18 October 2017

Radu Dumitru
Head of Risk Management and Internal Audit
Coal Services Pty Ltd
Level 21, 444 Market Street
SYDNEY NSW 2000

Our ref: 2219058
Your ref:

Dear Radu

PFAS Contamination Assessment - Summary Report
Hunter Valley Mines Rescue Facility, Singleton Heights

1 Introduction

GHD Pty Ltd (GHD) was engaged to assess the potential for per- and poly-fluoroalkyl substances (PFAS) contamination at the Hunter Valley Mines Rescue Facility located at 6 Lachlan Avenue, Singleton Heights NSW 2330 (the Site). The Site location and site layout is presented in Figures 1 and 2, Attachment A.

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

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

In May 2017, Mines Rescue completed targeted environmental investigations at the Site which included a desktop review of available information, site inspection and targeted shallow soil sampling (Senversa, 2017). Results identified PFAS in shallow soils at the Site, with leachate analysis indicating the propensity of PFAS to leach into solution and potentially affecting underlying groundwater and adjoining surface water bodies.

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

GHD completed a desktop review and intrusive site investigations between June and September 2017. Details of the works undertaken and the outcomes of the instigations are presented in GHD's report *Hunter Valley Mines Rescue Facility, Singleton Heights PFAS Contamination Assessment, October 2017.*

This letter provides a summary of the findings of the investigations completed by GHD and should be read in conjunction with the GHD (2017) report and the limitations presented in Section 10 of this letter report.

2 Objectives and scope of works

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

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

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

The scope of work comprised:

- Desktop review of available information including the Senversa 2017 report
- Site inspection and interviews with site personnel to gain an understanding of current site conditions, ground truth information obtained during the desktop review and to understand historical training practices at the Site
- Drilling and installation of three on-site groundwater wells (MW01 to MW03) and collection of six soil samples from the borehole locations
- Collection of one sediment sample from on-site trade waste water collection pit (Pit 1) and five sediment samples from the down gradient stormwater corridor off site (Swale 1 to Swale 4 and Bridge 1)
- Collection of two water samples from on-site trade waste water collection pits/tanks (Pit 1 and Tank 2) and two from the down gradient stormwater pits off site (Swale 03 and Swale 04)
- Collection of groundwater samples from the three installed groundwater wells (MW01 to MW03)
- Preparation of a report summarising the findings of the desktop review and intrusive investigations (GHD, 2017)

3 Site history

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

GHD understands that AFFF was in general use for fire fighting training at Mines Rescue facilities from the 1970's until AFFF were banned by Mines Rescue and their use discontinued by 2002. Based on conversations with site personnel, GHD understands that the majority of training exercises were undertaken within three main areas of the site including the western portion (in the location of the former tennis courts), the north western corner (in the region storing old mining infrastructure) and the central northern portion (where the fire cell is currently being refurbished). Water runoff from the fire training cell was collected into a polyethylene tank and disposed of off site by a liquid disposal subcontractor.

4 Sampling program and rationale

The sampling program was based on the preliminary Conceptual Site Model (CSM) which was developed based on the findings of the desktop review (GHD, 2017). Table 4-1 summarises the sampling program and rationale. In summary, the following activities were conducted in August 2017:

- 16 August 2017 – installation of three new groundwater wells and associated soil sampling (MW01 to MW03)
- 21 August 2017 – Sampling of sediment from on-site trade waste water collection pit (Pit 1) and sampling of water from on-site trade waste water collection pits and holding tank (Pit1, Tank 2)
- 28 August 2017 – groundwater sampling of all monitoring wells (MW01 to MW03), drainage line sampling from five locations (Swale 1 to 04, Bridge 1), surface water off site (Swale 3 and Swale 4)

Sample locations are presented in Figures 3 and 3a, Attachment A.

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

Table 4-1 Sampling program

Matrix	Monitoring location		Rationale	Number of samples	Laboratory analysis *
	ID	Location description			
Soil	MW01	Within area of PFAS application	Assess potential PFAS soil impacts	2	PFAS, ASLP – PFAS (2 samples with highest concentrations)
	MW02			2	
	MW03			2	

Matrix	Monitoring location		Rationale	Number of samples	Laboratory analysis *
	ID	Location description			
Groundwater	MW01	Sampling of newly installed groundwater wells	Assess PFAS impacts on-site. Confirm groundwater flow direction.	1	PFAS
	MW02			1	
	MW03			1	
Soil and sediment	Swale 1 – Swale 4 Bridge 1 Pit 1	In drainage line adjacent to and down gradient of the training areas Sediment from trade waste water collection pit (Pit 1)	Delineate PFAS concentration in soil within drainage pits and over an increasing distance from the site.	6	PFAS ASLP – PFAS (2 samples with highest concentrations)
Surface water	Swale 3 – 4 Pit 1 Tank 2	Collection of water samples from down gradient drainage line and from on-site trade waste water collection pits and holding tank	Assess PFAS concentrations in surface water within drainage pits on-site and down gradient from the site.	4	PFAS

* - PFAS = full suite

5 Results

Analytical results and field parameters are summarised in the following tables in Attachment B:

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

5.1 Soil and sediment results

A summary of the soil and sediment[1] results are presented in Table 5-1 and Figure 4, Attachment A.

Table 5-1 Summary soil analytical results

	On-site	Off-site
Human health investigation levels	On-site soil samples reported a maximum concentration of PFOS+PFHxS of 0.973 mg/kg, which is several orders of magnitude below the health based investigation level of 20 mg/kg. PFOA reported a maximum concentration of 0.023 mg/kg in on-site soils, which is several orders of magnitude below the health based investigation level of 100 mg/kg.	Off-site samples collected from drainage lines down-gradient of the site reported a maximum concentration of PFOS+PFHxS of 0.0035 mg/kg. Concentrations of PFOA were below the laboratory limit of reporting. Potential for human exposure to off-site soils in drainage lines is considered to be low however it is noted that the concentrations were lower than those reported on-site and orders of magnitude below all human health based investigation levels.
Ecological investigation levels	PFOS was reported at a maximum concentration of 0.911 mg/kg in on-site soils, with samples collected from MW02, MW03 and Pit 1 exceeding the ESL (indirect) of 0.14 mg/kg.	All off-site samples collected from the drainage line down-gradient of the site reported concentrations of PFOS below the nominated ecological screening levels.

5.2 Groundwater and surface water results

A summary of the groundwater and surface water results is presented in Table 5-2 and in Figure 6. Groundwater contours are presented in Figure 5.

[1] sediment samples collected from the internal drainage system on-site and drainage lines leaving the site have been classified as soils for the purpose of data interpretation and comparison with available guidelines.

Table 5-2 Summary groundwater and surface water results

	On-site	Off-site
Groundwater data		
Drinking water guidelines	**PFHxS + PFOS:** Concentration of 1.4 µg/L reported in MW03, exceeding the drinking water criteria of 0.07 µg/L Concentrations in groundwater at MW01 and MW02 were at or below the laboratory LOR **PFOA:** In all instances, concentrations of PFOA were below the drinking water criteria of 0.56 µg/L	*Not applicable – off-site groundwater samples not collected during these works.*
Ecological guidelines	**PFOS:** Reported at a concentration of 0.95 µg/L in MW03, exceeding the ecological screening level of 0.13 µg/L) Concentrations in groundwater at MW01 and MW02 were at or below the laboratory LOR **PFOA:** Reported below the ecological screening level (220 µg/L) in all on-site groundwater samples	*Not applicable – off-site groundwater samples not collected during these works.*
	Trade waste water collection system data	Stormwater system data
Drinking water guidelines (a)	**PFHxS+PFOS:** Reported in surface water at locations Pit 1 and Tank 2 at concentrations of 29.6 µg/L and 5.82 µg/L respectively, exceeding the drinking water criteria of 0.07 µg/L **PFOA:** Reported in surface water at locations Pit 1 and Tank 2 at concentrations of 4.54 µg/L and 1.51 µg/L respectively , exceeding the drinking water criteria of 0.56 µg/L	**PFHxS+PFOS:** Reported in off-site surface water at locations Swale 03 and Swale 04 at concentrations of 0.96 µg/L and 1.52 µg/L respectively, exceeding the drinking water criteria of 0.07 µg/L. **PFOA:** Reported below the drinking water criteria (0.56 µg/L) in both off-site surface water samples.

	On-site	Off-site
Ecological guidelines	**PFOS:** Reported in surface water at locations Pit 1 and Tank 2 at concentrations of 23.2 µg/L and 3.3 µg/L respectively, exceeding the ecological screening level of 0.13 µg/L **PFOA:** Reported below the ecological screening level (220 µg/L) in both on-site surface water samples	**PFOS:** Reported in surface water at locations Swale 03 and Swale 04 at concentrations of 0.74 µg/L and 1.27 µg/L respectively, exceeding the ecological screening level of 0.13 µg/L. **PFOA:** Reported below the ecological screening level (220 µg/L) in both off-site surface water samples.

6 Discussion

Table 6-1 and Table 6-2 presents a discussion results reported during this investigation.

Table 6-1 Summary discussion – soil and sediment results

Media	Summary discussion
Soils on site	Human health: No on-site soil samples reported PFAS concentrations exceeding the nominated screening criteria for human health. Ecological receptors: Soil samples collected from monitoring wells MW02 and MW03 reported concentrations of PFOS above the indirect ecological screening criteria for commercial/industrial land use. Samples were collected from monitoring well locations towards the northern boundary of the Site, in the area where GHD understands training has historically been conducted. Concentrations at MW02 were found to decrease marginally with depth, however at MW03, underlying soils samples from a depth of 0.35 – 0.5 metres reported a concentration of PFOS which was marginally higher than the surface sample suggesting that PFOS is likely migrating through surface soils. The vertical extent of PFOS was not confirmed during this stage of works and underlying samples have not yet been analysed at the time of issue of this report but are on hold at the project laboratory for further analyses. It is unlikely however that PFAS if present at depths greater than 0.5 m would present an ecological hazard.

Media	Summary discussion
Sediment samples in on site trade waste water collection pit	One sediment sample was collected from on-site trade waste water collection pit (Pit 1). Human health: Concentrations of PFAS were below nominated health based investigation levels for contaminants of concern. Ecological receptors: PFOS was reported above the indirect ecological screening criteria for commercial/industrial land use. The sample was collected from the on-site trade waste water system and the potential for ecological communities to be sustained within this system is considered to be low. Sediment sample Pit 1 was selected for ASLP and PFAS was reported in the resultant leachate sample. The presence of PFAS in leachate sample Pit 1 indicates the propensity for PFAS to leach into solution from sediments entrapped within infrastructure on the Site and potentially discharge to sewer. However, GHD has been advised by Mines Rescue that the fire training gallery has been inoperative since 2013 and the sediment collected from this location have been detained within a closed circuit during this time and has not been discharged to sewer as part of the trade waste system.
Sediment samples in surface water drainage lines down-gradient of the site	Concentrations in PFAS in sediments were generally low or below the laboratory LOR. Whilst the data indicates that PFAS has migrated off-site, in all instances, PFAS concentrations were orders of magnitude lower than those reported on-site and were reported below both the health based and ecological investigation levels for the individual contaminants of potential concern. Further, the potential for human exposure to sediments within the stormwater drainage lines leading from the site is considered to be low.

Table 6-2 Summary discussion – Groundwater and surface water

Media	Summary discussion
Groundwater on site	Based on observations made on site, local topography and survey data, groundwater would be expected to flow in a general north-easterly direction. MW03 reported a concentration of PFHxS + PFOS which exceeded the nominated drinking water criteria. However, no extraction of groundwater for drinking purposes takes place on site and there is no potential pathway for exposure to PFAS in groundwater for site users. Concentrations of PFOS were above the ecological screening levels in groundwater sampled from MW03.

Media	Summary discussion
Groundwater – potential for off-site migration	MW03 is located at the central northern boundary of the site, in the approximate vicinity of where former training activities were completed. Groundwater is understood to flow in a general north easterly direction, meaning PFAS impacted groundwater may be migrating off site at concentrations which exceed the drinking water criteria and ecological screening levels. GHD notes that no registered groundwater wells were identified within 1 km down gradient of the site. However, the potential for unregistered bores cannot be discounted. The salinity of the groundwater is likely to preclude use of the water for most beneficial purposes including stock, irrigation and drinking. In regards to the ecological screening levels, no major surface water receptor was identified down-gradient of the site where groundwater recharge to surface water may occur. The potential risk to ecological receptors associated with PFAS in groundwater is considered to be low.
Surface water in on-site drainage systems discharging to stormwater	Human Health: Whilst concentrations were reported above the drinking water criteria, incidental contact with surface water in the drains would not be expected to present an increased risk of adverse health effects. Ecological receptors: The concentration of PFOS was reported above the ecological investigation levels. However, the infrastructure sample locations are not considered to represent an environment suitable for aquatic ecosystems and ecological risks associated with the presence of PFOS in on-site surface water are considered to be low.
Surface water in on-site trade waste water systems discharging to sewer	Human Health: Whilst concentrations were reported above the drinking water criteria, incidental contact with surface water in the trade waste water systems would not be expected to present an increased risk of adverse health effects. In addition, GHD has been advised by Mines Rescue, that the fire training gallery has been inoperative since 2013. Any water within Pit 1 and Tank 2 have been detained within a closed circuit during this time and has not been discharged to sewer as part of the trade water system. Ecological receptors: The concentration of PFOS was reported above the ecological investigation levels. However, the infrastructure sample locations are not considered to represent an environment suitable for aquatic ecosystems and ecological risks associated with the presence of PFOS in on-site surface water are considered to be low. In addition, as noted above, the water is detained in a closed circuit since 2013 and has not been discharged to sewer as part of the trade waste system.

Media	Summary discussion
Off-site surface water	Human Health: Whilst concentrations were reported above the drinking water criteria, incidental contact with surface water in the stormwater drains is considered unlikely (or infrequent for short duration) and the recorded concentrations of PFOS + PFHxS are not deemed to present a potential risk of exposure to humans. The surface water data is consistent with sediment data, which reported a decline in concentration with distance from the site. However, confirmation of this trend to allow for seasonal variation and wet weather events would be required. Ecological receptors: The concentration of PFOS reported in samples collected from the off-site drainage line were above the ecological investigation levels. The drainage lines are not true aquatic ecosystems and may be dry at times. The potential for establishment of aquatic ecosystems in these drainage lines is considered to be low.

7 Conceptual site model

Based on the information collected in August 2017, the CSM presented in Table 7-1 and Figure 7-1 was developed for potential on-site sources of contamination.

Table 7-1 Refined CSM

Potential Source	Primary pathway	Receptor	Pathway present?
Firefighting foams in the fire training areas	Incidental ingestion of impacted soils/sediments	Site staff, intrusive maintenance workers and visitors	No – Samples were collected from areas of potential concern and concentrations were reported below the nominated health based investigation levels in all soil and sediment samples.
	Vertical/ horizontal migration of leachate through unsaturated zone	On-site ecological communities	Possible – Some soil samples reported concentrations of PFOS exceeding the indirect ESL. Vegetation on-site appeared healthy and did not exhibit any undue signs of distress. However, the indirect ESL accounts for bioaccumulation potential, meaning that PFAS may persist through the food chain if organisms on-site are consumed by predatory species.

Potential Source	Primary pathway	Receptor	Pathway present?
	Surface runoff and sediment transport	On-site surface waters (including drainage systems – secondary source)	Yes – PFAS impact was reported in surface waters collected from on-site surface water infrastructure and drainage lines. Further consideration of potential linkage via secondary sources is presented below.
		Off-site surface waters	Possible – PFAS was reported in off-site surface water sampled from the drainage line down gradient of the site (further consideration of potential linkage via secondary sources is presented below).
SECONDARY SOURCES			
Secondary source - PFAS In surface Water	Incidental ingestion of PFAS impacted surface waters	Site staff and intrusive maintenance workers	Unlikely – whilst concentrations of PFAS were reported above the drinking water guidelines, site personnel are unlikely to come into contact with on-site surface water contained within stormwater infrastructure and drainage lines on a daily basis and the potential for incidental ingestion of this water is considered to be low.
		Users of surface water down-gradient of the site	Unlikely – whilst concentrations of PFAS were reported above the drinking water guidelines in off-site stormwater samples, personnel are unlikely to come into regular contact with surface water contained within stormwater infrastructure and drainage lines on a daily basis and the potential for incidental ingestion of this water is considered to be low.
		Ecological communities down-gradient of the site	Unlikely – whilst concentration of PFOS reported in samples collected from the off-site drainage line were above the ecological investigation levels, the drainage lines are not true aquatic ecosystems and are dry at times. The potential for establishment of aquatic ecosystems in these drainage lines and subsequent risk of exposure to PFAS in surface water is considered to be low.

Potential Source	Primary pathway	Receptor	Pathway present?
Secondary source – PFAS in groundwater	Vertical/ horizontal migration	Down-gradient surface water receptors recharged by groundwater	Unlikely – Whilst PFAS was reported in groundwater at concentrations above ecological screening criteria, based on review of surrounding water courses, it is unlikely that groundwater in the vicinity of the site would discharge to surface water receptors.
		Abstraction bore (domestic, irrigation and/or stock use	Unlikely – The area is serviced by municipal water supplies and no registered groundwater bores were identified within 1 km down gradient of the site. Whilst the potential for unregistered bores cannot be discounted, based on the concentrations of PFAS reported in groundwater at the site boundary, the potential for use of groundwater for domestic or stock purposes is considered to be low as the groundwater is too saline.

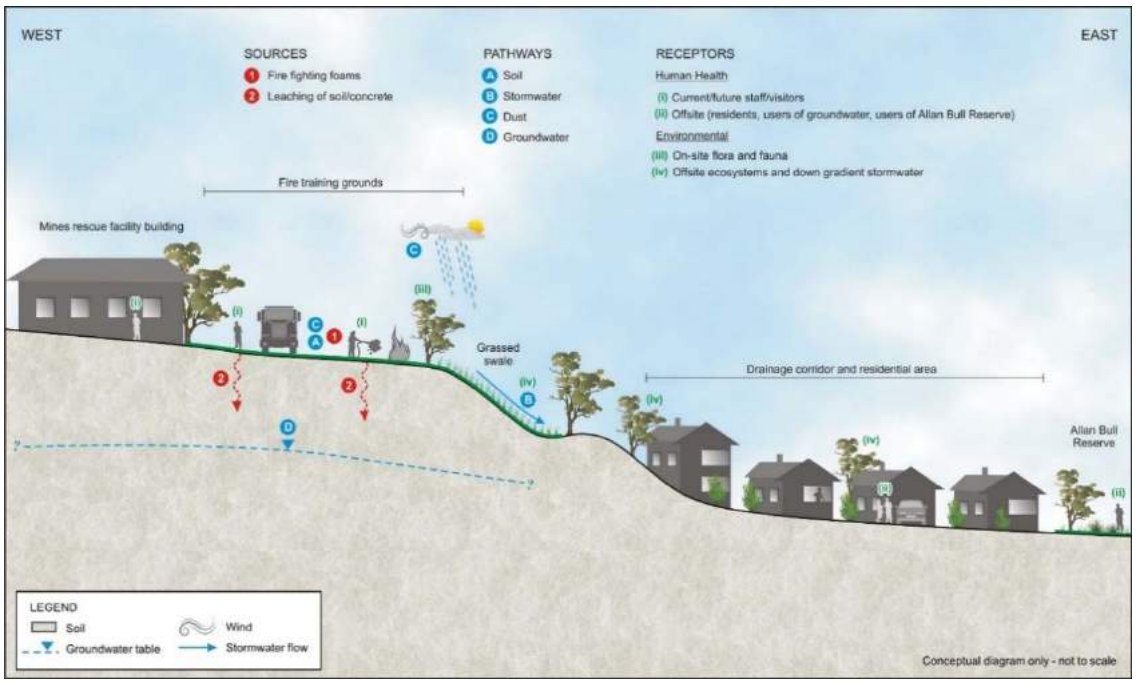


Figure 7-1 Conceptual Site Model

8 Conclusion

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

Objective 1: Potential for PFAS in Groundwater

- PFAS was reported in groundwater at concentrations exceeding the nominated drinking water and ecological investigation levels at one location along the northern boundary of the site (MW3).
- The inferred direction of groundwater flow appears to be in a general north easterly direction, meaning PFAS impacted water may be migrating off site at concentrations above the drinking water and ecological criteria.
- Whilst a complete pathway for migration of PFAS to groundwater was identified, groundwater is not extracted on-site and no registered groundwater bores were identified within 1 km down gradient of the site. Whilst the potential for unregistered bores cannot be discounted, GHD notes that the area is serviced by municipal water supply and the potential for ingestion of PFAS impacted groundwater based on the concentrations reported at the site boundary is considered to be low. The groundwater is also saline and would not be a suitable source for domestic, stock or irrigation purposes. However, further characterisation of groundwater down-gradient of the site should be undertaken to confirm groundwater concentrations off-site.
- In regards to the ecological screening levels, no major surface water receptor was identified down-gradient of the site where groundwater recharge to surface water may occur. The potential risk to ecological receptors associated with PFAS in groundwater is considered to be low.

Objective 2: PFAS In soils and sediments

- PFAS was reported in soil samples collected on-site however all samples reported PFAS concentrations which were below the nominated screening criteria for human health indicating that site soils do not present a risk to users of the site under the current land use scenario.
- Concentrations of PFOS were reported above the indirect ecological screening level in some soil samples collected on-site. Vegetation on-site appeared healthy and did not exhibit any undue signs of distress. However, the indirect Ecological Screening Level (ESL) accounts for bioaccumulation potential, meaning that PFAS may persist through the food chain if organisms on-site are consumed by predatory species.
- Concentrations of PFAS in the sediment sample collected from on-site trade waste water collection pit, Pit 1, were reported above the investigation levels for the protection of ecological receptors. The presence of PFAS in the resultant leachate from this sample indicates the potential for leaching of PFAS into solution from sediments entrapped within infrastructure on the site. However, given the trade waste system does not represent an environment suitable for aquatic ecosystems, ecological risks associated with the presence of PFAS is considered low. In addition, as advised by Mines Rescue, the sediments within this pit have been contained in a closed circuit since 2013 and have not been discharged as part of the trade waste system. Mines Rescue has committed to the controlled removal of the contaminated sediment, including consultation with Singleton Council and further monitoring is required before the system is reintroduced to service.

- Concentrations of PFAS in off-site sediments were generally low or below the laboratory limit of reporting and all samples reported concentrations below both human health and ecological receptors.

Objective 3 – PFAS in surface water

- Surface water flow is expected to follow the local topography on-site and flow towards the north east. Stormwater is managed by an onsite drainage system which discharges to the north east. A large drainage swale exists along the northern boundary of the site which acts as a method of surface water transport down gradient of the site.
- There are no surface water bodies located on-site. An unlined drainage system is located to the north of the site which drains water to the east towards Allan Bull Reserve approximately 700 m east of the Site. The Hunter River is located approximately 1.9 km south and south east of the Site.
- PFAS in surface water on-site:
  - PFAS was reported in surface water samples collected from the on-site pit (Pit 1) which discharges to trade waste. Whilst concentrations were reported above the drinking water criteria, incidental contact with water in this pit would not be expected to present an increased risk of adverse health effects.
  - PFOS in trade waste water collection pit sample Pit 1 (on-site) was reported above the ecological investigation levels. However, the infrastructure location was not considered to represent an environment suitable for aquatic ecosystems and ecological risks associated the presence of PFOS in on-site surface water are considered to be low. In addition, as advised by Mines Rescue, the water and sediments within this pit have been contained in a closed circuit since 2013 and have not been discharged as part of the trade waste system. Mines Rescue has committed to the controlled removal of the contaminated sediment, including consultation with Singleton Council and further monitoring is required before the system is reintroduced to service.
- PFAS in surface water off-site:
  - Off-site surface water samples reported PFAS concentrations above the drinking water criteria. However, noting the nature of these sampling locations being representative of a stormwater channel, incidental contact with surface waters in these drains is considered unlikely and reported concentrations of PFHxS + PFOS are not considered to present a potential risk of exposure to humans.
  - Off-site surface water data is consistent with sediment data, which reported a decline in concentration with distance from the site. However, confirmation of this trend to allow for seasonal variation and wet weather events would be required.

9 Recommendations

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

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

10 Limitations

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

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

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

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

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

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

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

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

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

Regards

Alison Monkley
Service Group Manager, Contamination Assessment and Remediation
+61 2 4979 9990

Attachments:

A – Figures

B – Results Summary Tables

Paper Size A4

0 25 50 75 100

Scale (metres)

LEGEND

Site boundary

N

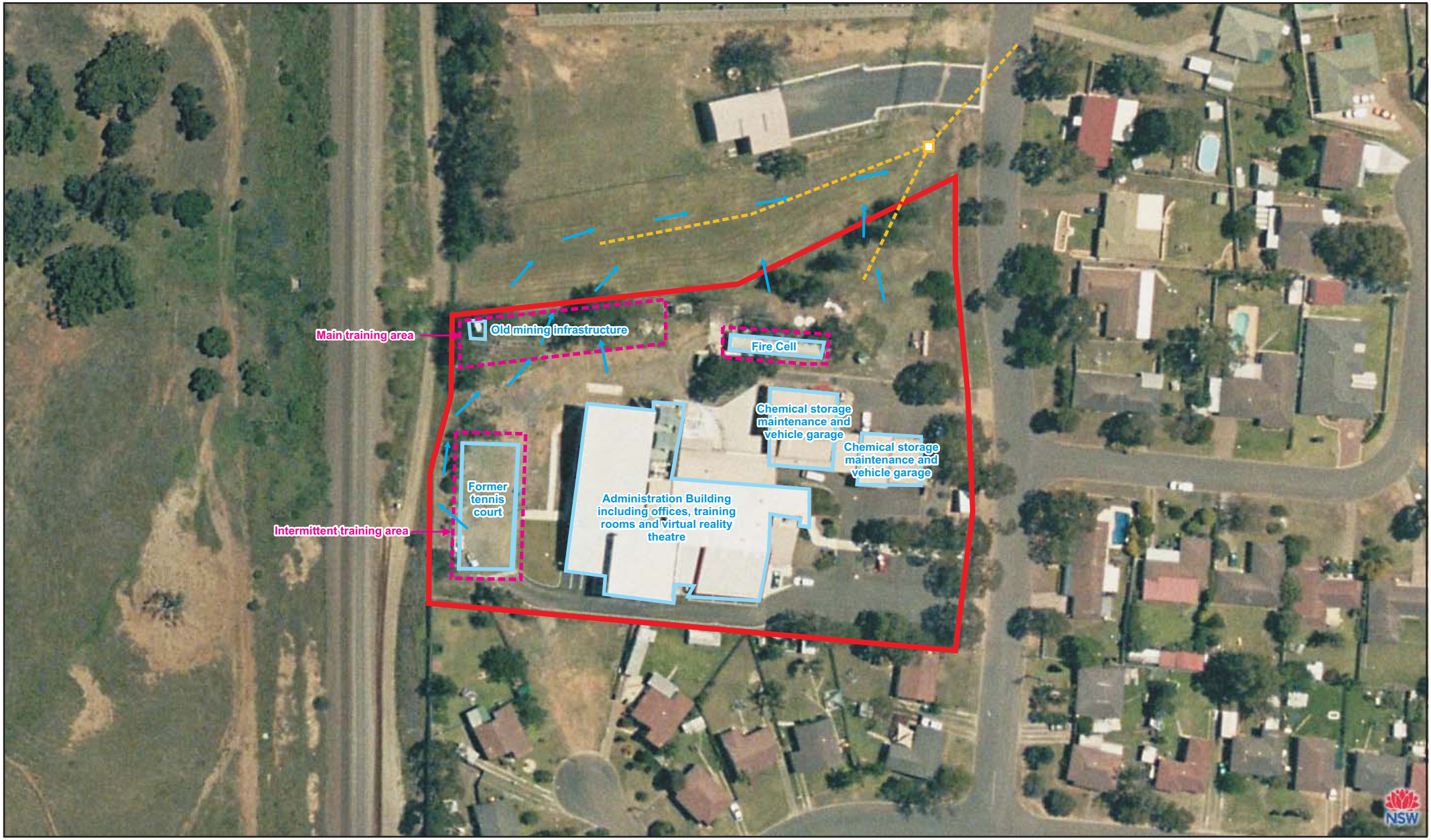
Mines Rescue Pty Ltd
Singleton Mines Rescue Station
6 Lachlan Avenue, Singleton Heights, NSW

Site Location

Job Number	22-19058
Revision	0
Date	11 Sep 2017

Figure 1

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



Paper Size A4

0 5 10 15 20

Scale (metres)

LEGEND

- Site boundary
- Surface water flow
- Stormwater pipework
- Stormwater pit
- Fire training areas

N

Mines Rescue Pty Ltd
Singleton Mines Rescue Station
6 Lachlan Avenue, Singleton Heights, NSW

Site Layout

Job Number	22-19058
Revision	0
Date	14 Oct 2017

Figure 2

GHD\Launceston\22\19058\2219058_LTN_02_Singleton.cdr

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

Paper Size A4

0 25 50 75 100

Scale (metres)

LEGEND

- Site boundary
- Down gradient stormwater corridor sampling location
- Groundwater monitoring location
- Water collection system sampling location

N

Mines Rescue Pty Ltd
Singleton Mines Rescue Station
6 Lachlan Avenue, Singleton Heights, NSW

Job Number 22-19058
Revision 0
Date 20 Sep 2017

Surrounding Area Sample Locations

Figure 3

GHD\Launceston\22\19058\2219058_LTN_03_Singleton.cdr

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

Paper Size A4

0 10 20 30

Scale (metres)

LEGEND

Site boundary

Groundwater monitoring location

Water collection system sampling location

N

Mines Rescue Pty Ltd
Singleton Mines Rescue Station
6 Lachlan Avenue, Singleton Heights, NSW

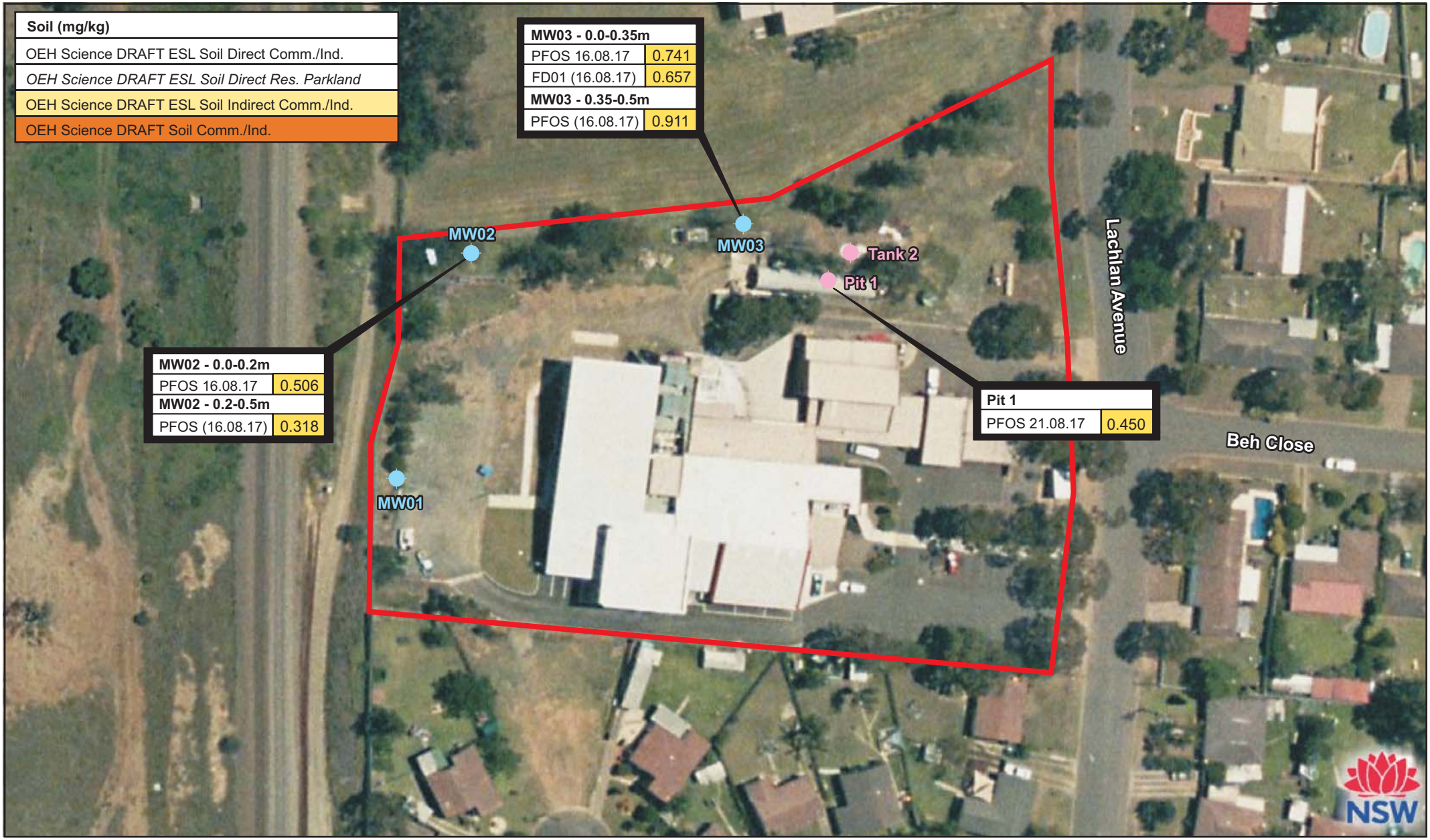
Sample Locations

Job Number	22-19058
Revision	0
Date	20 Sep 2017

Figure 3a

GHD\Launceston\22\19058\2219058_LTN_03a_Singleton.cdr

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



Paper Size A4

0 10 20 30

Scale (metres)

LEGEND

- Site boundary
- Groundwater monitoring location
- Water collection system sampling location

N

Mines Rescue Pty Ltd
Singleton Mines Rescue Station
6 Lachlan Avenue, Singleton Heights, NSW

Job Number	22-19058
Revision	0
Date	20 Sep 2017

Soil and Sediment Results Summary

Figure 4

GHD\Launceston\22\19058\2219058_LTN_04_Singleton.cdr

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

Paper Size A4

0 10 20 30

Scale (metres)

LEGEND

Site boundary

65.5 Groundwater contour

Groundwater monitoring location

Groundwater flow direction

N

Mines Rescue Pty Ltd
Singleton Mines Rescue Station
6 Lachlan Avenue, Singleton Heights, NSW

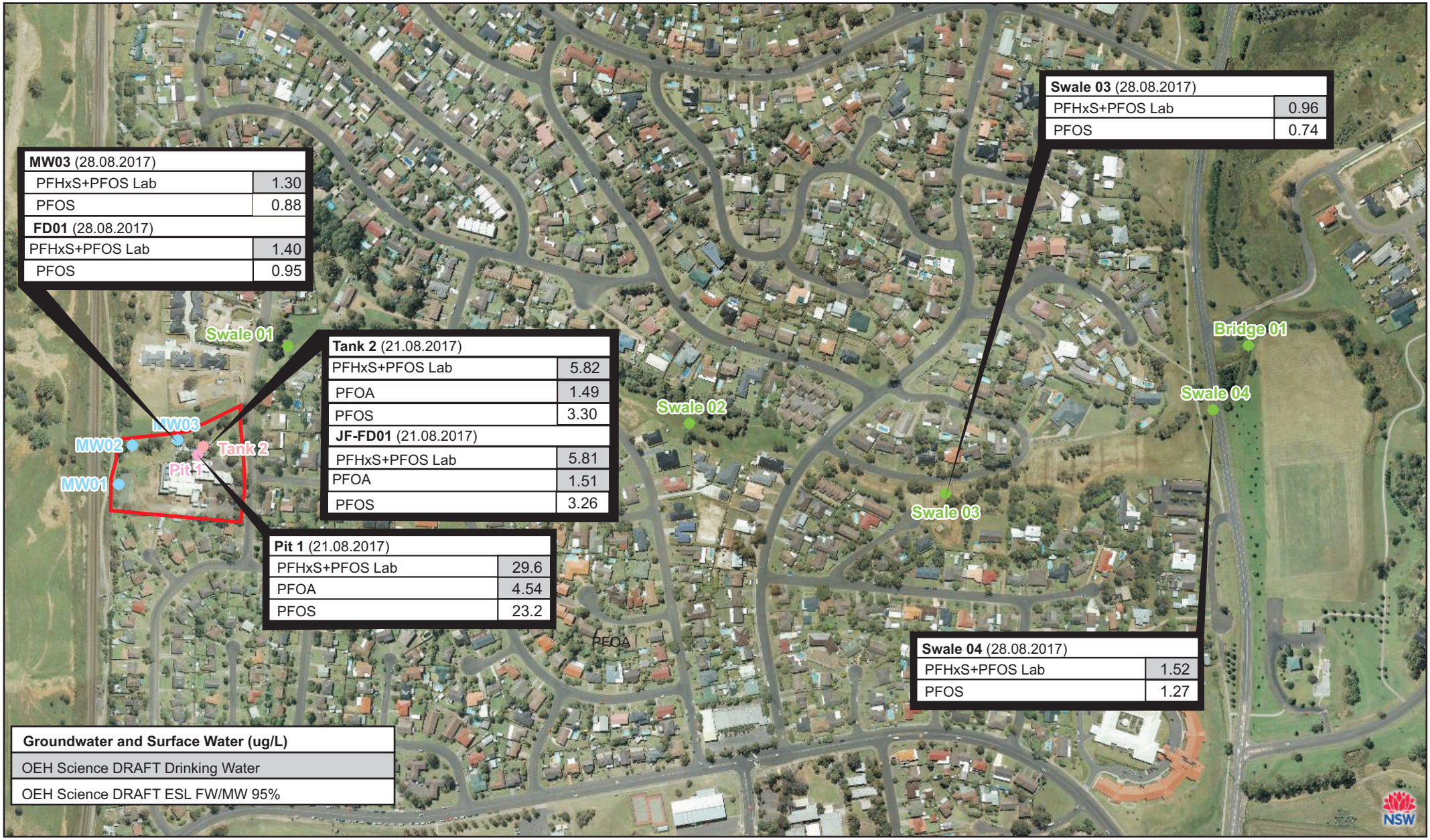
Groundwater Contours

Job Number	22-19058
Revision	0
Date	20 Sep 2017

Figure 5

GHD\Launceston\22\19058\2219058_LTN_05_Singleton.cdr

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



Paper Size A4

0 25 50 75 100

Scale (metres)

LEGEND

- Site boundary
- Down gradient stormwater corridor sampling location
- Groundwater monitoring location
- Water collection system sampling location

N

Mines Rescue Pty Ltd
Singleton Mines Rescue Station
6 Lachlan Avenue, Singleton Heights, NSW

Groundwater & Surface Water Results Summary

Job Number	22-19058
Revision	0
Date	20 Sep 2017

Figure 6

GHD\Launceston\22\19058\2219058_LTN_06_Singleton.cdr

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

Table A
Analytical Results Summary - Soil

		PFAS																
	% Moisture	N-Ethyl perfluorooctane sulfonamidoacetic acid	Perfluoroheptane sulfonic acid	Perfluorodecanesulfonic acid (PFDS)	10:2 Fluorotelomer sulfonic acid	4:2 Fluorotelomer sulfonic acid	Perfluorobutane sulfonic acid	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorohexane sulfonic acid (PFHxS)	PFHxS and PFOS (Sum of Total) - Lab Calc	Perfluoropentanoic acid	8:2 Fluorotelomer sulfonic acid	N-Ethyl perfluorooctane sulfonamide	N-Ethyl perfluorooctane sulfonamidoethanol	N-Methyl perfluorooctane sulfonamide	N-Methyl perfluorooctane sulfonamidoethanol	6:2 Fluorotelomer Sulfonate (6:2 FTS)
	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR	1	0.0002	0.0002	0.0002	0.0005	0.0005	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
OEH Science DRAFT ESL Soil direct Comm./Ind.																	
OEH Science DRAFT ESL Soil direct Res. Parkland																	
OEH Science DRAFT ESL Soil indirect Comm./Ind.																	
OEH Science DRAFT ESL Soil indirect Res. Parkland																	
OEH Science DRAFT Soil Comm/ Ind.										20							
Location Code	**Date/Time**	**Field ID**															
MW01	16-Aug-17	MW01_0.0-0.35	12.1	<0.0002	<0.0002	<0.0002	0.0031	<0.0005	<0.0002	<0.0002	0.0014	0.0078	0.0037	0.0059	<0.0005	<0.0005	<0.0005	<0.0005	0.0057
MW01	16-Aug-17	MW01_0.35-0.5	12.3	<0.0002	<0.0002	<0.0002	0.0021	<0.0005	<0.0002	<0.0002	0.0011	0.0046	0.0022	0.0041	<0.0005	<0.0005	<0.0005	<0.0005	0.0033
MW02	16-Aug-17	MW02_0.0-0.2	19.4	<0.0002	0.0054	0.0036	<0.0005	<0.0005	0.0062	<0.0002	0.0434	0.549	0.0068	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
MW02	16-Aug-17	MW02_0.2-0.5	17.8	<0.0002	0.0288	0.0004	<0.0005	<0.0005	0.0333	<0.0002	0.597	0.915	0.0112	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
MW03	16-Aug-17	MW03_0.0-0.35	10.7	0.0002	0.0053	0.0119	0.0089	<0.0005	0.0082	<0.0002	0.0502	0.791	0.0118	0.0140	<0.0005	<0.0005	<0.0005	<0.0005	0.0104
MW03	16-Aug-17	FD01	12.1	<0.0002	0.0039	0.0037	0.0018	<0.0005	0.0068	<0.0002	0.0413	0.698	0.0073	0.0011	<0.0005	<0.0005	<0.0005	<0.0005	0.0046
MW03	16-Aug-17	MW03_0.35-0.5	10.5	<0.0002	0.0064	0.0042	0.0012	<0.0005	0.0078	<0.0002	0.0619	0.973	0.0098	0.0026	<0.0005	<0.0005	<0.0005	<0.0005	0.0104
Onsite water collection system																			
PIT 1	21-Aug-17	PIT 1	69.2	<0.0002	0.0037	0.0025	0.0627	<0.0005	0.0011	<0.0002	0.0133	0.463	0.0035	0.594	<0.0005	<0.0005	<0.0005	<0.0005	0.137
Offsite soils within downgradient swale																			
Swale 01	28-Aug-17	SWALE 01	4.4	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	0.0015	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Swale 02	28-Aug-17	SWALE 02	3.0	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Swale 03	28-Aug-17	SWALE 03	3.7	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	0.0004	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Swale 04	28-Aug-17	SWALE 04	13.9	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0002	<0.0002	<0.0002	0.0008	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Bridge 01	28-Aug-17	BRIDGE 01	61.4	<0.0002	<0.0002	<0.0002	<0.0005	<0.0005	<0.0002	<0.0002	0.0007	0.0035	<0.0002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Table A
Analytical Results Summary - Soil

			PFAS (continued)														
			Perfluorooctanoic acid (PFOA)	Perfluoropentane sulfonic acid	Perfluorobutanoic acid	Perfluorodecanoic acid	Perfluorododecanoic acid	Perfluoroheptanoic acid	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctane sulfonamide (FOSA)	Perfluorotetradecanoic acid	Perfluorotridecanoic acid	Perfluoroundecanoic acid	PFAS (Sum of Total)	PFAS (Sum of Total)(WA DER List)
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR			0.0002	0.0002	0.001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0002	0.0002	0.0002	0.0002
OEH Science DRAFT ESL Soil direct Comm./Ind.			**48**								**60**						
OEH Science DRAFT ESL Soil direct Res. Parkland			*17*								*32*						
OEH Science DRAFT ESL Soil indirect Comm./Ind.											0.14						
OEH Science DRAFT ESL Soil indirect Res. Parkland											0.01						
OEH Science DRAFT Soil Comm/ Ind.			100														
Location Code	**Date/Time**	**Field ID**															
MW01	16-Aug-17	MW01_0.0-0.35	0.0046	<0.0002	<0.001	0.0008	<0.0002	0.0036	0.0067	0.0021	0.0064	<0.0002	<0.0005	<0.0002	<0.0002	0.0440	0.0380
MW01	16-Aug-17	MW01_0.35-0.5	0.0019	<0.0002	<0.001	0.0004	<0.0002	0.0023	0.0041	0.0010	0.0035	<0.0002	<0.0005	<0.0002	<0.0002	0.0260	0.0225
MW02	16-Aug-17	MW02_0.0-0.2	0.0032	0.0037	0.001	0.0010	<0.0002	0.0020	0.0108	0.0018	0.506	0.0006	<0.0005	<0.0002	0.0005	0.596	0.579
MW02	16-Aug-17	MW02_0.2-0.5	0.0232	0.0417	0.002	<0.0002	<0.0002	0.0146	0.0603	0.0010	0.318	<0.0002	<0.0005	<0.0002	<0.0002	1.13	1.06
MW03	16-Aug-17	MW03_0.0-0.35	0.0069	0.0059	0.002	0.0044	0.0007	0.0039	0.0174	0.0053	0.741	0.0023	<0.0005	<0.0002	0.0018	0.912	0.866
MW03	16-Aug-17	FD01	0.0053	0.0047	<0.001	0.0015	<0.0002	0.0032	0.0140	0.0024	0.657	0.0007	<0.0005	<0.0002	0.0003	0.760	0.741
MW03	16-Aug-17	MW03_0.35-0.5	0.0077	0.0064	0.002	0.0021	<0.0002	0.0035	0.0162	0.0044	0.911	0.0016	<0.0005	<0.0002	0.0002	1.06	1.03
Onsite water collection system																	
PIT 1	21-Aug-17	PIT 1	0.0116	0.0004	<0.001	0.0187	0.0024	0.0052	0.0067	0.0148	0.450	0.0016	<0.0005	0.0006	0.0046	1.33	1.22
Offsite soils within downgradient swale																	
Swale 01	28-Aug-17	SWALE 01	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0015	<0.0002	<0.0005	<0.0002	<0.0002	0.0015	0.0015
Swale 02	28-Aug-17	SWALE 02	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002	<0.0002
Swale 03	28-Aug-17	SWALE 03	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0004	<0.0002	<0.0005	<0.0002	<0.0002	0.0004	0.0004
Swale 04	28-Aug-17	SWALE 04	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0008	<0.0002	<0.0005	<0.0002	<0.0002	0.0008	0.0008
Bridge 01	28-Aug-17	BRIDGE 01	<0.0002	<0.0002	<0.001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0028	<0.0002	<0.0005	<0.0002	<0.0002	0.0035	0.0035

Table B
Analytical Results Summary
Groundwater and surface water

			Water Levels			Field Parameters						PFAS												
			Top of Casing Elevation	Depth to Water	Standing Water Level	Purge Volume	DO (mg/L) (Field)	Electrical conductivity (field)	pH (Field)	Redox (Field)	Temperature (Field)	N-Ethyl perfluorooctane sulfonamidoacetic acid	Perfluoroheptane sulfonic acid	Perfluorodecanesulfonic acid (PFDS)	10:2 Fluorotelomer sulfonic acid	4:2 Fluorotelomer sulfonic acid	Perfluorobutane sulfonic acid	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorohexane sulfonic acid (PFHxS)	PFHxS and PFOS (Sum of Total) - Lab Calc	Perfluoropentanoic acid	8:2 Fluorotelomer sulfonic acid	N-Ethyl perfluorooctane sulfonamide	N-Ethyl perfluorooctane sulfonamidoethanol
			mAHD	mb TOC	m AHD	L	mg/L	µS/cm	pH Units	mV	°C	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
LOR												0.02	0.02	0.02	0.05	0.05	0.02	0.02	0.02	0.01	0.02	0.05	0.05	0.05
OEH Science DRAFT Drinking Water																				0.07				
OEH Science DRAFT ESL FW/MW 95%																								
Location Code	**Date/Time**	**Field ID**																						
MW01	28/08/2017	MW01	74.72	8.32	66.4	3.3	0.6	14,160	6.49	-65.4	21.1	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	0.01	<0.02	<0.05	<0.05	<0.05
MW02	28/08/2017	MW02	68.91	2.915	66	6.5	0.74	10,657	6.39	-44	19.3	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.05	<0.05
MW03	28/08/2017	MW03	68.82	4.13	64.69	4.7	0.77	11,503	6.54	-44.8	20.8	<0.02	<0.02	<0.02	<0.05	<0.05	0.27	<0.02	0.42	1.30	0.16	<0.05	<0.05	<0.05
MW03	28/08/2017	FD01	-	-	-	-	-	-	-	-	-	<0.02	<0.02	<0.02	<0.05	<0.05	0.28	<0.02	0.45	1.40	0.15	<0.05	<0.05	<0.05
Onsite water collection system																								
PIT 1	21/08/2017	PIT 1	-	-	-	-	-	-	-	-	-	<0.02	0.86	0.04	<0.05	<0.05	0.47	<0.02	6.42	29.6	1.00	5.95	<0.05	<0.05
TANK 2	21/08/2017	TANK 2	-	-	-	-	-	-	-	-	-	<0.02	0.34	<0.02	<0.05	<0.05	0.14	<0.02	2.52	5.82	1.06	0.52	<0.05	<0.05
TANK 2	21/08/2017	JF-FD01	-	-	-	-	-	-	-	-	-	<0.02	0.34	<0.02	<0.05	<0.05	0.14	<0.02	2.55	5.81	1.09	0.52	<0.05	<0.05
Offsite storm water system																								
Swale 03	28/08/2017	SWALE 03	-	-	-	-	-	-	-	-	-	<0.02	<0.02	<0.02	<0.05	<0.05	0.06	<0.02	0.22	0.96	0.04	<0.05	<0.05	<0.05
Swale 04	28/08/2017	SWALE 04	-	-	-	-	-	-	-	-	-	<0.02	<0.02	<0.02	<0.05	<0.05	0.07	<0.02	0.25	1.52	0.06	<0.05	<0.05	<0.05

Table B
Analytical Results Summary
Groundwater and surface water

			PFAS (continued)																	
			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
LOR			0.05	0.05	0.05	0.01	0.02	0.1	0.02	0.02	0.02	0.02	0.02	0.01	0.02	0.05	0.02	0.02	0.01	0.01
OEH Science DRAFT Drinking Water						0.56														
OEH Science DRAFT ESL FW/MW 95%						**220**								**0.13**						
Location Code	**Date/Time**	**Field ID**																		
MW01	28/08/2017	MW01	<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
MW02	28/08/2017	MW02	<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
MW03	28/08/2017	MW03	<0.05	<0.05	<0.05	0.03	0.15	<0.1	<0.02	<0.02	0.04	0.34	<0.02	**0.88**	<0.02	<0.05	<0.02	<0.02	2.29	2.14
MW03	28/08/2017	FD01	<0.05	<0.05	<0.05	0.03	0.16	<0.1	<0.02	<0.02	0.04	0.36	<0.02	**0.95**	<0.02	<0.05	<0.02	<0.02	2.42	2.26
Onsite water collection system																				
PIT 1	21/08/2017	PIT 1	<0.05	<0.05	18.7	4.54	0.48	<0.1	1.36	<0.02	2.01	4.16	2.19	**23.2**	0.07	<0.05	<0.02	0.10	71.6	66.4
TANK 2	21/08/2017	TANK 2	<0.05	<0.05	8.20	1.49	0.20	<0.1	<0.02	<0.02	1.16	1.50	0.47	**3.30**	0.02	<0.05	<0.02	<0.02	20.9	19.9
TANK 2	21/08/2017	JF-FD01	<0.05	<0.05	9.65	1.51	0.19	<0.1	0.02	<0.02	1.14	1.51	0.48	**3.26**	0.02	<0.05	<0.02	<0.02	22.4	21.4
Offsite storm water system																				
Swale 03	28/08/2017	SWALE 03	<0.05	<0.05	<0.05	0.03	0.03	<0.1	<0.02	<0.02	<0.02	0.09	<0.02	**0.74**	<0.02	<0.05	<0.02	<0.02	1.21	1.18
Swale 04	28/08/2017	SWALE 04	<0.05	<0.05	0.06	0.04	0.03	<0.1	<0.02	<0.02	<0.02	0.13	<0.02	**1.27**	<0.02	<0.05	<0.02	<0.02	1.91	1.88

Table C
Analytical Results Tables- Leachate

				PFAS														
			pH (Final)	N-Ethyl perfluorooctane sulfonamidoacetic acid	Perfluoroheptane sulfonic acid	Perfluorodecanesulfonic acid (PFDS)	10:2 Fluorotelomer sulfonic acid	4:2 Fluorotelomer sulfonic acid	Perfluorobutane sulfonic acid	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorohexane sulfonic acid (PFHxS)	PFHxS and PFOS (Sum of Total) - Lab Calc	Perfluoropentanoic acid	8:2 Fluorotelomer sulfonic acid	N-Ethyl perfluorooctane sulfonamide	N-Ethyl perfluorooctane sulfonamidoethanol	N-Methyl perfluorooctane sulfonamide	N-Methyl perfluorooctane sulfonamidoethanol
			pH Units	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL			0.1	0.02	0.02	0.02	0.05	0.05	0.02	0.02	0.02	0.01	0.02	0.05	0.05	0.05	0.05	0.05
Location Code	**Date/ Time**	**Field ID**																
Bridge 01	28-Aug-17	BRIDGE 01	6.7	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	0.04	0.43	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05
MW02	16-Aug-17	MW02_0.2-0.5	7.4	<0.02	2.14	<0.02	<0.05	<0.05	1.24	<0.02	31.9	58.9	0.43	<0.05	<0.05	<0.05	<0.05	<0.05
MW03	16-Aug-17	MW03_0.35-0.5	8.2	<0.02	<0.02	<0.02	<0.05	<0.05	0.26	<0.02	0.30	0.42	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05
PIT 1	28-Aug-17	PIT 1	7.2	<0.02	0.19	<0.02	0.12	<0.05	0.03	<0.02	0.63	9.24	0.08	3.48	<0.05	<0.05	<0.05	<0.05

Table C
Analytical Results Tables- Leachate

			PFAS (continued)														
			6:2 Fluorotelomer Sulfonate (6:2 FTS)	Perfluorooctanoic acid (PFOA)	Perfluoropentane sulfonic acid	Perfluorobutanoic acid	Perfluorodecanoic acid	Perfluorododecanoic acid	Perfluoroheptanoic acid	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctane sulfonamide (FOSA)	Perfluorotetradecanoic acid	Perfluorotridecanoic acid	Perfluoroundecanoic acid	PFAS (Sum of Total)	PFAS (Sum of Total)(WA DER List)
			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			0.05	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
Location Code	**Date/ Time**	**Field ID**																
Bridge 01	28-Aug-17	BRIDGE 01	<0.05	<0.01	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	0.39	<0.02	<0.05	<0.02	<0.02	0.43	0.43
MW02	16-Aug-17	MW02_0.2-0.5	<0.05	1.40	2.12	<0.1	<0.02	<0.02	0.60	2.52	0.07	27.0	<0.02	<0.05	<0.02	<0.02	69.4	65.1
MW03	16-Aug-17	MW03_0.35-0.5	<0.05	0.01	0.13	<0.1	<0.02	<0.02	<0.02	0.20	<0.02	0.12	<0.02	<0.05	<0.02	<0.02	1.02	0.89
PIT 1	28-Aug-17	PIT 1	1.90	0.44	0.03	<0.1	0.26	<0.02	0.09	0.21	0.42	8.61	<0.02	<0.05	<0.02	<0.02	16.5	15.5

Table D
QA/QC summary- Field Duplicates

				PFAS														
			% Moisture	N-Ethyl perfluorooctane sulfonamidoacetic acid	Perfluoroheptane sulfonic acid	Perfluorodecanesulfonic acid (PFDS)	10:2 Fluorotelomer sulfonic acid	4:2 Fluorotelomer sulfonic acid	Perfluorobutane sulfonic acid	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorohexane sulfonic acid (PFHxS)	PFHxS and PFOS (Sum of Total) - Lab Calc	Perfluoropentanoic acid	8:2 Fluorotelomer sulfonic acid	N-Ethyl perfluorooctane sulfonamide	N-Ethyl perfluorooctane sulfonamidoethanol	N-Methyl perfluorooctane sulfonamide	N-Methyl perfluorooctane sulfonamidoethanol
			%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR			1	0.0002	0.0002	0.0002	0.0005	0.0005	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0005	0.0005	0.0005	0.0005
Location Code	**Date/ Time**	**Field ID**																
MW03	16-Aug-17	MW03_0.0-0.35	10.7	0.0002	0.0053	0.0119	0.0089	<0.0005	0.0082	<0.0002	0.0502	0.791	0.0118	0.0140	<0.0005	<0.0005	<0.0005	<0.0005
MW03	16-Aug-17	FD01	12.1	<0.0002	0.0039	0.0037	0.0018	<0.0005	0.0068	<0.0002	0.0413	0.698	0.0073	0.0011	<0.0005	<0.0005	<0.0005	<0.0005
RPD			*12*	*0*	*30*	***105***	***133***	*0*	*19*	*0*	*19*	-	*47*	***171***	*0*	*0*	*0*	*0*

			%	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
LOR			1	0.02	0.02	0.02	0.05	0.05	0.02	0.02	0.02	0.01	0.02	0.05	0.05	0.05	0.05	0.05
TANK 2	21-Aug-17	TANK 2	-	<0.02	0.34	<0.02	<0.05	<0.05	0.14	<0.02	2.52	5.82	1.06	0.52	<0.05	<0.05	<0.05	<0.05
TANK 2	21-Aug-17	JF-FD01	-	<0.02	0.34	<0.02	<0.05	<0.05	0.14	<0.02	2.55	5.81	1.09	0.52	<0.05	<0.05	<0.05	<0.05
RPD			-	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	-	*3*	*0*	*0*	*0*	*0*	*0*
MW03	28-Aug-17	MW03	-	<0.02	<0.02	<0.02	<0.05	<0.05	0.27	<0.02	0.42	1.30	0.16	<0.05	<0.05	<0.05	<0.05	<0.05
MW03	28-Aug-17	FD01	-	<0.02	<0.02	<0.02	<0.05	<0.05	0.28	<0.02	0.45	1.40	0.15	<0.05	<0.05	<0.05	<0.05	<0.05
RPD			-	*0*	*0*	*0*	*0*	*0*	*4*	*0*	*7*	-	*6*	*0*	*0*	*0*	*0*	*0*

Table D
QA/QC summary- Field Duplicates

			PFAS (continued)														
			6:2 Fluorotelomer Sulfonate (6:2 FTS)	Perfluorooctanoic acid (PFOA)	Perfluoropentane sulfonic acid	Perfluorobutanoic acid	Perfluorodecanoic acid	Perfluorododecanoic acid	Perfluoroheptanoic acid	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctane sulfonamide (FOSA)	Perfluorotetradecanoic acid	Perfluorotridecanoic acid	Perfluoroundecanoic acid	PFAS (Sum of Total)	PFAS (Sum of Total)(WA DER List)
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR			0.0005	0.0002	0.0002	0.001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0005	0.0002	0.0002	0.0002	0.0002
Location Code	**Date/ Time**	**Field ID**																
MW03	16-Aug-17	MW03_0.0-0.35	0.0104	0.0069	0.0059	0.002	0.0044	0.0007	0.0039	0.0174	0.0053	0.741	0.0023	<0.0005	<0.0002	0.0018	0.912	0.866
MW03	16-Aug-17	FD01	0.0046	0.0053	0.0047	<0.001	0.0015	<0.0002	0.0032	0.0140	0.0024	0.657	0.0007	<0.0005	<0.0002	0.0003	0.760	0.741
RPD			***77***	*26*	*23*	***67***	***98***	***111***	*20*	*22*	***75***	*12*	***107***	*0*	*0*	***143***	-	-
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
LOR			0.05	0.01	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
TANK 2	21-Aug-17	TANK 2	8.20	1.49	0.20	<0.1	<0.02	<0.02	1.16	1.50	0.47	3.30	0.02	<0.05	<0.02	<0.02	20.9	19.9
TANK 2	21-Aug-17	JF-FD01	9.65	1.51	0.19	<0.1	0.02	<0.02	1.14	1.51	0.48	3.26	0.02	<0.05	<0.02	<0.02	22.4	21.4
RPD			*16*	*1*	*5*	*0*	*0*	*0*	*2*	*1*	*2*	*1*	*0*	*0*	*0*	*0*	-	-
MW03	28-Aug-17	MW03	<0.05	0.03	0.15	<0.1	<0.02	<0.02	0.04	0.34	<0.02	0.88	<0.02	<0.05	<0.02	<0.02	2.29	2.14
MW03	28-Aug-17	FD01	<0.05	0.03	0.16	<0.1	<0.02	<0.02	0.04	0.36	<0.02	0.95	<0.02	<0.05	<0.02	<0.02	2.42	2.26
RPD			*0*	*0*	*6*	*0*	*0*	*0*	*0*	*6*	*0*	*8*	*0*	*0*	*0*	*0*	-	-

Table E
Analytical Results Summary- Blanks

			PFAS															
			N-Ethyl perfluorooctane sulfonamidoacetic acid	Perfluoroheptane sulfonic acid	Perfluorodecanesulfonic acid (PFDS)	10:2 Fluorotelomer sulfonic acid	4:2 Fluorotelomer sulfonic acid	Perfluorobutane sulfonic acid	N-Methyl perfluorooctane sulfonamidoacetic acid	Perfluorohexane sulfonic acid (PFHxS)	PFHxS and PFOS (Sum of Total) - Lab Calc	Perfluoropentanoic acid	8:2 Fluorotelomer sulfonic acid	N-Ethyl perfluorooctane sulfonamide	N-Ethyl perfluorooctane sulfonamidoethanol	N-Methyl perfluorooctane sulfonamide	N-Methyl perfluorooctane sulfonamidoethanol	6:2 Fluorotelomer Sulfonate (6:2 FTS)	Perfluorooctanoic acid (PFOA)
Date/Time	**Field ID**	**Sample Type**	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
16-Aug-17	RB01	Rinsate	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01
28-Aug-17	RB01	Rinsate	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01
28-Aug-17	TB01	Trip Blanks	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01

Table E
Analytical Results Summary- Blanks

			PFAS (continued)												
			Perfluoropentane sulfonic acid	Perfluorobutanoic acid	Perfluorodecanoic acid	Perfluorododecanoic acid	Perfluoroheptanoic acid	Perfluorohexanoic acid (PFHxA)	Perfluorononanoic acid	Perfluorooctane sulfonic acid (PFOS)	Perfluorooctane sulfonamide (FOSA)	Perfluorotetradecanoic acid	Perfluorotridecanoic acid	Perfluoroundecanoic acid	PFAS (Sum of Total)	PFAS (Sum of Total)(WA DER List)
Date/Time	Field ID	Sample Type	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
16-Aug-17	RB01	Rinsate	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.02	<0.02	<0.01	<0.01
28-Aug-17	RB01	Rinsate	<0.02	<0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01	<0.02	<0.05	<0.02	<0.02	<0.01	<0.01
28-Aug-17	TB01	Trip Blanks	<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