Fire & Rescue NSW

Deniliquin Training Facility

Environmental Site Assessment - PFAS

April 2017

27 April 2017

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Our ref: 21/25583
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Dear Sally

Fire and Rescue NSW - Deniliquin Training Facility Environmental Site Assessment - PFAS Addendum 1

1 Introduction

Between November 2016 and January 2017, GHD completed a combined preliminary and detailed site investigation at the Deniliquin Training Facility located at Deniliquin airport, NSW 2710 (the site). The site has historically been used for the training of firefighters, which has potentially included the use of aqueous film forming foams (AFFF). The foams used may have contained perfluoro alkyl substances (PFAS), which are potentially harmful to human health and the environment.

The findings of the environmental site assessment (ESA) are presented in:

- GHD Pty Ltd (2017) *Report for Fire and Rescue NSW – Deniliquin Training Facility Environmental Site Assessment – PFAS*. Final Report, April 2017 (the ESA report).

This addendum has been prepared following the release of new guidelines since the completion of the ESA report. This addendum must be read in conjunction with the GHD 2017 ESA report.

2 Basis for assessment

As a result of the emerging nature of this issue, screening criteria for the assessment of PFAS impacted sites are still in the process of being developed in Australia. Only a few values have been published by Australian regulatory agencies, some of which are interim, draft or are “to be reviewed”.

Section 5 of the ESA report outlines the investigation levels used for the purpose of screening data reported from soil, groundwater, surface water and sediment samples collected during the ESA (GHD, 2017).

For the purpose of screening groundwater and surface water data, reference was made to the interim screening criteria released by the Western Australia Department of Environment and Regulation (DER)[1] which are based on the enHealth (2016)[2] recommendations.

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[1] Department of Environment Regulation (DER), January 2017. *Interim Guideline on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS),* Contaminated Sites Guidelines, Government of Western Australia (WA)

[2] EnHealth, June 2016. *Interim national guidance on human health reference values for per- and poly-fluoroalkyl substances for use in site investigations in Australia*

In April 2017, Food Standards Australia New Zealand (FSANZ) released new guidance for the assessment of PFAS impacted sites. These new guidelines resulted in a reduction of the Tolerable Daily Intake (TDI) for key contaminants of concern including

- Perfluorooctane sulfonate (PFOS)
- Perfluorohexane sulfonate (PFHxS)
- Perfluorooctanoic acid (PFOA)

Changes to the TDI resulted in re-calculation of health based screening levels for the protection of drinking water and recreational water resources. These new values supersede the previous enHealth (2016) interim screening levels which were the basis of GHD's interpretation of data as outlined in the ESA report. Comparison of the FSANZ screening values, and the previous enHealth (2016) guidelines is provided in **Table 1**.

Table 1 Screening level comparison

Toxicity Reference Value	PFOS / PFHxS		PFOA	
	enHealth (2016)	FSANZ (2017)	enHealth (2016)	FSANZ (2017)
TDI	0.15 ug/kg/d	**0.02 ug/kg/d**	1.5 ug/kg/d	**0.16 ug/kg/d**
Drinking water quality guideline	0.5 ug/L	**0.07 ug/L**	5 ug/L	**0.56 ug/L**
Recreational water quality guideline	5 ug/L	**0.7 ug/L**	50 ug/L	**5.6 ug/L**

The revised FSANZ values focus on the assessment of potential risks to human health. These guidelines do not change any screening levels for the protection of ecological receptors and the screening criteria referenced in the ESA report (GHD, 2017) remain valid at the time of issue of this addenda.

3 Data review

Table 2 presents a summary of the groundwater and surface water data reported by GHD (2017) compared against the new FSANZ guidelines. For analytical data, reference is made to the ESA report.

Table 2 Interim data review

Summary information	Groundwater Data	Surface Water Data
Number of samples collected	Three groundwater samples were collected from on-site locations (MW01 to MW03)	Three off-site surface water samples were collected from surface water receptors down-gradient of the site.
Review of data for protection of drinking water quality	One location (MW01) reported concentrations of PFOS / PFHxS above the FSANZ (2017) screening value for the protection of drinking water quality	All three surface water samples reported concentrations of PFOS / PFHxS above the FSANZ (2017) screening value for the protection of drinking water quality

Summary information	Groundwater Data	Surface Water Data
Review of data for protection of recreational water quality	One location (MW01) reported a concentration of PFOS/PFHxS in groundwater above the FSANZ (2017) screening value for the protection of recreational water quality.	Two surface water sampling locations (SW01 and SW03), reported concentrations of PFOS / PFHxS above the FSANZ (2017) screening value for the protection of recreational water quality

Overall, the changes to the guidelines has resulted in the following changes to the interpretation of data reported by GHD (2017):

- Groundwater sample MW01 previously reported PFAS concentrations above the nominated enHealth (2016) screening values for the protection of drinking water. Concentrations in MW02 and MW03 were below the laboratory limit of reporting. The revision to the FSANZ (2017) guidelines does not impact on the overall interpretation of this data or the conceptual site model (CSM) prepared to assess contaminant source – pathway - receptor relationships.
- One additional surface water sample (SW02) now reports a concentration of PFOS / PFHxS above the screening value for the protection of drinking water. Two samples (SW01 and SW03) now report concentrations of PFOS / PFHxS above the screening criteria for the protection of recreational water quality.
- GHD is currently embarking on a program of further site investigations including additional groundwater and surface water investigations. As part of these works, a water use survey is being released to understand surface water usage in the area and further assist in the assessment of the potential for exposure to PFAS impacted waters.

A detailed review of all data with respect to the new guidelines will be undertaken as part of the next stage of investigation and full interpretation of all results will be reported at the completion of these works.

Sincerely
GHD Pty Ltd

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Executive summary

GHD Pty Ltd (GHD) was commissioned by Fire and Rescue NSW (FRNSW) to undertake a combined preliminary and detailed site investigation at the firefighting training site at Deniliquin Airport, NSW 2710 (the 'site').

The site is used for the training of firefighters, which has potentially included the use of aqueous film forming foams (AFFF). The AFFF used, may have contained perfluoro alkyl substances (PFAS) including perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), which are potentially harmful to human health and the environment.

The site is owned by Deniliquin Council NSW. The site is currently used by FRNSW as a firefighting training facility and is part of Deniliquin airport (Figure 1, Appendix A). The site is bound by Deniliquin airport to the west, south and east, and Macknight Drive, then vacant land to the north. The site was used as a station for the Royal Australian Air Force (RAAF), during the Second World War as part of the Empire Air Training Scheme (No. 7 Service Flying Training School).

The overall objective of the investigation is to characterise impacts and subsequently assess the potential risks to human health and the environment from historical firefighting training activities (specifically those involving PFAS) in the FRNSW site.

The scope of work comprised:

- Drilling and installation of three groundwater monitoring wells (MW01 to MW03) and five soil bores (SB01 to SB05).
- Collection of seven sediment samples (SS01 to SS07) and three surface water samples (SW01 to SW03).
- A groundwater monitoring event (GME) of the three new groundwater wells.
- Laboratory analysis of selected soil, sediment, surface water and groundwater samples for chemicals of potential concern (COPC) including:
  - PFAS, metals including aluminium, silicon and potassium, total organic carbon (TOC), total iron, grain size and cation exchange capacity in soils and sediments.
  - PFAS, major ions and alkalinity, total dissolved solids (TDS) and pH in groundwater and surface water.
- Laboratory analysis of a selection of soil and sediment samples for Australian standard leaching procedure (ASLP) and two soil samples for toxicity characteristics leaching procedure (TCLP)
- Surveying of newly installed wells.

Based on this scope of works and subject to the limitations presented in Section 11, the following conclusions are made:

- The inferred groundwater flow was in a northerly direction, and regional flows are likely to be towards the east and north. GHD notes that this interpretation of groundwater flow direction is based on a small number of wells (three) over a relatively large surface area and as such, groundwater flow direction should be reviewed in the context of the available site data.

  All soil results were below the nominated screening criteria for all COPC for the protection of human health. Risks associated with direct contact or accidental ingestion of PFAS impacted soils on site is therefore considered low, however the presence of PFAS in soils

represents a potential on-going source and risk to groundwater and surface water receptors.

- Leachability testing confirmed that PFAS impacted soils and sediments have the potential to release PFAS to the environment at concentrations exceeding the nominated screening levels.
- All off-site sediment samples reported detects of PFAS. This indicates that PFAS is likely to be migrating off-site via the surface water drainage pathways.
- Based on the EnRisk (2016) decision tree process for prioritisation, the site is currently classified as a priority 1 site based on detections of PFAS in soil and surface water at concentrations exceeding trigger value 1. It is important to note that the trigger point system has not been designed to be protective of all risks to people or the environment but is designed to assist with prioritisation of sites for further assessment and management.

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

- A survey of water use be conducted to better characterise groundwater and surface water use down gradient of the FRNSW site. This should include investigation into how often the final surface water dams along the drainage line would over top.
- Consideration of immediate management actions which can be implemented to address the mass of PFAS present on site and minimise further migration. These management actions may include, but not be limited to:
  - Drainage channels between the dams could be cleared out to remove soils and sediments which are likely to act as potential leaching sources.
  - Removal of impacted soils under and around the fire training area on the central to southern portion of the FRNSW site to remove the primary source zone.
- Additional sampling should be undertaken following the implementation of any management actions. Sampling should be undertaken to accommodate seasonal fluctuation and, for example, following rainfall events to enable assessment of the areas where surface water collects from the ponds.
- Additional off site investigation to assess whether impacted groundwater is migrating towards other potential abstraction points down gradient of the site towards the east and north-east.

Glossary

Abbreviation	Description
AHD	Australian Height Datum
ALS	Australian Laboratory Services
ANZECC	Australian and New Zealand Environment and Conservation Council
BTEXN	Benzene, toluene, ethylbenzene, xylenes and naphthalene
COC	Chain of custody
COPC	Contaminants of potential concern
CSM	Conceptual site model
DBYD	Dial Before You Dig
DO	Dissolved oxygen
DQI	Data quality indicator
DQO	Data quality objective
DTW	Depth to water
EC	Electrical conductivity
EIL	Ecological Investigation Level
EPA	NSW Environment Protection Authority
ESA	Environmental Site Assessment
ESL	Ecological Screening Level
GIL	Groundwater Investigation Level
GME	Groundwater monitoring event
GPR	Ground penetrating radar
HIL	Health Investigation Level
HSL	Health Screening Level
JSEA	Job Safety Environmental Analysis
LOR	Limit of reporting
mAHD	metres Australian Height Datum
m bgl	Metres below ground level
mbTOC	Metres below top of casing
mg/L	Milligrams per litre
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
PID	Photo-ionisation detector
QA/ QC	Quality assurance/ quality control
REDOX	Oxidation-reduction potential
RPD	Relative Percent Difference
SFOP	Standard field operating procedures
SPR	Source pathway receptor

Abbreviation	Description
SWL	Standing water level
TOC	Top of casing
TPH	Total petroleum hydrocarbons
TRH	Total recoverable hydrocarbons
µg/L	Micrograms per litre
UPSS	Underground Petroleum Storage System
USCS	Unified Soil Classification System

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Appendices

1. Introduction

GHD Pty Ltd (GHD) was commissioned by Fire and Rescue NSW (FRNSW) to undertake a combined preliminary and detailed site investigation at the firefighting training site at Deniliquin Airport, NSW 2710 (the 'site').

The site is used for the training of firefighters, which has potentially included the use of aqueous film forming foams (AFFF). The AFFF used, may have contained perfluoro alkyl substances (PFAS) including perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA), which are potentially harmful to human health and the environment.

A preliminary site investigation (PSI) was undertaken by GHD in 2016 to identify potential sources of contamination and areas of potential concern and develop a sampling and analytical plan for further intrusive investigations. The findings of the PSI are reported in:

- GHD (2016) *Deniliquin PFAS Investigation, Preliminary Site Investigation and Sampling & Analysis Quality Plan*. DRAFT August 2016.

This report documents the outcomes of intrusive investigations undertaken as part of the second stage of works. For full details on the site history, reference is made to GHD 2016.

1.1 Background

The site is approximately 23 000 m^2 (2.3 hectares) and comprises Lot 48 DP 1189132. The approximate site boundaries are presented in Figure 1, Appendix A.

The site is owned by Deniliquin Council NSW. The site is currently used by FRNSW as a firefighting training facility and is part of Deniliquin airport (Figure 1, Appendix A). The site is bound by Deniliquin airport to the west, south and east, and Macknight Drive, then vacant land to the north. The site was used as a station for the Royal Australian Air Force (RAAF), during the Second World War as part of the Empire Air Training Scheme (No. 7 Service Flying Training School).

GHD understands AFFF and other firefighting foams potentially containing PFAS have historically been used at a number FRNSW locations in NSW for firefighting training purposes. For this reason, PFAS may have been released to the environment, which may have resulted in contamination.

The NSW Environmental Protection Authority (NSW EPA) is currently undertaking an investigation program to assess the historical legacy of PFAS use across NSW. As part of this program they have identified impact in surface water and soil on site and have requested further investigation to understand potential contamination issues be undertaken by FRNSW.

1.2 Objective

The overall objective of the investigation is to characterise impacts and subsequently assess the potential risks to human health and the environment from historical firefighting training activities (specifically those involving PFAS) in the FRNSW site.

1.3 Scope

The scope of work comprised:

- Preparation of a Health, Safety and Environment Plan (HSEP) and site specific Job Safety and Environmental Analysis (JSEA)

- 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 groundwater monitoring wells (MW01 to MW03) and five soil bores (SB01 to SB05).
- Collection of seven sediment samples (SS01 to SS07) and three surface water samples (SW01 to SW03).
- A groundwater monitoring event (GME) of the three new groundwater wells.
- Laboratory analysis of selected soil, sediment, surface water and groundwater samples for chemicals of potential concern (COPC) including:
  - PFAS, metals including aluminium, silicon and potassium, total organic carbon (TOC), total iron, grain size and cation exchange capacity in soils and sediments.
  - PFAS, major ions and alkalinity, total dissolved solids (TDS) and pH in groundwater and surface water.
- Laboratory analysis of a selection of soil and sediment samples for Australian standard leaching procedure (ASLP) and two soil samples for toxicity characteristics leaching procedure (TCLP)
- A quality control and quality assurance (QA/QC) program
- Surveying of newly installed wells.
- Preparation of this detailed site investigation report

1.4 Limitations

This report is subject to the limitations provided in Section 11.

2. Site description

2.1 Site identification

A summary of FRNSW site identification details is provided in Table 2-1. The site location is presented in Figure 1 in Appendix A.

Table 2-1 FRNSW site identification summary

Information	Details
Street Address	The firefighting training site at Deniliquin Airport, Macknight Drive, NSW 2710
Lot and DP number	Lot 48 Deposited Plan 1189132
Site Area	Approximately 23 000 m^2 (2.3 ha) , with a perimeter of approximately 610 m.
Local Government Area	Deniliquin Council
Local Land Use Zoning	IN1 – General Industrial
Current Land Use	Training site.
Ownership	Land parcel owned by Deniliquin Council and is leased by FRNSW for use as a training facility. The lease area has been occupied by FRNSW since 1996.

2.2 Surrounding land use and zoning

The land uses surrounding the FRNSW site are summarised below in Table 2-2.

Table 2-2 Description of land use surrounding FRNSW site and respective zonings

Orientation	Description of Surrounding Land Use	Zoning (Deniliquin LEP 2013)
North	Rural properties including portions of vacant land and some industrial / commercial rural properties (eg. Charlie Carp and a rice-mill)	IN1 – General Industrial
East and South	Deniliquin Airport.	SP2 – Infrastructure; Air Transport facilities
West	Deniliquin Airport followed by Deniliquin cemetery and rural properties (including an abattoir and agricultural farm land)	SP2 – Infrastructure; Air Transport facilities IN1 – General Industrial

2.3 Site environmental setting

2.3.1 Topography

The investigation area lies approximately 96 m Australian Height Datum (AHD), according to NSW Land and Property Information. The regional topography appears to be mostly flat, with a slight fall from south-east to north-west.

2.3.2 Soils

General

According to eSPADE from Office of Environment & Heritage, the site is within the brown Chromosols landscape. The brown Chromosols landscape is found in sites with average rainfall between 0.35 m and 1.4 m. The soils have moderate agricultural potential, chemical fertility and soil drainage. The upper horizons are described as dark brown with up to 10% orange mottles silty clay loam, grading into a dark brown medium heavy clay.

Acid Sulphate Soils

The acid sulphate soil class in the investigation area is Class B4 (ASRIS, 2013) and the works would have a low probability of encountering acid sulphate containing soils. There are no other soil classes located within 500 m of the investigation area.

2.3.3 Hydrology

Surface water flow is expected to follow the local topography on-site and flow generally north and eastwards.

The closest natural water body is Aljoes Creek located 2.5 km east of the site. Aljoes Creek discharges to Edward River located approximately 2.8 km to the east and north of the site.

An irrigation channel, Mulwala Canal, runs approximately 800 m to the east and north of the site. It is the largest irrigation channel in the southern hemisphere. It starts at Lake Mulwala (over 130 km to the south-east of the site) and diverts water from the Murray River across the southern Riverina plain to the Edward River at Deniliquin and beyond. The Mulwala canal supplies water to the southern Riverina towns Berrigan and Finley (both up gradient of the site), Bunnaloo and Wakool (down gradient of the site), as well as agricultural properties.

It is understood that stormwater from the site was originally diverted to an unlined drain that ran approximately eastwards towards Edward River. At some point, stormwater has been diverted to the north of the site to an off-site dam approximately 150 m from the site. Dial before you dig underground utilities information did not provide an indication of stormwater or other service infrastructure through the site.

Stormwater originating from the site is not expected to travel to either the Edward River or Mulwala Channel. Water that does not reach the off-site dam is likely to seep into the ground.

2.3.4 Geology

The 1:250,000 scale Deniliquin geological map indicated the site is situated on the Shepparton Formation. The Shepparton Formation is described as unconsolidated to poorly consolidated, mottled, variegated clay, silty clay with lenses of polymictic, coarse to fine sand and gravel; partly modified by pedogenesis, includes intercalated red-brown palaeosols. The regional geology of the area is described in ASRIS (2013) as constituting 35% clay loam, sandy or silty clay loam.

GHD conducted a review of existing geological logs for groundwater bores in the area using the NSW Department of Primary industries, Office of Water, groundwater database in August 2016. The geological logs for bores GW503702 and GW503704 located on the Deniliquin Airport, adjacent to the site suggest that Clays are predominant to depths of approximately 14 m bgl with a sand lense between approximately 9.5 and 13.5 m bgl. The bore log for well GW501823 located approximately 2 km west extends to depths of 234 m bgl and suggests that there is intermingled layers of unconsolidated clays and that there is sands present to depths greater than 140 m bgl. Below these depths, layers of coal are reported to be intersected.

2.3.5 Hydrogeology

The site is located on Quaternary aged, Shepparton Formation, which is expected to form the primary water bearing aquifer unit in this area.

According to the 'Deniliquin' 1:250,000 scale Hydrogeological Map (Geoscience Australia, 1993), the total dissolved solids (TDS) in the groundwater beneath the site is likely to be in the order of 1000 to 1500 mg/L. This would be suitable for stock, domestic and some irrigation purposes. Additionally, bore yields were shown to be 0.5 to 5 L within the sand aquifer, with hydraulic conductivities between 5 to 10 m/day. Fresher water is likely to be located closer to the township of Deniliquin and the Edward River where several production bores are located.

The bore log for GW503702 (NSW Department of Primary industries, Office of Water, groundwater database, 2016) located on the Deniliquin Airport indicates that locally the salinity approximates 4200 mg/L. This is above recommended Australian drinking (NHMRC & NRMMC, 2011) and stock water criteria (ANZECC, 2000), which indicates that shallow groundwater is of limited beneficial use potential in this area.

The NSW Department of Primary industries, Office of Water, groundwater database, 2016 indicates that there are a large number of wells screened within slightly deeper zones of the Shepparton Formation (generally deeper than 30 m bgl) at distances greater than 1.7 km to the east of the site near to the Edward River. The bore records for these wells indicate that their salinities are less than the 1000 mg/L with yields above 1 L/s indicating that the aquifer is potentially of high beneficial use. The large number of wells in and around Edward River used for water supply purposes supports this interpretation. The depth to groundwater is generally ranges between 7 and 12 m bgl in these wells.

Based on the topography and the location of Edward River, groundwater flow is likely to be towards the east and north in the area off the site. However, the Deniliquin Hydrogeological map indicated a generally westerly groundwater flow in the shallow aquifer which might suggest the Edward River is generally a losing river and flow is more dominant towards the Murray River to the west.

The Deniliquin Hydrogeological map also indicates the depth to the water table near the site is in the order of 5 to 10 m. However, this level may have changed since the map was produced in 1993.

Existing Groundwater Bores

GHD conducted a review of existing groundwater borehole records using the NSW Department of Primary industries, Office of Water, groundwater database in August 2016. The search was conducted to identify registered groundwater boreholes in close proximity and to record information such as use and standing water level. No bores were located on the site but two groundwater monitoring bores were identified within a 500 metre radius of the site and were located on the adjoining Deniliquin Airport to the south of the site (summarised in Error! Reference source not found.).

As noted above, a large number of water supply wells were identified at a distance of greater than 1.7 km to the east of the site near to Edward River which are screened within slightly deeper units of the Shepparton Formation. A number of water supply wells screened in the Shepparton Formation are also located to the west at distances of greater than 2 km. The closest registered beneficial use bores in the possible directions of hydraulic flow have been included in Error! Reference source not found..

Table 2-3 Review of existing groundwater data

Borehole ID	Purpose	Depth (m)	Screen (m)	Standing Water Level (m)	Approx. Distance from Site	Licence status
GW503702	Monitoring Bore	14.50	12.5-13.5	No details	400 m south east	Active
GW503704	Monitoring Bore	11.0	9-10	No details	500 m south east	Active
GW501823	Stock, domestic, irrigation	226.0	188 - 226	No details	1820 m west	Converted
GW503094	Domestic, Stock	42.50	32 – 42.5	7.0	1700 m east	Converted

2.3.6 Surface water and drainage

2.4 Site layout and key site features

A site inspection was undertaken initially by GHD in June 2016. Observations made during the site inspection are presented in GHD (2016). Table 2-4 provides a summary of details including the layout and key features.

Table 2-4 Key features

Item	Summary observations
Fencing and access	A main cyclone fence encompasses the training facility. The FRNSW site is secure access, for authorised entry only with a locked gate from Macknight Drive. The site boundary is shown on Figure 2, Appendix A.
FRNSW site features	Key features of the area occupied by FRNSW include: • Small site office and garage area adjacent to entry driveway. • Asphalt area in the centre of the site used as fire training areas (including a partial building structure on the southern corner and hose drying poles, with a fence around the outside of the asphalt). • A former swimming pool (from when the site was used by the air-force) which has been built up around the sides and covered with a roof. It is now used for confined space training. • An above ground storage tank (AST) for LPG is adjacent to the former pool area. A second AST was located on the south-eastern portion of the site. • Police illicit substance incineration area on the southern portion of the site.

3. 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. The seven steps are outlined below:

- Step 1: State the Problem
- Step 2: Identify the Principal Study Question
- Step 3: Inputs to the Decision
- Step 4: Boundaries of the Study
- Step 5: Decision Rules
- Step 6: Tolerable Limits on Decision Errors
- Step 7: Optimisation of the Data Collection Process

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

Step 1: State the problem

The area has previously been used for the training of firefighters, which has potentially included the use of aqueous film forming foams (AFFF). The AFFF used may have contained PFAS including perfluorooctane sulfanoate (PFOS) and perfluorooctanoic acid (PFOA), which are potentially harmful to human health and the environment.

The problem as it stands is that the use of AFFF containing PFAS may have resulted in contamination of soil, surface water, groundwater and sediments both on the FRNSW site, wider training facility and the surrounding land, and this requires further investigation.

Step 2: Identify the decision/goal of the study

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

- Are contaminants 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) and adjacent land-uses (including rural land use)?
- 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?

Should contamination present at the site pose a potentially unacceptable risk to human health for the current land uses or the environment based on concentrations of PFAS in soils, sediments, groundwater or surface waters, the other decisions to be made are:

- Is the extent of the impact adequately delineated?
- 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, groundwater and surface water from laboratory analysis.
- Identify potential exposure routes and contamination migration pathways.
- The likelihood of PFAS migrating to groundwater and subsequently off-site.

Step 4: Define the boundaries of the study

Boundaries of the investigation are summarised in Table 3-1.

Table 3-1 Investigation boundaries

Boundary	Definition
Spatial boundaries	The spatial boundaries for the site are identified as the lateral extent of the investigation area as shown in Figure 3, Appendix A, and down to a depth of approximately 18 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 June (initial site investigation) to January 2017.
Scale of decision making	The scale of the decision making is limited to the boundaries of the training facility and identified off-site receptors

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 5.

The decision rule was considered to be:

- If concentrations of the COPC in soil, sediment, surface water, or groundwater on or off-site exceed the adopted criteria for permissible land use(s) (as per current zoning), then further assessment, remediation and/or management may be required.
- Conversely, no further action may be required in the event that concentrations are below adopted 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 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 4.

4. Methodology

4.1 General

The scope of work is summarised in Section 1.3. The tables in Section 4.2 to 4.5, summarise the groundwater well installation and soil sampling, sediment sampling, groundwater sampling and surface water sampling methodologies.

4.2 Groundwater well installation and soil sampling

Table 4-1 Groundwater well installation methodology (including soil and soil bore sampling)

Item	Description
Date of fieldwork	29 November to 1 December 2016. Redrill[1] 15 and 16 December 2016
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)
Ground clearance	Scanning using electromagnetic locating prior to mechanical drilling.
Drilling technique	Following hand auguring clearance to 1 m bgl, solid flight augers were employed until termination.
Bore logging	All field observations and subsurface conditions were recorded on lithological logs (Appendix D).
Field screening	Field screening for volatiles was undertaken prior to collection of soil samples for laboratory analysis using a PID, the results of which are included in Appendix D. PID calibration data is presented in Appendix C.
Soil sampling	Discrete soil samples were collected from the surface and from each lithological zone. Samples for VOC screening were collected in separate snap lock bags. Additionally, soil was sampled into laboratory supplied jars.
Sample Analysis	Two soil samples from each borehole was submitted for laboratory analysis of COPC including PFAS, organic carbon (TOC), total iron, potassium, aluminium, silicon, grain size and cation exchange capacity (CEC).
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 E.
QA/QC	A QA/QC sampling procedure was implemented and further details are described in Section 3 and Appendix F. QA/QC sampling included two intra-laboratory duplicate samples and two inter laboratory duplicate samples.

[1] MW02 and MW03 experienced well collapse and piezometer damage during the initial drilling works. They were therefore re-drilled, and the initial wells decommissioned, prior to the groundwater monitoring event.

Item	Description
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 at least 0.5 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
Surveying	Following well installation, all newly installed were surveyed by a registered surveyor. The survey report for the wells is provided in Appendix G.
Waste disposal	Soil cuttings and purged groundwater is currently stored in four 205 L drums on the FRNSW site for disposal of to a licenced waste facility. Waste disposal documentation will be provided during the stage 2 works.

4.3 Sediment sampling

Table 4-2 Sediment sampling methodology

Item	Description
Date of fieldwork	29 November 2016
Work clearance	JSEA including daily pre-work assessment and hazard identification
Technical guideline	GHD's Standard Field Operating Procedures
Sampling	Samples were collected by hand using a trowel and were placed directly into laboratory supplied sample jars.
Sample handling and transport	Following collection, sediment 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 E).
Decontamination	Prior to and following the collection of each sediment sample, all non-disposable sampling equipment underwent decontamination including: Washing of equipment with phosphate-free detergent (Decon Neutracon) Rinsing of equipment with fresh water
Sample analysis	All sediment samples were submitted for laboratory analysis of COPC including PFAS, organic carbon (TOC), total iron, potassium, aluminium, silicon, grain size and cation exchange capacity (CEC).
Quality assurance and quality control (QA/QC)	No QA/QC sampling was undertaken on the sediment for this site. Sediment sampling was considered part of the soil sampling program, therefore the QA/QC samples listed in Table 4-1 satisfy QA/QC requirements for sediment sampling.

4.4 Groundwater sampling

Table 4-3 Groundwater sampling methodology

Item	Description
Date of fieldwork	24 January 2017
Work clearance	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)
Gauging	Three on-site monitoring wells (MW01, MW02 and MW03) were gauged using an oil/water interface probe to measure standing water levels (SWL) and assess for the potential presence of light non-aqueous phase liquid (LNAPL). LNAPL was not encountered, therefore no LNAPL sampling was required.
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	All monitoring wells were low flow sampled using a micropurge pump.
Sample handling and transport	Following collection, samples were placed in the sample bottles. The groundwater samples were then 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 E).
Decontamination	Prior to and following the collection of each groundwater sample, all non-disposable sampling equipment underwent decontamination including: Washing of equipment with phosphate-free detergent (Decon Neutracon) Rinsing of equipment with fresh water
Sample analysis	All groundwater samples were submitted for laboratory analysis of COPC including PFAS, major ions and alkalinity, total dissolved solids (TDS) and pH. Laboratory results are summarised in Appendix B and certificates of analysis and COC included in Appendix E.
Quality assurance and quality control (QA/QC)	QA/QC sampling included the collection of one inter-laboratory duplicate sample.
Waste disposal	Purged groundwater was transferred into jerry cans which are currently stored on the FRNSW site for disposal of to a licenced waste facility. Waste disposal documentation will be provided during the stage 2 works.

4.5 Surface water sampling

Table 4-4 Surface water sampling methodology

Item	Description
Date of fieldwork	29 November 2016
Work clearance	JSEA including daily pre-work assessment and hazard identification
Technical guideline	GHD's Standard Field Operating Procedures
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. Field sampling sheets are presented in Appendix C.
Sample handling and transport	The surface water samples were then transferred into laboratory provided bottles. The sample bottles were transferred to 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 will be 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 COPC including PFAS, major ions and alkalinity, total dissolved solids (TDS) and pH. Laboratory results are summarised in Appendix B and certificates of analysis and COC included in Appendix E.
Quality assurance and quality control (QA/QC)	QA/QC sampling included the collection of one intra-laboratory duplicate sample and one inter-laboratory duplicate.

5. Assessment criteria

5.1 Basis for assessment

The following guidelines were adopted for the assessment of contamination.

- 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)

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". GHD is involved with the development of National guidelines for the assessment and management of PFAS contamination which has included drafting of the guidelines for a working group organised by CRC CARE and involving State and Commonwealth regulatory agencies and organisations.

In addition to works undertaken by GHD, published guideline documents currently available and considered as part of this review include:

- Department of Environment Regulation (DER), January 2017. *Interim Guideline on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS),* Contaminated Sites Guidelines, Government of Western Australia (WA).
- Department of Environment and Energy (DEE), October 2016. DRAFT *Commonwealth Environmental Management Guidance on Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFAS)*
- EnHealth, June 2016. *Interim national guidance on human health reference values for per- and poly-fluoroalkyl substances for use in site investigations in Australia*.
- Environmental Risk Sciences Pty Ltd, February 2016. *Proposed Decision Tree for Prioritising Sites Potentially Contaminated with PFAS, New South Wales Environment Protection Authority* (NSW EPA)

For the purpose of the assessment of data collected from the investigations, a number of guidelines and information sources have been reviewed in order to identify the most appropriate and current site assessment criteria at the time of preparation of this report. GHD notes that these criteria differ slightly to those initially outlined in the SAQP presented in GHD (2016) as new documentation has come to light since the preparation of the PSI (GHD, 2016). The screening criteria documented herein supersede any criteria previously specified in the PSI (GHD 2016).

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 comes to light.

5.2 Rationale for assessment criteria

The assessment criteria were selected to allow decisions to be made for the following identified receptors (from Section 2.1):

- On-site (FRNSW) site commercial workers.
- Potential intrusive maintenance workers on and off-site.
- Off-site hydraulically down-gradient agricultural and commercial receptors surrounding the site.
- Beneficial uses of groundwater, including domestic, stock, irrigation and recreational use groundwater resources.
- Terrestrial and ecological receptors on and off-site in land based ecosystems and surface water bodies (including those recharged by groundwater).

Given the rural nature of the area and proximity to the town of Deniliquin, it is possible that there are some residential properties amongst the commercial/industrial properties surrounding the site. Residential receptors have therefore also been considered as a conservative measure.

5.3 Nominated PFAS assessment criteria

5.3.1 Surface water and groundwater

To assess the potential contamination risk to the adjacent ecosystem, the WA DER (2017) interim screening levels are adopted for the surface water and groundwater assessment. The nominated screening levels are outlined in Table 5-1.

Table 5-1 Nominated screening criteria for surface water and groundwater

Exposure Scenario	PFOS / PFHxS	PFOA	Basis for nomination of criteria
Drinking water quality	0.5 µg/L	5 µg/L	Criteria adopted from DER (2017) which are based on the enHealth (2016) recommendations. Drinking water is not extracted on the FRNSW site, however one registered groundwater bore was located within a 500 metre radius of the FRNSW site, registered for stock use. Considering that there is no specific stock use criterion available, and that there is potential for the groundwater to be used for domestic potable use, drinking water criteria are considered appropriate for the purpose of this initial screening.
Ecological - freshwater	0.00023 µg/L	19 µg/L	Criteria adopted from DER (2017) freshwater criteria for high conservation value systems (99% species protection). Whilst the receiving ecosystem from the FRNSW site is not considered high conservation value, the draft guidelines recommend that the 99% level of protection is used for slightly to moderately disturbed systems as PFAS and PFOA have been shown to bio accumulate in wildlife.
Recreational water	50 µg/L (sum of PFOS and PFHxS)	500 µg/L	Criteria adopted from DER (2017) which are based on the enHealth (2016) recommendations. Dilution factor of 10 applied

5.3.2 Soil and sediment

Most of the currently available PFAS guidelines are based on direct contact with contaminated soils, however, as PFAS is highly soluble in water, and can be washed through soil into underlying groundwater or discharged into river systems, the leaching potential of the PFAS in soil should be the focus on an initial assessment (NSW EPA, 2016).

To assess the potential contamination risk to human health, the WA DER (2017) interim screening levels are adopted for the soil assessment. There are no published guidelines available for the assessment of ecological risk, therefore the Department of the Environment and Energy (DEE) draft *'Commonwealth Environmental Management Guidance on Perfluorooctane sulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA)*' were considered. These DEE draft guidelines have been considered as a comparative screening tool only, not as an action level or similar. The guideline screening values from Table 1 (developed for CRC Care through the application of Australia's ASC NEPM methodology) were used, considering that a separate water assessment has been included in the scope of works for these investigations.

In accordance with the technical guidance note prepared by EnRisk (2016), the Australian Standard Leachate Procedure (ASLP) criteria for soil/sediment leachate assessment adopted for the purpose pf this assessment is the surface water/groundwater criteria multiplied by a dilution factor of 10. A dilution factor of 20 is recommended by the USEPA as the minimum dilution that is likely to occur as a chemical move from soil into underlying groundwater, therefore using a dilution factor of 10 provides some additional conservatism (NSW EPA, 2016). Considering a factor of 10 is already applied to recreational groundwater criteria, a further dilution factor is not applied for the leachate recreational criteria.

The nominated screening criteria for the assessment of leachable concentrations of PFOS and PFOA from soils are presented in Table 5-2.

Table 5-2 Nominated screening criteria for soil - leachate

Exposure Scenario	PFOS / PFHxS	PFOA	Basis for nomination of criteria
Drinking water quality	5 µg/L	50 µg/L	Criteria adopted from DER (2017) which are based on the enHealth (2016) recommendations. Dilution factor of 10 applied
Ecological - freshwater	0.0023 µg/L	190 µg/L	Criteria adopted from DER (2017) freshwater criteria for high conservation value systems (99% species protection). Dilution factor of 10 applied

Health and ecological based screening levels to be applied to the assessment of soil and sediment data are summarised in Table 5-3.

Table 5-3 Nominated screening criteria for soil and sediment

Exposure Scenario	PFOS / PFHxS	PFOA	Basis for nomination of criteria
Health Based			
Residential	4 mg/kg (sum of PFOS and PFHxS)	40 mg/kg	Criteria adopted from DER (2017). Guideline values are based on interim tolerable daily intake value of 0.15 µg/kg/d for PFOS/PFHxS and 1.5 µg/kg/d for PFOA.

Exposure Scenario	PFOS / PFHxS	PFOA	Basis for nomination of criteria
Commercial / industrial	100 mg/kg (sum of PFOS and PFHxS)	1000 mg/kg	Criteria adopted from DER (2017). Guideline values are based on interim tolerable daily intake value of 0.15 µg/kg/d for PFOS/PFHxS and 1.5 µg/kg/d for PFOA.
Ecological			
National parks/areas with high ecological values	6.6 mg/kg (PFOS only)	1 mg/kg	Published guideline values unavailable at the time of preparation of this report. Unpublished value derived DEE – used as a comparative tool only.

1. Residential exposure has been use for conservative values for the agricultural grazing / cropping land use.

5.4 Assessment criteria –other COPCs

5.4.1 Soil and Sediment

The assessment of risk to human health, was undertaken in accordance with NEPC 2013. The following criteria have been adopted:

- NEPC (2013) Health investigation level (HIL)-D and health screening level (HSL) D; for on-site and off-site commercial/industrial land uses
- NEPC (2013) HIL-A and HSL A; for off-site agricultural land uses
- NEPC (2013) Ecological investigation level (EIL) D and ecological screening level (ESL) D; for on and off-site commercial/industrial land uses
- NEPC (2013) EIL and ESL Urban Residential/Public open space for off-site rural residential land uses
- CRC Care (2011) Direct contact HSLs (commercial/industrial); for on and off-site commercial/industrial land uses
- CRC Care (2011) Intrusive maintenance worker direct contact and HSLs; for on and off-site intrusive maintenance workers

The adopted soil criteria are presented in Table A1 and Table A2 in Appendix B. If the nominated assessment guidelines do not provide screening values for the analytes shown in the summary tables, the guideline was removed from the summary table.

All sediment samples collected in this investigation were considered to be classified as ‘soil’. Specific sediment based guidelines (ANZECC 2000, Interim-sediment quality guidelines, high and low) were reviewed and compared to the adopted soil assessment criteria, which were found to be more conservative and no change to the investigation results were identified. Therefore considering this and the physical nature of the samples, no sediment specific assessment criteria were adopted for the assessment of these samples.

5.4.2 Groundwater and surface water

In accordance with NSW EPA (2007) *Guidelines for the Assessment and Management of Groundwater Contamination*, contaminants identified in groundwater will be screened against existing generic groundwater investigation levels (GILs) which protect the following environmental values:

- Drinking water
- Aquatic ecosystems

The groundwater investigation levels (GILs) presented in NEPC 2013 are based on ANZECC 2000 and ADWG 2015. These criteria are considered to be protective of the environmental and drinking water values referenced by NSW EPA (2007). On the basis that groundwater could discharge to a fresh water system (Ultimately at Edward River located over 3 km north east of the site), NEPM GILs for fresh waters have been adopted.

The National Health Medical Research Council (NHMRC) recreational guidelines have also been adopted to account for potential use of groundwater for recreation use off-site, though this is considered unlikely.

6. Results

6.1 General

This section presents the results of all soil, groundwater, sediment and surface water investigations undertaken on the site by GHD in December 2016.

Analytical results and groundwater/surface water field parameters are summarised in the following tables in Appendix B:

- Table A: Soil and sediment analytical results – Human health and ecological
- Table B: ASLP analytical results
- Table C: Groundwater and surface water analytical results including field parameters

6.2 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.

The relative percentage difference (RPD) between primary and duplicate samples was calculated, and found to exceed the nominated assessment criteria in two soil pairs and one surface water pair. The data for these pairs was therefore assessed with caution, with both the primary and duplicate sample results considered in the data evaluation process for this site.

Other than the RPD exceedances, 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.

6.3 Soil results

Soil was examined by GHD during drilling works at newly installed groundwater wells (MW01 to MW03) and soil bores (SB01 to SB05). Descriptions of the 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.

6.3.1 Soil profile

The observed lithology at across the eight investigation locations completed during this scope of works is summarised in Table 6-1.

Table 6-1 Generalised lithology encountered

Depth range (m)	Lithology
0.0 – 1.6	Clayey SAND, red brown (fill)
0.3 to 8.0	CLAY dark brown (natural)
6.2 to 10.5	Silty CLAY, yellow brown (natural)
9.3 to Not determined	Sand, yellow brown (natural)

6.3.2 Soil analytical results

The soil sampling laboratory results are summarised in Table A, Appendix B and presented in Figure 4 in Appendix A. Laboratory certificates of analysis are presented in Appendix E.

All soil results were below the nominated screening criteria for all COPC for human health under a commercial / industrial land use scenario.

The highest concentration of PFAS was reported in soil sample collected from SB02 on the asphalt in the fire training area (15.7 mg/kg – WA DER sum of total). However, the concentration of PFAS reported approximately 0.9 m below this point, was at least an order of magnitude lower for all PFAS analytes (WA DER (sum of total) was 0.652 mg/kg in SB02_1.0).

The concentration of PFAS was noted to be greater in shallow soil samples compared to the deeper soil samples at each location. With the exception of SB02, concentrations of PFAS in soil samples were generally low, with the concentration of the majority of PFAS analytes below the laboratory limit of reporting (LOR) at each location. However PFAS was detected at all soil investigation locations (SB05 noted to have very low concentrations).

6.4 Sediment results

Sediment samples were collected at locations SS01 to SS07. SS08 was proposed further north of sample SS07; however, this location could not be accessed due to long grass and poor visibility. The sediment laboratory results presented in Figure 4 in Appendix A and Table A, Appendix B. Laboratory certificates of analysis are presented in Appendix E. Given the location and profile of the samples collected, the application of soil screening criteria for initial analysis of the data set is considered appropriate for this investigation.

There were no exceedances of the adopted assessment criteria, however all locations reported detectable concentrations of PFAS. Concentrations of PFAS in sediments were low and generally below or close to the laboratory limit of reporting. All PFAS concentrations in sediment samples collected were several orders of magnitude below the nominated investigation levels

The maximum concentrations reported for PFOS and PFOA in sediments were 0.297 mg/kg (SS01) and 0.0032 mg/kg (SS05) respectively. The concentration of PFAS (sum of total) was noted to be an order of magnitude greater in samples collected from on-site monitoring locations compared to off-site. The concentration of PFAS (sum of total) was the lowest at SS03.

6.5 ASLP analytical results

Ten soil samples and seven sediment samples were submitted for ASLP testing for PFAS, the results of which were compared to the surface water/groundwater criteria multiplied by a dilution factor of 10 (Table 5-2) for the purpose of preliminary data screening. The samples analysed for ASLP included:

- MW01_0.1, MW01_9.0, MW02_0.1, MW03_0.1
- SB01_0.1, SB02_0.1, SB03_0.1, SB03_1.0, SB04_0.15, SB05_0.1
- SS01, SS02, SS03, SS04, SS05, SS06, SS07

Two additional samples were analysed for TCLP for the purpose of waste classification (MW01_0.1 and MW01_9.0).

The leachate laboratory results are presented on Figure 5 in Appendix A, and summarised on Table B, Appendix B.

The concentration of PFHxS and PFOS (sum of total) was noted to be at least one order of magnitude greater in the leachate samples than in the original soil/sediment samples. A review of this data against the relevant screening criteria is provided in Sections 6.5.1 and 6.5.2.

6.5.1 Soils

The concentration of PFHxS and PFOS (sum of total) in all ten leachate samples (ASLP) exceeded the nominated leachability screening criteria adopted from WA DER (2017) ecological guidelines for fresh water. Leachate from six samples also exceeded the adopted criteria for the protection of drinking water. The concentration of PFHxS (sum of total) in MW01_0.1, SB02_0.1 and SB04_0.15 leachate samples also exceeded the adopted criteria for protection of recreational water.

The maximum concentration of PFHxS and PFOS (sum of total) in leachate was at SB02_0.1 (756 ug/L).

6.5.2 Sediment

The concentration of PFHxS and PFOS (sum of total) in all seven sediment leachate samples exceeded the nominated leachability screening criteria adopted from WA DER (2017) ecological guidelines for fresh water. The concentration of PFHxS and PFOS (sum of total) at SS01 and SS02 also exceeded the adopted drinking water guidelines. There were no exceedances of the recreational guidelines.

6.6 Groundwater and surface water results

6.6.1 Groundwater gauging results

Gauging results are summarised in Table 6-2. 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).

Table 6-2 Groundwater Gauging Data

Well ID	Depth of well (m)	Depth to groundwater (m bTOC)	TOC (m AHD)	Corrected groundwater elevation (m AHD)
MW01	14.06	11.278	93.688	82.410
MW02	12.74	11.123	92.682	81.599
MW03	17.34	12.157	92.810	80.663

Note: TOC = top of casing

A groundwater contour map showing the interpolated groundwater contours and the inferred groundwater flow direction is presented on Figure 7 in Appendix A. Groundwater contours were calculated based on groundwater elevations using an inbuilt ArcGIS interpolation tool to derive the contours with a kriging method.

The local groundwater flow was inferred to be in a northerly direction, however GHD notes that this is based on small number of data points.

6.6.2 Groundwater quality

Prior to groundwater sample collection, field parameters and observations were recorded during the purging of the well. Field parameters are summarised in Table 6-3 and Table C, Appendix B.

Table 6-3 Summary of groundwater quality field parameters

Parameter	Results and Comments
pH	pH range was 7.22 (MW02) and 7.73 (MW03)
Temp (°C)	Temperature was between 21.1°C (MW01) and 21.5°C (MW03)
EC (µS/cm)	EC ranged between 1,757 µS/cm (MW02) and 2,599 µS/cm (MW03)
DO (mg/L)	DO ranged between 1.98 mg/L (MW03) and 5.72 mg/L (MW01)
ORP* (mV)	Field redox ranged between 130 mV (MW03) and 177 mV (MW01)

* Oxidation Reduction Potential – field values adjusted by +205

No odours or sheen were noted. The purged groundwater was brown to yellow tinge and slightly turbid.

6.6.3 Analytical results

Samples were collected from three groundwater wells located on the FRNSW site; MW01, MW02 and MW03. Additionally, surface water samples were collected from off-site locations along drainage lines from the site (figure 3, Appendix A). The groundwater and surface water laboratory results are summarised in Table C, Appendix B. Laboratory certificates of analysis are presented in Appendix E.

Groundwater and surface water COPC reported in excess of the nominated screening criteria are summarised in Table 6-4, and are shown on Figure 6 in Appendix A. Further discussion pertaining to these exceedances is provided in Section 7.

Table 6-4 Summary groundwater and surface water exceedances

Analyte	Guideline Exceedance	Monitoring locations
PFHxS and PFOS (sum of total)	WA DER (2017) freshwater (ecological)	MW01, FD01 (field duplicate for MW01). MW02 and MW03 also exceeded, however concentration less than the LOR. SW01, SW02, SW03 (primary and duplicate samples FS01 and FD01)
	WA DER (2017) Drinking water (human health)	MW01, FD01 (field duplicate for MW01). SW01, SW03 (primary and duplicate samples FS01 and FD01)
	WA DER (2017) recreational (human health)	SW03 (duplicate sample FS01)
PFOA	none	

7. Discussion

A range of analytes were assessed as part of this investigation in response to EPA requests and guidance. These were compared against the nominated assessment criteria based on the identified potential receptors. However, as outlined in section 1.2, the objective of this report is to assess the potential risks to human health and the environment from potential PFAS contamination related to historic firefighting activities.

7.1 Soil and sediment

PFAS in soils and sediments – on-site

The concentration of PFHxS and PFOS (sum of total) at SB02 exceeded the WA DER (2017) guidelines for residential health (12.8 mg/kg). Considering this is an on-site investigation location and that there are no residential receptors on site, this exceedance is not considered to represent an unacceptable risk. The concentration of PFOS at SB02_0.1 m bgl also exceeded the adapted ecological screening criteria. Similarly, the site is considered a commercial/industrial land use, therefore this exceedance is unlikely to represent an unacceptable risk to ecological receptors. However, due to the rural nature of the site, it is acknowledged that ecological receptors may be transiently present at the site.

The highest concentrations of PFAS were noted to be in shallow soil samples from the firefighting training area and former AFFF use area (Figure 2, Appendix A). This suggests that the areas of firefighting training that are known to have used AFFF containing PFAS remain impacted and are likely to be acting as primary on-going source zones.

The concentration of PFAS declined substantially with depth at most of these locations (SB01, SB02, SB03, SB04 and MW01). This decrease was less pronounced at SB03, where the concentration of PFAS in the deeper soil sample was similar to the shallow soil sample. This could be because this monitoring location does not have a sealed, asphalt surface but is still in close proximity to the firefighting training area.

PFAS was detected in sediment samples collected from drainage lines near the firefighting training area (SS01 and SS02). These samples indicate that impacted soils and sediments are somewhat mobile on-site. However, the concentration of PFAS was an order of magnitude lower at the off-site monitoring connected to these drainage lines (SS03) close to the site boundary (see below for further discussion).

Minor concentrations of PFAS were detected in shallow soil samples collected on the northern portion of the site at MW02, MW03 and SB05. This may be from wind dispersed AFFF or minor historical training activities occurring in this portion of the site. These are not considered to pose a substantial ongoing source of PFAS to the local groundwater.

PFAS in sediments – off site

The concentration of PFAS in off-site sediment samples was an order of magnitude lower than sediment samples from with-in the FRNSW site, suggesting that there is some reduction of PFAS impacted sediments within the drainage lines. The concentration of PFAS in sediments along the northern drainage line leading towards the off-site dam (SS05, SS06, and SS07) was noted to decrease with increasing distance from the site, further supporting that there is some attenuation of sediments in this area.

The concentration of PFAS analytes was noted to generally be the lowest at SS03. This monitoring location is midway along a straight drainage line (south side of Macknight Drive) and is therefore likely to receive a relatively high flow rate, preventing sediment deposition. The

highest off-site PFAS concentration was at SS05, which is located in the bend of the current drainage line (north site of Macknight Drive). This bend is likely to be acting as a sediment trap due to the reduced water flow rates.

PFAS was detected at SS04 on the former drainage line in similar concentrations to those recorded in the current drainage line to the north. This indicates that PFAS is likely to remain present along the former drainage route.

PFAS leachability from soils and sediments

The most important process by which PFAS present in soil may pose a risk to people or the environment is contamination of surface and groundwater's from leaching from the soil (NSW EnRiskS, 2016).

Leachate testing completed on a number of these samples shows that there is potential for the release of PFAS to groundwater and surface water environments and the presence of PFAS in soils and, to some extent, sediments represents a likely on-going source to the environment.

All soil and sediment samples analysed for leachate potential (ASLP) exceeded the nominated leachability screening criteria adapted from WA DER (2017) ecological freshwater guidelines suggesting that the impacted soils/sediments both on and off site may continue to pose a risk to ecological aquatic receptors. The concentration of PFHxS and PFOS (sum of total) from shallow samples at SB01, SB02, SB03, SB04 and MW01 (all located within the training area) were noted to exceed the leachability screening criteria adapted from the WA DER (2017) Drinking water guidelines, as did sediment samples SS01 and SS02 which are connected to the training area. This suggests that the soils from the former training area are likely to be acting as the primary on-going source of PFAS contamination to the groundwater and local surface waters via sediment transport.

7.2 Groundwater and surface water

Groundwater contours indicate that the groundwater is flowing generally to the north. This aligns with the expected groundwater flow from the regional topography, geology and hydrogeology (Section 2.3), which indicated a north to north-east flow.

PFAS has been detected in the groundwater on the FRNSW site, and off-site in surface waters at concentrations greater than the adopted assessment criteria for the protection of drinking water, ecological, and recreational receptors.

PFAS in groundwater

The concentration of PFHxS and PFOS (sum of total) in groundwater at MW01 exceeded the WA DER (2017) freshwater ecological guidelines and drinking water guidelines. The concentration at MW02 and MW03 also exceeded the adopted ecological guidelines; however the concentration was less than the laboratory LOR. MW01 is located in the firefighting training area, and soil samples from this monitoring location were found to contain elevated levels of leachable PFAS. This was also the case for soil samples from surrounding monitoring locations. The PFAS impact detected in groundwater at MW01 is therefore likely to be from historic direct infiltration of AFFF during training activities and/or leachate from the impacted soils.

The lack of detectable PFAS at MW02 and MW03 indicates that there is likely to be limited migration of PFAS in groundwater to the north and west of the firefighting training area. The extent of the impact from MW01 to the north-east is unknown. Further investigation should be conducted to confirm this, considering there may be a north-east groundwater flow component and that this may connect to ecological receptors in Edward River (approximately 2.8 km to the

east and north of the site, Section 2.3.5) and drinking water receptors in Deniliquin (1.7 km east and north of the site).

PFAS in surface water

All surface water samples exceeded the WA DER (2017) ecological guidelines. This indicates that there is a potential risk to freshwater aquatic receptors. It is likely that the PFAS impact in surface water is from sediment leachate.

Considering the PFAS concentration in sediment samples was noted to decrease with distance from the site, and likely dilution of surface waters with increasing distance from the source, it would be expected that the concentration of PFAS in surface water samples would also decreased with distance from the site. However, this was not observed. SW03 (duplicate sample) had the highest PFAS concentration by and order of magnitude, despite being the furthest from the site. The concentration of PFHxS (sum of total) at this location exceeded both the adopted drinking water. The concentration of PFHxS (sum of total) also exceeded the drinking water guidelines at SW01, located up gradient of SW03. Further sampling of surface waters should be conducted to delineate the extent of PFAS impact down gradient of SW03, along the drainage line to the north of the site.

It is noted that SW03 also exceed the recreational guidelines for PFHxS and PFOS (sum of total). The location of the sample point is off-site in a roadside verge (drainage ditch). It is unlikely to be used for recreational purposes, and this exceedance is therefore unlikely to represent an unacceptable risk to recreational receptors.

7.3 EPA site prioritisation

EnRisk (2016) presents a decision tree process and trigger points to enable prioritisation of sites based on the findings of investigation. Trigger points for soil leachate, surface water and groundwater as reported by EnRisk (2016), are summarised below with reference to the analytical data collected during this preliminary stage of assessment.

Soil leachate data

- Trigger point 1: Soil leachate data reported above 100 µg/L[2]
- Trigger point 2: Soil leachate data reported above 1 µg/L

The maximum total PFAS concentration reported for soil leachate data was 756 µg/L collected from SB02, classifying the site as a 'Priority 1 site' under the EnRisk (2016) decision tree process based on soil leachate data.

Groundwater and surface water data

- Trigger point 1 (elevated contamination): Groundwater or surface water data reported above 10 µg/L[3]
- Trigger point 2: Groundwater or surface water data reported between 0.1 µg/L to 10 µg/L
- Trigger point 3 (low levels of contamination): Groundwater or surface water data reported between 0.05 µg/L to 0.1 µg/L

[2] Trigger points values can be applied to PFOS alone or to the sum of PFAS as discussed by EnRisd (2016)
[3] Trigger points values can be applied to PFOS alone or to the sum of PFAS as discussed by EnRisd (2016)

The maximum total PFAS concentration reported for surface water was 150 µg/L in SW03 (duplicate sample) collected from the drainage line, north of the site. The site would therefore be classified as a priority 1 site (where on-site surface water results are above trigger point 1).

Total PFAS concentrations in groundwater on site range between <0.02 and 0.88 µg/L. Under the EnRisk (2016) decision tree process, the site would be classified as priority 2 based on groundwater samples from on-site bores being reported between trigger points 2 and 3.

7.3.1 Overall prioritisation of the site

As outlined above, groundwater analytical data would classify the site as a priority 2 site for further investigation based on the data reported both on and off site. Surface water and soil leachate data indicated that the site should be classified as priority 1 owing the presence of total PFAS concentrations exceeding trigger point 1.

The conclusions and recommendations made in Section 9 of this report take into account this prioritisation.

8. Conceptual site model

It is noted that the primary objective of this investigation is to assess the historical impacts from fire training activities. Fire training activities are the key issue of concern for the site and the primary contaminants of potential concern (COPC) are therefore PFAS, notably PFOS and PFOA, which were components of AFFF. The CSM concentrates primarily on PFAS as the main COPC for the site and is the key driver for any additional work at the site.

Based on the sampling analytical results, the conceptual site model from the PSI (GHD, 2016) has been refined. The potential source-pathway-receptor linkages are summarised below (Table 8-1).

8.1 Sources

The site is currently occupied by FRNSW and is used by staff as storage space and fire training. AFFF containing PFAS are no longer used at the site.

Based on the findings of the PSI (GHD, 2016) and the results of intrusive investigations, the following primary sources of contamination and associated COPC have been identified:

- The firefighting training area (asphalt surface area) and former AFFF use area on the central to southern portion of the site.
- The storm water drainage channels, on and off-site.

Limited PFAS impact was detected around the former pool, now used for confined space firefighting training. Only one investigation location was near this area, and no sampling was conducted from underneath the pool. It is considered unlikely that there former pool area would be acting as a source zone, however further sampling would be required to confirm this. Site offices including storage of AFFF were identified as a possible source in the PSI (GHD, 2016), however no investigation was conducted around this area. Further sampling around this location should therefore be conducted to confirm the presence or absence of PFAS impact in soils and groundwater. Impacted soils and sediments which have migrated from the main source zones (including to off-site locations), with subsequent leaching of PFAS, represent a secondary source of contamination.

Sources of potential contaminants such as hydrocarbons were not assessed as part of this scope of work. Potential sources of other contaminants identified in the PSI (GHD, 2016) include:

- The firefighting training area (asphalt surface area) - fuel for ignition likely to have been used
- The former pool area - fuel for ignition likely to have been used
- Minor spills of petroleum hydrocarbons and oils from vehicles traversing the site. The main contaminants associated with fuel spills are expected to include petroleum hydrocarbons and polycyclic aromatic hydrocarbons.

8.2 Receptors

When evaluating potential adverse health / environmental effects from exposure to a contaminated site, all potentially exposed populations should be considered. For this investigation, the key populations or receptors of interest are considered to include those identified in section 5.2.

8.3 Exposure pathways

The primary pathways by which receptors could be exposed to the sources of contamination outlined above are considered to be:

- Dermal contact with contaminated shallow soil, sediments and dust.
- Incidental ingestion of contaminated soils and dust.
- Direct contact or ingestion of groundwater and/or surface water.
- Inhalation of contaminated soils or dust.
- Vertical and horizontal migration of contaminated liquid through the unsaturated zone into the saturated zone, and subsequent horizontal migration within the groundwater and subsequent discharge to surface waters. The US EPA (2014) notes that PFAS are water soluble and can migrate readily from soil to groundwater, where they can be transported long distances.
- Surface runoff and sediment transport into storm water drainage and subsequent transport and discharge to surface waters.

Schedule B2 of the NEPM (2013) states that "As a preliminary screening measure, the potential for a vapour intrusion risk should be considered where the Henry's law constant for a substance is greater than 1 x 10^{-5} atm/m^3/mol and its vapour pressure is > 1 mm Hg at room temperature". US EPA (2014) list Henry's law constants for PFOS and PFOA of 3.05 x10^{-9} atm/m^3/mol and 'not measurable' respectively, which based on the NEPM (2013) recommendation, suggests inhalation of vapours from these contaminants is unlikely to represent a human health risk at the site.

US EPA (2014) notes that once PFOS and PFOA are released to the atmosphere they are expected to absorb on to particles and settle to the ground through wet and dry deposition.

8.3.1 PFAS fate and transport

PFAS forms a component of AFFF, which is sprayed onto fires during training events. The mode of use of AFFF through hoses allows for it to spread through airborne dispersion beyond the training area. Typically, this results in diffuse low levels of PFAS over a wider area. Generally, the highest soil concentrations tend to be at the point source.

PFAS are stable and persistent compounds that do not readily degrade in the environment.

Once in soil, PFAS can leach from soil to water (due to its solubility in water) as water migrates downward through soil to the water table, resulting in contaminated groundwater. Generally, the shorter chain PFAS species are more soluble than the longer chain PFAS. Groundwater will migrate and discharge into the nearest down gradient surface water body – in the case of the site the main discharge area is likely to be either Aljoes Creek approximately 2.5 km to the east of Edward River approximately 3 km north and east of site. The river is likely to be used for recreational activities and fishing purposes.

Migration through the soil will depend on the attenuation properties of the soil. Some components of the soil (notably organic carbon) can sorb PFAS components. Generally, the longer chain PFAS species will sorb more readily. This, combined with the lower solubility of the longer PFAS species, can result in mainly shorter chain PFAS species being dissolved in water while the large molecules remain in the soil.

The surface water on-site is diverted to an unlined surface drain that discharges into an off-site dam approximately 150 m to the north of the site. It is unlikely this will discharge into any natural water bodies. However, it has the potential to leach vertically into the local groundwater.

Plants (including aquatic plants) have the ability to uptake PFAS through impacted soil water. Grasses and other flora can be consumed by micro- and macro-fauna, which may in turn be predated.

The main risks to human health mainly arise through ingestion of impacted media i.e. soil, water or organisms.

In terms of risks to ecological receptors, while contamination can give rise to direct toxic effects on ecosystems, the limiting factor can be the bioaccumulation of contaminants in fish or other species affecting persons or other animals that consume these fish or other species.

8.4 Source-pathway-receptor linkages

Based on the current information, the following CSM has been developed for on-site sources of contamination in Table 8-1 below and presented in Figure 8, Appendix A.

Table 8-1 Updated CSM

Potential source	Primary pathway	Receptor	Pathway present?
Soils in firefighting training area (central to southern portion of the site) contaminated with PFAS	Dermal contact	FRNSW commercial workers	Unlikely – PFAS impact detected in shallow soil samples from this area (SB01-SB04) however impact below adopted assessment criteria.
		Intrusive maintenance workers	Unlikely – PFAS impact detected in shallow soil samples from this area (SB01-SB04) however, impact below adopted assessment criteria.
	Vertical/horizontal migration of leachate through unsaturated zone	Groundwater – subsequent migration in groundwater (secondary)	Yes – PFAS impact reported in MW01 located in the training area.
	Surface runoff and sediment transport (including leachate – secondary source)	Surface waters (including drainage systems – secondary pathway)	Yes – PFAS detected in sediment samples from drainage lines associated with this area.
		Off-site rural commercial/ industrial properties (and possible residential)	Yes – sediment samples along drainage line off-site contain PFAS.
		Off-site ecological (terrestrial and aquatic)	Yes – off-site surface water indicate PFAS impact above ecological screening criteria, which is likely to be associated with this area in the FRNSW site. On site soil sample from SB02 also exceeded the ecological criteria, however the site is

Potential source	Primary pathway	Receptor	Pathway present?
			considered commercial/industrial and risks to on-site ecological receptors are considered to be low under the current land use scenario. All off-site surface water samples report PFAS concentrations above the adopted ecological guidelines.
Contaminated groundwater	Vertical/horizontal migration	Down gradient surface waters recharged by groundwater	Possible – PFAS impact detected above adopted assessment criteria in up-gradient well (MW01) and groundwater impact un-delineated to the north-east, therefore the extent of contamination in groundwater and hydraulic connection to surface waters requires further assessment. However no impact was detected in wells MW02 and MW03 north and west MW01 respectively.
		Abstraction bores (stock and/or domestic use)	Possible – PFAS impact detected above adopted assessment criteria in up-gradient well (MW01) Limited delineation of groundwater in direction of closest beneficial use bore (1.7 km east of the site) therefore extent of contamination in groundwater requires further assessment.
Site offices, including storage of AFFF	Dermal contact, Vertical/horizontal migration of leachate through unsaturated zone, And/or Surface runoff and sediment transport	FRNSW commercial workers, intrusive maintenance workers, groundwaters, surface waters, off-site rural commercial/ industrial properties (and possible residential), and off-site ecological (terrestrial and aquatic)	Possible – AFFF known to be present, and no sampling of this area to confirm presence/absence of PFAS.
Former pool area, now used for confined space training			Possible – limited PFAS impact was detected at single investigation location (MW03) however limited data from around and underneath the area (to account for possible leaching).

9. Conclusions and recommendations

9.1 Conclusions

The overall objective of this investigation is to characterise impacts and subsequently assess the potential risks to human health and the environment from historical firefighting training activities (specifically those involving PFAS) in the FRNSW site. Based on the scope of works presented in Section 1.3 of this report, the findings of the investigation and subject to the limitations presented in Section 11, the following conclusions are made:

- The inferred groundwater flow was in a northerly direction, and regional flows are likely to be towards the east and north. GHD notes that this interpretation of groundwater flow direction is based on a small number of wells (three) over a relatively large surface area and as such, groundwater flow direction should be reviewed in the context of the available site data.

  All soil results were below the nominated screening criteria for all COPC for the protection of human health. Risks associated with direct contact or accidental ingestion of PFAS impacted soils on site is therefore considered low, however the presence of PFAS in soils represents a potential on-going source and risk to groundwater and surface water receptors.
- Leachability testing confirmed that PFAS impacted soils and sediments have the potential to release PFAS to the environment at concentrations exceeding the nominated screening levels.
- All off-site sediment samples reported detects of PFAS. This indicates that PFAS is likely to be migrating off-site via the surface water drainage pathways.
- Based on the EnRisk (2016) decision tree process for prioritisation, the site is currently classified as a priority 1 site based on detections of PFAS in soil and surface water at concentrations exceeding trigger value 1. It is important to note that the trigger point system has not been designed to be protective of all risks to people or the environment but is designed to assist with prioritisation of sites for further assessment and management.

9.2 Recommendations

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

- A survey of water use be conducted to better characterise groundwater and surface water use down gradient of the FRNSW site. This should include investigation into how often the final surface water dams along the drainage line would over top.
- Consideration of immediate management actions which can be implemented to address the mass of PFAS present on site and minimise further migration. These management actions may include, but not be limited to:
  - Drainage channels between the dams could be cleared out to remove soils and sediments which are likely to act as potential leaching sources.
  - Removal of impacted soils under and around the fire training area on the central to southern portion of the FRNSW site to remove the primary source zone.
- Additional sampling should be undertaken following the implementation of any management actions. Sampling should be undertaken to accommodate seasonal fluctuation and, for example, following rainfall events to enable assessment of the areas where surface water collects from the ponds.

- Additional off site investigation to assess whether impacted groundwater is migrating towards other potential abstraction points down gradient of the site towards the east and north-east.

10. References

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Deniliquin LEP 2013

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11. Limitations

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

GHD otherwise disclaims responsibility to any person other than Fire & Rescue NSW 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 Fire & Rescue NSW 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

LEGEND

- Site Boundary
- Cadastre
- Streets
- Major Waterways
- Minor Waterways

0 50 100 200 300

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

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Fire & Rescue NSW
Deniliquin Site Investigation

Site Location and Key Off-site Receptors

Job Number 21-25583
Revision A
Date 03 Mar 2017

Figure 1

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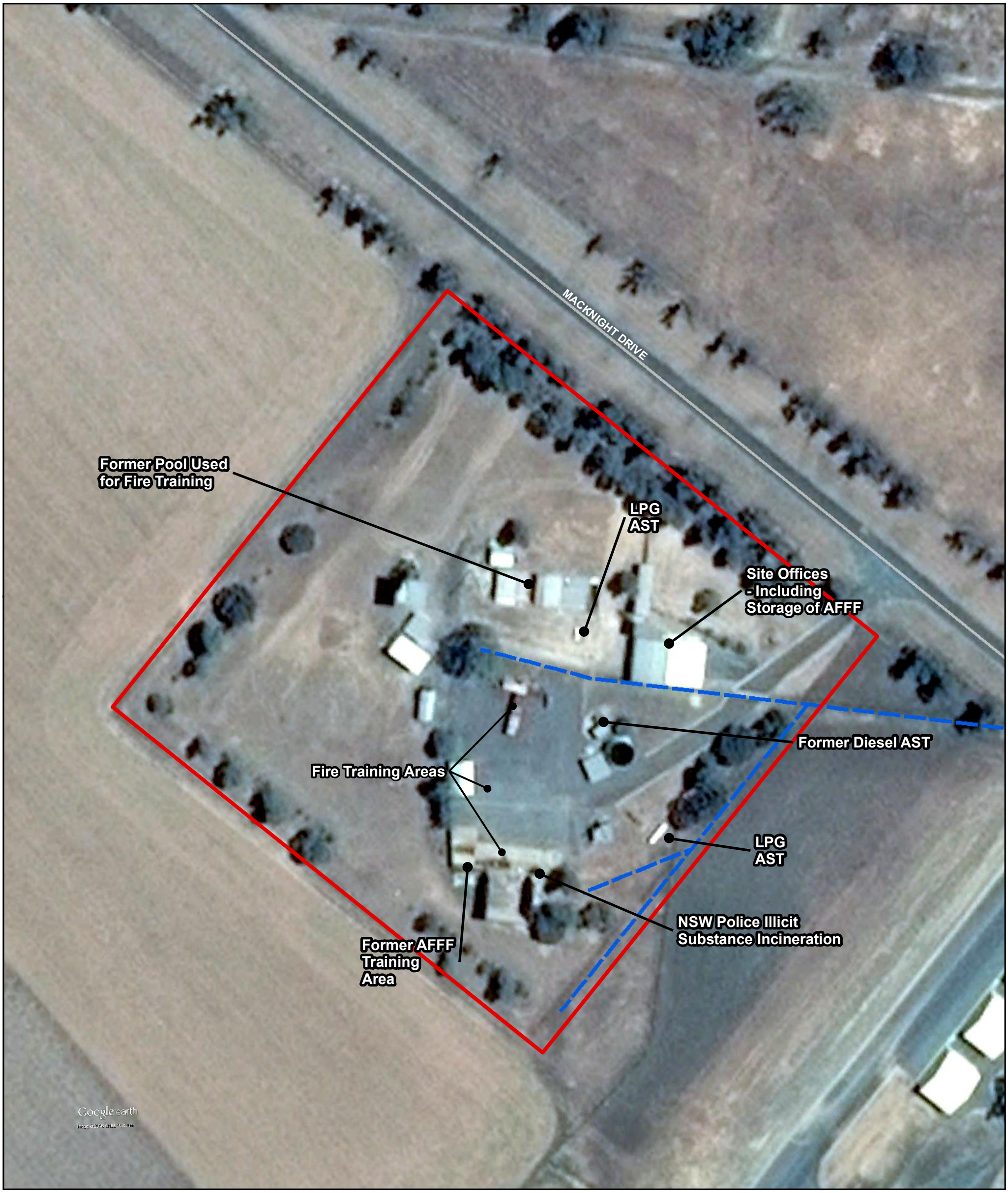
Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Imagery - Google Earth Pro; Streets, Waterways - NSW LPI 2012 DTDB. Created by:tnham



LEGEND

- Site Boundary
- Cadastre
- Streets
- Major Waterways
- Minor Waterways
- Surface Drainage

0 5 10 20 30 40

Metres

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

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Job Number 21-25583
Revision A
Date 03 Mar 2017

Site Layout

Figure 2

G:\21\25583\GIS\Maps\Deliverables\Deniliquin\21_25583_Z002_Deniliquin_SiteLayout.mxd Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Imagery - Google Earth Pro; Streets, Waterways - NSW LPI 2012 DTDB. Created by:tnham

LEGEND

- Site Boundary
- Surface Drainage
- Streets
- Groundwater Monitoring Well (GHD, 2016) (3)
- Shallow Soil Borehole (GHD, 2016) (3)
- Deep Soil Borehole (GHD, 2016) (2)
- Sediment Sample Location (GHD, 2016) (7)
- Surface Water Sample Location (GHD, 2016) (3)

0 10 20 40 60 80

Metres

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

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Fire & Rescue NSW
Deniliquin Site Investigation

Job Number 21-25583
Revision A
Date 03 Mar 2017

Investigation Locations

Figure 3

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Imagery - Google Earth Pro; Streets, Waterways - NSW LPI 2012 DTDB. Created by:tnham

SS07 - Sediment (mg/kg)	
PFHxS and PFOS	0.025
PFOA	<0.0002
PFAS (WA DER List)	0.025

SS06 - Sediment (mg/kg)	
PFHxS and PFOS	0.0329
PFOA	0.0002
PFAS (WA DER List)	0.0355

SS05 - Sediment (mg/kg)	
PFHxS and PFOS	0.043
PFOA	0.0032
PFAS (WA DER List)	0.0577

SS03 - Sediment (mg/kg)	
PFHxS and PFOS	0.0098
PFOA	<0.0002
PFAS (WA DER List)	0.0112

SS04 - Sediment (mg/kg)	
PFHxS and PFOS	0.0306
PFOA	0.0003
PFAS (WA DER List)	0.0326

SB05 - Soil Bore (mg/kg)	0.1	1.0
PFHxS and PFOS	0.0047	<0.0002
PFOA	0.0035	<0.0002
PFAS (WA DER List)	0.0121	<0.0002

MW03 - Soil Bore (mg/kg)	0.1	1.0
PFHxS and PFOS	0.0163	0.0016
PFOA	0.0067	0.0005
PFAS (WA DER List)	0.0257	0.0051

SB01 - Soil Bore (mg/kg)	0.1	1.0
PFHxS and PFOS	0.362	0.0315 (QA)
PFOA	0.0079	0.0009 (QA)
PFAS (WA DER List)	0.414	0.0697 (QA)

MW02 - Soil Bore (mg/kg)	0.1	13.5
PFHxS and PFOS	0.0026	<0.0002
PFOA	<0.0002	<0.0002
PFAS (WA DER List)	0.0036	<0.0002

SB02 - Soil Bore (mg/kg)	0.1	1.0
PFHxS and PFOS	12.8	0.29
PFOA	0.232	0.0113
PFOS	10.7	0.0778
PFAS (WA DER List)	15.7	0.652

SB04 - Soil Bore (mg/kg)	0.15	2.0
PFHxS and PFOS	0.749	0.0147
PFOA	0.0143	0.0002
PFAS (WA DER List)	0.852	0.0613 (QA)

SS02 - Sediment (mg/kg)	
PFHxS and PFOS	0.284
PFOA	0.0031
PFAS (WA DER List)	0.356

SB03 - Soil Bore (mg/kg)	0.1	13.5
PFHxS and PFOS	0.462	0.206
PFOA	0.0022	0.0148
PFAS (WA DER List)	0.485	0.492

MW01 - Soil Bore (mg/kg)	0.1	9.0
PFHxS and PFOS	1.36	0.0394
PFOA	0.0158	0.0005
PFAS (WA DER List)	1.46	0.0437

SS01 - Sediment (mg/kg)	
PFHxS and PFOS	0.302
PFOA	0.0022
PFAS (WA DER List)	0.332

	Exceeds DER (2016) Draft Management Guidance on PFOS and PFOA - ecological value
BLUE	Exceeds DER (2017) Interim PFAS Guidelines - Health residential

LEGEND

- Site Boundary
- Surface Drainage
- Streets
- Groundwater Monitoring Well (GHD, 2016) (3)
- Shallow Soil Borehole (GHD, 2016) (3)
- Deep Soil Borehole (GHD, 2016) (2)
- Sediment Sample Location (GHD, 2016) (7)
- Surface Water Sample Location (GHD, 2016) (3)

0 10 20 40 60 80 100

Metres

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

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Fire & Rescue NSW
Deniliquin Site Investigation

Job Number 21-25583
Revision A
Date 03 Mar 2017

Soil and Sediment Exeedances

Figure 4

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Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Imagery - Google Earth Pro; Streets, Waterways - NSW LPI 2012 DTDB. Created by:tnham

SS07 - ASLP (µg/L)	
PFHxS and PFOS	*1.26*
PFOA	<0.01
PFAS (WA DER List)	1.26

SS06 - ASLP (µg/L)	
PFHxS and PFOS	*2.27*
PFOA	<0.01
PFAS (WA DER List)	2.29

SS05 - ASLP (µg/L)	
PFHxS and PFOS	*1.41*
PFOA	0.12
PFAS (WA DER List)	1.71

SS03 - ASLP (µg/L)	
PFHxS and PFOS	*1.22*
PFOA	0.02
PFAS (WA DER List)	1.26

SS04 - ASLP (µg/L)	
PFHxS and PFOS	*0.36*
PFOA	<0.01
PFAS (WA DER List)	0.36

SB05 - ASLP (µg/L)	0.1
PFHxS and PFOS	*0.18*
PFOA	0.09
PFAS (WA DER List)	0.27

MW03 - ASLP (µg/L)	0.1
PFHxS and PFOS	*0.39*
PFOA	0.16
PFAS (WA DER List)	0.65

SB01 - ASLP (µg/L)	0.1
PFHxS and PFOS	*17*
PFOA	0.32
PFAS (WA DER List)	19.5

MW02 - ASLP (µg/L)	0.1
PFHxS and PFOS	*0.18*
PFOA	<0.01
PFAS (WA DER List)	0.22

SB02 - ASLP (µg/L)	0.1
PFHxS and PFOS	***756***
PFOA	9.88
PFAS (WA DER List)	862

SB04 - ASLP (µg/L)	0.15
PFHxS and PFOS	***51.7***
PFOA	0.8
PFAS (WA DER List)	56.8

SB03 - ASLP (µg/L)	0.1	1.0
PFHxS and PFOS	*17*	*6.05*
PFOA	0.09	0.29
PFAS (WA DER List)	17.7	21.5

SS02 - ASLP (µg/L)	
PFHxS and PFOS	*29*
PFOA	0.11
PFAS (WA DER List)	31.3

MW01 - ASLP (µg/L)	0.1	9.0
PFHxS and PFOS	***137***	*3.43*
PFOA	0.77	0.04
PFAS (WA DER List)	143	4.18
MW01 - TCLP (µg/L)	**0.1**	**9.0**
PFHxS and PFOS	***111***	*2.08*
PFOA	0.9	0.02
PFAS (WA DER List)	116	2.62

SS01 - ASLP (µg/L)	
PFHxS and PFOS	*16.2*
PFOA	0.12
PFAS (WA DER List)	17.3

5	Exceeds WA DER (2017) Drinking water quality
0.0023	Exceeds WA DER (2017) Ecological freshwater
50	Exceeds WA DER (2017) Recreational water

LEGEND

- Site Boundary
- Surface Drainage
- Streets
- Groundwater Monitoring Well (GHD, 2016) (3)
- Shallow Soil Borehole (GHD, 2016) (3)
- Deep Soil Borehole (GHD, 2016) (2)
- Sediment Sample Location (GHD, 2016) (7)
- Surface Water Sample Location (GHD, 2016) (3)

0 10 20 40 60 80 100
Metres

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

N

Fire & Rescue NSW
Deniliquin Site Investigation

Job Number 21-25583
Revision A
Date 03 Mar 2017

ASLP Exeedances

Figure 5

G:\21\25583\GIS\Maps\Deliverables\Deniliquin\21_25583_Z007_Deniliquin_ASLP_Exceedances.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Imagery - Google Earth Pro; Streets, Waterways - NSW LPI 2012 DTDB. Created by:tnham

LEGEND

- Site Boundary
- Surface Drainage
- Streets
- Groundwater Monitoring Well (GHD, 2016) (3)
- Shallow Soil Borehole (GHD, 2016) (3)
- Deep Soil Borehole (GHD, 2016) (2)
- Sediment Sample Location (GHD, 2016) (7)
- Surface Water Sample Location (GHD, 2016) (3)

0 10 20 40 60 80

Metres

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

N

GHD

Fire & Rescue NSW
Deniliquin Site Investigation

Groundwater and Surface Water Exceedances

Job Number	21-25583
Revision	A
Date	03 Mar 2017

Figure 6

G:\21\25583\GIS\Maps\Deliverables\Deniliquin\21_25583_Z005_Deniliquin_Water_Exceedances.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Imagery - Google Earth Pro; Streets, Waterways - NSW LPI 2012 DTDB. Created by:tnham

MACKNIGHT DRIVE

SB05

MW03

80.75

81

81.25

MW02

81.5

SB01

81.75

SB02

82

82.25

SB03

SB04

MW01

SS02

SS01

LEGEND

- Site Boundary
- Surface Drainage
- Streets
- Interpolated Groundwater Contours (mAHD)
- Groundwater Monitoring Well (GHD, 2016) (3)
- Shallow Soil Borehole (GHD, 2016) (3)
- Deep Soil Borehole (GHD, 2016) (2)
- Sediment Sample Location (GHD, 2016) (2)

0 5 10 20 30 40

Metres

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

N

Fire & Rescue NSW
Deniliquin Site Investigation

Job Number 21-25583
Revision A
Date 03 Mar 2017

Groundwater Contours

Figure 7

G:\21\25583\GIS\Maps\Deliverables\Deniliquin\21_25583_Z008_Deniliquin_Groundwater_Contours.mxd

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Data source: Imagery - Google Earth Pro; Streets, Waterways - NSW LPI 2012 DTDB. Created by:tnham

Conceptual diagram only - not to scale

LEGEND

- PFAS impact
- Groundwater table
- Vapour migration
- Surface water drainage
- Groundwater migration
- Sample location
- Soil bore
- Piezometer (groundwater well)
- Screen

Fire & Rescue NSW
Deliniquin Fire Training Centre

Conceptual Site Model

Job Number	21-25583
Revision	A
Date	3 Mar 2017

Figure 8

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com **W** www.ghd.com

Appendix B – Analytical results summary tables

	Cations					Particle Sizing							Soil Classification			TOC	Particle Size Analysis by Hydr							Inorganics		Metals							
	Exchangeable Calcium	Exchangeable Magnesium	Exchangeable Potassium	Exchangeable Sodium	CEC	+1180um	+2.36mm	+4.75mm	+9.5mm	+19.0mm	+37.5mm	+75.0mm	Cobbles (>6cm)	Gravel (>2mm)	Sand (0.06-2.00 mm)	Total Organic Carbon	Clay (<2 µm)	Silt (2-60 µm) EA150H	+600µm EA150H	+150µm EA150H	+300µm EA150H	+425µm EA150H	+75µm EA150H	DENSITY	Moisture	Aluminium	Arsenic	Cadmium	Chromium (III+VI)	Copper	Iron	Lead
	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	g/cm3	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.1	0.1	0.1	0.1	0.1	1	1	1	1	1	1	1	1	1	1	0.02	1	1	1	1	1	1	1	0.01	1	50	2	0.4	5	5	50	5
DER (2017) Interim PFAS Guidelines - Health commercial/industrial																																	
DER (2017) Interim PFAS Guidelines - Health residential																																	
DEE (2016) Draft Management Guidance on PFOS and PFOA - ecological value																																	
NEPM 2013 EIL-Commercial/Industrial																											160				85		1800
NEPM 2013 EIL-Urban Residential- Public Open Space																											100				60		1100
NEPM 2013 Table 1A(1) HIL D Comm/Ind																											*3000 #1*	*900*	*3600 #2*		*240000*		*1500 #3*
NEPM 2013 Table 1A(1) HIL A Res																											100 #1	20	100 #2		6000		300 #3
SampleCode	Field_ID	Location_Code	Sample_Depth_Range	Sampled_Date_Time																													
EM1614608035	MW01_0.1	MW01	0.1	30/11/2016	1.8	1	0.2	1.6	4.6	3	<1	<1	<1	<1	<1	<1	<1	1	30	0.26	43	26	8	19	14	11	25	2.64	10.4	5530	-	-	-	-	9080	-
EM1614608037	MW01_9.0	MW01	9	30/11/2016	6	8.3	0.4	5.1	19.8	3	<1	<1	<1	<1	<1	<1	<1	1	30	0.05	35	34	6	14	10	8	23	2.67	14.5	15,600	-	-	-	-	21,000	-
EM1614608038	MW02_0.1	MW02	0.1	30/11/2016	7.7	10.2	0.4	5.9	24.2	<1	<1	<1	<1	<1	<1	<1	<1	<1	18	0.3	53	29	1	5	2	2	9	2.67	17.8	16,300	-	-	-	-	20,800	-
S16-De23615	MW02B_10.2-10.3	MW02	10.2-10.3	15/12/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	6.1	<0.4	10	5.5	-	6.2
EM1614608040	MW02_13.5	MW02	13.5	30/11/2016	1.2	1.1	<0.2	1.8	4.1	20	5	<1	<1	<1	<1	<1	<1	9	81	<0.02	4	6	41	83	69	42	87	2.63	12.9	2580	-	-	-	-	4480	-
EM1614608041	MW03_0.1	MW03	0.1	30/11/2016	6.3	4.2	0.4	0.6	11.4	12	6	2	<1	<1	<1	<1	<1	7	46	0.47	27	20	20	35	29	25	42	2.67	11.2	13,000	-	-	-	-	17,200	-
EM1614608042	MW03_1.0	MW03	1	30/11/2016	8.1	7.4	0.5	5	21	4	<1	<1	<1	<1	<1	<1	<1	2	32	0.16	42	24	8	16	12	10	22	2.68	14.1	11,500	-	-	-	-	17,300	-
S16-De23616	MW03B_13.8-13.9	MW03	13.8-13.9	15/12/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	6.9	<0.4	21	6.6	-	6.9
EM1614608021	SB01_0.1	SB01	0.1	30/11/2016	5.4	2.9	0.5	2	10.8	3	<1	<1	<1	<1	<1	<1	<1	1	41	0.74	30	28	8	20	14	10	28	2.64	12.2	8400	-	-	-	-	14,100	-
EM1614608023	SB01_1.0	SB01	1	30/11/2016	11.3	8.5	0.5	3.8	24.1	<1	<1	<1	<1	<1	<1	<1	<1	<1	24	0.36	51	25	1	5	2	2	10	2.68	19.2	11,700	-	-	-	-	17,000	-
EM1614608043	FD02	SB01	1	30/11/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.38	-	-	-	-	-	-	-	-	18.4	17,500	-	-	-	-	-	-
M16-De05163	FS02	SB01	1	30/11/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	15	-	4.5	<0.4	32	19	-	26
EM1614608012	SB02_0.1	SB02	0.1	29/11/2016	2.6	2	0.4	3.3	8.2	15	6	2	<1	<1	<1	<1	<1	9	58	0.32	15	18	25	46	35	30	62	2.69	21.7	8190	-	-	-	-	15,500	-
EM1614608014	SB02_1.0	SB02	1	29/11/2016	6	6.9	0.5	8.8	22.2	<1	<1	<1	<1	<1	<1	<1	<1	<1	21	0.27	53	26	<1	5	2	<1	10	2.63	17.7	10,600	-	-	-	-	14,100	-
EM1614608015	SB03_0.1	SB03	0.1	29/11/2016	1.4	<0.2	<0.2	1.3	2.9	16	5	<1	<1	<1	<1	<1	<1	8	68	0.12	15	9	34	66	57	46	70	2.64	7.2	3230	-	-	-	-	5500	-
EM1614608017	SB03_1.0	SB03	1	29/11/2016	6.1	9.8	0.4	5.9	22.2	<1	<1	<1	<1	<1	<1	<1	<1	<1	24	0.16	47	29	1	5	3	2	12	2.7	15.4	17,400	-	-	-	-	21,400	-
EM1614608028	SB04_0.15	SB04	0.15	30/11/2016	5.2	5.4	0.7	14	25.3	<1	<1	<1	<1	<1	<1	<1	<1	<1	18	0.37	59	23	<1	4	2	1	8	2.57	23.2	24,600	-	-	-	-	28,800	-
EM1614608031	SB04_2.0	SB04	2	30/11/2016	6.3	10	0.5	5.9	22.8	<1	<1	<1	<1	<1	<1	<1	<1	<1	27	0.11	41	32	<1	7	3	2	14	2.65	16.1	12,900	-	-	-	-	17,000	-
EM1614608044	FD03	SB04	2	30/11/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.08	-	-	-	-	-	-	-	-	15.3	11,200	-	-	-	-	-	-
M16-De05164	FS03	SB04	2	30/11/2016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.1	-	-	-	-	-	-	-	-	16	-	4.4	<0.4	25	14	-	13
EM1614608018	SB05_0.1	SB05	0.1	29/11/2016	2.7	3.1	0.2	1.2	7.2	<1	<1	<1	<1	<1	<1	<1	<1	<1	19	0.52	59	22	2	6	4	3	9	2.61	17	17,200	-	-	-	-	21,900	-
EM1614608020	SB05_1.0	SB05	1	29/11/2016	5.2	4.2	0.2	1.9	11.4	<1	<1	<1	<1	<1	<1	<1	<1	<1	25	0.12	43	32	2	6	4	2	12	2.7	12.8	15,600	-	-	-	-	20,600	-
EM1614608001	SS01	SS01	surface	29/11/2016	6.6	5	0.6	2	14.2	7	4	2	<1	<1	<1	<1	<1	5	36	0.68	34	25	12	25	18	12	32	2.62	17.2	12,200	-	-	-	-	17,700	-
EM1614608002	SS02	SS02	surface	29/11/2016	10.9	9	0.8	2.4	23.2	<1	<1	<1	<1	<1	<1	<1	<1	<1	19	0.5	56	25	2	6	3	2	9	2.65	15.2	19,200	-	-	-	-	23,200	-
EM1614608003	SS03	SS03	surface	29/11/2016	16	8.1	1.1	0.5	25.6	3	<1	<1	<1	<1	<1	<1	<1	1	19	3.12	51	29	5	10	7	6	16	2.38	30.7	15,600	-	-	-	-	19,700	-
EM1614608004	SS04	SS04	surface	29/11/2016	14.5	5.1	0.9	0.3	20.8	2	<1	<1	<1	<1	<1	<1	<1	1	42	0.69	39	18	5	29	17	9	35	2.65	30.4	17,700	-	-	-	-	20,000	-
EM1614608005	SS05	SS05	surface	29/11/2016	9.7	7.1	1.1	0.7	18.6	3	2	2	<1	<1	<1	<1	<1	2	27	0.75	41	30	5	11	6	5	18	2.5	27.9	15,600	-	-	-	-	17,000	-
EM1614608006	SS06	SS06	surface	29/11/2016	9.4	11.7	1.1	1.2	23.4	1	<1	<1	<1	<1	<1	<1	<1	<1	28	0.61	49	23	2	8	5	4	13	2.65	27.3	21,700	-	-	-	-	26,200	-
EM1614608007	SS07	SS07	surface	29/11/2016	8.3	8.2	0.7	2.8	20	<1	<1	<1	<1	<1	<1	<1	<1	<1	21	0.47	57	22	2	7	4	2	13	2.65	31	18,900	-	-	-	-	21,000	-

Env Stds Comments
#1:Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Shedule B7).
#2:In the absence of a guideline value for total chromium, chromium VI value adopted
#3:Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be considered where appropriate.
#4:Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, or suspected to be present.
#5 On-site sample location therefore only screened against commercial / industrial criteria

																								PFAS			
	Mercury	Nickel	Silicon	Zinc	Perfluorodecanesulfonic acid (PFDS)	PFHxS and PFOS (Sum of Total) - Lab Calc	4:2 Fluorotelomer sulfonic acid	10:2 Fluorotelomer sulfonic acid	N-Ethyl perfluorooctane sulfonamidoacetic acid	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorobutane sulfonic acid	Perfluoroheptane sulfonic acid	Perfluorohexane sulfonic acid (PFHxS)	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)	Perfluoropentane sulfonic acid	Perfluorobutanoic acid	Perfluorodecanoic acid
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.1	5	1	5	0.005	0.0002	0.0005	0.0005	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0002	0.0002	0.001	0.0002
DER (2017) Interim PFAS Guidelines - Health commercial/industrial						100															1000			
DER (2017) Interim PFAS Guidelines - Health residential						4															40			
DEE (2016) Draft Management Guidance on PFOS and PFOA - ecological value																					1			
NEPM 2013 EIL-Commercial/Industrial		55		110																				
NEPM 2013 EIL-Urban Residential- Public Open Space		30		70																				
NEPM 2013 Table 1A(1) HIL D Comm/Ind	*730* [#4]	*6000*		*400000*																				
NEPM 2013 Table 1A(1) HIL A Res	40 [#4]	400		7400																				
SampleCode	Field_ID	Location_Code	Sample_Depth_Range	Sampled_Date_Time																							
EM1614608035	MW01_0.1	MW01	0.1	30/11/2016	-	-	8300	-	-	1.36	<0.0005	<0.0005	<0.0002	<0.0002	0.0033	0.016	0.0466	0.003	0.0185	<0.0005	<0.0005	<0.0005	<0.0005	0.0362	0.0158	0.0036	<0.001	0.0014
EM1614608037	MW01_9.0	MW01	9	30/11/2016	-	-	51	-	-	0.0394	<0.0005	<0.0005	<0.0002	<0.0002	0.0007	0.0003	0.0017	0.0007	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0007	0.0005	0.0006	<0.001	<0.0002
EM1614608038	MW02_0.1	MW02	0.1	30/11/2016	-	-	17,100	-	-	0.0026	<0.0005	<0.0005	<0.0002	<0.0002	0.0005	<0.0002	0.0018	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	0.0009	<0.001	<0.0002
S16-De23615	MW02B_10.2-10.3	MW02	10.2-10.3	15/12/2016	<0.1	7.5	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EM1614608040	MW02_13.5	MW02	13.5	30/11/2016	-	-	153	-	-	<0.0002	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.001	<0.0002
EM1614608041	MW03_0.1	MW03	0.1	30/11/2016	-	-	2700	-	-	0.0163	<0.0005	<0.0005	<0.0002	0.0027	0.0038	<0.0002	0.0002	0.002	0.0004	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0067	<0.0002	<0.001	<0.0002
EM1614608042	MW03_1.0	MW03	1	30/11/2016	-	-	150	-	-	0.0016	<0.0005	<0.0005	<0.0002	<0.0002	0.0006	<0.0002	0.0007	0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005	0.0002	<0.001	<0.0002
S16-De23616	MW03B_13.8-13.9	MW03	13.8-13.9	15/12/2016	<0.1	7.8	-	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EM1614608021	SB01_0.1	SB01	0.1	30/11/2016	-	-	4910	-	-	0.362	<0.0005	<0.0005	<0.0002	<0.0002	0.0046	0.007	0.0665	0.0043	0.0017	<0.0005	<0.0005	<0.0005	<0.0005	0.013	0.0079	0.0045	<0.001	0.0004
EM1614608023	SB01_1.0	SB01	1	30/11/2016	-	-	12,500	-	-	0.0105	<0.0005	<0.0005	<0.0002	<0.0002	0.0045	<0.0002	0.0078	0.0038	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0008	0.0006	0.003	<0.001	<0.0002
EM1614608043	FD02	SB01	1	30/11/2016	-	-	9870	-	-	0.0315	<0.0005	<0.0005	<0.0002	<0.0002	0.006	0.0003	0.0192	0.0051	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0018	0.0009	0.0041	<0.001	<0.0002
M16-De05163	FS02	SB01	1	30/11/2016	<0.1	14	-	46	<0.005	-	<0.005	-	-	-	<0.005	-	0.011	<0.005	<0.005	<0.01	-	<0.01	-	<0.01	<0.005	-	<0.005	<0.005
EM1614608012	SB02_0.1	SB02	0.1	29/11/2016	-	-	175	-	-	12.8 [#5]	0.0234	0.0126	<0.0002	<0.0002	0.343	0.309	2.15	0.165	0.154	<0.0005	<0.0005	<0.0005	<0.0005	1.29	0.232	0.306	0.06	0.0017
EM1614608014	SB02_1.0	SB02	1	29/11/2016	-	-	100	-	-	0.29	0.008	<0.0005	<0.0002	<0.0002	0.0879	0.0024	0.212	0.036	0.0011	<0.0005	<0.0005	<0.0005	<0.0005	0.0646	0.0113	0.066	<0.001	<0.0002
EM1614608015	SB03_0.1	SB03	0.1	29/11/2016	-	-	734	-	-	0.462	<0.0005	0.0013	<0.0002	<0.0002	0.0007	0.0013	0.0078	0.0006	0.0074	<0.0005	<0.0005	<0.0005	<0.0005	0.0076	0.0022	0.0008	<0.001	0.0004
EM1614608017	SB03_1.0	SB03	1	29/11/2016	-	-	44	-	-	0.206	<0.0005	<0.0005	<0.0002	<0.0002	0.048	0.0011	0.169	0.0395	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0157	0.0148	0.0415	<0.001	<0.0002
EM1614608028	SB04_0.15	SB04	0.15	30/11/2016	-	-	36,900	-	-	0.749	<0.0005	<0.0005	<0.0002	<0.0002	0.0043	0.0185	0.0578	0.0047	0.0044	<0.0005	<0.0005	<0.0005	<0.0005	0.0537	0.0143	0.0045	<0.001	<0.0002
EM1614608031	SB04_2.0	SB04	2	30/11/2016	-	-	24	-	-	0.0147	<0.0005	<0.0005	<0.0002	<0.0002	0.0084	0.0003	0.0019	0.0037	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.001	0.0002	0.0013	<0.001	<0.0002
EM1614608044	FD03	SB04	2	30/11/2016	-	-	33	-	-	0.0011	<0.0005	<0.0005	<0.0002	<0.0002	0.014	<0.0002	0.0003	0.0064	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	0.0088	<0.001	<0.0002
M16-De05164	FS03	SB04	2	30/11/2016	<0.1	14	-	41	<0.005	-	<0.005	-	-	-	0.012	-	<0.005	<0.005	<0.005	<0.01	-	<0.01	-	<0.01	<0.005	-	<0.005	<0.005
EM1614608018	SB05_0.1	SB05	0.1	29/11/2016	-	-	20,600	-	-	0.0047	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	0.0009	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0006	0.0035	<0.0002	<0.001	<0.0002
EM1614608020	SB05_1.0	SB05	1	29/11/2016	-	-	83	-	-	<0.0002	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.001	<0.0002
EM1614608001	SS01	SS01	surface	29/11/2016	-	-	4680	-	-	0.302	<0.0005	0.0026	<0.0002	<0.0002	0.0003	0.0006	0.0053	0.0015	0.0043	<0.0005	<0.0005	<0.0005	<0.0005	0.0164	0.0022	0.0003	<0.001	0.0011
EM1614608002	SS02	SS02	surface	29/11/2016	-	-	7200	-	-	0.284	<0.0005	0.0325	<0.0002	<0.0002	0.0004	0.0008	0.0065	0.0014	0.0244	<0.0005	<0.0005	<0.0005	<0.0005	0.0364	0.0031	0.0006	<0.001	0.0032
EM1614608003	SS03	SS03	surface	29/11/2016	-	-	2170	-	-	0.0098	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	0.0017	0.0004	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.001	<0.0002
EM1614608004	SS04	SS04	surface	29/11/2016	-	-	1700	-	-	0.0306	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	0.0003	0.0012	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0013	0.0003	<0.0002	<0.001	<0.0002
EM1614608005	SS05	SS05	surface	29/11/2016	-	-	3010	-	-	0.043	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	0.0004	0.0034	0.0014	0.0007	<0.0005	<0.0005	<0.0005	<0.0005	0.0044	0.0032	0.0002	<0.001	<0.0002
EM1614608006	SS06	SS06	surface	29/11/2016	-	-	8080	-	-	0.0329	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	0.0004	0.0002	0.0007	<0.0005	<0.0005	<0.0005	<0.0005	0.0012	0.0002	<0.0002	<0.001	<0.0002
EM1614608007	SS07	SS07	surface	29/11/2016	-	-	5700	-	-	0.025	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0002	<0.0002	<0.001	<0.0002

Env Stds Comments
#1:Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriat
#2:In the absence of a guideline value for total chromium, chromium VI value adopted
#3:Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specif
#4:Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is
#5 On-site sample location therefore only screened against commercial / industrial criteria

Appendix B
Table A
Soil and sediment analytical results

														Major Ions
	Perfluorodecane sulfonic 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)	Potassium
	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	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0002	0.0002	0.0002	0.0002	10
DER (2017) Interim PFAS Guidelines - Health commercial/industrial													
DER (2017) Interim PFAS Guidelines - Health residential													
DEE (2016) Draft Management Guidance on PFOS and PFOA - ecological value						6.6							
NEPM 2013 EIL-Commercial/Industrial													
NEPM 2013 EIL-Urban Residential- Public Open Space													
NEPM 2013 Table 1A(1) HIL D Comm/Ind													
NEPM 2013 Table 1A(1) HIL A Res													

SampleCode	Field_ID	Location_Code	Sample_Depth_Range	Sampled_Date_Time											
EM1614608035	MW01_0.1	MW01	0.1	30/11/2016	0.0018	<0.0002	0.0028	0.0202	0.0005	1.31	0.0014	<0.0005	<0.0002	<0.0002	1.48	1.46	460
EM1614608037	MW01_9.0	MW01	9	30/11/2016	<0.0002	<0.0002	<0.0002	0.0017	<0.0002	0.0377	<0.0002	<0.0005	<0.0002	<0.0002	0.0446	0.0437	<10
EM1614608038	MW02_0.1	MW02	0.1	30/11/2016	<0.0002	<0.0002	<0.0002	0.0005	<0.0002	0.0008	<0.0002	<0.0005	<0.0002	<0.0002	0.0045	0.0036	1160
S16-De23615	MW02B_10.2-10.3	MW02	10.2-10.3	15/12/2016	-	-	-	-	-	-	-	-	-	-	-	-	-
EM1614608040	MW02_13.5	MW02	13.5	30/11/2016	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<10
EM1614608041	MW03_0.1	MW03	0.1	30/11/2016	<0.0002	0.0003	0.0013	0.001	0.0004	0.0143	0.0016	<0.0005	<0.0002	<0.0002	0.0347	0.0257	180
EM1614608042	MW03_1.0	MW03	1	30/11/2016	<0.0002	<0.0002	0.0003	0.0019	<0.0002	0.0009	<0.0002	<0.0005	<0.0002	<0.0002	0.0053	0.0051	<10
S16-De23616	MW03B_13.8-13.9	MW03	13.8-13.9	15/12/2016	-	-	-	-	-	-	-	-	-	-	-	-	-
EM1614608021	SB01_0.1	SB01	0.1	30/11/2016	<0.0002	<0.0002	0.0019	0.0186	<0.0002	0.295	0.0004	<0.0005	<0.0002	<0.0002	0.426	0.414	360
EM1614608023	SB01_1.0	SB01	1	30/11/2016	<0.0002	<0.0002	0.0006	0.0161	<0.0002	0.0027	<0.0002	<0.0005	<0.0002	<0.0002	0.0399	0.0369	790
EM1614608043	FD02	SB01	1	30/11/2016	<0.0002	<0.0002	0.0011	0.0233	<0.0002	0.0123	<0.0002	<0.0005	<0.0002	<0.0002	0.0741	0.0697	600
M16-De05163	FS02	SB01	1	30/11/2016	-	<0.005	<0.005	0.015	<0.005	0.012	<0.01	<0.005	<0.005	<0.005	-	-	3000
EM1614608012	SB02_0.1	SB02	0.1	29/11/2016	0.0068	0.0005	0.0407	0.608	0.0005	10.7 #5	0.0156	<0.0005	<0.0002	<0.0002	16.4	15.7	30
EM1614608014	SB02_1.0	SB02	1	29/11/2016	<0.0002	<0.0002	0.0148	0.146	<0.0002	0.0778	<0.0002	<0.0005	<0.0002	<0.0002	0.728	0.652	<10
EM1614608015	SB03_0.1	SB03	0.1	29/11/2016	0.0034	<0.0002	0.0005	0.0041	<0.0002	0.454	0.0031	<0.0005	<0.0002	0.0012	0.496	0.485	50
EM1614608017	SB03_1.0	SB03	1	29/11/2016	0.0004	<0.0002	0.0267	0.141	<0.0002	0.0371	<0.0002	<0.0005	<0.0002	<0.0002	0.535	0.492	<10
EM1614608028	SB04_0.15	SB04	0.15	30/11/2016	0.0003	<0.0002	0.0025	0.0192	<0.0002	0.691	0.0004	<0.0005	<0.0002	<0.0002	0.876	0.852	2400
EM1614608031	SB04_2.0	SB04	2	30/11/2016	<0.0002	<0.0002	<0.0002	0.0125	<0.0002	0.0128	<0.0002	<0.0005	<0.0002	<0.0002	0.0421	0.0405	<10
EM1614608044	FD03	SB04	2	30/11/2016	<0.0002	<0.0002	0.0004	0.0394	<0.0002	0.0008	<0.0002	<0.0005	<0.0002	<0.0002	0.0701	0.0613	<10
M16-De05164	FS03	SB04	2	30/11/2016	-	<0.005	<0.005	0.033	<0.005	<0.005	<0.01	<0.005	<0.005	<0.005	-	-	2600
EM1614608018	SB05_0.1	SB05	0.1	29/11/2016	<0.0002	<0.0002	0.0013	0.0015	<0.0002	0.0038	<0.0002	<0.0005	<0.0002	<0.0002	0.0121	0.0121	1260
EM1614608020	SB05_1.0	SB05	1	29/11/2016	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<10
EM1614608001	SS01	SS01	surface	29/11/2016	0.0014	<0.0002	0.0011	0.0038	0.0008	0.297	0.0009	<0.0005	<0.0002	<0.0002	0.34	0.332	310
EM1614608002	SS02	SS02	surface	29/11/2016	0.0072	0.002	0.0008	0.0063	0.0002	0.277	0.0076	<0.0005	<0.0002	0.0014	0.412	0.356	410
EM1614608003	SS03	SS03	surface	29/11/2016	<0.0002	<0.0002	<0.0002	0.001	<0.0002	0.0081	<0.0002	<0.0005	<0.0002	<0.0002	0.0112	0.0112	140
EM1614608004	SS04	SS04	surface	29/11/2016	<0.0002	<0.0002	<0.0002	0.0004	<0.0002	0.0294	<0.0002	<0.0005	<0.0002	<0.0002	0.0329	0.0326	110
EM1614608005	SS05	SS05	surface	29/11/2016	0.0009	<0.0002	0.0019	0.0031	0.0004	0.0396	0.0006	<0.0005	<0.0002	<0.0002	0.0602	0.0577	190
EM1614608006	SS06	SS06	surface	29/11/2016	0.0002	<0.0002	<0.0002	0.0003	<0.0002	0.0325	0.0005	<0.0005	<0.0002	<0.0002	0.0362	0.0355	470
EM1614608007	SS07	SS07	surface	29/11/2016	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.025	<0.0002	<0.0005	<0.0002	<0.0002	0.025	0.025	320

Env Stds Comments
#1:Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriat
#2:In the absence of a guideline value for total chromium, chromium VI value adopted
#3:Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specif
#4:Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is p
#5 On-site sample location therefore only screened against commercial / industrial criteria

						PFAS																														
						Perfluorodecanesulfonic acid (PFDS)	PFHxS and PFOS (Sum of Total) - Lab Calc	4:2 Fluorotelomer sulfonic acid	10:2 Fluorotelomer sulfonic acid	N-Ethyl perfluorooctane sulfonamidoacetic acid	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorobutane sulfonic acid	Perfluoroheptane sulfonic acid	Perfluorohexane sulfonic acid (PFHxS)	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)	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	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						0.02	0.01	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.02	0.05	0.05	0.05	0.05	0.05	0.05	0.01	0.02	0.1	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.05	0.02	0.02	0.01	0.01
WA DER (2017) Drinking water quality							5#1															50#1														
WA DER (2017) Ecolgocial freshwater							*0.0023#1*															*190#1*														
WA DER (2017) Recreational water							50#1															500#1														
SampleCode	Field_ID	Location_Code	Sample Depth (m)	Sampled_Date	Matrix_Description																															
ES1701175001	MW01_0.1	MW01	0.1	30-Nov-16	ASLP	0.07	137	<0.05	<0.05	<0.02	<0.02	0.38	1.43	3.49	0.29	1.76	<0.05	<0.05	<0.05	<0.05	1.54	0.77	0.26	<0.1	0.05	<0.02	0.12	0.96	0.07	134	0.12	<0.05	<0.02	<0.02	145	143
ES1701175002	MW01_9.0	MW01	9	30-Nov-16	ASLP	<0.02	3.43	<0.05	<0.05	<0.02	<0.02	0.15	0.04	0.27	0.11	0.06	<0.05	<0.05	<0.05	<0.05	0.09	0.04	0.06	<0.1	<0.02	<0.02	0.02	0.28	<0.02	3.16	<0.02	<0.05	<0.02	<0.02	4.28	4.18
ES1701175003	MW02_0.1	MW02	0.1	30-Nov-16	ASLP	<0.02	0.18	<0.05	<0.05	<0.02	<0.02	0.02	<0.02	0.12	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	0.02	<0.1	<0.02	<0.02	<0.02	0.02	<0.02	0.06	<0.02	<0.05	<0.02	<0.02	0.24	0.22
ES1701175004	MW03_0.1	MW03	0.1	30-Nov-16	ASLP	<0.02	0.39	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	0.08	0.03	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.16	<0.02	<0.1	<0.02	<0.02	0.03	0.04	<0.02	0.31	<0.02	<0.05	<0.02	<0.02	0.65	0.65
ES1701175005	SB01_0.1	SB01	0.1	30-Nov-16	ASLP	<0.02	17	<0.05	<0.05	<0.02	<0.02	0.43	0.35	4.29	0.35	0.08	<0.05	<0.05	<0.05	<0.05	0.45	0.32	0.35	<0.1	<0.02	<0.02	0.1	0.8	<0.02	12.7	<0.02	<0.05	<0.02	<0.02	20.2	19.5
ES1701175006	SB02_0.1	SB02	0.1	29-Nov-16	ASLP	<0.2	756	0.54	<0.5	<0.2	<0.2	11.3	15.8	84.7	5.21	8.63	<0.5	<0.5	<0.5	<0.5	45.9	9.88	9.11	4.4	<0.2	<0.2	2.31	18.2	<0.2	671	2.01	<0.5	<0.2	<0.2	889	862
ES1701175007	SB03_0.1	SB03	0.1	29-Nov-16	ASLP	0.11	17	<0.05	<0.05	<0.02	<0.02	0.05	0.06	0.44	0.06	0.15	<0.05	<0.05	<0.05	<0.05	0.12	0.09	0.04	<0.1	<0.02	<0.02	0.03	0.19	<0.02	16.6	0.13	<0.05	<0.02	<0.02	18.1	17.7
ES1701175008	SB03_1.0	SB03	1	29-Nov-16	ASLP	<0.02	6.05	<0.05	<0.05	<0.02	<0.02	4.09	0.03	5.13	3.14	<0.05	<0.05	<0.05	<0.05	<0.05	0.19	0.29	2.28	0.8	<0.02	<0.02	0.88	6.02	<0.02	0.92	<0.02	<0.05	<0.02	<0.02	23.8	21.5
ES1701175009	SB04_0.15	SB04	0.15	30-Nov-16	ASLP	<0.02	51.7	<0.05	<0.05	<0.02	<0.02	0.43	1.78	6.02	0.21	0.17	<0.05	<0.05	<0.05	<0.05	2.72	0.8	0.41	<0.1	<0.02	<0.02	0.15	0.62	<0.02	45.7	<0.02	<0.05	<0.02	<0.02	59	56.8
ES1701175010	SB05_0.1	SB05	0.1	29-Nov-16	ASLP	<0.02	0.18	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	0.05	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.09	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	0.13	<0.02	<0.05	<0.02	<0.02	0.27	0.27
ES1701175011	SS01	SS01		29-Nov-16	ASLP	<0.02	16.2	<0.05	<0.05	<0.02	<0.02	0.07	0.05	0.31	0.09	0.28	<0.05	<0.05	<0.05	<0.05	0.31	0.12	0.04	<0.1	0.04	<0.02	0.03	0.16	0.05	15.9	0.06	<0.05	<0.02	<0.02	17.5	17.3
ES1701175012	SS02	SS02		29-Nov-16	ASLP	0.26	29	<0.05	0.3	<0.02	<0.02	0.04	0.05	0.26	0.11	1.26	<0.05	<0.05	<0.05	<0.05	0.54	0.11	0.02	<0	0.3	0.04	0.04	0.2	<0.02	28.7	0.59	<0.05	<0.02	0.11	32.9	31.3
ES1701175013	SS03	SS03		29-Nov-16	ASLP	<0.02	1.22	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	0.05	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.02	<0.02	<0	<0.02	<0.02	<0.02	0.02	<0.02	1.17	<0.02	<0.05	<0.02	<0.02	1.26	1.26
ES1701175014	SS04	SS04		29-Nov-16	ASLP	<0.02	0.36	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0	<0.02	<0.02	<0.02	<0.02	<0.02	0.36	<0.02	<0.05	<0.02	<0.02	0.36	0.36
ES1701175015	SS05	SS05		29-Nov-16	ASLP	<0.02	1.41	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	0.09	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.12	<0.02	<0	<0.02	<0.02	0.05	0.07	<0.02	1.32	<0.02	<0.05	<0.02	<0.02	1.71	1.71
ES1701175016	SS06	SS06		29-Nov-16	ASLP	<0.02	2.27	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	0.03	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0	<0.02	<0.02	<0.02	0.02	<0.02	2.24	<0.02	<0.05	<0.02	<0.02	2.29	2.29
ES1701175017	SS07	SS07		29-Nov-16	ASLP	<0.02	1.26	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0	<0.02	<0.02	<0.02	<0.02	<0.02	1.26	<0.02	<0.05	<0.02	<0.02	1.26	1.26
ES1701294003	MW01_0.1	MW01	0.1	30-Nov-16	TCLP	<0.02	111	<0.05	<0.05	<0.02	<0.02	0.56	1.73	4.72	0.45	0.33	<0.05	<0.05	<0.05	<0.05	0.97	0.9	0.37	<0.1	0.08	<0.02	0.13	1.62	0.11	106	<0.02	<0.05	<0.02	<0.02	118	116
ES1701294004	MW01_9.0	MW01	9	30-Nov-16	TCLP	<0.02	2.08	<0.05	<0.05	<0.02	<0.02	0.16	0.02	0.25	0.11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.02	0.08	<0.1	<0.02	<0.02	<0.02	0.25	<0.02	1.83	<0.02	<0.05	<0.02	<0.02	2.72	2.62

Env Stds Comments
#1:WA DER 2017 - PFC Guidelines, dilution factor of 10 applied

			Field Parameters					Inorganics			PFAS																									
			DO (mg/L) (Field)	Electrical conductivity (field)	pH (Field)	Redox (Field)	Temperature (Field)	Sulfate as SO4 - Turbidimetric (Filtered)	pH (Lab)	Total Dissolved Solids (Filtered)	Perfluorodecanesulfonic acid (PFDS)	PFHxS and PFOS (Sum of Total) - Lab Calc	4:2 Fluorotelomer sulfonic acid	10:2 Fluorotelomer sulfonic acid	N-Ethyl perfluorooctane sulfonamidoacetic acid	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorobutane sulfonic acid	Perfluoroheptane sulfonic acid	Perfluorohexane sulfonic acid (PFHxS)	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)	Perfluoropentane sulfonic acid	Perfluorobutanoic acid	Perfluorodecanoic acid	Perfluorodecane sulfonic acid	Perfluorododecanoic acid	Perfluoroheptanoic acid	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctane sulfonamide (FOSA)
			mg/L	µS/cm	pH Units	mV	°C	mg/L	pH Units	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL								1	0.01	10	0.02	0.01	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.05	0.05	0.05	0.05	0.05	0.01	0.02	0.1	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.02
NEPM 2013 Table 1C GILs, Drinking Water (inclusive of WA DER PFAS criterion)												0.5 [#2]																5 [#2]									
NEPM 2013 Table 1C GILs, Fresh Waters (inclusive of WA DER PFAS criterion)												0.00023 [#1]																19 [#1]									
NHMRC Recreational Guidelines 2008 (inclusive of WA DER PFAS criterion)												5 [#3]																50 [#3]									
Field_ID	Location_Code	Sampled_Date																																			
SW01	SW01	29-Nov-16	-	-	-	-	-	16	7.29	250	-	2.4	<0.05	<0.05	<0.02	<0.02	0.07	0.02	0.39	0.21	<0.05	<0.05	<0.05	<0.05	<0.05	0.13	0.06	0.06	<0.1	<0.02	<0.02	<0.02	0.04	0.19	<0.02	2.01	<0.02
SW02	SW02	29-Nov-16	-	-	-	-	-	6	6.87	158	-	0.2	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.2	<0.02
SW03	SW03	29-Nov-16	-	-	-	-	-	8	7.01	176	-	1.63	<0.05	<0.05	<0.02	<0.02	0.06	<0.02	0.31	0.2	<0.05	<0.05	<0.05	<0.05	<0.05	0.09	0.05	0.07	<0.1	<0.02	<0.02	<0.02	0.02	0.4	<0.02	1.32	<0.02
FS01	SW03	29-Nov-16	-	-	-	-	-	-	7.7	-	<0.01	*150*	<0.01	-	-	-	0.03	-	0.18 [#1]	0.08	<0.01	<0.05	-	<0.05	-	0.05	0.04 [#1]	-	0.07	<0.01	-	<0.01	0.03	0.15 [#1]	0.02	1.1 [#1]	<0.05
FD01	SW03	29-Nov-16	-	-	-	-	-	-	7.05	162	-	1.48	<0.05	<0.05	<0.02	<0.02	0.06	<0.02	0.24	0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	0.08	<0.1	<0.02	<0.02	<0.02	0.04	0.39	<0.02	1.24	<0.02
FD01	MW01	24-Jan-17	-	-	-	-	-	-	7.79	1020	<0.02	0.86	<0.05	<0.05	<0.02	<0.02	0.15	<0.02	0.26	0.12	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.03	0.08	<0.1	<0.02	-	<0.02	0.06	0.32	<0.02	0.6	<0.02
MW01	MW01	24-Jan-17	5.72	1826	7.51	176.6	21.1	70	7.77	1670	<0.02	0.88	<0.05	<0.05	<0.02	<0.02	0.14	<0.02	0.24	0.13	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.03	0.08	<0.1	<0.02	-	<0.02	0.04	0.33	<0.02	0.64	<0.02
MW02	MW02	24-Jan-17	5.66	1757	7.22	156.3	21.4	60	7.8	1150	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	-	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02
MW03	MW03	24-Jan-17	1.98	2599	7.73	129.5	21.5	155	7.71	1700	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.02	<0.1	<0.02	-	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02

Env Stds Comments
#1: WA DER 2017 - Ecological PFC 99% species protection guidelines
#2: WA DER 2017 - Drinking water guideline, based on enHealth (2016) recommendations
#3: WA DER 2017 - Recreational waters guideline, based on enHealth (2016) recommendations

Data Comments
#1 Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.

Appendix B
Table C
Groundwater and surface water analytical results

							Alkalinity				Major Ions								
			Perfluorotetradecanoic acid	Perfluorotridecanoic acid	Perfluoroundecanoic acid	PFAS (Sum of Total)	PFAS (Sum of Total)(WA DER List)	Alkalinity (Carbonate as CaCO3)	Alkalinity (Hydroxide as CaCO3)	Alkalinity (total as CaCO3)	Bicarbonate Alkalinity as CaCO3	Calcium (Filtered)	Chloride	Magnesium (Filtered)	Anions Total	Potassium (Filtered)	Sodium (Filtered)	Cations Total	Ionic Balance
			µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	mg/L	mg/L	meq/L	%
EQL			0.05	0.02	0.02	0.01	0.01	1	1	1	1	1	1	1	0.01	1	1	0.01	0.01
NEPM 2013 Table 1C GILs, Drinking Water (inclusive of WA DER PFAS criterion)																			
NEPM 2013 Table 1C GILs, Fresh Waters (inclusive of WA DER PFAS criterion)																			
NHMRC Recreational Guidelines 2008 (inclusive of WA DER PFAS criterion)																			
Field_ID	Location_Code	Sampled_Date																	
SW01	SW01	29-Nov-16	<0.05	<0.02	<0.02	3.18	3.1	<1	<1	73	73	6	11	4	2.1	4	24	1.77	-
SW02	SW02	29-Nov-16	<0.05	<0.02	<0.02	0.2	0.2	<1	<1	35	35	4	6	2	0.99	3	6	0.7	-
SW03	SW03	29-Nov-16	<0.05	<0.02	<0.02	2.52	2.45	<1	<1	60	60	4	10	3	1.65	5	20	1.44	-
FS01	SW03	29-Nov-16	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FD01	SW03	29-Nov-16	<0.05	<0.02	<0.02	2.25	2.17	-	-	-	-	-	-	-	-	-	-	-	-
FD01	MW01	24-Jan-17	<0.05	<0.02	<0.02	1.62	1.54	-	-	-	-	-	-	-	-	-	-	-	-
MW01	MW01	24-Jan-17	<0.05	<0.02	<0.02	1.63	1.55	<1	<1	290	290	18	448	24	19.9	1	316	16.6	8.88
MW02	MW02	24-Jan-17	<0.05	<0.02	<0.02	<0.02	<0.02	<1	<1	308	308	18	384	23	18.2	2	305	16.1	6.19
MW03	MW03	24-Jan-17	<0.05	<0.02	<0.02	<0.02	<0.02	<1	<1	186	186	38	749	41	28.1	9	420	23.8	8.3

Env Stds Comments
#1: WA DER 2017 - Ecological PFC 99% species protection guidelines
#2: WA DER 2017 - Drinking water guideline, based on enHealth (2016) recommendatio
#3: WA DER 2017 - Recreational waters guideline, based on enHealth (2016) recommen

Data Comments
#1 Quantification of linear and branched isomers has been conducted as a single total r

Appendix C – Field Sampling Sheets and equipment calibration certificates

Purging and Sampling Record

Bore ID: MW01

Job Information	Sampling Information	Bore Information
Client: Fire & Rescue NSW	**Purge Method:** micropurge	**SWL(mbTOC):** 11.278 m **Logic Check:** Y
Project: Deniliquin PFAS Investigation	**Sample Method:** low flow	**Screen:** From:.....to..... m **Stick Up:** - m
Proj. No.: 21/25583/05	**WQ Meter Type:** YSI Pro Plus	**NAPL Check:** **Bore Diam.:** 50 mm
Sampler: C.Wines	**Flow Cell:** (Y) / N **Pump Depth:** 13 m	**Ref.datum:** **Well Cap Secure?** Y
Date: 24/01/17	**WLevel Meter Type:** Dip / Fox / Int.Fce / Gge	**Bore Depth:** 14.06 m
Round Jan-17	**Field Filtered? Y / N** (filter vessel, disposable filter, filter/syringe)	

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (µS/cm)	Dis.Oxygen (ppm)	Ox-Red Pt. (± mV)	SWL (m TOC)	(LPM)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):	-	*+/- 0.05 pH*	*+/- 3%*	*+/- 10%*	*+/- 10 mV*	*stable*			
							11.200	@ pump down	
8:26	0.5	21.5	8.15	1855	4.46	-64.4	11.465	2	clear-yellow, low-med turb, no odour,
8:28	1.0	21.4	7.95	1849	4.39	-56.8	11.470	2	no sheen
8:30	1.5	21.3	7.82	1838	4.50	-51.4	" "	" "	med turb "
8:32	2.0	21.2	7.73	1828	4.49	-46.8	" "	" "	" "
8:34	2.5	21.1	7.66	1820	4.89	-42.3	11.518	" "	" "
8:37	3.0	21.1	7.60	1815	4.90	-37.7	" "	" "	" "
8:39	3.5	21.2	7.57	1811	5.40	-34.8	" "	" "	low turb "
8:41	4.0	21.2	7.55	1814	5.50	-33.2	" "	" "	" "
8:43	4.5	21.1	7.52	1821	5.66	-29.5	" "	" "	" "
8:45	5.0	21.1	7.51	1826	5.72	-28.4	" "	" "	" "
	Parameters stable. Began sampling at							8:45	

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

FD01 and FS01 taken here

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: MW02

Job Information	Sampling Information	Bore Information
Client: Fire & Rescue NSW	**Purge Method:** Micropurge	**SWL(mbTOC):** 11.128 m **Logic Check:** Y
Project: Deniliquin PFAS Investigation	**Sample Method:** low flow	**Screen:** From:.....to..... m **Stick Up:** - m
Proj. No.: 21/25583/05	**WQ Meter Type:** YSI Pro Plus	**NAPL Check:**..... **Bore Diam.:** 50 mm
Sampler: C.Wines	**Flow Cell:** Y / N **Pump Depth:** 12 m	**Ref.datum:** ..... **Well Cap Secure?** Y
Date: 24/01/17	**WLevel Meter Type:** Dip / Fox / Int.Fce / Gge	**Bore Depth:** 12.74 m
Round Jan-17	**Field Filtered? Y / N** (filter vessel, disposable filter, filter/syringe)	

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (µS/cm)	Dis.Oxygen (ppm)	Ox-Red Pt. (± mV)	SWL (m TOC)	(cpm)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):	-	*+/- 0.05 pH*	*+/- 3%*	*+/- 10%*	*+/- 10 mV*	*stable*			
							11.140	w pump down	
9:26	0.5	21.5	8.07	1776	2.93	-57.8	11.175	2	Orange-brown, med-high turb,
9:28	1.0	21.4	8.03	1772	3.39	-56.4	" "	2	no odour, no sheen
9:30	1.5	21.3	7.97	1768	3.94	-55.1	" "	2	" "
9:32	2.0	21.3	7.93	1766	4.20	-54.8	" "	2	" "
9:34	2.5	21.3	7.89	1762	4.45	-54.0	" "	2	med turb
9:36	3.0	21.4	7.84	1763	4.80	-53.3	11.185	2	" "
9:38	3.5	21.4	7.80	1765	4.72	-52.3	" "	2	" "
9:41	4.0	21.3	7.78	1757	5.48	-50.6	" "	2	clear - white/yellow, low ~~med~~ turb
9:43	4.5	21.5	7.74	1759	5.64	-48.7	" "	2	" "
9:45	5.0	21.4	7.72	1757	5.66	-48.7	" "	2	" "
	Parameters stable. Began sampling at 9:45								

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

Purging and Sampling Record

Bore ID: MW03

Job Information	Sampling Information	Bore Information
Client: Fire & Rescue NSW	**Purge Method:** Micropurge	**SWL(mbTOC):** 12.156 m **Logic Check:** Y
Project: Deniliquin PFAS Investigation	**Sample Method:** Low flow	**Screen:** From:.....to..... m **Stick Up:** - m
Proj. No.: 21/25583/05	**WQ Meter Type:** YSI Pro Plus	**NAPL Check:**..... **Bore Diam.:** 50 mm
Sampler: C.Wines	**Flow Cell:** (Y) N **Pump Depth:** 16 m	**Ref.datum:**..... **Well Cap Secure?** Y
Date: 24/01/17	**WLevel Meter Type:** Dip / Fox / Int.Fce / Gge	**Bore Depth:** 17.39 m
Round Jan-17	**Field Filtered? Y / N** (filter vessel, disposable filter, filter/syringe)	

Time (.....)	Volume (L)	Temp (°C)	pH (pH units)	Elec.Cond (µS/cm)	Dis.Oxygen (ppm)	Ox-Red Pt. (± mV)	SWL (m TOC)	(LPM)	Comment: Colour, turbidity, sediment load, sheen, odour, flow rate, purged dry?
Stable when (3 consecutive readings):	-	*+/- 0.05 pH*	*+/- 3%*	*+/- 10%*	*+/- 10 mV*	*stable*			
							12.150	w pump down	
10:24	0.5	21.1	7.76	2808	4.04	-49.1	12.180	3	clear-brown, cloudy, med-high turb,
10:26	1.0	21.5	7.84	2815	3.43	-68.4	" "	2	no odour, no sheen
10:29	1.5	21.4	7.88	2780	2.76	-78.9	12.218	2	" "
10:31	2.0	21.3	7.88	2754	2.43	-82.3	" "	2	" "
10:33	2.5	21.4	7.85	2699	1.97	-85.4	" "	2	" "
10:36	3.0	21.5	7.84	2683	1.88	-85.3	" "	2	" "
10:38	3.5	21.4	7.80	2649	1.82	-82.2	" "	2	" "
10:40	4.0	21.4	7.76	2628	1.89	-79.5	" "	2	" "
10:42	4.5	21.5	7.73	2599	1.98	-75.5	" "	2	" "
	Parameters stable. Began sampling at							10:42	

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

RB01 taken off pump

Purge Volumes

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

*Double for gravel pack

Oil / Water Interface Meter

airmet

Air-Met Scientific Pty Ltd
1300 137 067

Instrument **Interface Meter (30M)**
Serial No. **288044**

Item	Test	Pass	Comments
Battery	Compartment	✓	
	Capacity	✓	
	above 7.9V		
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.

Tested by: **Caitlin Tolsma**

Test date: **19/01/2017**

Next Test due: **18/07/2017**

Multi Parameter Water Meter

Instrument YSI Quatro Pro Plus
Serial No. 15K101081

airmet
Air-Met Scientific Pty Ltd
1300 137 067

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

Certificate of Calibration

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

Sensor	Serial no	Standard Solutions	Certified	Solution Bottle Number	Instrument Reading
1. D.O		0 ppm		1608226559	0 ppm
2. Conductivity		2760uS		290786	2760uS
3. pH7		pH 7.00		288996	pH 7.00
4. pH4		pH 4.00		NI1607	pH 4.00
5. ORP mV		225.86		NI 1033/1034	225.86
7. Temp °C		23.7		Hanna- 163377	23.7

Calibrated by: Ariane Ventura

Calibration date: 17-Jan-17

Next calibration due: 16-Jul-17

Appendix D – Borehole Logs

BOREHOLE LOG

ENVIRONMENTAL-GROUNDWATER

MONITORING WELL MW01

Client Fire & Rescue NSW	**Drill Co.** BG Drilling Co	**Easting, Northing** 313820.797, 6063782.963
Project Deniliquin FRNSW Site Investigation	**Driller** Luke & Joel	**Grid Ref** GDA94_MGA_zone_55
Project No. 212558305	**Rig Type** D&B-8D	**Elevation** 93.77
Site Deniliquin Airport	**Drill Method** Solid Flight Auger	**Collar RL** 93.688
Location Deniliquin Airport, NSW 2710	**Total Depth (m)** 15	**Logged By** Sid Paleri
Date Drilled 30/11/2016 - 01/12/2016	**Diameter (mm)** 125	**Checked By**

B.C.L No. N/A **Casing** 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	SFA	0.1	MW01_0.1				GRASS	D	L		93.77
1		0	MW01_1.0				clayey SAND, fine to medium, orange-brown (FILL)	D	S		93
2							CLAY, low to medium plasticity, brown with mottled black- orange (NATURAL - SOIL)				92
3							sandy CLAY, yellow- brown with mottled orange, medium to coarse sand (NATURAL - SOIL)	D	F		91
4											90
5					Grout		CLAY, yellow- brown with mottled orange (NATURAL - SOIL)	D	F		89
6											88
7											87
8							silty CLAY, yellow- brown, some fine sand (NATURAL - SOIL)	SM	F		86
9		0	MW01_9.0								85
10							SAND, fine, yellow- brown (NATURAL - SOIL)	D	D		84
11					Bentonite						83
12											82
13					Sand						81
14							SAND, medium to coarse, yellow- brown (NATURAL - SOIL)	W	D		80
15					Wall collapse						79
16							Termination Depth at:15.00 m. Target depth achieved.				78
17											77
18											76
19											75
											74

Notes Borehole collapsed approximately 0.5 metres between drilling depth (15.0m) and installation of screen (14.5m)

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 MW02

Client Fire & Rescue NSW
Project Deniliquin FRNSW Site Investigation
Project No. 212558305
Site Deniliquin Airport
Location Deniliquin Airport, NSW 2710
Date Drilled 30/11/2016 - 01/12/2016

Drill Co. BG Drilling Co
Driller Luke & Joel
Rig Type D&B-8D
Drill Method Solid Flight Auger
Total Depth (m) 15.5
Diameter (mm) 125

Easting, Northing ,
Grid Ref GDA94_MGA_zone_55
Elevation
Collar RL -
Logged By Sid Paleri
Checked By

B.C.L No. N/A

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	SFA	0.2	MW02_0.6				GRASS	D	L		0
1		0.1	MW02_1.0				clayey SAND, red- brown (FILL)	D	F		-1
							CLAY, medium plasticity, dark brown with mottled orange- red (NATURAL - SOIL)	D	F		
2											-2
							CLAY, low to medium plasticity, yellow- brown with mottled black (NATURAL - SOIL)	D	F		
3											-3
4							sandy CLAY, low to medium plasticity, grey- brown with mottled red- brown, medium to coarse sand (NATURAL - SOIL)				-4
5											-5
6											-6
7							silty CLAY, low to medium plasticity, yellow- brown (NATURAL - SOIL)	D	F		-7
8											-8
9											-9
10							SAND, fine, yellow- brown, trace silt (NATURAL - SOIL)	D	D		-10
11											-11
12							SAND, fine, dark orange- brown, trace silt (NATURAL - SOIL)	D	D		-12
13			MW02_13.5	▽			SAND, medium to coarse, brown, trace clay (NATURAL - SOIL)	W	D		-13
14											-14
15											-15
16							Termination Depth at:15.50 m. Borehole collapse.				-16
17											-17
18											-18
19											-19

Casing **Screen** **Surface Completion**

Notes Drilled extra 0.5 metres to try and account for borehole collapse. Did not work. Well collapse from 15.5 to 13.7 metres. Well was subsequently decommissioned following successful installation of MW02B.

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

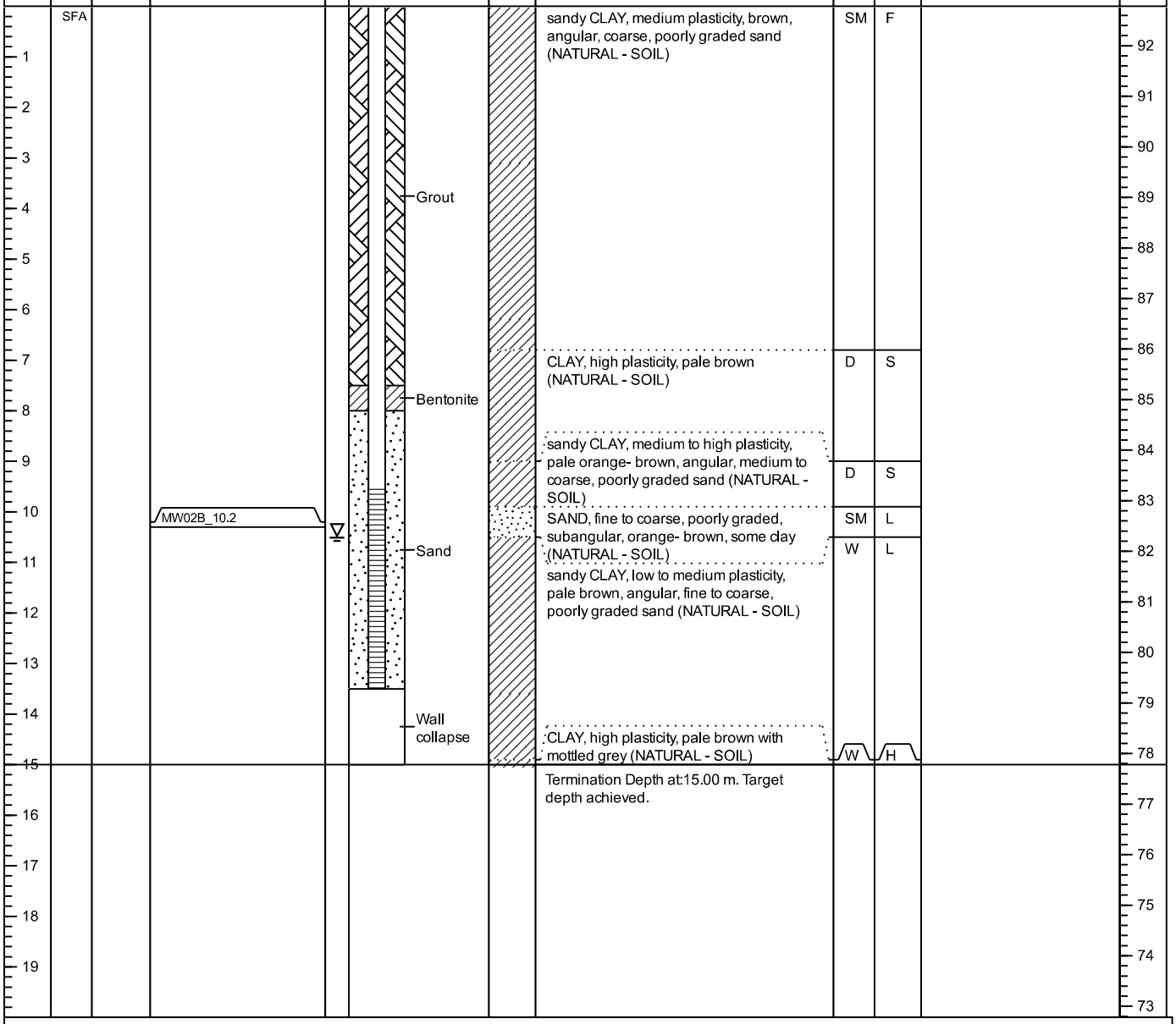
MONITORING WELL MW02B

Client Fire & Rescue NSW
Project Deniliquin FRNSW Site Investigation
Project No. 212558305
Site Deniliquin Airport
Location Deniliquin Airport, NSW 2710
Date Drilled 15/12/2016 - 15/12/2016

Drill Co. BG Drilling Co
Driller Matt & Randall
Rig Type D&B-8D
Drill Method Solid Flight Auger
Total Depth (m) 15
Diameter (mm) 125

Easting, Northing 313742.547, 6063752.26
Grid Ref GDA94_MGA_zone_55
Elevation 92.78
Collar RL 92.682
Logged By Alice Walker
Checked By

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



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 MW03

Client Fire & Rescue NSW
Project Deniliquin FRNSW Site Investigation
Project No. 212558305
Site Deniliquin Airport
Location Deniliquin Airport, NSW 2710
Date Drilled 30/11/2016 - 01/12/2016

Drill Co. BG Drilling Co
Driller Luke & Joel
Rig Type D&B-8D
Drill Method Solid Flight Auger
Total Depth (m) 16.7
Diameter (mm) 125

Easting, Northing ,
Grid Ref GDA94_MGA_zone_55
Elevation
Collar RL -
Logged By Sid Paleri
Checked By

B.C.L No. N/A

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	0.1	MW03_0.1				GRASS	D	D		0
1		0.1	MW03_1.0				silty SAND, fine, orange- brown (FILL)	D	F		-1
	SFA						sandy CLAY, medium plasticity, orange-brown with mottled black, fine to medium sand (FILL)				
2								D	F		-2
3							CLAY, medium plasticity, dark brown with mottled red- black, trace fine sand (NATURAL - SOIL)				-3
4											-4
5											-5
6											-6
7							silty CLAY, low to medium plasticity, yellow- brown, trace fine sand (NATURAL - SOIL)	D	F		-7
8											-8
9											-9
10											-10
11							SAND, fine to medium, yellow- brown (NATURAL - SOIL)	D	D		-11
12											-12
13											-13
14											-14
15											-15
16											-16
17							Termination Depth at:16.70 m. Borehole collapse.				-17
18											-18
19											-19

Notes Well appeared to be broken due to collapse. Well was subsequently decommissioned following successful installation of MW03B.

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 MW03B

Client Fire & Rescue NSW
Project Deniliquin FRNSW Site Investigation
Project No. 212558305
Site Deniliquin Airport
Location Deniliquin Airport, NSW 2710
Date Drilled 15/12/2016 - 15/12/2016

Drill Co. BG Drilling Co
Driller Matt & Randall
Rig Type D&B-8D
Drill Method Solid Flight Auger
Total Depth (m) 18
Diameter (mm) 125

Easting, Northing 313776.952, 6063695.994
Grid Ref GDA94_MGA_zone_55
Elevation 92.89
Collar RL 92.81
Logged By Alice Walker
Checked By

B.C.L No. N/A **Casing** 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	SFA						CLAY, high plasticity, dark brown (FILL)	SM	VST		92
2							CLAY, medium to high plasticity, tan-brown, trace gravel (NATURAL - SOIL)	SM	H		91
3											90
4											89
5											88
6					Grout		CLAY, medium to high plasticity, tan-brown, trace coarse gravel (NATURAL - SOIL)	D	H		87
7											86
8											85
9							CLAY, medium plasticity, pale grey-brown (NATURAL - SOIL)	D	S		84
10							CLAY, low plasticity, grey- brown (NATURAL - SOIL)	SM	S		83
11											82
12					Bentonite		CLAY, medium to high plasticity, orange-brown, some fine sand (NATURAL - SOIL)	SM	S		81
13							CLAY, medium to high plasticity, orange-brown, some medium sand (NATURAL - SOIL)	SM	S		80
14			MW03B_13.8				sandy CLAY, low to medium plasticity, pale brown, angular, fine to coarse, poorly graded sand (NATURAL - SOIL)	SM	S		79
15			MW03B_15.1		Sand		sandy CLAY, low to medium plasticity, pale brown, angular, fine to coarse, poorly graded sand (NATURAL - SOIL)	W	S		78
16											77
17											76
18					Wall collapse						75
19							Termination Depth at:18.00 m. Target depth achieved.				74
											73

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-SOIL BORE

SOIL BORE SB01

Client Fire & Rescue NSW
Project Deniliquin FRNSW Site Investigation
Project No. 212558305
Site Deniliquin Airport
Location Deniliquin Airport, NSW 2710
Date Drilled 29/11/2016 - 30/11/2016

Drill Co. BG Drilling Co
Driller Luke & Joel
Rig Type D&B-8D
Drill Method CC, HA, PT & SFA
Total Depth (m) 5.1
Diameter (mm) 125

Easting
Northing
Grid Ref GDA94_MGA_zone_55
Elevation
Logged By Sid Paleri
Checked By

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	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	CC	0.4	SB01_0.1			ASPHALT	D	ST		0
	HA					gravelly CLAY, medium plasticity, dark red- brown, trace fine to medium sand, fine to medium gravel (FILL)	D	ST		
0.5		0.2	SB01_0.5			CLAY, low to medium plasticity, dark grey- brown, trace fine to medium sand (possible FILL)				-0.5
1		0.2	SB01_1.0 (FD02, FS02)			CLAY, medium plasticity, brown with mottled orange-black, trace fine sand (possible FILL)	D	F		-1
1.5	PT									-1.5
2		0.2	SB01_2.0			sandy CLAY, medium plasticity, brown with mottled orange- black, fine to medium sand (possible FILL)	D	F		-2
2.5										-2.5
3	SFA	0.1	SB01_3.0							-3
3.5						CLAY, grey- brown with mottled orange, occasional harder sandy sections (NATURAL - SOIL)	D	H		-3.5
4		0.1	SB01_4.0							-4
4.5										-4.5
5		0.1	SB01_5.0							-5
5.5						Termination Depth at:5.10 m. Target depth achieved.				-5.5

Notes Went to solid flight auger at 2.8m due to hardness of clay

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-SOIL BORE

SOIL BORE SB02

Client Fire & Rescue NSW
Project Deniliquin FRNSW Site Investigation
Project No. 212558305
Site Deniliquin Airport
Location Deniliquin Airport, NSW 2710
Date Drilled 29/11/2016 - 29/11/2016

Drill Co. BG Drilling Co
Driller Luke & Joel
Rig Type D&B-8D
Drill Method CC & HA
Total Depth (m) 1.1
Diameter (mm) 100

Easting
Northing
Grid Ref GDA94_MGA_zone_55
Elevation
Logged By Sid Paleri
Checked By

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	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)
	CC	0.2	SB02_0.1			ASPHALT				
	HA					dayey SAND, fine to medium, pale brown (possible FILL)	D	D		
0.5		0.4	SB02_0.5			CLAY, medium plasticity, dark black- brown, rootlets (possible NATURAL - SOIL)	D	F	very weak odour	-0.5
1		0.3	SB02_1.0			CLAY, medium plasticity, brown with mottled black (NATURAL - SOIL)	D	F		-1
						Termination Depth at:1.10 m. Target depth achieved.				
1.5										-1.5
2										-2
2.5										-2.5
3										-3
3.5										-3.5
4										-4
4.5										-4.5
5										-5
5.5										-5.5

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-SOIL BORE

SOIL BORE SB03

Client Fire & Rescue NSW
Project Deniliquin FRNSW Site Investigation
Project No. 212558305
Site Deniliquin Airport
Location Deniliquin Airport, NSW 2710
Date Drilled 29/11/2016 - 29/11/2016

Drill Co. BG Drilling Co
Driller Luke & Joel
Rig Type N/A
Drill Method Hand Auger
Total Depth (m) 1.2
Diameter (mm) 75

Easting
Northing
Grid Ref GDA94_MGA_zone_55
Elevation
Logged By Sid Paleri
Checked By

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	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	0.1	SB03_0.1			SAND, fine to medium, orange- brown, trace clay (FILL)	D	L		0
0.5		0.2	SB03_0.5			CLAY, medium plasticity, brown with mottled orange (NATURAL - SOIL)	D	S		-0.5
1		0.3	SB03_1.0			CLAY, medium plasticity, pale brown with mottled orange (NATURAL - SOIL)	D	F		-1
1.2						Termination Depth at:1.20 m. Target depth achieved.				-1.2
1.5										-1.5
2										-2
2.5										-2.5
3										-3
3.5										-3.5
4										-4
4.5										-4.5
5										-5
5.5										-5.5

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-SOIL BORE

SOIL BORE SB04

Client Fire & Rescue NSW
Project Deniliquin FRNSW Site Investigation
Project No. 212558305
Site Deniliquin Airport
Location Deniliquin Airport, NSW 2710
Date Drilled 29/11/2016 - 29/11/2016

Drill Co. BG Drilling Co
Driller Luke & Joel
Rig Type D&B-8D
Drill Method CC, PT & SFA
Total Depth (m) 5.1
Diameter (mm) 125

Easting
Northing
Grid Ref GDA94_MGA_zone_55
Elevation
Logged By Sid Paleri
Checked By

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	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	CC	0.2	SB04_0.15			CONCRETE				0
	PT					CLAY, medium plasticity, dark red- brown, trace fine sand	D	S		
0.5		0.1	SB04_0.5			CLAY, medium plasticity, yellow- brown, trace fine sand	D	S		-0.5
1		0.1	SB04_1.0							-1
1.5										-1.5
2		0.2	SB04_2.0 (FD03, FS03)							-2
2.5	SFA					CLAY, medium plasticity, yellow- brown, trace fine sand	D	F		-2.5
3		0.1	SB04_3.0							-3
3.5										-3.5
4		0.1	SB04_4.0			CLAY, medium plasticity, yellow- brown with mottled orange, trace fine sand (NATURAL - SOIL)	D	H		-4
4.5										-4.5
5		0.1	SB04_5.0							-5
5.5						Termination Depth at:5.10 m. Target depth achieved.				-5.5

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-SOIL BORE

SOIL BORE SB05

Client Fire & Rescue NSW
Project Deniliquin FRNSW Site Investigation
Project No. 212558305
Site Deniliquin Airport
Location Deniliquin Airport, NSW 2710
Date Drilled 29/11/2016 - 29/11/2016

Drill Co. BG Drilling Co
Driller Luke & Joel
Rig Type N/A
Drill Method Hand Auger
Total Depth (m) 1.1
Diameter (mm) 75

Easting
Northing
Grid Ref GDA94_MGA_zone_55
Elevation
Logged By Sid Paleri
Checked By

Depth (m)	Drilling Method	PID (ppm)	Sample ID	Water	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	0.1	SB05_0.1			CLAY, medium plasticity, dark brown, some rootlets (NATURAL - SOIL)	D	F		0
0.5		0	SB05_0.5							-0.5
1		0.1	SB05_1.0			CLAY, medium plasticity, dark brown and pale grey, some rootlets (NATURAL - SOIL)	D	F		-1
						Termination Depth at:1.10 m. Target depth achieved.				
1.5										-1.5
2										-2
2.5										-2.5
3										-3
3.5										-3.5
4										-4
4.5										-4.5
5										-5
5.5										-5.5

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

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

CHAIN OF CUSTODY RECORD

GHD

Melbourne Office Address
180 Lonsdale Street, Melbourne 3000
Telephone: 613 8687 8000 Fax: 613 8687 8111

Completion Date / Turnaround: Standard

Quote # / GHD Reference:

Job Number: 21255830S
GHD Contact: Sid Palavi
Project: PFNSW - Dennilquin
GHD Project Manager: Ben Anderson
GHD Contact: Sid Palavi
GHD PM email: ben.anderson@ghd.com
GHD Contact email: sid.palavi@ghd.com

Laboratory: ALS Springvale
Address:
Laboratory Contact: Shirley LeGonu.

COURIER AND LABORATORY INSTRUCTIONS:
Sign **white copy** on receipt and release of samples.
Samples are to be delivered to the Laboratory Address.
On receipt of samples, **the laboratory contact** to sign white copy and fax/email to GHD Contact.
On completion of analyses please **return white** copy with results.
Pink copy is returned to the sampler once the courier has signed for the samples.
E-mail results to the **GHD Project Manager** and **GHD Contact** with the GHD Job Number in the e-mail subject line.

Note email format: firstname.lastname@ghd.com

Results to be provided in ESDAT compatible format

	Sample I.D.	Date	Time	Composite Sample	Sample Matrix (S: Soil, SL: Sludge, W: Water, A: Air, GW: Groundwater)	Container Type (J: Soil jar, B: Bag, V: Vial, G: glass bottle, P: plastic bottle)	Container Number	Container Volume (mL)	PFAS extended suite	TOC	Total Fe	CEC	Grain Size	Metals*			Major Ions	Alkalinity	TDS	pH								HOLD
1	SS01	29/11/16			S	J, B	3		X	X	X	X	X	X													
2	SS02								X	X	X	X	X	X													
3	SS03								X	X	X	X	X	X													
4	SS04								X	X	X	X	X	X													
5	SS05								X	X	X	X	X	X													
6	SS06								X	X	X	X	X	X													
7	SS07								X	X	X	X	X	X													
8	~~SS08~~ SW01				W	P	2		X								X	X	X	X							
9	SW02								X								X	X	X	X							
10	SW03								X								X	X	X	X							
11	FD01								X								X	X	X	X							
.	FS01								X								X	X	X	X							Please send to Eurofins MGT
12	SB02_0.1				S	J, B	3		X	X	X	X	X	X													
13	SB02_0.5																										X
14	SB02_1.0								X	X	X	X	X	X													
15	SB03_0.1								X	X	X	X	X	X													
16	SB03_0.5																										X

TOTAL NUMBER OF SAMPLES:
TOTAL NUMBER OF ESKIES:
SAMPLES ENTERED ELECTRONICALLY (Y/N): Y

GENERAL COMMENTS

* Metals: 8 metals (Standard) + Al, K, Si

Environmental Division
Melbourne
Work Order Reference
EM1614608

Telephone: +61-3-8549 9600

Forwarded to Secondary Lab
Initials S.D **Date** 5/12

CUSTODY DETAILS

	Name	Date/Time Received	Date/Time Relinquished
SAMPLER	Sid Palavi	29/11/16 - 30/11/16	02/12/16 @ 1140
GHD SERVICE CENTRE	C JAYASEKERA	2/12/16 11:40am	02/12/16 12:25
COURIER			
LABORATORY		2/12, 1400	

CHAIN OF CUSTODY RECORD

GHD

Melbourne Office Address
180 Lonsdale Street, Melbourne 3000
Telephone: 613 8687 8000 Fax: 613 8687 8111

Completion Date / Turnaround: Standard (5 day)

Quote # / GHD Reference:

Job Number: 21255805	GHD Contact: Sid Patni
Project: TRNSW - Armidale	
GHD Project Manager: Ben Andrison	GHD Contact: Sid Patni
GHD PM email: ben.andrison@ghd.com	GHD Contact email:

Laboratory: ALS Springvale.
Address:
Laboratory Contact: Shirley Liauw

COURIER AND LABORATORY INSTRUCTIONS:
Sign **white copy** on receipt and release of samples.
Samples are to be delivered to the Laboratory Address.
On receipt of samples, **the laboratory contact** to sign white copy and fax/email to GHD Contact.
On completion of analyses please **return white** copy with results.
Pink copy is returned to the sampler once the courier has signed for the samples.
E-mail results to the **GHD Project Manager** and **GHD Contact** with the GHD Job Number in the e-mail subject line.

Note email format: firstname.lastname@ghd.com

Results to be provided in ESDAT compatible format

	Sample I.D.	Date	Time	Composite Sample	Sample Matrix S: Soil, SL: Sludge, W: Water, A: Air, GW: Groundwater	Container Type J: Jar, B: Bag, V: vial, G: glass bottle, P: plastic bottle	Container Number	Container Volume (mL)	PFAS standard suite	TOC	Total Fe	CEC	Grain size	Metals *	HOLD	SAMPLE COMMENTS
17	SB03_1.0	29/11/16			S	J, G	3		X	X	X	X	X	X		
18	SB05_0.1	↓			↓	↓	↓		X	X	X	X	X	X		
19	SB05_0.5														X	
20	SB05_1.0	↓							X	X	X	X	X	X		
21	SB01_0.1	30/11/16							X	X	X	X	X	X		
22	SB01_0.5														X	
23	SB01_1.0								X	X	X	X	X	X		
24	SB01_2.0														X	
25	SB01_3.0														X	
26	SB01_4.0														X	
27	SB01_5.0														X	
28	SB04_0.15								X	X	X	X	X	X		
29	SB04_0.5														X	
30	SB04_1.0														X	
31	SB04_2.0								X	X	X	X	X	X		
32	SB04_3.0														X	
33	SB04_4.0	↓			↓	↓	↓								X	

TOTAL NUMBER OF SAMPLES:
TOTAL NUMBER OF ESKIES: 6
SAMPLES/ESKY CHILLED? Y / N: Y

GENERAL COMMENTS: *Metals: 8 metals (standard) + Al, Si, K.

CUSTODY DETAILS:

	Name	Date/Time Received	Date/Time Relinquished
SAMPLER	Sid Patni	29/11/16 - 30/11/16	02/12/16 @ 1140
GHD SERVICE CENTRE	C. JAYASEKERA	2/12/16 11.40am	02/12/16
COURIER			
LABORATORY		2/12 16:00	

CHAIN OF CUSTODY RECORD

GHD

Melbourne Office Address
180 Lonsdale Street, Melbourne 3000
Telephone: 613 8687 8000 Fax: 613 8687 8111

Completion Date / Turnaround: Standard (5 day)

Quote # / GHD Reference:

Job Number: 21258305	GHD Contact: Sid Palesi
Project: FRNSW - Deniliquin	
GHD Project Manager: Ben Anderson	GHD Contact: Sid Palesi
GHD PM email: ben.anderson@ghd.com	GHD Contact email: sid.palesi@ghd.com

Laboratory: ALS Springvale
Address:
Laboratory Contact: Shirley LeCornu.

COURIER AND LABORATORY INSTRUCTIONS:
Sign **white copy** on receipt and release of samples.
Samples are to be delivered to the Laboratory Address.
On receipt of samples, **the laboratory contact** to sign white copy and fax/email to GHD Contact.
On completion of analyses please **return white** copy with results.
Pink copy is returned to the sampler once the courier has signed for the samples.
E-mail results to the **GHD Project Manager** and **GHD Contact** with the GHD Job Number in the e-mail subject line.

Note email format: firstname.lastname@ghd.com

Results to be provided in ESDAT compatible format

#	Sample I.D.	Date	Time	Composite Sample	Sample Matrix (S: Soil, SL: Sludge, W: Water, A: Air, GW: Groundwater)	Container Type (J: soil jar, B: bag, V: vial, G: glass bottle, P: plastic bottle)	Number	Volume (mL)	PFAS extended Suite	TOC	Total Fe	CEC	Grain Size	Metals*	HOLD	Sample Comments
34	SB04-5.0	30/11/16			S	J,B									X	
35	MW01_0.1	↓			↓	↓			X	X	X	X	X	X		
36	MW01_1.0														X	
37	MW02_9.0								X	X	X	X	X	X		
38	MW02_0.1								X	X	X	X	X	X		
39	MW02_1.0														X	
40	MW02_13.5								X	X	X	X	X	X		
41	MW03_0.1								X	X	X	X	X	X		
42	MW03_1.0								X	X	X	X	X	X		
43	FD02								X	X				X		
44	FD03								X	X				X		
-	FS02								X	X				X		Please forward to Eurofins MGT.
.	FS03	↓			↓	↓			X	X				X		

TOTAL NUMBER OF SAMPLES	
TOTAL NUMBER OF ESKIES	6
SAMPLES/ESKY CHILLED? Y/N	Y

GENERAL COMMENTS: * Metals: 8 metals (standard) + K, Si, Al.

CUSTODY DETAILS

	Name	Date/Time Received	Date/Time Relinquished
SAMPLER	Sid Palesi [signature]	29/11/16 – 30/11/16	02/12/16 @ 1140 [signature]
GHD SERVICE CENTRE	C JAYASEKERA	2/12/16 11:40am	02/12/16
COURIER	[signature]		
LABORATORY	[signature]	2/12 14:00	

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM1614608**	Page	: 1 of 26
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: MR BEN ANDERSON	Contact	: Shirley LeCornu
Address	: LEVEL 8, 180 LONSDALE ST MELBOURNE VIC, AUSTRALIA 3001	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 07 5413 8161	Telephone	: +61-3-8549 9630
Project	: 212558305	Date Samples Received	: 02-Dec-2016 14:00
Order number	: ----	Date Analysis Commenced	: 05-Dec-2016
C-O-C number	: ----	Issue Date	: 12-Dec-2016 17:58
Sampler	: SP		
Site	: DENILIQUIN		
Quote number	: EN/005/15 VICTORIA (Primary work only)		
No. of samples received	: 44		
No. of samples analysed	: 29		

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
Andrew Epps	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Dianne Blane	Laboratory Coordinator (2IC)	Newcastle - Inorganics, Mayfield West, NSW
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Lana Nguyen	Senior LCMS Chemist	Sydney Organics, 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.

- EA150H: Soil particle density results for sample #003 fell outside the scope of AS1289.3.6.3. Results should be scrutinised accordingly.
- TDS by method EA-015 may bias high for EM1614608 #8, 9, 10 and 11 due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SS01	SS02	SS03	SS04	SS05
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-001	EM1614608-002	EM1614608-003	EM1614608-004	EM1614608-005
					Result	Result	Result	Result	Result
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1	%		17.2	15.2	30.7	30.4	27.9
EA150: Particle Sizing									
+75µm	----	1	%		32	9	16	35	18
+150µm	----	1	%		25	6	10	29	11
+300µm	----	1	%		18	3	7	17	6
+425µm	----	1	%		12	2	6	9	5
+600µm	----	1	%		12	2	5	5	5
+1180µm	----	1	%		7	<1	3	2	3
+2.36mm	----	1	%		4	<1	<1	<1	2
+4.75mm	----	1	%		2	<1	<1	<1	2
+9.5mm	----	1	%		<1	<1	<1	<1	<1
+19.0mm	----	1	%		<1	<1	<1	<1	<1
+37.5mm	----	1	%		<1	<1	<1	<1	<1
+75.0mm	----	1	%		<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		34	56	51	39	41
Silt (2-60 µm)	----	1	%		25	25	29	18	30
Sand (0.06-2.00 mm)	----	1	%		36	19	19	42	27
Gravel (>2mm)	----	1	%		5	<1	1	1	2
Cobbles (>6cm)	----	1	%		<1	<1	<1	<1	<1
EA152: Soil Particle Density									
ø Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.62	2.65	2.38	2.65	2.50
ED006: Exchangeable Cations on Alkaline Soils									
Exchangeable Calcium	----	0.2	meq/100g		6.6	10.9	----	----	----
Exchangeable Magnesium	----	0.2	meq/100g		5.0	9.0	----	----	----
Exchangeable Potassium	----	0.2	meq/100g		0.6	0.8	----	----	----
Exchangeable Sodium	----	0.2	meq/100g		2.0	2.4	----	----	----
Cation Exchange Capacity	----	0.2	meq/100g		14.2	23.2	----	----	----
ED007: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g		----	----	16.0	14.5	9.7
Exchangeable Magnesium	----	0.1	meq/100g		----	----	8.1	5.1	7.1
Exchangeable Potassium	----	0.1	meq/100g		----	----	1.1	0.9	1.1
Exchangeable Sodium	----	0.1	meq/100g		----	----	0.5	0.3	0.7
Cation Exchange Capacity	----	0.1	meq/100g		----	----	25.6	20.8	18.6

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	SS01	SS02	SS03	SS04	SS05
			Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00
Compound	CAS Number	LOR	Unit	EM1614608-001	EM1614608-002	EM1614608-003	EM1614608-004	EM1614608-005
				Result	Result	Result	Result	Result
ED008: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	----	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g	----	----	----	----	----
Exchangeable Potassium	----	0.1	meq/100g	----	----	----	----	----
Exchangeable Sodium	----	0.1	meq/100g	----	----	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g	----	----	----	----	----
ED040S : Soluble Sulfate by ICPAES								
Silicon	7440-21-3	1	mg/kg	**4680**	**7200**	**2170**	**1700**	**3010**
ED093S: Soluble Major Cations								
Potassium	7440-09-7	10	mg/kg	**310**	**410**	**140**	**110**	**190**
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	**12200**	**19200**	**15600**	**17700**	**15600**
Iron	7439-89-6	50	mg/kg	**17700**	**23200**	**19700**	**20000**	**17000**
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**0.68**	**0.50**	**3.12**	**0.69**	**0.75**
EP231A: Perfluoroalkyl Sulfonic Acids								
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	**0.0003**	**0.0004**	<0.0002	<0.0002	<0.0002
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg	**0.0003**	**0.0006**	<0.0002	<0.0002	**0.0002**
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	**0.0053**	**0.0065**	**0.0017**	**0.0012**	**0.0034**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg	**0.0006**	**0.0008**	<0.0002	**0.0003**	**0.0004**
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	**0.297**	**0.277**	**0.0081**	**0.0294**	**0.0396**
Perfluorodecane sulfonic acid (PFDS)	67906-42-7	0.0002	mg/kg	**0.0014**	**0.0072**	<0.0002	<0.0002	**0.0009**
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	**0.0015**	**0.0014**	**0.0004**	<0.0002	**0.0014**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	**0.0038**	**0.0063**	**0.0010**	**0.0004**	**0.0031**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	**0.0011**	**0.0008**	<0.0002	<0.0002	**0.0019**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	**0.0022**	**0.0031**	<0.0002	**0.0003**	**0.0032**
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg	**0.0008**	**0.0002**	<0.0002	<0.0002	**0.0004**
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg	**0.0011**	**0.0032**	<0.0002	<0.0002	<0.0002

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SS01	SS02	SS03	SS04	SS05
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-001	EM1614608-002	EM1614608-003	EM1614608-004	EM1614608-005
					Result	Result	Result	Result	Result
EP231B: Perfluoroalkyl Carboxylic Acids - Continued									
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		<0.0002	**0.0014**	<0.0002	<0.0002	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	**0.0020**	<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		**0.0009**	**0.0076**	<0.0002	<0.0002	**0.0006**
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	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		**0.0164**	**0.0364**	<0.0005	**0.0013**	**0.0044**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		**0.0043**	**0.0244**	<0.0005	<0.0005	**0.0007**
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		**0.0026**	**0.0325**	<0.0005	<0.0005	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.340**	**0.412**	**0.0112**	**0.0329**	**0.0602**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SS01	SS02	SS03	SS04	SS05
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-001	EM1614608-002	EM1614608-003	EM1614608-004	EM1614608-005
					Result	Result	Result	Result	Result
EP231P: PFAS Sums - Continued									
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.302**	**0.284**	**0.0098**	**0.0306**	**0.0430**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.332**	**0.356**	**0.0112**	**0.0326**	**0.0577**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**112**	**104**	**96.0**	**109**	**120**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SS06	SS07	SB02_0.1	SB02_1.0	SB03_0.1
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-006	EM1614608-007	EM1614608-012	EM1614608-014	EM1614608-015
					Result	Result	Result	Result	Result
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1	%		27.3	31.0	21.7	17.7	7.2
EA150: Particle Sizing									
+75µm	----	1	%		13	13	62	10	70
+150µm	----	1	%		8	7	46	5	66
+300µm	----	1	%		5	4	35	2	57
+425µm	----	1	%		4	2	30	<1	46
+600µm	----	1	%		2	2	25	<1	34
+1180µm	----	1	%		1	<1	15	<1	16
+2.36mm	----	1	%		<1	<1	6	<1	5
+4.75mm	----	1	%		<1	<1	2	<1	<1
+9.5mm	----	1	%		<1	<1	<1	<1	<1
+19.0mm	----	1	%		<1	<1	<1	<1	<1
+37.5mm	----	1	%		<1	<1	<1	<1	<1
+75.0mm	----	1	%		<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		49	57	15	53	15
Silt (2-60 µm)	----	1	%		23	22	18	26	9
Sand (0.06-2.00 mm)	----	1	%		28	21	58	21	68
Gravel (>2mm)	----	1	%		<1	<1	9	<1	8
Cobbles (>6cm)	----	1	%		<1	<1	<1	<1	<1
EA152: Soil Particle Density									
ø Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.65	2.65	2.69	2.63	2.64
ED006: Exchangeable Cations on Alkaline Soils									
Exchangeable Calcium	----	0.2	meq/100g		----	8.3	2.6	6.0	1.4
Exchangeable Magnesium	----	0.2	meq/100g		----	8.2	2.0	6.9	<0.2
Exchangeable Potassium	----	0.2	meq/100g		----	0.7	0.4	0.5	<0.2
Exchangeable Sodium	----	0.2	meq/100g		----	2.8	3.3	8.8	1.3
Cation Exchange Capacity	----	0.2	meq/100g		----	20.0	8.2	22.2	2.9
ED007: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g		9.4	----	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g		11.7	----	----	----	----
Exchangeable Potassium	----	0.1	meq/100g		1.1	----	----	----	----
Exchangeable Sodium	----	0.1	meq/100g		1.2	----	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g		23.4	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SS06	SS07	SB02_0.1	SB02_1.0	SB03_0.1
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-006	EM1614608-007	EM1614608-012	EM1614608-014	EM1614608-015
					Result	Result	Result	Result	Result
ED008: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g		----	----	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g		----	----	----	----	----
Exchangeable Potassium	----	0.1	meq/100g		----	----	----	----	----
Exchangeable Sodium	----	0.1	meq/100g		----	----	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g		----	----	----	----	----
ED040S : Soluble Sulfate by ICPAES									
Silicon	7440-21-3	1	mg/kg		**8080**	**5700**	**175**	**100**	**734**
ED093S: Soluble Major Cations									
Potassium	7440-09-7	10	mg/kg		**470**	**320**	**30**	<10	**50**
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		**21700**	**18900**	**8190**	**10600**	**3230**
Iron	7439-89-6	50	mg/kg		**26200**	**21000**	**15500**	**14100**	**5500**
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		**0.61**	**0.47**	**0.32**	**0.27**	**0.12**
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		<0.0002	<0.0002	**0.343**	**0.0879**	**0.0007**
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		<0.0002	<0.0002	**0.306**	**0.0660**	**0.0008**
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		**0.0004**	<0.0002	**2.15**	**0.212**	**0.0078**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		<0.0002	<0.0002	**0.309**	**0.0024**	**0.0013**
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		**0.0325**	**0.0250**	**10.7**	**0.0778**	**0.454**
Perfluorodecane sulfonic acid (PFDS)	67906-42-7	0.0002	mg/kg		**0.0002**	<0.0002	**0.0068**	<0.0002	**0.0034**
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		<0.001	<0.001	**0.060**	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		**0.0002**	<0.0002	**0.165**	**0.0360**	**0.0006**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		**0.0003**	<0.0002	**0.608**	**0.146**	**0.0041**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		<0.0002	<0.0002	**0.0407**	**0.0148**	**0.0005**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		**0.0002**	<0.0002	**0.232**	**0.0113**	**0.0022**
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		<0.0002	<0.0002	**0.0005**	<0.0002	<0.0002
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		<0.0002	<0.0002	**0.0017**	<0.0002	**0.0004**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SS06	SS07	SB02_0.1	SB02_1.0	SB03_0.1
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-006	EM1614608-007	EM1614608-012	EM1614608-014	EM1614608-015
					Result	Result	Result	Result	Result
EP231B: Perfluoroalkyl Carboxylic Acids - Continued									
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	**0.0012**
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	<0.0002	**0.0005**	<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		**0.0005**	<0.0002	**0.0156**	<0.0002	**0.0031**
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	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	**0.0234**	**0.0080**	<0.0005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		**0.0012**	<0.0005	**1.29**	**0.0646**	**0.0076**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		**0.0007**	<0.0005	**0.154**	**0.0011**	**0.0074**
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	<0.0005	**0.0126**	<0.0005	**0.0013**
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.0362**	**0.0250**	**16.4**	**0.728**	**0.496**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SS06	SS07	SB02_0.1	SB02_1.0	SB03_0.1
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-006	EM1614608-007	EM1614608-012	EM1614608-014	EM1614608-015
					Result	Result	Result	Result	Result
EP231P: PFAS Sums - Continued									
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.0329**	**0.0250**	**12.8**	**0.290**	**0.462**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.0355**	**0.0250**	**15.7**	**0.652**	**0.485**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**81.0**	**92.0**	**87.0**	**117**	**79.0**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SB03_1.0	SB05_0.1	SB05_1.0	SB01_0.1	SB01_1.0
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-017	EM1614608-018	EM1614608-020	EM1614608-021	EM1614608-023
					Result	Result	Result	Result	Result
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1	%		15.4	17.0	12.8	12.2	19.2
EA150: Particle Sizing									
+75µm	----	1	%		12	9	12	28	10
+150µm	----	1	%		5	6	6	20	5
+300µm	----	1	%		3	4	4	14	2
+425µm	----	1	%		2	3	2	10	2
+600µm	----	1	%		1	2	2	8	1
+1180µm	----	1	%		<1	<1	<1	3	<1
+2.36mm	----	1	%		<1	<1	<1	<1	<1
+4.75mm	----	1	%		<1	<1	<1	<1	<1
+9.5mm	----	1	%		<1	<1	<1	<1	<1
+19.0mm	----	1	%		<1	<1	<1	<1	<1
+37.5mm	----	1	%		<1	<1	<1	<1	<1
+75.0mm	----	1	%		<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		47	59	43	30	51
Silt (2-60 µm)	----	1	%		29	22	32	28	25
Sand (0.06-2.00 mm)	----	1	%		24	19	25	41	24
Gravel (>2mm)	----	1	%		<1	<1	<1	1	<1
Cobbles (>6cm)	----	1	%		<1	<1	<1	<1	<1
EA152: Soil Particle Density									
ø Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.70	2.61	2.70	2.64	2.68
ED006: Exchangeable Cations on Alkaline Soils									
Exchangeable Calcium	----	0.2	meq/100g		6.1	----	----	5.4	11.3
Exchangeable Magnesium	----	0.2	meq/100g		9.8	----	----	2.9	8.5
Exchangeable Potassium	----	0.2	meq/100g		0.4	----	----	0.5	0.5
Exchangeable Sodium	----	0.2	meq/100g		5.9	----	----	2.0	3.8
Cation Exchange Capacity	----	0.2	meq/100g		22.2	----	----	10.8	24.1
ED007: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g		----	----	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g		----	----	----	----	----
Exchangeable Potassium	----	0.1	meq/100g		----	----	----	----	----
Exchangeable Sodium	----	0.1	meq/100g		----	----	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g		----	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SB03_1.0	SB05_0.1	SB05_1.0	SB01_0.1	SB01_1.0
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-017	EM1614608-018	EM1614608-020	EM1614608-021	EM1614608-023
					Result	Result	Result	Result	Result
ED008: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g		----	2.7	5.2	----	----
Exchangeable Magnesium	----	0.1	meq/100g		----	3.1	4.2	----	----
Exchangeable Potassium	----	0.1	meq/100g		----	0.2	0.2	----	----
Exchangeable Sodium	----	0.1	meq/100g		----	1.2	1.9	----	----
Cation Exchange Capacity	----	0.1	meq/100g		----	7.2	11.4	----	----
ED040S : Soluble Sulfate by ICPAES									
Silicon	7440-21-3	1	mg/kg		44	20600	83	4910	12500
ED093S: Soluble Major Cations									
Potassium	7440-09-7	10	mg/kg		<10	1260	<10	360	790
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		17400	17200	15600	8400	11700
Iron	7439-89-6	50	mg/kg		21400	21900	20600	14100	17000
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		0.16	0.52	0.12	0.74	0.36
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		0.0480	<0.0002	<0.0002	0.0046	0.0045
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		0.0415	<0.0002	<0.0002	0.0045	0.0030
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		0.169	0.0009	<0.0002	0.0665	0.0078
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		0.0011	<0.0002	<0.0002	0.0070	<0.0002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		0.0371	0.0038	<0.0002	0.295	0.0027
Perfluorodecane sulfonic acid (PFDS)	67906-42-7	0.0002	mg/kg		0.0004	<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		0.0395	0.0005	<0.0002	0.0043	0.0038
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		0.141	0.0015	<0.0002	0.0186	0.0161
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		0.0267	0.0013	<0.0002	0.0019	0.0006
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		0.0148	0.0035	<0.0002	0.0079	0.0006
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	0.0004	<0.0002

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SB03_1.0	SB05_0.1	SB05_1.0	SB01_0.1	SB01_1.0
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-017	EM1614608-018	EM1614608-020	EM1614608-021	EM1614608-023
					Result	Result	Result	Result	Result
EP231B: Perfluoroalkyl Carboxylic Acids - Continued									
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	**0.0004**	<0.0002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	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		**0.0157**	**0.0006**	<0.0005	**0.0130**	**0.0008**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	**0.0017**	<0.0005
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.535**	**0.0121**	<0.0002	**0.426**	**0.0399**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SB03_1.0	SB05_0.1	SB05_1.0	SB01_0.1	SB01_1.0
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-017	EM1614608-018	EM1614608-020	EM1614608-021	EM1614608-023
					Result	Result	Result	Result	Result
EP231P: PFAS Sums - Continued									
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.206**	**0.0047**	<0.0002	**0.362**	**0.0105**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.492**	**0.0121**	<0.0002	**0.414**	**0.0369**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**102**	**113**	**102**	**113**	**79.0**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SB04_0.15	SB04_2.0	MW01_0.1	MW01_9.0	MW02_0.1
				Client sampling date / time	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-028	EM1614608-031	EM1614608-035	EM1614608-037	EM1614608-038
					Result	Result	Result	Result	Result
EA055: Moisture Content									
Moisture Content (dried @ 103°C)	----	1	%		23.2	16.1	10.4	14.5	17.8
EA150: Particle Sizing									
+75µm	----	1	%		8	14	25	23	9
+150µm	----	1	%		4	7	19	14	5
+300µm	----	1	%		2	3	14	10	2
+425µm	----	1	%		1	2	11	8	2
+600µm	----	1	%		<1	<1	8	6	1
+1180µm	----	1	%		<1	<1	3	3	<1
+2.36mm	----	1	%		<1	<1	<1	<1	<1
+4.75mm	----	1	%		<1	<1	<1	<1	<1
+9.5mm	----	1	%		<1	<1	<1	<1	<1
+19.0mm	----	1	%		<1	<1	<1	<1	<1
+37.5mm	----	1	%		<1	<1	<1	<1	<1
+75.0mm	----	1	%		<1	<1	<1	<1	<1
EA150: Soil Classification based on Particle Size									
Clay (<2 µm)	----	1	%		59	41	43	35	53
Silt (2-60 µm)	----	1	%		23	32	26	34	29
Sand (0.06-2.00 mm)	----	1	%		18	27	30	30	18
Gravel (>2mm)	----	1	%		<1	<1	1	1	<1
Cobbles (>6cm)	----	1	%		<1	<1	<1	<1	<1
EA152: Soil Particle Density									
ø Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3		2.57	2.65	2.64	2.67	2.67
ED006: Exchangeable Cations on Alkaline Soils									
Exchangeable Calcium	----	0.2	meq/100g		5.2	6.3	1.8	6.0	7.7
Exchangeable Magnesium	----	0.2	meq/100g		5.4	10.0	1.0	8.3	10.2
Exchangeable Potassium	----	0.2	meq/100g		0.7	0.5	0.2	0.4	0.4
Exchangeable Sodium	----	0.2	meq/100g		14.0	5.9	1.6	5.1	5.9
Cation Exchange Capacity	----	0.2	meq/100g		25.3	22.8	4.6	19.8	24.2
ED007: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g		----	----	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g		----	----	----	----	----
Exchangeable Potassium	----	0.1	meq/100g		----	----	----	----	----
Exchangeable Sodium	----	0.1	meq/100g		----	----	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g		----	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SB04_0.15	SB04_2.0	MW01_0.1	MW01_9.0	MW02_0.1
				Client sampling date / time	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-028	EM1614608-031	EM1614608-035	EM1614608-037	EM1614608-038
					Result	Result	Result	Result	Result
ED008: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g		----	----	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g		----	----	----	----	----
Exchangeable Potassium	----	0.1	meq/100g		----	----	----	----	----
Exchangeable Sodium	----	0.1	meq/100g		----	----	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g		----	----	----	----	----
ED040S : Soluble Sulfate by ICPAES									
Silicon	7440-21-3	1	mg/kg		**36900**	**24**	**8300**	**51**	**17100**
ED093S: Soluble Major Cations									
Potassium	7440-09-7	10	mg/kg		**2400**	<10	**460**	<10	**1160**
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		**24600**	**12900**	**5530**	**15600**	**16300**
Iron	7439-89-6	50	mg/kg		**28800**	**17000**	**9080**	**21000**	**20800**
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		**0.37**	**0.11**	**0.26**	**0.05**	**0.30**
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		**0.0043**	**0.0084**	**0.0033**	**0.0007**	**0.0005**
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		**0.0045**	**0.0013**	**0.0036**	**0.0006**	**0.0009**
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		**0.0578**	**0.0019**	**0.0466**	**0.0017**	**0.0018**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		**0.0185**	**0.0003**	**0.0160**	**0.0003**	<0.0002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		**0.691**	**0.0128**	**1.31**	**0.0377**	**0.0008**
Perfluorodecane sulfonic acid (PFDS)	67906-42-7	0.0002	mg/kg		**0.0003**	<0.0002	**0.0018**	<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		**0.0047**	**0.0037**	**0.0030**	**0.0007**	<0.0002
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		**0.0192**	**0.0125**	**0.0202**	**0.0017**	**0.0005**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		**0.0025**	<0.0002	**0.0028**	<0.0002	<0.0002
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		**0.0143**	**0.0002**	**0.0158**	**0.0005**	<0.0002
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		<0.0002	<0.0002	**0.0005**	<0.0002	<0.0002
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		<0.0002	<0.0002	**0.0014**	<0.0002	<0.0002

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SB04_0.15	SB04_2.0	MW01_0.1	MW01_9.0	MW02_0.1
				Client sampling date / time	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-028	EM1614608-031	EM1614608-035	EM1614608-037	EM1614608-038
					Result	Result	Result	Result	Result
EP231B: Perfluoroalkyl Carboxylic Acids - Continued									
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.0002	mg/kg		**0.0004**	<0.0002	**0.0014**	<0.0002	<0.0002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	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		**0.0537**	**0.0010**	**0.0362**	**0.0007**	<0.0005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		**0.0044**	<0.0005	**0.0185**	<0.0005	<0.0005
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		**0.876**	**0.0421**	**1.48**	**0.0446**	**0.0045**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SB04_0.15	SB04_2.0	MW01_0.1	MW01_9.0	MW02_0.1
				Client sampling date / time	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-028	EM1614608-031	EM1614608-035	EM1614608-037	EM1614608-038
					Result	Result	Result	Result	Result
EP231P: PFAS Sums - Continued									
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		**0.749**	**0.0147**	**1.36**	**0.0394**	**0.0026**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		**0.852**	**0.0405**	**1.46**	**0.0437**	**0.0036**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**120**	**109**	**105**	**91.0**	**76.0**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	MW02_13.5	MW03_0.1	MW03_1.0	FD02	FD03
			Client sampling date / time	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00
Compound	CAS Number	LOR	Unit	EM1614608-040	EM1614608-041	EM1614608-042	EM1614608-043	EM1614608-044
				Result	Result	Result	Result	Result
EA055: Moisture Content								
Moisture Content (dried @ 103°C)	----	1	%	12.9	11.2	14.1	18.4	15.3
EA150: Particle Sizing								
+75µm	----	1	%	87	42	22	----	----
+150µm	----	1	%	83	35	16	----	----
+300µm	----	1	%	69	29	12	----	----
+425µm	----	1	%	42	25	10	----	----
+600µm	----	1	%	41	20	8	----	----
+1180µm	----	1	%	20	12	4	----	----
+2.36mm	----	1	%	5	6	<1	----	----
+4.75mm	----	1	%	<1	2	<1	----	----
+9.5mm	----	1	%	<1	<1	<1	----	----
+19.0mm	----	1	%	<1	<1	<1	----	----
+37.5mm	----	1	%	<1	<1	<1	----	----
+75.0mm	----	1	%	<1	<1	<1	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	4	27	42	----	----
Silt (2-60 µm)	----	1	%	6	20	24	----	----
Sand (0.06-2.00 mm)	----	1	%	81	46	32	----	----
Gravel (>2mm)	----	1	%	9	7	2	----	----
Cobbles (>6cm)	----	1	%	<1	<1	<1	----	----
EA152: Soil Particle Density								
ø Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.63	2.67	2.68	----	----
ED006: Exchangeable Cations on Alkaline Soils								
Exchangeable Calcium	----	0.2	meq/100g	1.2	----	8.1	----	----
Exchangeable Magnesium	----	0.2	meq/100g	1.1	----	7.4	----	----
Exchangeable Potassium	----	0.2	meq/100g	<0.2	----	0.5	----	----
Exchangeable Sodium	----	0.2	meq/100g	1.8	----	5.0	----	----
Cation Exchange Capacity	----	0.2	meq/100g	4.1	----	21.0	----	----
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	6.3	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g	----	4.2	----	----	----
Exchangeable Potassium	----	0.1	meq/100g	----	0.4	----	----	----
Exchangeable Sodium	----	0.1	meq/100g	----	0.6	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g	----	11.4	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	MW02_13.5	MW03_0.1	MW03_1.0	FD02	FD03
				Client sampling date / time	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-040	EM1614608-041	EM1614608-042	EM1614608-043	EM1614608-044
					Result	Result	Result	Result	Result
ED008: Exchangeable Cations									
Exchangeable Calcium	----	0.1	meq/100g		----	----	----	----	----
Exchangeable Magnesium	----	0.1	meq/100g		----	----	----	----	----
Exchangeable Potassium	----	0.1	meq/100g		----	----	----	----	----
Exchangeable Sodium	----	0.1	meq/100g		----	----	----	----	----
Cation Exchange Capacity	----	0.1	meq/100g		----	----	----	----	----
ED040S : Soluble Sulfate by ICPAES									
Silicon	7440-21-3	1	mg/kg		**153**	**2700**	**150**	**9870**	**33**
ED093S: Soluble Major Cations									
Potassium	7440-09-7	10	mg/kg		<10	**180**	<10	**600**	<10
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		**2580**	**13000**	**11500**	**17500**	**11200**
Iron	7439-89-6	50	mg/kg		**4480**	**17200**	**17300**	----	----
EP003: Total Organic Carbon (TOC) in Soil									
Total Organic Carbon	----	0.02	%		<0.02	**0.47**	**0.16**	**0.38**	**0.08**
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg		<0.0002	<0.0002	**0.0006**	**0.0060**	**0.0140**
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.0002	mg/kg		<0.0002	<0.0002	**0.0002**	**0.0041**	**0.0088**
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg		<0.0002	**0.0020**	**0.0007**	**0.0192**	**0.0003**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.0002	mg/kg		<0.0002	**0.0002**	<0.0002	**0.0003**	<0.0002
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg		<0.0002	**0.0143**	**0.0009**	**0.0123**	**0.0008**
Perfluorodecane sulfonic acid (PFDS)	67906-42-7	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg		<0.001	<0.001	<0.001	<0.001	<0.001
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg		<0.0002	**0.0004**	**0.0002**	**0.0051**	**0.0064**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg		<0.0002	**0.0010**	**0.0019**	**0.0233**	**0.0394**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg		<0.0002	**0.0013**	**0.0003**	**0.0011**	**0.0004**
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg		<0.0002	**0.0067**	**0.0005**	**0.0009**	<0.0002
Perfluorononanoic acid (PFNA)	375-95-1	0.0002	mg/kg		<0.0002	**0.0004**	<0.0002	<0.0002	<0.0002
Perfluorodecanoic acid (PFDA)	335-76-2	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	MW02_13.5	MW03_0.1	MW03_1.0	FD02	FD03
				Client sampling date / time	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-040	EM1614608-041	EM1614608-042	EM1614608-043	EM1614608-044
					Result	Result	Result	Result	Result
EP231B: Perfluoroalkyl Carboxylic Acids - Continued									
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.0002	mg/kg		<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.0002	mg/kg		<0.0002	**0.0003**	<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	**0.0016**	<0.0002	<0.0002	<0.0002
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	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	**0.0038**	<0.0002	<0.0002	<0.0002
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.0002	mg/kg		<0.0002	**0.0027**	<0.0002	<0.0002	<0.0002
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	**0.0018**	<0.0005
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP231P: PFAS Sums									
Sum of PFAS	----	0.0002	mg/kg		<0.0002	**0.0347**	**0.0053**	**0.0741**	**0.0701**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	MW02_13.5	MW03_0.1	MW03_1.0	FD02	FD03
				Client sampling date / time	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		EM1614608-040	EM1614608-041	EM1614608-042	EM1614608-043	EM1614608-044
					Result	Result	Result	Result	Result
EP231P: PFAS Sums - Continued									
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg		<0.0002	**0.0163**	**0.0016**	**0.0315**	**0.0011**
Sum of PFAS (WA DER List)	----	0.0002	mg/kg		<0.0002	**0.0257**	**0.0051**	**0.0697**	**0.0613**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.0002	%		**119**	**93.0**	**97.0**	**122**	**83.0**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW01	SW02	SW03	FD01	----
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	----
Compound	CAS Number	LOR	Unit		EM1614608-008	EM1614608-009	EM1614608-010	EM1614608-011	--------
					Result	Result	Result	Result	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**7.29**	**6.87**	**7.01**	**7.05**	**----**
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		**250**	**158**	**176**	**162**	**----**
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	**----**	**----**
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	**----**	**----**
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**73**	**35**	**60**	**----**	**----**
Total Alkalinity as CaCO3	----	1	mg/L		**73**	**35**	**60**	**----**	**----**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**16**	**6**	**8**	**----**	**----**
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**11**	**6**	**10**	**----**	**----**
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**6**	**4**	**4**	**----**	**----**
Magnesium	7439-95-4	1	mg/L		**4**	**2**	**3**	**----**	**----**
Sodium	7440-23-5	1	mg/L		**24**	**6**	**20**	**----**	**----**
Potassium	7440-09-7	1	mg/L		**4**	**3**	**5**	**----**	**----**
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**2.10**	**0.99**	**1.65**	**----**	**----**
Total Cations	----	0.01	meq/L		**1.77**	**0.70**	**1.44**	**----**	**----**
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		**0.07**	<0.02	**0.06**	**0.06**	**----**
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		**0.06**	<0.02	**0.07**	**0.08**	**----**
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L		**0.39**	<0.02	**0.31**	**0.24**	**----**
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		**2.01**	**0.20**	**1.32**	**1.24**	**----**
Perfluorodecane sulfonic acid (PFDS)	67906-42-7	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	**----**
EP231B: Perfluoroalkyl Carboxylic Acids									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW01	SW02	SW03	FD01	----
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	----
Compound	CAS Number	LOR	Unit		EM1614608-008	EM1614608-009	EM1614608-010	EM1614608-011	--------
					Result	Result	Result	Result	----
EP231B: Perfluoroalkyl Carboxylic Acids - Continued									
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		**0.21**	<0.02	**0.20**	**0.20**	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		**0.19**	<0.02	**0.40**	**0.39**	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		**0.04**	<0.02	**0.02**	**0.04**	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		**0.06**	<0.01	**0.05**	<0.01	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<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	----
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	----
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	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	SW01	SW02	SW03	FD01	----
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	----
Compound	CAS Number	LOR	Unit		EM1614608-008	EM1614608-009	EM1614608-010	EM1614608-011	--------
					Result	Result	Result	Result	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued									
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		**0.13**	<0.05	**0.09**	<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	**----**
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		**3.18**	**0.20**	**2.52**	**2.25**	**----**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		**2.40**	**0.20**	**1.63**	**1.48**	**----**
Sum of PFAS (WA DER List)	----	0.01	µg/L		**3.10**	**0.20**	**2.45**	**2.17**	**----**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**85.0**	**83.0**	**107**	**119**	**----**

Surrogate Control Limits

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

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM1614608**	Page	: 1 of 14
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: MR BEN ANDERSON	Telephone	: +61-3-8549 9630
Project	: 212558305	Date Samples Received	: 02-Dec-2016
Site	: DENILIQUIN	Issue Date	: 12-Dec-2016
Sampler	: SP	No. of samples received	: 44
Order number	: ----	No. of samples analysed	: 29

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Matrix Spike (MS) Recoveries							
EP231A: Perfluoroalkyl Sulfonic Acids	EM1614608--001	SS01	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231D: (n:2) Fluorotelomer Sulfonic Acids	EM1614608--001	SS01	**6:2 Fluorotelomer sulfonic acid (6:2 FTS)**	27619-97-2	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

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	EM1614608--008	SW01	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)		Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural							
SW01, SW03,	SW02, FD01	----	----	----	06-Dec-2016	29-Nov-2016	**7**
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Natural							
SW01, SW03	SW02,	----	----	----	07-Dec-2016	06-Dec-2016	**1**

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Matrix Spikes (MS)					
Total Metals by ICP-AES	0	25	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content							
Snap Lock Bag (EA055-103)							
SS01, SS02, SS03, SS04, SS05, SS06, SS07, SB02_0.1, SB02_1.0, SB03_0.1, SB03_1.0, SB05_0.1, SB05_1.0	**29-Nov-2016**	**----**	----	----	**07-Dec-2016**	13-Dec-2016	✓
Snap Lock Bag (EA055-103)							
SB01_0.1, SB01_1.0, SB04_0.15, SB04_2.0, MW01_0.1, MW01_9.0, MW02_0.1, MW02_13.5, MW03_0.1, MW03_1.0, FD02, FD03	**30-Nov-2016**	**----**	----	----	**07-Dec-2016**	14-Dec-2016	✓
EA150: Particle Sizing							
Snap Lock Bag (EA150H)							
SS01, SS02, SS03, SS04, SS05, SS06, SS07, SB02_0.1, SB02_1.0, SB03_0.1, SB03_1.0, SB05_0.1, SB05_1.0	**29-Nov-2016**	**----**	----	----	**08-Dec-2016**	28-May-2017	✓
Snap Lock Bag (EA150H)							
SB01_0.1, SB01_1.0, SB04_0.15, SB04_2.0, MW01_0.1, MW01_9.0, MW02_0.1, MW02_13.5, MW03_0.1, MW03_1.0	**30-Nov-2016**	**----**	----	----	**08-Dec-2016**	29-May-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
EA150: Soil Classification based on Particle Size							
Snap Lock Bag (EA150H)							
SS01, SS02, SS03, SS04, SS05, SS06, SS07, SB02_0.1, SB02_1.0, SB03_0.1, SB03_1.0, SB05_0.1, SB05_1.0	**29-Nov-2016**	**----**	----	----	**08-Dec-2016**	28-May-2017	✓
Snap Lock Bag (EA150H)							
SB01_0.1, SB01_1.0, SB04_0.15, SB04_2.0, MW01_0.1, MW01_9.0, MW02_0.1, MW02_13.5, MW03_0.1, MW03_1.0	**30-Nov-2016**	**----**	----	----	**08-Dec-2016**	29-May-2017	✓
EA152: Soil Particle Density							
Snap Lock Bag (EA152)							
SS01, SS02, SS03, SS04, SS05, SS06, SS07, SB02_0.1, SB02_1.0, SB03_0.1, SB03_1.0, SB05_0.1, SB05_1.0	**29-Nov-2016**	**----**	----	----	**08-Dec-2016**	28-May-2017	✓
Snap Lock Bag (EA152)							
SB01_0.1, SB01_1.0, SB04_0.15, SB04_2.0, MW01_0.1, MW01_9.0, MW02_0.1, MW02_13.5, MW03_0.1, MW03_1.0	**30-Nov-2016**	**----**	----	----	**08-Dec-2016**	29-May-2017	✓
ED006: Exchangeable Cations on Alkaline Soils							
Soil Glass Jar - Unpreserved (ED006)							
SS01, SS02, SS07, SB02_0.1, SB02_1.0, SB03_0.1, SB03_1.0	**29-Nov-2016**	**09-Dec-2016**	27-Dec-2016	✓	**09-Dec-2016**	27-Dec-2016	✓
Soil Glass Jar - Unpreserved (ED006)							
SB01_0.1, SB01_1.0, SB04_0.15, SB04_2.0, MW01_0.1, MW01_9.0, MW02_0.1, MW02_13.5, MW03_1.0	**30-Nov-2016**	**09-Dec-2016**	28-Dec-2016	✓	**09-Dec-2016**	28-Dec-2016	✓

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
ED007: Exchangeable Cations							
Snap Lock Bag (ED007)							
SS03, SS04, SS05, SS06	**29-Nov-2016**	**06-Dec-2016**	27-Dec-2016	✓	**09-Dec-2016**	27-Dec-2016	✓
Snap Lock Bag (ED007)							
MW03_0.1	**30-Nov-2016**	**06-Dec-2016**	28-Dec-2016	✓	**09-Dec-2016**	28-Dec-2016	✓
ED008: Exchangeable Cations							
Snap Lock Bag (ED008)							
SB05_0.1, SB05_1.0	**29-Nov-2016**	**06-Dec-2016**	27-Dec-2016	✓	**09-Dec-2016**	27-Dec-2016	✓
ED040S : Soluble Sulfate by ICPAES							
Snap Lock Bag (ED040S)							
SS01, SS02, SS03, SS04, SS05, SS06, SS07, SB02_0.1, SB02_1.0, SB03_0.1, SB03_1.0, SB05_0.1, SB05_1.0	**29-Nov-2016**	**07-Dec-2016**	27-Dec-2016	✓	**08-Dec-2016**	04-Jan-2017	✓
Snap Lock Bag (ED040S)							
SB01_0.1, SB01_1.0, SB04_0.15, SB04_2.0, MW01_0.1, MW01_9.0, MW02_0.1, MW02_13.5, MW03_0.1, MW03_1.0, FD02, FD03	**30-Nov-2016**	**07-Dec-2016**	28-Dec-2016	✓	**08-Dec-2016**	04-Jan-2017	✓
ED093S: Soluble Major Cations							
Snap Lock Bag (ED093S)							
SS01, SS02, SS03, SS04, SS05, SS06, SS07, SB02_0.1, SB02_1.0, SB03_0.1, SB03_1.0, SB05_0.1, SB05_1.0	**29-Nov-2016**	**07-Dec-2016**	28-May-2017	✓	**08-Dec-2016**	28-May-2017	✓
Snap Lock Bag (ED093S)							
SB01_0.1, SB01_1.0, SB04_0.15, SB04_2.0, MW01_0.1, MW01_9.0, MW02_0.1, MW02_13.5, MW03_0.1, MW03_1.0, FD02, FD03	**30-Nov-2016**	**07-Dec-2016**	29-May-2017	✓	**08-Dec-2016**	29-May-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
EG005T: Total Metals by ICP-AES							
Snap Lock Bag (EG005T)							
SS01, SS02, SS03, SS04, SS05, SS06, SS07, SB02_0.1, SB02_1.0, SB03_0.1, SB03_1.0, SB05_0.1, SB05_1.0	**29-Nov-2016**	**07-Dec-2016**	28-May-2017	✓	**08-Dec-2016**	28-May-2017	✓
Snap Lock Bag (EG005T)							
SB01_0.1, SB01_1.0, SB04_0.15, SB04_2.0, MW01_0.1, MW01_9.0, MW02_0.1, MW02_13.5, MW03_0.1, MW03_1.0, FD02, FD03	**30-Nov-2016**	**07-Dec-2016**	29-May-2017	✓	**08-Dec-2016**	29-May-2017	✓
EP003: Total Organic Carbon (TOC) in Soil							
Pulp Bag (EP003)							
SS01, SS02, SS03, SS04, SS05, SS06, SS07, SB02_0.1, SB02_1.0, SB03_0.1, SB03_1.0, SB05_0.1, SB05_1.0	**29-Nov-2016**	**08-Dec-2016**	27-Dec-2016	✓	**08-Dec-2016**	27-Dec-2016	✓
Pulp Bag (EP003)							
SB01_0.1, SB01_1.0, SB04_0.15, SB04_2.0, MW01_0.1, MW01_9.0, MW02_0.1, MW02_13.5, MW03_0.1, MW03_1.0, FD02, FD03	**30-Nov-2016**	**08-Dec-2016**	28-Dec-2016	✓	**08-Dec-2016**	28-Dec-2016	✓

Matrix: **SOIL**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE Soil Jar (EP231X)							
SS01, SS02, SS03, SS04, SS05, SS06, SS07, SB02_0.1, SB02_1.0, SB03_0.1, SB03_1.0, SB05_0.1, SB05_1.0	**29-Nov-2016**	**08-Dec-2016**	28-May-2017	✓	**08-Dec-2016**	17-Jan-2017	✓
HDPE Soil Jar (EP231X)							
SB01_0.1, SB01_1.0, SB04_0.15, SB04_2.0, MW01_0.1, MW01_9.0, MW02_0.1, MW02_13.5, MW03_0.1, MW03_1.0, FD02, FD03	**30-Nov-2016**	**08-Dec-2016**	29-May-2017	✓	**08-Dec-2016**	17-Jan-2017	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE Soil Jar (EP231X)							
SS01, SS02, SS03, SS04, SS05, SS06, SS07, SB02_0.1, SB02_1.0, SB03_0.1, SB03_1.0, SB05_0.1, SB05_1.0	**29-Nov-2016**	**08-Dec-2016**	28-May-2017	✓	**08-Dec-2016**	17-Jan-2017	✓
HDPE Soil Jar (EP231X)							
SB01_0.1, SB01_1.0, SB04_0.15, SB04_2.0, MW01_0.1, MW01_9.0, MW02_0.1, MW02_13.5, MW03_0.1, MW03_1.0, FD02, FD03	**30-Nov-2016**	**08-Dec-2016**	29-May-2017	✓	**08-Dec-2016**	17-Jan-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
EP231C: Perfluoroalkyl Sulfonamides							
HDPE Soil Jar (EP231X)							
SS01, SS02, SS03, SS04, SS05, SS06, SS07, SB02_0.1, SB02_1.0, SB03_0.1, SB03_1.0, SB05_0.1, SB05_1.0	**29-Nov-2016**	**08-Dec-2016**	28-May-2017	✓	**08-Dec-2016**	17-Jan-2017	✓
HDPE Soil Jar (EP231X)							
SB01_0.1, SB01_1.0, SB04_0.15, SB04_2.0, MW01_0.1, MW01_9.0, MW02_0.1, MW02_13.5, MW03_0.1, MW03_1.0, FD02, FD03	**30-Nov-2016**	**08-Dec-2016**	29-May-2017	✓	**08-Dec-2016**	17-Jan-2017	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE Soil Jar (EP231X)							
SS01, SS02, SS03, SS04, SS05, SS06, SS07, SB02_0.1, SB02_1.0, SB03_0.1, SB03_1.0, SB05_0.1, SB05_1.0	**29-Nov-2016**	**08-Dec-2016**	28-May-2017	✓	**08-Dec-2016**	17-Jan-2017	✓
HDPE Soil Jar (EP231X)							
SB01_0.1, SB01_1.0, SB04_0.15, SB04_2.0, MW01_0.1, MW01_9.0, MW02_0.1, MW02_13.5, MW03_0.1, MW03_1.0, FD02, FD03	**30-Nov-2016**	**08-Dec-2016**	29-May-2017	✓	**08-Dec-2016**	17-Jan-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)							
SS01, SS02, SS03, SS04, SS05, SS06, SS07, SB02_0.1, SB02_1.0, SB03_0.1, SB03_1.0, SB05_0.1, SB05_1.0	**29-Nov-2016**	**08-Dec-2016**	28-May-2017	✓	**08-Dec-2016**	17-Jan-2017	✓
HDPE Soil Jar (EP231X)							
SB01_0.1, SB01_1.0, SB04_0.15, SB04_2.0, MW01_0.1, MW01_9.0, MW02_0.1, MW02_13.5, MW03_0.1, MW03_1.0, FD02, FD03	**30-Nov-2016**	**08-Dec-2016**	29-May-2017	✓	**08-Dec-2016**	17-Jan-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
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural (EA005-P)							
SW01, SW02, SW03, FD01	**29-Nov-2016**	**----**	----	----	**06-Dec-2016**	29-Nov-2016	×
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H)							
SW01, SW02, SW03, FD01	**29-Nov-2016**	**----**	----	----	**06-Dec-2016**	06-Dec-2016	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
SW01, SW02, SW03	**29-Nov-2016**	**----**	----	----	**06-Dec-2016**	13-Dec-2016	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
SW01, SW02, SW03	**29-Nov-2016**	**----**	----	----	**08-Dec-2016**	27-Dec-2016	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
SW01, SW02, SW03	**29-Nov-2016**	**----**	----	----	**08-Dec-2016**	27-Dec-2016	✓

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
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Natural (ED093F)							
SW01, SW02, SW03	**29-Nov-2016**	**----**	----	----	**07-Dec-2016**	06-Dec-2016	×
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
SW01, SW02, SW03, FD01	**29-Nov-2016**	**----**	----	----	**08-Dec-2016**	28-May-2017	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X)							
SW01, SW02, SW03, FD01	**29-Nov-2016**	**----**	----	----	**08-Dec-2016**	28-May-2017	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X)							
SW01, SW02, SW03, FD01	**29-Nov-2016**	**----**	----	----	**08-Dec-2016**	28-May-2017	✓
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
SW01, SW02, SW03, FD01	**29-Nov-2016**	**----**	----	----	**08-Dec-2016**	28-May-2017	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X)							
SW01, SW02, SW03, FD01	**29-Nov-2016**	**----**	----	----	**08-Dec-2016**	28-May-2017	✓

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)							
Cations - soluble by ICP-AES	ED093S	3	25	**12.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	1	5	**20.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations with pre-treatment	ED008	1	2	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055-103	4	40	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	4	35	**11.43**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	4	25	**16.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	3	25	**12.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Cations - soluble by ICP-AES	ED093S	2	25	**8.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations with pre-treatment	ED008	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	35	**5.71**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	25	**8.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	25	**8.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Cations - soluble by ICP-AES	ED093S	2	25	**8.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	1	5	**20.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations with pre-treatment	ED008	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	35	**5.71**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	25	**8.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Organic Carbon	EP003	2	25	**8.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	35	**5.71**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	0	25	**0.00**	**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)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	17	**11.76**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

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

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP) - Continued							
pH by PC Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	17	**5.88**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	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	EA055-103	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 103-105 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3 - 2003
Soil Particle Density	* EA152	SOIL	Soil Particle Density by AS 1289.3.5.1-2006 : Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
Exchangeable Cations on Alkaline Soils	ED006	SOIL	In house: Referenced to Soil Survey Test Method C5. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with alcoholic ammonium chloride at pH 8.5. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil.
Exchangeable Cations	ED007	SOIL	In house: Referenced to Rayment & Lyons (2011) Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM (2013) Schedule B(3) (Method 301)
Exchangeable Cations with pre-treatment	ED008	SOIL	In house: Referenced to Rayment & Higginson (2011) Method 15A2. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM (2013) Schedule B(3) (Method 301)
Major Anions - Soluble	ED040S	SOIL	In house: Soluble Anions are determined off a 1:5 soil / water extract by ICPAES.
Cations - soluble by ICP-AES	ED093S	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010 (ICPAES) Water extracts of the soil are analyzed for major cations by ICPAES. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Organic Carbon	EP003	SOIL	In house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automaticaly measured by infra-red detector.
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.
pH by PC Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (2013) Schedule B(3)

Analytical Methods	Method	Matrix	Method Descriptions
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)
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
Exchangeable Cations Preparation Method (Alkaline Soils)	ED006PR	SOIL	In house: Referenced to Rayment and Lyons 2011 method 15C1.
Exchangeable Cations Preparation Method	ED007PR	SOIL	In house: Referenced to Rayment & Higginson (1992) method 15A1. A 1M NH4Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)
Sample Extraction for PFAS	EP231-PR	SOIL	In house
Dry and Pulverise (up to 100g)	GEO30	SOIL	#

CHAIN OF CUSTODY RECORD

GHD

Melbourne Office Address
180 Lonsdale Street, Melbourne 3000
Telephone: 613 8687 8000 Fax: 613 8687 8111

Completion Date / Turnaround: STANDARD

Quote # / GHD Reference: EN/005/16

Job Number	GHD Contact
21-25583-05	COURTNEY WINES
Project	
DENILIQUIN PFAS INVESTIGATION	
GHD Project Manager	GHD Contact
BEN ANDERSON	COURTNEY WINES
GHD PM email	GHD Contact email

Laboratory: ALS
Address: ALS SPRINGVALE
Laboratory Contact: SHIRLEY LE CORNU

COURIER AND LABORATORY INSTRUCTIONS:
Sign **white copy** on receipt and release of samples.
Samples are to be delivered to the Laboratory Address.
On receipt of samples, **the laboratory contact** to sign white copy and fax/email to GHD Contact.
On completion of analyses please **return white** copy with results.
Pink copy is returned to the sampler once the courier has signed for the samples.
E-mail results to the **GHD Project Manager** and **GHD Contact** with the GHD Job Number in the e-mail subject line.
Note email format: firstname.lastname@ghd.com
Results to be provided in ESDAT compatible format

	Sample I.D.	Date	Time	Composite Sample	Sample Matrix (S: Soil, SL: Sludge, W: Water, A: Air, GW: Groundwater)	Container Type (J: soil jar, B: bag, V: vial, G: glass bottle, P: plastic bottle)	Container Number	Container Volume (mL)	PFAS* EXT. SUITE	TDS	pH	MAJOR IONS	ALKALINITY	SAMPLE COMMENTS
1	MW01	24/01	AM		GW				X	X	X	X	X	
2	MW02	↓	↓		↓				X	X	X	X	X	
3	MW03								X	X	X	X	X	
4	FD01								X	X	X			
→	FS01								X	X	X			PLS FORWARD FS01 TO MGT
5	RB01	↓	↓		W				X					

Environmental Division
Melbourne
Work Order Reference
EM1700781

Telephone : + 61-3-8549 9600

Forwarded to Secondary Lab
Initials NP Date 27/1

TOTAL NUMBER OF SAMPLES	6
TOTAL NUMBER OF ESKIES	1
SAMPLES/ESKY CHILLED? Y / N	Y

GENERAL COMMENTS: * PFAS EXTENDED SUITE (ALS)

CUSTODY DETAILS:

	Name	Date/Time Received	Date/Time Relinquished
SAMPLER	C. WINES	24/01/17 AM	25/01/17 9:15
GHD SERVICE CENTRE	R. BORTHWICK	25/01/17 9:15 AM	Courtney 10:25am 25/01/2017.
COURIER	TNT	25/01/17 10:25	
LABORATORY	Per CAs	25/1/17 @ 11.20am	

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM1700781**	Page	: 1 of 8
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: MR BEN ANDERSON	Contact	: Shirley LeCornu
Address	: LEVEL 8, 180 LONSDALE ST MELBOURNE VIC, AUSTRALIA 3001	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 07 5413 8161	Telephone	: +61-3-8549 9630
Project	: 212558305	Date Samples Received	: 25-Jan-2017 11:20
Order number	: ----	Date Analysis Commenced	: 30-Jan-2017
C-O-C number	: ----	Issue Date	: 03-Feb-2017 17:11
Sampler	: COURTNEY WINES		
Site	: Deniliquin PFAS Investigation		
Quote number	: EN/005/15 VICTORIA (Primary work only)		
No. of samples received	: 5		
No. of samples analysed	: 5		

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
Chris Lemaitre	Non-Metals Team Leader	Melbourne Inorganics, Springvale, VIC

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.

- TDS by method EA-015 may bias high for EM1700781 #1 due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- Ionic balances were calculated using: major anions - chloride, alkalinity and sulfate; and major cations - calcium, magnesium, potassium and sodium.
- ED045G: The presence of thiocyanate can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Client sample ID	MW01	MW02	MW03	FD01	----
				Client sampling date / time	24-Jan-2017 00:00	24-Jan-2017 00:00	24-Jan-2017 00:00	24-Jan-2017 00:00	----
Compound	CAS Number	LOR	Unit		EM1700781-001	EM1700781-002	EM1700781-003	EM1700781-004	--------
					Result	Result	Result	Result	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		7.77	7.80	7.71	7.79	----
EA015: Total Dissolved Solids dried at 180 ± 5 °C									
Total Dissolved Solids @180°C	----	10	mg/L		1670	1150	1700	1020	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		290	308	186	----	----
Total Alkalinity as CaCO3	----	1	mg/L		290	308	186	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		70	60	155	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		448	384	749	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		18	18	38	----	----
Magnesium	7439-95-4	1	mg/L		24	23	41	----	----
Sodium	7440-23-5	1	mg/L		316	305	420	----	----
Potassium	7440-09-7	1	mg/L		1	2	9	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		19.9	18.2	28.1	----	----
Total Cations	----	0.01	meq/L		16.6	16.1	23.8	----	----
Ionic Balance	----	0.01	%		8.88	6.19	8.30	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		0.14	<0.02	<0.02	0.15	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		0.08	<0.02	<0.02	0.08	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L		0.24	<0.02	<0.02	0.26	----
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		0.64	<0.01	<0.01	0.60	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	<0.02	<0.02	<0.02	----

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Client sample ID	MW01	MW02	MW03	FD01	----
				Client sampling date / time	24-Jan-2017 00:00	24-Jan-2017 00:00	24-Jan-2017 00:00	24-Jan-2017 00:00	----
Compound	CAS Number	LOR	Unit		EM1700781-001	EM1700781-002	EM1700781-003	EM1700781-004	--------
					Result	Result	Result	Result	----
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		**0.13**	<0.02	<0.02	**0.12**	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		**0.33**	<0.02	<0.02	**0.32**	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		**0.04**	<0.02	<0.02	**0.06**	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		**0.03**	<0.01	<0.01	**0.03**	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<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	----
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	----
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	----

Analytical Results

Sub-Matrix: GROUNDWATER (Matrix: WATER)				Client sample ID	MW01	MW02	MW03	FD01	----
				Client sampling date / time	24-Jan-2017 00:00	24-Jan-2017 00:00	24-Jan-2017 00:00	24-Jan-2017 00:00	----
Compound	CAS Number	LOR	Unit		EM1700781-001	EM1700781-002	EM1700781-003	EM1700781-004	--------
					Result	Result	Result	Result	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids - Continued									
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	<0.05	<0.05	<0.05	----
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		**1.63**	<0.02	<0.02	**1.62**	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		**0.88**	<0.02	<0.02	**0.86**	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		**1.55**	<0.02	<0.02	**1.54**	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**111**	**86.0**	**113**	**110**	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	RB01	----	----	----	----
				Client sampling date / time	24-Jan-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM1700781-005	--------	--------	--------	--------
					Result	----	----	----	----
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		<0.02	----	----	----	----
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L		<0.02	----	----	----	----
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		<0.01	----	----	----	----
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	----	----	----	----
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	----	----	----	----
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		<0.02	----	----	----	----
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		<0.02	----	----	----	----
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		<0.02	----	----	----	----
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		<0.01	----	----	----	----
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<0.02	----	----	----	----
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.02	----	----	----	----
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	----	----	----	----
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.02	----	----	----	----
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.05	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		<0.02	----	----	----	----
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.05	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	RB01	----	----	----	----
				Client sampling date / time	24-Jan-2017 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM1700781-005	--------	--------	--------	--------
					Result	----	----	----	----
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.05	µg/L		<0.05	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.05	----	----	----	----
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.02	----	----	----	----
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.02	----	----	----	----
EP231D: (n:2) Fluorotelomer Sulfonic Acids									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.05	µg/L		<0.05	----	----	----	----
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		<0.05	----	----	----	----
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		<0.05	----	----	----	----
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	----	----	----	----
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		<0.02	----	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		<0.02	----	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		<0.02	----	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**92.0**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **GROUNDWATER**		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

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM1700781**	Page	: 1 of 6
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Melbourne
Contact	: MR BEN ANDERSON	Telephone	: +61-3-8549 9630
Project	: 212558305	Date Samples Received	: 25-Jan-2017
Site	: Deniliquin PFAS Investigation	Issue Date	: 03-Feb-2017
Sampler	: COURTNEY WINES	No. of samples received	: 5
Order number	: ----	No. of samples analysed	: 5

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

- **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	EM1700773--001	Anonymous	**Perfluorobutane sulfonic acid (PFBS)**	375-73-5	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231A: Perfluoroalkyl Sulfonic Acids	EM1700773--001	Anonymous	**Perfluoropentane sulfonic acid (PFPeS)**	2706-91-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231A: Perfluoroalkyl Sulfonic Acids	EM1700773--001	Anonymous	**Perfluorohexane sulfonic acid (PFHxS)**	355-46-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231A: Perfluoroalkyl Sulfonic Acids	EM1700773--001	Anonymous	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	EM1700773--001	Anonymous	**Perfluoropentanoic acid (PFPeA)**	2706-90-3	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231B: Perfluoroalkyl Carboxylic Acids	EM1700773--001	Anonymous	**Perfluorohexanoic acid (PFHxA)**	307-24-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**

Outliers : Analysis Holding Time Compliance

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation: Date extracted	Extraction / Preparation: Due for extraction	Extraction / Preparation: Days overdue	Analysis: Date analysed	Analysis: Due for analysis	Analysis: Days overdue
EA005P: pH by PC Titrator						
Clear Plastic Bottle - Natural						
MW01, MW02, MW03, FD01	----	----	----	30-Jan-2017	24-Jan-2017	**6**

Analysis Holding Time Compliance

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

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

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

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

Matrix: **WATER**

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

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

Matrix: **WATER**

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

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA005P: pH by PC Titrator							
Clear Plastic Bottle - Natural (EA005-P)							
MW01, MW02, MW03, FD01	**24-Jan-2017**	**----**	----	----	**30-Jan-2017**	24-Jan-2017	×
EA015: Total Dissolved Solids dried at 180 ± 5 °C							
Clear Plastic Bottle - Natural (EA015H)							
FD01	**24-Jan-2017**	**----**	----	----	**30-Jan-2017**	31-Jan-2017	✓
Clear Plastic Bottle - Natural (EA015H)							
MW01, MW02, MW03	**24-Jan-2017**	**----**	----	----	**31-Jan-2017**	31-Jan-2017	✓
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P)							
MW01, MW02, MW03	**24-Jan-2017**	**----**	----	----	**30-Jan-2017**	07-Feb-2017	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G)							
MW01, MW02, MW03	**24-Jan-2017**	**----**	----	----	**30-Jan-2017**	21-Feb-2017	✓
ED045G: Chloride by Discrete Analyser							
Clear Plastic Bottle - Natural (ED045G)							
MW01, MW02, MW03	**24-Jan-2017**	**----**	----	----	**30-Jan-2017**	21-Feb-2017	✓
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Natural (ED093F)							
MW01, MW02, MW03	**24-Jan-2017**	**----**	----	----	**31-Jan-2017**	31-Jan-2017	✓
EP231A: Perfluoroalkyl Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
MW01, MW02, MW03, FD01, RB01	**24-Jan-2017**	**----**	----	----	**31-Jan-2017**	23-Jul-2017	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X)							
MW01, MW02, MW03, FD01, RB01	**24-Jan-2017**	**----**	----	----	**31-Jan-2017**	23-Jul-2017	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X)							
MW01, MW02, MW03, FD01, RB01	**24-Jan-2017**	**----**	----	----	**31-Jan-2017**	23-Jul-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
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X)							
MW01, MW02, MW03, FD01, RB01	**24-Jan-2017**	**----**	----	----	**31-Jan-2017**	23-Jul-2017	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X)							
MW01, MW02, MW03, FD01, RB01	**24-Jan-2017**	**----**	----	----	**31-Jan-2017**	23-Jul-2017	✓

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)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH by PC Titrator	EA005-P	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	4	36	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Chloride by Discrete Analyser	ED045G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	4	36	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride by Discrete Analyser	ED045G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Cations - Dissolved	ED093F	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Dissolved Solids (High Level)	EA015H	2	36	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride by Discrete Analyser	ED045G	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	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
pH by PC Titrator	EA005-P	WATER	In house: Referenced to APHA 4500 H+ B. This procedure determines pH of water samples by automated ISE. This method is compliant with NEPM (2013) Schedule B(3)
Total Dissolved Solids (High Level)	EA015H	WATER	In house: Referenced to APHA 2540C. A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (2013) Schedule B(3)
Alkalinity by PC Titrator	ED037-P	WATER	In house: Referenced to APHA 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (2013) Schedule B(3)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	In house: Referenced to APHA 4500-SO4. Dissolved sulfate is determined in a 0.45um filtered sample. Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (2013) Schedule B(3)
Chloride by Discrete Analyser	ED045G	WATER	In house: Referenced to APHA 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	In house: Referenced to APHA 3120 and 3125; USEPA SW 846 - 6010 and 6020; Cations are determined by either ICP-AES or ICP-MS techniques. This method is compliant with NEPM (2013) Schedule B(3) Sodium Adsorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (2013) Schedule B(3) Hardness parameters are calculated based on APHA 2340 B. This method is compliant with NEPM (2013) Schedule B(3)
Ionic Balance by PCT DA and Turbi SO4 DA	EN055 - PG	WATER	In house: Referenced to APHA 1030F. This method is compliant with NEPM (2013) Schedule B(3)
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.

Fadi Soro

Fadi AZS 17-1-17 1405

From: Sepan Mahamad
Sent: Tuesday, 17 January 2017 1:23 PM
To: Samples Sydney
Cc: Brenda Hong
Subject: RE: ASLP Deniliquin Additional analysis

Environmental Division Sydney
Work Order Reference
ES1701175

Telephone : +61-2-8784 8555

HI All,

Client has confirmed that she requires ASLP – DI.

Kind regards,

Sepan Mahamad
Client Services Officer, Environmental Sydney

T +61 2 8784 8555 D +61 2 8784 8534
F +61 2 8784 8500
sepan.mahamad@alsglobal.com
277-289 Woodpark Road
Smithfield NSW 2164 Australia

1 MW01-0.1
2 MW01-0.0
3 MW02-0.1
4 MW03-0.1
5 SB01-0.1
6 SB02-0.1
7 SB03-0.1
8 SB03-1.0
9 SB04-0.15
10 SB05-0.1
11 S501
12 S502
13 S503
14 S504
15 S505
16 S506
17 S507

From: Sepan Mahamad
Sent: Monday, 16 January 2017 7:10 PM
To: Samples Sydney <Samples.Sydney@alsglobal.com>

Cc: Brenda Hong <Brenda.Hong@alsglobal.com>
Subject: FW: ASLP Deniliquin Additional analysis

Hi Team,

Please process rebatch as per the request below.

Kind regards,

Sepan Mahamad
Client Services Officer, Environmental
Sydney

T +61 2 8784 8555 D +61 2 8784 8534
F +61 2 8784 8500
sepan.mahamad@alsglobal.com
277-289 Woodpark Road
Smithfield NSW 2164 Australia

From: Samples Melbourne
Sent: Friday, 13 January 2017 2:41 PM
To: ALSEnviro Sydney <ALSEnviro.Sydney@ALSGlobal.com>
Cc: Ryan ODonnell <Ryan.ODonnell@alsglobal.com>
Subject: RE: ASLP Deniliquin Additional analysis

Hi Sepan

You already have these samples in Sydney as they were originally requested for EP231 on the soil

Thanks

Regards

ALS Melbourne - Christmas Closures 2016

Peter Ravlic

Front End – Springvale

Environmental

T +61 3 8549 9600
F +61 3 8549 9626
Peter.Ravlic@alsglobal.com
2-4 Westall Rd
Springvale Vic 3171
Australia

From: Sepan Mahamad **On Behalf Of** ALSEnviro Sydney
Sent: Friday, 13 January 2017 1:50 PM
To: Samples Melbourne <Samples.Melbourne@alsglobal.com>
Cc: Ryan ODonnell <Ryan.ODonnell@alsglobal.com>
Subject: FW: ASLP Deniliquin Additional analysis

Hi Team,

Can you please send the samples listed below to the Sydney lab for ASLP PFAS analysis?

Please let me know if there are any issues.

Kind regards,

Sepan Mahamad
Client Services Officer, Environmental
Sydney

T +61 2 8784 8555 D +61 2 8784 8534
F +61 2 8784 8500
sepan.mahamad@alsglobal.com
277-289 Woodpark Road
Smithfield NSW 2164 Australia

From: Nicole Rosen [mailto:Nicole.Rosen@ghd.com]
Sent: Friday, 13 January 2017 1:26 PM
To: Sepan Mahamad <Sepan.Mahamad@alsglobal.com>
Cc: ALSEnviro Sydney <ALSEnviro.Sydney@ALSGlobal.com>
Subject: ASLP Deniliquin Additional analysis

Hi Sepan,
Deniliquin 21/25583/05– From lab report EM1614608. Are you able to forward this onto the Melbourne lab?

The following samples are required for **ASLP** – PFAS full suite.
EM1614608035 - **MW01_0.1**
EM1614608037 - **MW01_9.0**
EM1614608038 - **MW02_0.1**
EM1614608041 - **MW03_0.1**
EM1614608023 - **SB01_0.1**
EM1614608012 - **SB02_0.1**
EM1614608015 - **SB03_0.1**
EM1614608017 - **SB03_1.0**
EM1614608028 - **SB04_0.15**

EM1614608018 - **SB05_0.1**
EM1614608001 - **SS01**
EM1614608002 - **SS02**
EM1614608003 - **SS03**
EM1614608004 - **SS04**
EM1614608005 - **SS05**
EM1614608006 - **SS06**
EM1614608007 - **SS07**

Thanks,

Nicole Rosen
Senior Environmental Consultant - Contamination Assessment and Remediation

GHD
T: +61 2 9239 7683 | F: 61 2 9239 7199 | V: 217683 | M: 0421 045 835 | E: nicole.rosen@ghd.com
Level 15 133 Castlereagh St Sydney NSW 2000 Australia | http://www.ghd.com/
Water | Energy & Resources | Environment | Property & Buildings | Transportation

Please consider the environment before printing this email

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1701175**	Page	: 1 of 15
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR BEN ANDERSON	Contact	: Customer Services ES
Address	: LEVEL 8, 180 LONSDALE ST MELBOURNE VIC, AUSTRALIA 3001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 07 5413 8161	Telephone	: +61-2-8784 8555
Project	: 212558305 FRNSW DENILIQUIN	Date Samples Received	: 17-Jan-2017 14:00
Order number	: ----	Date Analysis Commenced	: 23-Jan-2017
C-O-C number	: ----	Issue Date	: 27-Jan-2017 14:22
Sampler	: ----		
Site	: ----		
Quote number	: EN/005/15		
No. of samples received	: 17		
No. of samples analysed	: 17		

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
Celine Conceicao	Senior Spectroscopist	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.

- EP231: Particular samples required dilution due to the presence of high level contaminants. LOR values have been adjusted accordingly.

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)				Client sample ID	MW01_0.1	MW01_9.0	MW02_0.1	MW03_0.1	SB01_0.1
				Client sampling date / time	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		ES1701175-001	ES1701175-002	ES1701175-003	ES1701175-004	ES1701175-005
					Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		**0.38**	**0.15**	**0.02**	<0.02	**0.43**
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		**0.26**	**0.06**	**0.02**	<0.02	**0.35**
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L		**3.49**	**0.27**	**0.12**	**0.08**	**4.29**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		**1.43**	**0.04**	<0.02	<0.02	**0.35**
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		**134**	**3.16**	**0.06**	**0.31**	**12.7**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		**0.07**	<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	<0.1
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		**0.29**	**0.11**	<0.02	**0.03**	**0.35**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		**0.96**	**0.28**	**0.02**	**0.04**	**0.80**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		**0.12**	**0.02**	<0.02	**0.03**	**0.10**
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		**0.77**	**0.04**	<0.01	**0.16**	**0.32**
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		**0.07**	<0.02	<0.02	<0.02	<0.02
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		**0.05**	<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		**0.12**	<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: DI WATER LEACHATE (Matrix: WATER)				Client sample ID	MW01_0.1	MW01_9.0	MW02_0.1	MW03_0.1	SB01_0.1
				Client sampling date / time	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		ES1701175-001	ES1701175-002	ES1701175-003	ES1701175-004	ES1701175-005
					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		**1.54**	**0.09**	<0.05	<0.05	**0.45**
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		**1.76**	**0.06**	<0.05	<0.05	**0.08**
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		**145**	**4.28**	**0.24**	**0.65**	**20.2**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		**137**	**3.43**	**0.18**	**0.39**	**17.0**
Sum of PFAS (WA DER List)	----	0.01	µg/L		**143**	**4.18**	**0.22**	**0.65**	**19.5**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**102**	**106**	**107**	**91.0**	**95.3**

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)				Client sample ID	SB02_0.1	SB03_0.1	SB03_1.0	SB04_0.15	SB05_0.1
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	30-Nov-2016 00:00	29-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		ES1701175-006	ES1701175-007	ES1701175-008	ES1701175-009	ES1701175-010
					Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		**11.3**	**0.05**	**4.09**	**0.43**	<0.02
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		**9.11**	**0.04**	**2.28**	**0.41**	<0.02
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L		**84.7**	**0.44**	**5.13**	**6.02**	**0.05**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		**15.8**	**0.06**	**0.03**	**1.78**	<0.02
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		**671**	**16.6**	**0.92**	**45.7**	**0.13**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.20	**0.11**	<0.02	<0.02	<0.02
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		**4.4**	<0.1	**0.8**	<0.1	<0.1
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		**5.21**	**0.06**	**3.14**	**0.21**	<0.02
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		**18.2**	**0.19**	**6.02**	**0.62**	<0.02
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		**2.31**	**0.03**	**0.88**	**0.15**	<0.02
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		**9.88**	**0.09**	**0.29**	**0.80**	**0.09**
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		<0.20	<0.02	<0.02	<0.02	<0.02
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		<0.20	<0.02	<0.02	<0.02	<0.02
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.20	<0.02	<0.02	<0.02	<0.02
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.20	<0.02	<0.02	<0.02	<0.02
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.02	µg/L		<0.20	<0.02	<0.02	<0.02	<0.02
Perfluorotetradecanoic acid (PFTeDA)	376-06-7	0.05	µg/L		<0.50	<0.05	<0.05	<0.05	<0.05
EP231C: Perfluoroalkyl Sulfonamides									
Perfluorooctane sulfonamide (FOSA)	754-91-6	0.02	µg/L		**2.01**	**0.13**	<0.02	<0.02	<0.02
N-Methyl perfluorooctane sulfonamide (MeFOSA)	31506-32-8	0.05	µg/L		<0.50	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	4151-50-2	0.05	µg/L		<0.50	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)				Client sample ID	SB02_0.1	SB03_0.1	SB03_1.0	SB04_0.15	SB05_0.1
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	30-Nov-2016 00:00	29-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		ES1701175-006	ES1701175-007	ES1701175-008	ES1701175-009	ES1701175-010
					Result	Result	Result	Result	Result
EP231C: Perfluoroalkyl Sulfonamides - Continued									
N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	2448-09-7	0.05	µg/L		<0.50	<0.05	<0.05	<0.05	<0.05
N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	1691-99-2	0.05	µg/L		<0.50	<0.05	<0.05	<0.05	<0.05
N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	2355-31-9	0.02	µg/L		<0.20	<0.02	<0.02	<0.02	<0.02
N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	2991-50-6	0.02	µg/L		<0.20	<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		**0.54**	<0.05	<0.05	<0.05	<0.05
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.05	µg/L		**45.9**	**0.12**	**0.19**	**2.72**	<0.05
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		**8.63**	**0.15**	<0.05	**0.17**	<0.05
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.50	<0.05	<0.05	<0.05	<0.05
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		**889**	**18.1**	**23.8**	**59.0**	**0.27**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		**756**	**17.0**	**6.05**	**51.7**	**0.18**
Sum of PFAS (WA DER List)	----	0.01	µg/L		**862**	**17.7**	**21.5**	**56.8**	**0.27**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**95.4**	**94.7**	**100**	**106**	**89.1**

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)				Client sample ID	SS01	SS02	SS03	SS04	SS05
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00
Compound	CAS Number	LOR	Unit		ES1701175-011	ES1701175-012	ES1701175-013	ES1701175-014	ES1701175-015
					Result	Result	Result	Result	Result
EP231A: Perfluoroalkyl Sulfonic Acids									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.02	µg/L		**0.07**	**0.04**	<0.02	<0.02	<0.02
Perfluoropentane sulfonic acid (PFPeS)	2706-91-4	0.02	µg/L		**0.04**	**0.02**	<0.02	<0.02	<0.02
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.02	µg/L		**0.31**	**0.26**	**0.05**	<0.02	**0.09**
Perfluoroheptane sulfonic acid (PFHpS)	375-92-8	0.02	µg/L		**0.05**	**0.05**	<0.02	<0.02	<0.02
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.01	µg/L		**15.9**	**28.7**	**1.17**	**0.36**	**1.32**
Perfluorodecane sulfonic acid (PFDS)	335-77-3	0.02	µg/L		<0.02	**0.26**	<0.02	<0.02	<0.02
EP231B: Perfluoroalkyl Carboxylic Acids									
Perfluorobutanoic acid (PFBA)	375-22-4	0.1	µg/L		<0.1	<0.00	<0.00	<0.00	<0.00
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.02	µg/L		**0.09**	**0.11**	<0.02	<0.02	**0.06**
Perfluorohexanoic acid (PFHxA)	307-24-4	0.02	µg/L		**0.16**	**0.20**	**0.02**	<0.02	**0.07**
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.02	µg/L		**0.03**	**0.04**	<0.02	<0.02	**0.05**
Perfluorooctanoic acid (PFOA)	335-67-1	0.01	µg/L		**0.12**	**0.11**	**0.02**	<0.01	**0.12**
Perfluorononanoic acid (PFNA)	375-95-1	0.02	µg/L		**0.05**	<0.02	<0.02	<0.02	<0.02
Perfluorodecanoic acid (PFDA)	335-76-2	0.02	µg/L		**0.04**	**0.30**	<0.02	<0.02	<0.02
Perfluoroundecanoic acid (PFUnDA)	2058-94-8	0.02	µg/L		<0.02	**0.11**	<0.02	<0.02	<0.02
Perfluorododecanoic acid (PFDoDA)	307-55-1	0.02	µg/L		<0.02	**0.04**	<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		**0.06**	**0.59**	<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: **DI WATER LEACHATE** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	SS01	SS02	SS03	SS04	SS05
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00
					ES1701175-011	ES1701175-012	ES1701175-013	ES1701175-014	ES1701175-015
					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		**0.31**	**0.54**	<0.05	<0.05	<0.05
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.05	µg/L		**0.28**	**1.26**	<0.05	<0.05	<0.05
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.05	µg/L		<0.05	**0.30**	<0.05	<0.05	<0.05
EP231P: PFAS Sums									
Sum of PFAS	----	0.01	µg/L		**17.5**	**32.9**	**1.26**	**0.36**	**1.71**
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		**16.2**	**29.0**	**1.22**	**0.36**	**1.41**
Sum of PFAS (WA DER List)	----	0.01	µg/L		**17.3**	**31.3**	**1.26**	**0.36**	**1.71**
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**93.7**	**102**	**95.9**	**94.1**	**99.0**

Analytical Results

Sub-Matrix: DI WATER LEACHATE (Matrix: WATER)				Client sample ID	SS06	SS07	----	----	----
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1701175-016	ES1701175-017	--------	--------	--------
					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		**0.03**	<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		**2.24**	**1.26**	----	----	----
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		<0.00	<0.00	----	----	----
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: DI WATER LEACHATE (Matrix: WATER)				Client sample ID	SS06	SS07	----	----	----
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1701175-016	ES1701175-017	--------	--------	--------
					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		**2.29**	**1.26**	----	----	----
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.01	µg/L		**2.27**	**1.26**	----	----	----
Sum of PFAS (WA DER List)	----	0.01	µg/L		**2.29**	**1.26**	----	----	----
EP231S: PFAS Surrogate									
13C4-PFOS	----	0.02	%		**102**	**104**	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	MW01_0.1	MW01_9.0	MW02_0.1	MW03_0.1	SB01_0.1
			Client sampling date / time	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00	30-Nov-2016 00:00
Compound	CAS Number	LOR	Unit	ES1701175-001	ES1701175-002	ES1701175-003	ES1701175-004	ES1701175-005
				Result	Result	Result	Result	Result
EN60: Bottle Leaching Procedure								
Final pH	----	0.1	pH Unit	**7.6**	**9.4**	**8.6**	**6.9**	**7.3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	SB02_0.1	SB03_0.1	SB03_1.0	SB04_0.15	SB05_0.1
			Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	30-Nov-2016 00:00	29-Nov-2016 00:00
Compound	CAS Number	LOR	Unit	ES1701175-006	ES1701175-007	ES1701175-008	ES1701175-009	ES1701175-010
				Result	Result	Result	Result	Result
EN60: Bottle Leaching Procedure								
Final pH	----	0.1	pH Unit	**8.9**	**7.9**	**9.0**	**8.9**	**7.3**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	SS01	SS02	SS03	SS04	SS05
			Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00	29-Nov-2016 00:00
Compound	CAS Number	LOR	Unit	ES1701175-011	ES1701175-012	ES1701175-013	ES1701175-014	ES1701175-015
				Result	Result	Result	Result	Result
EN60: Bottle Leaching Procedure								
Final pH	----	0.1	pH Unit	**7.0**	**7.8**	**7.0**	**7.7**	**6.8**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	SS06	SS07	----	----	----
				Client sampling date / time	29-Nov-2016 00:00	29-Nov-2016 00:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1701175-016	ES1701175-017	--------	--------	--------
					Result	Result	----	----	----
EN60: Bottle Leaching Procedure									
Final pH	----	0.1	pH Unit		**7.6**	**8.2**	**----**	**----**	**----**

Surrogate Control Limits

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

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1701175**	Page	: 1 of 6
Client	: **GHD PTY LTD**	Laboratory	: Environmental Division Sydney
Contact	: MR BEN ANDERSON	Telephone	: +61-2-8784 8555
Project	: 212558305 FRNSW DENILIQUIN	Date Samples Received	: 17-Jan-2017
Site	: ----	Issue Date	: 27-Jan-2017
Sampler	: ----	No. of samples received	: 17
Order number	: ----	No. of samples analysed	: 17

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	ES1700845--003	Anonymous	**Perfluorohexane sulfonic acid (PFHxS)**	355-46-4	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231A: Perfluoroalkyl Sulfonic Acids	ES1700845--003	Anonymous	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	Not Determined	----	**MS recovery not determined, background level greater than or equal to 4x spike level.**
EP231A: Perfluoroalkyl Sulfonic Acids	ES1701175--012	SS02	**Perfluorooctane sulfonic acid (PFOS)**	1763-23-1	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
EN60: Bottle Leaching Procedure							
Non-Volatile Leach: 180 day HT (e.g. metals ex.Hg) (EN60-Dla)							
SB02_0.1, SB03_0.1, SB03_1.0, SB05_0.1, SS01, SS02, SS03, SS04, SS05, SS06, SS07	**29-Nov-2016**	**23-Jan-2017**	28-May-2017	✓	**----**	----	----
Non-Volatile Leach: 180 day HT (e.g. metals ex.Hg) (EN60-Dla)							
MW01_0.1, MW01_9.0, MW02_0.1, MW03_0.1, SB01_0.1, SB04_0.15	**30-Nov-2016**	**23-Jan-2017**	29-May-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

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)							
MW01_0.1, MW01_9.0, MW02_0.1, MW03_0.1, SB01_0.1, SB02_0.1, SB03_0.1, SB03_1.0, SB04_0.15, SB05_0.1, SS01	**23-Jan-2017**	**----**	----	----	**24-Jan-2017**	22-Jul-2017	✓
HDPE (no PTFE) (EP231X)							
SS02, SS03, SS04, SS05, SS06, SS07	**23-Jan-2017**	**----**	----	----	**25-Jan-2017**	22-Jul-2017	✓
EP231B: Perfluoroalkyl Carboxylic Acids							
HDPE (no PTFE) (EP231X)							
MW01_0.1, MW01_9.0, MW02_0.1, MW03_0.1, SB01_0.1, SB02_0.1, SB03_0.1, SB03_1.0, SB04_0.15, SB05_0.1, SS01	**23-Jan-2017**	**----**	----	----	**24-Jan-2017**	22-Jul-2017	✓
HDPE (no PTFE) (EP231X)							
SS02, SS03, SS04, SS05, SS06, SS07	**23-Jan-2017**	**----**	----	----	**25-Jan-2017**	22-Jul-2017	✓
EP231C: Perfluoroalkyl Sulfonamides							
HDPE (no PTFE) (EP231X)							
MW01_0.1, MW01_9.0, MW02_0.1, MW03_0.1, SB01_0.1, SB02_0.1, SB03_0.1, SB03_1.0, SB04_0.15, SB05_0.1, SS01	**23-Jan-2017**	**----**	----	----	**24-Jan-2017**	22-Jul-2017	✓
HDPE (no PTFE) (EP231X)							
SS02, SS03, SS04, SS05, SS06, SS07	**23-Jan-2017**	**----**	----	----	**25-Jan-2017**	22-Jul-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
EP231D: (n:2) Fluorotelomer Sulfonic Acids							
HDPE (no PTFE) (EP231X) MW01_0.1, MW01_9.0, MW02_0.1, MW03_0.1, SB01_0.1, SB02_0.1, SB03_0.1, SB03_1.0, SB04_0.15, SB05_0.1, SS01	**23-Jan-2017**	**----**	----	----	**24-Jan-2017**	22-Jul-2017	✓
HDPE (no PTFE) (EP231X) SS02, SS03, SS04, SS05, SS06, SS07	**23-Jan-2017**	**----**	----	----	**25-Jan-2017**	22-Jul-2017	✓
EP231P: PFAS Sums							
HDPE (no PTFE) (EP231X) MW01_0.1, MW01_9.0, MW02_0.1, MW03_0.1, SB01_0.1, SB02_0.1, SB03_0.1, SB03_1.0, SB04_0.15, SB05_0.1, SS01	**23-Jan-2017**	**----**	----	----	**24-Jan-2017**	22-Jul-2017	✓
HDPE (no PTFE) (EP231X) SS02, SS03, SS04, SS05, SS06, SS07	**23-Jan-2017**	**----**	----	----	**25-Jan-2017**	22-Jul-2017	✓

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	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
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

CHAIN OF CUSTODY RECORD

GHD

Melbourne Office Address
180 Lonsdale Street, Melbourne 3000
Telephone: 613 8687 8000 Fax: 613 8687 8111

Completion Date / Turnaround: Standard

Quote # / GHD Reference:

(2)

Job Number: 21/25583O5

GHD Contact: Sid Palani

Project: PRNSW - DENILIQUIN

GHD Project Manager: Ben Anderson.

GHD Contact: Sid Palani

GHD PM email: ben.anderson@ghd.com

GHD Contact email: sid.palani@ghd.com

Laboratory: ALS Springvale

Address:

Laboratory Contact: Shirley LeCornu.

COURIER AND LABORATORY INSTRUCTIONS:
Sign **white copy** on receipt and release of samples.
Samples are to be delivered to the Laboratory Address.
On receipt of samples, **the laboratory contact** to sign white copy and fax/email to GHD Contact.
On completion of analyses please **return white** copy with results.
Pink copy is returned to the sampler once the courier has signed for the samples.
E-mail results to the **GHD Project Manager** and **GHD Contact** with the GHD Job Number in the e-mail subject line.

Note email format: firstname.lastname@ghd.com

Results to be provided in ESDAT compatible format

Sample I.D.	Date	Time	Composite Sample	Sample Matrix (S: Soil SL: Sludge W: Water A: Air GW: Groundwater)	Container Type (J: soil jar B: bag V: vial G: glass bottle P: plastic bottle)	Container Number	Container Volume (mL)	PFAS extended suite	TOC	Total Fe	CEC	Grain size	Metals*		Major ions	Alkalinity	TDS	pH								HOLD	SAMPLE COMMENTS
SS01	29/11/16			S	J, B	3		X	X	X	X	X	X													
SS02								X	X	X	X	X	X													
SS03								X	X	X	X	X	X													
SS04								X	X	X	X	X	X													
SS05								X	X	X	X	X	X													
SS06								X	X	X	X	X	X													
SS07								X	X	X	X	X	X													
~~SS08~~ SW01				W	P	2		X							X	X	X	X								
SW02								X							X	X	X	X								
SW03								X							X	X	X	X								
FD01								X							[illegible]		X	X								
FS01								X							[illegible]		X	X								Please hold to confirm MG?
SB02_0.1				S	J, B	3		X	X	X	X	X	X													
SB02_0.5																									X	
SB02_1.0								X	X	X	X	X	X													
SB03_0.1								X	X	X	X	X	X													
SB03_0.5																									X	

Environmental Division
Melbourne
Work Order Reference
EM1614608

Telephone : + 61-3-8549 9600

TOTAL NUMBER OF SAMPLES:	
TOTAL NUMBER OF ESKIES:	
SAMPLES/ESKY CHILLED? Y / N	Y

GENERAL COMMENTS:

* Metals : 8 metals (Standard) + Al, K, Si

Relinquished by: [illegible] 05/12/16 1:00 pm

CUSTODY DETAILS:

	Name	Date/Time Received	Date/Time Relinquished
SAMPLER	Sid Palani	29/11/16 - 30/11/16	02/12/16 [illegible]
GHD SERVICE CENTRE	C. JAYASEKERA (76)	2/12/12 11:40am	02/12/16 12:25
COURIER			
LABORATORY		2/12, 1400	5/12 3:23pm SE26459

CHAIN OF CUSTODY RECORD

GHD

(2)

Melbourne Office Address
180 Lonsdale Street, Melbourne 3000
Telephone: 613 8687 8000 Fax: 613 8687 8111

Completion Date / Turnaround: Standard (5 day)

Quote # / GHD Reference:

Job Number	21258305
GHD Contact	Sid Palei
Project	FRNSW - DENILIQUIN
GHD Project Manager	Ben Anderson
GHD Contact	Sid Palei
GHD PM email	ben.anderson@ghd.com
GHD Contact email	sid.palei@ghd.com
Laboratory	ALS Springvale
Address	
Laboratory Contact	Shirley LeCornu

COURIER AND LABORATORY INSTRUCTIONS:
Sign **white copy** on receipt and release of samples.
Samples are to be delivered to the Laboratory Address.
On receipt of samples, **the laboratory contact** to sign white copy and fax/email to GHD Contact.
On completion of analyses please **return white** copy with results.
Pink copy is returned to the sampler once the courier has signed for the samples.
E-mail results to the **GHD Project Manager** and **GHD Contact** with the GHD Job Number in the e-mail subject line.

Note email format: firstname.lastname@ghd.com

Results to be provided in ESDAT compatible format

Sample I.D.	Date	Time	Composite Sample	Sample Matrix (S: Soil SL: Sludge W: Water A: Air GW: Groundwater)	Container Type (J: soil jar B: bag V: vial G: glass bottle P: plastic bottle)	Number	Volume (mL)	PFAS extended suite	TOC	Total Fe	CEC	Grain Size	Metals *	HOLD	SAMPLE COMMENTS
SB04_5.0	30/11/16			S	J, B									X	
MW01_0.1	↓			↓	↓			X	X	X	X	X	X		
MW01_1.0														X	
MW08_9.0								X	X	X	X	X	X		
MW02_0.1								X	X	X	X	X	X		
MW02_1.0														X	
MW02_13.5								X	X	X	X	X	X		
MW03_0.1								X	X	X	X	X	X		
MW03_1.0								X	X	X	X	X	X		
FD02								X	X				X		
FD03								X	X				X		
FS02								X	X				X		please forward to Envirolab MGT
FS03	↓			↓	↓			X	X				X		

TOTAL NUMBER OF SAMPLES:	
TOTAL NUMBER OF ESKIES:	6
SAMPLES/ESKY CHILLED? Y / N	Y

GENERAL COMMENTS: * Metals: 8 metals (standard) + K, Si, Al.

Relinquished by - RCAS 05/12/16 @ 1.00pm

CUSTODY DETAILS:

	Name	Date/Time Received	Date/Time Relinquished
SAMPLER	Sid Palei	29/11/16 - 30/11/16	02/12/16 @ 1140
GHD SERVICE CENTRE	C JAYASEKERA	2/12/16 11:40am	02/12/16
COURIER			
LABORATORY		2/12 14:02	

eurofins | mgt

Certificate of Analysis

GHD Melbourne
Level 8, 180 Lonsdale St
Melbourne
VIC 3000

NATA Accredited
Accreditation Number 1261
Site Number 1254

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

Attention: **Ben Anderson**

Report **526459-S**
Project name PRNSW-DENILQUIN
Project ID 212558305
Received Date Dec 05, 2016

Client Sample ID			**FS02**	**FS03**
Sample Matrix			**Soil**	**Soil**
Eurofins | mgt Sample No.			**M16-De05163**	**M16-De05164**
Date Sampled			**Nov 30, 2016**	**Nov 30, 2016**
Test/Reference	LOR	Unit		
Per- and Polyfluorinated Alkyl Substances (PFASs)				
Perfluorobutanesulfonic acid (PFBS)	0.005	mg/kg	< 0.005	0.012
Perfluorobutanoic acid (PFBA)	0.005	mg/kg	< 0.005	< 0.005
Perfluorohexanesulfonic acid (PFHxS)	0.005	mg/kg	0.011	< 0.005
Perfluorooctanesulfonic acid (PFOS)	0.005	mg/kg	0.012	< 0.005
Perfluorodecanesulfonic acid (PFDS)	0.005	mg/kg	< 0.005	< 0.005
Perfluoropentanoic acid (PFPeA)	0.005	mg/kg	< 0.005	< 0.005
Perfluorohexanoic acid (PFHxA)	0.005	mg/kg	0.015	0.033
Perfluoroheptanoic acid (PFHpA)	0.005	mg/kg	< 0.005	< 0.005
Perfluorooctanoic acid (PFOA)	0.005	mg/kg	< 0.005	< 0.005
Perfluorononanoic acid (PFNA)	0.005	mg/kg	< 0.005	< 0.005
Perfluorodecanoic acid (PFDA)	0.005	mg/kg	< 0.005	< 0.005
Perfluoroundecanoic acid (PFUnA)	0.005	mg/kg	< 0.005	< 0.005
Perfluorododecanoic acid (PFDoA)	0.005	mg/kg	< 0.005	< 0.005
Perfluorotridecanoic acid (PFTrDA)	0.005	mg/kg	< 0.005	< 0.005
Perfluorotetradecanoic acid (PFTeDA)	0.005	mg/kg	< 0.005	< 0.005
Perfluorooctanesulfonamide (PFOSA)	0.01	mg/kg	< 0.01	< 0.01
N-ethyl-perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.01	mg/kg	< 0.01	< 0.01
N-methyl-perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.01	mg/kg	< 0.01	< 0.01
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTS)	0.005	mg/kg	< 0.005	< 0.005
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS)	0.01	mg/kg	< 0.01	< 0.01
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS)	0.005	mg/kg	< 0.005	< 0.005
d5-n-EtFOSAA (surr.)	1	%	85	81
13C-PFHxA (surr.)	1	%	62	52
13C8-PFOS (surr.)	1	%	63	66
Total Organic Carbon	0.1	%	0.2	< 0.1
% Moisture	1	%	15	16
Alkali Metals				
Potassium	5	mg/kg	3000	2600
Heavy Metals				
Arsenic	2	mg/kg	4.5	4.4
Cadmium	0.4	mg/kg	< 0.4	< 0.4
Chromium	5	mg/kg	32	25
Copper	5	mg/kg	19	14

Client Sample ID			FS02	FS03
Sample Matrix			**Soil**	**Soil**
Eurofins | mgt Sample No.			**M16-De05163**	**M16-De05164**
Date Sampled			**Nov 30, 2016**	**Nov 30, 2016**
Test/Reference	LOR	Unit		
Heavy Metals				
Lead	5	mg/kg	26	13
Mercury	0.1	mg/kg	< 0.1	< 0.1
Nickel	5	mg/kg	14	14
Zinc	5	mg/kg	46	41

Sample History

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

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

Description	Testing Site	Extracted	Holding Time
Per- and Polyfluorinated Alkyl Substances (PFASs)	Brisbane	Dec 08, 2016	180 Day
- Method: LTM-ORG-2100 Per- and Polyfluorinated Alkyl Substances by LC-MS/MS			
Total Organic Carbon	Melbourne	Dec 07, 2016	28 Day
- Method: APHA 5310B Total Organic Carbon			
Alkali Metals	Melbourne	Dec 06, 2016	180 Day
- Method: USEPA 6010 Alkali Metals			
Metals M8	Melbourne	Dec 06, 2016	28 Days
- Method: LTM-MET-3030 by ICP-OES (hydride ICP-OES for Mercury)			
% Moisture	Melbourne	Dec 06, 2016	14 Day
- Method: LTM-GEN-7080 Moisture			

ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

Melbourne
2-5 Kingston Town Close
Oakleigh VIC 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
Unit F3, Building F
16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 18217

Company Name: GHD Pty Ltd VIC
Address: Level 8, 180 Lonsdale St
Melbourne
VIC 3000

Project Name: PRNSW-DENILQUIN
Project ID: 212558305

Order No.:
Report #: 526459
Phone: 8687 8000
Fax: 8687 8111

Received: Dec 5, 2016 3:23 PM
Due: Dec 12, 2016
Priority: 5 Day
Contact Name: Ben Anderson

Eurofins | mgt Analytical Services Manager : Mary Makarios

Sample Detail						pH	Potassium	Total Dissolved Solids	Total Organic Carbon	Metals M8	Per- and Polyfluorinated Alkyl Substances (PFASs)	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X		X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794											X	
Perth Laboratory - NATA Site # 18217												
External Laboratory												
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	FS01	Nov 29, 2016		Water	M16-De05162	X		X			X	
2	FS02	Nov 30, 2016		Soil	M16-De05163		X		X	X	X	X
3	FS03	Nov 30, 2016		Soil	M16-De05164		X		X	X	X	X
Test Counts						1	2	1	2	2	3	2

Internal Quality Control Review and Glossary

General

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

Holding Times

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

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

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

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

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

Units

mg/kg: milligrams per Kilogram

mg/l: milligrams per litre

ug/l: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100ml: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

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

Terms

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

QC - Acceptance Criteria

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

Results <10 times the LOR : No Limit

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

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

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs 20-130%

QC Data General Comments

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

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Per- and Polyfluorinated Alkyl Substances (PFASs)							
Perfluorobutanesulfonic acid (PFBS)	mg/kg	< 0.005			0.005	Pass	
Perfluorobutanoic acid (PFBA)	mg/kg	< 0.005			0.005	Pass	
Perfluorohexanesulfonic acid (PFHxS)	mg/kg	< 0.005			0.005	Pass	
Perfluorooctanesulfonic acid (PFOS)	mg/kg	< 0.005			0.005	Pass	
Perfluorodecanesulfonic acid (PFDS)	mg/kg	< 0.005			0.005	Pass	
Perfluoropentanoic acid (PFPeA)	mg/kg	< 0.005			0.005	Pass	
Perfluorohexanoic acid (PFHxA)	mg/kg	< 0.005			0.005	Pass	
Perfluoroheptanoic acid (PFHpA)	mg/kg	< 0.005			0.005	Pass	
Perfluorooctanoic acid (PFOA)	mg/kg	< 0.005			0.005	Pass	
Perfluorononanoic acid (PFNA)	mg/kg	< 0.005			0.005	Pass	
Perfluorodecanoic acid (PFDA)	mg/kg	< 0.005			0.005	Pass	
Perfluoroundecanoic acid (PFUnA)	mg/kg	< 0.005			0.005	Pass	
Perfluorododecanoic acid (PFDoA)	mg/kg	< 0.005			0.005	Pass	
Perfluorotridecanoic acid (PFTrDA)	mg/kg	< 0.005			0.005	Pass	
Perfluorotetradecanoic acid (PFTeDA)	mg/kg	< 0.005			0.005	Pass	
Perfluorooctanesulfonamide (PFOSA)	mg/kg	< 0.01			0.01	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	mg/kg	< 0.01			0.01	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	mg/kg	< 0.01			0.01	Pass	
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTS)	mg/kg	< 0.005			0.005	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS)	mg/kg	< 0.01			0.01	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS)	mg/kg	< 0.005			0.005	Pass	
Method Blank							
Total Organic Carbon	%	< 0.1			0.1	Pass	
Method Blank							
Heavy Metals							
Arsenic	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Chromium	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.1			0.1	Pass	
Nickel	mg/kg	< 5			5	Pass	
Zinc	mg/kg	< 5			5	Pass	
LCS - % Recovery							
Per- and Polyfluorinated Alkyl Substances (PFASs)							
Perfluorobutanesulfonic acid (PFBS)	%	81			50-150	Pass	
Perfluorobutanoic acid (PFBA)	%	104			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	%	85			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	%	113			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	%	83			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	%	68			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	%	124			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	%	78			50-150	Pass	
Perfluorooctanoic acid (PFOA)	%	116			50-150	Pass	
Perfluorononanoic acid (PFNA)	%	84			50-150	Pass	
Perfluorodecanoic acid (PFDA)	%	71			50-150	Pass	
Perfluoroundecanoic acid (PFUnA)	%	73			50-150	Pass	
Perfluorododecanoic acid (PFDoA)	%	81			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	%	83			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	%	87			50-150	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Perfluorooctanesulfonamide (PFOSA)	%	74			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	%	92			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	%	84			50-150	Pass	
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTS)	%	86			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS)	%	116			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS)	%	91			50-150	Pass	
LCS - % Recovery							
Heavy Metals							
Arsenic	%	102			80-120	Pass	
Cadmium	%	102			80-120	Pass	
Chromium	%	106			80-120	Pass	
Copper	%	108			80-120	Pass	
Lead	%	103			80-120	Pass	
Mercury	%	93			75-125	Pass	
Nickel	%	106			80-120	Pass	
Zinc	%	108			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	M16-De03622	NCP	%	102			75-125	Pass	
Cadmium	M16-De03622	NCP	%	101			75-125	Pass	
Chromium	M16-De03622	NCP	%	99			75-125	Pass	
Copper	M16-De03622	NCP	%	102			75-125	Pass	
Lead	M16-De03622	NCP	%	75			75-125	Pass	
Mercury	M16-De03622	NCP	%	85			70-130	Pass	
Nickel	M16-De03622	NCP	%	98			75-125	Pass	
Zinc	M16-De03611	NCP	%	51			75-125	Fail	Q08
Spike - % Recovery									
Per- and Polyfluorinated Alkyl Substances (PFASs)				Result 1					
Perfluorobutanesulfonic acid (PFBS)	M16-De05164	CP	%	76			50-150	Pass	
Perfluorobutanoic acid (PFBA)	M16-De05164	CP	%	93			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	M16-De05164	CP	%	73			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	M16-De05164	CP	%	119			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	M16-De05164	CP	%	72			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	M16-De05164	CP	%	50			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	M16-De05164	CP	%	117			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	M16-De05164	CP	%	72			50-150	Pass	
Perfluorooctanoic acid (PFOA)	M16-De05164	CP	%	111			50-150	Pass	
Perfluorononanoic acid (PFNA)	M16-De05164	CP	%	82			50-150	Pass	
Perfluorodecanoic acid (PFDA)	M16-De05164	CP	%	75			50-150	Pass	
Perfluoroundecanoic acid (PFUnA)	M16-De05164	CP	%	75			50-150	Pass	
Perfluorododecanoic acid (PFDoA)	M16-De05164	CP	%	82			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	M16-De05164	CP	%	86			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	M16-De05164	CP	%	87			50-150	Pass	
Perfluorooctanesulfonamide (PFOSA)	M16-De05164	CP	%	70			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	M16-De05164	CP	%	90			50-150	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
N-methyl-perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	M16-De05164	CP	%	78			50-150	Pass	
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTS)	M16-De05164	CP	%	52			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS)	M16-De05164	CP	%	117			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS)	M16-De05164	CP	%	82			50-150	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Per- and Polyfluorinated Alkyl Substances (PFASs)				Result 1	Result 2	RPD			
Perfluorobutanesulfonic acid (PFBS)	M16-De05163	CP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Perfluorobutanoic acid (PFBA)	M16-De05163	CP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Perfluorohexanesulfonic acid (PFHxS)	M16-De05163	CP	mg/kg	0.011	0.012	8.0	30%	Pass	
Perfluorooctanesulfonic acid (PFOS)	M16-De05163	CP	mg/kg	0.012	0.019	44	30%	Fail	Q15
Perfluorodecanesulfonic acid (PFDS)	M16-De05163	CP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Perfluoropentanoic acid (PFPeA)	M16-De05163	CP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Perfluorohexanoic acid (PFHxA)	M16-De05163	CP	mg/kg	0.015	0.016	11	30%	Pass	
Perfluoroheptanoic acid (PFHpA)	M16-De05163	CP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Perfluorooctanoic acid (PFOA)	M16-De05163	CP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Perfluorononanoic acid (PFNA)	M16-De05163	CP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Perfluorodecanoic acid (PFDA)	M16-De05163	CP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Perfluoroundecanoic acid (PFUnA)	M16-De05163	CP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Perfluorododecanoic acid (PFDoA)	M16-De05163	CP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Perfluorotridecanoic acid (PFTrDA)	M16-De05163	CP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Perfluorotetradecanoic acid (PFTeDA)	M16-De05163	CP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Perfluorooctanesulfonamide (PFOSA)	M16-De05163	CP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	M16-De05163	CP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	M16-De05163	CP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTS)	M16-De05163	CP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS)	M16-De05163	CP	mg/kg	< 0.01	< 0.01	<1	30%	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS)	M16-De05163	CP	mg/kg	< 0.005	< 0.005	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	M16-De05152	NCP	%	23	23	1.0	30%	Pass	
Duplicate									
Alkali Metals				Result 1	Result 2	RPD			
Potassium	M16-De06556	NCP	mg/kg	420	520	19	30%	Pass	

Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	M16-De03622	NCP	mg/kg	3.7	4.1	10	30%	Pass	
Cadmium	M16-De03622	NCP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	M16-De03622	NCP	mg/kg	6.2	6.1	1.0	30%	Pass	
Copper	M16-De03622	NCP	mg/kg	18	18	1.0	30%	Pass	
Lead	M16-De03622	NCP	mg/kg	40	39	1.0	30%	Pass	
Mercury	M16-De03622	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	M16-De03622	NCP	mg/kg	6.9	7.0	1.0	30%	Pass	
Zinc	M16-De03621	NCP	mg/kg	45	46	1.0	30%	Pass	

Comments

Sample Integrity

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

Qualifier Codes/Comments

Code	Description
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference
Q15	The RPD reported passes Eurofins | mgt's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised By

Mary Makarios	Analytical Services Manager
Alex Petridis	Senior Analyst-Metal (VIC)
Jonathon Angell	Senior Analyst-Organic (QLD)
Huong Le	Senior Analyst-Inorganic (VIC)

Glenn Jackson
National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request or please click here.

eurofins | mgt

Certificate of Analysis

GHD Melbourne
Level 8, 180 Lonsdale St
Melbourne
VIC 3000

NATA Accredited
Accreditation Number 1261
Site Number 1254

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

Attention: **Ben Anderson**

Report **526459-W**
Project name PRNSW-DENILQUIN
Project ID 212558305
Received Date Dec 05, 2016

Client Sample ID			**FS01**
Sample Matrix			**Water**
Eurofins | mgt Sample No.			**M16-De05162**
Date Sampled			**Nov 29, 2016**
Test/Reference	LOR	Unit	
Per- and Polyfluorinated Alkyl Substances (PFASs)			
Perfluorobutanesulfonic acid (PFBS)	0.00001	mg/L	0.00003
Perfluorobutanoic acid (PFBA)	0.00005	mg/L	0.00007
Perfluorohexanesulfonic acid (PFHxS)	0.00001	mg/L	[N09]0.00018
Perfluorooctanesulfonic acid (PFOS)	0.00001	mg/L	[N09]0.0011
Perfluorodecanesulfonic acid (PFDS)	0.00001	mg/L	< 0.00001
Perfluoropentanoic acid (PFPeA)	0.00001	mg/L	0.00008
Perfluorohexanoic acid (PFHxA)	0.00001	mg/L	[N09]0.00015
Perfluoroheptanoic acid (PFHpA)	0.00001	mg/L	0.00003
Perfluorooctanoic acid (PFOA)	0.00001	mg/L	[N09]0.00004
Perfluorononanoic acid (PFNA)	0.00001	mg/L	0.00002
Perfluorodecanoic acid (PFDA)	0.00001	mg/L	< 0.00001
Perfluoroundecanoic acid (PFUnA)	0.00001	mg/L	< 0.00001
Perfluorododecanoic acid (PFDoA)	0.00001	mg/L	< 0.00001
Perfluorotridecanoic acid (PFTrDA)	0.00001	mg/L	< 0.00001
Perfluorotetradecanoic acid (PFTeDA)	0.00001	mg/L	< 0.00001
Perfluorooctanesulfonamide (PFOSA)	0.00005	mg/L	< 0.00005
N-ethyl-perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.00005	mg/L	< 0.00005
N-methyl-perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.00005	mg/L	< 0.00005
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTS)	0.00001	mg/L	< 0.00001
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS)	0.00005	mg/L	0.00005
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS)	0.00001	mg/L	< 0.00001
d5-n-EtFOSAA (surr.)	1	%	71
13C-PFHxA (surr.)	1	%	77
13C8-PFOS (surr.)	1	%	80
pH	0.1	pH Units	7.7
Total Dissolved Solids	10	mg/L	150

Sample History

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

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

Description	Testing Site	Extracted	Holding Time
Per- and Polyfluorinated Alkyl Substances (PFASs)	Brisbane	Dec 08, 2016	14 Day
- Method: LTM-ORG-2100 Per- and Polyfluorinated Alkyl Substances by LC-MS/MS			
pH	Melbourne	Dec 06, 2016	0 Hours
- Method: LTM-GEN-7090 pH in water by ISE			
Total Dissolved Solids	Melbourne	Dec 06, 2016	7 Day
- Method: LM-LTM-INO-4110 (Total Dissolved Solids @ 178°C - 182°C)			

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Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 18217

Company Name: GHD Pty Ltd VIC
Address: Level 8, 180 Lonsdale St
Melbourne
VIC 3000

Project Name: PRNSW-DENILQUIN
Project ID: 212558305

Order No.:
Report #: 526459
Phone: 8687 8000
Fax: 8687 8111

Received: Dec 5, 2016 3:23 PM
Due: Dec 12, 2016
Priority: 5 Day
Contact Name: Ben Anderson

Eurofins | mgt Analytical Services Manager : Mary Makarios

Sample Detail						pH	Potassium	Total Dissolved Solids	Total Organic Carbon	Metals M8	Per- and Polyfluorinated Alkyl Substances (PFASs)	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X		X
Sydney Laboratory - NATA Site # 18217												
Brisbane Laboratory - NATA Site # 20794											X	
Perth Laboratory - NATA Site # 18217												
External Laboratory												
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**							
1	FS01	Nov 29, 2016		Water	M16-De05162	X		X			X	
2	FS02	Nov 30, 2016		Soil	M16-De05163		X		X	X	X	X
3	FS03	Nov 30, 2016		Soil	M16-De05164		X		X	X	X	X
Test Counts						1	2	1	2	2	3	2

Internal Quality Control Review and Glossary

General

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

Holding Times

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

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

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

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

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

Units

mg/kg: milligrams per Kilogram

ug/l: micrograms per litre

ppb: Parts per billion

org/100ml: Organisms per 100 millilitres

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

mg/l: milligrams per litre

ppm: Parts per million

%: Percentage

NTU: Nephelometric Turbidity Units

Terms

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

QC - Acceptance Criteria

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

Results <10 times the LOR : No Limit

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

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

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs 20-130%

QC Data General Comments

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

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Per- and Polyfluorinated Alkyl Substances (PFASs)							
Perfluorobutanesulfonic acid (PFBS)	mg/L	< 0.00001			0.00001	Pass	
Perfluorobutanoic acid (PFBA)	mg/L	< 0.00005			0.00005	Pass	
Perfluorohexanesulfonic acid (PFHxS)	mg/L	< 0.00001			0.00001	Pass	
Perfluorooctanesulfonic acid (PFOS)	mg/L	< 0.00001			0.00001	Pass	
Perfluorodecanesulfonic acid (PFDS)	mg/L	< 0.00001			0.00001	Pass	
Perfluoropentanoic acid (PFPeA)	mg/L	< 0.00001			0.00001	Pass	
Perfluorohexanoic acid (PFHxA)	mg/L	< 0.00001			0.00001	Pass	
Perfluoroheptanoic acid (PFHpA)	mg/L	< 0.00001			0.00001	Pass	
Perfluorooctanoic acid (PFOA)	mg/L	< 0.00001			0.00001	Pass	
Perfluorononanoic acid (PFNA)	mg/L	< 0.00001			0.00001	Pass	
Perfluorodecanoic acid (PFDA)	mg/L	< 0.00001			0.00001	Pass	
Perfluoroundecanoic acid (PFUnA)	mg/L	< 0.00001			0.00001	Pass	
Perfluorododecanoic acid (PFDoA)	mg/L	< 0.00001			0.00001	Pass	
Perfluorotridecanoic acid (PFTrDA)	mg/L	< 0.00001			0.00001	Pass	
Perfluorotetradecanoic acid (PFTeDA)	mg/L	< 0.00001			0.00001	Pass	
Perfluorooctanesulfonamide (PFOSA)	mg/L	< 0.00005			0.00005	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	mg/L	< 0.00005			0.00005	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	mg/L	< 0.00005			0.00005	Pass	
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTS)	mg/L	< 0.00001			0.00001	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS)	mg/L	< 0.00005			0.00005	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS)	mg/L	< 0.00001			0.00001	Pass	
Method Blank							
Total Dissolved Solids	mg/L	< 10			10	Pass	
LCS - % Recovery							
Per- and Polyfluorinated Alkyl Substances (PFASs)							
Perfluorobutanesulfonic acid (PFBS)	%	87			50-150	Pass	
Perfluorobutanoic acid (PFBA)	%	95			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	%	89			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	%	97			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	%	91			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	%	86			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	%	96			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	%	86			50-150	Pass	
Perfluorooctanoic acid (PFOA)	%	97			50-150	Pass	
Perfluorononanoic acid (PFNA)	%	88			50-150	Pass	
Perfluorodecanoic acid (PFDA)	%	86			50-150	Pass	
Perfluoroundecanoic acid (PFUnA)	%	94			50-150	Pass	
Perfluorododecanoic acid (PFDoA)	%	86			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	%	90			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	%	94			50-150	Pass	
Perfluorooctanesulfonamide (PFOSA)	%	84			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	%	95			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	%	86			50-150	Pass	
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTS)	%	90			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS)	%	96			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS)	%	89			50-150	Pass	
LCS - % Recovery							
Total Dissolved Solids	%	100			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Per- and Polyfluorinated Alkyl Substances (PFASs)				Result 1					
Perfluorobutanesulfonic acid (PFBS)	M16-De09633	NCP	%	122			50-150	Pass	
Perfluorobutanoic acid (PFBA)	M16-De09633	NCP	%	134			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	M16-De09633	NCP	%	121			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	M16-De09633	NCP	%	126			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	M16-De09633	NCP	%	122			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	M16-De09633	NCP	%	101			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	M16-De09633	NCP	%	129			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	M16-De09633	NCP	%	105			50-150	Pass	
Perfluorooctanoic acid (PFOA)	M16-De09633	NCP	%	135			50-150	Pass	
Perfluorononanoic acid (PFNA)	M16-De09633	NCP	%	108			50-150	Pass	
Perfluorodecanoic acid (PFDA)	M16-De09633	NCP	%	124			50-150	Pass	
Perfluoroundecanoic acid (PFUnA)	M16-De09633	NCP	%	122			50-150	Pass	
Perfluorododecanoic acid (PFDoA)	M16-De09633	NCP	%	117			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	M16-De09633	NCP	%	124			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	M16-De09633	NCP	%	113			50-150	Pass	
Perfluorooctanesulfonamide (PFOSA)	M16-De09633	NCP	%	110			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	M16-De09633	NCP	%	144			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	M16-De09633	NCP	%	118			50-150	Pass	
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTS)	M16-De09633	NCP	%	97			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS)	M16-De09633	NCP	%	134			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS)	M16-De09633	NCP	%	141			50-150	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Per- and Polyfluorinated Alkyl Substances (PFASs)				Result 1	Result 2	RPD			
Perfluorobutanesulfonic acid (PFBS)	M16-De09631	NCP	mg/L	< 0.0003	< 0.0003	<1	30%	Pass	
Perfluorobutanoic acid (PFBA)	M16-De09631	NCP	mg/L	< 0.0015	< 0.0015	<1	30%	Pass	
Perfluorohexanesulfonic acid (PFHxS)	M16-De09631	NCP	mg/L	< 0.0003	< 0.0003	<1	30%	Pass	
Perfluorooctanesulfonic acid (PFOS)	M16-De09631	NCP	mg/L	< 0.0003	< 0.0003	<1	30%	Pass	
Perfluorodecanesulfonic acid (PFDS)	M16-De09631	NCP	mg/L	< 0.0003	< 0.0003	<1	30%	Pass	
Perfluoropentanoic acid (PFPeA)	M16-De09631	NCP	mg/L	< 0.0003	< 0.0003	<1	30%	Pass	
Perfluorohexanoic acid (PFHxA)	M16-De09631	NCP	mg/L	< 0.0003	< 0.0003	<1	30%	Pass	
Perfluoroheptanoic acid (PFHpA)	M16-De09631	NCP	mg/L	< 0.0003	< 0.0003	<1	30%	Pass	
Perfluorooctanoic acid (PFOA)	M16-De09631	NCP	mg/L	< 0.0003	< 0.0003	<1	30%	Pass	
Perfluorononanoic acid (PFNA)	M16-De09631	NCP	mg/L	< 0.0003	< 0.0003	<1	30%	Pass	
Perfluorodecanoic acid (PFDA)	M16-De09631	NCP	mg/L	< 0.0003	< 0.0003	<1	30%	Pass	
Perfluoroundecanoic acid (PFUnA)	M16-De09631	NCP	mg/L	< 0.0003	< 0.0003	<1	30%	Pass	
Perfluorododecanoic acid (PFDoA)	M16-De09631	NCP	mg/L	< 0.0003	< 0.0003	<1	30%	Pass	
Perfluorotridecanoic acid (PFTrDA)	M16-De09631	NCP	mg/L	< 0.0003	< 0.0003	<1	30%	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Per- and Polyfluorinated Alkyl Substances (PFASs)				Result 1	Result 2	RPD			
Perfluorotetradecanoic acid (PFTeDA)	M16-De09631	NCP	mg/L	< 0.0003	< 0.0003	<1	30%	Pass	
Perfluorooctanesulfonamide (PFOSA)	M16-De09631	NCP	mg/L	< 0.0015	< 0.0015	<1	30%	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	M16-De09631	NCP	mg/L	< 0.0015	< 0.0015	<1	30%	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	M16-De09631	NCP	mg/L	< 0.0015	< 0.0015	<1	30%	Pass	
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTS)	M16-De09631	NCP	mg/L	< 0.0003	< 0.0003	<1	30%	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS)	M16-De09631	NCP	mg/L	< 0.0015	< 0.0015	<1	30%	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS)	M16-De09631	NCP	mg/L	< 0.0003	< 0.0003	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
pH	M16-De04884	NCP	pH Units	9.0	9.0	pass	30%	Pass	
Total Dissolved Solids	A16-De01895	NCP	mg/L	2500	2700	8.0	30%	Pass	

Comments

Sample Integrity

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

Qualifier Codes/Comments

Code	Description
N09	Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.

Authorised By

Mary Makarios	Analytical Services Manager
Jonathon Angell	Senior Analyst-Organic (QLD)
Huong Le	Senior Analyst-Inorganic (VIC)

Glenn Jackson
National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request or please click here.

STORM WATER

eurofins | mgt

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Email: enviro.bris@mgtlabmark.com.au

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Email: enquiries.melb@mgtlabmark.com.au

CHAIN OF CUSTODY RECORD

Page 1 of 1

CLIENT DETAILS

Company Name : GHD
Office Address : Level 15, 133 Castlereagh St, Sydney
Special Directions & Comments :
Eurofins | mgt DI water batch number:

Contact Name : Alice Walker
Project Manager : Ben Andersen / Nicole Rosen
Email for results : ben.anderson@ghd.com; nicole.rosen@ghd.com; alice.walker@ghd.com

Purchase Order : 21 25583 05
PROJECT Number : 21 25583 05
PROJECT Name : FRNSW - Deniliquin #2

COC Number :
Eurofins | mgt quote ID :
Data output format: esdat

	Sample ID	Date	Matrix	TOC	Total Fe	CEC	Grain size	Metals (standard 9, K, Si, Al)	PFAS extended suite	HOLD
1	MW02B_10.2-10.3	15/12	soil					X	X	
2	MW03B_13.8-13.9	↓	↓					X	X	
3	MW03B_15.1-15.2	↓	↓							X
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										

Some common holding times (with correct preservation). For further information contact 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: ~~Sophie Forrester~~ Alice Walker
Date & Time : 21/12/16
Signature: AWalker

Laboratory Staff
Received By: Kat
Date & Time : 22/12 12:17pm
Signature: Kat

Turn around time
1 DAY [2 DAY [3 DAY [
5 DAY [10 DAY Other:

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

Temperature on arrival:

Report number: S29080

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Certificate of Analysis

GHD Pty Ltd NSW
Level 15, 133 Castlereagh Street
Sydney
NSW 2000

NATA Accredited
Accreditation Number 1261
Site Number 18217

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

Attention: **Ben Anderson**

Report **529080-S**
Project name FRNSW-DENILIQUIN #2
Project ID 212558305
Received Date Dec 22, 2016

Client Sample ID			**MW02B_10.2-10.3**	**MW03B_13.8-13.9**
Sample Matrix			**Soil**	**Soil**
Eurofins | mgt Sample No.			**S16-De23615**	**S16-De23616**
Date Sampled			**Dec 15, 2016**	**Dec 15, 2016**
Test/Reference	LOR	Unit		
Heavy Metals				
Arsenic	2	mg/kg	6.1	6.9
Cadmium	0.4	mg/kg	< 0.4	< 0.4
Chromium	5	mg/kg	10	21
Copper	5	mg/kg	5.5	6.6
Lead	5	mg/kg	6.2	6.9
Mercury	0.1	mg/kg	< 0.1	< 0.1
Nickel	5	mg/kg	7.5	7.8
Zinc	5	mg/kg	18	21
% Moisture	1	%	14	4.4

Sample History

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

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

Description	Testing Site	Extracted	Holding Time
Metals M8	Melbourne	Dec 23, 2016	28 Days
- Method: LTM-MET-3030 by ICP-OES (hydride ICP-OES for Mercury)			
% Moisture	Melbourne	Dec 22, 2016	14 Day
- Method: LTM-GEN-7080 Moisture			

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ABN– 50 005 085 521
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NATA # 1261
Site # 1254 & 14271

Sydney
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16 Mars Road
Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 18217

Company Name: GHD Pty Ltd NSW
Address: Level 15, 133 Castlereagh Street
Sydney
NSW 2000

Project Name: FRNSW-DENILIQUIN #2
Project ID: 212558305

Order No.:
Report #: 529080
Phone: 02 9239 7100
Fax: 02 9239 7199

Received: Dec 22, 2016 12:17 PM
Due: Jan 3, 2017
Priority: 5 Day
Contact Name: Ben Anderson

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						HOLD	Metals M8	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794								
Perth Laboratory - NATA Site # 18217								
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	MW02B_10.2-10.3	Dec 15, 2016		Soil	S16-De23615		X	X
2	MW03B_13.8-13.9	Dec 15, 2016		Soil	S16-De23616		X	X
3	MW03B_15.1-15.2	Dec 15, 2016		Soil	S16-De23617	X		
Test Counts						1	2	2

Internal Quality Control Review and Glossary

General

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

Holding Times

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

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

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

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

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

Units

mg/kg: milligrams per Kilogram

ug/l: micrograms per litre

ppb: Parts per billion

org/100ml: Organisms per 100 millilitres

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

mg/l: milligrams per litre

ppm: Parts per million

%: Percentage

NTU: Nephelometric Turbidity Units

Terms

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

QC - Acceptance Criteria

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

Results <10 times the LOR : No Limit

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

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

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs 20-130%

QC Data General Comments

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

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Heavy Metals							
Arsenic	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.4			0.4	Pass	
Chromium	mg/kg	< 5			5	Pass	
Copper	mg/kg	< 5			5	Pass	
Lead	mg/kg	< 5			5	Pass	
Mercury	mg/kg	< 0.1			0.1	Pass	
Nickel	mg/kg	< 5			5	Pass	
Zinc	mg/kg	< 5			5	Pass	
LCS - % Recovery							
Heavy Metals							
Arsenic	%	84			80-120	Pass	
Cadmium	%	96			80-120	Pass	
Chromium	%	100			80-120	Pass	
Copper	%	101			80-120	Pass	
Lead	%	105			80-120	Pass	
Mercury	%	109			75-125	Pass	
Nickel	%	101			80-120	Pass	
Zinc	%	102			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic	M16-De22472	NCP	%	112			75-125	Pass	
Cadmium	M16-De22472	NCP	%	117			75-125	Pass	
Chromium	M16-De22472	NCP	%	111			75-125	Pass	
Copper	M16-De22472	NCP	%	116			75-125	Pass	
Lead	M16-De22472	NCP	%	126			75-125	Fail	Q08
Mercury	M16-De22472	NCP	%	133			70-130	Fail	Q08
Nickel	M16-De22472	NCP	%	113			75-125	Pass	
Zinc	M16-De22472	NCP	%	119			75-125	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1	Result 2	RPD	Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic	M16-De22471	NCP	mg/kg	4.0	3.8	4.0	30%	Pass	
Cadmium	M16-De22471	NCP	mg/kg	< 0.4	< 0.4	<1	30%	Pass	
Chromium	M16-De22471	NCP	mg/kg	59	79	29	30%	Pass	
Copper	M16-De22471	NCP	mg/kg	22	18	21	30%	Pass	
Lead	M16-De22471	NCP	mg/kg	16	14	10	30%	Pass	
Mercury	M16-De22471	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Nickel	M16-De22471	NCP	mg/kg	70	93	29	30%	Pass	
Zinc	M16-De22471	NCP	mg/kg	54	36	39	30%	Fail	Q15
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	S16-De23584	NCP	%	24	22	6.0	30%	Pass	

Comments

Sample Integrity

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

Qualifier Codes/Comments

Code	Description
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference
Q15	The RPD reported passes Eurofins | mgt's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised By

Nibha Vaidya	Analytical Services Manager
Alex Petridis	Senior Analyst-Metal (VIC)
Huong Le	Senior Analyst-Inorganic (VIC)

Glenn Jackson
National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request or please click here.

CHAIN OF CUSTODY RECORD

#11

GHD

Melbourne Office Address
180 Lonsdale Street, Melbourne 3000
Telephone: 613 8687 8000 Fax: 613 8687 8111

Completion Date / Turnaround: STANDARD

Quote # / GHD Reference: EN/005/16

Job Number	GHD Contact
21-25583-05	COURTNEY WINES
Project	
DENILIQUIN PFAS INVESTIGATION	
GHD Project Manager	GHD Contact
BEN ANDERSON	COURTNEY WINES
GHD PM email	GHD Contact email

Laboratory: ALS
Address: ALS SPRINGVALE
Laboratory Contact: SHIRLEY LE CORNU

COURIER AND LABORATORY INSTRUCTIONS:
Sign **white copy** on receipt and release of samples.
Samples are to be delivered to the Laboratory Address.
On receipt of samples, **the laboratory contact** to sign white copy and fax/email to GHD Contact.
On completion of analyses please **return white** copy with results.
Pink copy is returned to the sampler once the courier has signed for the samples.
E-mail results to the **GHD Project Manager** and **GHD Contact** with the GHD Job Number in the e-mail subject line.

Note email format: firstname.lastname@ghd.com

Results to be provided in ESDAT compatible format

Sample I.D.	Date	Time	Composite Sample	Sample Matrix: S: Soil SL: Sludge W: Water A: Air GW: Groundwater	Container Type: J: soil jar B: bag V: vial G: glass bottle P: plastic bottle	Container Number	Container Volume (mL)	Analyses Required: PFAS* EXT. SUITE	TDS	pH	MAJOR IONS	ALKALINITY	SAMPLE COMMENTS
MW01	24/01	AM		GW				X	X	X	XX	XX	
MW02	↓	↓		↓				X	X	X	X	X	
MW03								X	X	X	X	X	
FD01								X	X	X			
FS01				↓				X	X	X			PLS FORWARD FS01 TO MGT
RB01	↓	↓		W				X					

36

Relyated Cy.
Rec'd
27/1/17 @
2.10pm.

TOTAL NUMBER OF SAMPLES:	6
TOTAL NUMBER OF ESKIES:	1
SAMPLES/ESKY CHILLED? Y / N	Y

GENERAL COMMENTS: * PFAS EXTENDED SUITE (ALS)

CUSTODY DETAILS:

	Name	Date/Time Received	Date/Time Relinquished
SAMPLER	C. WINES	24/01/17 AM	25/01/17 9:15
GHD SERVICE CENTRE	R BORTHWICK	25/01/17 9:15 AM	10:25am 25/01/2017.
COURIER	TNT	25/01/17 10:25	
LABORATORY	Rec'd	25/1/17 @ 11.20a	JIMMY ALS 53/947

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Certificate of Analysis

GHD Melbourne
Level 8, 180 Lonsdale St
Melbourne
VIC 3000

NATA Accredited
Accreditation Number 1261
Site Number 1254

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

Attention: **Courtney Wines**

Report **531947-W**
Project name DENILIQUIN PFAS INVESTIGATION
Received Date Jan 27, 2017

Client Sample ID			**FS01**
Sample Matrix			**Water**
Eurofins | mgt Sample No.			**M17-Ja16913**
Date Sampled			**Jan 24, 2017**
Test/Reference	LOR	Unit	
Per- and Polyfluorinated Alkyl Substances (PFASs)			
Perfluorobutanesulfonic acid (PFBS)	0.00001	mg/L	0.00008
Perfluorobutanoic acid (PFBA)	0.00005	mg/L	< 0.00005
Perfluorohexanesulfonic acid (PFHxS)	0.00001	mg/L	[N09]0.00013
Perfluorooctanesulfonic acid (PFOS)	0.00001	mg/L	[N09]0.00035
Perfluorodecanesulfonic acid (PFDS)	0.00001	mg/L	< 0.00001
Perfluoropentanoic acid (PFPeA)	0.00001	mg/L	[N09]0.00006
Perfluorohexanoic acid (PFHxA)	0.00001	mg/L	[N09]0.00016
Perfluoroheptanoic acid (PFHpA)	0.00001	mg/L	[N09]0.00003
Perfluorooctanoic acid (PFOA)	0.00001	mg/L	[N09]0.00001
Perfluorononanoic acid (PFNA)	0.00001	mg/L	< 0.00001
Perfluorodecanoic acid (PFDA)	0.00001	mg/L	< 0.00001
Perfluoroundecanoic acid (PFUnA)	0.00001	mg/L	< 0.00001
Perfluorododecanoic acid (PFDoA)	0.00001	mg/L	< 0.00001
Perfluorotridecanoic acid (PFTrDA)	0.00001	mg/L	< 0.00001
Perfluorotetradecanoic acid (PFTeDA)	0.00001	mg/L	< 0.00001
Perfluorooctane sulfonamide (FOSA)	0.00005	mg/L	< 0.00005
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	0.00005	mg/L	< 0.00005
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	0.00005	mg/L	< 0.00005
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTS)	0.00001	mg/L	< 0.00001
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS)	0.00005	mg/L	< 0.00005
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS)	0.00001	mg/L	< 0.00001
D5-N-EtFOSAA (surr.)	1	%	31
13C5-PFHxA (surr.)	1	%	117
13C8-PFOS (surr.)	1	%	95
pH	0.1	pH Units	8.3
Total Dissolved Solids	10	mg/L	1000

Sample History

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

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

Description	Testing Site	Extracted	Holding Time
Per- and Polyfluorinated Alkyl Substances (PFASs)	Brisbane	Jan 31, 2017	14 Day
- Method: LTM-ORG-2100 Per- and Polyfluorinated Alkyl Substances by LC-MS/MS			
pH	Melbourne	Jan 30, 2017	0 Hours
- Method: LTM-GEN-7090 pH in water by ISE			
Total Dissolved Solids	Melbourne	Jan 30, 2017	7 Day
- Method: LM-LTM-INO-4110 (Total Dissolved Solids @ 178°C - 182°C)			

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Melbourne
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Site # 1254 & 14271

Sydney
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Lane Cove West NSW 2066
Phone : +61 2 9900 8400
NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
Murarrie QLD 4172
Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 18217

Company Name:	GHD Pty Ltd VIC	**Order No.:**		**Received:**	Jan 27, 2017 3:56 PM
Address:	Level 8, 180 Lonsdale St Melbourne VIC 3000	**Report #:** **Phone:** **Fax:**	531947 8687 8000 8687 8111	**Due:** **Priority:** **Contact Name:**	Feb 3, 2017 5 Day Courtney Wines
Project Name:	DENILIQUIN PFAS INVESTIGATION				

Eurofins | mgt Analytical Services Manager : Mary Makarios

Sample Detail						pH	Total Dissolved Solids	Per- and Polyfluorinated Alkyl Substances (PFASs)
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794								X
Perth Laboratory - NATA Site # 18217								
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	FS01	Jan 24, 2017		Water	M17-Ja16913	X	X	X
Test Counts						1	1	1

Internal Quality Control Review and Glossary

General

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

Holding Times

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

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

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

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

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

Units

mg/kg: milligrams per Kilogram

ug/l: micrograms per litre

ppb: Parts per billion

org/100ml: Organisms per 100 millilitres

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

mg/l: milligrams per litre

ppm: Parts per million

%: Percentage

NTU: Nephelometric Turbidity Units

Terms

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

QC - Acceptance Criteria

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

Results <10 times the LOR : No Limit

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

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

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs 20-130%

QC Data General Comments

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

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Per- and Polyfluorinated Alkyl Substances (PFASs)							
Perfluorobutanesulfonic acid (PFBS)	mg/L	< 0.00001			0.00001	Pass	
Perfluorobutanoic acid (PFBA)	mg/L	< 0.00005			0.00005	Pass	
Perfluorohexanesulfonic acid (PFHxS)	mg/L	< 0.00001			0.00001	Pass	
Perfluorooctanesulfonic acid (PFOS)	mg/L	< 0.00001			0.00001	Pass	
Perfluorodecanesulfonic acid (PFDS)	mg/L	< 0.00001			0.00001	Pass	
Perfluoropentanoic acid (PFPeA)	mg/L	< 0.00001			0.00001	Pass	
Perfluorohexanoic acid (PFHxA)	mg/L	< 0.00001			0.00001	Pass	
Perfluoroheptanoic acid (PFHpA)	mg/L	< 0.00001			0.00001	Pass	
Perfluorooctanoic acid (PFOA)	mg/L	< 0.00001			0.00001	Pass	
Perfluorononanoic acid (PFNA)	mg/L	< 0.00001			0.00001	Pass	
Perfluorodecanoic acid (PFDA)	mg/L	< 0.00001			0.00001	Pass	
Perfluoroundecanoic acid (PFUnA)	mg/L	< 0.00001			0.00001	Pass	
Perfluorododecanoic acid (PFDoA)	mg/L	< 0.00001			0.00001	Pass	
Perfluorotridecanoic acid (PFTrDA)	mg/L	< 0.00001			0.00001	Pass	
Perfluorotetradecanoic acid (PFTeDA)	mg/L	< 0.00001			0.00001	Pass	
Perfluorooctane sulfonamide (FOSA)	mg/L	< 0.00005			0.00005	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	mg/L	< 0.00005			0.00005	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	mg/L	< 0.00005			0.00005	Pass	
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTS)	mg/L	< 0.00001			0.00001	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS)	mg/L	< 0.00005			0.00005	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS)	mg/L	< 0.00001			0.00001	Pass	
Method Blank							
Total Dissolved Solids	mg/L	< 10			10	Pass	
LCS - % Recovery							
Per- and Polyfluorinated Alkyl Substances (PFASs)							
Perfluorobutanesulfonic acid (PFBS)	%	78			50-150	Pass	
Perfluorobutanoic acid (PFBA)	%	102			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	%	80			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	%	106			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	%	50			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	%	73			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	%	103			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	%	84			50-150	Pass	
Perfluorooctanoic acid (PFOA)	%	103			50-150	Pass	
Perfluorononanoic acid (PFNA)	%	94			50-150	Pass	
Perfluorodecanoic acid (PFDA)	%	78			50-150	Pass	
Perfluoroundecanoic acid (PFUnA)	%	61			50-150	Pass	
Perfluorododecanoic acid (PFDoA)	%	50			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	%	51			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	%	52			50-150	Pass	
Perfluorooctane sulfonamide (FOSA)	%	73			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	%	58			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	%	56			50-150	Pass	
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTS)	%	59			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS)	%	101			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS)	%	64			50-150	Pass	
LCS - % Recovery							
Total Dissolved Solids	%	98			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Per- and Polyfluorinated Alkyl Substances (PFASs)				Result 1					
Perfluorobutanesulfonic acid (PFBS)	S17-Ja09699	NCP	%	96			50-150	Pass	
Perfluorobutanoic acid (PFBA)	S17-Ja09699	NCP	%	96			50-150	Pass	
Perfluorohexanesulfonic acid (PFHxS)	S17-Ja09699	NCP	%	103			50-150	Pass	
Perfluorooctanesulfonic acid (PFOS)	S17-Ja09699	NCP	%	100			50-150	Pass	
Perfluorodecanesulfonic acid (PFDS)	S17-Ja09699	NCP	%	51			50-150	Pass	
Perfluoropentanoic acid (PFPeA)	S17-Ja09699	NCP	%	92			50-150	Pass	
Perfluorohexanoic acid (PFHxA)	S17-Ja09699	NCP	%	92			50-150	Pass	
Perfluoroheptanoic acid (PFHpA)	S17-Ja09699	NCP	%	109			50-150	Pass	
Perfluorooctanoic acid (PFOA)	S17-Ja09699	NCP	%	96			50-150	Pass	
Perfluorononanoic acid (PFNA)	S17-Ja09699	NCP	%	119			50-150	Pass	
Perfluorodecanoic acid (PFDA)	S17-Ja09699	NCP	%	86			50-150	Pass	
Perfluoroundecanoic acid (PFUnA)	S17-Ja09699	NCP	%	70			50-150	Pass	
Perfluorododecanoic acid (PFDoA)	S17-Ja09699	NCP	%	52			50-150	Pass	
Perfluorotridecanoic acid (PFTrDA)	S17-Ja09699	NCP	%	54			50-150	Pass	
Perfluorotetradecanoic acid (PFTeDA)	S17-Ja09699	NCP	%	61			50-150	Pass	
Perfluorooctane sulfonamide (FOSA)	S17-Ja09699	NCP	%	64			50-150	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	S17-Ja09699	NCP	%	53			50-150	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	S17-Ja09699	NCP	%	52			50-150	Pass	
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTS)	S17-Ja09699	NCP	%	81			50-150	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS)	S17-Ja09699	NCP	%	90			50-150	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS)	S17-Ja09699	NCP	%	63			50-150	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Per- and Polyfluorinated Alkyl Substances (PFASs)				Result 1	Result 2	RPD			
Perfluorobutanesulfonic acid (PFBS)	B17-Fe04499	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Perfluorobutanoic acid (PFBA)	B17-Fe04499	NCP	mg/L	< 0.00005	< 0.00005	<1	30%	Pass	
Perfluorohexanesulfonic acid (PFHxS)	B17-Fe04499	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Perfluorooctanesulfonic acid (PFOS)	B17-Fe04499	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Perfluorodecanesulfonic acid (PFDS)	B17-Fe04499	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Perfluoropentanoic acid (PFPeA)	B17-Fe04499	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Perfluorohexanoic acid (PFHxA)	B17-Fe04499	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Perfluoroheptanoic acid (PFHpA)	B17-Fe04499	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Perfluorooctanoic acid (PFOA)	B17-Fe04499	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Perfluorononanoic acid (PFNA)	B17-Fe04499	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Perfluorodecanoic acid (PFDA)	B17-Fe04499	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Perfluoroundecanoic acid (PFUnA)	B17-Fe04499	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Perfluorododecanoic acid (PFDoA)	B17-Fe04499	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Perfluorotridecanoic acid (PFTrDA)	B17-Fe04499	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Per- and Polyfluorinated Alkyl Substances (PFASs)				Result 1	Result 2	RPD			
Perfluorotetradecanoic acid (PFTeDA)	B17-Fe04499	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Perfluorooctane sulfonamide (FOSA)	B17-Fe04499	NCP	mg/L	< 0.00005	< 0.00005	<1	30%	Pass	
N-ethyl-perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	B17-Fe04499	NCP	mg/L	< 0.00005	< 0.00005	<1	30%	Pass	
N-methyl-perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	B17-Fe04499	NCP	mg/L	< 0.00005	< 0.00005	<1	30%	Pass	
1H.1H.2H.2H-perfluorohexanesulfonic acid (4:2 FTS)	B17-Fe04499	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS)	B17-Fe04499	NCP	mg/L	< 0.00005	< 0.00005	<1	30%	Pass	
1H.1H.2H.2H-perfluorodecanesulfonic acid (8:2 FTS)	B17-Fe04499	NCP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
pH	M17-Ja16351	NCP	pH Units	7.5	7.5	pass	30%	Pass	
Total Dissolved Solids	M17-Ja16326	NCP	mg/L	9400	-9052440	<1	30%	Pass	

Comments

Sample Integrity

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

Qualifier Codes/Comments

Code	Description
N09	Quantification of linear and branched isomers has been conducted as a single total response using the relative response factor for the corresponding linear/branched standard.

Authorised By

Mary Makarios	Analytical Services Manager
Huong Le	Senior Analyst-Inorganic (VIC)
Jonathon Angell	Senior Analyst-Organic (QLD)

Glenn Jackson
National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

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

Measurement uncertainty of test data is available on request or please click here.

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 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 1 Summary of quality assurance / quality control criteria for groundwater

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

Data quality indicator	Frequency	Data quality acceptance criteria
		Some exceptions to these holding times are listed below ([1])
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		

[1] Holding times with exception to the above include:

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.
  - Low flow pump: The low flow sampling equipment was provided by the equipment supplier 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. 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.
- Inter laboratory duplicate: Inter duplicates provide an indication of the repeatability of the results between laboratories.

Table 2 Quality control (QC) sampling frequency

Sample	Recommended sampling rate	Media	No. QC samples	No. of primary samples	Total
Intra	1/10 samples	Soil and sediment	2	25	29
Inter	1/10 samples		2		
Intra	1/10 samples	Water	2	6	9
Inter	1/10 samples		1		

All quality control sampling frequency criteria were met during this investigation.

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 3.

Table 3 Analysed quality control (QC) samples

Primary sample	Duplicate type	QC sample laboratory ID	QC sample field ID	Date sampled	Lab report number	Matrix
SB01_1.0	Intra	EM1614608-023	FD02	30/11/2016	EM1614608	Soil
SB04_2.0	Intra	EM1614608-031	FD03	30/11/2016	EM1614608	Soil
SB01_1.0	Inter	EM1614608-023	FS02	30/11/2016	526459	Soil
SB04_2.0	Inter	EM1614608-031	FS03	30/11/2016	526459	Soil
SW03	Intra	EM1614608-010	FD01	29/11/2016	EM1614608	Surface water
MW01	Intra	EM1700781-001	FD01	24/01/2017	EM1700781	Ground water
SW03	Inter	EM1614608-010	FS01	29/11/2016	EM1614608	Surface water

RPD exceedances were reported during this investigation.

FD02 – Primary sample SB01_1.0 - Perfluorohexane sulfonic acid (PFHxS) 84%
Perfluorooctane sulfonic acid (PFOS) 128%

FD03 – Primary sample SB04_2.0 - Perfluorobutane sulfonic acid 50%
Perfluoropentanoic acid 53%
Perfluoropentane sulfonic acid 149%
Perfluorohexanoic acid (PFHxA) 104%
Perfluorooctane sulfonic acid (PFOS) 176%

FS02 – Primary sample SB01_1.0 – total organic carbon 57%
Perfluorooctane sulfonic acid (PFOS) 127%

FS03 – Primary sample SB04_2.0 – Perfluorohexanoic acid (PFHxA) 90%
Perfluorooctane sulfonic acid (PFOS) 80%

FS01 – Primary sample SW03 – Perfluorohexane sulfonic acid (PFHxS) 53%
Perfluorohexanoic acid (PFHxA) 91%

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 4.

Table 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 5.

Table 5 Summary of outliers

Laboratory report	Quality Control Sample	Analytes	Sample Code	Results	Comment
EM1614308	Matrix Spike	Perfluorooctane sulfonic acid (PFOS)	EM1614608-001	not determined	MS recovery not determined, background level greater than or equal to 4x spike level
		6:2 Fluorotelomer sulfonic acid (6:2 FTS)			
		Perfluorooctane sulfonic acid (PFOS)	EM1614608-008		
	Frequency of quality control samples	Total metals			
EM1700781	Matrix Spike	Perfluorobutane sulfonic acid (PFBS)	EM1700773-001	not determined	MS recovery not determined, background level greater than or equal to 4x spike level
		Perfluoropentane sulfonic acid (PFPeS)			
		Perfluorohexane sulfonic acid (PFHxS)			
		Perfluorooctane sulfonic acid (PFOS)			
		Perfluoropentanoic acid (PFPeA)			
		Perfluorohexanoic acid (PFHxA)			
ES17001175	Matrix Spike	Perfluorohexane sulfonic acid (PFHxS)	ES1700845-003	not determined	MS recovery not determined, background level greater than or equal to 4x spike level
		Perfluorooctane sulfonic acid (PFOS)			
		Perfluorooctane sulfonic acid (PFOS)	ES1701175-012		
526459-S	Matrix Spike	Zinc	M16-De03611	51% (75-125)	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control

Laboratory report	Quality Control Sample	Analytes	Sample Code	Results	Comment
					sample indicating a sample matrix interference
	Duplicate	Perfluorooctane sulfonic acid (PFOS)	M16-De05163	44 % (30%)	The RPD reported passes Eurofins | mgt's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.
529080-S	Matrix Spike	Lead	M16-De22472	126 % (75-125)	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix Interference
		Mercury		133 (70-130)	
	Duplicate	Zinc	M16-De22471	39% (30%)	The RPD reported passes Eurofins | mgt's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.
ES1701294	Matrix Spike	Perfluorooctane sulfonic acid (PFOS)	ES1701294-001	not determined	MS recovery not determined, background level greater than or equal to 4x spike level

Sample holding times

In laboratory report EM1614608, four water samples exceeded the holding times for pH by 7 days. Major cations analysis was also exceeded by 1 day.

Laboratory report EM1700781, four water samples exceeded the holding times for pH by 6 days.

These are both field parameters and not the main COPCs and therefore these holding time exceedances do not impact the outcomes of the investigation.

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 3, 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). 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 – Survey Results

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postal: p.o box 182 keilor victoria, 3036
tel: 03 9310 5865 or 03 9310 5875 - fax: 03 9310 5920

CLIENT: GHD
CONTACT: James Lean
SITE: NSW Fire and Rescue - Macknight Drv Deniliquin
DATUM: MGA/AHD
SURVEYOR: R.Kuzman **Last Surveyed:** 22/02/2017

Well	Easting	Northing	TOC Level	Cover/Ground Level
MW01	313820.797	6063782.963	93.688	93.770
MW02	313742.547	6063752.260	92.682	92.780
MW03	313776.952	6063695.994	92.810	92.890
TBM Tie - In				
PM25244	314112.427	6063596.025	94.268	

Regards,

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Document Status

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1	N. Rosen	J Hallchurch		J Hallchurch		27/04/2017

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