 3: Identify the information inputs

The following inputs are required for the decision:

- The location of potential PFAS contamination sources.
- The concentrations of PFAS in soil, sediment, leachate (Australian standard leaching procedure (ASLP)), groundwater and surface water from laboratory analysis.
- Identify potential exposure routes and contamination migration pathways.
- The likelihood of PFAS migrating to off-site via groundwater.

Step 4: Define the boundaries of the study

Boundaries of the investigation are summarised in Table 5-1.

Table 5-1 Investigation boundaries

Boundary	Definition
Spatial boundaries	The spatial boundaries for the investigation area are identified as the lateral extent of the sampling locations as shown in Figure 3, Appendix A and down to a depth of approximately 8 m bgl, which is the maximum intrusive investigation depth.
Temporal boundaries	The timeframe for this investigation's scope of work primarily defined to the period of works undertaken in the investigation area as part of this assessment; namely August 2017.
Scale of decision making	The scale of the decision making is limited to the boundaries of the investigation area and identified off-site receptors.
Potential constraints on data collection	Collection of surface water and sediment samples is limited by the availability of the media for sampling at each investigation location.

Step 5: Decision rules

The degree of impact by contaminants and the decisions associated with accepting data will be assessed with reference to the chosen site investigation levels, which were established within the framework of guidelines made or approved by the NSW EPA.

The criteria used for screening analytical results are discussed in **Section 7**.

The decision rule was considered to be:

- If concentrations of the PFAS in soil, surface water, or groundwater on or off-site exceed the nominated criteria for permissible land use(s) (as per current zoning), then further assessment of the risks may be required which may lead to adopting an appropriate management strategy.
- Conversely, no further action may be required in the event that concentrations are below nominated site criteria.

Step 6: Tolerable limits on decision errors

Data generated during this investigation must be appropriate to allow decisions to be made with confidence.

Specific limits for this investigation have been adopted in accordance with the appropriate guidance from the AS4482.1, which includes appropriate indicators of data quality (data quality indicators [DQIs] used to assess QA/QC, and GHD's Standard Field Operating Procedures). The pre-determined DQIs established for the investigation are discussed in Table F-1 in Appendix F.

If any of the DQIs are not met, further investigation will be necessary to determine whether the non-conformance will significantly affect the usefulness of the data.

Step 7: Optimisation of the data collection process

This step involves identifying the most resource effective sampling and analysis design which is required to satisfy the DQOs. The sampling and analysis plan which was developed to meet this objective is summarised in Section 6.

6. Methodology

6.1 General

The scope of work is summarised in Section 1.2. The tables in Sections 6.2 to 6.5, summarise the groundwater well installation and soil sampling, sediment sampling, groundwater sampling and surface water sampling methodologies. In summary, the following activities were conducted in August 2017:

- 17 and 18 August 2017 – installation of three groundwater wells and associated soil sampling (MW001 to MW003), surface water, sediment and soil sampling at five locations (Pond 1, Pond 2, Swale 1, Swale 2, and Bridge 1) off-site
- 25 August 2017 – groundwater sampling of all monitoring wells (MW001 to MW003), surface water and soil sampling at one locations (SW Pit 01) on-site
- 29 August 2017- resampling of surface water at one location (SW Pit 01) on-site due to missing sample

In addition to the above works, gauging of all monitoring wells was undertaken on the 9 October 2017 to confirm groundwater flow direction.

Sampling methodologies were completed with reference to the procedures outlined in the Western Australia Department of Environment Regulation (WA DER) 2017 *Interim Guideline on the assessment and management of perfluoroalkyl and polyfluoroalkyl substances* Appendix 1 (PFAS specific sample collection methods, equipment and equipment decontamination methods).

6.2 Groundwater well installation and soil sampling soil bore sampling

Table 6-1 Soil bore sampling methodology

Item	Description
Date of fieldwork	17 and 18 August 2017
Works	Installation of three groundwater wells and associated soil sampling (MW001 to MW003), surface water and sediment sampling at five locations (POND 1, POND 2, SWALE 1, SWALE 2, and BRIDGE 1) off-site.
Work clearance	JSEA including daily pre-work assessment and hazard identification
Technical guideline	National Uniform Drillers Licensing Committee (2011) Minimum Construction Requirements for Water Bores in Australia (Edition 3, 2012) and the WA DER 2017 sampling procedures.
Ground clearance	Scanning using electromagnetic locating prior to mechanical drilling. Non-destructive drilling (NDD) was undertaken at MW003 due to its proximity to non-traceable gas and power services.
Drilling technique	Following hand augering (or NDD at MW003), push tubing with a tracked geoprobe rig to target depth.
Bore logging	All field observations and subsurface conditions were recorded on field sampling sheets (Appendix C) and borehole logs (Appendix D).
Soil sampling	Discrete soil samples were collected from the surface and from each lithological zone. Additionally, soil was sampled into laboratory supplied jars.

Item	Description
Sample Analysis	Two soil samples from each borehole were submitted for laboratory analysis of PFAS.
Sample handling and transport	Following collection, soil samples were immediately placed on ice and stored in a cool, dark environment (esky) prior to being forwarded to the analytical laboratory within the specified holding times along with a chain of custody (COC) form (Appendix G).
QA/QC	A QA/QC sampling procedure was implemented and further details are described in Section 5 and Appendix E. QA/QC sampling included one duplicate and one trip blank.
Well construction	Wells were installed with the following general characteristics: • 50 mm polyvinyl chloride (PVC) Class 18 blank and screened casings • Primary filter pack material comprising a chemically inert material which was well rounded, with a high coefficient of uniformity and extended at least 0.5 m above the screened PVC casing • Bentonite pellets used as annular sealant which extended 1.0 m above the filter pack, followed by a cement slurry to the ground surface • Monitoring wells were finished with trafficable gatic covers and concrete
Development	Well development occurred following installation using bailers until: • No further noticeable sand or silt was recovered • The water was relatively clear when removed from the well • All water was removed from the well • At least 3 well volumes removed
Surveying	Following well installation, all wells were surveyed by a registered surveyor. The survey report for the wells is provided in Appendix H.
Waste disposal	Soil cuttings and purged groundwater was transferred to 205 L drums and stored on-site.

6.3 Soil and sediment sampling

Table 6-2 Soil and sediment sampling methodology

Item	Description
Date of fieldwork	17, 25 and 29 August 2017
Works	Sediment (or soil) sampling at five locations (Pond 1, Pond2, Swale 1, Swale 2 and Bridge 1) off-site and one location (SW Pit 01) onsite.
Work clearance	JSEA including daily pre-work assessment and hazard identification
Technical guideline	GHD's Standard Field Operating Procedures and the WA DER 2017 sampling procedures.
Sampling	Samples were collected by hand directly into laboratory supplied sample jars. Field observations were recorded on the field sampling sheets (Appendix C).
Sample handling and transport	Following collection, soil and sediment samples were immediately stored in a cool, dark environment (esky) prior to being forwarded to the analytical laboratory within the specified holding times along with a COC form (Appendix G).
Decontamination	All sampling equipment was dedicated for each sampling location.

Item	Description
Sample analysis	All sediment (or soil) samples were submitted for laboratory analysis of PFAS.
QA/QC	QA/QC sampling included one duplicate (sediment), one duplicate (soil), one rinsate blank and one trip blank.

6.4 Groundwater sampling

Table 6-3 Groundwater sampling methodology

Item	Description
Date of fieldwork	25 August 2017
Works	Gauging of five locations (MW001, MW002, MW003, OS5 and OS5A) and sampling at four locations (MW001, MW002, MW003 and OS5)
Work clearance	Site specific induction and site walkover JSEA including daily pre-work assessment and hazard identification
Technical guideline	ASTM D6771–02, Standard practice for low-flow purging and sampling for wells and devices used for groundwater quality investigations, ASTM International. Australian Standard 5667:1998 Water Quality – Sampling, Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples (AS 5667.1:1998). Australian Standard 5667:1998 Water Quality – Sampling, Part 11: Guidance on the Sampling of Groundwaters (AS 566.11:1998). WA DER 2017 sampling procedures.
Gauging	Three on-site monitoring wells (MW001, MW002 and MW003) and two off-site monitoring wells (OS5 and OS5A) were gauged using an oil/water interface probe to measure standing water levels (SWL).
Field chemistry	Field measurements were taken using a calibrated water quality meter and flow through cell, with measurements of temperature, pH, electrical conductivity (EC), dissolved oxygen (DO) and oxidation-reduction potential (Redox) recorded. Field sampling sheets are presented in Appendix C.
Sampling	Four monitoring wells (MW001, MW002, MW003 and OS5) were purged and sampled using a peristaltic low flow pump.
Sample handling and transport	Following collection, the groundwater samples were immediately placed on ice and stored in a cool, dark environment (esky) prior to being forwarded to the analytical laboratory within the specified holding times along with a COC form (Appendix G).
Decontamination	Prior to and following the collection of each groundwater sample, all non-disposable sampling equipment was decontaminated including: Washing of equipment with tap water, Decon Neutracon and rinsing of equipment with deionised water.
Sample analysis	All groundwater samples (four) were submitted for laboratory analysis of PFAS. Laboratory certificates of analysis and COC included in Appendix G.
QA/QC	QA/QC sampling included the collection of one intra-laboratory duplicate sample, one rinsate and trip blank.
Waste disposal	Purged groundwater was transferred to 205 L drums and stored on-site.

6.5 Surface water sampling

Table 6-4 Surface water sampling methodology

Item	Description
Date of fieldwork	17, 25 and 29 August 2017
Works	Sampling of water at all surface water locations with ponded water including Pond 2, Bridge 1 and sampling of infrastructure containing water at SW PIT 01.
Work clearance	Site specific induction and site walkover. JSEA including daily pre-work assessment and hazard identification.
Technical guideline	GHD's Standard Field Operating Procedures and the WA DER 2017 sampling procedures.
Field chemistry	Field parameters were not taken due to accessibility and volume of water at sampling locations.
Sampling	Surface water samples were collected from locations close to the water's edge using a hand held water sampler fitted with a laboratory provided plastic unpreserved container that was changed between locations.
Sample handling and transport	The surface water samples were then transferred into laboratory provided bottles. placed in an ice filled cool box for sample preservation prior to and during shipment to the sampling laboratory. A chain of custody form was completed, and forwarded with the samples to the testing laboratory.
Decontamination	Dedicated sample bottles were used to collect surface water samples, eliminating the need for decontamination of equipment and rinsate samples.
Sample analysis	All surface water samples were submitted for laboratory analysis of PFAS. Laboratory certificates of analysis and COC included in Appendix G.
QA/QC	QA/QC sampling included the collection of one inter-laboratory duplicate sample.
Waste disposal	No excess surface water was collected during surface water sampling.

7. Assessment criteria

7.1 Basis for assessment

The investigation strategy was designed with consideration (where relevant) of the following guidelines:

- NSW EPA (1995) *Contaminated Sites: Sampling Design Guidelines*
- NSW DEC (2006) *Contaminated Sites: Guidelines for NSW Site Auditor Scheme*
- NSW DECC (2015) *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*
- NSW EPA (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*
- NEPM (2013) *National Environment Protection (Assessment of Site Contamination) Amendment Measure (No.1),* National Environment Protection Council (NEPC)
- NSW EPA (2016) Designing Sampling Programs for Sites Potentially Contaminated by PFAS
- OEH Science, May 2017. PFAS Screening Criteria (Draft), May 2017

Screening criteria for the assessment of PFAS impacted sites are still in the process of development in Australia. Only a few values have been published by Australian regulatory agencies, some of which are interim, draft or are “to be reviewed”. The NSW Office of Environment and Heritage (OEH) released Draft PFAS Screening Criteria (May 2017), referencing guidelines values to be use.

It is noted that the assessment of PFAS impacted sites is a rapidly developing field and consequently site assessment criteria are continually under review and may be revised as new scientific information becomes known. Published guideline documents currently available and considered in establishing appropriate investigation levels include:

- CRC CARE 2017. *Assessment, management and remediation guidance for perfluorooctanesulfonate (PFOS) and perfluorooctanoic acid (PFOA) – Part 2: Health screening levels, CRC CARE Technical Report no. 38*, CRC for Contamination Assessment and Remediation of the Environment, Newcastle, Australia
- Department of Environment and Energy (DoEE), October 2016. DRAFT *Commonwealth Environmental Management Guidance on Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFAS)*
- Environmental Risk Sciences Pty Ltd (EnRiskS), February 2016. *Proposed Decision Tree for Prioritising Sites Potentially Contaminated with PFASs, New South Wales Environment Protection Authority* (NSW EPA)
- EC 2017. Canadian Environmental Protection Act, 1999 Federal Environmental Quality Guidelines Perfluorooctane Sulfonate (PFOS). Environment and Climate Change Canada, February 2017
- Department of Health 2017. Release of Food Standards Australia New Zealand’s (FSANZ) report on: Perfluorinated chemicals in food. Supporting Information. Australian Government Department of Health, April 2017
- OEH Science May 2017. PFAS Screening Criteria (Draft), May 2017

7.2 Rationale for assessment criteria

The assessment criteria selected for this Site was based on the preliminary CSM prepared in Section 4 and considering likelihood of exposure of the receptors to PFAS based on our current understanding of the Site.

7.2.1 Soils and sediments

Guidelines based on a residential and commercial/industrial land use scenario have been adopted to assess the potential health impacts to residents, staff and other commercial workers from PFAS in soils and sediments in drainage lines at the Site. The rationale for this decision is summarised as follows:

- The Site is currently and has been historically been used for the training of volunteer mining staff which included fire training exercises.
- As outlined in **Section 4.3**, staff and visitors to the facility are considered to have minimal exposure to potentially impacted soils and sediments on-site during normal activities. In addition, during fire fighting training, staff are reported to wear PPE which further minimises their exposure to soils which may be impacted by PFAS.
- It was noted that a family is currently living within a residence located on the north western portion of the Site. While the family does not grow produce, the residents do have full access to the Mines Rescue facility at all hours. As a result there is a potential for exposure of residents to PFAS impacted soils, surface water and sediments at the Site.
- According to *Sediment quality assessment: a practical guide* (Simpson and Batley, 2016), a sediment is defined as 'unconsolidated mineral and organic particulate material that has settled to the bottom of aquatic environments'. Five of the six 'sediment' samples collected during these works were obtained from ephemeral drainage regions that are not considered to be 'true aquatic environments'. Comparison of the data to soil investigation levels is therefore considered appropriate for these works.
- There a potential for maintenance and intrusive works to be exposed to any PFAS in soils, and sediments during routine maintenance works. However, this is not considered to be a daily occurrence. In the absence of PFAS guidelines specific to intrusive maintenance workers, a qualitative assessment of the data with reference to commercial/industrial guidelines has been completed.
- It is unlikely that humans would come into contact with sediments/soils within drainage lines down gradient of the site and as such, assessment criteria for the protection have not been applied to the assessment of off-site drainage line samples.

7.2.2 Groundwater and surface water

Investigation levels appropriate for the protection of drinking water, recreational use and ecological communities have been used as a conservative assessment of PFAS impacts to groundwater and surface water. The rationale for this decision is summarised as follows:

- There are no registered domestic water bores located within 1 km of the Site, however, there may be the potential for unregistered bores in the area which are used for domestic or other purposes.
- A creek and drainage line to the south of the Site are considered potential receptors to either surface water runoff or sediment migration from the Site. In addition, the Council owned parkland immediately south of the site could be used by the general public for recreational purposes. Based on this scenario, the recreational/public open space guidelines have been used.

- While it is unlikely the creek and drainage line are used for recreational purposes, the recreational guidelines and drinking water guidelines have been used as a conservative measure to evaluate the significance of the data collected as part of this investigation. Given the highly disturbed nature of the water bodies, the ecological guidelines for 95% species protection level (slightly to moderately disturbed ecosystems) has been used to assess potential impacts to aquatic ecosystems.

7.3 Nominated PFAS assessment criteria

The overall objective of these investigations is to understand the extent of PFAS contamination at the Site and to assess the potential risks to human health and key environmental receptors. The following sections provide a summary of the investigation levels adopted to achieve this objective.

7.3.1 Soil and sediment

The nominated Tier 1 assessment criteria and screening levels for PFAS are outlined in Table 7-1, and are shown on Table A and Table B, Appendix E.

Table 7-1 Nominated Tier 1 screening criteria for soil

Exposure Scenario	PFOS/ PFHxS	PFOA	Basis for nomination of criteria
Health Based – onsite and offsite			
Commercial/Industrial	20 mg/kg	100 mg/kg	Criteria adopted from OEH *PFAS Screening Criteria* (May 2017) to account for activities on-site.
Residential	0.009 mg/kg	0.1 mg/kg	Criteria adopted from OEH *PFAS Screening Criteria* (May 2017) to account for residential land use on and off site.
Ecological based - onsite and offsite			
Soil – direct Commercial/industrial	60 mg/kg (PFOS only)	48 mg/kg	Criteria adopted from CRC Care (2017) to be applied for the purpose of soil screening on-site as per the OEH (May 2017).
Soil – direct urban residential and public open space	32 mg/kg (PFOS only)	17 mg/kg	Criteria adopted from CRC Care (2017) to be applied for the purpose of soil screening on-site as per the OEH (May 2017).
Soil – indirect Commercial/Industrial	0.14 mg/kg (PFOS only)	-	This value accounts for bioaccumulation and/or off-site transport and is recommended by the OEH (May 2017) and is from the Canadian Environmental Protection Act, 1999 Federal environmental Quality Guidelines Perfluorooctane Sulfonate (PFOS), (EC 2017).
Soil – indirect residential and parkland	0.01 mg/kg (PFOS only)	-	This value accounts for bioaccumulation and/or off-site transport and is recommended by the OEH (May 2017) and is from the Canadian Environmental Protection Act, 1999 Federal environmental Quality Guidelines Perfluorooctane Sulfonate (PFOS), (EC 2017).

7.3.2 Surface water and groundwater

The nominated Tier 1 assessment criteria and screening levels for PFAS are outlined in Table 7-2, and are shown on Table C, Appendix E. In accordance with the OEH guidelines, groundwater and surface water data have been compared to the following environmental values:

- Drinking water
- Recreational water quality
- Aquatic ecosystems

GHD notes that the OEH screening levels for PFAS for aquatic ecosystems cover both fresh and marine waters.

Table 7-2 Nominated Tier 1 screening criteria for surface water and groundwater

Exposure Scenario	PFOS + PFHxS	PFOA	Basis for nomination of criteria
Drinking water quality	0.07 µg/L	0.56 µg/L	Criteria adopted from the Australian Government Department of Health *Release of Food Standards Australia New Zealand report on perfluorinated chemicals in food supporting information* (Health, 2017) as recommended by NSW Office of Environment and Heritage (OEH). Drinking water is not extracted on-site. No domestic, irrigation or stock bores were registered within 1 km of the Site. However, the potential for localised use of groundwater for domestic or irrigation purposes should not be discounted, and as such drinking water criteria are considered for the purpose of this initial screening.
Recreational water quality	0.7 µg/L	5.6 µg/L	
Ecological – freshwater and marine	0.13 µg/L (PFOS only)	220 µg/L	Criteria adopted for direct toxicity assessment from the Draft Commonwealth Environmental Management Guidance on Perfluorooctance Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) (Australian Government Department of the Environment and Energy (DoEE), 2016). A 95% species protection level has been adopted (slightly to moderately disturbed ecosystems).

7.3.3 Bioaccumulation

For protection against bioaccumulation and secondary poisoning, NSW OEH notes that the ANZECC Water Quality Guidelines approach of using a higher level of species protection to account for bioaccumulation is problematic dur to the guideline value for 99% species protection being below the limit of reporting (LOR) for most commercial laboratories. OEH recommends the analysis of biota for these purposes.

GHD understands that DPI is conducting a program of biota sampling at a number of locations, including Cockle Creek and Lake Macquarie. GHD understands that the results of these investigations will be available in 2018 and the results of these works will provide a better indication of potential PFAS impacts, if any, within surface water receptors.

8. Results

8.1 General

This section presents the results of all soil, sediment, leachate, groundwater and surface water investigations undertaken on the site by GHD in August 2017.

Analytical results and field parameters are summarised in the following tables in Appendix E:

- Table A: Soil analytical results
- Table B: Sediment analytical results
- Table C: Groundwater and surface water analytical results and field parameters
- Table D: ASLP analytical results

Laboratory reports are presented in Appendix G.

8.2 Quality assurance and quality control

An evaluation of the field and laboratory data quality was undertaken in accordance with the NEPM '*Schedule B2, Assessment of data quality,'* and is included in Appendix F.

In summary, the review of the QA/QC program indicates that the soil, groundwater, surface water and sediment analytical data are of an acceptable quality upon which to draw meaningful conclusions regarding impacts to groundwater and soil at the Site.

8.3 Soil results

Soil was examined by GHD during drilling works at the three installed groundwater wells (MW001 to MW003). Descriptions of the site lithology including visual and olfactory observations, sample identifications along with the well construction details and elevations are presented in borehole logs contained in Appendix D.

8.3.1 Soil profile

The observed lithology at the three monitoring wells is summarised in Table 8-1.

Table 8-1 Generalised lithology encountered

Depth range (m)	Lithology
0.0 – 0.5	Fill: Sandy CLAY
0.5 – 4	Gravelly CLAY
4.0 – 8.0	Sandy CLAY

8.3.2 Soil analytical results

Soil samples were collected from three monitoring wells (MW001 to MW003), from an onsite storm water pit (SW Pit 01) and the drainage channels to the south of the site (Swale 1, Swale 2, Pond 1 and Pond 2). The locations are presented in Figure 3 in Appendix A.

PFAS summary results

All PFAS concentrations in the soil on-site were less than the nominated assessment criteria for residential and commercial human health and ecological receptors.

8.4 Sediment results

One sediment sample (Bridge 1) was collected from the creek located down gradient of the Site. The locations are presented in Figure 3 in Appendix A.

PFAS was detected within this sediment location with a total concentration of 0.0023 mg/kg. As noted before, there are currently no screening criteria applicable for sediments. However, this sample reported concentrations of PFAS above the level of detection and there still represent a potential on-going source of PFAS to surface water receptors. Further discussion regarding the leachate results is provided in Section 8.5.

8.5 Leachate –ASLP

Four samples (three soil and one sediment) were submitted for ASLP to assess the leaching potential of PFAS from soils and sediments reporting the highest concentrations of PFAS.

Table 8-2 shows the comparisons between the soil and its respective leachate results.

Table 8-2 Comparisons between soil and Leachate results

Location	PFHxS and PFOS (Sum of Total) - Lab Calc		%PFAS in leachate compared to soil
	Soil (mg/kg)	Leachate ASLP - µg/L	
On-site			
MW001 0-0.1	0.0205	0.4	1.95
MW002 0-0.2	0.0248	0.65	2.62
Off-site			
SWALE1	0.0255	0.31	1.22
BRIDGE1	0.0096	<0.001	-

8.6 Groundwater and surface water results

8.6.1 Groundwater gauging results

Groundwater gauging was initially completed during groundwater sampling on 25 August 2017 and results are summarised in Table C, Appendix E. On review of these results, it was suspected that groundwater levels had not sufficiently stabilised after development, with the groundwater contours showing flow direction in a north easterly direction which was not consistent with the expected hydrogeology based on the desktop review. As a result a second round of gauging was completed on 9 October 2017 to confirm the groundwater flow direction.

Groundwater gauging results are presented in Table 8-3

Table 8-3 Groundwater Gauging Results 9 October 2017

Monitoring Well	Standing Water Level (m below top of casing)	Survey Level (mAHD)
MW001	1.89	3.95
MW002	4.40	1.70
MW003	4.19	1.48
OS5	2.24	2.00

The top of casing (TOC) elevation was determined by a professional surveyor and was used to calculate the groundwater elevation in metres Australian Height Datum (AHD).

A groundwater contour map showing the interpolated groundwater contours and the inferred groundwater flow direction is presented on Figure 4 in Appendix A. Groundwater contours were calculated based on groundwater elevations collected on the 9 October 2017 using SURFER interpolation tool to derive the contours with a kriging method. The local groundwater flow was inferred to be in a south west/west direction.

8.6.2 Groundwater and surface water quality

Prior to groundwater sample collection, field parameters and observations were recorded during the purging of the well. Field parameters for the site are summarised in Table 8-4 and presented in Table C, Appendix E and the field records are provided in Appendix C.

Table 8-4 Summary of groundwater quality field parameters

Parameter	Results and Comments
pH	pH range was 4.31 (MW001) and 7.11 (OS5)
Temp (°C)	Temperature was between 18.5°C (OS5) and 21°C (MW003)
EC (µS/cm)	EC ranged between 2,687 µS/cm (MW001) and 4880 µS/cm (MW003)
DO (mg/L)	DO ranged between 0.87mg/L (MW003) and 5.18 mg/L (OS5)
Redox (mV)	Field redox ranged between -85 mV (OS5) and -21.5 mV (MW002)

* Reduction Oxidation Potential

The field data indicate that the groundwater is saline and would not be considered to be suitable for potable water use.

No field parameters were collected for the surface water sample due to the limited amount of water in the creek.

8.6.3 Analytical results

Groundwater and surface water PFAS concentrations reported in excess of the nominated screening criteria are summarised in Table 8-5. Groundwater samples exceeding nominated assessment criteria are presented in Figure 5 in Appendix A. Further discussion pertaining to these exceedances is provided in Section 9.

Table 8-5 Summary groundwater and surface water results

	On-site	Off-site
Groundwater data		
Drinking water guidelines	**PFHxS + PFOS**: • Reported at concentrations of 0.10 µg/L and 0.79 µg/L reported in MW001 and MW003 respectively, exceeding the drinking water criteria of 0.07 µg/L • Concentrations in groundwater at MW002 were at or below the laboratory LOR **PFOA:** • In all instances, concentrations of PFOA were below the drinking water criteria of 0.56 µg/L	**PFHxS + PFOS**: • Reported at concentration of 1.56 µg/L reported in OS5, exceeding the drinking water criteria of 0.07 µg/L **PFOA:** • The concentration of PFOA at OS5 was below the drinking water criteria of 0.56 µg/L

	On-site	Off-site
Recreational water guidelines	**PFHxS + PFOS**: • Reported at concentrations of 0.79 µg/L reported MW003, exceeding the recreational water criteria of 0.7 µg/L **PFOA:** • In all instances, concentrations of PFOA were below the recreational water criteria of 5.6 µg/L	**PFHxS + PFOS**: • Reported at concentrations of 1.56 µg/L reported in OS5, exceeding the recreational water criteria of 0.7 µg/L **PFOA:** • The concentration of PFOA at OS5 was below the recreational water criteria of 5.6 µg/L
Ecological guidelines	**PFOS:** • Reported at a concentration of 0.18 µg/L in MW003, exceeding the ecological screening level of 0.13 µg/L) **PFOA:** • Reported below the ecological screening level (220 µg/L) in all on-site groundwater samples	**PFOS:** • Reported at a concentration of 0.55 µg/L in OS5, exceeding the ecological screening level of 0.13 µg/L) **PFOA:** • Reported below the ecological screening level (220 µg/L) in the off-site groundwater sample
	Stormwater system data	**Surface water data**
Drinking water guidelines	**PFHxS+PFOS:** • Reported in water sample at location SW Pit 01 at a concentrations of 0.69 µg/L exceeding the drinking water criteria of 0.07 µg/L **PFOA:** • The concentration of PFOA at SW Pit 01 was below the drinking water criteria of 0.56 µg/L	**PFHxS+PFOS:** • Reported in off-site surface water at locations Pond 2 and Bridge 1 at concentrations of 4.11 µg/L and 5.02 µg/L respectively, exceeding the drinking water criteria of 0.07 µg/L **PFOA:** • Reported below the drinking water criteria (0.56 µg/L) in both off-site surface water samples
Recreational water guidelines	**PFHxS + PFOS**: • The concentration of PFOA at SW Pit 01 was below the recreational water criteria of 0.7 µg/L **PFOA:** • The concentration of PFOA at SW Pit 01 was below the recreational water criteria of 5.6 µg/L	**PFHxS + PFOS**: • Reported in off-site surface water at locations Pond 2 and Bridge 1 at concentrations of 4.11 µg/L and 5.02 µg/L respectively, exceeding the recreational water criteria of 0.7 µg/L **PFOA:** • Reported below the recreational water criteria of 5.6 µg/L
Ecological guidelines	**PFOS:** • Reported at a concentration of 0.38 µg/L in SW Pit 01, exceeding the ecological screening level of 0.13 µg/L) **PFOA:** • Reported below the ecological screening level (220 µg/L) in the on-site water sample	**PFOS:** • Reported in off-site surface water at locations Pond 2 and Bridge 1 at concentrations of 2.09 µg/L and 2.15 µg/L respectively, exceeding the ecological screening level of 0.13 µg/L **PFOA:** • Reported below the ecological screening level (220 µg/L) in both off-site surface water samples

9. Discussion

9.1 General

The Site is primarily used for training of Mines Rescue Staff, which includes fire fighting training. In addition, a family currently lives within one of the residential houses within the northern portion of the Site.

It has been reported that PFAS containing AFFF had been used at the site from the 1970's to mid-2001. Firefighting training was generally completed within the central eastern portion of the Site, within the underground gallery and off site to the south. Mines Rescue informed GHD that the use of AFFF was limited to a few times a year and use of PFAS containing AFFF has been banned since 2001.

9.2 Soil and sediment

Table 9-1 presents a discussion of soil and sediment results reported during this investigation. Where exceedances of nominated investigation levels were reported, discussion is provided with reference to the potential receptors identified in Section 2.1 of this report. This information has been used to refine the CSM which is provided in Section 9.4.

Table 9-1 Summary discussion – soil and sediment results

Media	Summary discussion
Soils on-site	Human health: • No on-site soil samples reported PFAS concentrations exceeding the nominated screening criteria for human health. Ecological receptors: • No on-site soil samples reported PFAS concentrations exceeding either the nominated ecological screening criteria for commercial/industrial land use. Results were within the ranges previously reported by Senversa (2017).
Sediment samples in on-site stormwater pit	One sediment sample was collected from on-site stormwater pit (SW Pit 01). Human health: • Concentrations of PFAS were below nominated health based investigation levels for contaminants of concern. Ecological receptors: • Concentrations of PFAS were reported below the indirect ecological screening criteria for commercial/industrial land use.
Sediment samples in surface water drainage lines down-gradient of the site	Human health: • Concentrations of PFAS were below nominated health based investigation levels for contaminants of concern. Ecological receptors: • Concentrations of PFAS were reported below the indirect ecological screening criteria for parks and open space. Whilst the data indicates that PFAS has migrated off-site, in all instances, PFAS concentrations were below both the health based and ecological investigation levels for the individual contaminants of potential concern. Further, the potential for human exposure to sediments within the drainage lines leading from the site is considered to be low.

9.3 Groundwater and surface water

Table 9-2 presents a discussion of groundwater and surface water results reported during this investigation. Where exceedances of nominated investigation levels were reported, discussion is provided with reference to the potential receptors identified in Section 2.1 of this report. This information has been used to refine the CSM which is provided in Section 9.4

Table 9-2 Summary discussion – groundwater and surface water

Media	Summary discussion
Groundwater on-site	Groundwater well locations were selected to target areas of potential concern. The location of groundwater wells were restricted due to the underground gallery located underneath the southern carpark as well as known underground services and access restrictions. Based on local topography and the presence of Cockle Creek to the west, groundwater flow was expected to be to the west. Based on the survey and gauging data completed during sampling, the inferred direction of groundwater flow was calculated to be south west/west which is consistent with the findings of the desktop review. MW001 and MW003 reported concentration of PFHxS+PFOS above the nominated drinking water criteria. However, no extraction of groundwater for drinking purposes takes place on-site and there is no pathway for exposure to PFAS in groundwater for Site users. In addition, the surrounding area is well serviced by municipal water, no registered groundwater abstractions bores are located within 1km of the Site and it is also understood that groundwater extraction is restricted in the area. MW003 also reported concentrations of PFHxS + PFOS above the nominated recreational water criteria. As for the reasons above, it is unlikely that groundwater is being extracted in the area for recreational purposes. Concentrations of PFOS were above the ecological screening levels in groundwater sampled from MW003. However, given the depth of groundwater it is unlikely that groundwater discharges to surface water on-site.
Groundwater – potential for off-site migration	MW003 is located along the western boundary, while OS5 is located off site to the south west. Groundwater has been calculated to flow in a south west/west direction towards Cockle Creek. OS5 reported concentration of PFHxS+PFOS above the nominated drinking water criteria. However, while the potential for unregistered bores can not be discounted, it is unlikely that groundwater is being used off site for drinking water purposes given the surrounding area is well serviced by municipal water, no registered groundwater abstractions bores are located within 1 km of the Site and it is also understood that groundwater extraction is restricted in the area. Further, GHD notes that the inferred direction of groundwater flow is to the south west/west, whilst the closes residential premises are located to the north and east of the Site. Anecdotal information indicates that groundwater is also not being extracted by the nearby golf course. OS5 also reported concentrations of PFHxS + PFOS above the nominated recreational water criteria. As for the reasons above, it is unlikely that groundwater is being extracted in the area for recreational purposes. While Cockle Creek located to the west may be a receptor to groundwater given the low concentrations of PFAS in groundwater the risk to ecological receptors is considered to be low.

Media	Summary discussion
Surface water in on-site drainage systems discharging to stormwater	PFAS was detected in surface water samples collected from the on-site surface water collection system, which discharges to stormwater. Human Health: • Whilst concentrations were reported above the drinking water criteria, incidental contact with surface water in the drains would not be expected to present an increased risk of adverse health effects. Ecological receptors: • The concentration of PFOS was reported above the ecological investigation levels. However, as discussed, the infrastructure sample locations are not considered to represent an environment suitable for aquatic ecosystems and ecological risks associated the presence of PFOS in on-site surface water are considered to be low.
Off-site surface water	Surface water samples were collected from stormwater drainage lines leading from the site. Human Health: • Whilst concentrations were reported above the drinking water criteria, incidental contact with surface water within these areas is considered unlikely and the recorded concentrations of PFOS + PFHxS are not deemed to present a potential risk of exposure to humans. • However, surface water would ultimately drains to Cockle Creek which is used for recreational purposes. Further investigations are required to assess potential risks to human health. In addition, trends due to seasonal variation and wet weather events would be required. Ecological receptors: • The concentration of PFOS reported in samples collected from the off-site drainage line were above the ecological investigation levels. As discussed above, this creek ultimately drains to Cockle Creek and further sampling is required to assess potential risks to ecological ecosystems.

9.4 Refined CSM

Based on the additional information collected in August 2017, the CSM has been refined as shown in Table 9-3.

Table 9-3 Refined CSM

Potential Source	Primary pathway	Receptor	Pathway present?
Firefighting foams in the fire training areas	Incidental ingestion of impacted soils/ sediments	Residents occupying house to the north	**No** – Samples were collected from areas of potential concern and concentrations were reported below the nominated health based investigation levels for all soil and sediment samples.
		Site staff, intrusive maintenance workers	**No** – Samples were collected from areas of potential concern and concentrations were reported below the nominated health based investigation levels for all soil and sediment samples.

Potential Source	Primary pathway	Receptor	Pathway present?
	Vertical/horizontal migration of leachate through unsaturated zone	On-site ecological communities	**No** – Samples were collected from areas of potential concern and concentrations were reported below the indirect ESL. Vegetation on-site appeared to be healthy and did not exhibit any undue signs of distress.
		Groundwater – subsequent migration in groundwater (secondary source)	**Yes** – PFAS impact was reported in groundwater beneath the site at concentrations exceeding the drinking water criteria at MW003 and off site at OS5. Further consideration of potential linkage via secondary sources is presented below.
	Surface runoff and sediment transport	On-site surface waters (including drainage systems – secondary source)	**Unlikely** – Although off-site surface water recorded PFAS concentrations above recreational and drinking water screening criteria, these exposure routes would not be plausible for the drainage line. Exposure of golf course users to PFAS in surface water would be infrequent and of limited duration (retrieving golf ball from channel). Concentrations of PFAS in surface water near Cockle Creek is not yet known.
		Off-site surface waters	**Yes** – PFAS was reported in off site surface waters sampled down gradient of the site at concentrations above the ecological screening criteria. Further consideration of potential linkage via secondary sources is presented below.
		Off-site ecosystems and surface waters (including drainage systems – secondary pathway)	**No** –PFAS detected in all source soil samples below the adopted direct and indirect ESL. Current training practises do not comprise use of PFAS containing AFFF. Majority of the site is covered in grass, buildings or sealed, limiting potential of this pathway.
Vertical/ horizontal migration of leachate through unsaturated zone	Groundwater – subsequent migration in groundwater (secondary)	Offsite users of groundwater	**Unlikely** – Given the region is serviced by municipal water supplies, the lack of registered users of groundwater down gradient of the site and the prohibition on groundwater extraction in the area.

Potential Source	Primary pathway	Receptor	Pathway present?
		Off-site ecosystems	**Unlikely** – Although groundwater from MW003 and OS5 had PFAS concentrations above ecological screening criteria, there is no evidence that groundwater discharges to surface water.
Secondary Sources			
Secondary source - PFAS In surface Water	Incidental ingestion of PFAS impacted surface waters	Site staff and intrusive maintenance workers.	**Unlikely** – whilst concentrations of PFAS were reported above the drinking water guidelines, site personnel are unlikely to come into contact with on-site surface water contained within stormwater infrastructure and drainage lines on a daily basis and the potential for incidental ingestion of this water is considered to be low.
		Users of surface water down-gradient of the site	**Potential**–concentrations of PFAS were reported above the drinking water and recreational guidelines in off-site surface water samples. While it is unlikely that personnel will come into regular contact with surface water in this area, surface water ultimately drains to Cockle Creek which is used for recreational purposes. Further investigations are required to assess potential impacts to human health.
		Ecological communities down-gradient of the site	**Potential** – whilst concentration of PFOS reported in surface water samples collected from the off-site drainage line were above the ecological investigation levels. Further sampling of surface water is required to assess the potential risks to ecological ecosystems.
Secondary source – PFAS in groundwater	Vertical/ horizontal migration	Down-gradient surface water receptors recharged by groundwater	**Potential** –PFAS was reported in groundwater at concentrations above ecological screening criteria. Surface water courses in the area may potentially be a receptor to groundwater, however, given the low concentrations, the risk to ecological receptors is considered low. Further sampling of surface water receptors are required to assess potential risks to ecological systems.

Potential Source	Primary pathway	Receptor	Pathway present?
		Abstraction bore (domestic, irrigation and/or stock use	**Unlikely** – The area is serviced by municipal water supplies and no registered groundwater bores were identified within a 1 km radius of the site. Whilst the potential for unregistered bores can not be discounted, based on the concentrations of PFAS reported in groundwater at the site boundary, the potential for use of groundwater for domestic or stock purposes is considered to be low.

10. Conclusions and recommendations

10.1 Conclusions

The Site has historically been used by Mines Rescue for the training of mine personnel in emergency response and rescue procedures, which has potentially included the use of AFFF which may have contained PFAS.

The overall objective of this investigation was to investigate and delineate the extent of PFAS identified during the previous investigation and to critically assess the potential risks to human health and key environmental receptors.

Specifically, the assessment was designed to investigate:

- Whether PFAS impacted groundwater is present on-site and if it has potentially migrated off-site at concentrations which may pose a risk to human health and/ or the environment.
- Whether PFAS impacted soils are present in on-site at concentrations which may pose a risk to human health or the environment.
- The potential for off-site migration of PFAS via surface water drainage.

With reference to these objectives, and the conceptual site model, the key findings of these works are summarised below.

Training history and potential source areas

GHD understands that the majority of training exercises were undertaken within:

- The central eastern portion of the Site
- Within the underground gallery (located within the southern portion of the Site)
- Off site to the south (within the adjoining parkland)

Objective 1: Potential for PFAS in Groundwater

- PFAS was reported in groundwater at concentrations exceeding the nominated drinking water and ecological screening criteria near the western boundary off Site (MW003) and to the south west off site (OS5).
- The inferred direction of groundwater flow was to the south west/west which was consistent with the findings of the desk top review.
- Whilst a complete pathway for migration of PFAS to groundwater was identified, groundwater is not extracted on-site and groundwater extraction is restricted within the surrounding area. Whilst the potential for unregistered bores can not be discounted, GHD notes that the area is serviced by municipal water supply. Accordingly, the potential for use and ingestion of groundwater is low.
- In regards to the ecological screening levels, surface water receptors were identified down-gradient of the site where groundwater recharge to surface water may occur. The potential risk to ecological receptors associated with PFAS in groundwater is considered to be low.

Objective 2: PFAS In soils and sediments

- PFAS was reported in soil samples collected on and off site however all samples reported PFAS concentrations which were below the nominated screening criteria for human health and ecological screening levels indicating that site soils do not present a risk to either users of the site under the current land use scenario or ecological receptors.
- Leachability testing showed that PFAS within soils on and off site have limited potential to release PFAS, and based on the concentrations reported during these works, this pathway is not considered to represent a significant on-going source of PFAS to groundwater and surface water across the Site.

Objective 3 – PFAS in surface water

- Surface water flow is managed by an onsite drainage system which discharges to the south west into a drainage channel which flows into a drainage line located to the south. This creek acts as a method of surface water transport down gradient of the site. This creek discharges into Cockle Creek, which ultimately flows to Lake Macquarie.
- PFAS in surface water on-site:
  - PFAS was reported in surface water samples collected from the on-site pit (SW Pit 01) which discharges to stormwater. Whilst concentrations were reported above the drinking water criteria, incidental contact with surface water in the drains would not be expected to present an increased risk of adverse health effects.
  - PFOS concentrations were reported for surface water sample collected from on-site pit (SW Pit 01) was above the ecological investigation levels. However, the infrastructure is not considered to represent an environment suitable for aquatic ecosystems and ecological risks associated with the presences of PFOS in on-site surface water are considered to be low.
- PFAS in surface water off site:
  - Off-site surface water samples reported PFAS concentrations above the drinking water and recreational criteria. However, noting the nature of these sampling locations, incidental contact with surface waters in this area of the drainage line is considered unlikely. However, surface waters from this creek discharges to Cockle Creek which is likely used for recreational purposes. Further sampling of surface waters is required to assess the potential impacts to human health.
- PFOS concentrations were reported in off site surface water samples above the ecological investigation levels. Further surface water sampling is required to assess the potential impacts to ecological receptors.
- GHD understands that DPI will be conducting a program of biota sampling, which will include locations within Lake Macquarie and stopping at the mouth of Cockle Creek. GHD understands that the results of these investigations will be available in 2018 and the results of these works will provide a better indication of potential PFAS impacts, if any, within surface water receptors.

10.2 Recommendations

Based on the findings of these works, the following recommendations are made:

- Installation of groundwater wells down gradient of the Site and an additional round of monitoring to confirm off-site PFAS concentrations and assess the potential for seasonal variation of PFAS concentrations in groundwater. All wells to be sampled for PFAS and major cations and anions.
- An additional round of surface water and sediment sampling from existing monitoring locations to assess the potential for seasonal variation in PFAS concentrations. Sampling should include a wet weather sampling event to assess PFAS concentrations in surface water and sediments during wet weather flow.
- Complete a survey of water use within the area to better characterise groundwater and surface water use in the area, including understanding of the potential for domestic users of groundwater in proximity of the site and refine the CSM with respect to migration of PFAS at concentrations above the drinking water criteria.
- Controlled removal of residual sediment from on-site infrastructure collection points.

11. References

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12. Limitations

This report has been prepared by GHD for Coal Services and may only be used and relied on by Coal Services for the purpose agreed between GHD and the Coal Services as set out in this report.

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

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

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

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

Where data supplied by Coal Services or other external sources, including previous site investigation data and site plans, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by GHD for incomplete or inaccurate data supplied by others.

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

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

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

Appendices

Appendix A – Figures

Paper Size A4

0 20 40 60 80

Scale (metres)

LEGEND

Site boundary

N

Mines Rescue Pty Ltd
Argenton Mines Rescue Station
533 Lake Road, Argenton, NSW

Site Location

Job Number	22-19058
Revision	0
Date	7 Sep 2017

Figure 1

GHD\Launceston\22\19058\2219058_LTN_02_Argenton.cdr

Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com

Paper Size A4

0 10 20 30

Scale (metres)

LEGEND

- Site boundary
- Slight ridge (where surface flow splits)
- Surface flow
- Sewer discharge point
- Pits
- Underground storage tank
- Oil water separator
- Waste water pipework

N

Mines Rescue Pty Ltd
Argenton Mines Rescue Station
533 Lake Road, Argenton, NSW

Site Layout

Job Number	22-19058
Revision	0
Date	15 Sep 2017

Figure 2

GHD\Launceston\22\19058\2219058_LTN_02_Argenton.cdr

Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com

Paper Size A4

0 10 20 30

Scale (metres)

LEGEND

- Previous drainage sediment sample location
- Soil/sediment/surface water sampling location
- Groundwater monitoring location (installed Aug 2017)
- Existing groundwater monitoring location
- Site boundary
- Previous surface sample location

N

Mines Rescue Pty Ltd
Argenton Mines Rescue Station
533 Lake Road, Argenton, NSW

Sample Locations

Job Number	22-19058
Revision	0
Date	7 Sep 2017

Figure 3

GHD\Launceston\22\19058\2219058_LTN_03_Argenton.cdr

Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com

Paper Size A4

0 10 20 30

Scale (metres)

LEGEND

- Site boundary
- Groundwater monitoring location (installed Aug 2017)
- Existing groundwater monitoring location
- Groundwater flow direction
- 2.0 Groundwater contour

N

Mines Rescue Pty Ltd
Argenton Mines Rescue Station
533 Lake Road, Argenton, NSW

Groundwater Contours

Job Number	22-19058
Revision	0
Date	10 Oct 2017

Figure 4

GHD\Launceston\22\19058\2219058_LTN_04a_Argenton.cdr

Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com

Paper Size A4

0 10 20 30

Scale (metres)

LEGEND

- Previous drainage sediment sample location
- Soil/sediment/surface water sampling location
- Groundwater monitoring location (installed Aug 2017)
- Existing groundwater monitoring location
- Site boundary
- Previous surface sample location

N

Mines Rescue Pty Ltd
Argenton Mines Rescue Station
533 Lake Road, Argenton, NSW

Job Number	22-19058
Revision	0
Date	7 Sep 2017

Groundwater & Surface Water Results Summary

Figure 5

GHD\Launceston\22\19058\2219058_LTN_05_Argenton.cdr

Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com

Appendix B – Desktop information

Macquarie Tuggerah Lakes Basin

bookmark this page

All data times are Eastern Standard Time

Map

Scale = 1 : 6771 | 151.612, -32.933

NSW Office of Water
Work Summary

GW079078

Licence: **Licence Status:**

Authorised Purpose(s):
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status:
Construct.Method:
Owner Type:

Commenced Date: **Final Depth:**
Completion Date: **Drilled Depth:**

Contractor Name:
Driller:
Assistant Driller:

Property: **Standing Water Level (m):**
GWMA: **Salinity Description:**
GW Zone: **Yield (L/s):**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:		.	
Licensed:			

Region: 20 - Hunter **CMA Map:**
River Basin: - Unknown **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6355009.0 **Latitude:** 32°56'08.1"S
Elevation Source: Unknown **Easting:** 370925.0 **Longitude:** 151°37'09.6"E

GS Map: - **MGA Zone:** 0 **Coordinate Source:** Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

11/10/1999: Form A Remarks:
LAKE MACQUARIE CITY COUNCIL
BOOLAROO

SAMPLE: D0782/107/1
BORE 1
27/11/2009: Reviewed data - nothing to update.

***** End of GW079078 *****

NSW Office of Water
Work Summary

GW079080

Licence:
Licence Status:
Authorised Purpose(s):
Intended Purpose(s): MONITORING BORE
Work Type: Bore
Work Status:
Construct.Method:
Owner Type:
Commenced Date:
Completion Date:
Final Depth:
Drilled Depth:
Contractor Name:
Driller:
Assistant Driller:
Property:
GWMA:
GW Zone:
Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:		.	
Licensed:			

Region: 20 - Hunter
River Basin: - Unknown
Area/District:
CMA Map:
Grid Zone:
Scale:
Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6355009.0
Easting: 370715.0
Latitude: 32°56'08.0"S
Longitude: 151°37'01.5"E
GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

11/10/1999: Form A Remarks:
LAKE MACQUARIE CITY COUNCIL
BOOLAROO

SAMPLE: D0782/107/3
BORE 4
27/11/2009: Reviewed data - nothing to update.

***** End of GW079080 *****

NSW Office of Water
Work Summary

GW079081

Licence:
Licence Status:
Authorised Purpose(s):
Intended Purpose(s): MONITORING BORE
Work Type: Bore
Work Status:
Construct.Method:
Owner Type:
Commenced Date:
Completion Date:
Final Depth:
Drilled Depth:
Contractor Name:
Driller:
Assistant Driller:
Property:
GWMA:
GW Zone:
Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:		.	
Licensed:			

Region: 20 - Hunter
River Basin: - Unknown
Area/District:
CMA Map:
Grid Zone:
Scale:
Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6354999.0
Easting: 370595.0
Latitude: 32°56'08.3"S
Longitude: 151°36'56.9"E
GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

11/10/1999: Form A Remarks:
LAKE MACQUARIE CITY COUNCIL
BOOLAROO

SAMPLE: D0782/107/4
BORE 6
27/11/2009: Reviewed data - nothing to update.

***** End of GW079081 *****

NSW Office of Water
Work Summary

GW079086

Licence: | **Licence Status:**

Authorised Purpose(s):
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status:
Construct.Method:
Owner Type:

Commenced Date: | **Final Depth:**
Completion Date: | **Drilled Depth:**

Contractor Name:
Driller:
Assistant Driller:

Property: | **Standing Water Level (m):**
GWMA: | **Salinity Description:**
GW Zone: | **Yield (L/s):**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:		.	
Licensed:			

Region: 20 - Hunter | **CMA Map:**
River Basin: - Unknown | **Grid Zone:** | **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) | **Northing:** 6354769.0 | **Latitude:** 32°56'15.8"S
Elevation Source: Unknown | **Easting:** 370805.0 | **Longitude:** 151°37'04.8"E

GS Map: - | **MGA Zone:** 0 | **Coordinate Source:** Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

11/10/1999: Form A Remarks:
LAKE MACQUARIE CITY COUNCIL
BOOLAROO

SAMPLE: D0782/107/9
CLIENT ID: EAST TRIBUTARY
27/11/2009: Reviewed data - nothing to update.

***** End of GW079086 *****

NSW Office of Water
Work Summary

GW079087

Licence: | **Licence Status:**

Authorised Purpose(s):
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status:
Construct.Method:
Owner Type:

Commenced Date: | **Final Depth:**
Completion Date: | **Drilled Depth:**

Contractor Name:
Driller:
Assistant Driller:

Property: | **Standing Water Level (m):**
GWMA: | **Salinity Description:**
GW Zone: | **Yield (L/s):**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:		.	
Licensed:			

Region: 20 - Hunter | **CMA Map:**
River Basin: - Unknown | **Grid Zone:** | **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) | **Northing:** 6354849.0 | **Latitude:** 32°56'13.3"S
Elevation Source: Unknown | **Easting:** 370995.0 | **Longitude:** 151°37'12.2"E

GS Map: - | **MGA Zone:** 0 | **Coordinate Source:** Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

11/10/1999: Form A Remarks:
LAKE MACQUARIE CITY COUNCIL
BOOLAROO

SAMPLE: D0782/107/10
CLIENT ID: NORTH TRIBUTARY
27/11/2009: Reviewed data - nothing to update.

***** End of GW079087 *****

NSW Office of Water
Work Summary

GW080307

Licence: 20BL168438 **Licence Status:** ACTIVE

Authorised Purpose(s): TEST BORE
Intended Purpose(s):

Work Type: Well
Work Status:
Construct.Method:
Owner Type:

Commenced Date:
Completion Date: 01/01/2001
Final Depth: 3.82 m
Drilled Depth:

Contractor Name: REYNOLDS DRILLING
Driller:
Assistant Driller:

Property: N/A RACECOURSE ROAD TERALBA 2284
GWMA: -
GW Zone: -
Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.059	LT2 DP16062
Licensed:	NORTHUMBERLAND	TERALBA	Whole Lot 4//16062

Region: 20 - Hunter
River Basin: 211 - MACQUARIE - TUGGERAH LAKES
Area/District:
CMA Map: 9232-3S
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: (Unknown)
Northing: 6355098.0
Easting: 370906.0
Latitude: 32°56'05.2"S
Longitude: 151°37'08.9"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	3.82	0			Unknown

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

01/01/2001: Form A Remarks:
Wells drilled for environmental investigation. Top of casing at ground level with gatic cover and locable caps

***** End of GW080307 *****

NSW Office of Water
Work Summary

GW080308

Licence: 20BL168438 **Licence Status:** ACTIVE

Authorised Purpose(s): TEST BORE
Intended Purpose(s):

Work Type: Well
Work Status:
Construct.Method:
Owner Type:

Commenced Date: **Final Depth:** 4.07 m
Completion Date: 01/01/2001 **Drilled Depth:**

Contractor Name: REYNOLDS DRILLING
Driller:
Assistant Driller:

Property: N/A RACECOURSE ROAD TERALBA 2284 **Standing Water Level (m):**
GWMA: - **Salinity Description:**
GW Zone: - **Yield (L/s):**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.059	LT2 DP16062
Licensed:	NORTHUMBERLAND	TERALBA	Whole Lot 4//16062

Region: 20 - Hunter **CMA Map:** 9232-3S
River Basin: 211 - MACQUARIE - TUGGERAH LAKES **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6354963.0 **Latitude:** 32°56'09.6"S
Elevation Source: (Unknown) **Easting:** 370873.0 **Longitude:** 151°37'07.6"E

GS Map: - **MGA Zone:** 0 **Coordinate Source:** Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	4.07	0			Unknown

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

01/01/2001: Form A Remarks:
Wells drilled for environmental investigation. top of casing at ground level with gatic cover and locable caps

***** End of GW080308 *****

NSW Office of Water
Work Summary

GW080309

Licence: 20BL168438 **Licence Status:** ACTIVE

Authorised Purpose(s): TEST BORE
Intended Purpose(s):

Work Type: Well
Work Status:
Construct.Method:
Owner Type:

Commenced Date:
Completion Date: 01/01/2001
Final Depth: 4.10 m
Drilled Depth:

Contractor Name: REYNOLDS DRILLING
Driller:
Assistant Driller:

Property: N/A RACECOURSE ROAD TERALBA 2284
GWMA: -
GW Zone: -
Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.059	LT4 DP16062
Licensed:	NORTHUMBERLAND	TERALBA	Whole Lot 4//16062

Region: 20 - Hunter
River Basin: 211 - MACQUARIE - TUGGERAH LAKES
Area/District:
CMA Map: 9232-3S
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: (Unknown)
Northing: 6354945.0
Easting: 370768.0
Latitude: 32°56'10.1"S
Longitude: 151°37'03.5"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	4.10	0			Unknown

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

01/01/2001: Form A Remarks:
Wells drilled for environmental investigation. Top of casing at ground level with gtic cover and locable caps

***** End of GW080309 *****

NSW Office of Water
Work Summary

GW080310

Licence: 20BL168438 **Licence Status:** ACTIVE

Authorised Purpose(s): TEST BORE
Intended Purpose(s):

Work Type: Well
Work Status:
Construct.Method:
Owner Type:

Commenced Date:
Completion Date: 01/01/2001
Final Depth: 4.04 m
Drilled Depth:

Contractor Name: REYNOLDS DRILLING
Driller:
Assistant Driller:

Property: N/A RACECOURSE ROAD TERALBA 2284
GWMA: -
GW Zone: -
Standing Water Level (m):
Salinity Description:
Yield (L/s):

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.059	LT4 DP16062
Licensed:	NORTHUMBERLAND	TERALBA	Whole Lot 4//16062

Region: 20 - Hunter
River Basin: 211 - MACQUARIE - TUGGERAH LAKES
Area/District:
CMA Map: 9232-3S
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: (Unknown)
Northing: 6354946.0
Easting: 370768.0
Latitude: 32°56'10.1"S
Longitude: 151°37'03.5"E

GS Map: -
MGA Zone: 0
Coordinate Source: Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	4.04	0			Unknown

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

01/01/2001: Form A Remarks:
Wells drilled for environmental investigation. Top of casing at ground level with gatic cover and locable caps

***** End of GW080310 *****

NSW Office of Water
Work Summary

GW080314

Licence: 20BL168438 **Licence Status:** ACTIVE

Authorised Purpose(s): TEST BORE
Intended Purpose(s):

Work Type: Well
Work Status:
Construct.Method:
Owner Type:

Commenced Date: **Final Depth:** 4.03 m
Completion Date: 01/01/2001 **Drilled Depth:**

Contractor Name: REYNOLDS DRILLING
Driller:
Assistant Driller:

Property: N/A RACECOURSE ROAD TERALBA 2284 **Standing Water Level (m):**
GWMA: - **Salinity Description:**
GW Zone: - **Yield (L/s):**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH.059	LT2 DP341679
Licensed:	NORTHUMBERLAND	TERALBA	Whole Lot 4//16062

Region: 20 - Hunter **CMA Map:** 9232-3S
River Basin: 211 - MACQUARIE - TUGGERAH LAKES **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6354989.0 **Latitude:** 32°56'08.8"S
Elevation Source: (Unknown) **Easting:** 371143.0 **Longitude:** 151°37'18.0"E

GS Map: - **MGA Zone:** 0 **Coordinate Source:** Unknown

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	4.03	0			Unknown

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments

Remarks

01/01/2001: Form A Remarks:
Wells drilled for environmental investigation. Top of casing at gorund level with gatic cover and locable caps

***** End of GW080314 *****

NSW Office of Water
Work Summary

GW202447

Licence: 20BL173323 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method:
Owner Type: Private

Commenced Date:
Completion Date: 01/07/2010
Final Depth: 5.00 m
Drilled Depth: 5.20 m

Contractor Name:
Driller: Unkown Unknown
Assistant Driller:

Property: N A 75 GRIFFEN ROAD TERALBA 2284
GWMA:
GW Zone:
Standing Water Level: 3.260
Salinity:
Yield:

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH,59	5//16062
Licensed:			

Region: 20 - Hunter
River Basin: 210 - HUNTER RIVER
Area/District:
CMA Map: 9232-3S
Grid Zone:
Scale:

Elevation: 0.00 m (A.H.D.)
Elevation Source: Unknown
Northing: 6354975.0
Easting: 370710.0
Latitude: 32°56'09.1"S
Longitude: 151°37'01.3"E

GS Map: -
MGA Zone: 0
Coordinate Source: GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	5.20	0			(Unknown)
1		Annulus	Bentonite	0.00	1.30				
1		Annulus	Waterworn/Rounded	1.30	5.00				Graded
1		Backfill	Bentonite	5.00	5.20				
1	1	Casing		0.00	5.00				Seated
1	1	Opening	Slots	1.50	5.00			1	()

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	0.50	0.50	Fill, Clayey Sand; medium dense, slightly	Fill	

			moist, low plasticity, grey-brown, contains wood & leaves		
0.50	0.90	0.40	Fill, Gravel; slightly moist, black stained gravels, HC odour	Fill	
0.90	1.70	0.80	Sandy Clay; medium stiff, slightly moist, medium plasticity, grey-brown, slight HC odour	Sandy Clay	
1.70	2.20	0.50	Sand; very loose, very moist, grye-brown, HC odour	Sand	
2.20	3.00	0.80	Sand; as above, grey, HC odour, becomes saturated @ 2.2m	Sand	
3.00	3.80	0.80	Sand; as above, black staining & potential HC visible from 3.0-3.2m	Sand	
3.80	4.70	0.90	Sandy Clay; medium stiff, saturated, HC odour	Sandy Clay	
4.70	5.20	0.50	Clay; hgih plasticity, moist, no odour	Clay	

Remarks

01/07/2010: Form A Remarks:
Nat Carling, 11-Oct-2012; All details were provided on consultants log & location map.

***** End of GW202447 *****

NSW Office of Water
Work Summary

GW202448

Licence: 20BL173323 **Licence Status:** ACTIVE

Authorised Purpose(s): MONITORING BORE
Intended Purpose(s): MONITORING BORE

Work Type: Bore
Work Status: Equipped
Construct.Method:
Owner Type: Private

Commenced Date: **Final Depth:** 4.20 m
Completion Date: 01/07/2010 **Drilled Depth:** 4.20 m

Contractor Name:
Driller: Unkown Unknown
Assistant Driller:

Property: N A 75 GRIFFEN ROAD TERALBA 2284 **Standing Water Level:** 3.790
GWMA: **Salinity:**
GW Zone: **Yield:**

Site Details

Site Chosen By:

	County	Parish	Cadastre
Form A:	NORTH	NORTH,59	5//16062
Licensed:			

Region: 20 - Hunter **CMA Map:** 9232-3S
River Basin: 210 - HUNTER RIVER **Grid Zone:** **Scale:**
Area/District:

Elevation: 0.00 m (A.H.D.) **Northing:** 6355145.0 **Latitude:** 32°56'03.6"S
Elevation Source: Unknown **Easting:** 370725.0 **Longitude:** 151°37'02.0"E

GS Map: - **MGA Zone:** 0 **Coordinate Source:** GIS - Geographic Information System

Construction

Negative depths indicate Above Ground Level; C-Cemented; SL-Slot Length; A-Aperture; GS-Grain Size; Q-Quantity; PL-Placement of Gravel Pack; PC-Pressure Cemented; S-Sump; CE-Centralisers

Hole	Pipe	Component	Type	From (m)	To (m)	Outside Diameter (mm)	Inside Diameter (mm)	Interval	Details
1		Hole	Hole	0.00	4.20	0			(Unknown)
1		Annulus	Bentonite	0.00	1.90				
1		Annulus	Waterworn/Rounded	1.90	4.20				Graded
1	1	Casing		0.00	4.20				Seated on Bottom
1	1	Opening	Slots	2.20	4.20			1	()

Water Bearing Zones

From (m)	To (m)	Thickness (m)	WBZ Type	S.W.L. (m)	D.D.L. (m)	Yield (L/s)	Hole Depth (m)	Duration (hr)	Salinity (mg/L)

Geologists Log
Drillers Log

From (m)	To (m)	Thickness (m)	Drillers Description	Geological Material	Comments
0.00	0.20	0.20	Fill, Sand; medium dense, slightly moist, dark brown, contains gravel & roots	Fill	

0.20	0.50	0.30	Fill, Gravel; very loose, slightly moist, grey & black	Fill	
0.50	0.90	0.40	Sand; medium dense, slightly moist, dark brown, fine grained	Sand	
0.90	1.30	0.40	Sand; as above, becomes grey-brown	Sand	
1.30	2.40	1.10	Sand; as above, becomes grey with minor orange staining	Sand	
2.40	2.60	0.20	Sand; as above, becomes very moist to saturated, slight organic odour	Sand	
2.60	3.30	0.70	Sand; as above, strong organic odour notes from 2.5m, becomes saturated @ 2.6m	Sand	
3.30	3.50	0.20	Sandy Clay; soft, saturated, high plasticity, grey-brown, organic odour	Sandy Clay	
3.50	3.60	0.10	Clayey sand; loose, saturated, low plasticity, grey, strong organic odour	Clayey Sand	
3.60	4.20	0.60	Sand; loose, saturated, grey, strong organic odour	Sand	

Remarks

01/07/2010: Form A Remarks:
Nat Carling, 11-Oct-2012; All details were provided on consultants log & location map.

***** End of GW202448 *****

Lotsearch

Aerial Imagery Report

533 Lake Road, Argenton, NSW 2284

Report Date: **21 July 2017**

Aerial Imagery 2016

533 Lake Road, Argenton, NSW 2284

Scale:
0 25 50 100
Meters

Data Sources: Aerial Imagery © 2017 Google Inc, used with permission. Google and the Google logo are registered trademarks of Google Inc.

Coordinate System:
GDA 1994 MGA Zone 56

Date: 20 July 2017

Aerial Imagery 2014

533 Lake Road, Argenton, NSW 2284

Scale: 0 25 50 100 Meters	Data Sources: Historical Aerials: © Department Finance, Services & Innovation	Coordinate System: GDA 1994 MGA Zone 56	Date: 21 July 2017

Aerial Imagery 2007

533 Lake Road, Argenton, NSW 2284

Scale: 0 25 50 100 Meters	Data Sources: Aerial Imagery © 2017 Google Inc, used with permission. Google and the Google logo are registered trademarks of Google Inc.	Coordinate System: GDA 1994 MGA Zone 56	Date: 20 July 2017

Aerial Imagery 2005

533 Lake Road, Argenton, NSW 2284

Scale: 0 25 50 100 Meters

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Coordinate System: GDA 1994 MGA Zone 56

Date: 20 July 2017

Aerial Imagery 1993

533 Lake Road, Argenton, NSW 2284

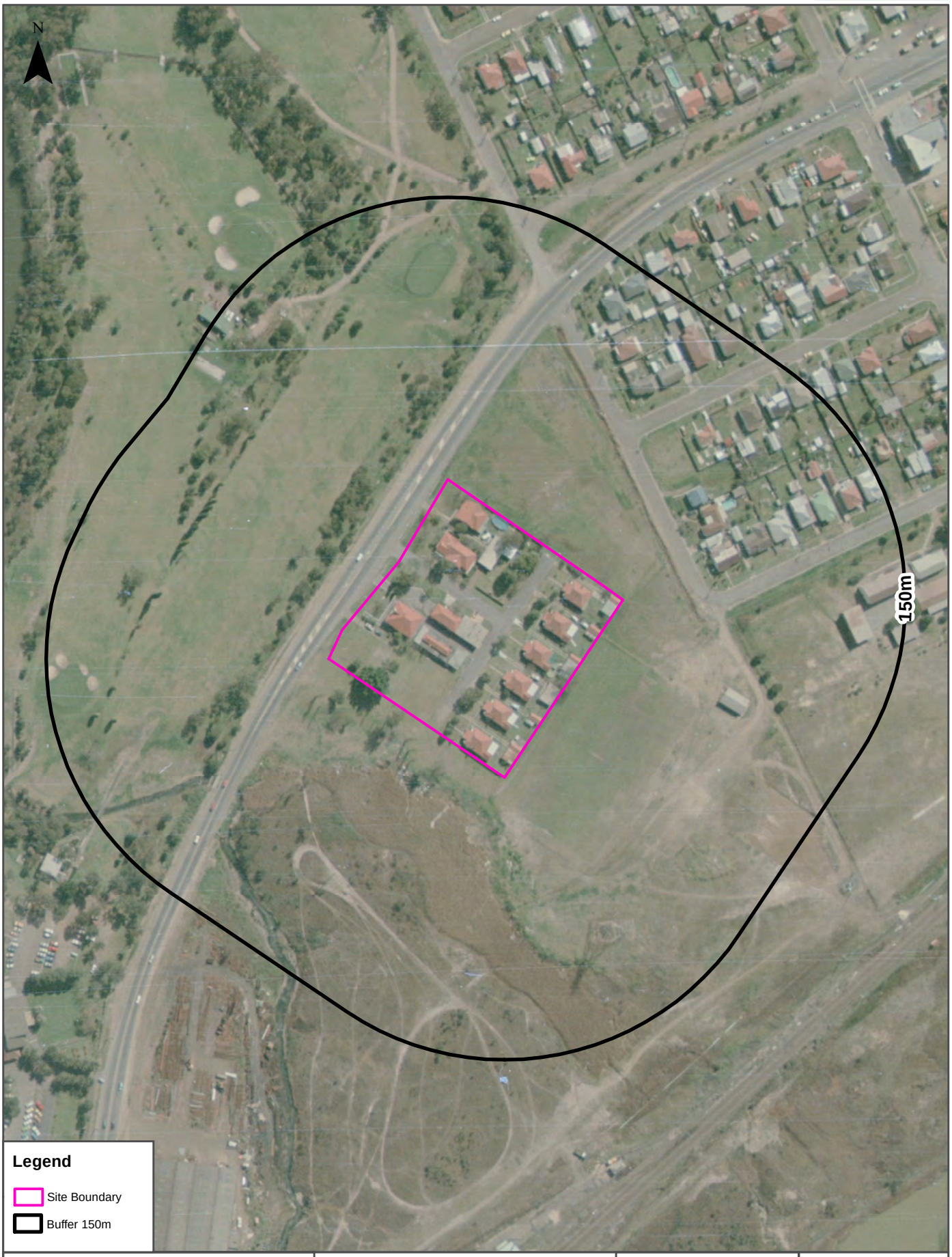
Data Sources: Historical Aerials: © Department Finance, Services & Innovation

Coordinate System: GDA 1994 MGA Zone 56

Date: 20 July 2017

Aerial Imagery 1983

533 Lake Road, Argenton, NSW 2284



Scale: 0 25 50 100 Meters	Data Sources: Historical Aerials: © Department Finance, Services & Innovation	Coordinate System: GDA 1994 MGA Zone 56	Date: 20 July 2017

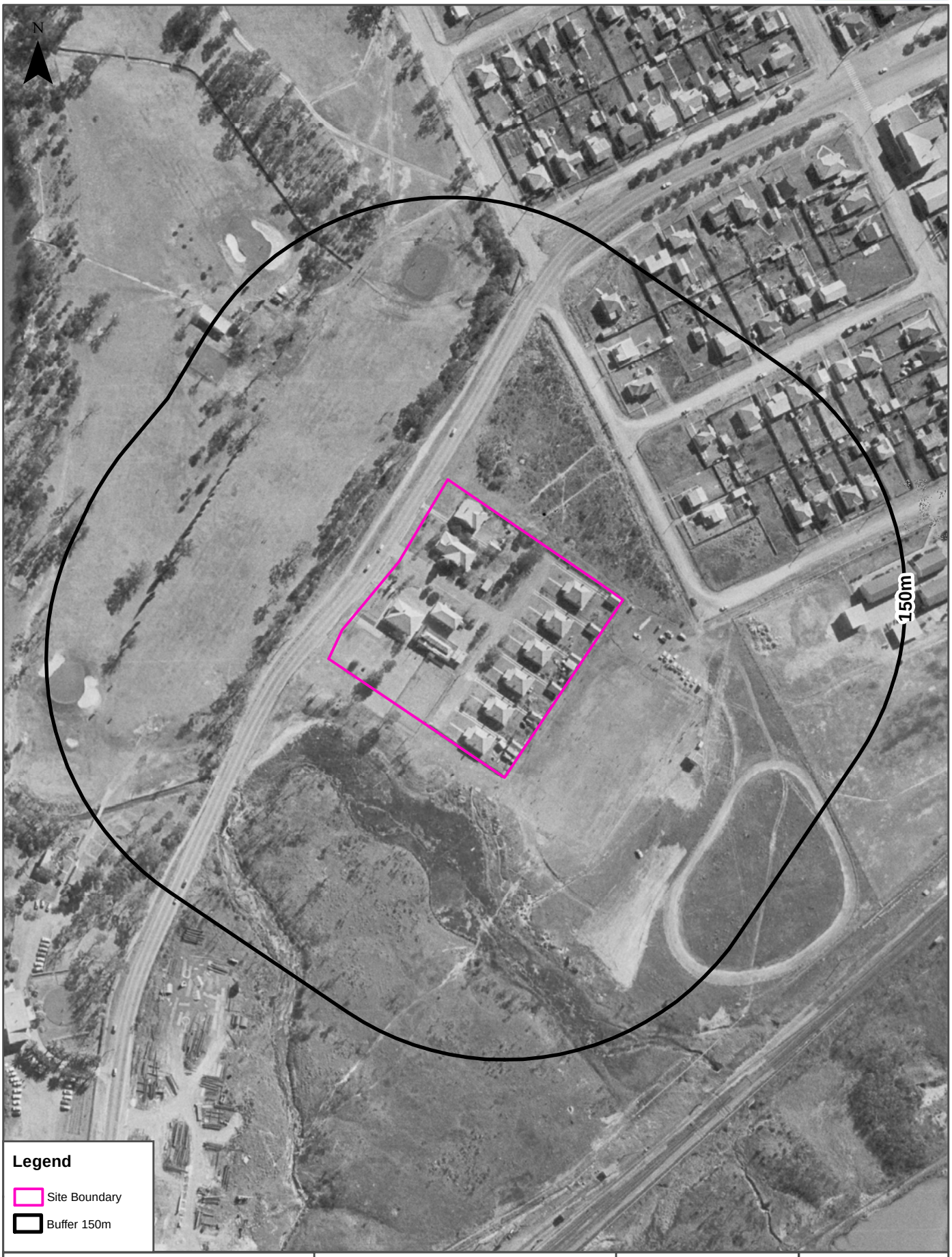
Aerial Imagery 1976

533 Lake Road, Argenton, NSW 2284

Scale: 0 25 50 100 Meters	Data Sources: Historical Aerials: © Department Finance, Services & Innovation	Coordinate System: GDA 1994 MGA Zone 56	Date: 20 July 2017

Aerial Imagery 1965

533 Lake Road, Argenton, NSW 2284



Aerial Imagery 1954

533 Lake Road, Argenton, NSW 2284

Scale: 0 25 50 100 Meters	Data Sources: Historical Aerials: © Department Finance, Services & Innovation	Coordinate System: GDA 1994 MGA Zone 56	Date: 21 July 2017

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Appendix C – Field sampling sheets and calibration certificates

GHD CLIENTS | PEOPLE | PERFORMANCE

Daily Record Sheet

ALEX VAC UNIT NEWCASTLE LOCATING SERVICES 0410 698 599

Client: GHD		**Job No:** 2219058	
Job Name: PFAS INVESTIGATIONS		**Date:** 15/8/17	
GHD Representatives:	TC	**Arrival Time:** 8am	**Departure Time:** 3:15pm
Weather Conditions:	(Please circle) **Fine** **Overcast** **Light Rain** **Heavy Rain** **Other**_____		
Works Being Undertaken:	SERVICE LOCATION		

Personnel/Contractor(s) Present (List all); Inducted into GHD H&SP?	Inducted	Arrival Time	Departure Time
SURESEARCH			
CALYN WILKINSON	Y	8am	315

Photographs Taken: (Please circle) **Yes** **No** **If Yes, list below or attach photo register.**

Location	Time	Record of Activities / Issues Encountered / Discussions with Client/Contractors / Sketch / Notes
8a.m ↔ SITE		MEET LOCATOR DISCUSS WORKS.
	8:15	MEET SITE CONTACT (HOWARD). SIGN IN. INDUCTION.
	8:30	Site walkover / familiarisation
	9:00	JSEA / PWSA. REVISE DBYDs / SITE SERVICES PLAN.
	9:30	Commence locating.
		Clear four locations due to site evidence of
		activities in area not proposed for subsequent
		discussion w/ JM.
	10:50	Pack up. Sign out.
	11:10	Leave site. Fuel.
	12:00	Arrive @ Argenton. Meet site contact (DARREN).
	12:20	PWSA / JSEA. REVISE DBYDs. REVISE SITE SERVICE PLANS
	12:50	Commence locating
	2:30	DISCUSS MW003 RELOCATION. CAN'T DUE TO GALLERY.
		DISCUSS POTHOLING.
	3PM	COMPLETE LOCATING W/ PROVISO OF POTHOLING
		MW003
	3:05	PAPER WORK
	3:10	SIGN OUT
	3:15	LEAVE SITE

Is a Notice of Proposed Variation, Variation Order or Site Instruction Required? (Please circle) **Yes** **No**

Provide Details:

Are there any H&S requirements to be considered for future works?

CALIBRATION RECORD

PID – Serial/Model No. NA **Time**.....

Sensor	Calibration Standards Used	Readings After Calibration	
		Zero	Span
PID	0.0 / 100 ppm Isobutylene		
Comments			

Water Meter – Serial/Model No. N/A **Time**.....

Sensor	Calibration Standards Used	Reading After Calibration	Comments
pH 7.00	pH 7.00		
pH 4.00	pH 4.00		
EC			
DO Zero	0.0 (Sodium Sulphite)		
DO Air	Saturation in Air		
Redox			
Comments (i.e. Temperature)			

Water Meter – Serial/Model No. NA **Time**.....

Sensor	Calibration Standards Used	Reading After Calibration	Comments
pH 7.00	pH 7.00		
pH 4.00	pH 4.00		
EC			
DO Zero	0.0 (Sodium Sulphite)		
DO Air	Saturation in Air		
Redox			
Comments (i.e. Temperature)			

SITES SAMPLED

CLEARING LOCATIONS ONLY

QC SAMPLES

FIELD SUPERVISOR T. Cye **CHECKED** (SIGN & DATE) 15/8/17

Gas free Checks NA

Location	Time	LEL	O_2	PID

Daily Environmental Checklist

	Satisfactory		Action Required
	Yes	No	
Site looks clear and neat	✓		
Area free of litter	✓		
All wastes placed in appropriate bins	✓		
No leaks or emission problems in vehicles or plant equipment	✓		
All contaminated solid waste stored correctly	✓		
All Staff and contractors have read and signed HASP and EMP acceptance forms	✓		
No excessive noise generated	✓		
Spare equipment stored in a tidy manner	✓		
Work areas tidy	✓		
Vehicles parked in designated areas	✓		
Contractors have completed Daily vehicle inspection checklist	✓		
Signature and Date	T. Cope		

GHD CLIENTS|PEOPLE|PERFORMANCE

Daily Record Sheet

Client: [redacted] MINES RESCUE		**Job No:** 2219058	
Job Name: PFAS INVESTIGATIONS		**Date:** 17/8/17	
GHD Representatives:	TC	**Arrival Time:** 7.30am	**Departure Time:** 4:20pm
Weather Conditions:	(Please circle) (Fine) Overcast Light Rain Heavy Rain Other_____		
Works Being Undertaken:	INSTALLING MWs		

Personnel/Contractor(s) Present (List all); Inducted into GHD H&SP?	Inducted	Arrival Time	Departure Time
TERRATEST			
Jason Tucker	Y	PRE 7:30	3:45pm
Matt Warren	Y	"	"

Photographs Taken: (Please circle) **Yes** **No** **If Yes, list below or attach photo register.**

Location	Time	Record of Activities / Issues Encountered / Discussions with Client/Contractors / Sketch / Notes
Argenton	730	ARRIVE ONSITE. MEET DRILLERS
Mines	740	SIGN IN & WAIT FOR DARREN. UNDERTAKE INDUCTION
Rescue	8:05	Move to MW001. Prep for works.
	8:30	JSEA/ PWSA. CONTINUE PREP WORKS
	8:35	COMMENCE HA @ MW001. Clear to 0.5mbgl
	8:50	Push tube to 2.2M
		* Service Struck. Agricultural drainage pipe @ 0.55mbgl
		Discuss options w/ drillers, Darren & Alison. Dig up for repairs*
	9:25	JT to bunnings for repair connectors. TC & MW to clear MW002 to 0.7mbgl
	10:40	JT ~~tear~~ repair ~~MW003~~ ag pipe, Move immediately adjacent. Concrete @ 0.12mbgl. Appears to be slab (driveway/footpath). Break up & continue to 0.7M
		Recommence PTs. PT to 7M.
		SFA to 7M
	12:40	Complete SAND/BENTONITE BACKFILLING @ MW001. LUNCH
	12:45	TC to sed/ water sample
	1:10	DRILLERS RECOMMENCE MW002
		PT to 7M SFA to 8M
	2:~~30~~	Scott cancel NDD. Joel rebook NDD
	3:15	Complete MW002. Pack up
	320	MW002 DTW = 0.82 mBTOC
	3:45	DRILLERS LEAVE. TAS SAMPLE SWALE 1, SWALE 2 & BRIDGE 1
	4:20	Leave site

Is a Notice of Proposed Variation, Variation Order or Site Instruction Required? (Please circle) **Yes** **No**

Provide Details:

Are there any H&S requirements to be considered for future works?

CALIBRATION RECORD

PID – Serial/Model No..... **Time**.....

Sensor	Calibration Standards Used	Readings After Calibration	
		Zero	Span
PID	0.0 / 100 ppm Isobutylene		
Comments			

Water Meter – Serial/Model No..... **Time**.....

Sensor	Calibration Standards Used	Reading After Calibration	Comments
pH 7.00	pH 7.00		
pH 4.00	pH 4.00		
EC			
DO Zero	0.0 (Sodium Sulphite)		
DO Air	Saturation in Air		
Redox			
Comments (i.e. Temperature)			

Water Meter – Serial/Model No..... **Time**.....

Sensor	Calibration Standards Used	Reading After Calibration	Comments
pH 7.00	pH 7.00		
pH 4.00	pH 4.00		
EC			
DO Zero	0.0 (Sodium Sulphite)		
DO Air	Saturation in Air		
Redox			
Comments (i.e. Temperature)			

SITES SAMPLED

MW001	BRIDGE 1			FD001 = MW001_0.0-0.1
MW002				FD002 = MW002_0.2-0.4
POND 1				FD003 = BRIDGE 1
POND 2				
SWALE 1				
SWALE 2				

QC SAMPLES

FIELD SUPERVISOR T. Cope **CHECKED** (SIGN & DATE) 17/8/17

Gas free Checks NA

Location	Time	LEL	O_2	PID

Daily Environmental Checklist

	Satisfactory		Action Required
	Yes	No	
Site looks clear and neat	✓		
Area free of litter	✓		
All wastes placed in appropriate bins	✓		
No leaks or emission problems in vehicles or plant equipment	✓		
All contaminated solid waste stored correctly	✓		
All Staff and contractors have read and signed HASP and EMP acceptance forms	✓		
No excessive noise generated	✓		
Spare equipment stored in a tidy manner	✓		
Work areas tidy	✓		
Vehicles parked in designated areas	✓		
Contractors have completed Daily vehicle inspection checklist	✓		
Signature and Date	T. Cope		17/8/17

GHD CLIENTS | PEOPLE | PERFORMANCE

Daily Record Sheet

Client:		**Job No:**	
Job Name:		**Date:** 18/8/17	
GHD Representatives:	John Fook	**Arrival Time:** 700	**Departure Time:**
Weather Conditions:	(Please circle) (Fine) – (Overcast) **Light Rain** **Heavy Rain** **Other** Windy		
Works Being Undertaken:			

Personnel/Contractor(s) Present (List all); Inducted into GHD H&SP?	Inducted	Arrival Time	Departure Time

Photographs Taken: (Please circle) **Yes** **No** **If Yes, list below or attach photo register.**

Location	Time	Record of Activities / Issues Encountered / Discussions with Client/Contractors / Sketch / Notes
	0700	arrive on ste
		Brife Vac truck guys
		Induction, site walkover
	0735	speak with TC RE: location
		and potential issues
	0800	set up out front with Vac truck
		Identify wher to NDD, go thrug JSEA
	0830	start Vac, Drillers arrive.
	0900	Dipped wells while NDD still going
		MW001 = DTW- Dry T= 6.88 MW002 = DTW- 4.14, T- 7.99
	0930	Stop on NDD. Sign off paperwork
		Dipped 2 wells "off site" OS 5 - 2.01 DTW, 3.98 Total, 0.54 riser
		and OS 5A - 6.365 DTW, 27.505 Total, 0.57 Riser.
	0950	start Push tubes - to 8m collaps to 4.10
	1040	Start augers
	11:00	Stop augers clean off allow to sit for water
	11 30	DTW ~ 4.33 Spok with Alison - install 6m screen riser to surface.
	1240	set up to develop well

Is a Notice of Proposed Variation, Variation Order or Site Instruction Required? (Please circle) **Yes** **No**

Provide Details:

Are there any H&S requirements to be considered for future works?

7.8 1.5 to see grout. rest.

CALIBRATION RECORD

PID – Serial/Model No..... **Time.....**

Sensor	Calibration Standards Used	Readings After Calibration	
		Zero	Span
PID	0.0 / 100 ppm Isobutylene		
Comments			

Water Meter – Serial/Model No..... **Time.....**

Sensor	Calibration Standards Used	Reading After Calibration	Comments
pH 7.00	pH 7.00		
pH 4.00	pH 4.00		
EC			
DO Zero	0.0 (Sodium Sulphite)		
DO Air	Saturation in Air		
Redox			
Comments (i.e. Temperature)			

Water Meter – Serial/Model No..... **Time.....**

Sensor	Calibration Standards Used	Reading After Calibration	Comments
pH 7.00	pH 7.00		
pH 4.00	pH 4.00		
EC			
DO Zero	0.0 (Sodium Sulphite)		
DO Air	Saturation in Air		
Redox			
Comments (i.e. Temperature)			

SITES SAMPLED **QC SAMPLES**

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FIELD SUPERVISOR ..... **CHECKED** (SIGN & DATE) .....

Gas free Checks

Location	Time	LEL	O_2	PID

Daily Environmental Checklist

	Satisfactory		Action Required
	Yes	No	
Site looks clear and neat			
Area free of litter			
All wastes placed in appropriate bins			
No leaks or emission problems in vehicles or plant equipment			
All contaminated solid waste stored correctly			
All Staff and contractors have read and signed HASP and EMP acceptance forms			
No excessive noise generated			
Spare equipment stored in a tidy manner			
Work areas tidy			
Vehicles parked in designated areas			
Contractors have completed Daily vehicle inspection checklist			
Signature and Date			

GHD CLIENTS | PEOPLE | PERFORMANCE

Daily Record Sheet

Client: ~~TSJV~~ MINES RESCUE		Job No: ~~2218468~~ 2219058	
Job Name: ~~Bridge Duplication~~ ARGENTON GROUNDWATER		Date: 25/8/17	
GHD Representatives:	TC	Arrival Time: 8:30	Departure Time:
Weather Conditions:	(Please circle) (Fine) Overcast (Light Rain) Heavy Rain Other_____		
Works Being Undertaken:	GW MON		

Personnel/Contractor(s) Present (List all); Inducted into GHD H&SP?	Inducted	Arrival Time	Departure Time
TC	Y	8:30	

Photographs Taken: (Please circle) Yes No If Yes, list below or attach photo register.

Location	Time	Record of Activities / Issues Encountered / Discussions with Client/Contractors / Sketch / Notes
	6.50	Go to TNT
	7AM	PARCEL (IP) NOT ARRIVED YET. WAIT FOR IP
	8:05	GIVEN IP. LEAVE TNT. DRIVE TO MINES RESCUE.
	8:30	SIGN IN. PUSA.
	8:40	INSPECT SURFACE FLOW. SEND PHOTOS TO JMS/PDS
	850	COMMENCE MW001.
	9:20	ATTEMPT TO CONTACT JM RE: DRAWDOWN
	9:30	DISCUSS W/ AM pre-purged dry sample of MW001.
	9:37	Sample MW001, within minutes purged dry, lower pump, purge dry
	9:45	Move to MW002. Commence MW002.
	10:05	DRAWDOWN HALTING STABILIZATION AGAN REDUCE FLOW RATE
	10:50	SAMPLE MW002 (FD001). PACK UP/ CLEAN UP
	11:00	MOVE TO MW003. PERFORM RINSATE RB001 & FBS01
	11:15	COMMENCE MW003.
		SAMPLE MW003. PACK UP / TIDY
	12.05	DIP/BAIL MW002 TO CHECK RECHARGE/NAPL. NO NAPL
	12:15	DIP MW001 TO CHECK RECHARGE.
	12:20	MOVE TO 055A. GAUGE.
	12:30	MOVE TO 055. COMMENCE PURGE.

Is a Notice of Proposed Variation, Variation Order or Site Instruction Required? (Please circle) Yes No

Provide Details:

Are there any H&S requirements to be considered for future works?

CALIBRATION RECORD

PID – Serial/Model No. NA **Time**

Sensor	Calibration Standards Used	Readings After Calibration	
		Zero	Span
PID	0.0 / 100 ppm Isobutylene		
Comments			

Water Meter – Serial/Model No. SEE CAL CERT **Time**

Sensor	Calibration Standards Used	Reading After Calibration	Comments
pH 7.00	pH 7.00		
pH 4.00	pH 4.00		
EC			
DO Zero	0.0 (Sodium Sulphite)		
DO Air	Saturation in Air		
Redox			
Comments (i.e. Temperature)	SEE CAL CERT		

Water Meter – Serial/Model No. NA **Time**

Sensor	Calibration Standards Used	Reading After Calibration	Comments
pH 7.00	pH 7.00		
pH 4.00	pH 4.00		
EC			
DO Zero	0.0 (Sodium Sulphite)		
DO Air	Saturation in Air		
Redox			
Comments (i.e. Temperature)			

SITES SAMPLED

MW001 DRY

MW002

QC SAMPLES

MW002 = FD001

RB001 & FB001

TB001

FIELD SUPERVISOR **CHECKED** (SIGN & DATE)

Daily Environmental Checklist			
	Satisfactory		Action Required
	Yes	No	
Site looks clear and neat			
Area free of litter			
All wastes placed in appropriate bins			
No leaks or emission problems in vehicles or plant equipment			
All contaminated solid waste stored correctly			
All Staff and contractors have read and signed HASP and EMP acceptance forms			
No excessive noise generated			
Spare equipment stored in a tidy manner			
Work areas tidy			
Vehicles parked in designated areas			
Contractors have completed Daily vehicle inspection checklist			
Signature and Date			

Purging and Sampling Record

Bore ID: VARIOUS

Job Information	Sampling Information	Bore Information
Client: Mines Rescue	Purge Method: N/A	SWL(mbTOC): VARIOUS m
Project: 2219058	Sample Method: N/A	Logic Check:
Proj. No.: PFAS INVESTIGATIONS	WQ Meter Type: N/A	Screen: From: to m
Sampler: TC	Flow Cell: Y / N	Stick Up: m
Date: 9 / 10 / 17	Pump Depth: m	NAPL Check: (SEE BELOW FOR DTW)
Round: Gauge only	WLevel Meter Type: Dip / Fox / Int.Fce / Gge	Bore Diam.: mm
	Field Filtered? Y / N (filter vessel, disposable filter/syringe)	Ref.datum:
		Well Cap Secure?
		Bore Depth: m
		PID Well Head: ppm

Time (WELL)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (m TOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/- 0.05 pH*	*+/- 3%*	*+/- 10%*	*+/- 10 mV*	*stable*		
MW001							1.89		
MW002							4.40		
MW003							4.19		
~~MW004~~							2.24		
OSS							6.545		
OSSA									

Field QA Checks:

Air bubbles in vials? Y / N Any violent reactions? Y / N
Decontamination as per GHD procedure? Y / N
Was sampling equipment pre-cleaned? Y / N
COC updated? Y / N

Parameters	BTEX	TPH	PAH	CHC	PCB	OCP	OPP	Tot. Metal	Biol.				
Preservatives													

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

Purge Volumes

Casing Int. Dia (mm)	50	100	150
Vol (L/m of casing)	2.0	7.9	17.7

*Double for gravel pack

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 13D100014

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. pH 10.00		pH 10.00		291176	pH 9.64
2. pH 7.00		pH 7.00		290453	pH 6.92
3. pH 4.00		pH 4.00		288994	pH 4.00
4. mV		229.6mV		299345/297604	229.6mV
5. EC		2.76mS		292380	2.76mS
6. D.O		0.00ppm		3829	0.01ppm
7. Temp		22.0°C		MultiTherm	21.2°C

Calibrated by: Sarah Lian **Sarah Lian**

Calibration date: **23/08/2017**

Next calibration due: **19/02/2018**

Oil / Water Interface Meter

Instrument Geotech Interface Meter (30M)
Serial No. 3908

airmet
Air-Met Scientific Pty Ltd
1300 137 067

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
Probe	Cleaned/Decon.	✓	
	Operation	✓	
Connectors	Condition	✓	
		✓	
Tape Check	Cleaned	✓	
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: Sarah Lian **Sarah Lian**

Calibration date: **24/08/2017**

Next calibration due: **23/10/2017**

Purging and Sampling Record

Bore ID: MW601

Job Information
- Client: ~~Fourle Street Joint Venture~~ MINES RESCUE
- Project: Groundwater monitoring
- Proj. No.: 22190558
- Sampler: TR
- Date: 25 / 8 / 17
- Round: August

Sampling Information
- Purge Method: (Peri) MP Bailer
- Sample Method: (Peri) MP Balier
- WQ Meter Type: YSI Pro Plus
- Flow Cell: (Y) / N Pump Depth: 6.75 m
- WLevel Meter Type: Dip / Fox / (Int.Fce) / Gge
- Field Filtered? Y / N (filter vessel, disposable filter/syringe)

Bore Information
- SWL(mbTOC): 5.84 m Logic Check: .....
- Screen: From: 1.88 to 6.88 m Stick Up: -0.12 m
- NAPL Check: No NAPL Bore Diam.: 50 mm
- Ref.datum: TOC Well Cap Secure? Y
- Bore Depth: 6.88 m PID Well Head: - ppm

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (m TOC)	Flow rate (.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/- 0.05 pH*	*+/- 3%*	*+/- 10%*	*+/- 10 mV*	*stable*		
9:02	0.5	18.9	6.52	2999	4.86	-24.1	5.54	140	Clear, colourless, no o/s
9:07	1.2	20.2	6.42	3042	4.85	-24.7	5.705	140	" " " "
9:12	1.9	20.4	6.42	3037	4.75	-27.9	5.84	"	" " " "
9:17	2.6	20.5	6.38	2926	4.70	-32.3	5.98	"	" " " "
9:22	3.3	20.5	6.35	2421	5.28	-34.8	6.16	"	" " " "
9:27	4.0	20.6	6.29	2444	5.00	-34.9	6.34	"	" " " "
9:32	4.7	20.6	6.29	2345	4.94	-34.6	6.495	"	" " " "
9:37	5.4	20.8	6.29	2311	4.64	-35.6	6.65	140	" " " " Sampled first & lowered
9:42	6.1	20.6	6.22	2681	4.31	-40.4	6.83 (RW)	140 &	Sl. turbid, Grey, " "
12:17	-	-	-	-	-	-	6.78		

Field QA Checks:
- Air bubbles in vials? (Y) / N Any violent reactions? Y / N
- Decontamination as per GHD procedure? (Y) / N
- Was sampling equipment pre-cleaned? (Y) / N
- COC updated? Y / N

Parameters	BTEX	TPH	PAH	CHC	PCB	OCP	OPP	Tot. Metal	Biol.	PFAS			
Preservatives										X			

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

~~2 x 250~~ 1M/4L x 0.7L = 0.175M

Purge Volumes

Casing Int. Dia (mm)	50	100	150
Vol (L/m of casing)	2.0	7.9	17.7

*Double for gravel pack

Purging and Sampling Record

Bore ID: MW002

Job Information
Client: Mines Rescue
Project: Groundwater monitoring
Proj. No.: 72190S8
Sampler: TC
Date: 25 / 8 / 17
Round: August

Sampling Information
Purge Method: (Peri) MP Bailer
Sample Method: (Peri) MP Balier
WQ Meter Type: YSI Pro Plus
Flow Cell: (Y) / N Pump Depth: 7.7 m
WLevel Meter Type: Dip / Fox / (Int.Fce) / Gge
Field Filtered? Y / (N) (filter vessel, disposable filter/syringe)

Bore Information
SWL(mbTOC): 4.225 m Logic Check:
Screen: From: 1.99 to 7.99 m Stick Up: -0.1 m
NAPL Check: No NAPL Bore Diam.: 50 mm
Ref.datum: TOC Well Cap Secure? Y
Bore Depth: 7.99 m PID Well Head: - ppm

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (m TOC)	Flow rate (ml/min)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/- 0.05 pH*	*+/- 3%*	*+/- 10%*	*+/- 10 mV*	*stable*		
9:55	0.5	19.9	6.02	3124	1.55	-35.2	4.365	190	Pale grey/brown, ~~no~~ turbid, no o/s
10:00	1.35	20.3	6.01	3200	3.08	-28.9	4.525	" >120	" " " " " "
10:05	2.2	20.2	6.00	3237	3.08	-26.2	4.635	120	" " " " " "
10:10	2.8	20.0	6.00	3259	3.16	-24.7	4.73	"	" " " " " "
10:15	3.4	20.1	6.00	3271	3.19	-23.8	4.82	"	" " " " " "
10:20	4.0	20.0	6.00	3268	3.25	-22.9	4.89	"	" " " sl. " " "
10:25	4.6	20.0	6.00	3272	3.32	-22.1	4.965	"	" " " " " "
10:30	5.2	19.9	5.99	3282	3.26	-22.0	5.045	"	" " " " " " * SOLID BEEP w/ 10 (ANOCCASION)
10:35	5.8	19.9	5.97	3283	3.36	-21.7	5.095	"	clear, colourless, no odour or sheen
10:40	6.4	19.9	5.97	3287	3.17	-21.2	5.155	"	" " " " " "
10:45	7.0	19.9	5.97	3286	3.18	-20.9	5.215	"	~~clear~~ " " " " " "
10:50	7.6	20.1	5.97	3285	3.16	-21.5	5.26	"	" " " " " "
12:09	-	-	-	-	-	-	4.715	BAILER	Clear colourless, no o/s (NO NAPL)

Field QA Checks:
Air bubbles in vials? Y / ~~N~~ Any violent reactions? Y / (N)
Decontamination as per GHD procedure? (Y) / N
Was sampling equipment pre-cleaned? (Y) / N
COC updated? (Y) / N

Parameters	BTEX	TPH	PAH	CHC	PCB	OCP	OPP	Tot. Metal	Biol.	PFAS			
Preservatives										X			

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

15cm for 120ml/min
21.25cm for 190ml/min

FD001 = MW002 Dup RB001 & FB001 TAKEN AFTER MW002

Purge Volumes

Casing Int. Dia (mm)	50	100	150
Vol (L/m of casing)	2.0	7.9	17.7

*Double for gravel pack

Purging and Sampling Record

Bore ID: MW003

Job Information

Client: ~~Fourie Street Joint Venture~~
Project: Groundwater monitoring
Proj. No.: 22/9058
Sampler: TC
Date: 25 / 8 / 17
Round: August

Sampling Information

Purge Method: (Peri) MP Bailer
Sample Method: (Peri) MP Balier
WQ Meter Type: YSI Pro Plus
Flow Cell: (Y) / N Pump Depth:.....m
WLevel Meter Type: Dip / Fox / (Int.Pce) / Gge
Field Filtered? Y / (N) (filter vessel, disposable filter/syringe)

Bore Information

SWL(mbTOC): 4.00 m Logic Check: .....
Screen: From: 1.78 to 7.78 m Stick Up: -0.1 m
NAPL Check: No NAPL Bore Diam.: 50 mm
Ref.datum: TOS Well Cap Secure? Y
Bore Depth: 7.78 m PID Well Head: - ppm

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (m TOC)	Flow rate (.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/- 0.05 pH*	*+/- 3%*	*+/- 10%*	*+/- 10 mV*	*stable*		
11:20	0.5	20.8	5.95	5280	0.71	-33.2	4.095	190	Pale grey, sl. turbid, no o/s
11:25	1.35	20.8	5.94	5264	0.50	-45.0	4.11	"	" " " " "
11:30	2.2	20.8	5.91	5194	0.45	-53.4	4.14	"	" " " " "
11:35	3.05	20.9	5.88	5074	0.51	-58.5	4.15	"	" " " " "
11:40	3.9	20.9	5.86	4981	0.58	-62.3	4.16	"	" " " " "
11:45	4.75	20.9	5.83	4911	0.72	-64.5	4.16	"	" " " " "
11:50	5.6	21.0	5.81	4880	0.87	-64.4	4.165	"	" " " " "

Field QA Checks:

Air bubbles in vials? Y / N Any violent reactions? Y / N
Decontamination as per GHD procedure? Y / N
Was sampling equipment pre-cleaned? Y / N
COC updated? Y / N

Parameters	BTEX	TPH	PAH	CHC	PCB	OCP	OPP	Tot. Metal	Biol.	PFAS.			
Preservatives										X			

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

Purge Volumes

Casing Int. Dia (mm)	50	100	150
Vol (L/m of casing)	2.0	7.9	17.7

*Double for gravel pack

Purging and Sampling Record

Bore ID: 055

Job Information
Client: ~~Tourle Street Joint Venture~~ MINES RESCUE
Project: Groundwater monitoring
Proj. No.: 221905B
Sampler: TK
Date: 25 / 8 / 17
Round: August

Sampling Information
Purge Method: (Peri) MP Bailer
Sample Method: (Peri) MP Balier
WQ Meter Type: YSI Pro Plus
Flow Cell: Y / N Pump Depth: 3.6 m
WLevel Meter Type: Dip / Fox / Int.Fce / Gge
Field Filtered? Y / N (filter vessel, disposable filter/syringe)

Bore Information
SWL(mbTOC): 2.655 m
Screen: From:.....to..... m
NAPL Check: NO NAPL
Ref.datum: TOC
Bore Depth: 3.975 m
Logic Check:
Stick Up: ~0.5 m
Bore Diam.: 50 mm
Well Cap Secure? Y
PID Well Head: - ppm

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (m TOC)	Flow rate (.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/- 0.05 pH*	*+/- 3%*	*+/- 10%*	*+/- 10 mV*	*stable*		
12:42	0.5	17.9	7.02	3404	0.45	-186.2	2.32	210	Clear w/ black sed, colourless no o/s
12:47	1.5	17.6	7.02	3399	0.39	-167.1	2.78	210	" " " " "
12:52	2.1	18.2	7.01	3394	0.46	-149.1	2.94	110	" " " " "
12:57	2.7	17.6	7.02	3378	0.69	-134.2	3.095	"	" " " "
13:02	3.2	17.5	7.01	3324	1.22	-119.0	3.24	"	" " " "
13:07	3.8	17.6	7.00	3282	1.70	-102.1	3.38	"	" " " "
13:12	4.3	MISSED	READINGS.						
13:17	4.9	18.5	7.11	3227	5.18	-85.0	3.585*	"	" " " "

Field QA Checks:
Air bubbles in vials? Y / N Any violent reactions? Y / N
Decontamination as per GHD procedure? Y / N
Was sampling equipment pre-cleaned? Y / N
COC updated? Y / N

Parameters	BTEX	TPH	PAH	CHC	PCB	OCP	OPP	Tot. Metal	Biol.	PFAS			
Preservatives										X			

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc
* DRAWN DOWN TO HEIGHT OF TUBING INLET.
SAMPLE TAKEN W/OUT LOWERING TUBING (OF RECHARGE)

Purge Volumes

Casing Int. Dia (mm)	50	100	150
Vol (L/m of casing)	2.0	7.9	17.7

*Double for gravel pack

Purging and Sampling Record

Bore ID: 055A

Job Information

Client: ~~Fourie Street Joint Venture~~ MINES RESCUE
Project: Groundwater monitoring
Proj. No.: 2219058
Sampler: TR
Date: 25 / 8 / 17
Round: August

Sampling Information

Purge Method: Peri / MP / Bailer
Sample Method: Peri / MP / Balier
WQ Meter Type: YSI Pro Plus
Flow Cell: Y / N
Pump Depth: .....m
WLevel Meter Type: Dip / Fox / Int.Fce / Gge
Field Filtered? Y / N (filter vessel, disposable filter/syringe)

Bore Information

SWL(mbTOC): 6.44 m
Logic Check: .....
Screen: From:.....to..... m
Stick Up: 0.5 m
NAPL Check: NO NAPL
Bore Diam.: 50 mm
Ref.datum: TOC
Well Cap Secure? Y
Bore Depth: 27.48 m
PID Well Head: - ppm

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (.....)	Dis.Oxygen (.....)	Ox-Red Pt. (± mV)	SWL (m TOC)	(.....)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):		-	*+/- 0.05 pH*	*+/- 3%*	*+/- 10%*	*+/- 10 mV*	*stable*		
				GAUGE	ONLY				

Field QA Checks:

Air bubbles in vials? Y / N Any violent reactions? Y / N
Decontamination as per GHD procedure? Y / N
Was sampling equipment pre-cleaned? Y / N
COC updated? Y / N

Parameters	BTEX	TPH	PAH	CHC	PCB	OCP	OPP	Tot. Metal	Biol.				
Preservatives													

Comment: Duplicate samples collected, bottles used, access, condition of headworks etc

Purge Volumes

Casing Int. Dia (mm)	50	100	150
Vol (L/m of casing)	2.0	7.9	17.7

*Double for gravel pack

Appendix D – Borehole logs

BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL MW003

Client Coal Services Pty Ltd
Project Mines Rescue - PFAS Investigations
Project No. 2219058
Site Coal Services - Mines Rescue - Argenton
Location 533 Lake Road, Argenton
Date Drilled 18/08/2017 - 18/08/2017

Drill Co. Terratest
Driller J Tucker
Rig Type Geoprobe
Drill Method See below
Total Depth (m) 7.800
Diameter (mm) 125

Easting, Northing 371574.545, 6354738.69
Grid Ref GDA94_MGA_zone_56
Elevation 5.769
Collar RL 5.677
Logged By Taz Coupe
Checked By Alison Monkley

B.C.L No. N/A **Casing** 50 mm PVC (Class 18) **Screen** 0.5mm Slotted PVC (Class 18) **Surface Completion** Gatic

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
0	NDD		MW003_0.0_0.1		Grout		TOPSOIL			staining, Clayey sand. Some grass and weeds. Pale brown, dry	5.5
0.5			MW003_0.5_0.6				CL - Sandy CLAY dark brown- black to dark grey- brown, with gravel (FILL)	SM		staining	5
1					Bentonite		CL - Sandy CLAY dark grey- to, with gravel (FILL)	SM		staining	4.5
1.5											4
2	PT		MW003_2.0_2.2								3.5
2.5							Clayey GRAVEL pale grey- white (possible NATURAL - SOIL)	SM		staining	3
3			MW003_2.7_2.9				Gravelly CLAY pale orange- brown and pale grey- white, trace sand (possible NATURAL - SOIL)	D		staining	2.5
3.5			MW003_3.3_3.5				Gravelly CLAY pale grey- white and dark grey-, trace sand (possible NATURAL - SOIL)	SM		staining	2
4				▽							1.5
4.5			MW003_4.3_4.7 (JF_FD01)		Sand		Sandy CLAY dark grey- with mottled orange- brown (NATURAL - SOIL)	VM		staining	1
5											0.5
5.5			MW003_5.3_5.5								0
6							Sandy CLAY dark grey- brown with mottled orange- brown (NATURAL - SOIL)	VM		staining	-0.5
6.5			MW003_6.3_6.5								-1
7				▽							-1.5
7.5			MW003_7.0_7.2								-2
8			MW003_7.8_8.0				Termination Depth at: 8.00 m. Target depth achieved.				-2.5

Notes

GHD Soil Classifications The GHD Soil Classification is based on Australian Standards AS 1726-1993. This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	**Granular Soils** VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense	**Cohesive Soils** VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL MW002

Client Coal Services Pty Ltd
Project Mines Rescue - PFAS Investigations
Project No. 2219058
Site Coal Services - Mines Rescue - Argenton
Location 533 Lake Road, Argenton
Date Drilled 17/08/2017 - 17/08/2017

Drill Co. Terratest
Driller J Tucker
Rig Type Geoprobe
Drill Method See below
Total Depth (m) 8.000
Diameter (mm) 125

Easting, Northing 371638.294, 6354707.95
Grid Ref GDA94_MGA_zone_56
Elevation 6.172
Collar RL 6.102
Logged By Taz Coupe
Checked By Alison Monkley

B.C.L No. N/A **Casing** 50 mm PVC (Class 18) **Screen** 0.5mm Slotted PVC (Class 18) **Surface Completion** Gatic

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
0	HA		MW002_0.0_0.2_4021		Grout		SP - Clayey SAND fine to medium, poorly graded, brown, with rootlets (FILL)	D	D	no odour no staining	6
			MW002_0.2_0.4_4022 (FD002)					D	D	no odour no staining	
0.5			MW002_0.5_0.6_4023				SW - Gravelly SAND fine to medium, well graded, subrounded, brown, with silt, subrounded, medium to coarse gravel (FILL)	M	F	no odour no staining	5.5
	PT										
1			MW002_1.0_1.2_4024		Bentonite		CH - Sandy CLAY high plasticity, grey-brown, some fine to medium gravel (possible NATURAL - SOIL)	D	F	no odour no staining	5
1.5							CH - Gravelly CLAY high plasticity, pale grey- brown mottled yellow- orange, with medium to coarse sand, angular, fine to coarse gravel (possible NATURAL - SOIL)				4.5
2			MW002_2.0_2.2_4025				CH - Gravelly CLAY high plasticity, orange mottled grey- brown, with medium to coarse sand, angular, fine to coarse gravel (possible NATURAL - SOIL)	SM	ST	no odour no staining	4
2.5											3.5
			MW002_2.7_2.9_4026								
3											3
3.5				▽			CH - Gravelly CLAY high plasticity, orange mottled grey- brown, with medium to coarse sand, angular, fine to coarse gravel (possible NATURAL - SOIL)	M	F	no odour no staining	2.5
4			MW002_3.8_4_4027								2
4.5					Sand		CH - Sandy CLAY high plasticity, grey-brown mottled orange, with medium to coarse gravel, angular, fine to coarse gravel (possible NATURAL - SOIL)	M	F	no odour no staining	1.5
5			MW002_5.0_5.2_4028								1
5.5											0.5
			MW002_5.8_6_4029								
6											0
6.5											-0.5
			MW002_6.8_7_4030								
7	SFA										-1
7.5											-1.5
			MW002_7.8_8_4031								
8							Termination Depth at: 8.00 m. Target depth achieved.				-2

Notes

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Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	**Granular Soils** VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense	**Cohesive Soils** VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL MW001

Client Coal Services Pty Ltd
Project Mines Rescue - PFAS Investigations
Project No. 2219058
Site Coal Services - Mines Rescue - Argenton
Location 533 Lake Road, Argenton
Date Drilled 17/08/2017 - 17/08/2017

Drill Co. Terratest
Driller J Tucker
Rig Type Geoprobe
Drill Method See below
Total Depth (m) 7.000
Diameter (mm) 125

Easting, Northing 371652.323, 6354728.232
Grid Ref GDA94_MGA_zone_56
Elevation 5.95
Collar RL 5.835
Logged By Taz Coupe
Checked By Alison Monkley

B.C.L No. N/A **Casing** 50 mm PVC (Class 18) **Screen** 0.5mm Slotted PVC (Class 18) **Surface Completion** Gatic

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	Well Details	Graphic Log	LITHOLOGICAL DESCRIPTION Soil Type (Classification Group Symbol); Particle Size; Colour; Secondary / Minor Components.	Moisture	Consistency	COMMENTS/ CONTAMINANT INDICATORS Odours, staining, waste materials,separate phase liquids, imported fill, ash.	Elevation (m)
0	HA		MW001_0.0_0.1_4010 (FD001)		Grout		SP - Clayey SAND fine to medium, poorly graded, brown, with rootlets (FILL)	D	D	concrete from 0.12 - 0.18 m, no odour no staining	5.95
			MW001_0.2_0.3_4011		Bentonite		SW - Gravelly SAND fine to medium, well graded, subrounded, brown, with silt, subrounded, medium to coarse gravel (FILL)	D	D	no odour no staining	
0.5			MW001_0.5_0.6_4012					M	MD	no odour no staining	5.5
	PT		MW001_0.6_0.8_4013					M	F	no odour no staining	
1			MW001_1.0_1.2_4014				GP - GRAVEL medium, poorly graded, subrounded, pale grey, some silt (FILL)	D	F	no odour no staining	5
1.5							CH - Sandy CLAY high plasticity, grey-brown, some fine to medium gravel (possible NATURAL - SOIL)				4.5
2			MW001_2.0_2.2_4015				CH - Gravelly CLAY high plasticity, pale grey- brown mottled yellow- orange, with medium to coarse sand, angular, fine to coarse gravel (possible NATURAL - SOIL)				4
2.5							CH - Gravelly CLAY high plasticity, orange mottled grey- brown, with medium to coarse sand, angular, fine to coarse gravel (possible NATURAL - SOIL)	SM	ST	no odour no staining	3.5
			MW001_2.8_3_4016	▽			CH - Gravelly CLAY high plasticity, orange mottled grey- brown, with medium to coarse sand, angular, fine to coarse gravel (possible NATURAL - SOIL)	M	F	no odour no staining	3
3.5											2.5
4			MW001_4.0_4.2_4017		Sand		CH - Sandy CLAY high plasticity, grey-brown mottled orange, with medium to coarse gravel, angular, fine to coarse gravel (possible NATURAL - SOIL)	M	S	no odour no staining	2
4.5			MW001_4.7_4.9_4018								1.5
5											1
5.5											0.5
6			MW001_6.0_6.2_4019								0
6.5			MW001_6.5_6.7_4020								-0.5
7							Termination Depth at: 7.00 m. Target depth achieved.				-1

Notes

GHD Soil Classifications The GHD Soil Classification is based on Australian Standards AS 1726-1993. This log is not intended for geotechnical purposes.

Drilling Abbreviations	Moisture Abbreviations	Consistency Abbreviations	
AH-Air Hammer, AR-Air Rotary, BE-Bucket Excavation, CC-Concrete Coring, DC-Diamond Core, FH-Foam Hammer, HA-Hand Auger, HE-Hand Excavation (shovel), HFA-Hollow Flight Auger, NDD-Non Destructive Drilling, PT-Pushtube, SD-Sonic Drilling, SFA-Solid Flight Auger, SS-Split Spoon, WB-Wash Bore, WS-Window Sampler	D-Dry, SM-Slightly Moist, M-Moist, VM-Very Moist, W-Wet, S-Saturated	**Granular Soils** VL-Very Loose, L-Loose, MD-Medium Dense, D-Dense,VD - Very Dense	**Cohesive Soils** VS-Very Soft, S-Soft, F-Firm, ST-Stiff, VST-Very Stiff, H-Hard

Appendix E – Analytical result summary tables

			PFAS															
		% Moisture	N-Ethyl perfluorooctane sulfonamidoacetic acid	Perfluoroheptane sulfonic acid	Perfluorodecanesulfonic acid (PFDS)	10:2 Fluorotelomer sulfonic acid	4:2 Fluorotelomer sulfonic acid	Perfluorobutane sulfonic acid	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorohexane sulfonic acid (PFHxS)	PFHxS and PFOS (Sum of Total) Lab Calc	Perfluoropentanoic acid	8:2 Fluorotelomer sulfonic acid	N-Ethyl perfluorooctane sulfonamide	N-Ethyl perfluorooctane sulfonamidoethanol	N-Methyl perfluorooctane sulfonamide	N-Methyl perfluorooctane sulfonamidoethanol
		%	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		1	0.0002	0.0002	0.0002	0.0005	0.0005	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005	0.0005
OEH Science DRAFT ESL Soil direct Comm./Ind.																	
OEH Science DRAFT ESL Soil direct Res. Parkland																	
OEH Science DRAFT ESL Soil indirect Comm./Ind.																	
OEH Science DRAFT ESL Soil indirect Res. Parkland																	
OEH Science DRAFT Soil Comm/ Ind.											20						
OEH Science DRAFT Soil Residential											0.009						
Location Code	**Date/ Time**	**Field ID**															
MW001	17-Aug-17	MW001_0.0-0.1	7.8	<0.0002	<0.0002	<0.0002	0.0031	<0.0005	<0.0002	<0.0002	<0.0002	0.0013	0.0009	0.0052	<0.0005	<0.0005	<0.0005	<0.0005
MW001	17-Aug-17	MW001_0.2-0.3	3.9	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	0.0003	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
MW002	17-Aug-17	MW002_0.0-0.2	4.1	<0.0002	<0.0002	<0.0002	0.0046	<0.0005	<0.0002	<0.0002	<0.0002	0.0040	0.0023	0.0054	<0.0005	<0.0005	<0.0005	<0.0005
MW002	17-Aug-17	MW002_0.2-0.4	19.8	<0.0002	<0.0002	<0.0002	0.0006	<0.0005	<0.0002	<0.0002	0.0010	0.0024	0.0052	0.0006	<0.0005	<0.0005	<0.0005	<0.0005
MW002	17-Aug-17	FD002	22.5	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0002	<0.0002	0.0010	0.0029	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
MW003	18-Aug-17	MW003_0.0-0.1	3.0	0.0010	<0.0002	<0.0002	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	0.0038	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
MW003	18-Aug-17	MW003_0.5-0.6	17.7	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0002	<0.0002	0.0010	0.0010	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
POND 1	17-Aug-17	POND 1	60.1	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	0.0016	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
POND 2	17-Aug-17	POND 2	67.3	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0002	<0.0002	0.0002	0.0039	<0.0002	0.0006	<0.0005	<0.0005	<0.0005	<0.0005
SWALE 1	17-Aug-17	SWALE 1	15.2	<0.0002	<0.0002	<0.0002	0.0103	<0.0005	<0.0002	<0.0002	0.0005	0.0025	0.0019	0.0014	<0.0005	<0.0005	<0.0005	<0.0005
SWALE 2	17-Aug-17	SWALE 2	13.0	<0.0002	<0.0002	<0.0002	0.0051	<0.0005	<0.0002	<0.0002	0.0003	0.0020	<0.0002	0.0007	<0.0005	<0.0005	<0.0005	<0.0005
SW Pit 01	25-Aug-17	SW PIT 01	75.9	<0.0002	<0.0002	<0.0002	0.0013	<0.0005	<0.0002	<0.0002	<0.0002	0.0040	<0.0002	0.0013	<0.0005	<0.0005	<0.0005	<0.0005

			PFAS (continued)															
			6:2 Fluorotelomer Sulfonate (6:2 FTS)	Perfluorooctanoic acid (PFOA)	Perfluoropentane sulfonic acid	Perfluorobutanoic acid	Perfluorodecanoic acid	Perfluorododecanoic acid	Perfluoroheptanoic acid	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctane sulfonamide (FOSA)	Perfluorotetradecanoic acid	Perfluorotridecanoic acid	Perfluoroundecanoic acid	PFAS (Sum of Total)	PFAS (Sum of Total)(WA DER List)
			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	0.0002	0.0002	0.001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0002	0.0002	0.0002	0.0002
OEH Science DRAFT ESL Soil direct Comm./Ind.				**48**								**60**						
OEH Science DRAFT ESL Soil direct Res. Parkland				*17*								*32*						
OEH Science DRAFT ESL Soil indirect Comm./Ind.												0.14						
OEH Science DRAFT ESL Soil indirect Res. Parkland												0.01						
OEH Science DRAFT Soil Comm/ Ind.				100														
OEH Science DRAFT Soil Residential				0.1														
Location Code	**Date/ Time**	**Field ID**																
MW001	17-Aug-17	MW001_0.0-0.1	0.0016	0.0008	<0.0002	<0.001	0.0027	0.0003	0.0010	0.0006	0.0018	0.0013	<0.0002	<0.0005	<0.0002	0.0012	0.0205	0.0114
MW001	17-Aug-17	MW001_0.2-0.3	<0.0005	<0.0002	<0.0002	<0.001	0.0003	<0.0002	0.0002	<0.0002	0.0003	0.0003	<0.0002	<0.0005	<0.0002	<0.0002	0.0011	0.0005
MW002	17-Aug-17	MW002_0.0-0.2	0.0022	0.0009	<0.0002	<0.001	0.0014	<0.0002	0.0011	0.0012	0.0013	0.0040	<0.0002	<0.0005	<0.0002	0.0004	0.0248	0.0171
MW002	17-Aug-17	MW002_0.2-0.4	0.0008	0.0009	<0.0002	<0.001	0.0003	<0.0002	0.0037	0.0055	0.0005	0.0014	<0.0002	<0.0005	<0.0002	<0.0002	0.0205	0.0191
MW002	17-Aug-17	FD002	<0.0005	0.0009	<0.0002	<0.001	<0.0002	<0.0002	0.0028	0.0042	0.0003	0.0019	<0.0002	<0.0005	<0.0002	<0.0002	0.0111	0.0108
MW003	18-Aug-17	MW003_0.0-0.1	<0.0005	0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	0.0003	0.0038	<0.0002	<0.0005	<0.0002	<0.0002	0.0053	0.0040
MW003	18-Aug-17	MW003_0.5-0.6	<0.0005	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	0.0010	0.0010
POND 1	17-Aug-17	POND 1	<0.0005	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0016	<0.0002	<0.0005	<0.0002	<0.0002	0.0016	0.0016
POND 2	17-Aug-17	POND 2	<0.0005	0.0004	0.0008	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	0.0002	0.0037	<0.0002	<0.0005	<0.0002	<0.0002	0.0059	0.0049
SWALE 1	17-Aug-17	SWALE 1	0.0035	0.0006	<0.0002	<0.001	0.0014	0.0004	0.0007	0.0006	0.0007	0.0020	<0.0002	<0.0005	<0.0002	0.0015	0.0255	0.0112
SWALE 2	17-Aug-17	SWALE 2	<0.0005	0.0002	<0.0002	<0.001	0.0008	0.0003	0.0002	<0.0002	0.0003	0.0017	<0.0002	<0.0005	<0.0002	0.0008	0.0104	0.0031
SW Pit 01	25-Aug-17	SW PIT 01	<0.0005	<0.0002	<0.0002	<0.001	<0.0002	0.0004	<0.0002	<0.0002	0.0007	0.0040	<0.0002	<0.0005	0.0018	0.0013	0.0108	0.0053

			PFAS															
			% Moisture	N-Ethyl perfluorooctane sulfonamidoacetic acid	Perfluoroheptane sulfonic acid	Perfluorodecanesulfonic acid (PFDS)	10:2 Fluorotelomer sulfonic acid	4:2 Fluorotelomer sulfonic acid	Perfluorobutane sulfonic acid	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorohexane sulfonic acid (PFHxS)	PFHxS and PFOS (Sum of Total) - Lab Calc	Perfluoropentanoic acid	8:2 Fluorotelomer sulfonic acid	N-Ethyl perfluorooctane sulfonamide	N-Ethyl perfluorooctane sulfonamidoethanol	N-Methyl perfluorooctane sulfonamide	N-Methyl perfluorooctane sulfonamidoethanol
			%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR			1	0.0002	0.0002	0.0002	0.0005	0.0005	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005	0.0005
OEH Science DRAFT ESL Soil direct Comm./Ind.																		
OEH Science DRAFT ESL Soil direct Res. Parkland																		
OEH Science DRAFT ESL Soil indirect Comm./Ind.																		
OEH Science DRAFT ESL Soil indirect Res. Parkland																		
OEH Science DRAFT Soil Comm/ Ind.												20						
OEH Science DRAFT Soil Residential												0.009						
Location Code	**Date/Time**	**Field ID**																
BRIDGE 1	17-Aug-17	BRIDGE 1	70.5	<0.0002	<0.0002	0.0003	0.0068	<0.0005	<0.0002	<0.0002	0.0002	0.0013	<0.0002	0.0010	<0.0005	<0.0005	<0.0005	<0.0005
BRIDGE 1	17-Aug-17	FD003	75.8	<0.0002	<0.0002	<0.0002	0.0082	<0.0005	<0.0002	<0.0002	0.0002	0.0009	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

			PFAS (continued)															
			6:2 Fluorotelomer Sulfonate (6:2 FTS)	Perfluorooctanoic acid (PFOA)	Perfluoropentane sulfonic acid	Perfluorobutanoic acid	Perfluorodecanoic acid	Perfluorododecanoic acid	Perfluoroheptanoic acid	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctane sulfonamide (FOSA)	Perfluorotetradecanoic acid	Perfluorotridecanoic acid	Perfluoroundecanoic acid	PFAS (Sum of Total)	PFAS (Sum of Total)(WA DER List)
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR			0.0005	0.0002	0.0002	0.001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0002	0.0002	0.0002	0.0002
OEH Science DRAFT ESL Soil direct Comm./Ind.				**48**								**60**						
OEH Science DRAFT ESL Soil direct Res. Parkland				*17*								*32*						
OEH Science DRAFT ESL Soil indirect Comm./Ind.												0.14						
OEH Science DRAFT ESL Soil indirect Res. Parkland												0.01						
OEH Science DRAFT Soil Comm/ Ind.				100														
OEH Science DRAFT Soil Residential				0.1														
Location Code	**Date/Time**	**Field ID**																
BRIDGE 1	17-Aug-17	BRIDGE 1	<0.0005	<0.0002	<0.0002	<0.001	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0011	<0.0002	<0.0005	<0.0002	<0.0002	0.0096	0.0023
BRIDGE 1	17-Aug-17	FD003	<0.0005	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0007	<0.0002	<0.0005	<0.0002	<0.0002	0.0091	0.0009

			Water Levels			Field Parameters					PFAS											
			Top of Casing Elevation	Depth to water	Standing Water Level	Purge Volume	DO (mg/L) (Field)	Electrical conductivity (field)	pH (Field)	Temperature (Field)	N-Ethyl perfluorooctane sulfonamidoacetic acid	Perfluoroheptane sulfonic acid	Perfluorodecanesulfonic acid (PFDS)	10:2 Fluorotelomer sulfonic acid	4:2 Fluorotelomer sulfonic acid	Perfluorobutane sulfonic acid	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorohexane sulfonic acid (PFHxS)	PFHxS and PFOS (Sum of Total) - Lab Calc	Perfluoropentanoic acid	8:2 Fluorotelomer sulfonic acid	N-Ethyl perfluorooctane sulfonamide
			mAHD	mb TOC	mAHD	L	mg/L	µS/cm	pH Units	°C	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
LOR											0.02	0.02	0.02	0.05	0.05	0.02	0.02	0.02	0.01	0.02	0.05	0.05
OEH Science DRAFT Drinking Water																			0.07			
OEH Science DRAFT ESL FW/MW 95%																						
OEH Science DRAFT Recreational Water																			0.7			
Location Code	**Date/ Time**	**Field ID**																				
MW001	25-Aug-17	MW001	5.835	5.44	0.395	6.1	4.31	2,687	4.31	20.6	<0.02	<0.02	<0.02	<0.05	<0.05	0.18	<0.02	0.08	0.10	0.70	<0.05	<0.05
MW002	25-Aug-17	MW002	6.102	4.225	1.877	7.6	3.16	3,285	5.97	20.1	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.05
MW002	25-Aug-17	FD001	-	-	-	-	-	-	-	-	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.05
MW003	25-Aug-17	MW003	5.677	4	1.677	5.6	0.87	4,880	5.81	21	<0.02	<0.02	<0.02	<0.05	<0.05	0.07	<0.02	0.61	0.79	0.92	<0.05	<0.05
OS5	25-Aug-17	OS5	4.244	2.055	2.189	4.9	5.18	3,227	7.11	18.5	<0.02	0.04	<0.02	<0.05	<0.05	0.09	<0.02	1.01	1.56	1.55	<0.05	<0.05
Onsite stormwater system																						
SW Pit 01	29-Aug-17	SW PIT 01	-	-	-	-	-	-	-	-	<0.02	0.04	<0.02	<0.05	<0.05	0.05	<0.02	0.31	0.69	0.22	<0.05	<0.05
Offsite surface water																						
POND 2	17-Aug-17	POND 2	-	-	-	-	-	-	-	-	<0.02	<0.02	<0.02	<0.05	<0.05	0.30	<0.02	2.02	4.11	0.19	<0.05	<0.05
BRIDGE 1	17-Aug-17	BRIDGE 1	-	-	-	-	-	-	-	-	<0.02	<0.02	<0.02	<0.05	<0.05	0.36	<0.02	2.87	5.02	0.16	<0.05	<0.05

			PFAS (continued)																		
			N-Ethyl perfluorooctane sulfonamidoethanol	N-Methyl perfluorooctane sulfonamide	N-Methyl perfluorooctane sulfonamidoethanol	6:2 Fluorotelomer Sulfonate (6:2 FTS)	Perfluorooctanoic acid (PFOA)	Perfluoropentane sulfonic acid	Perfluorobutanoic acid	Perfluorodecanoic acid	Perfluorododecanoic acid	Perfluoroheptanoic acid	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctane sulfonamide (FOSA)	Perfluorotetradecanoic acid	Perfluorotridecanoic acid	Perfluoroundecanoic acid	PFAS (Sum of Total)	PFAS (Sum of Total)(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	µg/L	µg/L
LOR			0.05	0.05	0.05	0.05	0.01	0.02	0.1	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.05	0.02	0.02	0.01	0.01
OEH Science DRAFT Drinking Water							0.56														
OEH Science DRAFT ESL FW/MW 95%							**220**								**0.13**						
OEH Science DRAFT Recreational Water							5.6														
Location Code	**Date/ Time**	**Field ID**																			
MW001	25-Aug-17	MW001	<0.05	<0.05	<0.05	<0.05	<0.01	0.10	0.1	<0.02	<0.02	0.04	0.35	<0.02	0.02	<0.02	<0.05	<0.02	<0.02	1.57	1.47
MW002	25-Aug-17	MW002	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.02	<0.02	<0.01	<0.01
MW002	25-Aug-17	FD001	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.02	<0.02	<0.01	<0.01
MW003	25-Aug-17	MW003	<0.05	<0.05	<0.05	2.27	0.16	0.08	0.1	<0.02	<0.02	0.21	0.54	<0.02	**0.18**	<0.02	<0.05	<0.02	<0.02	5.14	5.06
OS5	25-Aug-17	OS5	<0.05	<0.05	<0.05	1.24	0.29	0.14	0.2	<0.02	<0.02	0.42	1.00	<0.02	**0.55**	<0.02	<0.05	<0.02	<0.02	6.53	6.35
Onsite stormwater system																					
SW Pit 01	29-Aug-17	SW PIT 01	<0.05	<0.05	<0.05	<0.05	0.08	0.04	<0.1	<0.02	<0.02	0.12	0.15	0.14	**0.38**	<0.02	<0.05	<0.02	<0.02	1.53	1.31
Offsite surface water																					
POND 2	17-Aug-17	POND 2	<0.05	<0.05	<0.05	<0.05	<0.01	0.38	<0.1	<0.02	<0.02	<0.02	0.85	0.02	**2.09**	<0.02	<0.05	<0.02	<0.02	5.85	5.45
BRIDGE 1	17-Aug-17	BRIDGE 1	<0.05	<0.05	<0.05	<0.05	<0.01	0.44	<0.1	<0.02	<0.02	<0.02	0.72	<0.02	**2.15**	<0.02	<0.05	<0.02	<0.02	6.70	6.26

			PFAS															
		pH (Final)	N-Ethyl perfluorooctane sulfonamidoacetic acid	Perfluoroheptane sulfonic acid	Perfluorodecanesulfonic acid (PFDS)	10:2 Fluorotelomer sulfonic acid	4:2 Fluorotelomer sulfonic acid	Perfluorobutane sulfonic acid	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorohexane sulfonic acid (PFHxS)	PFHxS and PFOS (Sum of Total) - Lab Calc	Perfluoropentanoic acid	8:2 Fluorotelomer sulfonic acid	N-Ethyl perfluorooctane sulfonamide	N-Ethyl perfluorooctane sulfonamidoethanol	N-Methyl perfluorooctane sulfonamide	N-Methyl perfluorooctane sulfonamidoethanol	6:2 Fluorotelomer Sulfonate (6:2 FTS)
		pH Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
LOR		0.1	0.02	0.02	0.02	0.05	0.05	0.02	0.02	0.02	0.01	0.02	0.05	0.05	0.05	0.05	0.05	0.05
NSW EPA 2016 EnRisks surface water Trigger point 1																		
NSW EPA 2016 EnRisks surface water Trigger point 2																		
NSW EPA 2016 EnRisks surface water Trigger point 3																		
Location Code	**Date/Time**	**Field ID**																
MW001	17-Aug-17	MW001_0.0-0.1	6.6	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	0.05	<0.02	0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MW002	17-Aug-17	MW002_0.0-0.2	6.4	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	0.22	<0.02	0.11	<0.05	<0.05	<0.05	<0.05	<0.05
SWALE 1	17-Aug-17	SWALE1	6.7	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	0.02	0.09	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	0.06
BRIDGE 1	17-Aug-17	BRIDGE 1	6.4	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

			PFAS (continued)													
			Perfluorooctanoic acid (PFOA)	Perfluoropentane sulfonic acid	Perfluorobutanoic acid	Perfluorodecanoic acid	Perfluorododecanoic acid	Perfluoroheptanoic acid	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctane sulfonamide (FOSA)	Perfluorotetradecanoic acid	Perfluorotridecanoic acid	Perfluoroundecanoic acid	PFAS (Sum of Total)	PFAS (Sum of Total)(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
LOR			0.01	0.02	0.1	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.05	0.02	0.02	0.01	0.01
NSW EPA 2016 EnRisks surface water Trigger point 1																**10**	**10**
NSW EPA 2016 EnRisks surface water Trigger point 2																0.1	0.1
NSW EPA 2016 EnRisks surface water Trigger point 3																0.05	0.05
Location Code	**Date/Time**	**Field ID**															
MW001	17-Aug-17	MW001_0.0-0.1	0.04	<0.02	<0.1	0.08	<0.02	0.05	0.03	0.10	0.05	<0.02	<0.05	<0.02	<0.02	0.40	0.22
MW002	17-Aug-17	MW002_0.0-0.2	0.06	<0.02	<0.1	0.05	<0.02	0.06	0.07	0.08	0.22	<0.02	<0.05	<0.02	<0.02	0.65	0.52
SWALE 1	17-Aug-17	SWALE1	0.03	<0.02	<0.1	0.02	<0.02	0.04	0.04	0.03	0.07	<0.02	<0.05	<0.02	<0.02	0.31	0.26
BRIDGE 1	17-Aug-17	BRIDGE 1	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.02	<0.02	<0.01	<0.01

Location Code	Date/ Time	Field ID		PFAS															
			% Moisture	N-Ethyl perfluorooctane sulfonamidoacetic acid	Perfluoroheptane sulfonic acid	Perfluorodecanesulfonic acid (PFDS)	10:2 Fluorotelomer sulfonic acid	4:2 Fluorotelomer sulfonic acid	Perfluorobutane sulfonic acid	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorohexane sulfonic acid (PFHxS)	PFHxS and PFOS (Sum of Total) - Lab Calc	Perfluoropentanoic acid	8:2 Fluorotelomer sulfonic acid	N-Ethyl perfluorooctane sulfonamide	N-Ethyl perfluorooctane sulfonamidoethanol	N-Methyl perfluorooctane sulfonamide	N-Methyl perfluorooctane sulfonamidoethanol	6:2 Fluorotelomer Sulfonate (6:2 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	mg/kg
EQL			1	0.0002	0.0002	0.0002	0.0005	0.0005	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
BRIDGE 1	17-Aug-17	BRIDGE 1	70.5	<0.0002	<0.0002	0.0003	0.0068	<0.0005	<0.0002	<0.0002	0.0002	0.0013	<0.0002	0.0010	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
BRIDGE 1	17-Aug-17	FD003	75.8	<0.0002	<0.0002	<0.0002	0.0082	<0.0005	<0.0002	<0.0002	0.0002	0.0009	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
RPD			7	0	0	**40**	19	0	0	0	0	-	0	**67**	0	0	0	0	0
MW002	17-Aug-17	MW002_0.2-0.4	19.8	<0.0002	<0.0002	<0.0002	0.0006	<0.0005	<0.0002	<0.0002	0.0010	0.0024	0.0052	0.0006	<0.0005	<0.0005	<0.0005	<0.0005	0.0008
MW002	17-Aug-17	FD002	22.5	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0002	<0.0002	0.0010	0.0029	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
RPD			13	0	0	0	18	0	0	0	0	-	**185**	18	0	0	0	0	**46**
			%	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	0.02	0.02	0.02	0.05	0.05	0.02	0.02	0.02	0.01	0.02	0.05	0.05	0.05	0.05	0.05	0.05
MW002	25-Aug-17	MW002	-	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
MW002	25-Aug-17	FD001	-	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
RPD			-	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0

			PFAS (continued)													
			Perfluorooctanoic acid (PFOA)	Perfluoropentane sulfonic acid	Perfluorobutanoic acid	Perfluorodecanoic acid	Perfluorododecanoic acid	Perfluoroheptanoic acid	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctane sulfonamide (FOSA)	Perfluorotetradecanoic acid	Perfluorotridecanoic acid	Perfluoroundecanoic acid	PFAS (Sum of Total)	PFAS (Sum of Total)(WA DER List)
			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	0.0002	0.001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0002	0.0002	0.0002	0.0002
Location Code	**Date/ Time**	**Field ID**															
BRIDGE 1	17-Aug-17	BRIDGE 1	<0.0002	<0.0002	<0.001	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0011	<0.0002	<0.0005	<0.0002	<0.0002	0.0096	0.0023
BRIDGE 1	17-Aug-17	FD003	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0007	<0.0002	<0.0005	<0.0002	<0.0002	0.0091	0.0009
RPD			0	0	0	0	0	0	0	0	**44**	0	0	0	0	-	-
MW002	17-Aug-17	MW002_0.2-0.4	0.0009	<0.0002	<0.001	0.0003	<0.0002	0.0037	0.0055	0.0005	0.0014	<0.0002	<0.0005	<0.0002	<0.0002	0.0205	0.0191
MW002	17-Aug-17	FD002	0.0009	<0.0002	<0.001	<0.0002	<0.0002	0.0028	0.0042	0.0003	0.0019	<0.0002	<0.0005	<0.0002	<0.0002	0.0111	0.0108
RPD			0	0	0	**40**	0	28	27	**50**	30	0	0	0	0	-	-
			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			0.01	0.02	0.1	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.05	0.02	0.02	0.01	0.01
MW002	25-Aug-17	MW002	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.02	<0.02	<0.01	<0.01
MW002	25-Aug-17	FD001	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.02	<0.02	<0.01	<0.01
RPD			0	0	0	0	0	0	0	0	0	0	0	0	0	-	-

Appendix E
Table F
Analytical Results Summary- Blanks

Mines Rescue - PFAS Investigations
Coal Services- Mines Rescue
Argenton Training Facility

			PFAS															
			N-Ethyl perfluorooctane sulfonamidoacetic acid	Perfluoroheptane sulfonic acid	Perfluorodecanesulfonic acid (PFDS)	10:2 Fluorotelomer sulfonic acid	4:2 Fluorotelomer sulfonic acid	Perfluorobutane sulfonic acid	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorohexane sulfonic acid (PFHxS)	PFHxS and PFOS (Sum of Total) - Lab Calc	Perfluoropentanoic acid	8:2 Fluorotelomer sulfonic acid	N-Ethyl perfluorooctane sulfonamide	N-Ethyl perfluorooctane sulfonamidoethanol	N-Methyl perfluorooctane sulfonamide	N-Methyl perfluorooctane sulfonamidoethanol	6:2 Fluorotelomer Sulfonate (6:2 FTS)	Perfluorooctanoic acid (PFOA)
Date/ Time	**Field ID**	**Sample Type**	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
18-Aug-17	JF_TB01	Trip Blank	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01
25-Aug-17	RB001	Rinsate	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01
25-Aug-17	TB001	Trip Blank	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01

			PFAS (continued)												
			Perfluoropentane sulfonic acid	Perfluorobutanoic acid	Perfluorodecanoic acid	Perfluorododecanoic acid	Perfluoroheptanoic acid	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctane sulfonamide (FOSA)	Perfluorotetradecanoic acid	Perfluorotridecanoic acid	Perfluoroundecanoic acid	PFAS (Sum of Total)	PFAS (Sum of Total)(WA DER List)
Date/ Time	Field ID	Sample Type	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
18-Aug-17	JF_TB01	Trip Blank	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.02	<0.02	<0.01	<0.01
25-Aug-17	RB001	Rinsate	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.02	<0.02	<0.01	<0.01
25-Aug-17	TB001	Trip Blank	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.02	<0.02	<0.01	<0.01

Appendix F – Assessment of data quality

Quality Assurance and Quality Control Report

Data quality indicators

Data generated during this investigation must be appropriate to allow decisions to be made with confidence. Specific limits for this investigation have been adopted in accordance with guidance from the AS4482.1, which includes appropriate indicators of data quality (data quality indicators [DQIs] used to assess QA/QC, and GHD's Standard Field Operating Procedures).

To assess the usability of the data prior to making decisions, the data is assessed against pre-determined DQIs. The DQIs including precision, accuracy, representativeness, comparability and completeness, will be reviewed at the completion of the investigation works to assess for the presence of decision errors.

The pre-determined DQIs established for the investigation are discussed below and shown in Table F-1.

- Precision - measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques is assessed by calculating the Relative Percentage Difference (RPD) of duplicate samples.
- Accuracy - measures the bias in a measurement system. The accuracy of the laboratory data that are generated during this investigation is a measure of the closeness of the analytical results obtained by a method to the 'true' (or standard) value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards.
- Representativeness - expresses the degree to which sample data accurately and precisely represent a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples on a representative basis across the site, and by using an adequate number of sample locations to characterise the site to the required accuracy.
- Comparability - expresses the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to collect samples; ensuring analysing laboratories use consistent analysis techniques and reporting methods.
- Completeness - is defined as the percentage of measurements made which are judged to be valid measurements.

Table F-1 Summary of quality assurance/quality control criteria

Data quality indicator	Frequency	Data quality acceptance criteria
Precision		
Inter/intra duplicates	1/10 samples	<30-50% RPD
Accuracy		
Surrogate spikes Laboratory control samples Matrix spikes	All organic samples 1 per lab batch 1 per lab batch	70-130% <LOR 70-130%
Representativeness		
Sampling appropriate for media and analytes Samples extracted and analysed within holding times	All samples All samples	- Organics (7-14 days) Inorganics (6 months)

Data quality indicator	Frequency	Data quality acceptance criteria
LORs appropriate and consistent	All samples	All samples
Comparability		
Consistent field conditions, sampling staff and laboratory analysis	All samples	All samples
Standard operating procedures for sample collection & handling	All samples	All samples
Standard analytical methods used for all analyses	All samples	All samples
Completeness		
Sample description and COCs completed and appropriate	All Samples	All Samples
Appropriate documentation	All Samples	All Samples
Satisfactory frequency and result for QA/QC samples	All QA/QC samples	-
Data from critical samples is considered valid	-	Critical samples valid
Acronyms COC: Chain of Custody LOR: Limit of Reporting QA/QC: Quality assurance/quality control		

If any of the DQIs are not met, further investigation will be necessary to determine whether the non-conformance will significantly affect the usefulness of the data.

Field quality assurance and quality control

The quality assurance/quality control (QA/QC) procedures are based on NSW EPA *Guidelines for the Site Auditor Scheme* (2006) and AS 4482.1 – 2005 and AS 4482.2 – 1999.

QA involves all the actions, procedures, checks and decisions undertaken to ensure the representativeness and integrity of samples and accuracy and reliability of analytical results (NEPC 2013). QC involves protocols to monitor and measure the effectiveness of QA procedures.

All fieldwork was conducted with reference to the Australian Standards AS 4482.1 – 2005 and AS 4482.2 – 1999 and GHD's Standard Field Operating Procedures, which ensure all samples, are collected by a set of uniform and systematic methods, as required by GHD's QA system. Key requirements of these procedures are listed below:

- Decontamination procedures – including washing and rinsing of re-useable equipment, the use of new disposable gloves and sampling tubing between each sampling location and the use of sampling containers provided by the laboratory.
- Sample identification procedures - samples were immediately transferred to sample containers of appropriate composition and preservation for the required laboratory analysis. All sample containers were clearly labelled with a sample number, job number, and sample date. The sample containers were then transferred to a chilled insulated container for sample preservation prior to and during shipment to the analytical laboratory.
- Chain of custody information requirements - a chain of custody form was completed and forwarded to the testing laboratory with the samples.

- Inter and intra duplicate and sample frequency.
- Calibration was undertaken by the rental supplier and certificates are provided in Appendix C.
- Field instrument field checks were undertaken on the equipment:
  - Interface probe: A daily equipment check was undertaken to ensure that the equipment worked correctly when immersed in water and that it has had no unauthorised repairs.
  - Low flow pump: The low flow sampling equipment was provided by the equipment supplier was in good working condition. The equipment was inspected by GHD at the start of each day to ensure that all parts of the equipment were in good working order. GHD measured the rate of water discharge during purging to ensure that the rate did not exceed 1 L per minute. Purge volumes were recorded on the groundwater sampling field sheets for each site.

Sampling and analysis quality control

The QC samples collected during the investigation are described below.

- Intra laboratory duplicate: Intra duplicates are used to identify the variation in the analyte concentration between samples from the same sampling point and the repeatability of the laboratory's analysis.

Table F-2 Quality control (QC) sampling frequency

Sample	Recommended sampling rate	Media	No. QC samples	No. of primary samples	Total
Intra	1/10 samples	Soil	1	11	12
Intra	1/10 samples	Sediment	1	1	2
Intra	1/10 samples	Groundwater	1	4	5

- Two water trip blanks accompanied the samples to the laboratory. All trip blanks were less than the limit of detection of the laboratory.
- One rinsate was collected during the water sampling on the day from the peristaltic pump used during the day of investigation. All results of the analysed rinsate were less than the limit of detection of the laboratory.

Relative percentage difference calculations

Relative percentage difference (RPD) calculations are used to assess how closely primary and inter/intra duplicate sample results match. RPDs are a quantitative measure of the accuracy of the analytical results and are calculated in accordance with the procedure described in *AS 4482.1 – 2005* (Standards Australia 2005). According to *AS 4482.1 – 2005* typical RPDs are expected to range between 30% and 50%; however, this may be higher for organics and for low concentrations of analytes. GHD adopts 30% for inorganics and 50% for organics as the general assessment criteria.

Where a result is below the laboratory limit of reporting (LOR) for one of the paired samples, the concentration assigned to that sample is the LOR. Where both results are reported below laboratory LOR the RPD is not calculated.

The QC samples analysed during the groundwater investigation are listed in Table F-3.

Table F-3 Analysed quality control (QC) samples

Primary sample	QC sample laboratory ID	QC sample field ID	Date sampled	Lab report number	Matrix
MW002_0.2-0.4	ES1720652012	FD002	17/08/2017	ES1720652 and ES1722228	Soil
BRIDGE 1	ES1720652027	FD003	17/08/2017	ES1720652	Sediment
MW002	ES1721241002	FD001	25/08/2017	ES1721241	Ground water

RPD exceedances were reported during this investigation.

- FD002 – Primary sample MW002_0.2-0.4 –8:2 Fluorotelomer Sulfonic acid (8:2 FTS) 67%.
- FD003 – Primary sample BRIDGE 1 - Perfluoropentanoic acid 185%.

Laboratory quality assurance/quality control

Laboratory methods used by the primary laboratory were suitable for environmental contaminant analysis and are based on established internationally recognised procedures such as those published by the United States Environmental Protection Agency (US EPA), American Public Health Association (APHA), AS and National Environment Protection (Assessment of Site Contamination) Measure (NEPM).

The individual testing laboratory conducted an assessment of the laboratory QC program however the results were also independently reviewed and assessed internally by GHD. Recovery targets below are defined in the ALS QA/QC section of the certificates of analysis reports. All laboratory QA/QC results are documented with the laboratory certificates of analysis in the appendices of the relevant site report.

Laboratory quality control procedures

Laboratory QC samples incorporated in the analytical process include:

Laboratory blind duplicate samples

A laboratory blind duplicate provides data on the analytical precision and reproducibility of the analytical result. The laboratory blind duplicate is created by sub sampling from one of the primary samples submitted for analysis. Laboratory blind duplicates are analysed at a rate equivalent to one in twenty samples per analytical batch, or one sample per batch if less than twenty samples are analysed in a batch.

The permitted ranges for the RPD of laboratory blind duplicates are dependent on the magnitude of the results in comparison to the level of reporting as shown in Table F-4.

Table F-4 Permitted laboratory blind duplicate relative percentage difference (RPD) ranges

Magnitude of result	Permitted RPD range
< 10 x limit of reporting (LOR)	No limits
10 – 20 x LOR	0% - 50%
> 20 x LOR	0% - 30%

Matrix spike recoveries

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

Laboratory control sample

The laboratory control sample (LCS) analysis of either a reference material or a control matrix fortified with analytes representative of the analyte class. The purpose of LCS is to monitor method precision and accuracy independent of the sample matrix. Typically, the percentage recovery of the LCS is compared to the dynamic recovery limit based on the statistical analysis of the processed LCS analysis. The ALS acceptance criteria, indicates recoveries must lie between 70% and 130%.

Surrogate spike recoveries

Surrogate Spikes provide a means of checking that no gross errors have occurred during any stage of the analytical method leading to significant analyte loss. Surrogate recoveries are similar to the analyte of interest in terms of chemical composition, extractability, and chromatographic conditions (retention time), but which are not normally found in environmental samples. Surrogate compounds are spiked into blanks, standards and samples submitted for organic analyses by gas-chromatographic techniques prior to sample extraction. Recoveries must lie between 50% and 150% for all analytes.

Method blank samples

Method or analysis blank sample analysis is the analysis of a sample that is as free as possible of the analytes of interest, but has been prepared the same manner as the samples under investigation. The analysis is to ascertain if laboratory reagent, glassware and other laboratory consumables contribute to the observed concentration of analytes in the process batch. If below the maximum acceptable method blank (20% of the practical quantification limit), the contribution is subtracted from the gross analytical signal for each analysis before calculating the sample analyte concentration. The method blank should return analyte concentrations as 'not detected'.

The individual testing laboratory conducted an assessment of the laboratory QC program internally. However, the results were also independently reviewed and assessed by GHD.

Laboratory quality control results

Laboratory RPDs, matrix spike, LCSs and method blanks were within the ALS acceptable ranges with the exception in Table F-5.

Table F-5 Summary of outliers

Laboratory report	Quality Control Sample	Analytes	Sample Code	Results	Comment
ES1720652	Matrix Spikes	Perfluorohexane sulfonic acid (PFHxS)	Anonymous	Not determined	MS recovery not determined. Background level greater than or equal to 4x spike level.

Sample holding times

All samples were extracted and analysed by the laboratory within holding times with the exception of moisture for FD002.

Sample preservation

All samples were preserved appropriately in the correct sample containers.

Evaluation of DQI

To minimise the potential for decision errors, the sampling and analysis program completed at the site by GHD has been evaluated with consideration of the Data Quality Indicators (DQIs) described in **Section 5** namely representativeness, completeness, comparability, precision and accuracy.

- Data representativeness: The sampling methodology ensured all environmental samples were collected by a set of uniform and systematic methods. Laboratory and field QA/QC procedures were carried out to ensure data representativeness. All samples were provided to the laboratory with adequate preservation and in compliant containers as stated in the laboratory sample receipt documentation. Consequently, data representativeness is considered to have been satisfied.
- Completeness: It is considered that the field QA/QC procedures carried out such as blind duplicate collection frequencies and the analytes tested provide completeness in terms of the required number of field duplicate samples. Laboratory QA/QC sample analysis is considered sufficient to provide a complete overview of QA/QC procedures.
- Precision: Field blind duplicate results reported RPDs below the adopted criterion (30% for inorganics and 50% for organics) the exceptions to this are not considered likely to impact on the assessment against nominated guidelines. GHD therefore considers that laboratory results are acceptable for interpretation in this report.
- Accuracy: Environmental sampling procedures ensured that collection, preservation and laboratory analytical techniques are appropriate for analysis of environmental contaminants.
- Comparability: All field work was conducted with reference to the Australian Standards, which ensured all environmental samples were collected by a set of uniform and systematic methods, as required by GHD's QA system. GHD considers that the laboratory data are of a suitable quality for assessing the environmental status of the site.

The overall review of the QC results from the primary and secondary laboratories indicates that the current analytical data are of an acceptable quality upon which to draw meaningful conclusions regarding impacts at the site as part of this investigation.

Appendix G – NATA accredited laboratory reports and chain of custody documentation

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1720652**	Page	: 1 of 13
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Vanessa Mattes
Address	: PO BOX 5403 NEWCASTLE WEST NSW, AUSTRALIA 2302	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 9239 7100	Telephone	: +61-2-8784 8555
Project	: 2219058	Date Samples Received	: 18-Aug-2017 15:50
Order number	: ----	Date Analysis Commenced	: 21-Aug-2017
C-O-C number	: ----	Issue Date	: 29-Aug-2017 13:05
Sampler	: ----		
Site	: ----		
Quote number	: SY/361/17		
No. of samples received	: 45		
No. of samples analysed	: 15		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

When 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.

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: SEDIMENT (Matrix: SOIL)				Client sample ID	POND 1	POND 2	SWALE 1	SWALE 2	BRIDGE 1
				Client sampling date / time	17-Aug-2017 00:00	17-Aug-2017 00:00	17-Aug-2017 00:00	17-Aug-2017 00:00	17-Aug-2017 00:00
Compound	CAS Number	LOR	Unit		ES1720652-023	ES1720652-024	ES1720652-025	ES1720652-026	ES1720652-027
					Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)									
Moisture Content	----	1.0	%		**60.1**	**67.3**	**15.2**	**13.0**	**70.5**
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	**0.0008**	<0.0002	<0.0002	<0.0002
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		<0.0002	**0.0002**	**0.0005**	**0.0003**	**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		**0.0016**	**0.0037**	**0.0020**	**0.0017**	**0.0011**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	**0.0003**
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		<0.001	<0.001	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		<0.0002	<0.0002	**0.0019**	<0.0002	<0.0002
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		<0.0002	<0.0002	**0.0006**	<0.0002	<0.0002
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		<0.0002	<0.0002	**0.0007**	**0.0002**	<0.0002
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		<0.0002	**0.0004**	**0.0006**	**0.0002**	<0.0002
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		<0.0002	**0.0002**	**0.0007**	**0.0003**	<0.0002
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		<0.0002	<0.0002	**0.0014**	**0.0008**	**0.0002**
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		<0.0002	<0.0002	**0.0015**	**0.0008**	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	<0.0002	**0.0004**	**0.0003**	<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: SEDIMENT (Matrix: SOIL)				Client sample ID	POND 1	POND 2	SWALE 1	SWALE 2	BRIDGE 1
				Client sampling date / time	17-Aug-2017 00:00	17-Aug-2017 00:00	17-Aug-2017 00:00	17-Aug-2017 00:00	17-Aug-2017 00:00
Compound	CAS Number	LOR	Unit		ES1720652-023	ES1720652-024	ES1720652-025	ES1720652-026	ES1720652-027
					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)	2448-09-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		<0.0005	<0.0005	**0.0035**	<0.0005	<0.0005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	**0.0006**	**0.0014**	**0.0007**	**0.0010**
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	<0.0005	**0.0103**	**0.0051**	**0.0068**
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0016**	**0.0059**	**0.0255**	**0.0104**	**0.0096**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0016**	**0.0039**	**0.0025**	**0.0020**	**0.0013**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0016**	**0.0049**	**0.0112**	**0.0031**	**0.0023**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**86.0**	**90.0**	**77.0**	**77.0**	**99.0**

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)			Client sample ID	FD003	----	----	----	----
			Client sampling date / time	17-Aug-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1720652-035	--------	--------	--------	--------
				Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**75.8**	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	**0.0002**	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	**0.0007**	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	----	----	----	----

Analytical Results

Sub-Matrix: SEDIMENT (Matrix: SOIL)				Client sample ID	FD003	----	----	----	----
				Client sampling date / time	17-Aug-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1720652-035	--------	--------	--------	--------	
				Result	----	----	----	----	
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	----	----	----	----	
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.0005	mg/kg	<0.0005	----	----	----	----	
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	----	----	----	----	
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	----	----	----	----	
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	----	----	----	----	
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	----	----	----	----	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	----	----	----	----	
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	----	----	----	----	
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	**0.0082**	----	----	----	----	
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg	**0.0091**	----	----	----	----	
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	**0.0009**	----	----	----	----	
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	**0.0009**	----	----	----	----	
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%	**79.0**	----	----	----	----	

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	MW001_0.0-0.1	MW001_0.2-0.3	MW002_0.0-0.2	MW002_0.2-0.4	MW003_0.0-0.1
			Client sampling date / time	17-Aug-2017 00:00	17-Aug-2017 00:00	17-Aug-2017 00:00	17-Aug-2017 00:00	18-Aug-2017 00:00
Compound	CAS Number	LOR	Unit	ES1720652-001	ES1720652-002	ES1720652-012	ES1720652-013	ES1720652-037
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**7.8**	**3.9**	**4.1**	**19.8**	**3.0**
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	**0.0010**	<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	**0.0013**	**0.0003**	**0.0040**	**0.0014**	**0.0038**
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	**0.0009**	<0.0002	**0.0023**	**0.0052**	<0.0002
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	**0.0006**	<0.0002	**0.0012**	**0.0055**	<0.0002
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	**0.0010**	**0.0002**	**0.0011**	**0.0037**	<0.0002
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	**0.0008**	<0.0002	**0.0009**	**0.0009**	**0.0002**
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	**0.0018**	**0.0003**	**0.0013**	**0.0005**	**0.0003**
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	**0.0027**	**0.0003**	**0.0014**	**0.0003**	<0.0002
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	**0.0012**	<0.0002	**0.0004**	<0.0002	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	**0.0003**	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	MW001_0.0-0.1	MW001_0.2-0.3	MW002_0.0-0.2	MW002_0.2-0.4	MW003_0.0-0.1
				Client sampling date / time	17-Aug-2017 00:00	17-Aug-2017 00:00	17-Aug-2017 00:00	17-Aug-2017 00:00	18-Aug-2017 00:00
Compound	CAS Number	LOR	Unit		ES1720652-001	ES1720652-002	ES1720652-012	ES1720652-013	ES1720652-037
					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)	2448-09-7	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	**0.0010**
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		**0.0016**	<0.0005	**0.0022**	**0.0008**	<0.0005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		**0.0052**	<0.0005	**0.0054**	**0.0006**	<0.0005
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		**0.0031**	<0.0005	**0.0046**	**0.0006**	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0205**	**0.0011**	**0.0248**	**0.0205**	**0.0053**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0013**	**0.0003**	**0.0040**	**0.0024**	**0.0038**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0114**	**0.0005**	**0.0171**	**0.0191**	**0.0040**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**82.0**	**79.0**	**108**	**71.0**	**122**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	MW003_0.5-0.6	----	----	----	----
			Client sampling date / time	18-Aug-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1720652-038	--------	--------	--------	--------
				Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**17.7**	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	**0.0010**	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	MW003_0.5-0.6	----	----	----	----
				Client sampling date / time	18-Aug-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1720652-038	--------	--------	--------	--------
					Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.0005	mg/kg		<0.0005	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg		<0.0002	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg		<0.0005	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		<0.0005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	----	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0010**	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0010**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0010**	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**71.0**	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	POND 2	BRIDGE 1	JF_TB01	----	----
				Client sampling date / time	17-Aug-2017 00:00	17-Aug-2017 00:00	18-Aug-2017 00:00	----	----
Compound	CAS Number	LOR	Unit		ES1720652-029	ES1720652-032	ES1720652-048	--------	--------
					Result	Result	Result	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		**0.30**	**0.36**	<0.02	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		**0.38**	**0.44**	<0.02	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L		**2.02**	**2.87**	<0.02	----	----
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		**2.09**	**2.15**	<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		**0.19**	**0.16**	<0.02	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		**0.85**	**0.72**	<0.02	----	----
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	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	POND 2	BRIDGE 1	JF_TB01	----	----
				Client sampling date / time	17-Aug-2017 00:00	17-Aug-2017 00:00	18-Aug-2017 00:00	----	----
Compound	CAS Number	LOR	Unit		ES1720652-029	ES1720652-032	ES1720652-048	--------	--------
					Result	Result	Result	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	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	----	----
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		**5.85**	**6.70**	<0.01	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		**4.11**	**5.02**	<0.01	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		**5.45**	**6.26**	<0.01	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**79.0**	**91.6**	**91.0**	----	----

Surrogate Control Limits

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

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

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	130

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1720652**	Page	: 1 of 14
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Vanessa Mattes
Address	: PO BOX 5403 NEWCASTLE WEST NSW, AUSTRALIA 2302	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 9239 7100	Telephone	: +61-2-8784 8555
Project	: 2219058	Date Samples Received	: 18-Aug-2017
Order number	: ----	Date Analysis Commenced	: 21-Aug-2017
C-O-C number	: ----	Issue Date	: 29-Aug-2017
Sampler	: ----		
Site	: ----		
Quote number	: SY/361/17		
No. of samples received	: 45		
No. of samples analysed	: 15		

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. 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
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 1067913)									
ES1720652-001	MW001_0.0-0.1	EA055: Moisture Content	----	1	%	7.8	7.0	11.5	No Limit
ES1720652-038	MW003_0.5-0.6	EA055: Moisture Content	----	1	%	17.7	17.6	0.918	0% - 50%
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 1063702)									
EB1716703-002	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
ES1720652-012	MW002_0.0-0.2	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0040	0.0044	11.4	0% - 20%
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1063702)									
EB1716703-002	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1063702) - continued									
EB1716703-002	Anonymous	EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
ES1720652-012	MW002_0.0-0.2	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	0.0023	0.0023	0.00	0% - 50%
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	0.0012	0.0014	19.4	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	0.0011	0.0013	17.5	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	0.0009	0.0011	17.0	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	0.0013	0.0016	17.6	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	0.0014	0.0015	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	0.0004	0.0004	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 1063702)									
EB1716703-002	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
ES1720652-012	MW002_0.0-0.2	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 1063702)									
EB1716703-002	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
ES1720652-012	MW002_0.0-0.2	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	0.0022	0.0024	10.5	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	0.0054	0.0055	0.00	0% - 50%
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	0.0046	0.0051	11.6	0% - 50%

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 1063715)									
ES1720454-029	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	1.42	1.22	14.8	0% - 20%
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	0.12	0.13	10.7	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	0.18	0.18	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	2.15	2.08	2.98	0% - 20%
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
ET1701072-004	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	2.20	2.14	3.18	0% - 20%
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	0.38	0.35	9.60	0% - 50%
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	0.50	0.44	11.9	0% - 20%
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	3.04	3.05	0.00	0% - 20%
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 1068857)									
ES1720652-048	JF_TB01	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1063715)									
ES1720454-029	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report					
				LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1063715) - continued									
ES1720454-029	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.12	0.12	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.25	0.25	0.00	0% - 50%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
ET1701072-004	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.15	0.15	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.85	0.77	10.5	0% - 20%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1068857)									
ES1720652-048	JF_TB01	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 1063715)									
ES1720454-029	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 1063715) - continued									
ES1720454-029	Anonymous	EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
ET1701072-004	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 1068857)									
ES1720652-048	JF_TB01	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 1063715)									
ES1720454-029	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 1063715) - continued									
ES1720454-029	Anonymous	EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit
ET1701072-004	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 1068857)									
ES1720652-048	JF_TB01	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EP231P: PFAS Sums (QC Lot: 1063715)									
ES1720454-029	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	4.24	3.98	6.33	0% - 20%
ET1701072-004	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	7.12	6.90	3.14	0% - 20%
EP231P: PFAS Sums (QC Lot: 1068857)									
ES1720652-048	JF_TB01	EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	<0.01	0.00	No Limit

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1063702)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	95.3	57	121
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	96.6	55	125
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	91.7	52	126
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	82.5	54	123
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	84.2	55	127
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	67.1	54	125
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1063702)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	104	52	128
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	100	54	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	101	58	127
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	82.1	57	128
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	105	60	134
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.7	63	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.7	55	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	92.2	62	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	89.2	53	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	56.2	49	129
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	97.7	59	129
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1063702)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.2	52	132
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	89.8	65	126
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	97.9	64	126
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	92.4	63	124
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	102	58	125
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	93.8	61	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	126	55	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1063702)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	106	54	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	101	61	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	94.0	62	130

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1063702) - continued								
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	78.7	60	130

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1063715)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.5 µg/L	79.0	70	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.5 µg/L	74.4	70	130
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.5 µg/L	75.4	70	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.5 µg/L	82.6	70	130
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.5 µg/L	70.6	70	130
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.5 µg/L	76.4	70	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1068857)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.5 µg/L	84.2	70	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.5 µg/L	93.4	70	130
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.5 µg/L	96.2	70	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.5 µg/L	99.8	70	130
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.5 µg/L	98.8	70	130
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.5 µg/L	104	70	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1063715)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	2.5 µg/L	83.7	70	130
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.5 µg/L	94.8	70	130
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.5 µg/L	72.8	70	130
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.5 µg/L	73.0	70	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.5 µg/L	75.2	70	130
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.5 µg/L	71.6	70	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.5 µg/L	78.6	70	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.5 µg/L	75.4	70	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.5 µg/L	74.6	70	130
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.5 µg/L	78.0	70	130
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	1.25 µg/L	74.4	70	150
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1068857)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	2.5 µg/L	104	70	130
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.5 µg/L	102	70	130
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.5 µg/L	98.4	70	130
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.5 µg/L	101	70	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.5 µg/L	97.0	70	130
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.5 µg/L	95.4	70	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.5 µg/L	101	70	130

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1068857) - continued								
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.5 µg/L	109	70	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.5 µg/L	88.4	70	130
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.5 µg/L	95.2	70	130
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	1.25 µg/L	111	70	150
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1063715)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.5 µg/L	74.4	70	130
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	1.25 µg/L	74.2	70	150
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	1.25 µg/L	81.3	70	150
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.05	µg/L	<0.05	1.25 µg/L	75.8	70	150
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	1.25 µg/L	106	70	150
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.5 µg/L	79.6	70	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.5 µg/L	110	70	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1068857)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.5 µg/L	103	70	130
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	1.25 µg/L	109	70	150
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	1.25 µg/L	91.5	70	150
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.05	µg/L	<0.05	1.25 µg/L	92.6	70	150
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	1.25 µg/L	78.0	70	150
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.5 µg/L	104	70	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.5 µg/L	99.8	70	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1063715)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.5 µg/L	88.0	70	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.5 µg/L	73.8	70	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.5 µg/L	77.6	70	130
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.5 µg/L	76.6	70	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1068857)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.5 µg/L	95.6	70	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.5 µg/L	81.0	70	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.5 µg/L	91.0	70	130
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.5 µg/L	102	70	130

Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1063702)							
EB1716703-002	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	89.9	50	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	92.6	50	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	90.4	50	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	79.8	50	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	84.0	50	130
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	64.3	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1063702)							
EB1716703-002	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	90.6	30	130
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	104	50	130
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	99.3	50	130
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	80.9	50	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	107	50	130
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	91.4	50	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	94.6	50	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	85.0	50	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	86.8	50	130
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	66.9	30	130
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	99.4	30	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1063702)							
EB1716703-002	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	99.0	50	130
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	95.9	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	95.2	30	130
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.00312 mg/kg	87.9	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	102	30	130
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	102	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	129	30	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1063702)							
EB1716703-002	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	106	50	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	108	50	130

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Matrix Spike (MS) Report: Recovery Limits (%) Low	Matrix Spike (MS) Report: Recovery Limits (%) High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1063702) - continued							
EB1716703-002	Anonymous	EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	90.7	50	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	76.6	50	130

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Matrix Spike (MS) Report: Recovery Limits (%) Low	Matrix Spike (MS) Report: Recovery Limits (%) High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1063715)							
ES1720454-029	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.5 µg/L	119	50	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.5 µg/L	111	50	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.5 µg/L	# Not Determined	50	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.5 µg/L	66.2	50	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.5 µg/L	116	50	130
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.5 µg/L	51.8	50	130
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1068857)							
ES1720652-048	JF_TB01	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.5 µg/L	84.4	50	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.5 µg/L	92.0	50	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.5 µg/L	98.2	50	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.5 µg/L	96.8	50	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.5 µg/L	101	50	130
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.5 µg/L	102	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1063715)							
ES1720454-029	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	2.5 µg/L	90.5	50	130
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.5 µg/L	120	50	130
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.5 µg/L	127	50	130
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.5 µg/L	128	50	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.5 µg/L	125	50	130
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.5 µg/L	128	50	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.5 µg/L	102	50	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.5 µg/L	76.2	50	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.5 µg/L	119	50	130
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.5 µg/L	96.8	50	130
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	1.25 µg/L	68.4	50	150
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1068857)							
ES1720652-048	JF_TB01	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	2.5 µg/L	102	50	130
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.5 µg/L	81.8	50	130
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.5 µg/L	99.2	50	130
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.5 µg/L	101	50	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.5 µg/L	99.4	50	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1068857) - continued							
ES1720652-048	JF_TB01	EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.5 µg/L	97.0	50	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.5 µg/L	102	50	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.5 µg/L	111	50	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.5 µg/L	84.6	50	130
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.5 µg/L	100	50	130
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	1.25 µg/L	100	50	150
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1063715)							
ES1720454-029	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.5 µg/L	65.4	50	130
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	1.25 µg/L	129	50	150
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	1.25 µg/L	115	50	150
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	1.25 µg/L	125	50	150
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	1.25 µg/L	118	50	150
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.5 µg/L	88.4	50	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.5 µg/L	117	50	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1068857)							
ES1720652-048	JF_TB01	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.5 µg/L	93.2	50	130
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	1.25 µg/L	107	50	150
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	1.25 µg/L	98.6	50	150
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	1.25 µg/L	93.8	50	150
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	1.25 µg/L	97.4	50	150
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.5 µg/L	104	50	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.5 µg/L	102	50	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1063715)							
ES1720454-029	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.5 µg/L	125	50	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.5 µg/L	52.8	50	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.5 µg/L	118	50	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.5 µg/L	62.6	50	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1068857)							

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1068857) - continued							
ES1720652-048	JF_TB01	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.5 µg/L	96.0	50	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.5 µg/L	83.4	50	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.5 µg/L	84.8	50	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.5 µg/L	75.4	50	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1720652**	Page	: 1 of 6
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Telephone	: +61-2-8784 8555
Project	: 2219058	Date Samples Received	: 18-Aug-2017
Site	: ----	Issue Date	: 29-Aug-2017
Sampler	: ----	No. of samples received	: 45
Order number	: ----	No. of samples analysed	: 15

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	ES1720454--029	Anonymous	**Perfluorohexane sulfonic acid (PFHxS)**	355-46-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

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)								
MW001_0.0-0.1,	MW001_0.2-0.3,	**17-Aug-2017**	**----**	----	----	**22-Aug-2017**	31-Aug-2017	✓
MW002_0.0-0.2,	MW002_0.2-0.4							
HDPE Soil Jar (EA055)								
MW003_0.0-0.1,	MW003_0.5-0.6	**18-Aug-2017**	**----**	----	----	**22-Aug-2017**	01-Sep-2017	✓
Soil Glass Jar - Unpreserved (EA055)								
POND 1,	POND 2,	**17-Aug-2017**	**----**	----	----	**22-Aug-2017**	31-Aug-2017	✓
SWALE 1,	SWALE 2,							
BRIDGE 1,	FD003							
EP231A: Perfluoroalkyl Sulfonic Acids								
HDPE Soil Jar (EP231X)								
MW001_0.0-0.1,	MW001_0.2-0.3,	**17-Aug-2017**	**23-Aug-2017**	13-Feb-2018	✓	**23-Aug-2017**	02-Oct-2017	✓
MW002_0.0-0.2,	MW002_0.2-0.4,							
POND 1,	POND 2,							
SWALE 1,	SWALE 2,							
BRIDGE 1								
HDPE Soil Jar (EP231X)								
MW003_0.0-0.1,	MW003_0.5-0.6	**18-Aug-2017**	**23-Aug-2017**	14-Feb-2018	✓	**23-Aug-2017**	02-Oct-2017	✓
Soil Glass Jar - Unpreserved (EP231X)								
FD003		**17-Aug-2017**	**23-Aug-2017**	13-Feb-2018	✓	**23-Aug-2017**	02-Oct-2017	✓

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)								
MW001_0.0-0.1,	MW001_0.2-0.3,	**17-Aug-2017**	**23-Aug-2017**	13-Feb-2018	✓	**23-Aug-2017**	02-Oct-2017	✓
MW002_0.0-0.2,	MW002_0.2-0.4,							
POND 1,	POND 2,							
SWALE 1,	SWALE 2,							
BRIDGE 1								
HDPE Soil Jar (EP231X)								
MW003_0.0-0.1,	MW003_0.5-0.6	**18-Aug-2017**	**23-Aug-2017**	14-Feb-2018	✓	**23-Aug-2017**	02-Oct-2017	✓
Soil Glass Jar - Unpreserved (EP231X)								
FD003		**17-Aug-2017**	**23-Aug-2017**	13-Feb-2018	✓	**23-Aug-2017**	02-Oct-2017	✓
EP231C: Perfluoroalkyl Sulfonamides								
HDPE Soil Jar (EP231X)								
MW001_0.0-0.1,	MW001_0.2-0.3,	**17-Aug-2017**	**23-Aug-2017**	13-Feb-2018	✓	**23-Aug-2017**	02-Oct-2017	✓
MW002_0.0-0.2,	MW002_0.2-0.4,							
POND 1,	POND 2,							
SWALE 1,	SWALE 2,							
BRIDGE 1								
HDPE Soil Jar (EP231X)								
MW003_0.0-0.1,	MW003_0.5-0.6	**18-Aug-2017**	**23-Aug-2017**	14-Feb-2018	✓	**23-Aug-2017**	02-Oct-2017	✓
Soil Glass Jar - Unpreserved (EP231X)								
FD003		**17-Aug-2017**	**23-Aug-2017**	13-Feb-2018	✓	**23-Aug-2017**	02-Oct-2017	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids								
HDPE Soil Jar (EP231X)								
MW001_0.0-0.1,	MW001_0.2-0.3,	**17-Aug-2017**	**23-Aug-2017**	13-Feb-2018	✓	**23-Aug-2017**	02-Oct-2017	✓
MW002_0.0-0.2,	MW002_0.2-0.4,							
POND 1,	POND 2,							
SWALE 1,	SWALE 2,							
BRIDGE 1								
HDPE Soil Jar (EP231X)								
MW003_0.0-0.1,	MW003_0.5-0.6	**18-Aug-2017**	**23-Aug-2017**	14-Feb-2018	✓	**23-Aug-2017**	02-Oct-2017	✓
Soil Glass Jar - Unpreserved (EP231X)								
FD003		**17-Aug-2017**	**23-Aug-2017**	13-Feb-2018	✓	**23-Aug-2017**	02-Oct-2017	✓

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)							
MW001_0.0-0.1, MW001_0.2-0.3, MW002_0.0-0.2, MW002_0.2-0.4, POND 1, POND 2, SWALE 1, SWALE 2, BRIDGE 1	**17-Aug-2017**	**23-Aug-2017**	13-Feb-2018	✓	**23-Aug-2017**	02-Oct-2017	✓
HDPE Soil Jar (EP231X)							
MW003_0.0-0.1, MW003_0.5-0.6	**18-Aug-2017**	**23-Aug-2017**	14-Feb-2018	✓	**23-Aug-2017**	02-Oct-2017	✓
Soil Glass Jar - Unpreserved (EP231X)							
FD003	**17-Aug-2017**	**23-Aug-2017**	13-Feb-2018	✓	**23-Aug-2017**	02-Oct-2017	✓

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)							
POND 2, BRIDGE 1	**17-Aug-2017**	**----**	----	----	**21-Aug-2017**	13-Feb-2018	✓
HDPE (no PTFE) (EP231X)							
JF_TB01	**18-Aug-2017**	**----**	----	----	**24-Aug-2017**	14-Feb-2018	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X)							
POND 2, BRIDGE 1	**17-Aug-2017**	**----**	----	----	**21-Aug-2017**	13-Feb-2018	✓
HDPE (no PTFE) (EP231X)							
JF_TB01	**18-Aug-2017**	**----**	----	----	**24-Aug-2017**	14-Feb-2018	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X)							
POND 2, BRIDGE 1	**17-Aug-2017**	**----**	----	----	**21-Aug-2017**	13-Feb-2018	✓
HDPE (no PTFE) (EP231X)							
JF_TB01	**18-Aug-2017**	**----**	----	----	**24-Aug-2017**	14-Feb-2018	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
POND 2, BRIDGE 1	**17-Aug-2017**	**----**	----	----	**21-Aug-2017**	13-Feb-2018	✓
HDPE (no PTFE) (EP231X)							
JF_TB01	**18-Aug-2017**	**----**	----	----	**24-Aug-2017**	14-Feb-2018	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X)							
POND 2, BRIDGE 1	**17-Aug-2017**	**----**	----	----	**21-Aug-2017**	13-Feb-2018	✓
HDPE (no PTFE) (EP231X)							
JF_TB01	**18-Aug-2017**	**----**	----	----	**24-Aug-2017**	14-Feb-2018	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **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
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

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	3	22	**13.64**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	22	**9.09**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-House. A portion of soil is extracted with MTBE. The extract is taken to dryness, made up in mobile phase. Analysis is by LC/MSMS, ESI Negative Mode using MRM. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In house: Direct injection analysis of fresh waters after dilution (1:1) with methanol. Analysis by LC-Electrospray-MS-MS, Negative Mode using MRM. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers.

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

LAB OF ORIGIN: NEWCASTLE

LAB OF ORIGIN: NEWCASTLE

☐ **Sydney**
Unit F3 - Building F, 16 Mars Road, Lane Cove
Phone: +612 9900 8400
Email: enviro.syd@mgtlabmark.com.au

☐ **Brisbane**
Unit 1 21 Smallwood Place, Murarrie
Phone: +617 3902 4600
Email: enviro.bris@mgtlabmark.com.au

☐ **Melbourne**
2 Kingston Town Close, Oakleigh, VIC 3166
Phone: +613 8564 5000 Fax: +613 8564 5050
Email: enquiries.melb@mgtlabmark.com.au

CHAIN OF CUSTODY RECORD

Page 1 of 3

CLIENT DETAILS

Company Name: GHD
Office Address: 24 Honeysuckle Drive
Newcastle 2300

Contact Name: Tasman Coupe
Project Manager: Jacqui Hallchurch
Email for results: Jacqui Hallchurch, Tasman Coupe, Alison Monkley: ...@ghd.com

Purchase Order:
PROJECT Number: 2219058
PROJECT Name: 2219058

COC Number:
quote ID: SY/381/17
Data output format: ESDAT

Special Directions & Comments:

Eurofins | mgt DI water batch number:

Analytes

	Sample ID	Date	Matrix	EP231x	Hold
1	MW001_00-0.1	17/8/17	Soil	X	
2	MW001_0.2-0.3			X	
3	MW001_0.5-0.6				X
4	MW001_0.6-0.8				X
5	MW001_1.0-1.2				X
6	MW001_2.0-2.2				X
7	MW001_2.8-3.0				X
8	MW001_4.0-4.2				X
9	MW001_4.7-4.9				X
10	MW001_6.0-6.2				X
11	MW001_6.5-6.7				X
12	MW002_0.0-0.2			X	
13	MW002_0.2-0.4			X	
14	MW002_0.5-0.6				X
15	MW002_1.0-1.2				X
16	MW002_2.0-2.2				X

Some common holding times (with correct preservation).
For further information, consult the lab

Waters		Soils	
BTEX, MAH, VOC	14 days	BTEX, MAH, VOC	14 days
TRH, PAH, Phenols, Pesticides	7 days	TRH, PAH, Phenols, Pesticides	14 days
Heavy Metals	6 months	Heavy Metals	6 months
Mercury, CrVI	28 days	Mercury, CrVI	28 days
Microbiological testing	24 hours	Microbiological testing	72 hours
BOD, Nitrate, Nitrite, Total N	2 days	Anions	28 days
Solids - TSS, TDS etc	7 days	SPOCAS, pH Field and FOX, CrS	24 hours
Ferrous iron	7 days	ASLP, TCLP	7 days

Containers:

1LP	250P	125P	1LA	40mL vial	125mL A	Jar

Sample comments:

Environmental Division
Sydney
Work Order Reference
ES1720652

Telephone : +61-2-8784 8555

Relinquished By: John Fowler
Date & Time: 18/8/17 1550
Signature:

Laboratory Staff
Received By:
Date & Time: 18/8/17 16:00
Signature:

Turn around time
☐ 1 DAY ☐ 2 DAY ☐ 3 DAY ☐
☐ 5 DAY ☐ 10 DAY ☐ Other: Standard

Method Of Shipment
☐ Courier
☐ Hand Delivered
☐ Postal
Courier Consignment #:

Temperature on arrival: 5.8 °C
Report number:

V.Rytel
18/8/17 7:30 PM

☐ **Sydney**
Unit F6 - 6 Building F, 16 Mars Road, Lane Cove
Phone: +612 9900 8400
Email: enviro.syd@mgtlabmark.com.au

☐ **Brisbane**
Unit 1-21 Smallwood Place, Murarrie
Phone: +617 3902 4600
Email: enviro.bris@mgtlabmark.com.au

☐ **Melbourne**
2 Kingston Town Close, Oakleigh, VIC 3166
Phone: +613 8564 5000 Fax: +613 8564 5090
Email: enquiries.melb@mgtlabmark.com.au

CHAIN OF CUSTODY RECORD

CLIENT DETAILS

Company Name :	GHD	Contact Name:	Tasman Coupe	Purchase Order :	COC Number :
Office Address :	24 Honeysuckle Drive	Project Manager :	Jacqui Hallchurch	PROJECT Number : 2219058	quote ID : SY/361/17
	Newcastle 2300	Email for results :	Jacqui Hallchurch, Tasman Coupe, Anson Mooney, ...	PROJECT Name : 2219058	Data output format: ESDAT

Special Directions & Comments :

Eurofins | mgt DI water batch number:

		Sample ID	Date	Matrix	EP231X	Hold
17	1	MW002-2.7-2.9	17/8/17	Soil		X
18	2	MW002-3.8-4.0				X
19	3	MW002-5.0-5.2				X
20	4	MW002-5.8-6.0				X
21	5	MW002-6.6-7.0				X
22	6	MW002-7.8-8.0				X
23	7	~~FD01~~ POND 1		Sediment	X	
24	8	POND 2			X	
25	9	SWALE 1			X	
26	10	SWALE 2			X	
27	11	BRIDGE 1			X	
28	12	~~FD02~~ POND 1		Water	X	Not received
29	13	~~FD03~~ POND 2			X	
30	14	SWALE 1			X	
31	15	SWALE 2			X	Not received
32	16	BRIDGE 1			X	

Analytes

Some common holding times (with correct preservation).
For further information please see the lab

Waters		Soils	
BTEX, MAH, VOC	14 days	BTEX, MAH, VOC	14 days
TRH, PAH, Phenols, Pesticides	7 days	TRH, PAH, Phenols, Pesticides	14 days
Heavy Metals	6 months	Heavy Metals	6 months
Mercury, CrVI	28 days	Mercury, CrVI	28 days
Microbiological testing	24 hours	Microbiological testing	72 hours
BOD, Nitrate, Nitrite, Total N	2 days	Anions	28 days
Solids - TSS, TDS etc	7 days	SPOCAS, pH Field and FOX, CrS	24 hours
Ferrous iron	7 days	ASLP, TCLP	7 days

Containers:

1LP	250P	125P	1LA	40mL vial	125mL A	Jar

Sample comments:

Relinquished By:	Laboratory Staff	Turn around time	Method Of Shipment	Temperature on arrival:
Julian Fowler	Received By: V. Murra	☐ 1 DAY ☐ 2 DAY ☐ 3 DAY ☐ 5 DAY ☐ 10 DAY ☐ Other: Standard	☐ Courier ☐ Hand Delivered ☐ Postal Courier Consignment # :	Report number:
Date & Time: 18/8/17 1550	Date & Time: 18/8/17 16:00			
Signature:	Signature:			

V. Perte
18/8/17 7:30pm

☐ **Sydney**
Unit F3 - 6 Building F, 16 Mars Road, Lane Cove
Phone: +612 9900 8400
Email: enviro.syd@mgflabmark.com.au

☐ **Brisbane**
Unit 1-21 Smallwood Place, Murarrie
Phone: +617 3902 4600
Email: enviro.bris@mgflabmark.com.au

☐ **Melbourne**
2 Kingston Town Close, Oakleigh, VIC 3166
Phone: +613 8564 5000 Fax: +613 8564 5090
Email: enquiries.melb@mgflabmark.com.au

CHAIN OF CUSTODY RECORD

CLIENT DETAILS

Company Name : GHD
Office Address : 24 Honeysuckle Drive
Newcastle 2300

Special Directions & Comments :

Eurofins | mgt DI water batch number:

Contact Name: Tasman Coupe
Project Manager: Jacqui Hallchurch
Email for results: Jacqui Hallchurch, Tasman Coupe, Alison Moakley, ntlter@ghd.com

Purchase Order :
PROJECT Number : 2219058
PROJECT Name : 2219058

Page 3 of 3
COC Number :
quote ID : S4/361/17
Data output format: ESDAT

Analytes

	Sample ID	Date	Matrix	EP231X	Hold
33	1 FD001	17/8/17	Soil		X
34	2 FD002	↓	"		
35	3 FD003	↓	SED	X	
36	4 FD003	17/8/17	WATER	X	
37	5 MW003_0.0-0.1	18/8/17	SOIL	X	
38	6 MW003_0.5-0.6			X	
39	7 MW003_2.0-2.2				X
40	8 MW003_2.7-2.9				X
41	9 MW003_3.3-3.5				X
42	10 MW003_4.3-4.5				X
43	11 MW003_5.3-5.5				X
44	12 MW003_6.3-6.5				X
45	13 MW003_7.0-7.2				X
46	14 MW003_7.8-8.0				X
47	15 JF_FD01	↓	↓		X
48	16 JF_TB01	18/8/17	WATER	X	

Some common holding times (with correct preservation).
For current recommendations see www.mgflabmark.com.au

Waters		Soils	
BTEX, MAH, VOC	14 days	BTEX, MAH, VOC	14 days
TRH, PAH, Phenols, Pesticides	7 days	TRH, PAH, Phenols, Pesticides	14 days
Heavy Metals	6 months	Heavy Metals	6 months
Mercury, CrVI	28 days	Mercury, CrVI	28 days
Microbiological testing	24 hours	Microbiological testing	72 hours
BOD, Nitrate, Nitrite, Total N	2 days	Anions	28 days
Solids - TSS, TDS etc	7 days	SPOCAS, pH Field and FOX, CrS	24 hours
Ferrous iron	7 days	ASLP, TCLP	7 days

Containers:

1LP	250P	125P	1LA	40mL vial	125mL A	Jar	

Sample comments:

Laboratory Staff

Relinquished By: Julian Fowle
Date & Time:: 18/8/17 1550
Signature:

Received By:
Date & Time: 18/8/17 16:00
Signature:

Turn around time

1 DAY ☐ 2 DAY ☐ 3 DAY ☐
5 DAY ☐ 10 DAY ☐ Other:
Standard

Method Of Shipment

☐ Courier
☐ Hand Delivered
☐ Postal
Courier Consignment # :

Temperature on arrival:

Report number:

V. Patel
18/8/17 7:30PM

Megan Gould

From: Fadi Soro
Sent: Tuesday, 22 August 2017 8:40 AM
To: Megan Gould
Cc: Saman Taeidi
Subject: FW: Minor update to CoC for workorder ES1720652

Hey Megan,

Can you please amend WO ES1720652 as per below?

Regards

Fadi

From: Julian Fowler [mailto:Julian.Fowler@ghd.com]
Sent: Friday, 18 August 2017 6:41 PM
To: Samples Newcastle <samples.newcastle@alsglobal.com>; Samples Sydney <Samples.Sydney@alsglobal.com>
Subject: Minor update to CoC for workorder ES1720652

Good afternoon,

for workorder ES1720652

On the 3rd page of the CoC, last sample, ID: JF_TB01, I forgot to:
1) Cross the analysis for PFAS (EP231X)
2) mark the date sampled: 18/8/17
3) mark the matrix as: Water

Thanks

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1721241**	Page	: 1 of 9
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS ALISON MONKLEY	Contact	: Vanessa Mattes
Address	: PO BOX 5403 NEWCASTLE WEST NSW, AUSTRALIA 2302	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 2219058	Date Samples Received	: 25-Aug-2017 14:26
Order number	: ----	Date Analysis Commenced	: 29-Aug-2017
C-O-C number	: ----	Issue Date	: 31-Aug-2017 14:42
Sampler	: TASMAN COUPE		
Site	: ----		
Quote number	: SY/361/17		
No. of samples received	: 10		
No. of samples analysed	: 8		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

When 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.

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)			Client sample ID	SW PIT 01	----	----	----	----
			Client sampling date / time	25-Aug-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1721241-010	--------	--------	--------	--------
				Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**75.9**	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	**0.0040**	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids								
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	**0.0007**	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	**0.0013**	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	**0.0004**	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	**0.0018**	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides								
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SW PIT 01	----	----	----	----
				Client sampling date / time	25-Aug-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1721241-010	--------	--------	--------	--------
					Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.0005	mg/kg		<0.0005	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg		<0.0005	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg		<0.0002	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg		<0.0005	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		<0.0005	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		**0.0013**	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		**0.0013**	----	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0108**	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0040**	----	----	----	----
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0053**	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**81.0**	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MW001	MW002	MW003	OS5	FD001
				Client sampling date / time	25-Aug-2017 00:00	25-Aug-2017 00:00	25-Aug-2017 00:00	25-Aug-2017 00:00	25-Aug-2017 00:00
Compound	CAS Number	LOR	Unit		ES1721241-001	ES1721241-002	ES1721241-003	ES1721241-004	ES1721241-005
					Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		**0.18**	<0.02	**0.07**	**0.09**	<0.02
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		**0.10**	<0.02	**0.08**	**0.14**	<0.02
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L		**0.08**	<0.02	**0.61**	**1.01**	<0.02
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		<0.02	<0.02	<0.02	**0.04**	<0.02
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		**0.02**	<0.01	**0.18**	**0.55**	<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	**0.1**	**0.2**	<0.1
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		**0.70**	<0.02	**0.92**	**1.55**	<0.02
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		**0.35**	<0.02	**0.54**	**1.00**	<0.02
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		**0.04**	<0.02	**0.21**	**0.42**	<0.02
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		<0.01	<0.01	**0.16**	**0.29**	<0.01
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	<0.02
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
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)				Client sample ID	MW001	MW002	MW003	OS5	FD001
				Client sampling date / time	25-Aug-2017 00:00	25-Aug-2017 00:00	25-Aug-2017 00:00	25-Aug-2017 00:00	25-Aug-2017 00:00
Compound	CAS Number	LOR	Unit		ES1721241-001	ES1721241-002	ES1721241-003	ES1721241-004	ES1721241-005
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	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	<0.05	**2.27**	**1.24**	<0.05
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	<0.05
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		**1.57**	<0.01	**5.14**	**6.53**	<0.01
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		**0.10**	<0.01	**0.79**	**1.56**	<0.01
Sum of PFAS (WA DER List)	----	0.01	µg/L		**1.47**	<0.01	**5.06**	**6.35**	<0.01
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**104**	**90.7**	**112**	**109**	**106**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	RB001	TB001	----	----	----
				Client sampling date / time	25-Aug-2017 00:00	25-Aug-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1721241-006	ES1721241-008	--------	--------	--------
					Result	Result	----	----	----
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	0.02	µg/L		<0.02	<0.02	----	----	----
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	----	----	----
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	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	RB001	TB001	----	----	----
				Client sampling date / time	25-Aug-2017 00:00	25-Aug-2017 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1721241-006	ES1721241-008	--------	--------	--------
					Result	Result	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	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	----	----	----
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	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**109**	**110**	----	----	----

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	130

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	130

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1721241**	Page	: 1 of 11
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS ALISON MONKLEY	Contact	: Vanessa Mattes
Address	: PO BOX 5403 NEWCASTLE WEST NSW, AUSTRALIA 2302	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: 2219058	Date Samples Received	: 25-Aug-2017
Order number	: ----	Date Analysis Commenced	: 29-Aug-2017
C-O-C number	: ----	Issue Date	: 31-Aug-2017
Sampler	: TASMAN COUPE		
Site	: ----		
Quote number	: SY/361/17		
No. of samples received	: 10		
No. of samples analysed	: 8		

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. 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
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 1080692)									
ES1721232-007	Anonymous	EA055: Moisture Content	----	1	%	31.4	31.0	1.31	0% - 20%
ES1721332-001	Anonymous	EA055: Moisture Content	----	1	%	6.2	5.8	6.53	No Limit
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 1077352)									
EB1717292-007	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP1709164-003	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0002	0.0002	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1077352)									
EB1717292-007	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1077352) - continued									
EB1717292-007	Anonymous	EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EP1709164-003	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 1077352)									
EB1717292-007	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EP1709164-003	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	<0.0002	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 1077352)									
EB1717292-007	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
EP1709164-003	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.00	No Limit

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Laboratory Duplicate (DUP) Report LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 1077872)									
EP1709134-001	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.22	0.22	0.00	0% - 20%
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	0.06	0.06	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	0.05	0.05	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	0.27	0.24	11.2	0% - 50%
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
ES1721241-001	MW001	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	0.02	0.03	45.4	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	0.18	0.19	5.90	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	0.10	0.09	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	0.08	0.09	17.1	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1077872)									
EP1709134-001	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	0.07	0.06	0.00	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.14	0.13	8.06	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	0.02	0.02	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1077872) - continued									
EP1709134-001	Anonymous	EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	0.2	0.2	0.00	No Limit
ES1721241-001	MW001	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	0.70	0.73	3.65	0% - 20%
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	0.35	0.36	0.00	0% - 50%
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	0.04	0.04	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	0.1	<0.1	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 1077872)									
EP1709134-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
ES1721241-001	MW001	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 1077872)									
EP1709134-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit
ES1721241-001	MW001	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EP231P: PFAS Sums (QC Lot: 1077872)									
EP1709134-001	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	1.05	0.98	6.90	0% - 20%
ES1721241-001	MW001	EP231X: Sum of PFAS	----	0.01	µg/L	1.57	1.53	2.58	0% - 20%

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1077352)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	77.8	57	121
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	75.6	55	125
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	68.0	52	126
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	77.2	54	123
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	84.2	55	127
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	70.0	54	125
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1077352)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	105	52	128
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	90.0	54	129
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	72.8	58	127
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	74.0	57	128
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	76.4	60	134
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	85.0	63	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	<0.0002	0.00125 mg/kg	73.2	55	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	94.0	62	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	88.0	53	134
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg	<0.0002	0.00125 mg/kg	85.6	49	129
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	100	59	129
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1077352)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	76.6	52	132
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg	<0.0005	0.00312 mg/kg	97.8	65	126
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	96.2	64	126
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.0005	mg/kg	<0.0005	0.00312 mg/kg	76.3	63	124
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.0005	mg/kg	<0.0005	0.00312 mg/kg	86.9	58	125
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	70.2	61	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg	<0.0002	0.00125 mg/kg	92.0	55	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1077352)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	80.0	54	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	68.6	61	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	63.0	62	130

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1077352) - continued								
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	81.0	60	130

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1077872)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.5 µg/L	117	70	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.5 µg/L	124	70	130
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.5 µg/L	114	70	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.5 µg/L	120	70	130
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.5 µg/L	119	70	130
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.5 µg/L	115	70	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1077872)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	2.5 µg/L	84.2	70	130
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.5 µg/L	129	70	130
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.5 µg/L	129	70	130
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.5 µg/L	127	70	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.5 µg/L	128	70	130
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.5 µg/L	121	70	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.5 µg/L	122	70	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.5 µg/L	117	70	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.5 µg/L	118	70	130
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.5 µg/L	120	70	130
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	1.25 µg/L	138	70	150
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1077872)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.5 µg/L	129	70	130
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	1.25 µg/L	137	70	150
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	1.25 µg/L	126	70	150
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.05	µg/L	<0.05	1.25 µg/L	135	70	150
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	1.25 µg/L	108	70	150
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.5 µg/L	97.8	70	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.5 µg/L	130	70	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1077872)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.5 µg/L	126	70	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.5 µg/L	124	70	130

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1077872) - continued								
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.5 µg/L	129	70	130
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.5 µg/L	83.4	70	130

Matrix Spike (MS) Report

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

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1077352)							
EB1717292-007	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	69.9	50	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.00125 mg/kg	70.9	50	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	69.5	50	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.00125 mg/kg	70.9	50	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	87.8	50	130
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.00125 mg/kg	60.4	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1077352)							
EB1717292-007	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	66.4	30	130
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	85.6	50	130
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	73.9	50	130
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	79.7	50	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	78.6	50	130
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.00125 mg/kg	84.1	50	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.00125 mg/kg	83.4	50	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.00125 mg/kg	104	50	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.00125 mg/kg	82.4	50	130
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.00125 mg/kg	89.7	30	130
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.00312 mg/kg	80.3	30	130
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1077352)							
EB1717292-007	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.00125 mg/kg	99.0	50	130
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.00312 mg/kg	85.6	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.00312 mg/kg	101	30	130
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.00312 mg/kg	58.2	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.00312 mg/kg	79.8	30	130

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1077352) - continued							
EB1717292-007	Anonymous	EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.00125 mg/kg	107	30	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.00125 mg/kg	59.0	30	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1077352)							
EB1717292-007	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	99.5	50	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	78.3	50	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	85.1	50	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	66.3	50	130

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	Matrix Spike (MS) Report: SpikeRecovery(%) MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1077872)							
EP1709134-001	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.5 µg/L	114	50	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.5 µg/L	120	50	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.5 µg/L	96.4	50	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.5 µg/L	112	50	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.5 µg/L	112	50	130
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.5 µg/L	103	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1077872)							
EP1709134-001	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	2.5 µg/L	92.4	50	130
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.5 µg/L	122	50	130
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.5 µg/L	104	50	130
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.5 µg/L	112	50	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.5 µg/L	127	50	130
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.5 µg/L	123	50	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.5 µg/L	112	50	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.5 µg/L	121	50	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.5 µg/L	127	50	130
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.5 µg/L	116	50	130
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	1.25 µg/L	136	50	150
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1077872)							
EP1709134-001	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.5 µg/L	124	50	130
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	1.25 µg/L	122	50	150
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	1.25 µg/L	129	50	150
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	1.25 µg/L	126	50	150

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1077872) - continued							
EP1709134-001	Anonymous	EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	1.25 µg/L	113	50	150
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.5 µg/L	127	50	130
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.5 µg/L	86.6	50	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1077872)							
EP1709134-001	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.5 µg/L	127	50	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.5 µg/L	127	50	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.5 µg/L	127	50	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.5 µg/L	72.2	50	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1721241**	Page	: 1 of 5
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS ALISON MONKLEY	Telephone	: +61-2-8784 8555
Project	: 2219058	Date Samples Received	: 25-Aug-2017
Site	: ----	Issue Date	: 31-Aug-2017
Sampler	: TASMAN COUPE	No. of samples received	: 10
Order number	: ----	No. of samples analysed	: 8

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Analysis Holding Time Compliance

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

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

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

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

Matrix: **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)							
SW PIT 01	**25-Aug-2017**	**----**	----	----	**29-Aug-2017**	08-Sep-2017	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X)							
SW PIT 01	**25-Aug-2017**	**29-Aug-2017**	21-Feb-2018	✓	**29-Aug-2017**	08-Oct-2017	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X)							
SW PIT 01	**25-Aug-2017**	**29-Aug-2017**	21-Feb-2018	✓	**29-Aug-2017**	08-Oct-2017	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X)							
SW PIT 01	**25-Aug-2017**	**29-Aug-2017**	21-Feb-2018	✓	**29-Aug-2017**	08-Oct-2017	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X)							
SW PIT 01	**25-Aug-2017**	**29-Aug-2017**	21-Feb-2018	✓	**29-Aug-2017**	08-Oct-2017	✓
EP231P: PFAS Sums							
HDPE Soil Jar (EP231X)							
SW PIT 01	**25-Aug-2017**	**29-Aug-2017**	21-Feb-2018	✓	**29-Aug-2017**	08-Oct-2017	✓

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)							
MW001, MW002, MW003, OS5, FD001, RB001, TB001	**25-Aug-2017**	**----**	----	----	**29-Aug-2017**	21-Feb-2018	✓

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X)							
MW001, MW002, MW003, OS5, FD001, RB001, TB001	**25-Aug-2017**	**----**	----	----	**29-Aug-2017**	21-Feb-2018	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X)							
MW001, MW002, MW003, OS5, FD001, RB001, TB001	**25-Aug-2017**	**----**	----	----	**29-Aug-2017**	21-Feb-2018	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
MW001, MW002, MW003, OS5, FD001, RB001, TB001	**25-Aug-2017**	**----**	----	----	**29-Aug-2017**	21-Feb-2018	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X)							
MW001, MW002, MW003, OS5, FD001, RB001, TB001	**25-Aug-2017**	**----**	----	----	**29-Aug-2017**	21-Feb-2018	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **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	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	15	**13.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	15	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	15	**6.67**	**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 (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-House. A portion of soil is extracted with MTBE. The extract is taken to dryness, made up in mobile phase. Analysis is by LC/MSMS, ESI Negative Mode using MRM. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers.
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	WATER	In house: Direct injection analysis of fresh waters after dilution (1:1) with methanol. Analysis by LC-Electrospray-MS-MS, Negative Mode using MRM. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers.

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

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order	: **ES1721241**		
Amendment	: **1**		
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS ALISON MONKLEY	Contact	: Vanessa Mattes
Address	: PO BOX 5403 NEWCASTLE WEST NSW, AUSTRALIA 2302	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: alison.monkley@ghd.com	E-mail	: ALSEnviro.Sydney@alsglobal.com
Telephone	: ----	Telephone	: +61-2-8784 8555
Facsimile	: ----	Facsimile	: +61-2-8784 8500
Project	: 2219058	Page	: 1 of 3
Order number	: ----	Quote number	: ES2017GHDSER0024 (SY/361/17)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: TASMAN COUPE		

Dates

Date Samples Received	: 25-Aug-2017 14:26	Issue Date	: 08-Sep-2017
Client Requested Due Date	: 11-Sep-2017	Scheduled Reporting Date	: **11-Sep-2017**

Delivery Details

Mode of Delivery	: Undefined	Security Seal	: Not intact.
No. of coolers/boxes	: 1	Temperature	: 20.6
Receipt Detail	:	No. of samples received / analysed	: 12 / 9

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 SW PIT 01 (water matrix) was not received.**
- **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 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 (14 days), Solid (60 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

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

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

Summary of Sample(s) and Requested Analysis

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

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA055-103 Moisture Content	SOIL - EP231X (solids) PFAS - Full Suite (28 analytes)
ES1721241-010	25-Aug-2017 00:00	SW PIT 01	✓	✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	(On Hold) WATER No analysis requested	WATER - EP231X PFAS - Full Suite (28 analytes)
ES1721241-001	25-Aug-2017 00:00	MW001		✓
ES1721241-002	25-Aug-2017 00:00	MW002		✓
ES1721241-003	25-Aug-2017 00:00	MW003		✓
ES1721241-004	25-Aug-2017 00:00	OS5		✓
ES1721241-005	25-Aug-2017 00:00	FD001		✓
ES1721241-006	25-Aug-2017 00:00	RB001		✓
ES1721241-007	25-Aug-2017 00:00	FB001	✓	
ES1721241-008	25-Aug-2017 00:00	TB001		✓
ES1721241-009	25-Aug-2017 00:00	MW001 DRY	✓	
ES1721241-011	25-Aug-2017 00:00	SW PIT 01	✓	
ES1721241-012	29-Aug-2017 00:00	SW PIT 01		✓

Proactive Holding Time Report

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

Requested Deliverables

ACCOUNTS PAYABLE (Brisbane)

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

ALISON MONKLEY

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

JACQUI HALLCHURCH

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

JACQUI TAYLOR

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

ntl car

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

TASMAN COUPE

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

ALS Environmental — CHAIN OF CUSTODY

ALS Laboratory: please tick →

☐ ADELAIDE ☐ BRISBANE ☐ CHINCHILLA ☐ DARWIN ☐ EMERALD ☐ GLADSTONE ☐ MACKAY ☐ MELBOURNE ☐ MUDGEE ☑ NEWCASTLE ☐ NOWRA ☐ PERTH ☐ ROMA ☐ SYDNEY ☐ TOWNSVILLE ☐ WOLLONGONG

CLIENT: [redacted] GHD
OFFICE: NEWCASTLE
PROJECT: 2219058
PURCHASE ORDER NUMBER:
PROJECT MANAGER: ALISON MONKLEY CONTACT PH: 0447 108 208
SAMPLER: TAZ COUPE SAMPLER MOBILE: 0421081113
COC emailed to ALS? (YES / NO) EDD FORMAT (or default):
Email Reports to (will default to PM if no other addresses are listed): ALISON, TASMAN, JACQUI, NTL.CAR
Email Invoice to (will default to PM if no other addresses are listed): AP.NSS@GHD.COM

TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)
☑ Standard TAT (List due date): 1/9/17
☐ Non Standard or urgent TAT (List due date):

ALS QUOTE NO.: S4/361/17

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: 20.6 °C
Other comment:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
T. Taye	KM		
DATE/TIME: 2:30 25/8	DATE/TIME: 25/8/17 1425	DATE/TIME: 25/8/17 17:00	DATE/TIME: 25/8/17 7:30PM

COMMENTS/ SPECIAL HANDLING/STORAGE OR DISPOSAL:

ALS USE	SAMPLE DETAILS MATRIX - SOLID (S), WATER (W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or dissolved (field filtered bottle required).								Additional Information
LAB ID	SAMPLE ID	DATE/ TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	EP-231X	Hold							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
1	MW001 [redacted]	25/8/17	W	ICE B ESKY (P)	1	X								E-MAILED
2	MW002					X								
3	MW003					X								
4	OSS					X								
5	FD001					X								
6	RB001					X								
7	FB001						X							
8	TB001					x								
9	MW001 DRY						X							
SNR	SW PIT 02		↓	↓	↓	X								
10	SW PIT 02	↓	S	P+G	3	X								
						~~X~~								
				TOTAL										

Environmental Division Sydney
Work Order Reference
ES1721241

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; 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; LI = Lugols Iodine Preserved; STT = Sterile Sodium Thiosulfate Preserved; Z = Zinc Acetate Preserved Bottle; E = Ed TA Preserved Bottles; ST = Sterile Bottle ***Soil Container Codes:*** ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

226811

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1721647**	Page	: 1 of 6
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Vanessa Mattes
Address	: PO BOX 5403 NEWCASTLE WEST NSW, AUSTRALIA 2302	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 9239 7100	Telephone	: +61-2-8784 8555
Project	: 2219058	Date Samples Received	: 30-Aug-2017 15:00
Order number	: ----	Date Analysis Commenced	: 03-Sep-2017
C-O-C number	: ----	Issue Date	: 07-Sep-2017 12:03
Sampler	: ----		
Site	: ----		
Quote number	: SY/361/17		
No. of samples received	: 4		
No. of samples analysed	: 4		

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Raymond Commodore	Instrument Chemist	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

When 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.

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: DI WATER LEACHATE (Matrix: WATER)				Client sample ID	MW001_0.0-0.1	MW002_0.0-0.2	SWALE1	BRIDGE 1	----
				Client sampling date / time	17-Aug-2017 00:00	17-Aug-2017 00:00	17-Aug-2017 00:00	17-Aug-2017 00:00	----
Compound	CAS Number	LOR	Unit		ES1721647-001	ES1721647-002	ES1721647-003	ES1721647-004	--------
					Result	Result	Result	Result	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		<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	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L		<0.02	<0.02	**0.02**	<0.02	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		**0.05**	**0.22**	**0.07**	<0.01	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<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	<0.1	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		**0.03**	**0.07**	**0.04**	<0.02	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		**0.05**	**0.06**	**0.04**	<0.02	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		**0.04**	**0.06**	**0.03**	<0.01	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		**0.10**	**0.08**	**0.03**	<0.02	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		**0.08**	**0.05**	**0.02**	<0.02	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<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	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<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	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<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	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	----

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)				Client sample ID	MW001_0.0-0.1	MW002_0.0-0.2	SWALE1	BRIDGE 1	----
				Client sampling date / time	17-Aug-2017 00:00	17-Aug-2017 00:00	17-Aug-2017 00:00	17-Aug-2017 00:00	----
Compound	CAS Number	LOR	Unit		ES1721647-001	ES1721647-002	ES1721647-003	ES1721647-004	--------
					Result	Result	Result	Result	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.05	µg/L		<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	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<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	----
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	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	<0.05	**0.06**	<0.05	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		**0.05**	**0.11**	<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	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		**0.40**	**0.65**	**0.31**	<0.01	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		**0.05**	**0.22**	**0.09**	<0.01	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		**0.22**	**0.52**	**0.26**	<0.01	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**80.4**	**78.7**	**80.7**	**80.5**	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	MW001_0.0-0.1	MW002_0.0-0.2	SWALE1	BRIDGE 1	----
			Client sampling date / time	17-Aug-2017 00:00	17-Aug-2017 00:00	17-Aug-2017 00:00	17-Aug-2017 00:00	----
Compound	CAS Number	LOR	Unit	ES1721647-001	ES1721647-002	ES1721647-003	ES1721647-004	--------
				Result	Result	Result	Result	----
EN60: Bottle Leaching Procedure								
Final pH	----	0.1	pH Unit	**6.6**	**6.4**	**6.7**	**6.4**	**----**

Surrogate Control Limits

Sub-Matrix: **DI WATER LEACHATE**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP231S: PFAS Surrogate			
13C4-PFOS	----	60	130

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1721647**	Page	: 1 of 6
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Vanessa Mattes
Address	: PO BOX 5403 NEWCASTLE WEST NSW, AUSTRALIA 2302	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 9239 7100	Telephone	: +61-2-8784 8555
Project	: 2219058	Date Samples Received	: 30-Aug-2017
Order number	: ----	Date Analysis Commenced	: 03-Sep-2017
C-O-C number	: ----	Issue Date	: 07-Sep-2017
Sampler	: ----		
Site	: ----		
Quote number	: SY/361/17		
No. of samples received	: 4		
No. of samples analysed	: 4		

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

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Raymond Commodore	Instrument Chemist	Sydney Inorganics, Smithfield, NSW

General Comments

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

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

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

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 1091307)									
EB1718002-006	Anonymous	EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 1091307)									
EB1718002-006	Anonymous	EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	<0.01	0.00	No Limit
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	<0.1	0.00	No Limit
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 1091307)									
EB1718002-006	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	<0.02	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	<0.02	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP231C: Perfluoroalkyl Sulfonamides (QC Lot: 1091307) - continued									
EB1718002-006	Anonymous	EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 1091307)									
EB1718002-006	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	<0.05	0.00	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	<0.05	0.00	No Limit
EP231P: PFAS Sums (QC Lot: 1091307)									
EB1718002-006	Anonymous	EP231X: Sum of PFAS	----	0.01	µg/L	<0.01	<0.01	0.00	No Limit

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

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

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1091307)								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L	<0.02	0.5 µg/L	92.0	70	130
EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L	<0.02	0.5 µg/L	105	70	130
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L	<0.02	0.5 µg/L	103	70	130
EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L	<0.02	0.5 µg/L	106	70	130
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L	<0.01	0.5 µg/L	94.6	70	130
EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L	<0.02	0.5 µg/L	125	70	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1091307)								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L	<0.1	2.5 µg/L	85.2	70	130
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L	<0.02	0.5 µg/L	99.0	70	130
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L	<0.02	0.5 µg/L	104	70	130
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L	<0.02	0.5 µg/L	103	70	130
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L	<0.01	0.5 µg/L	105	70	130
EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L	<0.02	0.5 µg/L	116	70	130
EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L	<0.02	0.5 µg/L	110	70	130
EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L	<0.02	0.5 µg/L	107	70	130
EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L	<0.02	0.5 µg/L	99.2	70	130
EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L	<0.02	0.5 µg/L	117	70	130
EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L	<0.05	1.25 µg/L	108	70	150
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1091307)								
EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L	<0.02	0.5 µg/L	105	70	130
EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L	<0.05	1.25 µg/L	94.7	70	150
EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L	<0.05	1.25 µg/L	91.3	70	150
EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.05	µg/L	<0.05	1.25 µg/L	118	70	150
EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L	<0.05	1.25 µg/L	105	70	150
EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L	<0.02	0.5 µg/L	99.0	70	130
EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L	<0.02	0.5 µg/L	89.0	70	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1091307)								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L	<0.05	0.5 µg/L	106	70	130
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L	<0.05	0.5 µg/L	101	70	130
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L	<0.05	0.5 µg/L	121	70	130

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1091307) - continued								
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L	<0.05	0.5 µg/L	88.2	70	130

Matrix Spike (MS) Report

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

Sub-Matrix: **WATER**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 1091307)							
EB1718002-006	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.5 µg/L	94.6	50	130
		EP231X: Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.5 µg/L	102	50	130
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.5 µg/L	97.6	50	130
		EP231X: Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.5 µg/L	100	50	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.5 µg/L	97.0	50	130
		EP231X: Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.5 µg/L	105	50	130
EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 1091307)							
EB1718002-006	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	2.5 µg/L	86.0	50	130
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.5 µg/L	114	50	130
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.5 µg/L	111	50	130
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.5 µg/L	123	50	130
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.5 µg/L	116	50	130
		EP231X: Perfluorononanoic acid (PFNA)	375-95-1	0.5 µg/L	116	50	130
		EP231X: Perfluorodecanoic acid (PFDA)	335-76-2	0.5 µg/L	116	50	130
		EP231X: Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.5 µg/L	120	50	130
		EP231X: Perfluorododecanoic acid (PFDoDA)	307-55-1	0.5 µg/L	118	50	130
		EP231X: Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.5 µg/L	111	50	130
		EP231X: Perfluorotetradecanoic acid (PFTeDA)	376-06-7	1.25 µg/L	112	50	150
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1091307)							
EB1718002-006	Anonymous	EP231X: Perfluorooctane sulfonamide (FOSA)	754-91-6	0.5 µg/L	128	50	130
		EP231X: N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	1.25 µg/L	104	50	150
		EP231X: N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	1.25 µg/L	103	50	150
		EP231X: N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	1.25 µg/L	109	50	150
		EP231X: N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	1.25 µg/L	82.9	50	150
		EP231X: N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.5 µg/L	110	50	130

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EP231C: Perfluoroalkyl Sulfonamides (QCLot: 1091307) - continued							
EB1718002-006	Anonymous	EP231X: N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.5 µg/L	116	50	130
EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 1091307)							
EB1718002-006	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.5 µg/L	114	50	130
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.5 µg/L	109	50	130
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.5 µg/L	126	50	130
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.5 µg/L	67.4	50	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1721647**	Page	: 1 of 4
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Telephone	: +61-2-8784 8555
Project	: 2219058	Date Samples Received	: 30-Aug-2017
Site	: ----	Issue Date	: 07-Sep-2017
Sampler	: ----	No. of samples received	: 4
Order number	: ----	No. of samples analysed	: 4

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Analysis Holding Time Compliance

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

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

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

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

Matrix: **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
EN60: Bottle Leaching Procedure							
Non-Volatile Leach: 180 day HT (e.g. metals ex.Hg) (EN60-Dla)							
MW001_0.0-0.1, MW002_0.0-0.2, SWALE1, BRIDGE 1	**17-Aug-2017**	**03-Sep-2017**	13-Feb-2018	✓	**----**	----	----

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
MW001_0.0-0.1, MW002_0.0-0.2, SWALE1, BRIDGE 1	**03-Sep-2017**	**----**	----	----	**06-Sep-2017**	02-Mar-2018	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X)							
MW001_0.0-0.1, MW002_0.0-0.2, SWALE1, BRIDGE 1	**03-Sep-2017**	**----**	----	----	**06-Sep-2017**	02-Mar-2018	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X)							
MW001_0.0-0.1, MW002_0.0-0.2, SWALE1, BRIDGE 1	**03-Sep-2017**	**----**	----	----	**06-Sep-2017**	02-Mar-2018	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
MW001_0.0-0.1, MW002_0.0-0.2, SWALE1, BRIDGE 1	**03-Sep-2017**	**----**	----	----	**06-Sep-2017**	02-Mar-2018	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X)							
MW001_0.0-0.1, MW002_0.0-0.2, SWALE1, BRIDGE 1	**03-Sep-2017**	**----**	----	----	**06-Sep-2017**	02-Mar-2018	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **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	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In house: Direct injection analysis of fresh waters after dilution (1:1) with methanol. Analysis by LC-Electrospray-MS-MS, Negative Mode using MRM. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers.

Preparation Methods	Method	Matrix	Method Descriptions
Deionised Water Leach	EN60-Dla	SOIL	In house QWI-EN/60 referenced to AS4439.3 Preparation of Leachates

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES1721647**

Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MS JACQUI HALLCHURCH	Contact	: Vanessa Mattes
Address	: PO BOX 5403 NEWCASTLE WEST NSW, AUSTRALIA 2302	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jacqui.hallchurch@ghd.com	E-mail	: ALSEnviro.Sydney@alsglobal.com
Telephone	: +61 02 9239 7100	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 9239 7199	Facsimile	: +61-2-8784 8500
Project	: 2219058	Page	: 1 of 3
Order number	: ----	Quote number	: ES2017GHDSER0024 (SY/361/17)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	:		

Dates

Date Samples Received	: 30-Aug-2017 15:00	Issue Date	: 30-Aug-2017
Client Requested Due Date	: 06-Sep-2017	Scheduled Reporting Date	: **06-Sep-2017**

Delivery Details

Mode of Delivery	: Undefined	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: 4.1'C
Receipt Detail	:	No. of samples received / analysed	: 4 / 4

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
- **This is rebatch of ES1720652**
- **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 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 (14 days), Solid (60 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

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

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

Summary of Sample(s) and Requested Analysis

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

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EN60-Dla Deionised Water Leach	SOIL - EP231X PFAS - Full Suite (28 analytes)
ES1721647-001	17-Aug-2017 00:00	MW001_0.0-0.1	✓	✓
ES1721647-002	17-Aug-2017 00:00	MW002_0.0-0.2	✓	✓
ES1721647-003	17-Aug-2017 00:00	SWALE1	✓	✓
ES1721647-004	17-Aug-2017 00:00	BRIDGE 1	✓	✓

Proactive Holding Time Report

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

Requested Deliverables

ACCOUNTS PAYABLE (Brisbane)		
- A4 - AU Tax Invoice (INV)	Email	ap-fss@ghd.com
ALISON MONKLEY		
- *AU Certificate of Analysis - NATA (COA)	Email	alison.monkley@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	alison.monkley@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	alison.monkley@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	alison.monkley@ghd.com
- Chain of Custody (CoC) (COC)	Email	alison.monkley@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	alison.monkley@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	alison.monkley@ghd.com
JACQUI HALLCHURCH		
- *AU Certificate of Analysis - NATA (COA)	Email	jacqui.hallchurch@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jacqui.hallchurch@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jacqui.hallchurch@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jacqui.hallchurch@ghd.com
- Chain of Custody (CoC) (COC)	Email	jacqui.hallchurch@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	jacqui.hallchurch@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	jacqui.hallchurch@ghd.com
ntl car		
- *AU Certificate of Analysis - NATA (COA)	Email	ntl.car@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ntl.car@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ntl.car@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	ntl.car@ghd.com
- Chain of Custody (CoC) (COC)	Email	ntl.car@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	ntl.car@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	ntl.car@ghd.com
RESULTS CONT LAND TEAM		
- *AU Certificate of Analysis - NATA (COA)	Email	ntl.car@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ntl.car@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ntl.car@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	ntl.car@ghd.com
- Chain of Custody (CoC) (COC)	Email	ntl.car@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	ntl.car@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	ntl.car@ghd.com
TASMAN COUPE		
- *AU Certificate of Analysis - NATA (COA)	Email	tasman.coupe@ghd.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	tasman.coupe@ghd.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	tasman.coupe@ghd.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	tasman.coupe@ghd.com
- Chain of Custody (CoC) (COC)	Email	tasman.coupe@ghd.com
- EDI Format - ENMRG (ENMRG)	Email	tasman.coupe@ghd.com
- EDI Format - ESDAT (ESDAT)	Email	tasman.coupe@ghd.com

Fadi Soro

30/8/17
3pm

From: Saman Taeidi
Sent: Wednesday, 30 August 2017 2:38 PM
To: Fadi Soro
Cc: Helen Simpson
Subject: FW: RESULTS & EDD for ALS Workorder : ES1720652 | Your Reference: 2219058

Hi Fadi,

Can you please arrange this rebatch.

Kind Regards,

Saman Taeidi
Sample Administration Coordinator, Environmental
Sydney

T +61 2 8784 8555 D +61 2 8784 8504
F +61 2 8784 8500
saman.taeidi@alsglobal.com
277-289 Woodpark Road
Smithfield NSW 2164
AUSTRALIA

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EnviroMail™ 115 - Rapid MALDI-TOF MS confirmation on standard and low level Legionella culture methods
EnviroMail™ 114 - Asbestos Fibre Identification by SEM/EDS
EnviroMail™ 113 - Amoeba Confirmation PCR
EnviroMail™ 112 - Algal Capabilities
EnviroMail™ 111 - Analysis of VOCs by Thermal Desorption Analysis
EnviroMail™ 110 - Identifying Hidden PFAS Chemicals in Environmental Samples and Firefighting Foams
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Environmental Division
Sydney
Work Order Reference
ES1721647

Telephone : +61-2-8784 8555

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From: Taz Coupe [mailto:Taz.Coupe@ghd.com]
Sent: Wednesday, 30 August 2017 2:25 PM
To: Saman Taeidi <Saman.Taeidi@alsglobal.com>; Helen Simpson <helen.simpson@alsglobal.com>; Samples Sydney <Samples.Sydney@alsglobal.com>
Cc: Alison Monkley <Alison.Monkley@ghd.com>
Subject: FW: RESULTS & EDD for ALS Workorder : ES1720652 | Your Reference: 2219058

Good afternoon,

Please arrange the following to be analysed using ASLP (DI Water) for PFAS analysis: full suite as per Saman

1 MW001_0.0-0.1 = 170817
2 MW002_0.0-0.2 = 170817
3 SWALE 1 = 170817
4 BRIDGE 1 = 170817

5664-668

#1, 12, 23, 27

Regards

Tasman Coupe
Environmental Engineer

GHD
T: 61 2 4910 7771| V: 227771 | E: tasman.coupe@ghd.com
Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 Australia | www.ghd.com
WATER | ENERGY & RESOURCES | ENVIRONMENT | PROPERTY & BUILDINGS | TRANSPORTATION


Please consider our environment before printing this email

From: angel-no-reply@alsglobal.com [mailto:angel-no-reply@alsglobal.com]
Sent: Tuesday, 29 August 2017 1:06 PM
To: Taz Coupe <Taz.Coupe@ghd.com>
Subject: RESULTS & EDD for ALS Workorder : ES1720652 | Your Reference: 2219058

TAT

ALS Environmental

Deliverables for ALS Workorder ES1720652

Project: 2219058

Dear TASMAN COUPE,

Please find enclosed the following deliverables for **ES1720652**:

- ES1720652_0_COA.pdf
- ES1720652_0_ENMRG.CSV
- Esdat_ES1720652.zip
- ES1720652_0_QC.pdf
- ES1720652_0_QCI.pdf
- ES1720652_0_GHDNEW.csv
- ES1720652_COC.pdf
- ES1720652_COC_1.pdf

Report Recipients

- ACCOUNTS PAYABLE (Brisbane)
  - ES1720652_COC.pdf (Email)
  - ES1720652_COC_1.pdf (Email)
- JACQUI HALLCHURCH
  - ES1720652_0_COA.pdf (Email)
  - ES1720652_0_ENMRG.CSV (Email)
  - ES1720652_0_QC.pdf (Email)

- ES1720652_0_QCI.pdf (Email)
- Esdat_ES1720652.zip (Email)
- ES1720652_0_GHDNEW.csv (Email)
- ES1720652_COC.pdf (Email)
- ES1720652_COC_1.pdf (Email)

- TASMAN COUPE
  - ES1720652_0_COA.pdf (Email)
  - ES1720652_0_ENMRG.CSV (Email)
  - Esdat_ES1720652.zip (Email)
  - ES1720652_0_QC.pdf (Email)
  - ES1720652_0_QCI.pdf (Email)
  - ES1720652_0_GHDNEW.csv (Email)
  - ES1720652_COC.pdf (Email)
  - ES1720652_COC_1.pdf (Email)
- ALISON MONKLEY
  - ES1720652_0_COA.pdf (Email)
  - ES1720652_0_ENMRG.CSV (Email)
  - Esdat_ES1720652.zip (Email)
  - ES1720652_0_QC.pdf (Email)
  - ES1720652_0_QCI.pdf (Email)
  - ES1720652_0_GHDNEW.csv (Email)
  - ES1720652_COC.pdf (Email)
  - ES1720652_COC_1.pdf (Email)
- ntl car
  - ES1720652_0_COA.pdf (Email)
  - ES1720652_0_ENMRG.CSV (Email)
  - Esdat_ES1720652.zip (Email)
  - ES1720652_0_QC.pdf (Email)
  - ES1720652_0_QCI.pdf (Email)
  - ES1720652_COC.pdf (Email)
  - ES1720652_COC_1.pdf (Email)

Appendix H – Survey report

geosurv
consulting surveyors, planners & engineers
GEOSURV PTY LTD
ABN 99 121 987 004
PO Box R1670
ROYAL EXCHANGE NSW 1225
tel: 1300 554 675
fax: 1300 859 564
e-mail: info@geosurv.com.au
www.geosurv.com.au

JOB NO: 170839

Monitoring Well Coordinates

DATE: 28/08/2017 SITE NAME: 533 Lake Rd Argenton

CONTRACTOR GHD Pty Ltd APPROVED BY: Wayne Heaton

ACTIVITY: Locate top of monitoring well conduit and Lid

Coordinate on MGA Zone 56 Azimuth and A.H.D Datum

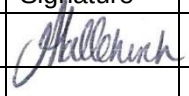
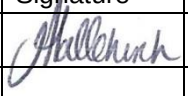
Well Number	Easting	Northing	R.L.	
MW001	371652.323	6354728.232	5.835	CASING
MW001L	371652.312	6354728.229	5.950	LID
MW002	371638.294	6354707.950	6.102	CASING
MW002L	371638.256	6354707.991	6.172	LID
MW003	371574.545	6354738.690	5.677	CASING
MW003L	371574.508	6354738.758	5.769	LID
OS5	371532.775	6354671.798	4.244	CASING
OS5 NS	371533.247	6354671.601	3.690	Natural Surface
OS5A	371534.864	6354675.108	4.186	CASING
OS5A NS	371535.553	6354675.121	3.566	Natural Surface

GHD

Level 3, GHD Tower
24 Honeysuckle Drive
T: 61 2 4979 9999 F: 61 2 4979 9988 E: ntlmail@ghd.com

2219058-1962/https://projects.ghd.com/OC/Newcastle/pfasinvestigationsmi/Delivery/Documents/2219058-REP-A_Argenton Mines Rescue Station - PFAS Contamination Assessment.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	A. Monkley	J. Hallchurch		J. Hallchurch		20/10/2017

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