APPENDIX 5. WATER SUMMARY REPORT

Newcastle Sands

Baseline Water Quality Summary Report

Williamtown Sand Syndicate Pty Ltd.

Project No. 20193820.001A

Report Date: 14 September 2020

Newcastle Sands

Baseline Water Quality Summary Report

298 Cabbage Tree Road, Williamtown, NSW

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1. INTRODUCTION

1.1 BACKGROUND

Kleinfelder Australia Pty Ltd (Kleinfelder) was engaged by Williamtown Sand Syndicate (WSS) to undertake a 12 month surface water and groundwater monitoring program to establish baseline conditions at the Newcastle Sands quarry site, 298 Cabbage Tree Road, Williamtown, New South Wales (NSW) (the 'Site'). The Site is located approximately 12 km north east of Newcastle at Williamtown, NSW. The location of the Site is depicted on **Figure 1** and the site layout is presented in **Figure 2**. This revised version of the Kleinfelder (March 2020) Baseline Water Quality Summary Report addresses comments provided by the NSW Department of Planning, Industry & Environment (DPIE).

Monitoring was undertaken to satisfy the requirements of the Soil and Water Management Plan (SWMP) (KLF, 2019) and Environmental Protection Licence 21264 (EPL). It is noted that the SWMP is a sub-plan within the overarching 'Newcastle Sands Quarry Environmental Management Plan' (June 2018), referred to herein as the EMP.

Groundwater and surface water monitoring was conducted over 12 consecutive months from February 2019 through to January 2020 and was generally completed between the 11th and 18th of each month. A Sampling Plan was prepared and presented in the SWMP, covering an appropriate methodology and quality control requirements for the monitoring program (see **Section 3** for further details).

The Sampling Plan was designed to obtain representative background data on water flow and quality in surface water bodies and groundwater that has the potential to be impacted by the site operations, or unrelated off-site sources. The SWMP identifies that, unless amended, the ongoing surface water and groundwater monitoring program will be consistent with the baseline water quality program.

1.2 PURPOSE OF THE BASELINE SUMMARY REPORT

The SWMP identifies that on completion of the baseline monitoring program, the following parameters would be reviewed and advice provided regarding ongoing monitoring requirements including:

- Location of sampling points, e.g. more suitable / representative location identified, or sampling location has insufficient water to accurately monitor development;
- The frequency of the sampling may be reduced, or increased, depending on the fluctuations in the results; and

- The parameters may be adjusted to remove superfluous analytes and/or add additional analytes.

1.3 OBJECTIVES

The objectives of the monitoring program were to:

- Establish background groundwater and surface water conditions across the Site;
- Establish site specific trigger values to be used during the operation of the quarry whereby concentrations outside these trigger values need to be reviewed in more detail; and
- Develop an ongoing sampling program (frequency and analysis) that will maintain compliance with the conditions of the EPL and EMP.

1.4 SCOPE OF WORK

The following provides the scope of work to deliver the baseline water quality summary report:

- Review and present Site characteristic information;
- Provide an assessment of quality assurance (QA) and quality control (QC) undertaken over the 12-month period and validate the data;
- Provide a summary of the water quality identified across the Site including:
  - Field observations;
  - Analytical results; =
  - Trend analysis;
- Establish trigger values for review against ongoing sampling; and
- Propose an ongoing monitoring program to be conducted during operations that will maintain compliance with the EMP and EPL.

The scope of work for each of the background monitoring rounds can be seen in the monthly summary reports.

2. SITE CHARACTERISTICS

2.1 SITE IDENTIFICATION DETAILS

Table 2.1 provides site-specific identification details.

Table 2.1 Site details

Site address	298 Cabbage Tree Road Williamtown, NSW.
Site name	Newcastle Sands Quarry.
Current Title identification details	Four titles within the Parish of Stockton, County of Gloucester including: • Lot 1 DP 224587 at 398 Cabbage Tree Road, Williamtown • Lot 121 DP 556403 at 282B Cabbage Tree Road, Williamtown. • Lot 11 DP 629503 at 282A Cabbage Tree Road, Williamtown. • Lot 1012 DP 814078 at 282 Cabbage Tree Road Williamtown
Current land use	Currently the Site comprises mostly native vegetation. Initial quarry works have progressed to include pre-works hardstand areas and administration buildings.
Site total area	Total Project Area of approximately 42.3 hectares from a Subject Land Area of approximately 176.2 hectares.
Current ownership	Port Stephens Shire Council under lease to Williamtown Sand Syndicate Pty Ltd.
Current land use zoning	The Site is currently RU2 – Rural Landscape (Port Stephens LEP 2013).
Local government	Port Stephens Council.
Proposed site use	Sand quarry extracting up to 530,000 tonnes per annum over a period of 6 to 15 years including the construction of an intersection with Cabbage Tree Road, sealed and gravel access roads, site office, workshop and weighbridges. Progressive rehabilitation of quarried land returning to native vegetation communities with potential future use of the facilities area.

2.2 CURRENT LAND USE

The Site currently has a workshop, office area comprising of demountable buildings, gravel aggregate hardstand areas for transitioning vehicles and future sorting. The areas surrounding the immediate vicinity of the Site comprise predominantly natural vegetation with exception to a gravel road, two former silica sand extraction areas and the verge of Cabbage Tree Road.

2.3 FORMER LAND USE

The Project Area consists predominantly of native vegetation, with some previously cleared areas present in the eastern part of the Site. Approximately 48 ha of the 176.2 ha Site was previously disturbed by heavy mineral sand mining and associated activities that were undertaken on the Site between 1970s and late 1990s. This disturbance included areas that were dredged as part of extracting heavy minerals, sand borrow pits, settling ponds, monazite trenches and access roads.

In March 2002, Port Stephens Council (PSC) purchased four allotments comprising the project area (398, 282B, 282A and 282 Cabbage Tree Road Williamtown) from Rutile and Zircon Mines and was subsequently used for cattle adjustment. In 2012 PSC sought tenders from interested parties for the extraction of sand from the project area.

2.4 SURROUNDING LAND USE

The Williamtown RAAF base is located 2.5 km to the north east, with Fullerton Cove approximately 600 m to the south and the Hunter River estuary beyond (**Figure 1**).

Residential dwellings are located to the east (closest dwelling is 244 m), south (closest dwelling is 61 m) and west (closest dwelling is 83 m) of the Site. Most are small properties utilised as hobby farms (e.g. keeping horses and chickens), some are larger and also graze livestock. Potable water for dwellings is likely to comprise primarily reticulated water from Hunter Water network and rainwater. Many properties appear to have spear point wells installed for stock and domestic use. No dwellings are located within 4 km north of the Site.

2.5 GEOLOGY

Review of the Newcastle 1:250,000 series geological map (Sheet S1 56-2, 1966) indicates that the site is underlain by Quaternary aged marine and freshwater deposits comprising gravel, sand, silt, clay and “Waterloo Rock”.

The majority of the Site is located above the Tomago Sandbeds. The Tomago Sandbeds were formed during the Pleistocene era with the original sand deposits occurring up to 250,000 years ago. Rising sea levels created a large bay extending from Newcastle to Port Stephens. The Hunter and Karuah Rivers both flowed into the bay and deposited large volumes of sand. A combination of wave and wind action spread the sand along the coastline and formed the series of shallow dunes that make up the Tomago Sandbeds (Hunter water website 15/08/2018).

The sand dunes consist of a layer of highly permeable fine-grained sands underlain by impervious clay and rock. The thickness of the sand layer reaches a maximum of 50 metres, but on average is 20 metres deep (Hunter Water website 15/08/2018).

The North Stockton Sandbeds, which form the current coastline between Newcastle and Port Stephens, were deposited much more recently than the Tomago Sands. They overlie the eastern extremity of the Tomago Sands and were deposited in the Holocene era (10,000 years ago) (Hunter water website 15/08/2018).

2.6 HYDROLOGY & HYDROGEOLOGY

2.6.1 Surface Water

The high permeability of the Tomago Sandbeds results in little or no defined surface runoff, noting no defined natural drainage lines are on the Site. Drainage is therefore predominantly via vertical infiltration into the sand, with any ephemeral surface drainage generally expected to be in the direction of the existing surface slopes.

In the area around the Site, the Tomago Sandbeds are located on the edge of low lying (about 2-3 m AHD) Holocene aged freshwater and alluvial and estuarine swamps deposits. These low-lying areas adjoining the Site are frequently waterlogged during high rainfall, due to increasing and shallow groundwater levels and a shallow groundwater gradient that slows the percolation of surface water. It is likely that the majority of accessible surface water onsite is an expression of groundwater, typically created through man made excavation.

The western portion of the southern and norther resources areas theoretically drain to the west, while the dominant surface drainage direction for most of the Site is to the east (i.e. Catchments 2 and 3 above). Here the landform drops from the edge of the resource area around 5 m AHD to the swamp or flats over a relatively short distance with the gradient reaching up to 16%. The swamp areas have a gradient of approximately 0.1% with the elevation falling 1.5 m over the 1100 m to the eastern boundary of the Subject Land with water conveyed by an open constructed channel (in middle of Catchment 3).

From the eastern boundary of the Site, drainage is directed via constructed channels through to Dawsons Drain and the northern extent of Fullerton Cove where the elevation drops 1 m over 1900 m (with an average gradient of 0.05%).

For the south eastern portion of the Project area, a portion of the resource area has the potential to drain south east across the Subject Land to a culvert beneath Cabbage Tree Road (Catchment 4). In this area the landform drops at about 14% to the swamp or flats that then appears to have a very slight gradient to the south eastern corner of the Site (i.e. less than 0.5 m over at least 140 m). From this point the area drains via series of constructed channels through to the Ring Drain, a large constructed channel around the northern extent of Fullerton Cove over a distance of 590 m with an average gradient of less than 0.4%. Inspection of the Site shows this culvert is only likely to flow during periods of extended rainfall and a high-water table.

Cabbage Tree Road has been built up during its construction, with shallow table drains constructed partially along the northern side of the road and deeper drains constructed partially

along the southern side. The nearest culvert is located at the eastern extent of the subject land, approximately 80 m beyond the proposed road construction area.

Following quarrying at the site the catchments will progressively change with Catchment 3 increasing in size with water from within the quarry footprint (currently draining west) directed south east into Catchment 3 (i.e. Catchment 1 will drain to Catchment 3). However, given the high permeabilities it is highly unlikely that any changes in flow would be realised across the site.

2.6.2 Groundwater

The Site is located on highly permeable Pleistocene Tomago Sandbeds (sand dunes). The source of the water within the Tomago Sandbeds is rainfall that lands directly on the sand surface. While a proportion of the rainfall is lost to plants and evaporation, sufficient water is stored in the sand to provide a viable and significant source of water for ongoing extraction. Over time rainfall landing on the sandbeds has washed out any remnants of sea salt leaving the deep sand system full of fresh water (Hunter Water website 15/08/2018).

A previous groundwater investigation was undertaken by RCA Australia (RCA Australia, 2015), groundwater was encountered on the Site ranging from 0.67 m below ground level (mbgl) to 15.65 mbgl. Groundwater when at its highest is visible at or near the surface for land below 3 m AHD. Groundwater at the Site has a low hydraulic gradient and was interpreted to flow in a general southerly to south-easterly direction, towards Fullerton Cove (RCA Australia, 2015) from Grahamstown Dam in the north toward Fullerton Cove in the south, the groundwater gradient within the local area is less than 0.2%.

The northern portion of the Site is located within the Hunter Water Special Area, owing to the presence of the Tomago Sandbeds and their use for a portion of the lower Hunter's drinking water supplies.

The Project area and extent of extraction has been designed such that sand extraction remains a minimum of 0.7 m above the highest predicted groundwater level, with the final landform to be established at no less than 1 m above the highest predicted groundwater level (about 2 m above the average level).

2.7 RCA GEOTECHNICAL AND GROUNDWATER INVESTIGATION

A geotechnical and groundwater investigation was undertaken by RCA Australia in 2015 to provide input into the characterisation of Site resources for the extraction of sand and to

provide further information on background groundwater quality and elevations across the Site in preparation for the preliminary Site Environmental Impact Statement.

As part of the investigation, the installation of 12 groundwater monitoring wells were undertaken including subsequent soil and groundwater analyses. Soil logs including groundwater and soil results from RCA Australia, 2015 are provided as **Appendix A.**

3. BACKGROUND MONITORING PROGRAM

3.1 SAMPLING PLAN

The SWMP required monthly sampling to be undertaken over a 12-month period to characterise background groundwater and surface water conditions throughout the Site.

10 groundwater (BH1, BH2, BH4, BH6, BH7, BH8, BH9, BH10, BH11 and MW239S) and 4 surface water (SW1, SW2, SW3 and SW4) locations were sampled throughout the 12 monitoring rounds as outlined in **Figure 2**. The remaining Site wells (BH3, BH12, MW239D and BH5) were used to provide additional groundwater elevation data.

Each monitoring event included sampling for:

- General water quality parameters: (Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), pH, Electrical Conductivity (EC), Chloride (Cl), Sulphate (SO_4), Alkalinity, Hardness & Total Dissolved Solids (TDS) (Calc'));
- Total Recoverable Hydrocarbons (TRH);
- Total Petroleum Hydrocarbons (TPH);
- Benzene, Toluene, Ethylbenzene, Total Xylenes, Naphthalene (BTEXN);
- Metals (Arsenic (As), Boron (B), Barium (Ba), Beryllium (Be), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Iron (Fe), Lead (Pb), Manganese (Mn), Mercury (Hg), Nickel (Ni), Selenium (Se), Vanadium (V), Zinc (Zn)); and
- PFAS including Perfluorooctane sulfonate (PFOS), Perfluorooctanoic acid (PFOA), Perfluorohexanesulfonate (PFHxS) & Perfluorodecane sulfonic acid (PFDS).

Each well location was gauged using a water level meter to determine groundwater depth (relative to the top of the well casing) and the total depth of the well, in order to calculate the volume of water in the well. Following gauging, a high-density polyethylene (HDPE) HydraSleeve™ was then placed into the well ensuring the top of the sleeve was located below standing water level and left in place while all remaining wells were gauged. Following gauging, each of the HydraSleeves were removed and representative groundwater samples taken. Hydrasleeves™ were applied to this project as outlined in the SWMP and as recommended within the PFAS National Environmental Management Plan (Version 2.0, January 2020) given their suitability for sampling of PFAS.

The baseline sampling program also included an initial sampling round and quarterly monitoring where additional analysis was included for an extended water quality suite (including hardness, Nitrate, Nitrite, Ammonia, Reactive Phosphorous, Total Nitrogen and

TKN). Some additional groundwater monitoring locations were also included in quarterly monitoring as identified in **Table 3.1.**

Table 3.1 2019-2020 Monitoring Schedule

Action	2019											2020
	Feb*	Mar	Apr	May*	Jun	Jul	Aug	Sep*	Oct	Nov*	Dec	Jan
Monthly Gauging and groundwater sampling BH1, BH2, BH4, BH6, BH7, BH8, BH9[1], BH10[1], BH11, MW239s	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Surface water sampling SW1, SW2[1], SW3, SW4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Gauging only BH3, BH5, BH12, MW239D	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Groundwater Sampling BH3 & BH5	✓											

1: Sample locations were dry
* Shaded months indicate quarterly sampling suite

Following each monitoring round, a monthly factual letter report was prepared (see **Appendix B**). Each report presented:

- The field observations and field data;
- The results of the laboratory analysis;
- A comparison of the results against industry guidelines; and
- Rainfall data from the preceding month.

3.2 FIELD OBSERVATIONS

3.2.1 General

Surface water and groundwater monitoring was initiated in February 2019 and continued each month for a duration of 12 months until January 2020. Sampling times were generally consistent, undertaken each time within the middle of the month (between the 11th and 18th of the month). Within the first two monitoring rounds (February and March) re-insertion of PVC piping was required at fire effected location BH1 and for root bound effected location BH12. Site works, focussing on initial Site infrastructure and access roads, began in October 2019 in preparation for the proposed quarry extraction works which are expected to initiate from early to mid-2020.

3.2.2 Monitoring Location Observations

Groundwater and surface water observations made during gauging and sampling at monitoring locations BH1, BH2, BH3 BH4, BH6, BH7, BH8, BH9, BH10, BH11, MW239S, SW1, SW2,

SW3 and SW4 are summarised below. Conditions at each location were generally consistent throughout the monitoring period with the exception of surface water which provided intermittent periods of accessible water throughout the monitoring program.

Sensory observations of visual and olfactory quality were made on groundwater and surface water during sampling. A summary of these observations is presented in **Table 3.2** below.

Table 3.2 Monitoring locations: General observations

Location	General Observations
BH1	Generally, slightly cloudy brown with occasional sulfur odour. Well was reinstated in February 2019 following fire damage. The month following reinstatement an acrylic odour was detected which was most likely a bonding material used to fuse the PVC well piping together.
BH2[1]	Mostly dark brown in colour with a silty material at the base of well. A slight sulfur odour was evident throughout the monitoring period.
BH3	Prior to well decommissioning in September 2019 due to initial site works, observations of groundwater were identified as light brown with no odour. Well base contained fine silty material. No samples were taken following initial sampling round in February 2019.
BH4[1]	Generally light brown in colour with slight sulfur odour.
BH5	Generally light brown with no apparent odour. No samples taken throughout the monitoring program, only gauging.
BH6[2]	Generally, light brown in colour with a slight sulfur odour.
BH7[1]	Generally, light to moderately brown in colour with a slight sulfur odour.
BH8	Generally, brown to dark brown in colour with a moderate sulfur odour.
BH9[1]	Well was dry for the duration of the baseline monitoring program.
BH10	Well was dry for the duration of the baseline monitoring program.
BH11[2]	Generally, cloudy light brown with a moderate sulfur odour.
BH12	Well was reinstated in March 2019 following inundation of roots into the well. A 40mm inner PVC pipe was installed. The months following reinstatement of a well an acrylic odour was detected which was most likely a bonding material used to fuse the PVC well piping together. No sample was taken.
MW239S[1]	Cloudy dark brown in colour with a moderate sulfur odour.
MW239D	Cloudy dark brown in colour with a moderate sulfur odour. No sample was taken.
SW01	Intermittent periods of pooling at monitoring location. Water is generally stained with natural tannins, dark brown with a slight sulfur odour.
SW02	Monitoring location was observed to be dry for the duration of the baseline monitoring program.
SW03	Water mostly clear with no apparent odour. Often water was stagnant and at times dry.
SW04	Water mostly clear with no apparent odour. Often water was stagnant and at times dry.

1 – Down-gradient monitoring location
2 – Up-gradient control location

3.2.3 Geochemical Parameters and Gauging Data

Geochemical parameters and gauging data were recorded during the sampling program and are presented on field sheets in **Appendix C** and summarised as maximum and minimum values in **Table 3.3** and **Table 3.4.**

Table 3.3 Geochemical parameters (maximum and minimum values) February 2019 – January 2020

Monitoring Location	Temp (°C)		EC (µs/cm) (Chart 3)		pH (Chart 20)		Redox (mV)	
	Min	Max	Min	Max	Min	Max	Min	Max
BH1	18.4	22.52	18	182	5.39	6.43	15.2	103
Groundwater								
BH2	18.3	24.49	48	136	4.29	6.41	88	308
BH3[1]	22.1		82.4		4.54		94	
BH4	17.6	23.3	8	129.2	3.85	6.49	88	322
BH5[2]	20.1		320		4.06		122	
BH6	17.2	24.62	110	335	4.28	5.52	-144	178
BH7	17.2	25	164	391	4.04	5.93	-228	179
BH8	16.8	22.5	224	995	4.08	7.43	-341	176
BH9	Dry		Dry		Dry		Dry	
BH10	Dry		Dry		Dry		Dry	
BH11	16.9	22.65	124	402	3.78	6.41	-117	176
BH12[3]	-		-		-		-	
MW239S	15.8	24.71	37	718	4.09	5.7	-132	179
MW239D[3]	-		-		-		-	
Surface Water								
SW1	9.52	23.75	811	1964	3.95	6.4	99	406
SW2	Dry		Dry		Dry		Dry	
SW3	11.96	26	290	470	4.27	6.41	-12.8	315
SW4	8.07	18.46	313	538	3.69	6.44	116	430.5

1 – One sampling event (Feb 2019) and well decommissioned September 2019
2 – One sampling event (Feb 2019)
3 – No sampling undertaken

Table 3.4 Gauging data (maximum and minimum values) February 2019 – January 2020

Monitoring Location	Georeferenced Location (MGA-UTM)		Ground Surface RL (mAHD)	Top of Casing (mAHD)	Bore Depth (m)	Depth to Water (mBTOC)		Groundwater Elevation (mAHD) (Chart 2)	
	Easting	Northing				Min	Max	Min	Max
Groundwater									
BH1	387741.2	6369495.8	8.21	8.64	9.45	5.776	6.701	1.939	2.864
BH2	387704.7	6369175.1	7.4	7.79	9.45	5.083	6.153	1.637	2.707

Monitoring Location	Georeferenced Location (MGA-UTM)		Ground Surface RL (mAHD)	Top of Casing (mAHD)	Bore Depth (m)	Depth to Water (mBTOC)		Groundwater Elevation (mAHD) (Chart 2)	
	Easting	Northing				Min	Max	Min	Max
BH3[1]	387751.7	6368964.4	7.03	7.57	9.45	5.938	6.146	1.424	1.632
BH4	387855	6368742.8	2.81	3.06	6.45	1.531	2.252	0.808	1.529
BH5[2]	388768.5	6369334.7	6.76	7.36	9.28	5.767	6.315	1.045	1.593
BH6	388729.8	6369582.3	3.01	3.62	4.95	1.591	2.169	1.451	2.029
BH7	388827.8	6369245.3	2.6	2.98	4.95	1.514	2.169	0.811	1.466
BH8	389178.3	6369271.7	3.28	3.88	6.28	2.233	2.969	0.911	1.647
BH9	387520.4	6368798.9	17.07	17.745	18.18	Dry			
BH10	387931.2	6369744.4	6.09	6.69	5.45	Dry			
BH11	387650.7	6369979.8	6.02	6.63	5.95	3.02	3.962	2.668	3.61
BH12[3]	388203	6369333	8.06	8.67	8.39	6.799	7.252	1.418	1.871
MW239S	388619.1	6369306.6	3.09	3.04	4	1.248	1.823	1.217	1.792
MW239D[3]	388619.2	6369305.7	2.97	2.92	20	1.226	1.799	1.241	1.814
Surface Water[4]									
SW1	387693	6368814	NA	NA	NA	NA	NA	Dry	290mm
SW2	387995	6369246	NA	NA	NA	NA	NA	Dry[3]	
SW3	388424	6369061	NA	NA	NA	NA	NA	Dry	290mm
SW4	389053	6368967	NA	NA	NA	NA	NA	Dry	350mm

1– One sampling event (Feb 2019) and well decommissioned September 2019
2 – One sampling event (Feb 2019)
3 – No sampling undertaken
4 - Surface water levels (mm) identified from measured stake at each location (When dry number is ground elevation AHD)
NA – Not applicable

3.3 GROUNDWATER AND SURFACE WATER ANALYSIS

3.3.1 Industry Guidelines

In order to understand background surface and groundwater quality in relation to published data, laboratory results were compared against trigger values found in industry guidelines as outlined in the SWMP.

An exceedance of any adopted trigger value does not necessarily indicate that there is an unacceptable risk on site (CRC-CARE Technical Report 10: 2011), but rather identifies the need to explore the results in more detail. For this report we are reviewing natural background conditions and this comparison identifies the quality of the natural conditions indicative of the Site and regional area.

The following industry guidelines have been used for baseline characterisation:

- Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), Water Quality Guidelines for Fresh and Marine Water Quality 95% species protection for fresh water (ANZECC 2000);
- The Heads of Environmental Protection Authorities in Australia and New Zealand (HEPA) Per- and polyfluoroalkyl substances (PFAS) National Environmental Management Plan (NEMP 2018); and
- Australian Drinking Water Guidelines 6 (ADWG) (2011).

3.3.2 Summary of results

Summary tables outlining the analytical data obtained from the Baseline Monitoring Program, and a comparison against trigger values are provided within the **Tables** section at the rear of this report. **Table 3.5** below provides a summary of groundwater and surface water concentrations as a range (minimum to maximum) for all analytes across the Site.

An assessment of Kleinfelder's Quality Assurance and Quality Control (QA/QC) processes and procedures has been provided in **Section 6**. Laboratory Certificates of Analysis (COA) including laboratory QC reports are presented as Appendix A of the monthly reports, which have been provided as **Appendix B** of this document**.**

Table 3.5 Summary of groundwater and surface water concentration range

Analyte	Units	LOR	ANZECC (2000) 95% level of species protection freshwater	ADWG (2011)	Detected Concentration Range (Groundwater)	Detected Concentration Range (Surface Water)	Comparison against trigger values
BETXN (Table A)							
Benzene	µg/L	1	950	1	<1.0	<1.0	Below LOR
Toluene	µg/L	2	-	800	<2.0	<2.0	Below LOR
Ethylbenzene	µg/L	2	-	300	<2.0	<2.0	Below LOR
o Xylene	µg/L	2	350	350	<2.0	<2.0	Below LOR
Total Xylenes	µg/L	2	-	600	<2.0	<2.0	Below LOR
Naphthalene	µg/L	5	16	-	<5.0	<5.0	Below LOR
Total Petroleum Hydrocarbons – Silica Gel Clean up (Table A)							
Sum of C_{10}-C_{36}	µg/L	50	-	-	<50-250	<50	No criteria
Total Recoverable Hydrocarbons – Silica Gel Clean up (Table A)							
Sum of C_{10}-C_{40}	µg/L	100	-	-	<100-280	<100	No criteria
Dissolved Metals (Table B)							
Arsenic	mg/L	0.001	0.013	0.01	<0.001-0.003	<0.001-0.006	Concentrations below trigger values
Barium	mg/L	0.001	-	-	0.001-0.034	0.027-0.08	No criteria
Beryllium	mg/L	0.001	-	0.06	<0.001	<0.001	Below LOR
Boron	mg/L	0.05	0.37	4	<0.05-0.06	<0.05-0.14	Concentrations below trigger values
Cadmium	mg/L	0.0001	0.0002	0.002	<0.0001	<0.0001-0.0002	Concentrations below trigger values
Chromium	mg/L	0.001	0.001	0.05	<0.001-0.004	<0.001-0.002	Elevated concentrations above trigger values (ANZECC 2000 trigger values) were detected at BH1 (entire monitoring period), BH2 (Dec 2019), BH3 (Feb 2019), BH7 (Feb, April, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec 2019 & Jan 2020), BH8 (Sep, Nov, Dec 2019 & Jan 2020),

Analyte	Units	LOR	ANZECC (2000) 95% level of species protection freshwater	ADWG (2011)	Detected Concentration Range (Groundwater)	Detected Concentration Range (Surface Water)	Comparison against trigger values
							BH11 (Feb, Apr, May, Jul, Aug, Oct, Nov, Dec 2019 & Jan 2020), MW239S (entire monitoring period) and SW3 (Dec 2019)
Cobalt	mg/L	0.001	-	-	<0.001-0.003	<0.001-0.017	No criteria
Copper	mg/L	0.001	0.0014	2	<0.001-0.051	<0.001-0.02	Elevated concentrations above trigger values (ANZECC 2000 trigger values) were detected at BH1 (Apr, Jul, Aug, Oct 2019 & Jan 2020), BH2 (Feb, Mar, Apr, Jun, Jul, Aug, Sep, Oct, Nov, Dec 2019 & Jan 2020), BH4 (Feb, Apr, Jun, Jul, Aug, Sep, Oct, Nov, Dec 2019 & Jan 2020), BH6 (Aug, Sep & Dec 2019), BH7 (Oct & Nov 2019), BH8 (Oct, Nov & Dec 2019), SW1 (Apr, May, Jun, Jul, Aug, Sep & Oct 2019), SW3 (Jul, Aug, Sep, Oct & Dec 2019), SW4 (Apr, Jun, Jul, Sep & Oct 2019)
Iron	mg/L	0.05	-	0.32	<0.05-12.5	0.57-9.26	Elevated concentrations above trigger values (ADWG) were detected at BH1 (entire monitoring period), BH2 (Oct 2019 & Jan 2020), BH4 (Apr & Oct 2019), BH5 (Feb 2019), BH6 (entire monitoring period), BH7 (entire monitoring period), BH8 (entire monitoring period), BH11 (Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec 2019 & Jan 2020), MW239S (entire sampling period), SW1 (entire monitoring period), SW3 (entire monitoring period), SW4 (entire monitoring period)
Lead	mg/L	0.001	0.0034	0.01	<0.001-0.001	<0.001-0.001	Concentrations below trigger values
Manganese	mg/L	0.001	1.9	0.5	0.003-0.136	0.026-0.841	Elevated concentrations above trigger values (ADWG) were detected at SW1 (Apr, May, Jun, Jul and Sep 2019)
Mercury	mg/L	0.0001	0.0006	0.001	<0.0001	<0.0001	Concentrations below initial baseline criteria
Nickel	mg/L	0.001	0.011	0.02	<0.001-0.07	<0.001-0.02	Elevated concentrations above trigger values (ANZECC trigger values) were detected at BH2 (Feb 2019), BH4 (Feb 2019), BH7 (Sep & Nov 2019), BH8 (Nov 2019), SW1 (Apr, May & Sep 2019) and SW4 (Sep 2019). Elevated concentrations above trigger values (ADWG trigger values) were detected at BH3 (Feb 2019) and BH4 (Mar & May 2019)
Selenium	mg/L	0.01	0.011	0.01	<0.01	<0.01	Below LOR

Analyte	Units	LOR	ANZECC (2000) 95% level of species protection freshwater	ADWG (2011)	Detected Concentration Range (Groundwater)	Detected Concentration Range (Surface Water)	Comparison against trigger values
Vanadium	mg/L	0.01	-	-	<0.01	<0.01	Below LOR
Zinc	mg/L	0.005	0.008	32	<0.005-1.27	<0.005-0.535	Elevated concentrations above initial trigger values (ANZECC 2000 trigger values) were detected at BH1 (entire monitoring period), BH2 (Nov 2019 & Jan 2020), BH4 (Feb, Mar, May, Oct 2019 & Jan 2020), BH6 (Feb, Mar, Apr, Sep & Nov 2019), BH7 (Feb, Mar, Apr, May, Sep, Oct & Nov 2019), BH8 (Oct, Nov 2019 & Jan 2020), BH11 (Feb, Mar, Apr, May, Sep & Oct 2019), MW239S (Sep, Oct & Nov 2019), SW1 (entire monitoring period), SW3 (Feb, Mar, Apr, May, Jun, Jul, Aug, Sep & Oct 2019), SW4 (Apr, May, Jun, Jul, Aug, Sep & Oct 2019)
PFAS (Table C)							
PFOS	µg/L	0.01	0.00023[3]	-	<0.01	<0.01-0.05	Concentrations reported above LOR at SW4 (16 Sep & 25 Sep 2019).
PFOA	µg/L	0.02	19[3] 5.6[4]	0.56	<0.02-0.02	<0.02	Concentrations below trigger values
PFOS/PFHxS	µg/L	0.01	0.7[4]	0.07	<0.01	<0.01-0.05	Concentrations below trigger values
PFDS	µg/L	0.02	-	-	<0.02-0.02	<0.02	Concentrations reported above LOR at BH4 (16 Sep 2019)
Sum of PFHxS and PFOS	µg/L	0.01	-	0.07	<0.01	<0.01-0.05	Concentration reported above LOR at SW4 (16 Sep & 25 Sep 2019)
Sum of PFAS	µg/L	0.01	-	-	<0.01-0.19	<0.01-0.05	Concentrations reported above LOR at BH4 (16 Sep 2019), BH6 (17 Dec 2019) and SW4 (16 Sep & 25 Sep 2019)
Physical and Chemical Stressors (Table D)							
pH	pH units	0.01	6.5-8.0[1]-	6.5-8.5[2]	4.37-6.29	4.0-6.21	pH values across the entire Site for both surface water and groundwater were below ANZECC 2000 and ADWG acceptable range
Sodium	mg/L	1	-	180[2]	6.0-67	32-142	Concentrations below trigger values
Calcium	mg/L	1	-	-	<1.0-3.0	4.0-34	Concentrations below trigger values

Analyte	Units	LOR	ANZECC (2000) 95% level of species protection freshwater	ADWG (2011)	Detected Concentration Range (Groundwater)	Detected Concentration Range (Surface Water)	Comparison against trigger values
Magnesium	mg/L	1	-	-	<1.0-10	4.0-52	Concentrations below trigger values
Potassium	mg/L	1	-	-	<1.0-2.0	<1.0-6.0	Concentrations below trigger values
Sulphate	mg/L	1	-	250[2]	2.0-70	16-324	Elevated concentrations above trigger values (ADWG aesthetic) detected in April and May 2019 at SW1
Chloride	mg/L	1	-	250[2]	16-127	53-234	Concentrations below trigger values
Fluoride	mg/L	0.1	-	1.5	<0.1-0.2	<0.1-0.7	Concentrations below trigger values
Reactive phosphorus as P	mg/L	0.01	0.02[1]	-	<0.01-0.03	<0.01-0.01	Elevated concentrations above trigger values (ANZECC 2000 default trigger values) detected at BH1 in May 2019
Total Phosphorus	mg/L	0.01	0.05[1]	-	<0.01-2.76	<0.01-0.13	Elevated concentrations above trigger values (ANZECC 2000) trigger values were detected at BH1 (Sep 2019), BH2 (Feb, Sept & Nov 2019), BH3 (Feb 2019), BH4 (Feb, May, Sept, Nov 2019), BH 5 (Feb 2019), BH6 (May, Sep & Nov 2019), BH7 (Feb, May & Sep 2019), BH8 (Feb, Sep & Nov 2019), BH11 (Sep & Nov 2019), MW239S (Feb, May, Sep & Nov 2019), SW1 (May 2019) and SW3 (Feb 2019)
Ammonia as N	mg/L	0.01	0.9	0.5[2]	<0.01-0.34	<0.01-0.16	Concentrations below trigger values
Total Nitrogen as N	mg/L	0.01	0.35[1]	-	0.03-5.9	0.1-1.8	Elevated concentrations above trigger values (ANZECC 2000 trigger values) were detected at BH2 (Feb, May, Oct & Nov 2019), BH3 (Feb 2019), BH4 (Feb, May & Oct 2019), BH5 (Feb 2019), BH6 (Feb, May, Sep and Nov 2019), BH7 (Feb, May, Sep & Nov 2019), BH8 (Feb, May, Sep & Nov 2019), BH11 (Feb, May, Sep & Nov 2019), MW239S (Feb, May, Sep & Nov 2019), SW1 (May, Sep & Nov 2019) and SW3 (Feb & Nov 2019)
Total Cations	meq/L	0.01	-	-	0.39-3.57	2.23-10	No criteria
Total Anions	meq/L	0.01	-	-	0.54-6.61	2.18-11	No criteria

Analyte	Units	LOR	ANZECC (2000) 95% level of species protection freshwater	ADWG (2011)	Detected Concentration Range (Groundwater)	Detected Concentration Range (Surface Water)	Comparison against trigger values
Total Alkalinity as CaCO3	mg/L	1	-	-	<1.0-24	<1.0-11	No criteria
Total Hardness as CaCO3	mg/L	1	-	200[2]	5.0-41	26-299	Elevated concentrations above trigger values (ADWG aesthetic) were detected at SW1 (Apr, May & Sep 2019)
Electrical Conductivity @ 25°C*	mg/L	1	125-2200	-	54-439	220-1090	Concentrations below trigger values
Total Dissolved Solids	mg/L	1	-	600[2]	35-285	143-708	Elevated concentrations above trigger values (ADWG aesthetic) were detected at SW1 (May, Sep, Oct & Nov 2019)

1 – Default trigger values for physical and chemical stressors, for slightly disturbed ecosystems in lowland rivers, Southeast Australia (value is for base flow and not storm event)
2 – Aesthetic
3 – HEPA NEMP 2020 99% level of protection in freshwater
4 – HEPA NEMP 2020 Recreation Water

4. BASELINE WATER QUALITY ASSESSMENT

4.1 METALS

Elevated concentrations of chromium above trigger values (ANZECC 2000) were recorded at monitoring locations BH1, BH2, BH3, BH7, BH8, BH11, MW239S and SW3. Concentrations ranged from <0.001mg/L - 0.004 mg/L for groundwater and from <0.001 – 0.002 mg/L for surface water.

Elevated concentrations of copper above trigger values (ANZECC 2000) were recorded at monitoring locations BH1, BH2, BH4, BH6, BH7, BH8, BH11, MW239S, SW1, SW3 and SW4. Concentrations ranged from <0.001mg/L - 0.051 mg/L for groundwater and from <0.001 mg/L – 0.02 mg/L for surface water.

Elevated concentrations of iron above trigger values (ADWG) were recorded at all monitoring locations. Concentrations ranged from <0.05 mg/L – 12.5 mg/L for groundwater and from 0.57mg/L– 9.26 mg/L for surface water. Iron concentrations were particularly higher at location BH1.

Elevated concentrations of manganese above trigger values (ADWG) were recorded at monitoring location SW1. Concentrations ranged from <0.003 mg/L – 0.136 mg/L for groundwater and from 0.026 mg/L– 0.841 mg/L for surface water.

Elevated concentrations of nickel above trigger values (ANZECC 2000) were recorded at monitoring locations BH2, BH4, BH7, BH8, SW1, SW3 & SW4. Elevated concentrations of nickel above trigger values (ADWG) were recorded at monitoring locations BH3, BH4 and BH11. Concentrations ranged from <0.001 mg/L – 0.07 mg/L for groundwater and from <0.001mg/L– 0.02 mg/L for surface water.

Elevated concentrations of zinc above trigger values (ANZECC 2000) were recorded at monitoring locations BH1, BH2, BH4, BH6, BH7, BH8, BH11, MW239S, SW1, SW3 and SW4. Concentrations ranged from <0.005 mg/L – 1.27 mg/L for groundwater and from <0.005 mg/L – 0.535 mg/L for surface water.

4.2 PHYSICAL AND CHEMICAL STRESSORS

Elevated concentrations of sulphate above trigger values (ADWG aesthetic) were recorded at monitoring location SW1. Concentrations ranged from 2.0 mg/L – 7.0 mg/L for groundwater and from 16 mg/L – 324 mg/L for surface water.

An elevated concentration of reactive phosphorus above trigger values (ANZECC 2000) default trigger values was recorded at BH1. Concentrations ranged from<0.01 – 0.03 mg/L for groundwater and <0.01-0.13 mg/L for surface water.

Elevated concentrations of total phosphorus above trigger values (ANZECC 2000) were recorded at monitoring locations BH1 and BH2. Concentrations ranged from <0.01 mg/L – 2.11 mg/L for groundwater and from 0.01 mg/L – 0.13 mg/L for surface water.

Elevated concentrations of total nitrogen above trigger values (ANZECC 2000) were recorded at monitoring locations B2, BH3, BH4, BH5, BH6, BH7 BH8, BH11, MW239S, SW1 and SW3. Concentrations ranged from <0.01 mg/L – 2.11 mg/L for groundwater and from 0.01 mg/L – 0.13 mg/L for surface water

Elevated concentrations of Total Hardness as $CaCO_3$ above trigger values (ADWG aesthetic) were recorded at monitoring location SW1. Concentrations ranged from 5.0 mg/L – 41 mg/L for groundwater and from 26 mg/L – 299 mg/L for surface water.

Elevated concentrations of Total Dissolved Solids above trigger values (ADWG aesthetic) were recorded at monitoring location SW1. Concentrations ranged from 35 mg/L – 285 mg/L for groundwater and from 143 mg/L – 708 mg/L for surface water.

Concentrations of pH were below/outside the trigger value range at all monitoring locations. Concentrations ranged from 4.37– 6.29 for groundwater and from 4.0– 6.21 for surface water.

4.3 TPH, TRH AND BTEXN

No hydrocarbon exceedances above adopted criteria were recorded throughout the 12-month monitoring program. Detections were recorded at locations BH1 and BH4. Detections of hydrocarbons at BH1 can be attributed to an acrylic adhesive used for the reinstatement of the above ground section of the well. Detections of hydrocarbons at BH4 followed in close succession with rainfall recorded in the region. BH4 is located adjacent to Cabbage Tree Road and detected concentrations may be attributed to roadway runoff.

4.4 PFAS

One detection of PFOS above adopted aquatic criteria (LOR) protection was recorded at SW4 (0.03 µg/L) and subsequently identified again (0.05 µg/L) during follow-up sampling one week later. Further detections above LOR were identified at BH4 (PFDS -0.02 µg/L) and BH6 (6:2 FTS – 0.19 µg/L). Detections of PFAS at SW4 followed on from recent rainfall in the area which may have contributed to groundwater migration from surrounding known sources (i.e.

Williamtown RAAF Base). Kleinfelder would expect local groundwater to exceed the aquatic criteria given the scale of PFAS reported in groundwater within the Red Zone.

4.5 TREND ANALYSIS

A description of the trends observed throughout the 12-month monitoring period are provided in the sections below and graphical representations are located in the **Chart** section at the rear of this report.

4.5.1 Rainfall

Rainfall for the Site was generally well below the mean average (1942-present) for the locality (BOM Williamtown RAAF 61078) over the 12-month monitoring period. Rainfall exceedances above the mean were recorded in March, June, August and September 2019 with the remainder of months experiencing significantly lower rainfall than would normally be expected. The total rainfall recorded over the 12-month monitoring program was 731.8mm which is 486.4mm less than the yearly mean total of 1218.2mm. **Chart 1** provides a graphical representation of rainfall totals for each month.

4.5.2 Groundwater Elevation

Groundwater throughout the sampling locations demonstrated a general decline in elevations throughout the 12-month period. Most notably the greatest decline in groundwater elevations was observed in the months following the November 2019 water monitoring event which correlate directly with a significant decrease in rainfall from the mean average and increase in temperatures. **Chart 2** provides a graphical representation of groundwater elevation identified following gauging throughout the 12-month monitoring period.

4.5.3 Mann Kendall Analysis

Where sufficient data is available, statistical trend analysis using the Mann-Kendall Trend Test has been undertaken for selected analytes at EPL and SWMP monitoring points to determine if obvious trends were apparent in the dataset (**Table 4.1** and **Table 4.2**). The purpose of the Mann-Kendall Test (Mann 1945, Kendall 1975, Gilbert 1987) is to statistically assess if there is a monotonic upward or downward trend of the variable of interest over time. A monotonic upward (downward) trend means that the variable consistently increases (decreases) through time, but the trend may or may not be linear.

MKA relies on three statistical metrics including:

- **The 'S' Statistic**: Indicates whether concentration trend vs. time is generally decreasing (negative S value) or increasing (positive S value).

- **The Confidence Factor (CF):** The CF value modifies the S Statistic calculation to indicate the degree of confidence in the trend result, as in ‘Decreasing” vs. “Probably Decreasing” or “Increasing” vs. “Probably Increasing.” Additionally, if the confidence factor is quite low, due either to considerable variability in concentrations vs. time or little change in concentrations vs. time, the CF is used to apply a preliminary “No Trend” classification, pending consideration of the COV.
- **The Coefficient of Variation (COV):** The COV is used to distinguish between a “No Trend” result (significant scatter in concentration trend vs. time) and a “Stable” result (limited variability in concentration vs. time) for datasets with no significant increasing or decreasing trend (e.g. low CF).

Where an analyte has recorded a non-detect following laboratory analysis half of the value of detection (LOR) has been applied.

Table 4.1 Mann-Kendall analysis for metals

Site ID	Mann-Kendall Analysis	Metals						
		Barium	Chromium	Copper	Iron	Manganese	Nickel	Zinc
BH1	Coefficient of Variation	0.47	0.24	0.93	0.31	0.25	0.67	1.91
	Mann-Kendall Statistic (S)	-3	-12	11	-15	-16	-2	-33
	Confidence Factor	56.0%	79.9%	77.7%	85.9%	87.5%	53.0%	99.5%
	Concentration Trend	Stable	Stable	No Trend	Stable	Stable	Stable	Decreasing
BH2	Coefficient of Variation	0.20	0.69	0.62	1.05	0.27	1.77	1.15
	Mann-Kendall Statistic (S)	-9	9	29	16	-26	-8	24
	Confidence Factor	70.4%	70.4%	97.4%	87.5	95.7%	68.1%	94.2%
	Concentration Trend	Stable	No Trend	Increasing	No Trend	Decreasing	No Trend	Prob. Increasing
BH4	Coefficient of Variation	0.10	0.27	1.15	0.90	1.11	1.38	1.02
	Mann-Kendall Statistic (S)	-26	9	13	2	-16	-31	-25
	Confidence Factor	95.7%	70.4%	79.0%	59.2%	84.5%	98.1%	95.0%
	Concentration Trend	Decreasing	No Trend	No Trend	No Trend	No Trend	Decreasing	Prob. Decreasing
BH6	Coefficient of Variation	0.09	0.27	1.37	0.29	0.20	1.54	1.27
	Mann-Kendall Statistic (S)	-6	9	10	-2	-19	9	-12
	Confidence Factor	63.1%	70.4%	72.7%	52.7%	88.9%	70.4%	77.0%
	Concentration Trend	Stable	No Trend	No Trend	Stable	Stable	No Trend	No Trend
BH7	Coefficient of Variation	0.45	0.15	1.56	0.28	0.38	0.92	1.37
	Mann-Kendall Statistic (S)	18	9	7	-49	-43	-14	-6
	Confidence Factor	87.5%	70.4%	65.6%	>99.9%	99.9%	81.0%	63.1%
	Concentration Trend	No Trend	No Trend	No Trend	Decreasing	Decreasing	Stable	No Trend
BH8	Coefficient of Variation	0.23	0.37	0.90	0.24	0.36	1.10	1.70
	Mann-Kendall Statistic (S)	-8	30	23	-26	9	2	20
	Confidence Factor	68.1%	97.8%	93.3%	95.7%	70.4%	52.7%	90.2%

Site ID	Mann-Kendall Analysis	Metals						
		Barium	Chromium	Copper	Iron	Manganese	Nickel	Zinc
	Concentration Trend	Stable	Increasing	Prob. Increasing	Decreasing	No Trend	No Trend	Prob. Increasing
BH11	Coefficient of Variation	0.35	0.26	1.10	0.35	0.28	1.9	0.87
	Mann-Kendall Statistic (S)	-24	9	16	7	23	-28	-32
	Confidence Factor	94.2%	70.4%	84.5%	65.6%	93.3%	96.9%	98.4%
	Concentration Trend	Prob. Decreasing	No Trend	No Trend	No Trend	Prob. Increasing	Decreasing	Decreasing
MW239S	Coefficient of Variation	0.25	0.14	0.41	0.20	0.24	0.78	1.10
	Mann-Kendall Statistic (S)	11	9	-1	5	6	5	5
	Confidence Factor	74.9%	70.4%	50.0%	60.6	63.1%	60.6%	60.6%
	Concentration Trend	No Trend	No Trend	Stable	No Trend	No Trend	No Trend	No Trend
SW1	Coefficient of Variation	0.27	0.37	0.77	0.67	0.27	0.858	0.88
	Mann-Kendall Statistic (S)	5	10	7	-20	-26	-19	-16
	Confidence Factor	68.3%	86.2%	80.9%	99.3%	100.0%	98.9	96.9%
	Concentration Trend	No Trend	No Trend	No Trend	Decreasing	Decreasing	Decreasing	Decreasing
SW3	Coefficient of Variation	0.37	0.64	1.48	0.95	0.21	1.07	1.20
	Mann-Kendall Statistic (S)	-23	18	8	-25	-34	-9	-3
	Confidence Factor	95.7%	90.5%	89.8%	97.0%	99.6%	83.2%	56.0%
	Concentration Trend	Decreasing	Prob. Increasing	No Trend	Decreasing	Decreasing	No Trend	No Trend
SW4	Coefficient of Variation	0.17	0.00	1.3	1.18	0.13	1.06	1.08
	Mann-Kendall Statistic (S)	-20	0	2.0	-8	-3	-9	-11
	Confidence Factor	99.3%	45.2%	57.0%	80.1%	59.4%	83.2%	88.7%
	Concentration Trend	Decreasing	Stable	No Trend	No Trend	Stable	No Trend	No Trend

Table 4.2 Mann-Kendall analysis for anions, cations alkalinity and inorganics

Site ID	Mann-Kendall Analysis	Anions and Cations					Alkalinity		Inorganics		
		Sodium	Calcium	Magnesium	Sulphate	Chloride	Total Alkalinity as CaCO3	Total Hardness as CaCO3	EC	TDS	pH
BH1	Coefficient of Variation	0.14	0.68	0.22	0.46	0.08	0.48	0.16	0.12	0.12	0.05
	Mann-Kendall Statistic (S)	24	-19	19	3	-17	22	-5	14	14	11
	Confidence Factor	96.4%	91.8%	91.8%	56.0%	89.1%	94.9%	61.9%	84.0%	84.0%	77.7%
	Concentration Trend	Increasing	Prob. Decreasing	Prob. Increasing	No Trend	Stable	Prob. Increasing	Stable	No Trend	No Trend	No Trend
BH2	Coefficient of Variation	0.10	0.27	0.15	0.54	0.11	1.48	0.13	0.11	0.29	0.06
	Mann-Kendall Statistic (S)	17	-5	-7	-2	-46	21	-13	30	10	34
	Confidence Factor	86.0%	60.6%	65.6%	52.7%	100.0%	91.3%	79.0%	97.8%	72.7%	99.0%
	Concentration Trend	No Trend	Stable	Stable	Stable	Decreasing	Prob. Increasing	Stable	Increasing	No Trend	Increasing
BH4	Coefficient of Variation	0.19	0.30	0.41	0.75	0.06	1.27	0.30	0.14	0.27	0.05
	Mann-Kendall Statistic (S)	28	-18	19	14	-9	8	5	33	16	4
	Confidence Factor	96.9%	87.5%	89.9%	81.0%	70.4%	68.1%	60.6%	98.7%	84.5%	58.0%
	Concentration Trend	Increasing	Stable	No Trend	No Trend	Stable	No Trend	No Trend	Increasing	No Trend	No Trend
BH6	Coefficient of Variation	0.11	0.21	0.12	0.21	0.10	1.29	0.10	0.12	0.13	0.07
	Mann-Kendall Statistic (S)	23	-2	-11	-19	16	19	-15	42	27	36
	Confidence Factor	93.3%	52.7%	74.9%	88.9%	84.5	88.9%	82.8%	99.8%	96.3%	99.3%
	Concentration Trend	Prob. Increasing	Stable	Stable	Stable	No Trend	No Trend	Stable	Increasing	Increasing	Increasing
BH7	Coefficient of Variation	0.12	0.00	0.15	0.14	0.14	1.31	0.16	0.10	0.13	0.05
	Mann-Kendall Statistic (S)	-36	0	-20	-4	-35	20	-20	-8	-21	42
	Confidence Factor	99.3%	47.3%	90.2%	58.0%	99.2%	90.2%	90.2%	68.1%	91.3%	99.8%

Site ID	Mann-Kendall Analysis	Anions and Cations					Alkalinity		Inorganics		
		Sodium	Calcium	Magnesium	Sulphate	Chloride	Total Alkalinity as CaCO3	Total Hardness as CaCO3	EC	TDS	pH
	Concentration Trend	Decreasing	Stable	Prob. Decreasing	Stable	Decreasing	Prob. Increasing	Prob. Decreasing	Stable	Prob. Decreasing	Increasing
BH8	Coefficient of Variation	0.08	0.00	0.27	1.49	0.18	1.55	0.29	0.09	0.12	0.05
	Mann-Kendall Statistic (S)	-1	0	-29	2	-18	18	-29	4	2	51
	Confidence Factor	50.0%	47.3%	97.4%	52.7%	87.5%	87.5%	97.4%%	58.0%	52.7%	>99.9%
	Concentration Trend	Stable	Stable	Decreasing	No Trend	Stable	No Trend	Decreasing	No Trend	No Trend	Increasing
BH11	Coefficient of Variation	0.27	0.00	0.56	1.52	0.20	0.78	0.58	0.28	0.36	0.03
	Mann-Kendall Statistic (S)	-26	0	-14	-23	-34	20	-14	-4	-5	28
	Confidence Factor	95.7%	47.3%	81.0%	93.3%	99.0%	90.2%	81.0%	58.0%	60.6%	96.9%
	Concentration Trend	Decreasing	Stable	Stable	Prob. Decreasing	Decreasing	Prob. Increasing	Stable	Stable	Stable	Increasing
MW239S	Coefficient of Variation	0.10	0.00	0.12	0.43	0.18	1.33	0.12	0.12	0.12	0.04
	Mann-Kendall Statistic (S)	22	0	19	-3	11	7	19	46	40	-11
	Confidence Factor	92.4%	47.3%	88.9%	55.4%	74.9%	65.6%	88.9%	100.0%	99.7%	74.9%
	Concentration Trend	Prob. Increasing	Stable	No Trend	Stable	No Trend	No Trend	No Trend	Increasing	Increasing	Stable
SW1	Coefficient of Variation	0.21	0.29	0.20	0.30	0.33	0.00	0.22	0.12	0.12	0.09
	Mann-Kendall Statistic (S)	20	-21	-20	-14	25	0	-20	10	10	10
	Confidence Factor	99.3%	99.6%	99.3%	'94.6%	100.0%	45.2%	99.3%	86.2%	86.2%	86.2%
	Concentration Trend	Increasing	Decreasing	Decreasing	Prob. Decreasing	Increasing	Stable	Decreasing	No Trend	No Trend	No Trend

Site ID	Mann-Kendall Analysis	Anions and Cations					Alkalinity		Inorganics		
		Sodium	Calcium	Magnesium	Sulphate	Chloride	Total Alkalinity as CaCO3	Total Hardness as CaCO3	EC	TDS	pH
SW3	Coefficient of Variation	0.11	0.24	0.32	0.52	0.14	1.47	0.25	0.21	0.19	0.12
	Mann-Kendall Statistic (S)	-2	-14	18	-4	2	-14	3	17	5	-12
	Confidence Factor	53.0%	84.0%	90.5%	59.0%	53.0%	84.0%	56.0%	89.1%	61.9%	79.9%
	Concentration Trend	Stable	Stable	Prob. Increasing	Stable	No Trend	No Trend	No Trend	No Trend	No Trend	Stable
SW4	Coefficient of Variation	0.06	0.19	0.14	0.23	0.06	0.00	0.16	0.08	0.08	0.04
	Mann-Kendall Statistic (S)	8	1	5	-7	-5	0	0	10	10	21
	Confidence Factor	80.1%	50.0%	68.3%	76.4%	68.3%	45.2%	45.2%	86.2%	86.2%	99.6%
	Concentration Trend	No Trend	No Trend	No Trend	Stable	Stable	Stable	Stable	No Trend	No Trend	Increasing

Table 4.1 and **Table 4.2** provide trend analysis on sampling locations for a number of chemicals, primarily those identified in the EPL as requiring analysis. The trend analysis identifies if the chemical is stable, increasing or decreasing in concentration. This will be useful in future monitoring should a sample be found to be above the adopted trigger value, triggering further assessment.

The majority of the chemicals were found to be stable or no trend was identified. This is typically expected from background monitoring programs. A number of monitoring locations have identified decreasing trends (i.e. Barium is decreasing in BH4, BH11, SW3 and SW4 and Manganese is decreasing in BH2, BH7, SW1 and SW3). Only a few locations were found to be have an increasing trend (Copper in BH2, Chromium in BH8). Throughout the 12-month sampling period NSW was undergoing one of the worst drought periods on record. Changing concentrations of some chemicals may be due to natural fluctuations in in the water (especially following a rainfall event) and/or could be due to the drought conditions. Should this be the case then when periods of heavy rainfall occur it is likely that changes in chemical concentrations may also occur.

5. SITE SPECIFIC ASSESSMENT CRITERIA

5.1 SWMP & EMP REQUIREMENTS

As identified in **Section 1.1**Error! Reference source not found. and **1.2** the SWMP requires that surface and groundwater monitoring is to continue as identified in **Section 1.2**. However, it also states that the following monitoring parameters will be reviewed:

- Location of sampling points, e.g. more suitable / representative location identified, or sampling location has insufficient water to accurately monitor development;
- The frequency of the sampling may be reduced, or increased, depending on the fluctuations in the results; and
- The parameters may be adjusted to remove superfluous analytes and/or add additional analytes.

Therefore, this section presents a review of the parameters identified and makes recommendations for the ongoing monitoring program. It is noted that any proposed changes must be approved by the Department's Secretary (or delegate) and must also be updated in the SWMP.

5.2 EPL REQUIREMENTS

The Sites EPL minimum requirements for the monitoring of groundwater are outlined in **Table 5.1** below.

Table 5.1 EPA Site water monitoring requirements (EPL21264)

Pollutant	Unit of measure	Frequency	Sampling Method	Sample location
Arsenic	mg/L	Monthly	Grab Sample	BH2, BH4, BH6, BH7, BH9, BH11 & MW239S
Conductivity	mS/cm	Monthly	Grab Sample	BH2, BH4, BH6, BH7, BH9, BH11 & MW239S
Depth	M	Monthly	Grab Sample	BH2, BH4, BH6, BH7, BH9, BH11 & MW239S
Iron	mg/L	Monthly	Grab Sample	BH2, BH4, BH6, BH7, BH9, BH11 & MW239S
Manganese	mg/L	Monthly	Grab Sample	BH2, BH4, BH6, BH7, BH9, BH11 & MW239S
pH	pH	Monthly	Grab Sample	BH2, BH4, BH6, BH7, BH9, BH11 & MW239S
Turbidity	Nephelometric Turbidity Units (NTU)	Monthly	Grab Sample	BH2, BH4, BH6, BH7, BH9, BH11 & MW239S

5.3 ANALYTICAL PARAMETERS

This section provides details on the recommended analytical suite for ongoing monitoring (note this is in addition to the requirements of the EPL).

5.3.1 Metals

Beryllium, Cadmium, Mercury, Selenium, Vanadium were all identified to be below the laboratory LOR throughout the 12-month sampling period. The operations across the Site are not considered likely to introduce sources of these metals and therefore it is not considered necessary to continue to monitor for these metals. Analysis for lead identified only four samples out of 124 to be above the LOR and these were reported at the LOR. Analysis for Cadmium identified only 3 samples at SW1 to be at or marginally above the LOR. It is recommended that Lead and Cadmium also be removed from the monitoring programme.

Concentrations of Boron were identified to be present above the LOR in 7 samples. However, the exception is SW1 where all samples taken had concentrations above LOR. Cobalt was found to be above LOR in one sample with the exception of surface water and in BH7. There are no trigger values presented in the ANZECC 2000 guidelines. It is considered unlikely that the quarrying operations would introduce Boron and Cobalt into the environment at significant concentrations and therefore it is recommended that Boron and Cobalt not be analysed in groundwater. However, due to the presence of Boron in SW1 and Cobalt in the surface water, both Boron and Cobalt should continue to be monitored in surface water. Should future surface water monitoring identify an increase in Boron or Cobalt concentrations, then consideration should be given to adding these to the groundwater analytical suite.

It is recommended that 8 Metals continue to be analysed in groundwater and surface water:

- Arsenic (this is required by the EPL);
- Barium (all samples were above LOR, there is no ANZECC criteria for Barium);
- Chromium (samples were found to be above LOR and some samples were found to be above the ANZECC trigger criteria);
- Copper (samples were found to be above LOR and some samples were found to be above the ANZECC trigger criteria);
- Iron (this is required by the EPL);
- Manganese (this is required by the EPL);
- Nickel (samples were found to be above LOR and some samples were found to be above the ANZECC trigger criteria); and
- Zinc (samples were found to be above LOR and some samples were found to be above the ANZECC trigger criteria).

An additional two metals (Boron and Cobalt) should also be analysed in surface water.

5.3.2 Nutrients

Concentrations of Total Phosphorous and Total Nitrogen were found to be elevated above ANZECC 2000 Trigger Values for a low land river in south-east Australia in a number of sampling locations on multiple occasions.

Concentrations of Ammonia were also identified to be present above LOR, however, concentrations were all recorded below the ANZECC 2000 Trigger Values and aesthetic ADWG values.

It is therefore considered appropriate to maintain sampling to identify potential significant changes in concentrations that would impact the local environment.

5.3.3 Hydrocarbons

With the exception of 4 samples, all concentrations were found to be below the LOR. However, the quarry operations plan to store diesel fuel on Site for the operational plant. The Site will also have a maintenance workshop where oils, greases, lubricants and cleaning agents (degreasers) will be stored and used on Site. It is therefore necessary to continue to monitor for hydrocarbons.

It is recommended that TRH continues to be monitored. Should the TRH identify concentrations of C_6 to C_{10} then this should trigger further analysis of BTEXN. Likewise, should concentrations of C_{16} to C_{40} be identified then this should trigger the analysis of PAH.

5.3.4 PFAS

The majority of results were identified to be below the LOR. However, due to the sensitive nature of PFAS and the location of the Site being on the edge of the Williamtown Red Zone, PFAS monitoring should continue.

5.4 LOCATIONS

BH2, BH4, BH6, BH7, BH9, BH11 and MW239S are required to be monitored on a monthly basis as part of the EPL requirements. It is noted that MW9 has been dry consistently through the background monitoring period.

In addition to the above it is recommended that BH8 also be monitored.

5.5 SCHEDULE

Monthly monitoring is required by the EPL. It is not recommended that additional monitoring be undertaken above this every month (however we understand that DPIE has requested Site to make minor modifications to the below program e.g. monthly PFAS monitoring).

It is recommended that quarterly monitoring be undertaken to include:

- 8 metals (as identified above);
- TRH;
- PFAS;
- Nutrients (Total Phosphorus, Total Nitrogen and Ammonia as N); and
- and the inclusion of sampling BH8.

As part of the quarterly monitoring, all available wells should be gauged for groundwater depths and observed for monitoring well condition.

In order to review and confirm the continued relevance of the outcome of this summary document and proposed analytical program, an annual monitoring event should be undertaken including all analytes and locations sampled as part of the background monitoring.

Additional analysis may be required should there be a recorded spill event or other potential pollution incident.

5.6 SUMMARY OF PROPOSED SAMPLING

Table 5.2 provides a summary of the proposed ongoing operational monitoring schedule for the Site. **Table 5.3** provides a summary of the proposed testing schedule for the different monitoring events .

Table 5.2 Proposed operational monitoring schedule

Location	Monthly	Quarterly	Annually
BH2, BH4, BH6, BH7, BH9, BH11 and MW239S	✓	✓	✓
BH8 SW1, SW2, SW3, SW4		✓	✓
BH1, BH5, BH12			✓

Table 5.3 Proposed testing schedule

Monthly	Quarterly	Annually
• Conductivity; • pH; • Depth; • Turbidity; • Arsenic; • Iron; and • Manganese.	• Gauging all available wells; • Conductivity; • pH; • Depth; • Turbidity; • Nutrients (Total Phosphorus, Total Nitrogen and Ammonia as N); • 8 metals (As, Ba, Cr, Cu, Fe, Mg, Ni and Zn); • Additional 2 metals (B and Co) for surface water; • TRH; and • PFAS.	• Gauging all available wells; • Conductivity; • pH; • Depth; • General water quality parameters (Ca, Mg, Na, K, pH, EC, Cl, SO_4, Alkalinity, Hardness & TDS); • Nutrients (Total Phosphorus, Total Nitrogen and Ammonia as N); • Turbidity; • Metals (As, B, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Se, V, Zn); • TRH and BTEXN; and • PFAS.

5.7 SITE SPECIFIC TRIGGER VALUES

As discussed in **Section 1.3** one of the objectives of this report is to establish Site specific trigger values to be used for long-term monitoring during the operation of the sand quarry. An exceedance of a trigger value does not necessarily indicate that there is an unacceptable risk on Site, but rather a trigger for further investigation or evaluation of management options (CRC-CARE Technical Report 10: 2011). **Section 5.8** provides details on the proposed action response should a trigger value be exceeded.

The baseline groundwater and surface water assessment criteria adopted for future quarry extraction works for locations to be monitored under the Sites EPL, and defined in the SWMP, are summarised below. Nationally accepted water quality guidelines; ANZECC (2000) *Australian and New Zealand Water Quality Guidelines for Fresh and Marine Waters, 95% species Protection for freshwater,* HEPA NEMP (2018) *PFAS National Environmental Management Plan* and ADWG (2011) *Australian Drinking Water Guidelines 6,* have been considered in developing Site specific trigger values.

Table 5.4 and **Table 5.5** presents the proposed trigger values for groundwater and surface water respectively along with a justification for selecting that value. The trigger values are to be applied to the sample locations monitored monthly and quarterly. Locations monitored as part of the annual monitoring should be compared against currently available data for that location only as they have not been considered when developing the trigger values.

Table 5.4 Site specific trigger values for Groundwater

Analyte	Units	Adopted Site specific trigger value	Location	Justification
Inorganics				
pH	pH units	4 - 7	Site wide	The lowest pH value recorded was 4.37 (noting 4.0 in surface water). It is feasible that pH values could continue to be low. The highest pH value recorded was 6.21 indicating a generally acidic environment. It is therefore unlikely the pH would exceed 7.
Total Phosphorus	mg/L	2	Site wide	The majority of baseline results were found to be elevated above the ANZECC 2000 trigger values for a Lowland river in South-east Australia. It is therefore not considered appropriate to use this criterion. The majority of baseline sample results were less than 2mg/L, however it is noted that the highest value recorded was 2.76mg/L at BH3 (noting one sample event and the well is no longer operational) and 2.11mg/L in BH11. The third highest concentration of 1.97mg/L was located at BH8. The sample locations identified represent a large cross section of the Site therefore represent the likely range that could be expected at the Site.
Ammonia as N	mg/L	0.5	Site wide	The detected range of <0.01-0.34mg/L was not found to be elevated above the ANZECC 2000 and ADWG. Based on the results obtained it is considered that adopting the 0.5mg/L ADWG provides a conservative value for a trigger response. It is noted that the ANZECC criteria is 0.9mg/L.
Total Nitrogen as N	mg/L	3	Site wide	Results from the majority of locations were generally found to be elevated above the ANZECC 2000 trigger values, with the exception of BH1 where concentrations were recorded to be marginally lower than the initial criteria. The highest concentrations were recorded in BH11 (considered to be up hydraulic gradient of the Site) and BH2 located centrally on Site. Concentrations as high as 2.2mg/L (in BH7) were identified at locations down/ cross hydraulic gradient of the Site. It is evident that concentrations of Nitrogen can be found naturally across the Site and can be varied over time. Concentrations of Total Nitrogen are not expected to be elevated above the highest recorded value of 5.9mg/L. However, to maintain a level of conservatism a trigger value of 3mg/L (half the highest concentration) has been adopted understanding that four previous samples exceeded this value. Elevated concentrations above the adopted trigger value is a requirement to look at the concentration with more detail to determine if it is in line with previous sampling results or considered to be an outlier potentially presenting a significant increase.
Electrical Conductivity @ 25°C*	µc/cm	125-2200	Site wide	Concentrations across the Site were identified to vary considerably. However, no concentration was found to be elevated above 2200 µc/cm. Trigger criteria has been taken from ANZECC 2000 for a lowland river is south-eastern Australia and is considered appropriate.

Analyte	Units	Adopted Site specific trigger value	Location	Justification
Turbidity	NTU	6-50	Site wide	Criteria taken from ANZECC 2000 for a lowland river is south-eastern Australia.
Dissolved Metals				
Arsenic	mg/L	0.003	Site wide	Arsenic was not detected within the majority of groundwater locations with the exception of BH8 recording a maximum concentration of 0.003 mg/L. The adopted trigger value has been taken as the maximum value obtained throughout the baseline monitoring period.
Barium	mg/L	0.035	Site wide	All results for Barium were found to be above the LOR. The highest concentration recorded was 0.034mg/L in BH6 (considered to be up/ cross hydraulic gradient of the Site). The adopted trigger value has been taken to be one significant figure above the highest concentration.
Chromium	mg/L	0.004	Site wide	All locations recoded concentrations of chromium at or marginally above LOR. Exceedances above initial baseline criteria (ANZECC 2000) were recorded at most locations with the exception of BH4 & BH6. The adopted trigger value has been taken as the maximum value obtained throughout the baseline monitoring period.
Copper	mg/L	0.013	Site wide (except BH4)	Detections of copper concentrations above LOR were recorded at all locations. The adopted trigger value has been taken as the maximum value obtained throughout the baseline monitoring period.
		0.051	BH4	Concentration range for copper at location BH4 was generally greater than other locations. It is feasible that stormwater runoff from the adjacent Cabbage Tree Road may impact this borehole. Therefore, a higher specific trigger value has been adopted which is the highest concentration identified during the baseline monitoring.
Iron	mg/L	4.1	Northern Half (BH6, BH7, BH8, BH11 and MW239S),	The Site can be divided into a northern section and southern section with an access road between the two sections (between BH2 and SW2). The north and south areas are divided by surface water (where SW2 and SW3 are located). Upon review of the groundwater data from the baseline monitoring it appears that there are greater concentrations of iron in the northern area than the southern area. Two separate criteria have been developed based on this. The highest concentration identified during the baseline monitoring for this area has been adopted as the Trigger Value.
		1	Southern half (BH2, BH4, BH9)	The highest concentration identified during the baseline monitoring for this area has been adopted as the Trigger Value.

Analyte	Units	Adopted Site specific trigger value	Location	Justification
				BH1, BH5, BH12 are only proposed to be sampled during the annual monitoring round. When assessing these wells, concentrations will be assessed against previous criteria for those locations.
Manganese	mg/L	0.136	Site wide	A similar range of results were identified across all locations. BH4 recorded the highest value of Manganese (0.136mg/L) across the Site. The highest concentration identified during the baseline monitoring has been adopted as the Trigger Value. It is noted that the ANZECC 2000 criteria is 1.9mg/L.
Nickel	mg/L	0.037	BH11	BH11 is located to the north of the Site and is considered to be in an up hydraulic gradient location. The highest concentration identified in BH11 was 0.037mg/L. This has been adopted as the trigger value for this location.
		0.022	Site wide (excluding BH11)	With the exception of BH6 and MW239S, at least one concentration from each monitoring location throughout the baseline monitoring was found to be elevated above than the ANZECC 2000 trigger values. Generally, concentrations of Nickel are similar across the Site (with the exception of BH11). Therefore, the highest recorded value from the baseline monitoring round has been adopted as the trigger value.
Zinc	mg/L	0.085	Site wide	At least one concentration from each monitoring location throughout the baseline monitoring was found to be elevated above than the ANZECC 2000 trigger values. Generally, concentrations of Zinc are similar across the Site. Therefore, the highest recorded value from the baseline monitoring round has been adopted as the trigger value. Noting that BH1 is not proposed to be sampled until the annual monitoring round where the results should be assessed against previous results from that location only.
TRH				
TRH C_6 – C_{10}	µg/L	20	Site wide	Concentrations of TRH were identified to be below the LOR for the majority of the baseline monitoring. The exceptions were following well maintenance work or were observed in BH4 following a high rainfall event. It is feasible that stormwater runoff from the adjacent Cabbage Tree Road may locally impact BH4. Based on the understanding of the above, generally TRH is not identified within the groundwater across the Site. The Laboratory LOR has therefore been adopted as a trigger value.
C_6 - C_{10} minus BTEX (F1)	µg/L	20	Site wide	
TRH C_{10} – C_{16}	µg/L	100	Site wide	
TRH C_{10} - C_{16} minus N (F2)	µg/L	100	Site wide	
TRH C_{16} – C_{34}	µg/L	100	Site wide	

Analyte	Units	Adopted Site specific trigger value	Location	Justification
TRH C_{34} - C_{40}	µg/L	100	Site wide	
PFAS				
PFOS+ PFHxS	µg/L	0.07	Site wide	Site criteria has been provided in the SWMP. In 2016, Food Standards Australia New Zealand (FSANZ) were commissioned to develop health-based guidance values for a selection of PFAS. FSANZ (2017) published levels for use in Site investigations which were updated and incorporated into the HEPA NEMP (2018), which was revised in 2019. The HEPA NEMP (2019) is the recognised national guidance for the investigation and management of PFAS in Australia and forms the key guidelines for this SWMP. This has therefore been adopted in this report.
PFOA	µg/L	0.56	Site wide	
PFOS	µg/L	0.01	Site wide	Standard LOR has been adopted as the Site wide criteria as it is known that PFAS are widely present in the local area owing to the Red Zone. Ambient concentrations have been detected above this in groundwater emanating from Williamtown RAAF Base.

1- National Health and Australian Drinking Water Guidelines 6 (ADWG) (2011)
ANZECC (2000) 95% level of species protection in freshwater -

Table 5.5 Site specific trigger values for Surface Water

Analyte	Units	Adopted Site specific trigger value	Location	Justification
Inorganics				
pH	pH units	4 - 7	Site wide	The lowest pH value recorded was 4.01 in surface water). It is feasible that pH values could continue to be low. The highest pH value recorded was 6.21 indicating a generally acidic environment. It is therefore unlikely the pH would exceed 7.
Total Phosphorus	mg/L	0.13	Site wide	The two out of the 10 surface water baseline results were found to be above the ANZECC 2000 trigger values for a Lowland river in South-east Australia. It is therefore not considered appropriate to use this value. The highest recorded value in the surface water was 0.13mg/L in SW1. This value has been adopted as the trigger value for surface water.
Ammonia as N	mg/L	0.25	Site wide	The detected range of <0.01-0.16mg/L was not found to be elevated above the ANZECC 2000 and ADWG. Based on the results obtained it is considered that adopting half the 0.5mg/L ADWG value provides a conservative approach for a trigger level. It is noted that the ANZECC criteria is 0.9mg/L.

Analyte	Units	Adopted Site specific trigger value	Location	Justification
Total Nitrogen as N	mg/L	1.8	Site wide	Results from the majority of locations were found to be elevated above the ANZECC 2000 trigger criteria. The highest concentrations were recorded in SW1. It is evident that concentrations of Nitrogen can be found naturally across the Site and vary over time. Concentrations of Total Nitrogen are not expected to be elevated above the highest recorded value of 1.8mg/L. Therefore, this has been adopted as the trigger value.
Electrical Conductivity @ 25°C*	µc/cm	125-2200	Site wide	Concentrations across the Site were identified to vary considerably. However, no concentration was found to be elevated above 2200 µc/cm. Trigger criteria has been taken from ANZECC 2000 for a lowland river is south-eastern Australia and is considered appropriate for this Site.
Turbidity	NTU	6-50	Site wide	Criteria taken from ANZECC 2000 for a lowland river is south-eastern Australia.
Dissolved Metals				
Arsenic	mg/L	0.001	Site wide	Arsenic was not detected within the majority of groundwater locations with the exception of SW3 recording a maximum concentration of 0.006 mg/L. As the majority of results were recorded below the LOR, the adopted trigger value has been taken as the laboratory LOR.
Barium	mg/L	0.08	Site wide	All results for Barium were found to be above the LOR. The highest concentration recorded was 0.08mg/L in SW3. The adopted trigger value has been taken to be the highest concentration recorded.
Boron	mg/L	0.14	SW1	All results at SW1 for Boron were found to be above the LOR compared to all other locations that had concentrations below LOR. Therefore, a location specific trigger value has been adopted for SW1.
		0.05	SW3 & SW4	All results were found to be below the LOR. The adopted trigger value has been taken as LOR.
Chromium	mg/L	0.002	Site wide	The majority of results were found to be below the LOR with one result higher than the ANZECC 2000 trigger value recorded in SW3. The adopted trigger value has been taken as the maximum value obtained throughout the baseline monitoring period.
Cobalt	mg/L	0.017	Site wide	Detections of Cobalt concentrations above LOR were detected at all surface water locations. The highest concentration was 0.017mg/L in SW1. The adopted trigger value has been taken to be the highest concentration recorded.
Copper	mg/L	0.013	Site wide	Detections of Copper concentrations above LOR were recorded at all locations. The adopted trigger value has been taken as the same value as the groundwater trigger value. The maximum value obtained in surface water throughout the baseline monitoring period was 0.012mg/L.

Analyte	Units	Adopted Site specific trigger value	Location	Justification
Iron	mg/L	9.26	Site wide	The concentrations of Iron identified in the surface water monitoring results were varied and the Mann-Kendal analysis identified a decreasing trend in SW1 and SW3 and no trend in SW4. The highest concentration identified during the baseline monitoring for this area has been adopted as the Trigger Value. Based on the trend analysis it is not expected this value would be exceeded.
Manganese	mg/L	0.048	SW1 & SW3	Concentrations of manganese in SW1 and SW3 were found to be similar. The highest concentration identified has been adopted as the trigger value for these locations.
		0.841	SW4	Concentrations of manganese in SW4 were found to be elevated above those in SW1 and SW3. It is feasible that stormwater runoff from the adjacent Cabbage Tree Road may impact this location. Therefore, the highest concentration found in SW4 has been taken as the trigger value.
Nickel	mg/L	0.022	Site wide	Concentrations of nickel in each of the surface water locations was found to be similar. The highest concentration identified in SW1 was 0.02mg/L. This is similar to the trigger value adopted for groundwater; therefore, the same value has been adopted as the trigger value.
Zinc	mg/L	0.085	SW1 & SW3	Concentrations of Zinc in SW1 and SW3 were found to be similar. The highest concentration identified has been adopted as the trigger value for these locations.
		0.535	SW4	Concentrations of Zinc in SW4 were found to be elevated above those in SW1 and SW3. It is feasible that stormwater runoff from the adjacent Cabbage Tree Road may impact this location. Therefore, the highest concentration found in SW4 has been taken as the trigger value.
TRH				
TRH C_6 – C_{10}	µg/L	20	Site wide	All concentrations of TRH were identified to be below the LOR. The Laboratory LOR has therefore been adopted as the trigger value.
C_6 - C_{10} minus BTEX (F1)	µg/L	20	Site wide	
TRH C_{10} – C_{16}	µg/L	100	Site wide	
TRH C_{10} - C_{16} minus N (F2)	µg/L	100	Site wide	
TRH C_{16} – C_{34}	µg/L	100	Site wide	
TRH C_{34} - C_{40}	µg/L	100	Site wide	

Analyte	Units	Adopted Site specific trigger value	Location	Justification
PFAS				
PFOS+ PFHxS	µg/L	0.07	Site wide	Site criteria has been provided in the SWMP. In 2016, Food Standards Australia New Zealand (FSANZ) were commissioned to develop health-based guidance values for a selection of PFAS. FSANZ (2017) published levels for use in Site investigations which were updated and incorporated into the HEPA NEMP (2018). The HEPA NEMP (2018), revised in 2019, is the recognised national guidance for the investigation and management of PFAS in Australia and form the key guidelines for this SWMP. This has therefore been adopted in this report.
PFOA	µg/L	0.56	Site wide	
PFOS	µg/L	0.01	Site wide	Standard LOR has been adopted as the Site wide criteria as it is known that PFAS are widely present in the local area owing to the Red Zone. Ambient concentrations have been detected above this in groundwater emanating from Williamtown RAAF Base.

5.8 TRIGGER RESPONSE ACTIONS

5.8.1 Metals & Nutrients

The following provides details on the proposed response action required should an analyte concentration be found above the adopted trigger value:

- Review value against previous data including Mann-Kendal trends presented in **Table 4.1** to determine if the concentrations is in line with previous monitoring data, or if considered significantly different then:
  - Question result with the laboratory;
  - Discuss what operations have been undertaken that may cause the elevated concentration; and
  - Review rainfall data and groundwater elevations to establish if concentration is due to seasonal adjustments.
- Re-sample location and elevated metal in the following two monthly monitoring rounds to gauge if the exceedance was an exception of change in trend or characteristic of background changes.

Where the outcome of the above assessment indicates a potential contamination issue then a water trigger investigation should be undertaken in accordance with the SWMP (see **Section 5.8.4**).

5.8.2 Hydrocarbons

The following provides details on the proposed response action required should an analyte concentration be found above the adopted trigger value:

- Question result with the laboratory to determine if there were any laboratory errors;
- Discuss what operations have been undertaken that may cause the elevated concentration;
- Review rainfall data and groundwater elevations to establish if concentration is due to seasonal adjustments; and
- Re-sample location in the following two monthly monitoring rounds to gauge if the exceedance was an exception of change in trend, or characteristic of background changes, and include the following additional analysis:
  - Where TRH C_6 to C_{10} has been detected then BTEXN will also be analysed; and/or
  - Where TRH C_{16} to C_{40} has been detected then PAH will also be analysed.

Where the outcome of the above indicates a potential issue then a water trigger investigation should be undertaken in accordance with the SWMP (see **Section 5.8.4**).

Where a spill or potential pollution incident event has occurred, or the above conversation with the quarry operations indicates a potential contamination issue, then sampling (or re-sampling) at the closest (down hydraulic gradient) location should be undertaken within 48 hours. An incident investigation in accordance with the SWMP must be undertaken.

5.8.3 PFAS

Where PFAS is identified above the adopted criteria (or maximum background value detected previously at a specific monitoring location) an additional water sample will be collected within 48 hours and submitted for analysis. In the event the trigger value is exceeded by more than 10% in both the primary sample and the follow-up sample, a water trigger Investigation will be completed to determine if the change is related to:

- The quarry operations;
- External influence; and/or
- Natural variation.

5.8.4 Water Trigger Investigation

Upon triggering the need for a water trigger investigation Hunter Water Corporation (HWC), NSW Environmental Protection Agency (EPA) and Department of Planning Industry and Environment (DPIE) must be notified within 24hours. The SWMP stipulates that the water trigger investigation will evaluate the following:

- A review of the Site conceptual site model to understand the risk potential of the exceedance;
- Identify the potential for other sources to be present that may require confirmatory sampling (and include intrusive investigation if considered appropriate);
- Recent climate and rainfall data;
- Other activities within the catchment (both on and off the Site) in the preceding period;
- Operational activities of the quarry in the preceding period; and
- Historical potential for those quarry activities to cause exceedance.

The water trigger investigation report will be submitted as an incident notification to HWC, EPA and DPIE. The report will also be summarised in the Annual Environmental Review (AER).

6. QUALITY ASSURANCE AND QUALITY CONTROL

6.1 DATA VALIDATION

The QA/QC program implemented for this monitoring program followed the requirements of the SWMP.

Data Quality Indicators (DQIs) were developed prior to commencing background monitoring and have been summarised in **Table 6.1.** DQIs established acceptable limits for field and laboratory data collected from the monitoring program.

Table 6.1 QA/QC data quality indicators

QA/QC Objective	Data quality indicator (DQI)
Successful completion of project	To conduct a baseline water quality sampling program in accordance with NEPM 2013 and AS4482.1 – 1999 in order to achieve the objective set out in **Section 1**.
Suitable environmental consultant	The environmental consultant was to maintain QA Systems certified to AS/NZS ISO 9001:2015.
Suitable field personnel	All Kleinfelder field personnel conducting sampling were to be trained in the requirements detailed in this SWMP. All Kleinfelder field personnel have relevant tertiary qualifications and have demonstrated competence in Kleinfelder procedures for sampling (consistent with NEPM 2013 and AS4482.1 - 1999).
Adequate sample collection density	The sampling strategy was developed based on historical information available for the Site and the objective of the investigation.
Standardised sample nomenclature	All samples were labelled with a unique identifier that can be related to sample location. Surface water and Groundwater samples were labelled as per monitoring well ID. The following naming convention was utilised: Bore Hole (BH) – Number (1, 2, 3…): E.g. MW1 Surface water (SW) – Number (1, 2, 3…): E.g. SW1
Decontamination of field equipment	When sampling equipment was used, nitrile gloves were worn and changed between locations. Non-dedicated sampling equipment was decontaminated between sample locations using an appropriate surface-active cleaning agent (e.g. Liquinox for use with PFAS) as consistent with NEPM 2013 and HEPA NEMP (2019).
Calibration of field instruments	All field instruments were calibrated prior to use, and the calibration certificates have been provided in **Appendix C** .
Transportation	A Chain of Custody (COC) document was used to ensure the integrity of the samples from collection to receipt by the analytical laboratory within appropriate holding times.
National Association of Testing Authorities (NATA) accredited laboratory analysis	All samples were forwarded to a laboratory holding NATA accreditation for the required analyses. The following Laboratories were utilised: • ALS – Primary Laboratory for chemical analysis; and • Eurofins – Secondary Laboratory for chemical analysis.

QA/QC Objective	Data quality indicator (DQI)
Field QA/QC	Duplicate samples (intra-laboratory) were collected at a rate of one in every twenty (1:20) primary water samples and submitted to the primary laboratory for analysis. Standard NEPM 2013 duplicate and triplicate requirements were deemed reasonable for the sampling of PFAS for the purpose of baseline water monitoring. Triplicate samples (inter-laboratory) were also collected at a rate of one in every twenty (1:20) primary water samples and submitted to the secondary laboratory for analysis. Field duplicate and triplicate samples are used to assess field and analytical precision and the precision measurement is determined using the relative percent difference (RPD) between the primary sample (X1) and duplicate sample (X2) results, as shown in the following equation: $\text{Relative percent difference (RPD)} = \frac{(X1 - X2)}{(X1 + X2)/2} \times 100$ Generally, it is recommended that RPD is <30% (NEPM 2013). Default RPD levels in the field may be non-compliant for the following reasons: • The differing laboratory equipment, procedures and limits of reporting (between the primary and secondary laboratories); • Due to sample matrix interference; and/or • Due to the reported concentrations being close to the limit of reporting where laboratory precision and accuracy are inherently low. A rinsate blank sample was collected for each piece of non-dedicated sampling equipment per day onsite and submitted to the primary laboratory for analysis. A transport blank sample was collected for each batch of samples sent to the laboratory (~one per day in the field) and submitted to the primary laboratory for analysis for each day samples are taken. QA/QC non-compliance was documented and discussed in the monthly summary letter (see **Appendix B**). Where exceedances were identified (i.e. duplicates and triplicates be above the RPD or rinsate blanks, field blanks or transport blanks be above the LOR) then consideration was given to the sample(s) being re-analysed, the higher concentration level to be conservatively adopted and/or reviewing field practices for continued prevention of potential cross contamination.
Laboratory Quality Control – Duplicates, spikes, blanks and surrogates – Acceptable Limits	Laboratory QA/QC acceptance limits are as follows: Surrogates: 70% to 130% recovery; Matrix Spikes: 70% to 130% recovery for organics or 80% to 120% recovery for inorganics; Control Samples: 70% to 130% recovery for soil or 80% to 120% recovery for waters; Duplicate Samples: <4 Practical Quantitation Limits (PQL) - +/- 2PQL, 4-10PQL – 0.-25 or 50%RPD, >10PQL – 0-10 or 30%RPD; and Method Blanks: zero to <PQL.

6.2 QA/QC RESULTS

6.2.1 Field Method Validation

To ensure the completeness, comparability, representativeness, precision and accuracy of QA/QC items, **Table 6.2** details how the QA/QC compliance has been met.

Table 6.2 Field QA/QC

QA/QC Objective	Data Quality Indicator (DQI)
Suitable field personnel	The Site work was undertaken by Dan Kousbroek who has 4 years' experience in contaminated land investigations. Dan was informed of the requirements of the agreed scope of works. Dan has relevant tertiary qualifications and has demonstrated competence with Kleinfelder's sampling procedures (consistent with NEPM 2013 requirements and AS4482.1 2005).
Adequate sample collection density	Water sampling was undertaken based on information provided in the SWMP. A targeted sampling program was undertaken requiring sampling at 10 groundwater locations and 4 surface water locations and then analysed. It is noted that a number of the surface water locations were found to be dry throughout the 12 months due to an extended drought period in NSW.
Field equipment	YSI 556 Water Quality Meter and Solinst oil/water interface meter were used during field works.
Calibration of field instruments	Calibration certificates for each piece of equipment used in the field are attached in **Appendix C**
Sample preservation	Samples were collected in laboratory supplied containers and immediately stored in an insulated esky chilled with ice.
Sample handling	Samples were delivered straight to ALS Newcastle following each sampling event. Chains of custody are included in Appendix A of the monthly reports**,** which have been provided as **Appendix B** of this document.

6.2.2 Laboratory QA/QC

The results for internal laboratory QA/QC procedures are provided within the laboratory analysis reports (Appendix A of the monthly reports, which have been provided as **Appendix B** of this document). **Table 6.3** summarises conformance to specific QA/QC procedures, also see **Tables E, F** and **G** at the rear of this report for a summary of the data.

Table 6.3 Laboratory QA/QC

Quality assurance	Conformed	Comment
Collection of rinsate water from decontaminated field equipment	Yes	Rinsate was sourced from a NATA accredited laboratory and supplied with the sample containers. A rinsate sample was taken from the sampling equipment during each sampling event. A total of 12 rinsate samples were taken. All samples were non detect. See **Tables E, F** and **G** at the back of this report.
Collection of transport blanks through the sampling day	Majority	12 transport blank samples were collected (two samples in March (due to a return confirmatory sampling event), no transport taken in August 19) 2nd transport blank taken in March (15/03/19) was found to contain barium (2ug/l). As no other transport blanks were found to have concentrations above LOR and the following months samples resulted in non detect the data is considered reliable. See **Tables E, F** and **G** at the back of this report.
Holding times met	Yes	Holding times were met for all analytes and samples. Every effort was made by Kleinfelder to deliver samples to the laboratory as soon as possible after sampling.

Quality assurance	Conformed	Comment
LOR less than assessment criteria	Yes	Majority of LOR were below the adopted screening criteria. Adopted criteria for PFOS (HEPA NEMP 2018) is below LOR. It is noted that PFAS are likely to be in the region given the reported scale of PFAS in groundwater within the Red Zone, therefore the standard LOR has been adopted.
All analyses National Association of Testing Authorities (NATA) accredited	Yes	All samples were delivered to a NATA accredited laboratory for the required analysis, within specified holding times. The primary laboratory used was ALS (delivered to the Newcastle laboratory). Triplicate samples were forwarded by ALS to the secondary laboratory, Eurofins mgt (Newcastle).
Field intra-laboratory duplicate samples collected and analysed to represent 5% of sample population	Majority	One intra-laboratory duplicate sample and one inter-laboratory triplicate water sample were collected. This is considered to exceed the requirement of 5% of the total number of primary analyses undertaken (minimum 1 in 20 duplicate and 1 in 20 triplicate samples). Due to a laboratory error in transferring samples, one intra-laboratory triplicate (March 2019) was only sampled for Metals and PFAS with TRH and BTEX being missed from the COC to the tertiary laboratory. With the exception of some minor elevations of TRH and BTEX which were attributed to maintenance work on the well, there were no recorded concentrations above LOR. Therefore, this is not considered to impair the reliability of data in meeting the objectives of this monitoring programme. See **Table 6.5** for details.
Did duplicate sample meet RPD requirements	Majority	The majority of samples met the RPD requirements of being within 30% (See **Tables E, F** and **G** at the back of this report). The following did not meet these requirements: • Arsenic – 67% BH8 (Feb 2019) • Cobalt – 40% BH7 (March 2019) • Copper – 190% SW4 (September 2019) • Lead – 67% SW4 (September 2019) • Nickel – 140% SW4 (September 2019), 67% BH6 (January 2020) • Zinc – 100% BH8 (February 2019), 151% SW4 (September 2019) In general, for these exceedances at least one sample was found to be below or close to the Laboratory LOR, which leads to exaggerated RPD calculations. In order to take a conservative approach, the highest recorded concentration has been selected for results screening. These RPD exceedances are therefore not considered to have a negative impact on the outcome of the assessment.
Did triplicate sample meet RPD requirements	Majority	The majority of samples met the RPD requirements of being within 30% (See **Tables E, F** and **G** at the back of this report). The following did not meet these requirements: Water: • Arsenic – 67% BH8 (February 2019) • Chromium – 86% BH8 (February 2019), 67% SW3 (June 2019) • Cobalt – 40% • Copper – 190% SW4 (September 2019), 156% BH6 (January 2020)

Quality assurance	Conformed	Comment
		• Lead – 67% SW4 (September 2019) • Nickel – 156% BH7 (March 2019), 140% SW4 (September 2019), 111% SW4 (November 2019) • Zinc – 113% BH7 (March 2019), 151% SW4 (September 2019), 172% SW4 (November 2019) & 131% BH6 (January 2020) • PFOS – 100% SW4 (September 2019) • Sum of PFHxS and PFOS – 100% (September 2019) • Sum of PFAS (WA DER List) – 86% (September 2019) • Sum of PFAS – 133% (September 2019) A number of exceedances were calculated with one sample being below the Laboratory LOR. This leads to a potentially exaggerated RPD calculations. In order to take a conservative approach, the highest recorded concentration has been selected for results screening. RPD exceedances for triplicates can often be attributed to differences in methods used by each of the labs and are not considered to impair the reliability of the data in meeting the objectives of this monitoring programme.
Internal laboratory procedures	Majority.	Holding time breaches are discussed above. Internal laboratory QC procedures were generally met. Some exceedances of internal procedures for laboratory duplicates and matrix spikes were recorded for water samples, for organic analysis. However, the primary laboratory results recorded these analytes to be below the LOR. Therefore, this does not impair the reliability of the analytical data for decision making. This is not considered to impact the outcome of the results and thus unlikely to impair the outcome of decision making.

A summary of the water sample container types, preservation and the order of container filling is provided in **Table 6.4**.

Table 6.4 Container types, preservation and order of filling

Analyte	Container Type	Preservation
PFAS incl PFOS, PFOA, PFOS/PFHxS, PFDS	1 x 60mL Plastic Bottle - Unpreserved	Refrigerate
TPH (C_{10}-C_{36})	1 x 100mL Amber Glass Bottle - Unpreserved	Refrigerate
TRH (C_6-C_{10}), BTEXN, VOC	2 x 40mL amber Glass Vials with Teflon lined septa	Sulfuric Acid
Heavy metals - Dissolved	1 x 60mL Clear Plastic Bottle - Filtered	Nitric acid
Extended Water Suite	1 x 500mL Clear Plastic Bottle – Unpreserved 1 x 60mL Clear Plastic Bottle	Refrigerate Sulfuric Acid
General Water Suite	1 x 500mL Clear Plastic Bottle – Unpreserved	Refrigerate

Table 6.5 Summary of groundwater QC program

Analyte	Number of Groundwater Samples Analysed			% QC Samples Relative to Primary Samples
	Primary	Field Duplicates (intra-lab)	Laboratory Splits (inter-lab)	
TRH	124	6	**5**	**9%**
BTEXN	124	6	**5**	**9%**
Dissolved metals	124	6	6	10%
PFAS	65	5	5	15%

Bold: Indicates not meeting the triplicate density.

6.3 QUALITY STATEMENT

Field sampling procedures conformed to Kleinfelder's QA/QC protocols to prevent cross contamination, preserve sample integrity and allow for collection of a suitable data set from which to make technically sound and justifiable decisions with data of satisfactory useability.

Based on a review of the results for the Kleinfelder and laboratory QA/QC program adopted, the overall data quality is considered to be suitably reliable and representative of groundwater conditions beneath the Site. Copies of the final NATA endorsed laboratory reports, including internal QA/QC results and chain-of-custody documentation for the primary and secondary laboratories are attached as Appendix A of the monthly reports, which have been provided as **Appendix B** of this document.

6.4 EQUIPMENT CALIBRATION

All equipment used was supplied calibrated with appropriate calibration certificates (see **Appendix A**). Kleinfelder undertook pre-mobilisation checks of equipment (including calibration as required). Prior to commencing field operations, the following equipment and calibration checks were conducted:

- **Water Quality Meter** – The water quality meter came calibrated from the supplier. A daily confidence check of dissolved oxygen, pH and EC was undertaken using air and standards of known concentration, and calibration performed as warranted.
- **PID** – the PID came calibrated from the supplier. A daily fresh air calibration check was undertaken on Site.

7. SUMMARY STATEMENT

A baseline water monitoring program was conducted at the Site to characterise groundwater and surface water for ongoing use of the Site as an operational sand quarry from February 2019 through to January 2020.

The analytical results indicate that metals, namely barium, chromium, copper, iron manganese, nickel and zinc, were detected regularly throughout the monitoring period, and at the majority of the sample locations, indicating likely natural background concentrations. Iron concentrations were typically higher at BH1 throughout the baseline monitoring program which are likely indicative of concentrations in this area.

BTEXN, TPH and TRH were generally not detected across the majority of the Site with the exception of BH1 and BH4. At the initiation of the baseline sampling program in February 2019 BH1 was refitted with a PVC pipe to replace a previously fire damaged one. In the process an acrylic adhesive was applied to fuse the pipes together which likely initiated increased concentrations of TPH C_6 - C_9 (1,710µg/L) and TRH C_6 - C_{10} (1,690µg/L) within the well. The subsequent months following reinstallation of the well concentrations of TPH and TRH fell to below LOR. Concentration of hydrocarbons detected at BH4 are most likely influenced by the adjacent Cabbage Tree Road. Concentrations were detected following some form of rainfall in the region and ongoing detections are likely given the location of BH4 being in close proximity to a relatively busy carriageway. Ongoing monitoring of hydrocarbons is recommended, for due diligence purposes, given the potential likelihood for spills to occur from operational vehicles.

PFAS detections above LOR were recorded at locations BH4, BH6 and SW4. Concentrations of PFAS identified at BH6 and SW4 are likely sourced from an upgradient source from the Site, namely the Williamtown RAAF Base where historical use of PFAS containing materials have been used. PFAS identified at location BH4, and directly adjacent to Cabbage Tree Road, is likely to have occurred from a different historical source. Ongoing monitoring of PFAS should be undertaken directly following initial excavation works.

It should also be noted that the Site and regional area has experienced a significant drought over the past couple of years and this may have a bearing on groundwater and surface water conditions should significant rainfall reoccur in the region. Baseline data provided within this report should be reassessed following a full year of data with average to above average rainfall to identify potential outliers that may be present.

Table 7.1 provides a summary of the proposed ongoing operational monitoring schedule for the Site (however we understand that DPIE has requested Site to make minor modifications

to the below program e.g. monthly PFAS monitoring). **Table 7.2** provides a summary of the proposed testing schedule for the different monitoring events and presents the adopted groundwater (GW) and surface water (SW) trigger values.

Table 7.1 Proposed operational monitoring schedule

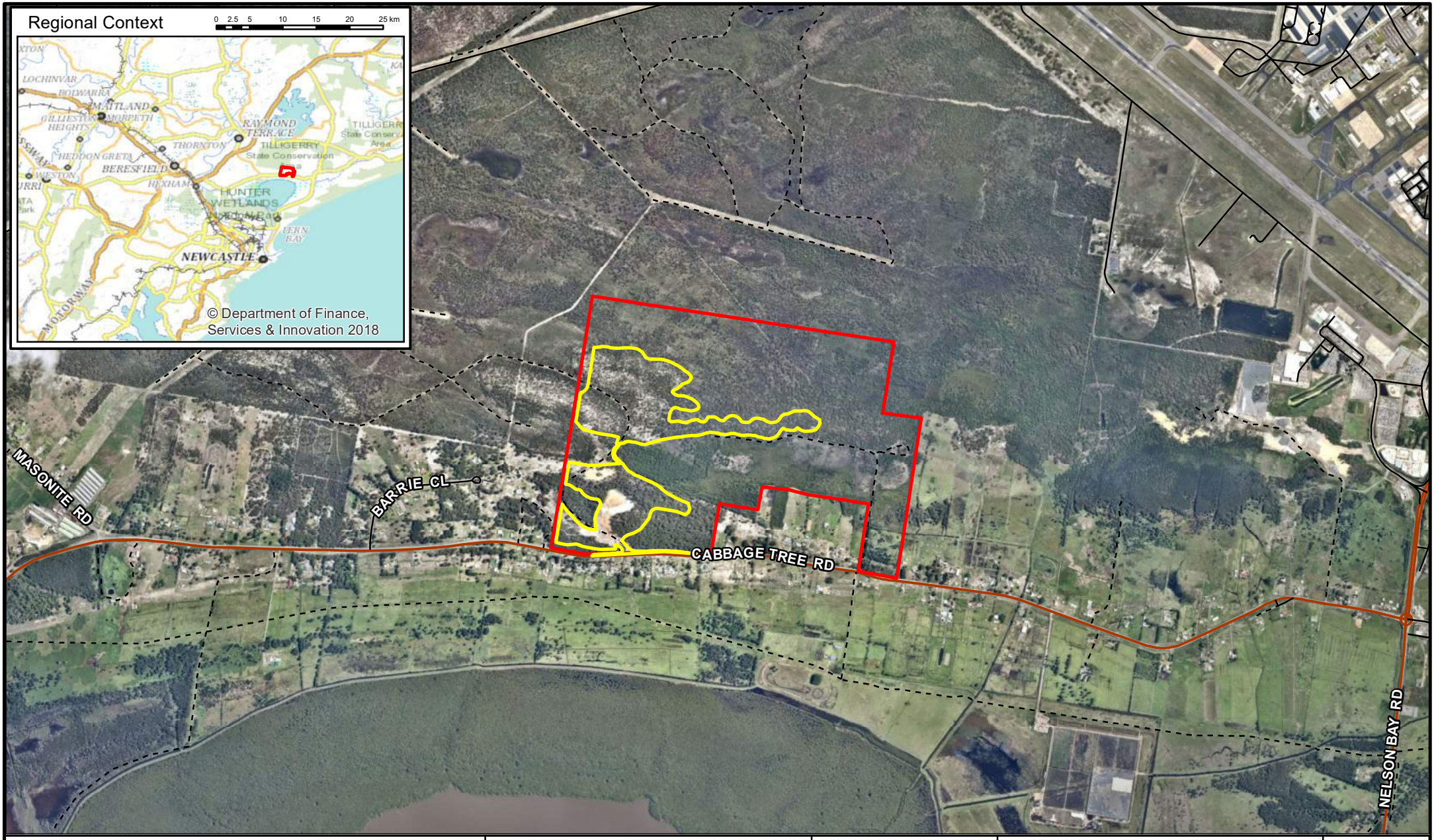
Location	Monthly	Quarterly	Annually
BH2, BH4, BH6, BH7, BH9, BH11 and MW239S	✓	✓	✓
BH8 SW1, SW2, SW3, SW4		✓	✓
BH1, BH5, BH12			✓

Table 7.2 Proposed testing schedule

Testing schedule			Specified Location otherwise site wide	Trigger value		
Monthly	Quarterly	Annually		Units	GW	SW
pH	pH	pH			4 - 7	4 - 7
Conductivity	Conductivity	Conductivity		µc/cm	125-2200	125-2200
Turbidity	Turbidity	Turbidity		NTU	6-50	6-50
Arsenic	Arsenic	Arsenic		mg/L	0.003	0.001
Iron	Iron	Iron	Northern Half (BH6, BH7, BH8, BH11 and MW239S),	mg/L	4.1	9.26
			Southern half (BH2, BH4, BH9)	mg/L	1	
Manganese	Manganese	Manganese		mg/L	0.136	0.048
Gauging selected wells	Gauging all available wells;	Gauging all available wells;		-	-	-
	Total Phosphorus	Total Phosphorus		mg/L	2	0.13
	Total Nitrogen	Total Nitrogen		mg/L	3	1.8
	Ammonia as N	Ammonia as N		mg/L	0.5	0.25
	Barium	Barium		mg/L	0.035	0.08
	Chromium	Chromium		mg/L	0.004	0.002
	Copper	Copper	Site wide (except BH4)	mg/L	0.013	0.013
			BH4	mg/L	0.051	
	Nickel	Nickel	BH11	mg/L	0.037	0.022
			Site wide (excluding BH11)	mg/L	0.022	
	Zinc	Zinc	Site wide (excluding SW4)	mg/L	0.085	0.085
			SW4	mg/L		0.535
	Boron	Boron	SW1	mg/L	N/A	0.14
			SW2, SW3 & SW4	mg/L		0.05
	Cobalt	Cobalt		mg/L	N/A	0.017

Testing schedule			Specified Location otherwise site wide	Trigger value		
Monthly	Quarterly	Annually		Units	GW	SW
	TRH C_6 – C_{10}	TRH C_6 – C_{10}		µg/L	20	20
	C_6 - C_{10} minus BTEX (F1)	C_6 - C_{10} minus BTEX (F1)		µg/L	20	20
	TRH C_{10} – C_{16}	TRH C_{10} – C_{16}		µg/L	100	100
	TRH C_{10} - C_{16} minus N (F2)	TRH C_{10} - C_{16} minus N (F2)		µg/L	100	100
	TRH C_{16} – C_{34}	TRH C_{16} – C_{34}		µg/L	100	100
	TRH C_{34} - C_{40}	TRH C_{34} - C_{40}		µg/L	100	100
	PFOS	PFOS		µg/L	0.01	0.01
	PFOS+ PFHxS	PFOS+ PFHxS		µg/L	0.07	0.07
	PFOA	PFOA		µg/L	0.56	0.56
		General water quality parameters (Ca, Mg, Na, K, pH, EC, Cl, SO_4, Alkalinity, Hardness & TDS);		-	-	-

FIGURES



Legend

- Subject Land Boundary
- Quarry Project Area
- Arterial Road
- Local Road
- Track

km
0 0.1 0.2 0.4 0.6 0.8 1

N

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PROJECT REFERENCE: 20193820

DATE DRAWN: 11/03/2020 10:25 Version 1

DRAWN BY: BDeane

DATA SOURCE:
NSW DFSI - 2018
nearmap - 2020

Site Location

Williamtown Sand Syndicate
Cabbage Tree Road Sand Quarry
Baseline Water Quality Summary Report
Cabbage Tree Road, Williamtown

FIGURE:

1

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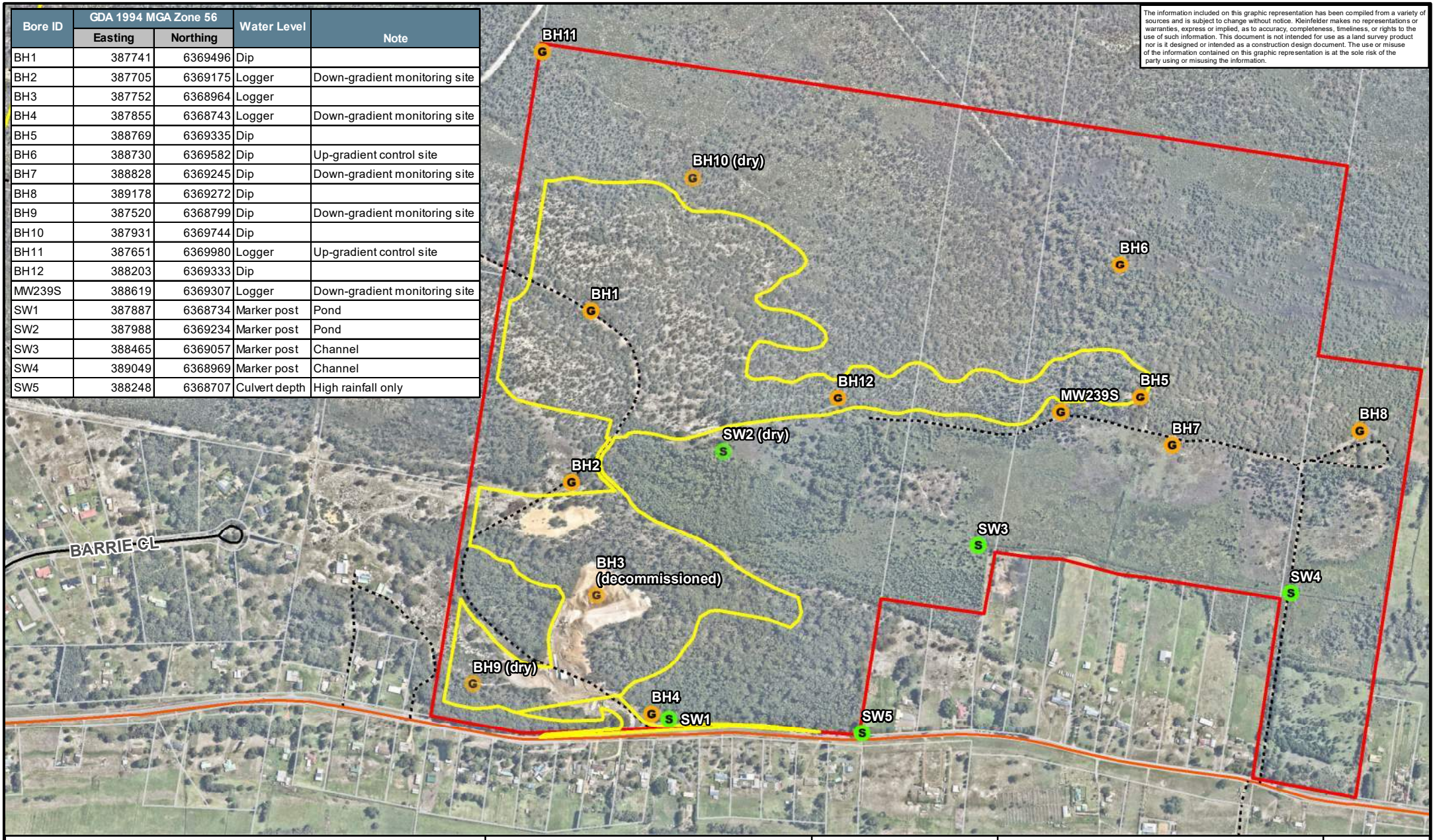
Bore ID	GDA 1994 MGA Zone 56		Water Level	Note
	Easting	Northing		
BH1	387741	6369496	Dip	
BH2	387705	6369175	Logger	Down-gradient monitoring site
BH3	387752	6368964	Logger	
BH4	387855	6368743	Logger	Down-gradient monitoring site
BH5	388769	6369335	Dip	
BH6	388730	6369582	Dip	Up-gradient control site
BH7	388828	6369245	Dip	Down-gradient monitoring site
BH8	389178	6369272	Dip	
BH9	387520	6368799	Dip	Down-gradient monitoring site
BH10	387931	6369744	Dip	
BH11	387651	6369980	Logger	Up-gradient control site
BH12	388203	6369333	Dip	
MW239S	388619	6369307	Logger	Down-gradient monitoring site
SW1	387887	6368734	Marker post	Pond
SW2	387988	6369234	Marker post	Pond
SW3	388465	6369057	Marker post	Channel
SW4	389049	6368969	Marker post	Channel
SW5	388248	6368707	Culvert depth	High rainfall only



Groundwater Monitoring Sites

- G Groundwater Sample Site
- S Surface Water Sample Site

- Subject Land Boundary
- Quarry Project Area
- Arterial Road
- Local Road
- Track

Metres
0 50 100 200 300 400 500
N

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PROJECT REFERENCE: 20170448
DATE DRAWN: 11/03/2020 10:21 Version 2
DRAWN BY: BDeane

DATA SOURCE:
NSW DFSI - 2018
Nearmap - 2020

Groundwater and Surface Water Sampling Locations

Williamtown Sand Syndicate
Cabbage Tree Road Sand Quarry
Baseline Water Quality Summary Report
Cabbage Tree Road, Williamtown

FIGURE:
2

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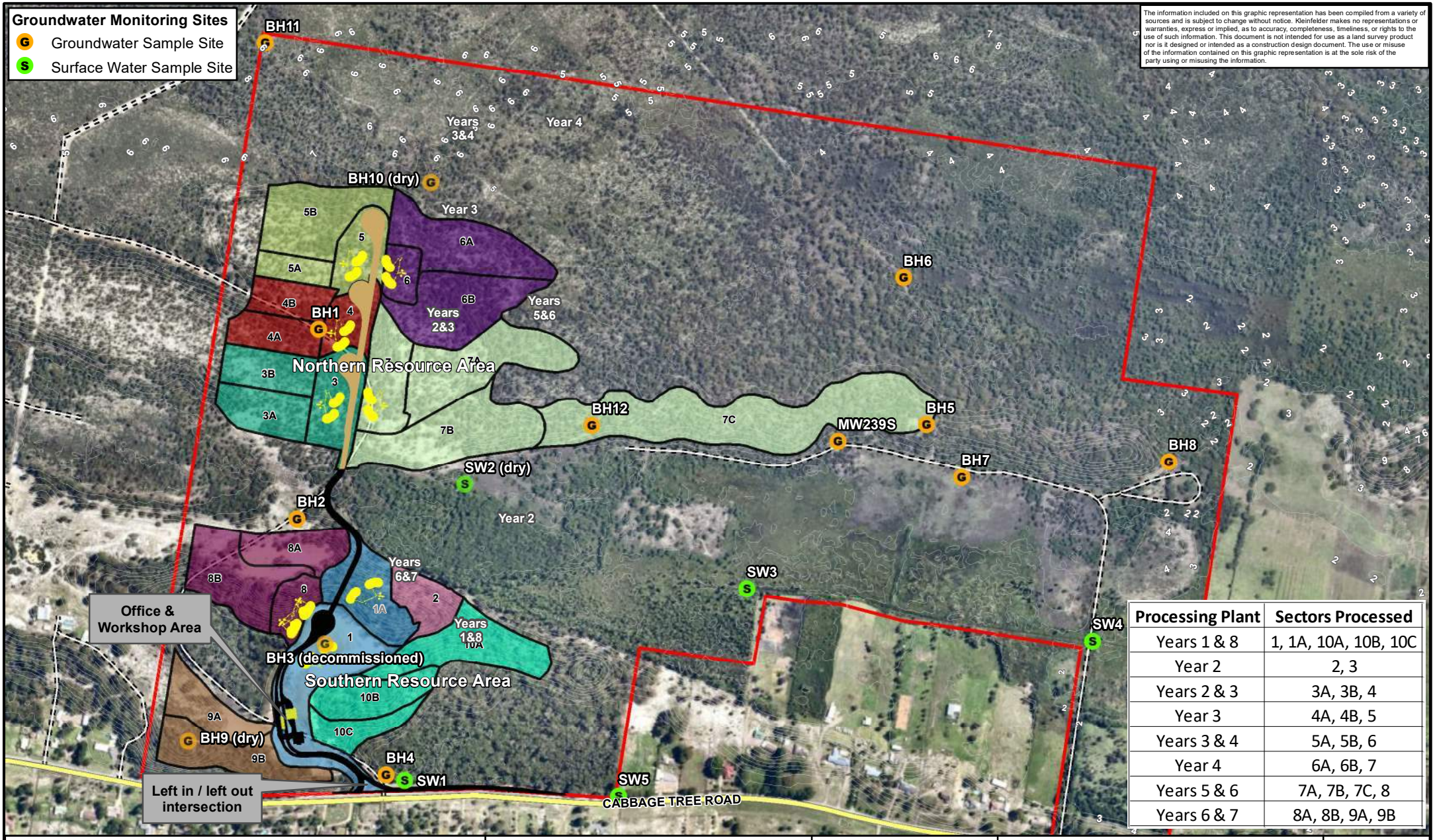

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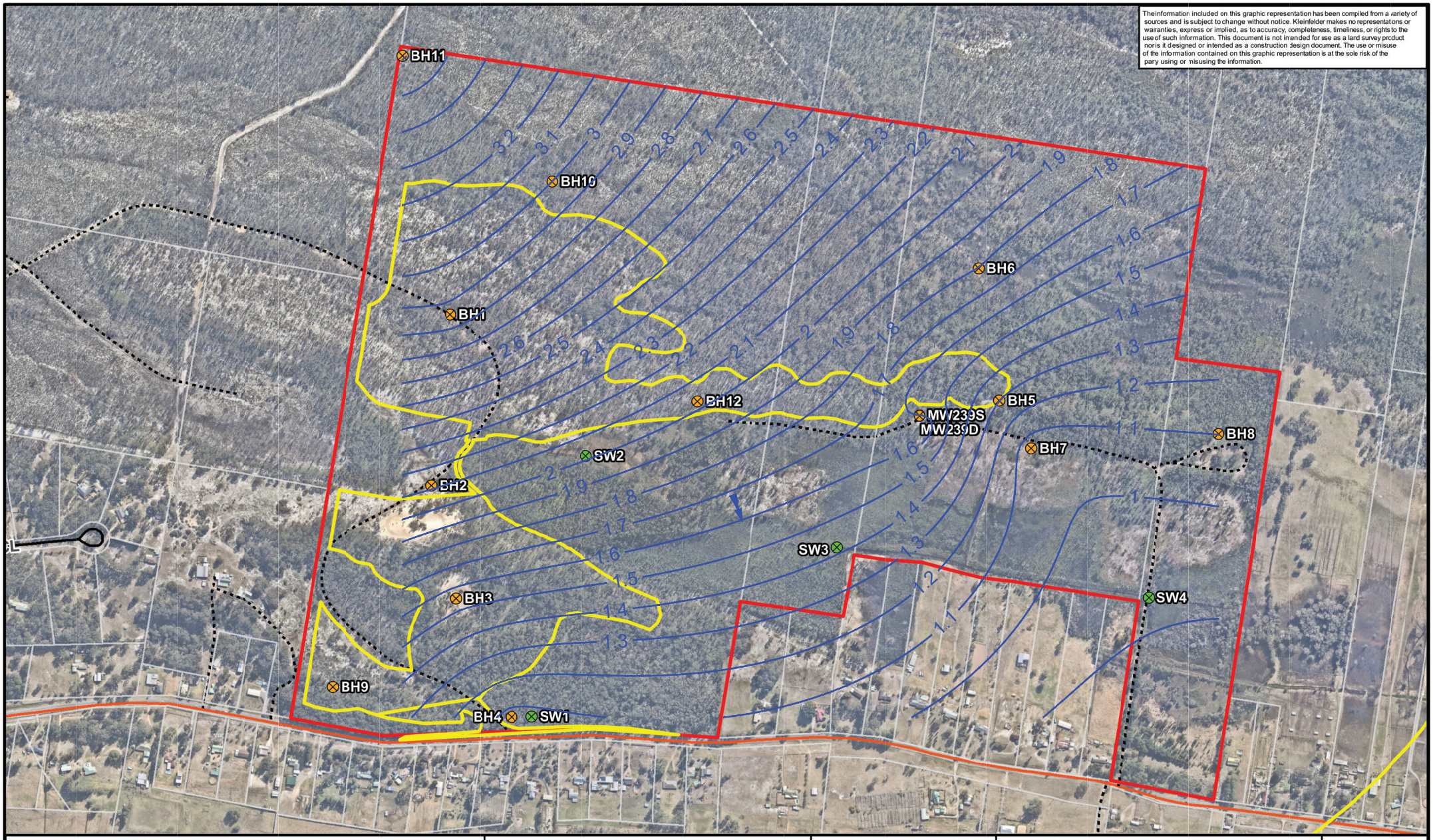

- Groundwater Sample Site
- Surface Water Sample Site
- Groundwater Elevation (1.7)
- Groundwater Flow
- Subject Land Boundary
- Quarry Project Area
- Arterial Road
- Local Road
- Track

Metres
0 50 100 200 300 400 500
N

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PROJECT REFERENCE: 20170448
DATE DRAWN: 13/02/2019 09:48 Version 1
DRAWN BY: gjoyce

DATA SOURCE:
NSW DFSI - 2017
Nearmap - 2018

Groundwater Elevation and Flow Direction (February 2019)

Williamtown Sand Syndicate
Proposed Sand Quarry
Cabbage Tree Road, Williamtown

FIGURE:
4

L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_WMP_Fig2_WaterMonitoringPlan.mxd
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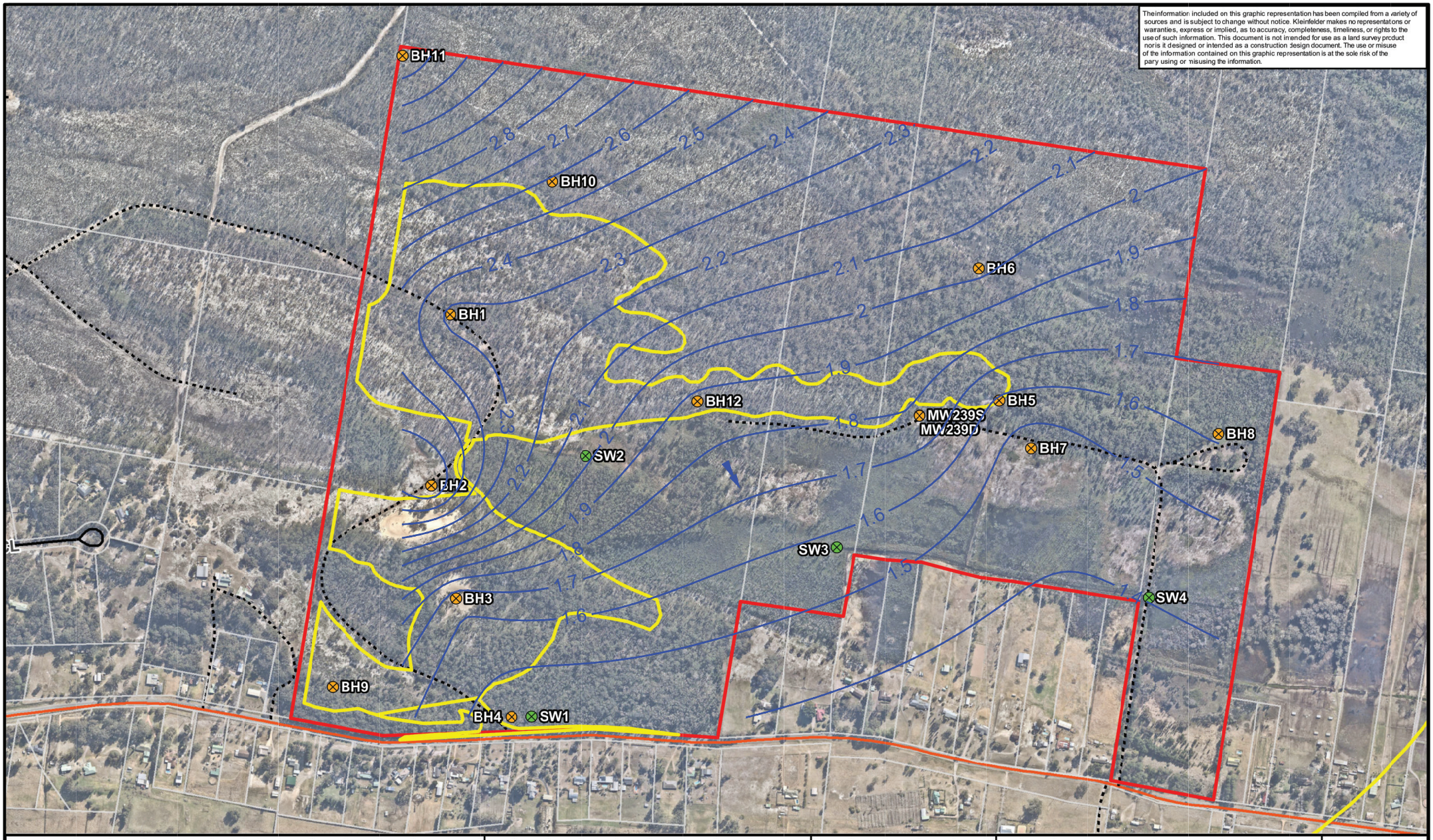

- Groundwater Sample Site
- Surface Water Sample Site
- Groundwater Elevation
- Groundwater Flow
- Subject Land Boundary
- Quarry Project Area
- Arterial Road
- Local Road
- Track

Metres
0 50 100 200 300 400 500
N

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PROJECT REFERENCE: 20170448
DATE DRAWN: 13/02/2019 09:48 Version 1
DRAWN BY: gjoyce

DATA SOURCE:
NSW DFSI - 2017
Nearmap - 2018

Groundwater Elevation and Flow Direction (July 2019)

Williamtown Sand Syndicate
Proposed Sand Quarry
Cabbage Tree Road, Williamtown

FIGURE:
5

L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_WMP_Fig2_WaterMonitoringPlan.mxd
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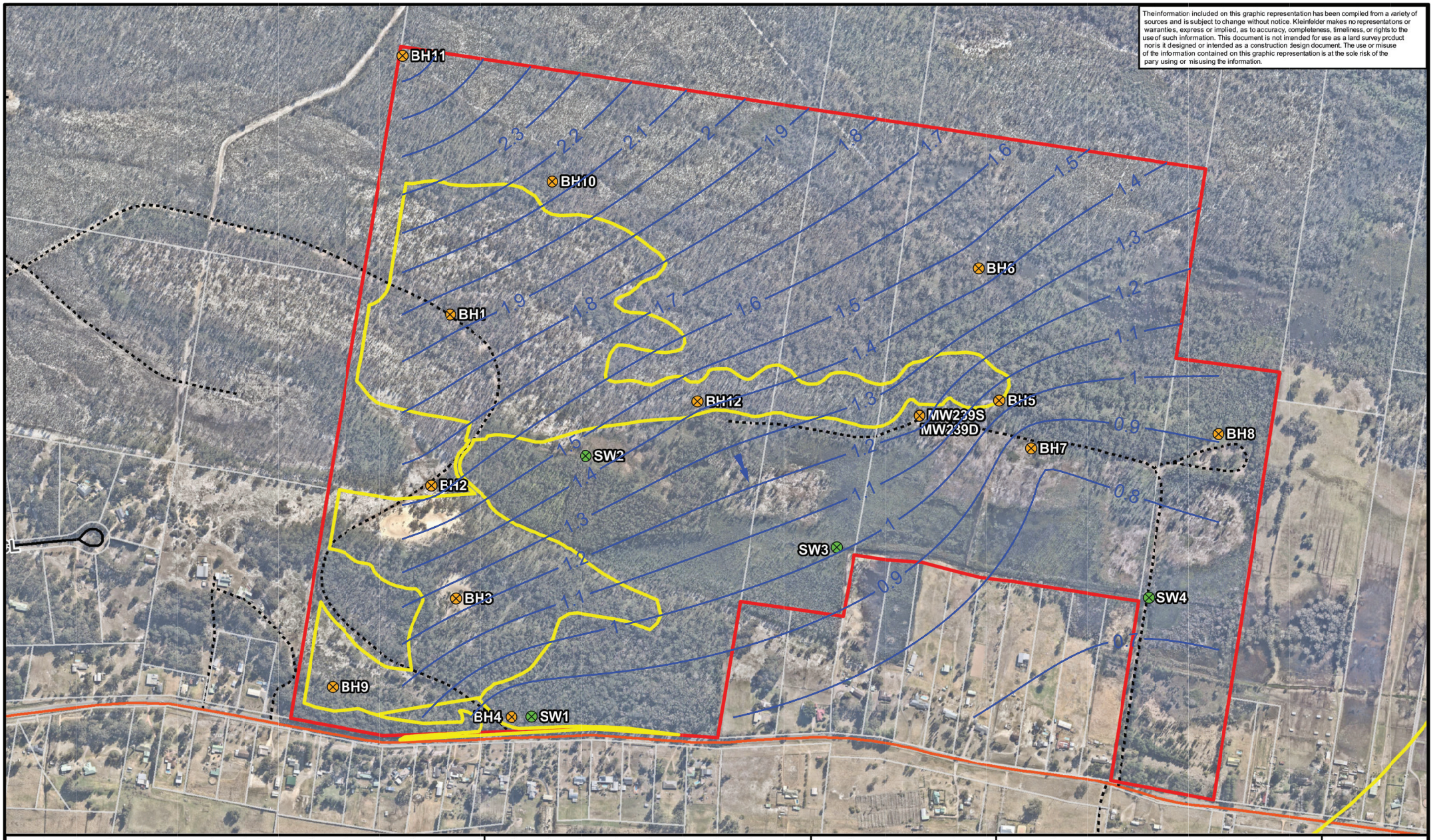

- Groundwater Sample Site
- Surface Water Sample Site
- Groundwater Elevation (1.7)
- Groundwater Flow
- Subject Land Boundary
- Quarry Project Area
- Arterial Road
- Local Road
- Track

Metres
0 50 100 200 300 400 500
N

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DATE DRAWN: 13/02/2019 09:48 Version 1
DRAWN BY: gjoyce
DATA SOURCE:
NSW DFSI - 2017
Nearmap - 2018

Groundwater Elevation and Flow Direction (January 2020)

Williamtown Sand Syndicate
Proposed Sand Quarry
Cabbage Tree Road, Williamtown

FIGURE:
6

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DATA TABLES

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Newcastle Sands

Baseline Water Quality Summary Report

Williamtown Sand Syndicate Pty Ltd.

Project No. 20193820.001A

Report Date: 27 March 2020

Newcastle Sands

Baseline Water Quality Summary Report

298 Cabbage Tree Road, Williamtown, NSW

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Prepared for:

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1. INTRODUCTION

1.1 BACKGROUND

Kleinfelder Australia Pty Ltd (Kleinfelder) was engaged by Williamtown Sand Syndicate (WSS) to undertake a 12 month surface water and groundwater monitoring program to establish baseline conditions at the Newcastle Sands quarry site, 298 Cabbage Tree Road, Williamtown, New South Wales (NSW) (the 'Site'). The Site is located approximately 12 km north east of Newcastle at Williamtown, NSW. The location of the Site is depicted on **Figure 1** and the site layout is presented in **Figure 2**.

Monitoring was undertaken to satisfy the requirements of the Soil and Water Management Plan (SWMP) (KLF, 2019) and Environmental Protection Licence 21264 (EPL). It is noted that the SWMP is a sub-plan within the overarching 'Newcastle Sands Quarry Environmental Management Plan' (June 2018), referred to herein as the EMP.

Groundwater and surface water monitoring was conducted over 12 consecutive months from February 2019 through to January 2020 and was generally completed between the 11th and 18th of each month. A Sampling Plan was prepared and presented in the SWMP, covering an appropriate methodology and quality control requirements for the monitoring program (see **Section 3** for further details).

The Sampling Plan was designed to obtain representative background data on water flow and quality in surface water bodies and groundwater that has the potential to be impacted by the site operations, or unrelated off-site sources. The SWMP identifies that, unless amended, the ongoing surface water and groundwater monitoring program will be consistent with the baseline water quality program.

1.2 PURPOSE OF THE BASELINE SUMMARY REPORT

The SWMP identifies that on completion of the baseline monitoring program, the following parameters would be reviewed and advise ongoing monitoring requirements including:

- Location of sampling points, e.g. more suitable / representative location identified, or sampling location has insufficient water to accurately monitor development.
- The frequency of the sampling may be reduced, or increased, depending on the fluctuations in the results.
- The parameters may be adjusted to remove superfluous analytes and/or add additional analytes.

1.3 OBJECTIVES

The objectives of the monitoring program were to:

- Establish background groundwater and surface water conditions across the Site;
- Establish site specific trigger values to be used during the operation of the quarry whereby concentrations outside these trigger values need to be reviewed in more detail; and
- Develop an ongoing sampling program (frequency and analysis) that will maintain compliance with the conditions of the EPL and EMP.

1.4 SCOPE OF WORK

The following provides the scope of work to deliver the baseline water quality summary report:

- Review and present site characteristic information;
- Provide an assessment of quality assurance (QA) and quality control (QC) undertaken over the 12-month period and validate the data;
- Provide a summary of the water quality identified across the site including:
  - Field observations;
  - Analytical results; and
  - Trend analysis;
- Establish trigger values for review against ongoing sampling; and
- Propose an ongoing monitoring programme to be conducted during operations that will maintain compliance with the EMP and EPL.

The scope of work for each of the background monitoring rounds can be seen in the monthly summary reports.

2. SITE CHARACTERISTICS

2.1 SITE IDENTIFICATION DETAILS

Table 2.1 provides site-specific identification details.

Table 2.1 Site details

Site address	298 Cabbage Tree Road Williamtown, NSW.
Site name	Newcastle Sands Quarry.
Current Title identification details	Four titles within the Parish of Stockton, County of Gloucester including: • Lot 1 DP 224587 at 398 Cabbage Tree Road, Williamtown • Lot 121 DP 556403 at 282B Cabbage Tree Road, Williamtown. • Lot 11 DP 629503 at 282A Cabbage Tree Road, Williamtown. • Lot 1012 DP 814078 at 282 Cabbage Tree Road Williamtown
Current land use	Currently the Site comprises mostly native vegetation. Initial quarry works have progressed to include pre-works hardstand areas and administration buildings.
Site total area	Total Project Area of approximately 42.3 hectares from a Subject Land Area of approximately 176.2 hectares.
Current ownership	Port Stephens Shire Council under lease to Williamtown Sand Syndicate Pty Ltd.
Current land use zoning	The site is currently RU2 – Rural Landscape (Port Stephens LEP 2013).
Local government	Port Stephens Council.
Proposed site use	Sand quarry extracting up to 530,000 tonnes per annum over a period of 6 to 15 years including the construction of an intersection with Cabbage Tree Road, sealed and gravel access roads, site office, workshop and weighbridges. Progressive rehabilitation of quarried land returning to native vegetation communities with potential future use of the facilities area.

2.2 CURRENT LAND USE

The Site currently has a workshop, office area comprising of demountable buildings, gravel aggregate hardstand areas for transitioning vehicles and future sorting. The areas surrounding the immediate vicinity of the Site comprise predominantly natural vegetation with exception to a gravel road, two former silica sand extraction areas and the verge of Cabbage Tree Road.

2.3 FORMER LAND USE

The Project Area consists predominantly of native vegetation, with some previously cleared areas present in the eastern part of the site. Approximately 48 ha of the 176.2 ha site was previously disturbed by heavy mineral sand mining and associated activities that were undertaken on the site between 1970s and late 1990s. This disturbance included areas that were dredged as part of extracting heavy minerals, sand borrow pits, settling ponds, monazite trenches and access roads.

In March 2002, Port Stephens Council (PSC) purchased four allotments comprising the project area (398, 282B, 282A and 282 Cabbage Tree Road Williamtown) from Rutile and Zircon Mines and was subsequently used for cattle adjustment. In 2012 PSC sought tenders from interested parties for the extraction of sand from the project area.

2.4 SURROUNDING LAND USE

The Williamtown RAAF base is located 2.5 km to the north east, with Fullerton Cove approximately 600 m to the south and the Hunter River estuary beyond (**Figure 1**).

Residential dwellings are located to the east (closest dwelling is 244 m), south (closest dwelling is 61 m) and west (closest dwelling is 83 m) of the Site. Most are small properties utilised as hobby farms (e.g. keeping horses and chickens), some are larger and also graze livestock. Potable water for dwellings is likely to comprise primarily reticulated water from Hunter Water network and rainwater. Many properties appear to have spear point wells installed for stock and domestic use. No dwellings are located within 4 km north of the Site.

2.5 GEOLOGY

Review of the Newcastle 1:250,000 series geological map (Sheet S1 56-2, 1966) indicates that the site is underlain by Quaternary aged marine and freshwater deposits comprising gravel, sand, silt, clay and “Waterloo Rock”.

The majority of the Site is located above the Tomago Sandbeds. The Tomago Sandbeds were formed during the Pleistocene era with the original sand deposits occurring up to 250,000 years ago. Rising sea levels created a large bay extending from Newcastle to Port Stephens. The Hunter and Karuah Rivers both flowed into the bay and deposited large volumes of sand. A combination of wave and wind action spread the sand along the coastline and formed the series of shallow dunes that make up the Tomago Sandbeds (Hunter water website 15/08/2018).

The sand dunes consist of a layer of highly permeable fine-grained sands underlain by impervious clay and rock. The thickness of the sand layer reaches a maximum of 50 metres, but on average is 20 metres deep (Hunter Water website 15/08/2018).

The North Stockton Sandbeds, which form the current coastline between Newcastle and Port Stephens, were deposited much more recently than the Tomago Sands. They overlie the eastern extremity of the Tomago Sands and were deposited in the Holocene era (10,000 years ago) (Hunter water website 15/08/2018).

2.6 HYDROLOGY & HYDROGEOLOGY

2.6.1 Surface Water

The high permeability of the Tomago Sandbeds result in little or no defined surface runoff, noting no defined natural drainage lines are on the site. Drainage is therefore predominantly via vertical infiltration into the sand, with any ephemeral surface drainage generally expected to be in the direction of the existing surface slopes.

In the area around the Site, the Tomago Sandbeds are located on the edge of low lying (about 2-3 m AHD) Holocene aged freshwater and alluvial and estuarine swamps deposits. These low-lying areas adjoining the Site are frequently waterlogged during high rainfall, due to increasing and shallow groundwater levels and a shallow groundwater gradient that slows the percolation of surface water. It is likely that the majority of accessible surface water onsite is an expression of groundwater, typically created through man made excavation.

The western portion of the southern and norther resources areas theoretically drain to the west, while the dominant surface drainage direction for most of the Site is to the east (i.e. Catchments 2 and 3 above). Here the landform drops from the edge of the resource area around 5 m AHD to the swamp or flats over a relatively short distance with the gradient reaching up to 16%. The swamp areas have a gradient of approximately 0.1% with the elevation falling 1.5 m over the 1100 m to the eastern boundary of the Subject Land with water conveyed by an open constructed channel (in middle of Catchment 3).

From the eastern boundary of the Site, drainage is directed via constructed channels through to Dawsons Drain and the northern extent of Fullerton Cove where the elevation drops 1 m over 1900 m (with an average gradient of 0.05%).

For the south eastern portion of the Project area, a portion of the resource area has the potential to drain south east across the Subject Land to a culvert beneath Cabbage Tree Road (Catchment 4). In this area the landform drops at about 14% to the swamp or flats that then appears to have a very slight gradient to the south eastern corner of the site (i.e. less than 0.5 m over at least 140 m). From this point the area drains via series of constructed channels through to the Ring Drain, a large constructed channel around the northern extent of Fullerton Cove over a distance of 590 m with an average gradient of less than 0.4%. Inspection of the site shows this culvert is only likely to flow during periods of extended rainfall and a high-water table.

Cabbage Tree Road has been built up during its construction, with shallow table drains constructed partially along the northern side of the road and deeper drains constructed partially

along the southern side. The nearest culvert is located at the eastern extent of the subject land, approximately 80 m beyond the proposed road construction area.

Following quarrying at the site the catchments will progressively change with Catchment 3 increasing in size with water from within the quarry footprint (currently draining west) directed south east into Catchment 3 (i.e. Catchment 1 will drain to Catchment 3). However, given the high permeabilities it is highly unlikely that any changes in flow would be realised across the site.

2.6.2 Groundwater

The Site is located on highly permeable Pleistocene Tomago Sandbeds (sand dunes). The source of the water within the Tomago Sandbeds is rainfall that lands directly on the sand surface. While a proportion of the rainfall is lost to plants and evaporation, sufficient water is stored in the sand to provide a viable and significant source of water for ongoing extraction. Over time rainfall landing on the sandbeds has washed out any remnants of sea salt leaving the deep sand system full of fresh water (Hunter Water website 15/08/2018).

A previous groundwater investigation was undertaken by RCA Australia (RCA Australia, 2015), groundwater was encountered on the Site ranging from 0.67 m below ground level (mbgl) to 15.65 mbgl. Groundwater when at its highest is visible at or near the surface for land below 3 m AHD. Groundwater at the Site has a low hydraulic gradient and was interpreted to flow in a general southerly to south-easterly direction, towards Fullerton Cove (RCA Australia, 2015) from Grahamstown Dam in the north toward Fullerton Cove in the south, the groundwater gradient within the local area is less than 0.2%.

The northern portion of the Site is located within the Hunter Water Special Area, owing to the presence of the Tomago Sandbeds and their use for a portion of the lower Hunter's drinking water supplies.

The Project area and extent of extraction has been designed such that sand extraction remains a minimum of 0.7 m above the highest predicted groundwater level, with the final landform to be established at no less than 1 m above the highest predicted groundwater level (about 2 m above the average level).

3. BACKGROUND MONITORING PROGRAM

3.1 SAMPLING PLAN

The SWMP required monthly sampling to be undertaken over a 12-month period to characterise background groundwater and surface water conditions throughout the site.

10 groundwater (BH1, BH2, BH4, BH6, BH7, BH8, BH9, BH10, BH11 and MW239S) and 4 surface water (SW1, SW2, SW3 and SW4) locations were sampled throughout the 12 monitoring rounds as outlined in **Figure 2**. The remaining site wells (BH3, BH12, MW239D and BH5) were used to provide additional groundwater elevation data.

Each monitoring event included sampling for:

- General water quality parameters: (Calcium (Ca), Magnesium (Mg), Sodium (Na), Potassium (K), pH, Electrical Conductivity (EC), Chloride (Cl), Sulphate (SO_4), Alkalinity, Hardness & Total Dissolved Solids (TDS) (Calc')),
- Total Recoverable Hydrocarbons (TRH),
- Total Petroleum Hydrocarbons (TPH),
- Benzene, Toluene, Ethylbenzene, Total Xylenes, Naphthalene (BTEXN),
- Metals (Arsenic (As), Boron (B), Barium (Ba), Beryllium (Be), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Iron (Fe), Lead (Pb), Manganese (Mn), Mercury (Hg), Nickel (Ni), Selenium (Se), Vanadium (V), Zinc (Zn)); and
- PFAS including Perfluorooctane sulfonate (PFOS), Perfluorooctanoic acid (PFOA), Perfluorohexanesulfonate (PFHxS) & perfluorodecane sulfonic acid (PFDS).

The baseline sampling program also included an initial sampling round and quarterly monitoring where additional analysis was included for an extended water quality suite (including hardness, Nitrate, Nitrite, Ammonia, Reactive Phosphorous, Total Nitrogen and TKN). Some additional groundwater monitoring locations were also included in quarterly monitoring as identified in **Table 3.1.**

Table 3.1 2019-2020 Monitoring Schedule

Action	2019											2020
	Feb*	Mar	Apr	May*	Jun	Jul	Aug	Sep*	Oct	Nov*	Dec	Jan
Monthly Gauging and groundwater sampling BH1, BH2, BH4, BH6, BH7, BH8, BH9[1], BH10[1], BH11, MW239s	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Surface water sampling SW1, SW2[1], SW3, SW4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Action	2019											2020
	Feb*	Mar	Apr	May*	Jun	Jul	Aug	Sep*	Oct	Nov*	Dec	Jan
Gauging only BH3, BH5, BH12, MW239D	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Groundwater Sampling BH3 & BH5	✓											

1: Sample locations were dry
* Shaded months indicate quarterly sampling suite

Following each monitoring round, a monthly factual letter report was prepared (see **Appendix A**). Each report presented:

- The field observations and field data;
- The results of the laboratory analysis;
- A comparison of the results against industry guidelines; and
- Rainfall data from the preceding month.

3.2 FIELD OBSERVATIONS

3.2.1 General

Surface water and groundwater monitoring was initiated in February 2019 and continued each month for a duration of 12 months until January 2020. Sampling times were generally consistent, undertaken each time within the middle of the month (between the 11th and 18th of the month). Within the first two monitoring rounds (February and March) re-insertion of PVC piping was required at fire effected location BH1 and for root bound effected location BH12. Site works, focussing on initial site infrastructure and access roads, began in October 2019 in preparation for the proposed quarry extraction works which are expected to initiate from early to mid 2020.

3.2.2 Monitoring Location Observations

Groundwater and surface water observations made during gauging and sampling at monitoring locations BH1, BH2, BH3 BH4, BH6, BH7, BH8, BH9, BH10, BH11, MW239S, SW1, SW2, SW3 and SW4 are summarised below. Conditions at each location were generally consistent throughout the monitoring period with the exception of surface water which provided intermittent periods of accessible water throughout the monitoring program.

Sensory observations of visual and olfactory quality were made on groundwater and surface water during sampling. A summary of these observations is presented in **Table 3.2** below.

Table 3.2 Monitoring locations: General observations

Location	General Observations
BH1	Generally, slightly cloudy brown with occasional sulfur odour. Well was reinstated in February 2019 following fire damage. The month following reinstatement an acrylic odour was detected which was most likely a bonding material used to fuse the PVC well piping together.
BH2[1]	Mostly dark brown in colour with a silty material at the base of well. A slight sulfur odour was evident throughout the monitoring period.
BH3	Prior to well decommissioning in September 2019 due to initial site works, observations of groundwater were identified as light brown with no odour. Well base contained fine silty material. No samples were taken following initial sampling round in February 2019.
BH4[1]	Generally light brown in colour with slight sulfur odour.
BH5	Generally light brown with no apparent odour. No samples taken throughout the monitoring program, only gauging.
BH6[2]	Generally, light brown in colour with a slight sulfur odour.
BH7[1]	Generally, light to moderately brown in colour with a slight sulfur odour.
BH8	Generally, brown to dark brown in colour with a moderate sulfur odour.
BH9[1]	Well was dry for the duration of the baseline monitoring program.
BH10	Well was dry for the duration of the baseline monitoring program.
BH11[2]	Generally, cloudy light brown with a moderate sulfur odour.
BH12	Well was reinstated in March 2019 following inundation of roots into the well. A 40mm inner PVC pipe was installed. The months following reinstatement of a well an acrylic odour was detected which was most likely a bonding material used to fuse the PVC well piping together. No sample was taken.
MW239S[1]	Cloudy dark brown in colour with a moderate sulfur odour.
MW239D	Cloudy dark brown in colour with a moderate sulfur odour. No sample was taken.
SW01	Intermittent periods of pooling at monitoring location. Water is generally stained with natural tannins, dark brown with a slight sulfur odour.
SW02	Monitoring location was observed to be dry for the duration of the baseline monitoring program.
SW03	Water mostly clear with no apparent odour. Often water was stagnant and at times dry.
SW04	Water mostly clear with no apparent odour. Often water was stagnant and at times dry.

1 – Down gradient monitoring location
2 – Upgradient control location

3.2.3 Geochemical parameters and gauging data

Geochemical parameters and gauging data were recorded during the sampling program and are presented on field sheets in **Appendix A** and summarised as a maximum and minimum values in **Table 3.3.**

Table 3.3 Geochemical Parameters and Gauging Data (maximum and minimum values)

Monitoring Location	Depth to Water (mBTOC) (Chart 1)		Temp (°C)		EC (µs/cm) (Chart 3)		pH (Chart 20)		Redox (mV)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Groundwater										
BH1	5.776	6.701	18.4	22.52	18	182	5.39	6.43	15.2	103
BH2	5.083	6.153	18.3	24.49	48	136	4.29	6.41	88	308
BH3[1]	5.938	6.146	22.1		82.4		4.54		94	
BH4	1.531	2.252	17.6	23.3	8	129.2	3.85	6.49	88	322
BH5[2]	5.767	6.315	20.1		320		4.06		122	
BH6	1.591	2.169	17.2	24.62	110	335	4.28	5.52	-144	178
BH7	1.514	2.169	17.2	25	164	391	4.04	5.93	-228	179
BH8	2.233	2.969	16.8	22.5	224	995	4.08	7.43	-341	176
BH9	Dry		-		-		-		-	
BH10	Dry		-		-		-		-	
BH11	3.02	3.962	16.9	22.65	124	402	3.78	6.41	-117	176
BH12[3]	6.799	7.252	-		-		-		-	
MW239S	1.248	1.823	15.8	24.71	37	718	4.09	5.7	-132	179
MW239D[3]	1.226	1.799	-		-		-		-	
Surface Water										
SW1	Dry	0.290mm[4]	9.52	23.75	811	1964	3.95	6.4	99	406
SW2	Dry[3,4]		-		-		-		-	
SW3	Dry	0.290mm[4]	11.96	26	290	470	4.27	6.41	-12.8	315
SW4	Dry	0.350mm[4]	8.07	18.46	313	538	3.69	6.44	116	430.5

1 – One sampling event (Feb 2019) and well decommissioned September 2019
2 – One sampling event (Feb 2019)
3 – No sampling undertaken
4 - Surface water levels (mm) identified from measured stake at each location (When dry number is ground elevation AHD)

3.3 GROUNDWATER AND SURFACE WATER ANALYSIS

3.3.1 Industry guidelines

In order to understand background surface and groundwater quality in relation to published data, laboratory results were compared against trigger values found in industry guidelines as outlined in the SWMP.

An exceedance of any adopted trigger value does not necessarily indicate that there is an unacceptable risk on site (CRC-CARE Technical Report 10: 2011), but rather identifies the need to explore the results in more detail. For this report we are reviewing natural background conditions and this comparison identifies the quality of the natural conditions indicative of this area.

The following industry guidelines have been used:

- Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), Water Quality Guidelines for Fresh and Marine Water Quality 95% species protection for fresh water (ANZECC 2000);
- The Heads of Environmental Protection Authorities in Australia and New Zealand (HEPA) Per- and polyfluoroalkyl substances (PFAS) National Environmental Management Plan (NEMP 2018); and
- Australian Drinking Water Guidelines 6 (ADWG) (2011).

3.3.2 Summary of results

Summary tables outlining the analytical data obtained from the Baseline Monitoring Program, and a comparison against trigger values are provided within the **Tables** section at the rear of this report. **Table 3.4** below provides a summary of groundwater and surface water concentrations as a range (minimum to maximum) for all analytes across the Site.

An assessment of Kleinfelder's Quality Assurance and Quality Control (QA/QC) processes and procedures has been provided in **Section 6**. Laboratory Certificates of Analysis (COA) including laboratory QC reports are presented as Appendix A of the monthly reports, which have been provided as **Appendix B** of this document**.**

Table 3.4 Summary of groundwater and surface water concentration range

Analyte	Units	LOR	ANZECC (2000) 95% level of species protection freshwater	ADWG (2011)	Detected Concentration Range (Groundwater)	Detected Concentration Range (Surface Water)	Comparison against trigger values
BETXN (Table A)							
Benzene	µg/L	1	950	1	<1.0	<1.0	Below LOR
Toluene	µg/L	2	-	800	<2.0	<2.0	Below LOR
Ethylbenzene	µg/L	2	-	300	<2.0	<2.0	Below LOR
o Xylene	µg/L	2	350	350	<2.0	<2.0	Below LOR
Total Xylenes	µg/L	2	-	600	<2.0	<2.0	Below LOR
Naphthalene	µg/L	5	16	-	<5.0	<5.0	Below LOR
Total Petroleum Hydrocarbons – Silica Gel Clean up (Table A)							
Sum of C_{10}-C_{36}	µg/L	50	-	-	<50-250	<50	No criteria
Total Recoverable Hydrocarbons – Silica Gel Clean up (Table A)							
Sum of C_{10}-C_{40}	µg/L	100	-	-	<100-280	<100	No criteria
Dissolved Metals (Table B)							
Arsenic	mg/L	0.001	0.013	0.01	<0.001-0.003	<0.001-0.006	Concentrations below trigger values
Barium	mg/L	0.001	-	-	0.001-0.034	0.027-0.08	No criteria
Beryllium	mg/L	0.001	-	0.06	<0.001	<0.001	Below LOR
Boron	mg/L	0.05	0.37	4	<0.05-0.06	<0.05-0.14	Concentrations below trigger values
Cadmium	mg/L	0.0001	0.0002	0.002	<0.0001	<0.0001-0.0002	Concentrations below trigger values
Chromium	mg/L	0.001	0.001	0.05	<0.001-0.004	<0.001-0.002	Elevated concentrations above trigger values (ANZECC 2000 trigger values) were detected at BH1 (entire monitoring period), BH2 (Dec 2019), BH3 (Feb 2019), BH7 (Feb, April, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec 2019 & Jan 2020), BH8 (Sep, Nov, Dec 2019 & Jan 2020),

Analyte	Units	LOR	ANZECC (2000) 95% level of species protection freshwater	ADWG (2011)	Detected Concentration Range (Groundwater)	Detected Concentration Range (Surface Water)	Comparison against trigger values
							BH11 (Feb, Apr, May, Jul, Aug, Oct, Nov, Dec 2019 & Jan 2020), MW239S (entire monitoring period) and SW3 (Dec 2019)
Cobalt	mg/L	0.001	-	-	<0.001-0.003	<0.001-0.017	No criteria
Copper	mg/L	0.001	0.0014	2	<0.001-0.051	<0.001-0.02	Elevated concentrations above trigger values (ANZECC 2000 trigger values) were detected at BH1 (Apr, Jul, Aug, Oct 2019 & Jan 2020), BH2 (Feb, Mar, Apr, Jun, Jul, Aug, Sep, Oct, Nov, Dec 2019 & Jan 2020), BH4 (Feb, Apr, Jun, Jul, Aug, Sep, Oct, Nov, Dec 2019 & Jan 2020), BH6 (Aug, Sep & Dec 2019), BH7 (Oct & Nov 2019), BH8 (Oct, Nov & Dec 2019), SW1 (Apr, May, Jun, Jul, Aug, Sep & Oct 2019), SW3 (Jul, Aug, Sep, Oct & Dec 2019), SW4 (Apr, Jun, Jul, Sep & Oct 2019)
Iron	mg/L	0.05	-	0.32	<0.05-12.5	0.57-9.26	Elevated concentrations above trigger values (ADWG) were detected at BH1 (entire monitoring period), BH2 (Oct 2019 & Jan 2020), BH4 (Apr & Oct 2019), BH5 (Feb 2019), BH6 (entire monitoring period), BH7 (entire monitoring period), BH8 (entire monitoring period), BH11 (Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec 2019 & Jan 2020), MW239S (entire sampling period), SW1 (entire monitoring period), SW3 (entire monitoring period), SW4 (entire monitoring period)
Lead	mg/L	0.001	0.0034	0.01	<0.001-0.001	<0.001-0.001	Concentrations below trigger values
Manganese	mg/L	0.001	1.9	0.5	0.003-0.136	0.026-0.841	Elevated concentrations above trigger values (ADWG) were detected at SW1 (Apr, May, Jun, Jul and Sep 2019)
Mercury	mg/L	0.0001	0.0006	0.001	<0.0001	<0.0001	Concentrations below initial baseline criteria
Nickel	mg/L	0.001	0.011	0.02	<0.001-0.07	<0.001-0.02	Elevated concentrations above trigger values (ANZECC trigger values) were detected at BH2 (Feb 2019), BH4 (Feb 2019), BH7 (Sep & Nov 2019), BH8 (Nov 2019), SW1 (Apr, May & Sep 2019) and SW4 (Sep 2019). Elevated concentrations above trigger values (ADWG trigger values) were detected at BH3 (Feb 2019) and BH4 (Mar & May 2019)
Selenium	mg/L	0.01	0.011	0.01	<0.01	<0.01	Below LOR

Analyte	Units	LOR	ANZECC (2000) 95% level of species protection freshwater	ADWG (2011)	Detected Concentration Range (Groundwater)	Detected Concentration Range (Surface Water)	Comparison against trigger values
Vanadium	mg/L	0.01	-	-	<0.01	<0.01	Below LOR
Zinc	mg/L	0.005	0.008	32	<0.005-1.27	<0.005-0.535	Elevated concentrations above initial trigger values (ANZECC 2000 trigger values) were detected at BH1 (entire monitoring period), BH2 (Nov 2019 & Jan 2020), BH4 (Feb, Mar, May, Oct 2019 & Jan 2020), BH6 (Feb, Mar, Apr, Sep & Nov 2019), BH7 (Feb, Mar, Apr, May, Sep, Oct & Nov 2019), BH8 (Oct, Nov 2019 & Jan 2020), BH11 (Feb, Mar, Apr, May, Sep & Oct 2019), MW239S (Sep, Oct & Nov 2019), SW1 (entire monitoring period), SW3 (Feb, Mar, Apr, May, Jun, Jul, Aug, Sep & Oct 2019), SW4 (Apr, May, Jun, Jul, Aug, Sep & Oct 2019)
PFAS (Table C)							
PFOS	µg/L	0.01	0.00023[3]	-	<0.01	<0.01-0.05	Concentrations reported above LOR at SW4 (16 Sep & 25 Sep 2019).
PFOA	µg/L	0.02	19[3] 5.6[4]	0.56	<0.02-0.02	<0.02	Concentrations below trigger values
PFOS/PFHxS	µg/L	0.01	0.7[4]	0.07	<0.01	<0.01-0.05	Concentrations below trigger values
PFDS	µg/L		-	-	<0.02-0.02	<0.02	Concentrations below trigger values
Physical and Chemical Stressors (Table D)							
pH	pH units	0.01	6.5-8.0[1]-	6.5-8.5[2]	4.37-6.29	4.0-6.21	pH values across the entire site for both surface water and groundwater were below ANZECC 2000 and ADWG acceptable range
Sodium	mg/L	1	-	180[2]	6.0-67	32-142	Concentrations below trigger values
Calcium	mg/L	1	-	-	<1.0-3.0	4.0-34	Concentrations below trigger values
Magnesium	mg/L	1	-	-	<1.0-10	4.0-52	Concentrations below trigger values
Potassium	mg/L	1	-	-	<1.0-2.0	<1.0-6.0	Concentrations below trigger values
Sulphate	mg/L	1	-	250[2]	2.0-70	16-324	Elevated concentrations above trigger values (ADWG aesthetic) detected in April and May 2019 at SW1
Chloride	mg/L	1	-	250[2]	16-127	53-234	Concentrations below trigger values
Fluoride	mg/L	0.1	-	1.5	<0.1-0.2	<0.1-0.7	Concentrations below trigger values

Analyte	Units	LOR	ANZECC (2000) 95% level of species protection freshwater	ADWG (2011)	Detected Concentration Range (Groundwater)	Detected Concentration Range (Surface Water)	Comparison against trigger values
Reactive phosphorus as P	mg/L	0.01	0.02[1]	-	<0.01-0.03	<0.01-0.01	Elevated concentrations above trigger values (ANZECC 2000 default trigger values) detected at BH1 in May 2019
Total Phosphorus	mg/L	0.01	0.05[1]	-	<0.01-2.76	<0.01-0.13	Elevated concentrations above trigger values (ANZECC 2000) trigger values were detected at BH1 (Sep 2019), BH2 (Feb, Sept & Nov 2019), BH3 (Feb 2019), BH4 (Feb, May, Sept, Nov 2019), BH 5 (Feb 2019), BH6 (May, Sep & Nov 2019), BH7 (Feb, May & Sep 2019), BH8 (Feb, Sep & Nov 2019), BH11 (Sep & Nov 2019), MW239S (Feb, May, Sep & Nov 2019), SW1 (May 2019) and SW3 (Feb 2019).
Ammonia as N	mg/L	0.01	0.9	0.5[2]	<0.01-0.34	<0.01-0.16	Concentrations below trigger values
Total Nitrogen as N	mg/L	0.01	0.35[1]	-	0.03-5.9	0.1-1.8	Elevated concentrations above trigger values (ANZECC 2000 trigger values) were detected at BH2 (Feb, May, Oct & Nov 2019), BH3 (Feb 2019), BH4 (Feb, May & Oct 2019), BH5 (Feb 2019), BH6 (Feb, May, Sep and Nov 2019), BH7 (Feb, May, Sep & Nov 2019), BH8 (Feb, May, Sep & Nov 2019), BH11 (Feb, May, Sep & Nov 2019), MW239S (Feb, May, Sep & Nov 2019), SW1 (May, Sep & Nov 2019) and SW3 (Feb & Nov 2019).
Total Cations	meq/L	0.01	-	-	0.39-3.57	2.23-10	No criteria
Total Anions	meq/L	0.01	-	-	0.54-6.61	2.18-11	No criteria
Total Alkalinity as CaCO3	mg/L	1	-	-	<1.0-24	<1.0-11	No criteria
Total Hardness as CaCO3	mg/L	1	-	200[2]	5.0-41	26-299	Elevated concentrations above trigger values (ADWG aesthetic) were detected at SW1 (Apr, May & Sep 2019).
Electrical Conductivity @ 25°C*	mg/L	1	125-2200	-	54-439	220-1090	Concentrations below trigger values

Analyte	Units	LOR	ANZECC (2000) 95% level of species protection freshwater	ADWG (2011)	Detected Concentration Range (Groundwater)	Detected Concentration Range (Surface Water)	Comparison against trigger values
Total Dissolved Solids	mg/L	1	-	600[2]	35-285	143-708	Elevated concentrations above trigger values (ADWG aesthetic) were detected at SW1 (May, Sep, Oct & Nov 2019).

1 – Default trigger values for physical and chemical stressors, for slightly disturbed ecosystems in lowland rivers, Southeast Australia (value is for base flow and not storm event)
2 – Aesthetic
3 – HEPA NEMP 2018 99% level of protection in freshwater
4 – HEPA NEMP 2018 Recreation Water

4. BASELINE WATER QUALITY ASSESSMENT

4.1 METALS

Elevated concentrations of chromium above trigger values (ANZECC 2000) were recorded at monitoring locations BH1, BH2, BH3, BH7, BH8, BH11, MW239S and SW3. Concentrations ranged from <0.001mg/L - 0.004 mg/L for groundwater and from <0.001 – 0.002 mg/L for surface water.

Elevated concentrations of copper above trigger values (ANZECC 2000) were recorded at monitoring locations BH1, BH2, BH4, BH6, BH7, BH8, BH11, MW239S, SW1, SW3 and SW4. Concentrations ranged from <0.001mg/L - 0.051 mg/L for groundwater and from <0.001 mg/L – 0.02 mg/L for surface water.

Elevated concentrations of iron above trigger values (ADWG) were recorded at all monitoring locations. Concentrations ranged from <0.05 mg/L – 12.5 mg/L for groundwater and from 0.57mg/L– 9.26 mg/L for surface water. Iron concentrations were particularly higher at location BH1.

Elevated concentrations of manganese above trigger values (ADWG) were recorded at monitoring location SW1. Concentrations ranged from <0.003 mg/L – 0.136 mg/L for groundwater and from 0.026 mg/L– 0.841 mg/L for surface water.

Elevated concentrations of nickel above trigger values (ANZECC 2000) were recorded at monitoring locations BH2, BH4, BH7, BH8, SW1, SW3 & SW4. Elevated concentrations of nickel above trigger values (ADWG) were recorded at monitoring locations BH3, BH4 and BH11. Concentrations ranged from <0.001 mg/L – 0.07 mg/L for groundwater and from <0.001mg/L– 0.02 mg/L for surface water.

Elevated concentrations of zinc above trigger values (ANZECC 2000) were recorded at monitoring locations BH1, BH2, BH4, BH6, BH7, BH8, BH11, MW239S, SW1, SW3 and SW4. Concentrations ranged from <0.005 mg/L – 1.27 mg/L for groundwater and from <0.005 mg/L – 0.535 mg/L for surface water.

4.2 PHYSICAL AND CHEMICAL STRESSORS

Elevated concentrations of sulphate above trigger values (ADWG aesthetic) were recorded at monitoring location SW1. Concentrations ranged from 2.0 mg/L – 7.0 mg/L for groundwater and from 16 mg/L – 324 mg/L for surface water.

An elevated concentration of reactive phosphorus above trigger values (ANZECC 2000) default trigger values was recorded at BH1. Concentrations ranged from<0.01 – 0.03 mg/L for groundwater and <0.01-0.13 mg/L for surface water.

Elevated concentrations of total phosphorus above trigger values (ANZECC 2000) were recorded at monitoring locations BH1 and BH2. Concentrations ranged from <0.01 mg/L – 2.11 mg/L for groundwater and from 0.01 mg/L – 0.13 mg/L for surface water.

Elevated concentrations of total nitrogen above trigger values (ANZECC 2000) were recorded at monitoring locations B2, BH3, BH4, BH5, BH6, BH7 BH8, BH11, MW239S, SW1 and SW3. Concentrations ranged from <0.01 mg/L – 2.11 mg/L for groundwater and from 0.01 mg/L – 0.13 mg/L for surface water

Elevated concentrations of Total Hardness as $CaCO_3$ above trigger values (ADWG aesthetic) were recorded at monitoring location SW1. Concentrations ranged from 5.0 mg/L – 41 mg/L for groundwater and from 26 mg/L – 299 mg/L for surface water.

Elevated concentrations of Total Dissolved Solids above trigger values (ADWG aesthetic) were recorded at monitoring location SW1. Concentrations ranged from 35 mg/L – 285 mg/L for groundwater and from 143 mg/L – 708 mg/L for surface water.

Concentrations of pH were below/outside the trigger value range at all monitoring locations. Concentrations ranged from 4.37– 6.29 for groundwater and from 4.0– 6.21 for surface water.

4.3 TPH, TRH AND BTEXN

No hydrocarbon exceedances above adopted criteria were recorded throughout the 12-month monitoring program. Detections were recorded at locations BH1 and BH4. Detections of hydrocarbons at BH1 can be attributed to an acrylic adhesive used for the reinstatement of the above ground section of the well. Detections of hydrocarbons at BH4 followed in close succession with rainfall recorded in the region. BH4 is located adjacent to Cabbage Tree Road and detected concentrations may be attributed to roadway runoff.

4.4 PFAS

One detection of PFOS above adopted aquatic criteria (LOR) protection was recorded at SW4 (0.03 µg/L) and subsequently identified again (0.05 µg/L) during follow-up sampling one week later. Further detections above LOR were identified at BH4 (PFDS -0.02 µg/L) and BH6 (6:2 FTS – 0.19 µg/L). Detections of PFAS at SW4 followed on from recent rainfall in the area which may have contributed to groundwater migration from surrounding known sources (i.e.

Williamtown RAAF Base). Kleinfelder would expect local groundwater to exceed the aquatic criteria given the scale of PFAS reported in groundwater within the Red Zone.

4.5 TREND ANALYSIS

A description of the trends observed throughout the 12-month monitoring period are provided in the sections below and graphical representations are located in the **Chart** section at the rear of this report.

4.5.1 Rainfall

Rainfall for the site was generally well below the mean average (1942-present) for the locality (BOM Williamtown RAAF 61078) over the 12-month monitoring period. Rainfall exceedances above the mean were recorded in March, June, August and September 2019 with the remainder of months experiencing significantly lower rainfall than would normally be expected. The total rainfall recorded over the 12-month monitoring program was 731.8mm which is 486.4mm less than the yearly mean total of 1218.2mm. **Chart 1** provides a graphical representation of rainfall totals for each month.

4.5.2 Groundwater Elevation

Groundwater throughout the sampling locations demonstrated a general decline in elevations throughout the 12-month period. Most notably the greatest decline in groundwater elevations was observed in the months following the November 2019 water monitoring event which correlate directly with a significant decrease in rainfall from the mean average and increase in temperatures. **Chart 2** provides a graphical representation of groundwater elevation identified following gauging throughout the 12-month monitoring period.

4.5.3 Mann Kendall Analysis

Where sufficient data is available, statistical trend analysis using the Mann-Kendall Trend Test has been undertaken for selected analytes at EPL and SWMP monitoring points to determine if obvious trends were apparent in the dataset (**Table 4.1** and **Table 4.2**). The purpose of the Mann-Kendall Test (Mann 1945, Kendall 1975, Gilbert 1987) is to statistically assess if there is a monotonic upward or downward trend of the variable of interest over time. A monotonic upward (downward) trend means that the variable consistently increases (decreases) through time, but the trend may or may not be linear.

MKA relies on three statistical metrics including:

- **The 'S' Statistic**: Indicates whether concentration trend vs. time is generally decreasing (negative S value) or increasing (positive S value).

- **The Confidence Factor (CF):** The CF value modifies the S Statistic calculation to indicate the degree of confidence in the trend result, as in ‘Decreasing” vs. “Probably Decreasing” or “Increasing” vs. “Probably Increasing.” Additionally, if the confidence factor is quite low, due either to considerable variability in concentrations vs. time or little change in concentrations vs. time, the CF is used to apply a preliminary “No Trend” classification, pending consideration of the COV.
- **The Coefficient of Variation (COV):** The COV is used to distinguish between a “No Trend” result (significant scatter in concentration trend vs. time) and a “Stable” result (limited variability in concentration vs. time) for datasets with no significant increasing or decreasing trend (e.g. low CF).

Where an analyte has recorded a non-detect following laboratory analysis half of the value of detection (LOR) has been applied.

Table 4.1 Mann-Kendall analysis for metal

Site ID	Mann-Kendall Analysis	Metals						
		Barium	Chromium	Copper	Iron	Manganese	Nickel	Zinc
BH1	Coefficient of Variation	0.47	0.24	0.93	0.31	0.25	0.67	1.91
	Mann-Kendall Statistic (S)	-3	-12	11	-15	-16	-2	-33
	Confidence Factor	56.0%	79.9%	77.7%	85.9%	87.5%	53.0%	99.5%
	Concentration Trend	Stable	Stable	No Trend	Stable	Stable	Stable	Decreasing
BH2	Coefficient of Variation	0.20	0.69	0.62	1.05	0.27	1.77	1.15
	Mann-Kendall Statistic (S)	-9	9	29	16	-26	-8	24
	Confidence Factor	70.4%	70.4%	97.4%	87.5	95.7%	68.1%	94.2%
	Concentration Trend	Stable	No Trend	Increasing	No Trend	Decreasing	No Trend	Prob. Increasing
BH4	Coefficient of Variation	0.10	0.27	1.15	0.90	1.11	1.38	1.02
	Mann-Kendall Statistic (S)	-26	9	13	2	-16	-31	-25
	Confidence Factor	95.7%	70.4%	79.0%	59.2%	84.5%	98.1%	95.0%
	Concentration Trend	Decreasing	No Trend	No Trend	No Trend	No Trend	Decreasing	Prob. Decreasing
BH6	Coefficient of Variation	0.09	0.27	1.37	0.29	0.20	1.54	1.27
	Mann-Kendall Statistic (S)	-6	9	10	-2	-19	9	-12
	Confidence Factor	63.1%	70.4%	72.7%	52.7%	88.9%	70.4%	77.0%
	Concentration Trend	Stable	No Trend	No Trend	Stable	Stable	No Trend	No Trend
BH7	Coefficient of Variation	0.45	0.15	1.56	0.28	0.38	0.92	1.37
	Mann-Kendall Statistic (S)	18	9	7	-49	-43	-14	-6
	Confidence Factor	87.5%	70.4%	65.6%	>99.9%	99.9%	81.0%	63.1%
	Concentration Trend	No Trend	No Trend	No Trend	Decreasing	Decreasing	Stable	No Trend
BH8	Coefficient of Variation	0.23	0.37	0.90	0.24	0.36	1.10	1.70
	Mann-Kendall Statistic (S)	-8	30	23	-26	9	2	20
	Confidence Factor	68.1%	97.8%	93.3%	95.7%	70.4%	52.7%	90.2%

Site ID	Mann-Kendall Analysis	Metals						
		Barium	Chromium	Copper	Iron	Manganese	Nickel	Zinc
	Concentration Trend	Stable	Increasing	Prob. Increasing	Decreasing	No Trend	No Trend	Prob. Increasing
BH11	Coefficient of Variation	0.35	0.26	1.10	0.35	0.28	1.9	0.87
	Mann-Kendall Statistic (S)	-24	9	16	7	23	-28	-32
	Confidence Factor	94.2%	70.4%	84.5%	65.6%	93.3%	96.9%	98.4%
	Concentration Trend	Prob. Decreasing	No Trend	No Trend	No Trend	Prob. Increasing	Decreasing	Decreasing
MW239S	Coefficient of Variation	0.25	0.14	0.41	0.20	0.24	0.78	1.10
	Mann-Kendall Statistic (S)	11	9	-1	5	6	5	5
	Confidence Factor	74.9%	70.4%	50.0%	60.6	63.1%	60.6%	60.6%
	Concentration Trend	No Trend	No Trend	Stable	No Trend	No Trend	No Trend	No Trend
SW1	Coefficient of Variation	0.27	0.37	0.77	0.67	0.27	0.858	0.88
	Mann-Kendall Statistic (S)	5	10	7	-20	-26	-19	-16
	Confidence Factor	68.3%	86.2%	80.9%	99.3%	100.0%	98.9	96.9%
	Concentration Trend	No Trend	No Trend	No Trend	Decreasing	Decreasing	Decreasing	Decreasing
SW3	Coefficient of Variation	0.37	0.64	1.48	0.95	0.21	1.07	1.20
	Mann-Kendall Statistic (S)	-23	18	8	-25	-34	-9	-3
	Confidence Factor	95.7%	90.5%	89.8%	97.0%	99.6%	83.2%	56.0%
	Concentration Trend	Decreasing	Prob. Increasing	No Trend	Decreasing	Decreasing	No Trend	No Trend
SW4	Coefficient of Variation	0.17	0.00	1.3	1.18	0.13	1.06	1.08
	Mann-Kendall Statistic (S)	-20	0	2.0	-8	-3	-9	-11
	Confidence Factor	99.3%	45.2%	57.0%	80.1%	59.4%	83.2%	88.7%
	Concentration Trend	Decreasing	Stable	No Trend	No Trend	Stable	No Trend	No Trend

Table 4.2 Mann-Kendall analysis for anions, cations alkalinity and inorganics

Site ID	Mann-Kendall Analysis	Anions and Cations					Alkalinity		Inorganics		
		Sodium	Calcium	Magnesium	Sulphate	Chloride	Total Alkalinity as CaCO3	Total Hardness as CaCO3	EC	TDS	pH
BH1	Coefficient of Variation	0.14	0.68	0.22	0.46	0.08	0.48	0.16	0.12	0.12	0.05
	Mann-Kendall Statistic (S)	24	-19	19	3	-17	22	-5	14	14	11
	Confidence Factor	96.4%	91.8%	91.8%	56.0%	89.1%	94.9%	61.9%	84.0%	84.0%	77.7%
	Concentration Trend	Increasing	Prob. Decreasing	Prob. Increasing	No Trend	Stable	Prob. Increasing	Stable	No Trend	No Trend	No Trend
BH2	Coefficient of Variation	0.10	0.27	0.15	0.54	0.11	1.48	0.13	0.11	0.29	0.06
	Mann-Kendall Statistic (S)	17	-5	-7	-2	-46	21	-13	30	10	34
	Confidence Factor	86.0%	60.6%	65.6%	52.7%	100.0%	91.3%	79.0%	97.8%	72.7%	99.0%
	Concentration Trend	No Trend	Stable	Stable	Stable	Decreasing	Prob. Increasing	Stable	Increasing	No Trend	Increasing
BH4	Coefficient of Variation	0.19	0.30	0.41	0.75	0.06	1.27	0.30	0.14	0.27	0.05
	Mann-Kendall Statistic (S)	28	-18	19	14	-9	8	5	33	16	4
	Confidence Factor	96.9%	87.5%	89.9%	81.0%	70.4%	68.1%	60.6%	98.7%	84.5%	58.0%
	Concentration Trend	Increasing	Stable	No Trend	No Trend	Stable	No Trend	No Trend	Increasing	No Trend	No Trend
BH6	Coefficient of Variation	0.11	0.21	0.12	0.21	0.10	1.29	0.10	0.12	0.13	0.07
	Mann-Kendall Statistic (S)	23	-2	-11	-19	16	19	-15	42	27	36
	Confidence Factor	93.3%	52.7%	74.9%	88.9%	84.5	88.9%	82.8%	99.8%	96.3%	99.3%
	Concentration Trend	Prob. Increasing	Stable	Stable	Stable	No Trend	No Trend	Stable	Increasing	Increasing	Increasing
BH7	Coefficient of Variation	0.12	0.00	0.15	0.14	0.14	1.31	0.16	0.10	0.13	0.05
	Mann-Kendall Statistic (S)	-36	0	-20	-4	-35	20	-20	-8	-21	42
	Confidence Factor	99.3%	47.3%	90.2%	58.0%	99.2%	90.2%	90.2%	68.1%	91.3%	99.8%

Site ID	Mann-Kendall Analysis	Anions and Cations					Alkalinity		Inorganics		
		Sodium	Calcium	Magnesium	Sulphate	Chloride	Total Alkalinity as CaCO3	Total Hardness as CaCO3	EC	TDS	pH
	Concentration Trend	Decreasing	Stable	Prob. Decreasing	Stable	Decreasing	Prob. Increasing	Prob. Decreasing	Stable	Prob. Decreasing	Increasing
BH8	Coefficient of Variation	0.08	0.00	0.27	1.49	0.18	1.55	0.29	0.09	0.12	0.05
	Mann-Kendall Statistic (S)	-1	0	-29	2	-18	18	-29	4	2	51
	Confidence Factor	50.0%	47.3%	97.4%	52.7%	87.5%	87.5%	97.4%%	58.0%	52.7%	>99.9%
	Concentration Trend	Stable	Stable	Decreasing	No Trend	Stable	No Trend	Decreasing	No Trend	No Trend	Increasing
BH11	Coefficient of Variation	0.27	0.00	0.56	1.52	0.20	0.78	0.58	0.28	0.36	0.03
	Mann-Kendall Statistic (S)	-26	0	-14	-23	-34	20	-14	-4	-5	28
	Confidence Factor	95.7%	47.3%	81.0%	93.3%	99.0%	90.2%	81.0%	58.0%	60.6%	96.9%
	Concentration Trend	Decreasing	Stable	Stable	Prob. Decreasing	Decreasing	Prob. Increasing	Stable	Stable	Stable	Increasing
MW239S	Coefficient of Variation	0.10	0.00	0.12	0.43	0.18	1.33	0.12	0.12	0.12	0.04
	Mann-Kendall Statistic (S)	22	0	19	-3	11	7	19	46	40	-11
	Confidence Factor	92.4%	47.3%	88.9%	55.4%	74.9%	65.6%	88.9%	100.0%	99.7%	74.9%
	Concentration Trend	Prob. Increasing	Stable	No Trend	Stable	No Trend	No Trend	No Trend	Increasing	Increasing	Stable
SW1	Coefficient of Variation	0.21	0.29	0.20	0.30	0.33	0.00	0.22	0.12	0.12	0.09
	Mann-Kendall Statistic (S)	20	-21	-20	-14	25	0	-20	10	10	10
	Confidence Factor	99.3%	99.6%	99.3%	'94.6%	100.0%	45.2%	99.3%	86.2%	86.2%	86.2%
	Concentration Trend	Increasing	Decreasing	Decreasing	Prob. Decreasing	Increasing	Stable	Decreasing	No Trend	No Trend	No Trend

Site ID	Mann-Kendall Analysis	Anions and Cations					Alkalinity		Inorganics		
		Sodium	Calcium	Magnesium	Sulphate	Chloride	Total Alkalinity as CaCO3	Total Hardness as CaCO3	EC	TDS	pH
SW3	Coefficient of Variation	0.11	0.24	0.32	0.52	0.14	1.47	0.25	0.21	0.19	0.12
	Mann-Kendall Statistic (S)	-2	-14	18	-4	2	-14	3	17	5	-12
	Confidence Factor	53.0%	84.0%	90.5%	59.0%	53.0%	84.0%	56.0%	89.1%	61.9%	79.9%
	Concentration Trend	Stable	Stable	Prob. Increasing	Stable	No Trend	No Trend	No Trend	No Trend	No Trend	Stable
SW4	Coefficient of Variation	0.06	0.19	0.14	0.23	0.06	0.00	0.16	0.08	0.08	0.04
	Mann-Kendall Statistic (S)	8	1	5	-7	-5	0	0	10	10	21
	Confidence Factor	80.1%	50.0%	68.3%	76.4%	68.3%	45.2%	45.2%	86.2%	86.2%	99.6%
	Concentration Trend	No Trend	No Trend	No Trend	Stable	Stable	Stable	Stable	No Trend	No Trend	Increasing

Table 4.1 and **Table 4.2** provide trend analysis on sampling locations for a number of chemicals, primarily those identified in the EPL as requiring analysis. The trend analysis identifies if the chemical is stable, increasing or decreasing in concentration. This will be useful in future monitoring should a sample be found to be above the adopted trigger value, triggering further assessment.

The majority of the chemicals were found to be stable or no trend was identified. This is typically expected for background monitoring. A number of monitoring locations have identified decreasing trends (i.e. Barium is decreasing in BH4, BH11, SW3 and SW4 and Manganese is decreasing in BH2, BH7, SW1 and SW3). Only a few locations were found to be have an increasing trend (Copper in BH2, Chromium in BH8). Throughout the 12-month sampling period NSW was undergoing one of the worst drought periods on record. Changing concentrations of some chemicals may be due to natural fluctuations in in the water (especially following a rainfall event) and/or could be due to the drought conditions. Should this be the case then when periods of heavy rainfall occur it is likely that changes in chemical concentrations may also occur.

5. SITE SPECIFIC ASSESSMENT CRITERIA

5.1 SWMP & EMP REQUIREMENTS

As identified in **Section 1.1**Error! Reference source not found. and **1.2** the SWMP requires that surface and groundwater monitoring is to continue as identified in **Section 1.2**. However, it also states that the following monitoring parameters will be reviewed:

- Location of sampling points, e.g. more suitable / representative location identified, or sampling location has insufficient water to accurately monitor development.
- The frequency of the sampling may be reduced, or increased, depending on the fluctuations in the results.
- The parameters may be adjusted to remove superfluous analytes and/or add additional analytes.

Therefore, this section presents a review of the parameters identified and makes recommendations for the ongoing monitoring program. It is noted that any proposed changes must be approved by the Department's Secretary (or delegate) and must also be updated in the SWMP.

5.2 EPL REQUIREMENTS

The sites EPL minimum requirements for the monitoring of groundwater are outlined in **Table 5.1** below.

Table 5.1 EPA Site water monitoring requirements (EPL21264)

Pollutant	Unit of measure	Frequency	Sampling Method	Sample location
Arsenic	mg/L	Monthly	Grab Sample	BH2, BH4, BH6, BH7, BH9, BH11 & MW239S
Conductivity	mS/cm	Monthly	Grab Sample	BH2, BH4, BH6, BH7, BH9, BH11 & MW239S
Depth	M	Monthly	Grab Sample	BH2, BH4, BH6, BH7, BH9, BH11 & MW239S
Iron	mg/L	Monthly	Grab Sample	BH2, BH4, BH6, BH7, BH9, BH11 & MW239S
Manganese	mg/L	Monthly	Grab Sample	BH2, BH4, BH6, BH7, BH9, BH11 & MW239S
pH	pH	Monthly	Grab Sample	BH2, BH4, BH6, BH7, BH9, BH11 & MW239S
Turbidity	Nephelometric Turbidity Units (NTU)	Monthly	Grab Sample	BH2, BH4, BH6, BH7, BH9, BH11 & MW239S

5.3 ANALYTICAL PARAMETERS

This section provides details on the recommended analytical suite for ongoing monitoring (note this is in addition to the requirements of the EPL).

5.3.1 Metals

Beryllium, Cadmium, Mercury, Selenium, Vanadium were all identified to be below the laboratory LOR throughout the 12-month sampling period. The operations across the Site are not considered likely to introduce sources of these metals and therefore it is not considered necessary to continue to monitor for these metals. Analysis for lead identified only four samples out of 124 to be above the LOR and these were reported at the LOR. Analysis for Cadmium identified only 3 samples at SW1 to be at or marginally above the LOR. It is recommended that Lead and Cadmium also be removed from the monitoring programme.

Concentrations of Boron were identified to be present above the LOR in 7 samples. However, the exception is SW1 where all samples taken had concentrations above LOR. Cobalt was found to be above LOR in one sample with the exception of surface water and in BH7. There are no trigger values presented in the ANZECC 2000 guidelines. It is considered unlikely that the quarrying operations would introduce Boron and Cobalt into the environment at significant concentrations and therefore it is recommended that Boron and Cobalt not be analysed in groundwater. However, due to the presence of Boron in SW1 and Cobalt in the surface water, both Boron and Cobalt should continue to be monitored in surface water. Should future surface water monitoring identify an increase in Boron or Cobalt concentrations, then consideration should be given to adding these to the groundwater analytical suite.

It is recommended that 8 Metals continue to be analysed in groundwater and surface water:

- Arsenic (this is required by the EPL);
- Barium (all samples were above LOR, there is no ANZECC criteria for Barium);
- Chromium (samples were found to be above LOR and some samples were found to be above the ANZECC trigger criteria);
- Copper (samples were found to be above LOR and some samples were found to be above the ANZECC trigger criteria);
- Iron (this is required by the EPL);
- Manganese (this is required by the EPL);
- Nickel (samples were found to be above LOR and some samples were found to be above the ANZECC trigger criteria); and
- Zinc (samples were found to be above LOR and some samples were found to be above the ANZECC trigger criteria).

An additional two metals (Boron and Cobalt) should also be analysed in surface water.

5.3.2 Nutrients

Concentrations of Total Phosphorous and Total Nitrogen were found to be elevated above ANZECC 2000 Trigger Values for a low land river in south-east Australia in a number of sampling locations on multiple occasions.

Concentrations of Ammonia were also identified to be present above LOR, however, concentrations were all recorded below the ANZECC 2000 Trigger Values and aesthetic ADWG values.

It is therefore considered appropriate to maintain sampling to identify potential significant changes in concentrations that would impact the local environment.

5.3.3 Hydrocarbons

With the exception of 4 samples, all concentrations were found to be below the LOR. However, the quarry operations plan to store diesel fuel on site for the operational plant. The site will also have a maintenance workshop where oils, greases, lubricants and cleaning agents (degreasers) will be stored and used on site. It is therefore necessary to continue to monitor for hydrocarbons.

It is recommended that TRH continues to be monitored. Should the TRH identify concentrations of C_6 to C_{10} then this should trigger further analysis of BTEXN. Likewise, should concentrations of C_{16} to C_{40} be identified then this should trigger the analysis of PAH.

5.3.4 PFAS

The majority of results were identified to be below the LOR. However, due to the sensitive nature of PFAS and the location of the site being on the edge of the Williamtown Red Zone, PFAS monitoring should continue.

5.4 LOCATIONS

BH2, BH4, BH6, BH7, BH9, BH11 and MW239S are required to be monitored on a monthly basis as part of the EPL requirements. It is noted that MW9 has been dry consistently through the background monitoring period.

In addition to the above it is recommended that BH8 also be monitored.

5.5 SCHEDULE

Monthly monitoring is required by the EPL. It is not recommended that additional monitoring be undertaken above this every month.

It is recommended that quarterly monitoring be undertaken to include:

- 8 metals (as identified above);
- TRH;
- PFAS;
- Nutrients (Total Phosphorus, Total Nitrogen and Ammonia as N); and
- and the inclusion of sampling BH8.

As part of the quarterly monitoring, all available wells should be gauged for groundwater depths and observed for monitoring well condition.

In order to review and confirm the continued relevance of the outcome of this summary document and proposed analytical program, an annual monitoring event should be undertaken including all analytes and locations sampled as part of the background monitoring.

Additional analysis may be required should there be a recorded spill event or other potential pollution incident.

5.6 SUMMARY OF PROPOSED SAMPLING

Table 5.2 provides a summary of the proposed ongoing operational monitoring schedule for the site. **Table 5.3** provides a summary of the proposed testing schedule for the different monitoring events.

Table 5.2 Proposed operational monitoring schedule

Location	Monthly	Quarterly	Annually
BH2, BH4, BH6, BH7, BH9, BH11 and MW239S	✓	✓	✓
BH8 SW1, SW2, SW3, SW4		✓	✓
BH1, BH5, BH12			✓

Table 5.3 Proposed testing schedule

Monthly	Quarterly	Annually
• Conductivity; • pH; • Depth; • Turbidity; • Arsenic; • Iron; and • Manganese.	• Gauging all available wells; • Conductivity; • pH; • Depth; • Turbidity; • Nutrients (Total Phosphorus, Total Nitrogen and Ammonia as N); • 8 metals (As, Ba, Cr, Cu, Fe, Mg, Ni and Zn); • Additional 2 metals (B and Co) for surface water; • TRH; and • PFAS.	• Gauging all available wells; • Conductivity; • pH; • Depth; • General water quality parameters (Ca, Mg, Na, K, pH, EC, Cl, SO_4, Alkalinity, Hardness & TDS); • Nutrients (Total Phosphorus, Total Nitrogen and Ammonia as N); • Turbidity; • Metals (As, B, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Ni, Se, V, Zn); • TRH and BTEXN; and • PFAS.

5.7 SITE SPECIFIC TRIGGER VALUES

As discussed in **Section 1.3** one of the objectives of this report is to establish Site specific trigger values to be used for long-term monitoring during the operation of the sand quarry. An exceedance of a trigger value does not necessarily indicate that there is an unacceptable risk on site, but rather a trigger for further investigation or evaluation of management options (CRC-CARE Technical Report 10: 2011). **Section 5.8** provides details on the proposed action response should a trigger value be exceeded.

The baseline groundwater and surface water assessment criteria adopted for future quarry extraction works for locations to be monitored under the Sites EPL, and defined in the SWMP, are summarised below. Nationally accepted water quality guidelines; ANZECC (2000) *Australian and New Zealand Water Quality Guidelines for Fresh and Marine Waters, 95% species Protection for freshwater,* HEPA NEMP (2018) *PFAS National Environmental Management Plan* and ADWG (2011) *Australian Drinking Water Guidelines 6,* have been considered in developing site specific trigger values.

Table 5.4 and **Table 5.5** presents the proposed trigger values for groundwater and surface water respectively along with a justification for selecting that value. The trigger values are to be applied to the sample locations monitored monthly and quarterly. Locations monitored as part of the annual monitoring should be compared against currently available data for that location only as they have not been considered when developing the trigger values.

Table 5.4 Site specific trigger values for Groundwater

Analyte	Units	Adopted Site specific trigger value	Location	Justification
Inorganics				
pH	pH units	4 - 7	Site wide	The lowest pH value recorded was 4.37 (noting 4.0 in surface water). It is feasible that pH values could continue to be low. The highest pH value recorded was 6.21 indicating a generally acidic environment. It is therefore unlikely the pH would exceed 7.
Total Phosphorus	mg/L	2	Site wide	The majority of baseline results were found to be elevated above the ANZECC 2000 trigger values for a Lowland river in South-east Australia. It is therefore not considered appropriate to use this criterion. The majority of baseline sample results were less than 2mg/L, however it is noted that the highest value recorded was 2.76mg/L at BH3 (noting one sample event and the well is no longer operational) and 2.11mg/L in BH11. The third highest concentration of 1.97mg/L was located at BH8. The sample locations identified represent a large cross section of the Site therefore represent the likely range that could be expected at the Site.
Ammonia as N	mg/L	0.5	Site wide	The detected range of <0.01-0.34mg/L was not found to be elevated above the ANZECC 2000 and ADWG. Based on the results obtained it is considered that adopting the 0.5mg/L ADWG provides a conservative value for a trigger response. It is noted that the ANZECC criteria is 0.9mg/L.
Total Nitrogen as N	mg/L	3	Site wide	Results from the majority of locations were generally found to be elevated above the ANZECC 2000 trigger values, with the exception of BH1 where concentrations were recorded to be marginally lower than the initial criteria. The highest concentrations were recorded in BH11 (considered to be up hydraulic gradient of the Site) and BH2 located centrally on Site. Concentrations as high as 2.2mg/L (in BH7) were identified at locations down/ cross hydraulic gradient of the Site. It is evident that concentrations of Nitrogen can be found naturally across the Site and can be varied over time. Concentrations of Total Nitrogen are not expected to be elevated above the highest recorded value of 5.9mg/L. However, to maintain a level of conservatism a trigger value of 3mg/L (half the highest concentration) has been adopted understanding that four previous samples exceeded this value. Elevated concentrations above the adopted trigger value is a requirement to look at the concentration with more detail to determine if it is in line with previous sampling results or considered to be an outlier potentially presenting a significant increase.
Electrical Conductivity @ 25°C*	µc/cm	125-2200	Site wide	Concentrations across the Site were identified to vary considerably. However, no concentration was found to be elevated above 2200 µc/cm. Trigger criteria has been taken from ANZECC 2000 for a lowland river is south-eastern Australia and is considered appropriate.

Analyte	Units	Adopted Site specific trigger value	Location	Justification
Turbidity	NTU	6-50	Site wide	Criteria taken from ANZECC 2000 for a lowland river is south-eastern Australia.
Dissolved Metals				
Arsenic	mg/L	0.003	Site wide	Arsenic was not detected within the majority of groundwater locations with the exception of BH8 recording a maximum concentration of 0.003 mg/L. The adopted trigger value has been taken as the maximum value obtained throughout the baseline monitoring period.
Barium	mg/L	0.035	Site wide	All results for Barium were found to be above the LOR. The highest concentration recorded was 0.034mg/L in BH6 (considered to be up/ cross hydraulic gradient of the Site). The adopted trigger value has been taken to be one significant figure above the highest concentration.
Chromium	mg/L	0.004	Site wide	All locations recoded concentrations of chromium at or marginally above LOR. Exceedances above initial baseline criteria (ANZECC 2000) were recorded at most locations with the exception of BH4 & BH6. The adopted trigger value has been taken as the maximum value obtained throughout the baseline monitoring period.
Copper	mg/L	0.013	Site wide (except BH4)	Detections of copper concentrations above LOR were recorded at all locations. The adopted trigger value has been taken as the maximum value obtained throughout the baseline monitoring period.
		0.051	BH4	Concentration range for copper at location BH4 was generally greater than other locations. It is feasible that stormwater runoff from the adjacent Cabbage Tree Road may impact this borehole. Therefore, a higher specific trigger value has been adopted which is the highest concentration identified during the baseline monitoring.
Iron	mg/L	4.1	Northern Half (BH6, BH7, BH8, BH11 and MW239S),	The Site can be divided into a northern section and southern section with an access road between the two sections (between BH2 and SW2). The north and south areas are divided by surface water (where SW2 and SW3 are located). Upon review of the groundwater data from the baseline monitoring it appears that there are greater concentrations of iron in the northern area than the southern area. Two separate criteria have been developed based on this. The highest concentration identified during the baseline monitoring for this area has been adopted as the Trigger Value.
		1	Southern half (BH2, BH4, BH9)	The highest concentration identified during the baseline monitoring for this area has been adopted as the Trigger Value.

Analyte	Units	Adopted Site specific trigger value	Location	Justification
				BH1, BH5, BH12 are only proposed to be sampled during the annual monitoring round. When assessing these wells, concentrations will be assessed against previous criteria for those locations.
Manganese	mg/L	0.136	Site wide	A similar range of results were identified across all locations. BH4 recorded the highest value of Manganese (0.136mg/L) across the Site. The highest concentration identified during the baseline monitoring has been adopted as the Trigger Value. It is noted that the ANZECC 2000 criteria is 1.9mg/L.
Nickel	mg/L	0.037	BH11	BH11 is located to the north of the Site and is considered to be in an up hydraulic gradient location. The highest concentration identified in BH11 was 0.037mg/L. This has been adopted as the trigger value for this location.
		0.022	Site wide (excluding BH11)	With the exception of BH6 and MW239S, at least one concentration from each monitoring location throughout the baseline monitoring was found to be elevated above than the ANZECC 2000 trigger values. Generally, concentrations of Nickel are similar across the Site (with the exception of BH11). Therefore, the highest recorded value from the baseline monitoring round has been adopted as the trigger value.
Zinc	mg/L	0.085	Site wide	At least one concentration from each monitoring location throughout the baseline monitoring was found to be elevated above than the ANZECC 2000 trigger values. Generally, concentrations of Zinc are similar across the Site. Therefore, the highest recorded value from the baseline monitoring round has been adopted as the trigger value. Noting that BH1 is not proposed to be sampled until the annual monitoring round where the results should be assessed against previous results from that location only.
TRH				
TRH C_6 – C_{10}	µg/L	20	Site wide	Concentrations of TRH were identified to be below the LOR for the majority of the baseline monitoring. The exceptions were following well maintenance work or were observed in BH4 following a high rainfall event. It is feasible that stormwater runoff from the adjacent Cabbage Tree Road may locally impact BH4. Based on the understanding of the above, generally TRH is not identified within the groundwater across the Site. The Laboratory LOR has therefore been adopted as a trigger value.
C_6 - C_{10} minus BTEX (F1)	µg/L	20	Site wide	
TRH C_{10} – C_{16}	µg/L	100	Site wide	
TRH C_{10} - C_{16} minus N (F2)	µg/L	100	Site wide	
TRH C_{16} – C_{34}	µg/L	100	Site wide	

Analyte	Units	Adopted Site specific trigger value	Location	Justification
TRH C_{34} - C_{40}	µg/L	100	Site wide	
PFAS				
PFOS+ PFHxS	µg/L	0.07	Site wide	Site criteria has been provided in the SWMP. In 2016, Food Standards Australia New Zealand (FSANZ) were commissioned to develop health-based guidance values for a selection of PFAS. FSANZ (2017) published levels for use in Site investigations which were updated and incorporated into the HEPA NEMP (2018), which was revised in 2019. The HEPA NEMP (2019) is the recognised national guidance for the investigation and management of PFAS in Australia and forms the key guidelines for this SWMP.This has therefore been adopted in this report.
PFOA	µg/L	0.56	Site wide	
PFOS	µg/L	0.01	Site wide	Standard LOR has been adopted as the Site wide criteria as it is known that PFAS are widely present in the local area owing to the Red Zone. Ambient concentrations have been detected above this in groundwater emanating from Williamtown RAAF Base.

1- National Health and Australian Drinking Water Guidelines 6 (ADWG) (2011)
ANZECC (2000) 95% level of species protection in freshwater -

Table 5.5 Site specific trigger values for Surface water

Analyte	Units	Adopted Site specific trigger value	Location	Justification
Inorganics				
pH	pH units	4 - 7	Site wide	The lowest pH value recorded was 4.01 in surface water). It is feasible that pH values could continue to be low. The highest pH value recorded was 6.21 indicating a generally acidic environment. It is therefore unlikely the pH would exceed 7.
Total Phosphorus	mg/L	0.13	Site wide	The two out of the 10 surface water baseline results were found to be above the ANZECC 2000 trigger values for a Lowland river in South-east Australia. It is therefore not considered appropriate to use this value. The highest recorded value in the surface water was 0.13mg/L in SW1. This value has been adopted as the trigger value for surface water.
Ammonia as N	mg/L	0.25	Site wide	The detected range of <0.01-0.16mg/L was not found to be elevated above the ANZECC 2000 and ADWG. Based on the results obtained it is considered that adopting half the 0.5mg/L ADWG value provides a conservative approach for a trigger level. It is noted that the ANZECC criteria is 0.9mg/L.

Analyte	Units	Adopted Site specific trigger value	Location	Justification
Total Nitrogen as N	mg/L	1.8	Site wide	Results from the majority of locations were found to be elevated above the ANZECC 2000 trigger criteria. The highest concentrations were recorded in SW1. It is evident that concentrations of Nitrogen can be found naturally across the Site and vary over time. Concentrations of Total Nitrogen are not expected to be elevated above the highest recorded value of 1.8mg/L. Therefore, this has been adopted as the trigger value.
Electrical Conductivity @ 25°C*	µc/cm	125-2200	Site wide	Concentrations across the Site were identified to vary considerably. However, no concentration was found to be elevated above 2200 µc/cm. Trigger criteria has been taken from ANZECC 2000 for a lowland river is south-eastern Australia and is considered appropriate for this Site.
Turbidity	NTU	6-50	Site wide	Criteria taken from ANZECC 2000 for a lowland river is south-eastern Australia.
Dissolved Metals				
Arsenic	mg/L	0.001	Site wide	Arsenic was not detected within the majority of groundwater locations with the exception of SW3 recording a maximum concentration of 0.006 mg/L. As the majority of results were recorded below the LOR, the adopted trigger value has been taken as the laboratory LOR.
Barium	mg/L	0.08	Site wide	All results for Barium were found to be above the LOR. The highest concentration recorded was 0.08mg/L in SW3. The adopted trigger value has been taken to be the highest concentration recorded.
Boron	mg/L	0.14	SW1	All results at SW1 for Boron were found to be above the LOR compared to all other locations that had concentrations below LOR. Therefore, a location specific trigger value has been adopted for SW1.
		0.05	SW3 & SW4	All results were found to be below the LOR. The adopted trigger value has been taken as LOR.
Chromium	mg/L	0.002	Site wide	The majority of results were found to be below the LOR with one result higher than the ANZECC 2000 trigger value recorded in SW3. The adopted trigger value has been taken as the maximum value obtained throughout the baseline monitoring period.
Cobalt	mg/L	0.017	Site wide	Detections of Cobalt concentrations above LOR were detected at all surface water locations. The highest concentration was 0.017mg/L in SW1. The adopted trigger value has been taken to be the highest concentration recorded.
Copper	mg/L	0.013	Site wide	Detections of Copper concentrations above LOR were recorded at all locations. The adopted trigger value has been taken as the same value as the groundwater trigger value. The maximum value obtained in surface water throughout the baseline monitoring period was 0.012mg/L.

Analyte	Units	Adopted Site specific trigger value	Location	Justification
Iron	mg/L	9.26	Site wide	The concentrations of Iron identified in the surface water monitoring results were varied and the Mann-Kendal analysis identified a decreasing trend in SW1 and SW3 and no trend in SW4. The highest concentration identified during the baseline monitoring for this area has been adopted as the Trigger Value. Based on the trend analysis it is not expected this value would be exceeded.
Manganese	mg/L	0.048	SW1 & SW3	Concentrations of manganese in SW1 and SW3 were found to be similar. The highest concentration identified has been adopted as the trigger value for these locations.
		0.841	SW4	Concentrations of manganese in SW4 were found to be elevated above those in SW1 and SW3. It is feasible that stormwater runoff from the adjacent Cabbage Tree Road may impact this location. Therefore, the highest concentration found in SW4 has been taken as the trigger value.
Nickel	mg/L	0.022	Site wide	Concentrations of nickel in each of the surface water locations was found to be similar. The highest concentration identified in SW1 was 0.02mg/L. This is similar to the trigger value adopted for groundwater; therefore, the same value has been adopted as the trigger value.
Zinc	mg/L	0.085	SW1 & SW3	Concentrations of Zinc in SW1 and SW3 were found to be similar. The highest concentration identified has been adopted as the trigger value for these locations.
		0.535	SW4	Concentrations of Zinc in SW4 were found to be elevated above those in SW1 and SW3. It is feasible that stormwater runoff from the adjacent Cabbage Tree Road may impact this location. Therefore, the highest concentration found in SW4 has been taken as the trigger value.
TRH				
TRH C_6 – C_{10}	µg/L	20	Site wide	All concentrations of TRH were identified to be below the LOR. The Laboratory LOR has therefore been adopted as the trigger value.
C_6 - C_{10} minus BTEX (F1)	µg/L	20	Site wide	
TRH C_{10} – C_{16}	µg/L	100	Site wide	
TRH C_{10} - C_{16} minus N (F2)	µg/L	100	Site wide	
TRH C_{16} – C_{34}	µg/L	100	Site wide	
TRH C_{34} - C_{40}	µg/L	100	Site wide	

Analyte	Units	Adopted Site specific trigger value	Location	Justification
PFAS				
PFOS+ PFHxS	µg/L	0.07	Site wide	Site criteria has been provided in the SWMP. In 2016, Food Standards Australia New Zealand (FSANZ) were commissioned to develop health-based guidance values for a selection of PFAS. FSANZ (2017) published levels for use in Site investigations which were updated and incorporated into the HEPA NEMP (2018). The HEPA NEMP (2018), revised in 2019, is the recognised national guidance for the investigation and management of PFAS in Australia and form the key guidelines for this SWMP. This has therefore been adopted in this report.
PFOA	µg/L	0.56	Site wide	
PFOS	µg/L	0.01	Site wide	Standard LOR has been adopted as the Site wide criteria as it is known that PFAS are widely present in the local area owing to the Red Zone. Ambient concentrations have been detected above this in groundwater emanating from Williamtown RAAF Base.

5.8 TRIGGER RESPONSE ACTIONS

5.8.1 Metals & Nutrients

The following provides details on the proposed response action required should an analyte concentration be found above the adopted trigger value:

- Review value against previous data including Mann-Kendal trends presented in **Table 4.1** to determine if the concentrations is in line with previous monitoring data, or if considered significantly different then:
  - Question result with the laboratory;
  - Discuss what operations have been undertaken that may cause the elevated concentration; and
  - Review rainfall data and groundwater elevations to establish if concentration is due to seasonal adjustments.
- Re-sample location and elevated metal in the following two monthly monitoring rounds to gauge if the exceedance was an exception of change in trend or characteristic of background changes.

Where the outcome of the above assessment indicates a potential contamination issue then a water trigger investigation should be undertaken in accordance with the SWMP (see **Section 5.8.4**).

5.8.2 Hydrocarbons

The following provides details on the proposed response action required should an analyte concentration be found above the adopted trigger value:

- Question result with the laboratory to determine if there were any laboratory errors;
- Discuss what operations have been undertaken that may cause the elevated concentration;
- Review rainfall data and groundwater elevations to establish if concentration is due to seasonal adjustments; and
- Re-sample location in the following two monthly monitoring rounds to gauge if the exceedance was an exception of change in trend, or characteristic of background changes, and include the following additional analysis:
  - Where TRH C_6 to C_{10} has been detected then BTEXN will also be analysed; and/or
  - Where TRH C_{16} to C_{40} has been detected then PAH will also be analysed.

Where the outcome of the above indicates a potential issue then a water trigger investigation should be undertaken in accordance with the SWMP (see **Section 5.8.4**).

Where a spill or potential pollution incident event has occurred, or the above conversation with the quarry operations indicates a potential contamination issue, then sampling (or re-sampling) at the closest (down hydraulic gradient) location should be undertaken within 48 hours. An incident investigation in accordance with the SWMP must be undertaken.

5.8.3 PFAS

Where PFAS is identified above the adopted criteria (or maximum background value detected previously at a specific monitoring location) an additional water sample will be collected within 48 hours and submitted for analysis. In the event the trigger value is exceeded by more than 10% in both the primary sample and the follow-up sample, a water trigger Investigation will be completed to determine if the change is related to:

- The quarry operations;
- External influence; and/or
- Natural variation.

5.8.4 Water Trigger Investigation

Upon triggering the need for a water trigger investigation Hunter Water Corporation (HWC), NSW Environmental Protection Agency (EPA) and Department of Planning Industry and Environment (DPIE) must be notified within 24hours. The SWMP stipulates that the water trigger investigation will evaluate the following:

- A review of the site conceptual site model to understand the risk potential of the exceedance;
- Identify the potential for other sources to be present that may require confirmatory sampling (and include intrusive investigation if considered appropriate);
- Recent climate and rainfall data;
- Other activities within the catchment (both on and off the Site) in the preceding period;
- Operational activities of the quarry in the preceding period; and
- Historical potential for those quarry activities to cause exceedance.

The water trigger investigation report will be submitted as an incident notification to HWC, EPA and DPIE. The report will also be summarised in the Annual Environmental Review (AER).

6. QUALITY ASSURANCE AND QUALITY CONTROL

6.1 DATA VALIDATION

The QA/QC program implemented for this monitoring program followed the requirements of the SWMP.

Data Quality Indicators (DQIs) were developed prior to commencing background monitoring and have been summarised in **Table 6.1.** DQIs established acceptable limits for field and laboratory data collected from the monitoring program.

Table 6.1 QA/QC data quality indicators

QA/QC Objective	Data quality indicator (DQI)
Successful completion of project	To conduct a baseline water quality sampling program in accordance with NEPM 2013 and AS4482.1 – 1999 in order to achieve the objective set out in **Section 1**.
Suitable environmental consultant	The environmental consultant was to maintain QA Systems certified to AS/NZS ISO 9001:2015.
Suitable field personnel	All Kleinfelder field personnel conducting sampling were to be trained in the requirements detailed in this SWMP. All Kleinfelder field personnel have relevant tertiary qualifications and have demonstrated competence in Kleinfelder procedures for sampling (consistent with NEPM 2013 and AS4482.1 - 1999).
Adequate sample collection density	The sampling strategy was developed based on historical information available for the site and the objective of the investigation.
Standardised sample nomenclature	All samples were labelled with a unique identifier that can be related to sample location. Surface water and Groundwater samples were labelled as per monitoring well ID. The following naming convention was utilised: Bore Hole (BH) – Number (1, 2, 3…): E.g. MW1 Surface water (SW) – Number (1, 2, 3…): E.g. SW1
Decontamination of field equipment	When sampling equipment was used, nitrile gloves were worn and changed between locations. Non-dedicated sampling equipment was decontaminated between sample locations using an appropriate surface-active cleaning agent (e.g. Liquinox for use with PFAS) as consistent with NEPM 2013 and HEPA NEMP (2019).
Calibration of field instruments	All field instruments were calibrated prior to use, and the calibration certificates have been provided in **Appendix A**.
Transportation	A Chain of Custody (COC) document was used to ensure the integrity of the samples from collection to receipt by the analytical laboratory within appropriate holding times.
National Association of Testing Authorities (NATA) accredited laboratory analysis	All samples were forwarded to a laboratory holding NATA accreditation for the required analyses. The following Laboratories were utilised: • ALS – Primary Laboratory for chemical analysis; and • Eurofins – Secondary Laboratory for chemical analysis.

QA/QC Objective	Data quality indicator (DQI)
Field QA/QC	Duplicate samples (intra-laboratory) were collected at a rate of one in every twenty (1:20) primary water samples and submitted to the primary laboratory for analysis. Standard NEPM 2013 duplicate and triplicate requirements were deemed reasonable for the sampling of PFAS for the purpose of baseline water monitoring. Triplicate samples (inter-laboratory) were also collected at a rate of one in every twenty (1:20) primary water samples and submitted to the secondary laboratory for analysis. Field duplicate and triplicate samples are used to assess field and analytical precision and the precision measurement is determined using the relative percent difference (RPD) between the primary sample (X1) and duplicate sample (X2) results, as shown in the following equation: $\text{Relative percent difference (RPD)} = \frac{(X1 - X2)}{(X1 + X2)/2} \times 100$ Generally, it is recommended that RPD is <30% (NEPM 2013). Default RPD levels in the field may be non-compliant for the following reasons: • The differing laboratory equipment, procedures and limits of reporting (between the primary and secondary laboratories); • Due to sample matrix interference; and/or • Due to the reported concentrations being close to the limit of reporting where laboratory precision and accuracy are inherently low. A rinsate blank sample was collected for each piece of non-dedicated sampling equipment per day onsite and submitted to the primary laboratory for analysis. A transport blank sample was collected for each batch of samples sent to the laboratory (~one per day in the field) and submitted to the primary laboratory for analysis for each day samples are taken. QA/QC non-compliance was documented and discussed in the monthly summary letter (see **Appendix B**). Where exceedances were identified (i.e. duplicates and triplicates be above the RPD or rinsate blanks, field blanks or transport blanks be above the LOR) then consideration was given to the sample(s) being re-analysed, the higher concentration level to be conservatively adopted and/or reviewing field practices for continued prevention of potential cross contamination.
Laboratory Quality Control – Duplicates, spikes, blanks and surrogates – Acceptable Limits	Laboratory QA/QC acceptance limits are as follows: Surrogates: 70% to 130% recovery; Matrix Spikes: 70% to 130% recovery for organics or 80% to 120% recovery for inorganics; Control Samples: 70% to 130% recovery for soil or 80% to 120% recovery for waters; Duplicate Samples: <4 Practical Quantitation Limits (PQL) - +/- 2PQL, 4-10PQL – 0.-25 or 50%RPD, >10PQL – 0-10 or 30%RPD; and Method Blanks: zero to <PQL.

6.2 QA/QC RESULTS

6.2.1 Field Method Validation

To ensure the completeness, comparability, representativeness, precision and accuracy of QA/QC items, **Table 6.2** details how the QA/QC compliance has been met.

Table 6.2 Field QA/QC

QA/QC Objective	Data Quality Indicator (DQI)
Suitable field personnel	The site work was undertaken by Dan Kousbroek who has 4 years' experience in contaminated land investigations. Dan was informed of the requirements of the agreed scope of works. Dan has relevant tertiary qualifications and has demonstrated competence with Kleinfelder's sampling procedures (consistent with NEPM 2013 requirements and AS4482.1 2005).
Adequate sample collection density	Water sampling was undertaken based on information provided in the SWMP. A targeted sampling program was undertaken requiring sampling at 10 groundwater locations and 4 surface water locations and then analysed. It is noted that a number of the surface water locations were found to be dry throughout the 12 months due to an extended drought period in NSW.
Field equipment	YSI 556 Water Quality Meter and Solinst oil/water interface meter were used during field works.
Calibration of field instruments	Calibration certificates for each piece of equipment used in the field are attached in **Appendix A**
Sample preservation	Samples were collected in laboratory supplied containers and immediately stored in an insulated esky chilled with ice.
Sample handling	Samples were delivered straight to ALS Newcastle following each sampling event. Chains of custody are included in Appendix A of the monthly reports**,** which have been provided as **Appendix B** of this document.

6.2.2 Laboratory QA/QC

The results for internal laboratory QA/QC procedures are provided within the laboratory analysis reports (Appendix A of the monthly reports, which have been provided as **Appendix B** of this document). **Table 6.3** summarises conformance to specific QA/QC procedures, also see **Tables E, F** and **G** at the rear of this report for a summary of the data.

Table 6.3 Laboratory QA/QC

Quality assurance	Conformed	Comment
Collection of rinsate water from decontaminated field equipment	Yes	Rinsate was sourced from a NATA accredited laboratory and supplied with the sample containers. A rinsate sample was taken from the sampling equipment during each sampling event. A total of 12 rinsate samples were taken. All samples were non detect. See **Tables E, F** and **G** at the back of this report.
Collection of transport blanks through the sampling day	Majority	12 transport blank samples were collected (two samples in March (due to a return confirmatory sampling event), no transport taken in August 19) 2nd transport blank taken in March (15/03/19) was found to contain barium (2ug/l). As no other transport blanks were found to have concentrations above LOR and the following months samples resulted in non detect the data is considered reliable. See **Tables E, F** and **G** at the back of this report.
Holding times met	Yes	Holding times were met for all analytes and samples. Every effort was made by Kleinfelder to deliver samples to the laboratory as soon as possible after sampling.

Quality assurance	Conformed	Comment
LOR less than assessment criteria	Yes	Majority of LOR were below the adopted screening criteria. Adopted criteria for PFOS (HEPA NEMP 2018) is below LOR. It is noted that PFAS are likely to be in the region given the reported scale of PFAS in groundwater within the Red Zone, therefore the standard LOR has been adopted.
All analyses National Association of Testing Authorities (NATA) accredited	Yes	All samples were delivered to a NATA accredited laboratory for the required analysis, within specified holding times. The primary laboratory used was ALS (delivered to the Newcastle laboratory). Triplicate samples were forwarded by ALS to the secondary laboratory, Eurofins mgt (Newcastle).
Field intra-laboratory duplicate samples collected and analysed to represent 5% of sample population	Majority	One intra-laboratory duplicate sample and one inter-laboratory triplicate water sample were collected. This is considered to exceed the requirement of 5% of the total number of primary analyses undertaken (minimum 1 in 20 duplicate and 1 in 20 triplicate samples). Due to a laboratory error in transferring samples, one intra-laboratory triplicate (March 2019) was only sampled for Metals and PFAS with TRH and BTEX being missed from the COC to the tertiary laboratory. With the exception of some minor elevations of TRH and BTEX which were attributed to maintenance work on the well, there were no recorded concentrations above LOR. Therefore, this is not considered to impair the reliability of data in meeting the objectives of this monitoring programme. See **Table 6.5** for details.
Did duplicate sample meet RPD requirements	Majority	The majority of samples met the RPD requirements of being within 30% (See **Tables E, F** and **G** at the back of this report). The following did not meet these requirements: • Arsenic – 67% BH8 (Feb 2019) • Cobalt – 40% BH7 (March 2019) • Copper – 190% SW4 (September 2019) • Lead – 67% SW4 (September 2019) • Nickel – 140% SW4 (September 2019), 67% BH6 (January 2020) • Zinc – 100% BH8 (February 2019), 151% SW4 (September 2019) In general, for these exceedances at least one sample was found to be below or close to the Laboratory LOR, which leads to exaggerated RPD calculations. In order to take a conservative approach, the highest recorded concentration has been selected for results screening. These RPD exceedances are therefore not considered to have a negative impact on the outcome of the assessment.
Did triplicate sample meet RPD requirements	Majority	The majority of samples met the RPD requirements of being within 30% (See **Tables E, F** and **G** at the back of this report). The following did not meet these requirements: Water: • Arsenic – 67% BH8 (February 2019) • Chromium – 86% BH8 (February 2019), 67% SW3 (June 2019) • Cobalt – 40% • Copper – 190% SW4 (September 2019), 156% BH6 (January 2020)

Quality assurance	Conformed	Comment
		• Lead – 67% SW4 (September 2019) • Nickel – 156% BH7 (March 2019), 140% SW4 (September 2019), 111% SW4 (November 2019) • Zinc – 113% BH7 (March 2019), 151% SW4 (September 2019), 172% SW4 (November 2019) & 131% BH6 (January 2020) • PFOS – 100% SW4 (September 2019) • Sum of PFHxS and PFOS – 100% (September 2019) • Sum of PFAS (WA DER List) – 86% (September 2019) • Sum of PFAS – 133% (September 2019) A number of exceedances were calculated with one sample being below the Laboratory LOR. This leads to a potentially exaggerated RPD calculations. In order to take a conservative approach, the highest recorded concentration has been selected for results screening. RPD exceedances for triplicates can often be attributed to differences in methods used by each of the labs and are not considered to impair the reliability of the data in meeting the objectives of this monitoring programme.
Internal laboratory procedures	Majority.	Holding time breaches are discussed above. Internal laboratory QC procedures were generally met. Some exceedances of internal procedures for laboratory duplicates and matrix spikes were recorded for water samples, for organic analysis. However, the primary laboratory results recorded these analytes to be below the LOR. Therefore, this does not impair the reliability of the analytical data for decision making. This is not considered to impact the outcome of the results and thus unlikely to impair the outcome of decision making.

A summary of the water sample container types, preservation and the order of container filling is provided in **Table 6.4**.

Table 6.4 Container types, preservation and order of filling

Analyte	Container Type	Preservation
PFAS incl PFOS, PFOA, PFOS/PFHxS, PFDS	1 x 60mL Plastic Bottle - Unpreserved	Refrigerate
TPH (C_{10}-C_{36})	1 x 100mL Amber Glass Bottle - Unpreserved	Refrigerate
TRH (C_6-C_{10}), BTEXN, VOC	2 x 40mL amber Glass Vials with Teflon lined septa	Sulfuric Acid
Heavy metals - Dissolved	1 x 60mL Clear Plastic Bottle - Filtered	Nitric acid
Extended Water Suite	1 x 500mL Clear Plastic Bottle – Unpreserved 1 x 60mL Clear Plastic Bottle	Refrigerate Sulfuric Acid
General Water Suite	1 x 500mL Clear Plastic Bottle – Unpreserved	Refrigerate

Table 6.5 Summary of groundwater QC program

Analyte	Number of Groundwater Samples Analysed			% QC Samples Relative to Primary Samples
	Primary	Field Duplicates (intra-lab)	Laboratory Splits (inter-lab)	
TRH	124	6	**5**	**9%**
BTEXN	124	6	**5**	**9%**
Dissolved metals	124	6	6	10%
PFAS	65	5	5	15%

Bold: Indicates not meeting the triplicate density.

6.3 QUALITY STATEMENT

Field sampling procedures conformed to Kleinfelder's QA/QC protocols to prevent cross contamination, preserve sample integrity and allow for collection of a suitable data set from which to make technically sound and justifiable decisions with data of satisfactory useability.

Based on a review of the results for the Kleinfelder and laboratory QA/QC program adopted, the overall data quality is considered to be suitably reliable and representative of groundwater conditions beneath the Site. Copies of the final NATA endorsed laboratory reports, including internal QA/QC results and chain-of-custody documentation for the primary and secondary laboratories are attached as Appendix A of the monthly reports, which have been provided as **Appendix B** of this document.

6.4 EQUIPMENT CALIBRATION

All equipment used was supplied calibrated with appropriate calibration certificates (see **Appendix A**). Kleinfelder undertook pre-mobilisation checks of equipment (including calibration as required). Prior to commencing field operations, the following equipment and calibration checks were conducted:

- **Water Quality Meter** – The water quality meter came calibrated from the supplier. A daily confidence check of dissolved oxygen, pH and EC was undertaken using air and standards of known concentration, and calibration performed as warranted.
- **PID** – the PID came calibrated from the supplier. A daily fresh air calibration check was undertaken on site.

7. SUMMARY STATEMENT

A baseline water monitoring program was conducted at the Site to characterise groundwater and surface water for ongoing use of the Site as an operational sand quarry from February 2019 through to January 2020.

The analytical results indicate that metals, namely barium, chromium, copper, iron manganese, nickel and zinc, were detected regularly throughout the monitoring period, and at the majority of the sample locations, indicating likely natural background concentrations. Iron concentrations were typically higher at BH1 throughout the baseline monitoring program which are likely indicative of concentrations in this area.

BTEXN, TPH and TRH were generally not detected across the majority of the Site with the exception of BH1 and BH4. At the initiation of the baseline sampling program in February 2019 BH1 was refitted with a PVC pipe to replace a previously fire damaged one. In the process an acrylic adhesive was applied to fuse the pipes together which likely initiated increased concentrations of TPH C_6 - C_9 (1,710µg/L) and TRH C_6 - C_{10} (1,690µg/L) within the well. The subsequent months following reinstallation of the well concentrations of TPH and TRH fell to below LOR. Concentration of hydrocarbons detected at BH4 are most likely influenced by the adjacent Cabbage Tree Road. Concentrations were detected following some form of rainfall in the region and ongoing detections are likely given the location of BH4 being in close proximity to a relatively busy carriageway. Ongoing monitoring of hydrocarbons is recommended, for due diligence purposes, given the potential likelihood for spills to occur from operational vehicles.

PFAS detections above LOR were recorded at locations BH4, BH6 and SW4. Concentrations of PFAS identified at BH6 and SW4 are likely sourced from an upgradient source from the Site, namely the Williamtown RAAF Base where historical use of PFAS containing materials have been used. PFAS identified at location BH4, and directly adjacent to Cabbage Tree Road, is likely to have occurred from a different historical source. Ongoing monitoring of PFAS should be undertaken directly following initial excavation works.

It should also be noted that the Site and regional area has experienced a significant drought over the past couple of years and this may have a bearing on groundwater and surface water conditions should significant rainfall reoccur in the region. Baseline data provided within this report should be reassessed following a full year of data with average to above average rainfall to identify potential outliers that may be present.

Table 7.1 provides a summary of the proposed ongoing operational monitoring schedule for the Site. **Table 7.2** provides a summary of the proposed testing schedule for the different

monitoring events and presents the adopted groundwater (GW) and surface water (SW) trigger values.

Table 7.1 Proposed operational monitoring schedule

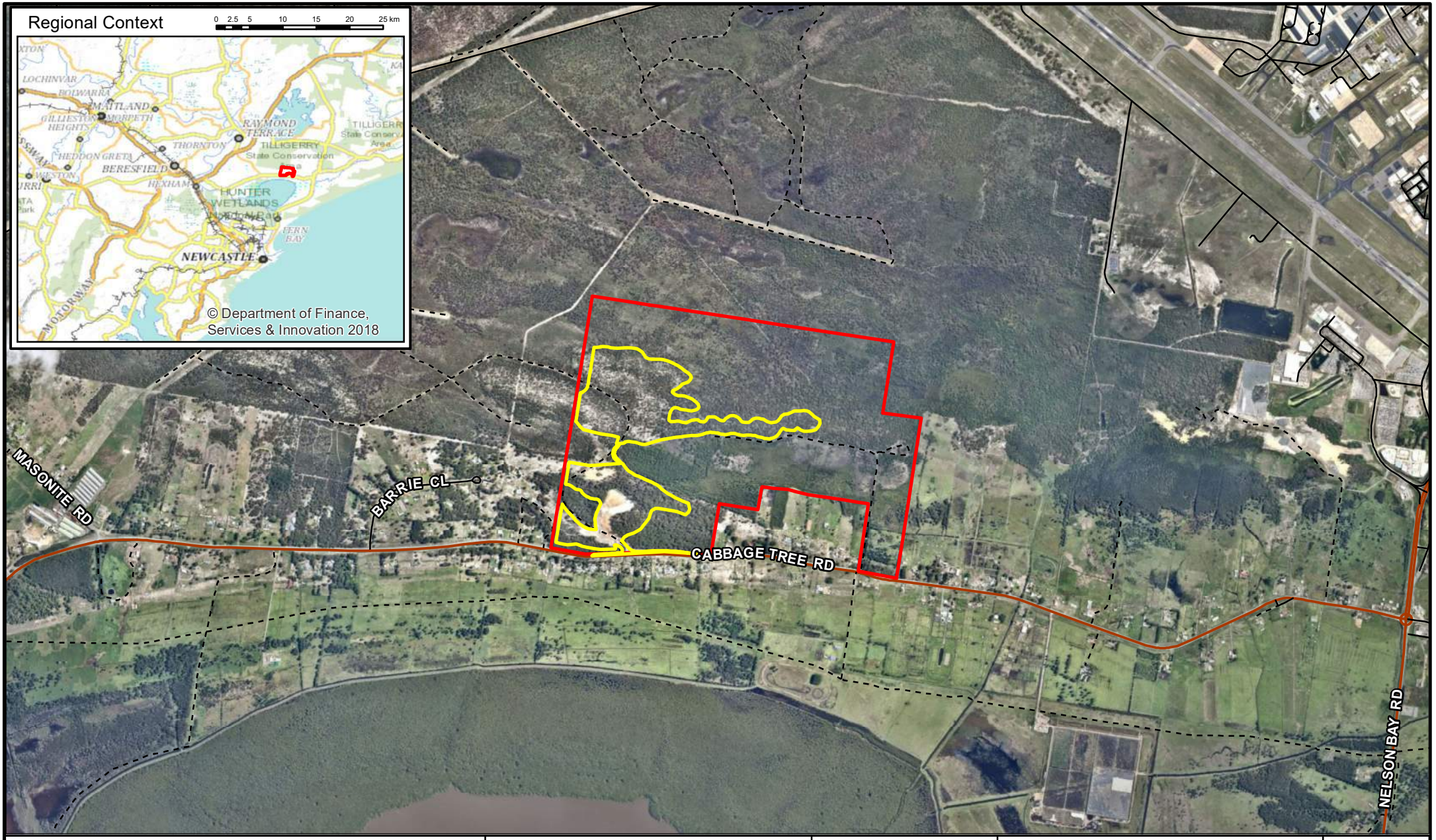
Location	Monthly	Quarterly	Annually
BH2, BH4, BH6, BH7, BH9, BH11 and MW239S	✓	✓	✓
BH8 SW1, SW2, SW3, SW4		✓	✓
BH1, BH5, BH12			✓

Table 7.2 Proposed testing schedule

Testing schedule			Specified Location otherwise site wide	Trigger value		
Monthly	Quarterly	Annually		Units	GW	SW
pH	pH	pH			4 - 7	4 - 7
Conductivity	Conductivity	Conductivity		µc/cm	125-2200	125-2200
Turbidity	Turbidity	Turbidity		NTU	6-50	6-50
Arsenic	Arsenic	Arsenic		mg/L	0.003	0.001
Iron	Iron	Iron	Northern Half (BH6, BH7, BH8, BH11 and MW239S),	mg/L	4.1	9.26
			Southern half (BH2, BH4, BH9)	mg/L	1	
Manganese	Manganese	Manganese		mg/L	0.136	0.048
Gauging selected wells	Gauging all available wells;	Gauging all available wells;		-	-	-
	Total Phosphorus	Total Phosphorus		mg/L	2	0.13
	Total Nitrogen	Total Nitrogen		mg/L	3	1.8
	Ammonia as N	Ammonia as N		mg/L	0.5	0.25
	Barium	Barium		mg/L	0.035	0.08
	Chromium	Chromium		mg/L	0.004	0.002
	Copper	Copper	Site wide (except BH4)	mg/L	0.013	0.013
			BH4	mg/L	0.051	
	Nickel	Nickel	BH11	mg/L	0.037	0.022
			Site wide (excluding BH11)	mg/L	0.022	
	Zinc	Zinc	Site wide (excluding SW4)	mg/L	0.085	0.085
			SW4	mg/L		0.535
	Boron	Boron	SW1	mg/L	N/A	0.14
			SW2, SW3 & SW4	mg/L		0.05
	Cobalt	Cobalt		mg/L	N/A	0.017

Testing schedule			Specified Location otherwise site wide	Trigger value		
Monthly	Quarterly	Annually		Units	GW	SW
	TRH C_6 – C_{10}	TRH C_6 – C_{10}		µg/L	20	20
	C_6 - C_{10} minus BTEX (F1)	C_6 - C_{10} minus BTEX (F1)		µg/L	20	20
	TRH C_{10} – C_{16}	TRH C_{10} – C_{16}		µg/L	100	100
	TRH C_{10} - C_{16} minus N (F2)	TRH C_{10} - C_{16} minus N (F2)		µg/L	100	100
	TRH C_{16} – C_{34}	TRH C_{16} – C_{34}		µg/L	100	100
	TRH C_{34} - C_{40}	TRH C_{34} - C_{40}		µg/L	100	100
	PFOS	PFOS		µg/L	0.01	0.01
	PFOS+ PFHxS	PFOS+ PFHxS		µg/L	0.07	0.07
	PFOA	PFOA		µg/L	0.56	0.56
		General water quality parameters (Ca, Mg, Na, K, pH, EC, Cl, SO_4, Alkalinity, Hardness & TDS);		-	-	-

FIGURES



Legend

- Subject Land Boundary
- Quarry Project Area
- Arterial Road
- Local Road
- Track

km
0 0.1 0.2 0.4 0.6 0.8 1

N

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PROJECT REFERENCE: 20193820

DATE DRAWN: 11/03/2020 10:25 Version 1

DRAWN BY: BDeane

DATA SOURCE:
NSW DFSI - 2018
nearmap - 2020

Site Location

Williamtown Sand Syndicate
Cabbage Tree Road Sand Quarry
Baseline Water Quality Summary Report
Cabbage Tree Road, Williamtown

FIGURE:

1

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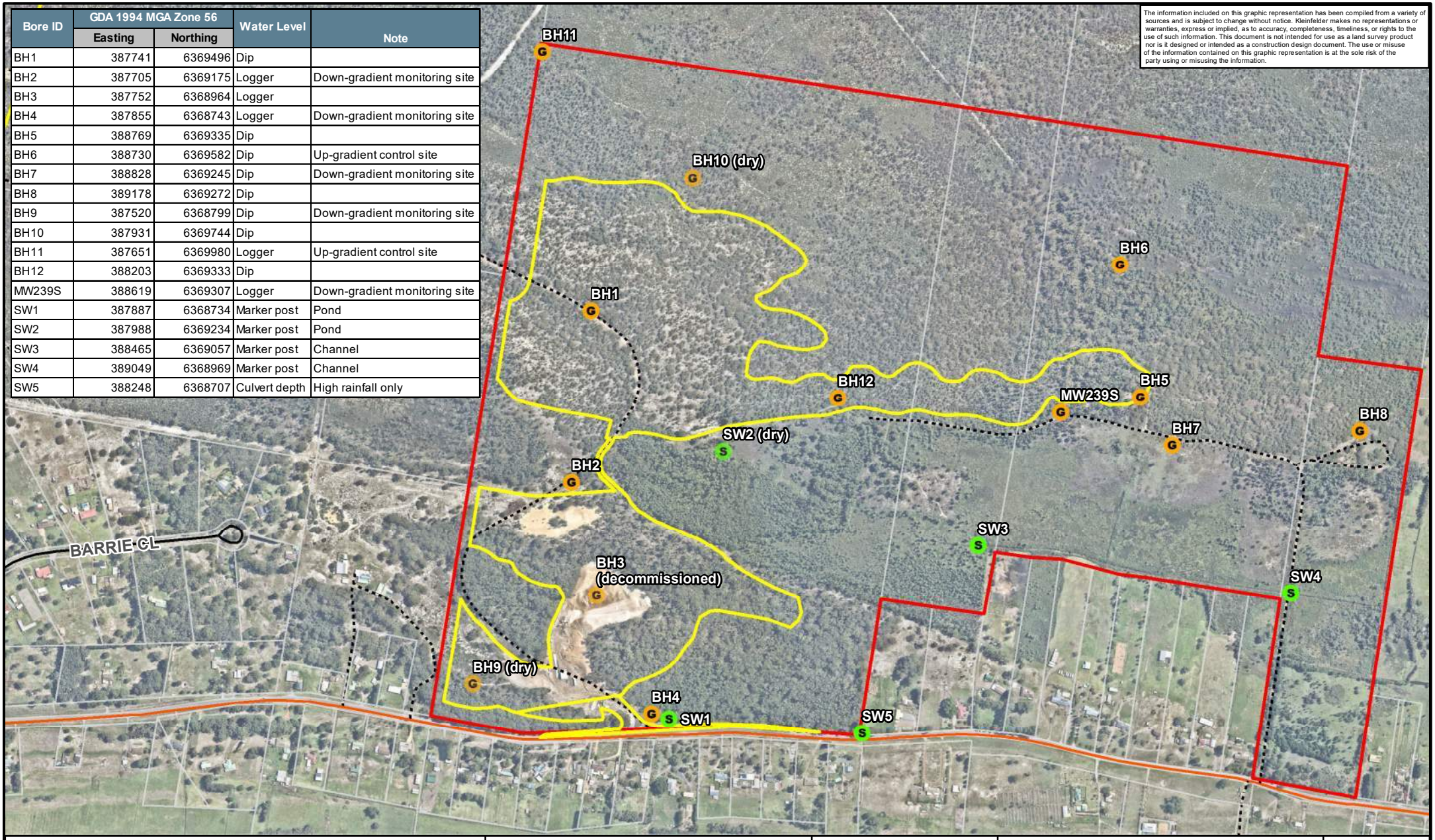
Bore ID	GDA 1994 MGA Zone 56		Water Level	Note
	Easting	Northing		
BH1	387741	6369496	Dip	
BH2	387705	6369175	Logger	Down-gradient monitoring site
BH3	387752	6368964	Logger	
BH4	387855	6368743	Logger	Down-gradient monitoring site
BH5	388769	6369335	Dip	
BH6	388730	6369582	Dip	Up-gradient control site
BH7	388828	6369245	Dip	Down-gradient monitoring site
BH8	389178	6369272	Dip	
BH9	387520	6368799	Dip	Down-gradient monitoring site
BH10	387931	6369744	Dip	
BH11	387651	6369980	Logger	Up-gradient control site
BH12	388203	6369333	Dip	
MW239S	388619	6369307	Logger	Down-gradient monitoring site
SW1	387887	6368734	Marker post	Pond
SW2	387988	6369234	Marker post	Pond
SW3	388465	6369057	Marker post	Channel
SW4	389049	6368969	Marker post	Channel
SW5	388248	6368707	Culvert depth	High rainfall only



Groundwater Monitoring Sites

- G Groundwater Sample Site
- S Surface Water Sample Site

- Subject Land Boundary
- Quarry Project Area
- Arterial Road
- Local Road
- Track

Metres
0 50 100 200 300 400 500
N

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PROJECT REFERENCE: 20170448
DATE DRAWN: 11/03/2020 10:21 Version 2
DRAWN BY: BDeane

DATA SOURCE:
NSW DFSI - 2018
Nearmap - 2020

Groundwater and Surface Water Sampling Locations

Williamtown Sand Syndicate
Cabbage Tree Road Sand Quarry
Baseline Water Quality Summary Report
Cabbage Tree Road, Williamtown

FIGURE:
2

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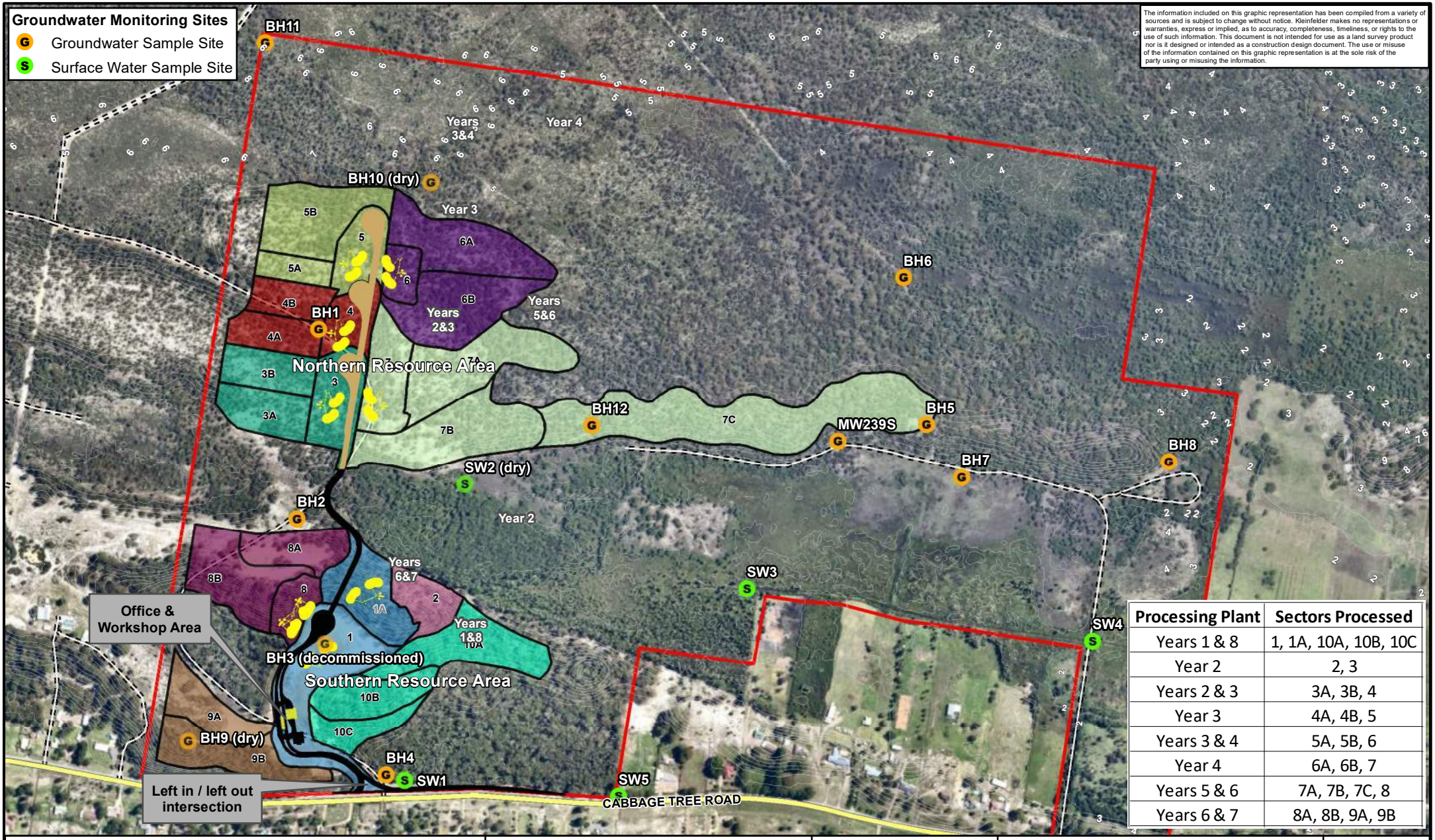

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DATA TABLES

Table A
Groundwater and Surface Water Analytical Data - BTEXN
Williamtown Sand Syndicate

Analyte		BTEXN								Total Petroleum Hydrocarbons	Total Petroleum Hydrocarbons - Silcia Clean up				Total Recoverable Hydrocarbons		Total Recoverable Hydrocarbons - Silcia Clean up				
		Benzene**	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene**	Total Xylenes	Naphthalene **	Sum of BTEX	C_6 - C_9	C_{10}-C_{14} - Silica Cleanup	C_{15}-C_{28} - Silica Cleanup	C_{29}-C_{36} - Silica Cleanup	C_{10}-C_{36} Sum - Silica Cleanup	C_6 - C_{10}	C_6 - C_{10} minus BTEX (F1)	>C_{10}-C_{16} - Silica Cleanup	F2 - Silica Cleanup	>C_{16}-C_{34} - Silica Cleanup	>C_{34}-C_{40} - Silica Cleanup	>C_{10}-C_{40} - Silica Cleanup
LOR		1	2	2	2	2	2	5	1	20	50	100	50	50	20	20	100	100	100	100	100
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
ANZECC 2000 Trigger Values		950	-	-	-	350		16													
NHMRC ADWG 6		1	800	300	-	350	600														
Sample Name	Sample Date																				
BH1	15-Mar-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	**1,710**	< 50	< 100	< 50	< 50	**1,690**	**1,690**	< 100	< 100	< 100	< 100	< 100
	23-Apr-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	**40**	< 50	< 100	< 50	< 50	**30**	**30**	< 100	< 100	< 100	< 100	< 100
	16-May-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	14-Jun-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jul-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Aug-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Sep-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Oct-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	18-Nov-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	17-Dec-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jan-20	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
BH11	21-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Mar-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	23-Apr-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-May-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	14-Jun-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jul-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Aug-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Sep-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Oct-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	18-Nov-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	17-Dec-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jan-20	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
BH2	22-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Mar-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	23-Apr-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-May-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	14-Jun-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jul-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Aug-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Sep-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Oct-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	18-Nov-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	17-Dec-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jan-20	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
BH3	21-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
BH4	21-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Mar-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	23-Apr-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-May-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	**250**	< 50	**250**	< 20	< 20	< 100	< 100	**280**	< 100	**280**
	14-Jun-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jul-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Aug-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Sep-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	**130**	< 50	**130**	< 20	< 20	< 100	< 100	**140**	< 100	**140**
	15-Oct-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	18-Nov-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	17-Dec-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jan-20	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
BH5	22-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
BH6	22-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	14-Mar-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	23-Apr-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-May-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	14-Jun-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jul-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Aug-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Sep-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Oct-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	18-Nov-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	17-Dec-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jan-20	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
BH7	22-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	14-Mar-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	23-Apr-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-May-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	14-Jun-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jul-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Aug-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Sep-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Oct-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	18-Nov-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	17-Dec-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jan-20	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	21-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	14-Mar-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	23-Apr-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100

Table A
Groundwater and Surface Water Analytical Data - BTEXN
Williamtown Sand Syndicate

Analyte		BTEXN								Total Petroleum Hydrocarbons	Total Petroleum Hydrocarbons - Silcia Clean up				Total Recoverable Hydrocarbons		Total Recoverable Hydrocarbons - Silcia Clean up				
		Benzene**	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene**	Total Xylenes	Naphthalene **	Sum of BTEX	C_6 - C_9	C_{10}-C_{14} - Silica Cleanup	C_{15}-C_{28} - Silica Cleanup	C_{29}-C_{36} - Silica Cleanup	C_{10}-C_{36} Sum - Silica Cleanup	C_6 - C_{10}	C_6 - C_{10} minus BTEX (F1)	>C_{10}-C_{16} - Silica Cleanup	F2 - Silica Cleanup	>C_{16}-C_{34} - Silica Cleanup	>C_{34}-C_{40} - Silica Cleanup	>C_{10}-C_{40} - Silica Cleanup
LOR		1	2	2	2	2	2	5	1	20	50	100	50	50	20	20	100	100	100	100	100
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
ANZECC 2000 Trigger Values		950	-	-	-	350		16													
NHMRC ADWG 6		1	800	300	-	350	600														
Sample Name	Sample Date																				
BH8	16-May-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	14-Jun-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jul-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Aug-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Sep-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Oct-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	18-Nov-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	17-Dec-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jan-20	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
MW239S	22-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	14-Mar-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	23-Apr-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-May-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	14-Jun-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jul-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Aug-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Sep-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Oct-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	18-Nov-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	17-Dec-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jan-20	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
SW1	23-Apr-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-May-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	14-Jun-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jul-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Aug-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Sep-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Oct-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	18-Nov-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
SW3	22-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	14-Mar-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	23-Apr-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-May-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	14-Jun-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jul-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Aug-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Sep-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Oct-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	18-Nov-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	17-Dec-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
SW4	23-Apr-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-May-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	14-Jun-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Jul-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Aug-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	16-Sep-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	15-Oct-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
	18-Nov-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
µg/L - Micrograms per litre
BTEXN - Benzene, toluene, ethylbenzene, xylenes, naphthalen

** 95% Level of protection in freshwater

Table B
Groundwater and Surface Water Analytical Data - Metals
Williamtown Sand Syndicate

Analyte		Metals														
		Arsenic**	Barium	Beryllium	Boron**	Cadmium**	Chromium**[1]	Cobalt	Copper**	Iron	Lead**	Manganese**	Mercury**[2]	Nickel**	Selenium**	Vanadium	Zinc**
LOR		0.001	0.001	0.001	0.05	0.0001	0.001	0.001	0.001	0.05	0.001	0.001	0.0001	0.001	0.01	0.01	0.005
Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ANZECC 2000 Trigger Values		0.013			0.37	0.0002	0.001	-	0.0014	-	0.0034	1.9	0.0006	0.011	0.011	-	0.008
NHMRC ADWG 6		0.01		0.06	4	0.002	0.05	-	2	0.3[3]	0.01	0.5	0.001	0.02	0.01	-	3[3]
Sample Name	Sample Date																
BH1	15-Mar-19	< 0.001	**0.003**	< 0.001	< 0.05	< 0.0001	**0.004**	< 0.001	< 0.001	**13**	< 0.001	**0.014**	< 0.0001	< 0.001	< 0.01	< 0.01	**1.27**
	23-Apr-19	< 0.001	**0.003**	< 0.001	< 0.05	< 0.0001	**0.004**	< 0.001	**0.002**	**10**	**0.001**	**0.015**	< 0.0001	**0.002**	< 0.01	< 0.01	**0.363**
	16-May-19	< 0.001	**0.002**	< 0.001	< 0.05	< 0.0001	**0.003**	< 0.001	< 0.001	**8.33**	< 0.001	**0.009**	< 0.0001	**0.002**	< 0.01	< 0.01	**0.132**
	14-Jun-19	< 0.001	**0.001**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	**0.001**	**6.31**	< 0.001	**0.009**	< 0.0001	< 0.001	< 0.01	< 0.01	**0.074**
	16-Jul-19	< 0.001	**0.002**	< 0.001	< 0.05	< 0.0001	**0.003**	< 0.001	**0.002**	**7.35**	< 0.001	**0.01**	< 0.0001	**0.001**	< 0.01	< 0.01	**0.116**
	15-Aug-19	< 0.001	**0.002**	< 0.001	< 0.05	< 0.0001	**0.003**	< 0.001	**0.002**	**7.96**	< 0.001	**0.008**	< 0.0001	< 0.001	< 0.01	< 0.01	**0.023**
	16-Sep-19	< 0.001	**0.002**	< 0.001	< 0.05	< 0.0001	**0.004**	< 0.001	**0.001**	**8.84**	< 0.001	**0.009**	< 0.0001	< 0.001	< 0.01	< 0.01	**0.034**
	15-Oct-19	< 0.001	**0.005**	< 0.001	< 0.05	< 0.0001	**0.003**	< 0.001	**0.006**	**4.32**	< 0.001	**0.007**	< 0.0001	< 0.001	< 0.01	< 0.01	**0.037**
	18-Nov-19	< 0.001	**0.001**	< 0.001	< 0.05	< 0.0001	**0.004**	< 0.001	< 0.001	**11**	< 0.001	**0.008**	< 0.0001	**0.001**	< 0.01	< 0.01	**0.012**
	17-Dec-19	<0.001	**0.002**	<0.001	<0.05	<0.0001	**0.003**	<0.001	0.001	**8.48**	<0.001	**0.009**	<0.0001	<0.001	<0.01	<0.01	**0.028**
	16-Jan-20	<0.001	**0.003**	<0.001	<0.05	<0.0001	**0.002**	<0.001	**0.002**	**4.43**	<0.001	**0.011**	<0.0001	**0.002**	<0.01	<0.01	**0.044**
BH11	21-Feb-19	< 0.001	**0.008**	< 0.001	< 0.05	< 0.0001	**0.002**	**0.001**	< 0.001	**0.26**	< 0.001	**0.003**	< 0.0001	**0.005**	< 0.01	< 0.01	**0.031**
	15-Mar-19	< 0.001	**0.005**	< 0.001	< 0.05	< 0.0001	**0.001**	< 0.001	< 0.001	**1.49**	< 0.001	**0.007**	< 0.0001	**0.037**	< 0.01	< 0.01	**0.016**
	23-Apr-19	< 0.001	**0.006**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	< 0.001	**0.98**	< 0.001	**0.007**	< 0.0001	**0.07**	< 0.01	< 0.01	**0.04**
	16-May-19	< 0.001	**0.005**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	< 0.001	**0.97**	< 0.001	**0.006**	< 0.0001	**0.004**	< 0.01	< 0.01	**0.024**
	14-Jun-19	< 0.001	**0.004**	< 0.001	< 0.05	< 0.0001	**0.001**	< 0.001	< 0.001	**0.98**	< 0.001	**0.005**	< 0.0001	**0.001**	< 0.01	< 0.01	**0.005**
	16-Jul-19	< 0.001	**0.01**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	< 0.001	**0.47**	< 0.001	**0.003**	< 0.0001	**0.004**	< 0.01	< 0.01	**0.007**
	15-Aug-19	< 0.001	**0.004**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	**0.001**	**0.87**	< 0.001	**0.007**	< 0.0001	**0.001**	< 0.01	< 0.01	**0.005**
	16-Sep-19	< 0.001	**0.005**	< 0.001	< 0.05	< 0.0001	**0.001**	< 0.001	< 0.001	**0.79**	< 0.001	**0.008**	< 0.0001	**0.002**	< 0.01	< 0.01	**0.012**
	15-Oct-19	< 0.001	**0.004**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	**0.004**	**0.74**	< 0.001	**0.006**	< 0.0001	**0.003**	< 0.01	< 0.01	**0.016**
	18-Nov-19	< 0.001	**0.004**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	< 0.001	**0.95**	< 0.001	**0.008**	< 0.0001	**0.002**	< 0.01	< 0.01	< 0.005
	17-Dec-19	<0.001	**0.004**	<0.001	**0.06**	<0.0001	**0.002**	<0.001	**0.002**	**1**	<0.001	**0.008**	<0.0001	**0.001**	<0.01	<0.01	**0.006**
	16-Jan-20	<0.001	**0.005**	<0.001	<0.05	<0.0001	**0.002**	<0.001	<0.001	**1.08**	<0.001	**0.007**	<0.0001	**0.003**	<0.01	<0.01	**0.005**
BH2	22-Feb-19	< 0.001	**0.005**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.002**	**0.14**	< 0.001	**0.021**	< 0.0001	**0.015**	< 0.01	< 0.01	**0.006**
	15-Mar-19	< 0.001	**0.004**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.003**	< 0.05	< 0.001	**0.02**	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
	23-Apr-19	< 0.001	**0.005**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.004**	**0.19**	< 0.001	**0.018**	< 0.0001	**0.001**	< 0.01	< 0.01	**0.008**
	16-May-19	< 0.001	**0.004**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.001**	**0.06**	< 0.001	**0.014**	< 0.0001	**0.001**	< 0.01	< 0.01	< 0.005
	14-Jun-19	< 0.001	**0.004**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.004**	**0.08**	< 0.001	**0.009**	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
	16-Jul-19	< 0.001	**0.004**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.008**	**0.05**	< 0.001	**0.013**	< 0.0001	**0.001**	< 0.01	< 0.01	**0.006**
	15-Aug-19	< 0.001	**0.004**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.012**	**0.08**	< 0.001	**0.011**	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
	16-Sep-19	< 0.001	**0.004**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.008**	**0.26**	< 0.001	**0.014**	< 0.0001	**0.001**	< 0.01	< 0.01	**0.007**
	15-Oct-19	< 0.001	**0.004**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.006**	**0.46**	< 0.001	**0.011**	< 0.0001	< 0.001	< 0.01	< 0.01	**0.007**
	18-Nov-19	< 0.001	**0.007**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.013**	**0.08**	< 0.001	**0.011**	< 0.0001	**0.007**	< 0.01	< 0.01	**0.028**
	17-Dec-19	<0.001	**0.004**	<0.001	<0.05	<0.0001	**0.002**	<0.001	**0.006**	**0.1**	<0.001	**0.012**	<0.0001	**0.001**	<0.01	<0.01	**0.006**
	16-Jan-20	<0.001	**0.004**	<0.001	<0.05	<0.0001	<0.001	<0.001	**0.005**	**0.73**	<0.001	**0.014**	<0.0001	<0.001	<0.01	<0.01	**0.01**
BH3	21-Feb-19	< 0.001	**0.003**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	< 0.001	**0.06**	< 0.001	**0.005**	< 0.0001	**0.053**	< 0.01	< 0.01	< 0.005
BH4	21-Feb-19	< 0.001	**0.014**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.002**	**0.16**	< 0.001	**0.039**	< 0.0001	**0.018**	< 0.01	< 0.01	**0.014**
	15-Mar-19	< 0.001	**0.014**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.001**	< 0.05	< 0.001	**0.014**	< 0.0001	**0.022**	< 0.01	< 0.01	**0.043**
	23-Apr-19	< 0.001	**0.013**	< 0.001	**0.05**	< 0.0001	< 0.001	< 0.001	**0.002**	**0.99**	< 0.001	**0.045**	< 0.0001	**0.007**	< 0.01	< 0.01	**0.008**
	16-May-19	< 0.001	**0.013**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	**0.27**	< 0.001	**0.022**	< 0.0001	**0.022**	< 0.01	< 0.01	**0.011**
	14-Jun-19	< 0.001	**0.012**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.038**	< 0.05	< 0.001	**0.014**	< 0.0001	< 0.001	< 0.01	< 0.01	**0.005**
	16-Jul-19	< 0.001	**0.013**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.046**	< 0.05	< 0.001	**0.019**	< 0.0001	< 0.001	< 0.01	< 0.01	**0.007**
	15-Aug-19	< 0.001	**0.013**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.026**	< 0.05	< 0.001	**0.018**	< 0.0001	**0.001**	< 0.01	< 0.01	**0.007**
	16-Sep-19	< 0.001	**0.012**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.051**	**0.19**	< 0.001	**0.026**	< 0.0001	**0.002**	< 0.01	< 0.01	**0.005**
	15-Oct-19	< 0.001	**0.01**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.011**	**0.31**	< 0.001	**0.136**	< 0.0001	**0.002**	< 0.01	< 0.01	**0.014**
	18-Nov-19	< 0.001	**0.011**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.005**	< 0.05	< 0.001	**0.013**	< 0.0001	**0.001**	< 0.01	< 0.01	< 0.005
	17-Dec-19	<0.001	**0.012**	<0.001	**0.06**	<0.0001	**0.001**	<0.001	**0.008**	<0.05	<0.001	**0.014**	<0.0001	<0.001	<0.01	<0.01	**0.005**
	16-Jan-20	<0.001	**0.014**	<0.001	<0.05	<0.0001	<0.001	<0.001	**0.006**	<0.05	<0.001	**0.014**	<0.0001	<0.001	<0.01	<0.01	**0.009**
BH5	22-Feb-19	< 0.001	**0.01**	< 0.001	< 0.05	< 0.0001	**0.001**	< 0.001	< 0.001	**1.4**	< 0.001	**0.005**	< 0.0001	**0.003**	< 0.01	< 0.01	**0.008**
BH6	22-Feb-19	< 0.001	**0.03**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	**1.03**	< 0.001	**0.014**	< 0.0001	**0.001**	< 0.01	< 0.01	**0.019**
	14-Mar-19	< 0.001	**0.027**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	**1.9**	< 0.001	**0.01**	< 0.0001	< 0.001	< 0.01	< 0.01	**0.012**
	23-Apr-19	< 0.001	**0.03**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.001**	**0.96**	< 0.001	**0.01**	< 0.0001	< 0.001	< 0.01	< 0.01	**0.022**
	16-May-19	< 0.001	**0.029**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	**2.57**	< 0.001	**0.009**	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
	14-Jun-19	< 0.001	**0.027**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.001**	**2.86**	< 0.001	**0.008**	< 0.0001	< 0.001	< 0.01	< 0.01	**0.008**
	16-Jul-19	< 0.001	**0.026**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.002**	**2.41**	< 0.001	**0.008**	< 0.0001	< 0.001	< 0.01	< 0.01	**0.005**
	15-Aug-19	< 0.001	**0.026**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.001**	**2.19**	< 0.001	**0.008**	< 0.0001	< 0.001	< 0.01	< 0.01	**0.007**
	16-Sep-19	< 0.001	**0.034**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.008**	**2.08**	< 0.001	**0.012**	< 0.0001	**0.007**	< 0.01	< 0.01	**0.035**
	15-Oct-19	< 0.001	**0.026**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	**1.95**	< 0.001	**0.009**	< 0.0001	< 0.001	< 0.01	< 0.01	**0.006**
	18-Nov-19	< 0.001	**0.03**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	**1.58**	< 0.001	**0.009**	< 0.0001	**0.008**	< 0.01	< 0.01	**0.073**
	17-Dec-19	<0.001	**0.026**	<0.001	**0.05**	<0.0001	**0.001**	<0.001	**0.003**	**1.78**	<0.001	**0.007**	<0.0001	**0.001**	<0.01	<0.01	**0.006**
	16-Jan-20	<0.001	**0.032**	<0.001	<0.05	<0.0001	<0.001	<0.001	<0.001	**2.15**	<0.001	**0.01**	<0.0001	<0.001	<0.01	<0.01	<0.005
BH7	22-Feb-19	< 0.001	**0.004**	< 0.001	< 0.05	< 0.0001	**0.002**	**0.003**	< 0.001	**1.8**	< 0.001	**0.026**	< 0.0001	**0.004**	< 0.01	< 0.01	**0.019**
	14-Mar-19	< 0.001	**0.01**	< 0.001	< 0.05	< 0.0001	**0.001**	**0.003**	< 0.001	**1.8**	< 0.001	**0.02**	< 0.0001	**0.004**	< 0.01	< 0.01	**0.009**
	23-Apr-19	< 0.001	**0.012**	< 0.001	< 0.05	< 0.0001	**0.002**	**0.003**	< 0.001	**2.0**	< 0.001	**0.026**	< 0.0001	**0.004**	< 0.01	< 0.01	**0.01**
	16-May-19	< 0.001	**0.008**	< 0.001	< 0.05	< 0.0001	**0.002**	**0.003**	< 0.001	**2.32**	< 0.001	**0.035**	< 0.0001	**0.005**	< 0.01	< 0.01	**0.013**
	14-Jun-19	< 0.001	**0.005**	< 0.001	< 0.05	< 0.0001	**0.002**	**0.002**	< 0.001	**2.06**	< 0.001	**0.03**	< 0.0001	**0.004**	< 0.01	< 0.01	**0.006**
	16-Jul-19	< 0.001	**0.005**	< 0.001	< 0.05	< 0.0001	**0.002**	**0.002**	< 0.001	**1.66**	< 0.001	**0.025**	< 0.0001	**0.003**	< 0.01	< 0.01	< 0.005
	15-Aug-19	< 0.001	**0.005**	< 0.001	< 0.05	< 0.0001	**0.002**	**0.002**	< 0.001	**1.54**	< 0.001	**0.023**	< 0.0001	**0.003**	< 0.01	< 0.01	< 0.005
	16-Sep-19	< 0.001	**0.016**	< 0.001	**0.06**	< 0.0001	**0.002**	**0.002**	**0.007**	**1.42**	**0.001**	**0.024**	< 0.0001	**0.02**	< 0.01	< 0.01	**0.085**
	15-Oct-19	< 0.001	**0.009**	< 0.001	< 0.05	< 0.0001	**0.002**	**0.002**	**0.003**	**1.32**	< 0.001	**0.018**	< 0.0001	**0.003**	< 0.01	< 0.01	**0.011**
	18-Nov-19	< 0.001	**0.016**	< 0.001	< 0.05	< 0.0001	**0.002**	**0.002**	< 0.001	**1.1**	< 0.001	**0.015**	< 0.0001	**0.013**	< 0.01	< 0.01	**0.053**
	17-Dec-19	<0.001	**0.009**	<0.001	**0.06**	<0.0001	**0.002**	**0.001**	<0.001	**0.98**	<0.001	**0.011**	<0.0001	**0.003**	<0.01	<0.01	**0.007**
	16-Jan-20	<0.001	**0.01**	<0.001	<0.05	<0.0001	**0.002**	<0.001	<0.001	**0.93**	<0.001	**0.006**	<0.0001	**0.003**	<0.01	<0.01	**0.007**
BH8	21-Feb-19	**0.001 ***	**0.011**	< 0.001	< 0.05	< 0.0001	**0.001**	< 0.001	< 0.001	**4.1**	< 0.001	**0.012**	< 0.0001	**0.002**	< 0.01	< 0.01	**0.006**
	14-Mar-19	< 0.001	**0.006**	< 0.001	< 0.05	< 0.0001	**0.001**	< 0.001	< 0.001	**3.25**	< 0.001	**0.008**	< 0.0001	**0.002**	< 0.01	< 0.01	< 0.005
	23-Apr-19	**0.001**	**0.008**	< 0.001	< 0.05	< 0.0001	**0.001**	< 0.001	< 0.001	**3.2**	< 0.001	**0.009**	< 0.0001	**0.002**	< 0.01	< 0.01	**0.008**
	16-May-19	**0.003**	**0.01**	< 0.001	< 0.05	< 0.0001	**0.001**	< 0.001	< 0.001	**3.0**	< 0.001	**0.01**	< 0.0001	**0.003**	< 0.01	< 0.01	< 0.005
	14-Jun-19	< 0.001	**0.01**	< 0.001	< 0.05	< 0.0001	**0.001**	< 0.001	< 0.001	**2.5**	< 0.001	**0.005**	< 0.0001	**0.002**	< 0.01	< 0.01	**0.006**
	16-Jul-19	**0.001**	**0.012**	< 0.001	< 0.05	< 0.0001	**0.001**	< 0.001	< 0.001	**2.6**	< 0.001	**0.004**	< 0.0001	**0.002**	< 0.01	< 0.01	< 0.005
	15-Aug-19	**0.001**	**0.008**	< 0.001	< 0.05	< 0.0001	**0.001**	< 0.001	< 0.001	**1.72**	< 0.001	**0.004**	< 0.0001	**0.001**	< 0.01	< 0.01	< 0.005
	16-Sep-19	**0.001**	**0.01**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	< 0.001	**2.06**	< 0.001	**0.005**	< 0.0001	**0.002**	< 0.01	< 0.01	< 0.005
	15-Oct-19	< 0.001	**0.007**	< 0.001	< 0.05	< 0.0001	**0.001**	< 0.001	**0.002**	**2.08**	< 0.001	**0.009**	< 0.0001	**0.002**	< 0.01	< 0.01	**0.011**
	18-Nov-19	< 0.001	**0.012**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	**0.002**	**2.49**	< 0.001	**0.01**	< 0.0001	**0.013**	< 0.01	< 0.01	**0.053**
	17-Dec-19	<0.001	**0.007**	<0.001	**0.05**	<0.0001	**0.002**	<0.001	**0.003**	**3.02**	<0.001	**0.011**	<0.0001	**0.002**	<0.01	<0.01	**0.007**
	16-Jan-20	<0.001	**0.007**	<0.001	<0.05	<0.0001	**0.002**	<0.001	<0.001	**2.94**	<0.001	**0.011**	<0.0001	**0.002**	<0.01	<0.01	**0.011**
MW239S	22-Feb-19	< 0.001	**0.007**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	< 0.001	**1.11**	< 0.001	**0.003**	< 0.0001	**0.001**	< 0.01	< 0.01	**0.006**
	14-Mar-19	< 0.001	**0.008**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	< 0.001	**1.25**	< 0.001	**0.005**	< 0.0001	**0.005**	< 0.01	< 0.01	**0.008**
	23-Apr-19	< 0.001	**0.008**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	< 0.001	**1.01**	< 0.001	**0.004**	< 0.0001	**0.004**	< 0.01	< 0.01	**0.007**
	16-May-19	< 0.001	**0.005**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	< 0.001	**0.87**	< 0.001	**0.003**	< 0.0001	**0.002**	< 0.01	< 0.01	< 0.005
	14-Jun-19	< 0.001	**0.005**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	**0.002**	**0.8**	< 0.001	**0.003**	< 0.0001	**0.001**	< 0.01	< 0.01	< 0.005
	16-Jul-19	< 0.001	**0.006**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	< 0.001	**0.87**	< 0.001	**0.003**	< 0.0001	**0.002**	< 0.01	< 0.01	< 0.005
	15-Aug-19	< 0.001	**0.006**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	< 0.001	**1.0**	< 0.001	**0.004**	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
	16-Sep-19	< 0.001	**0.01**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	**0.002**	**0.94**	< 0.001	**0.006**	< 0.0001	**0.006**	< 0.01	< 0.01	**0.032**
	15-Oct-19	< 0.001	**0.005**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	**0.003**	**0.68**	< 0.001	**0.004**	< 0.0001	**0.002**	< 0.01	< 0.01	**0.011**
	18-Nov-19	< 0.001	**0.01**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	< 0.001	**1.1**	< 0.001	**0.004**	< 0.0001	**0.008**	< 0.01	< 0.01	**0.03**
	17-Dec-19	<0.001	**0.008**	<0.001	<0.05	<0.0001	**0.003**	<0.001	**0.001**	**1.33**	<0.001	**0.003**	<0.0001	**0.002**	<0.01	<0.01	<0.005
	16-Jan-20	<0.001	**0.008**	<0.001	<0.05	<0.0001	**0.002**	<0.001	<0.001	**1.31**	<0.001	**0.004**	<0.0001	**0.002**	<0.01	<0.01	**0.007**
SW1	23-Apr-19	< 0.001	**0.043**	< 0.001	**0.14**	< 0.0001	< 0.001	**0.017**	**0.002**	**4.16**	< 0.001	**0.841**	< 0.0001	**0.02**	< 0.01	< 0.01	**0.356**
	16-May-19	< 0.001	**0.029**	< 0.001	**0.1**	< 0.0001	< 0.001	**0.01**	**0.003**	**7.25**	< 0.001	**0.666**	< 0.0001	**0.012**	< 0.01	< 0.01	**0.077**
	14-Jun-19	< 0.001	**0.029**	< 0.001	**0.09**	**0.0002**	< 0.001	**0.009**	**0.006**	**2.75**	< 0.001	**0.595**	< 0.0001	**0.011**	< 0.01	< 0.01	**0.535**
	16-Jul-19	< 0.001	**0.032**	< 0.001	**0.08**	**0.0001**	< 0.001	**0.007**	**0.003**	**1.86**	< 0.001	**0.59**	< 0.0001	**0.008**	< 0.01	< 0.01	**0.239**
	15-Aug-19	< 0.001	**0.027**	< 0.001	**0.09**	< 0.0001	< 0.001	**0.005**	**0.003**	**2.15**	< 0.001	**0.482**	< 0.0001	**0.005**	< 0.01	< 0.01	**0.075**
	16-Sep-19	< 0.001	**0.056**	< 0.001	**0.09**	**0.0002**	**0.001**	**0.008**	**0.012**	**2.45**	**0.001**	**0.587**	< 0.0001	**0.014**	< 0.01	< 0.01	**0.282**
	15-Oct-19	< 0.001	**0.036**	< 0.001	**0.07**	< 0.0001	< 0.001	**0.005**	**0.003**	**1.61**	< 0.001	**0.383**	< 0.0001	**0.005**	< 0.01	< 0.01	**0.055**
	18-Nov-19	< 0.001	**0.042**	< 0.001	**0.11**	< 0.0001	**0.001**	**0.003**	< 0.001	**1.14**	< 0.001	**0.366**	< 0.0001	**0.003**	< 0.01	< 0.01	**0.026**
SW3	22-Feb-19	**0.003**	**0.075**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	**4.84**	< 0.001	**0.033**	< 0.0001	**0.002**	< 0.01	< 0.01	**0.016**
	14-Mar-19	**0.006**	**0.08**	< 0.001	< 0.05	< 0.0001	< 0.001	**0.003**	< 0.001	**9.26**	< 0.001	**0.048**	< 0.0001	**0.002**	< 0.01	< 0.01	**0.009**
	23-Apr-19	< 0.001	**0.043**	< 0.001	< 0.05	< 0.0001	< 0.001	**0.003**	**0.001**	**2.01**	< 0.001	**0.046**	< 0.0001	**0.004**	< 0.01	< 0.01	**0.016**
	16-May-19	< 0.001	**0.034**	< 0.001	< 0.05	< 0.0001	< 0.001	**0.002**	< 0.001	**1.78**	< 0.001	**0.038**	< 0.0001	**0.003**	< 0.01	< 0.01	**0.012**
	14-Jun-19	< 0.001	**0.035**	< 0.001	< 0.05	< 0.0001	**0.001 ***	**0.003**	< 0.001	**1.68**	< 0.001	**0.038**	< 0.0001	**0.003**	< 0.01	< 0.01	**0.016**
	16-Jul-19	< 0.001	**0.055**	< 0.001	< 0.05	< 0.0001	< 0.001	**0.007**	**0.002**	**1.25**	< 0.001	**0.043**	< 0.0001	**0.006**	< 0.01	< 0.01	**0.029**
	15-Aug-19	< 0.001	**0.035**	< 0.001	< 0.05	< 0.0001	< 0.001	**0.003**	**0.002**	**1.16**	< 0.001	**0.036**	< 0.0001	**0.003**	< 0.01	< 0.01	**0.013**
	16-Sep-19	< 0.001	**0.045**	< 0.001	< 0.05	< 0.0001	< 0.001	**0.004**	**0.02**	**0.69**	**0.001**	**0.036**	< 0.0001	**0.017**	< 0.01	< 0.01	**0.094**
	15-Oct-19	< 0.001	**0.034**	< 0.001	< 0.05	< 0.0001	< 0.001	**0.005**	**0.002**	**1.7**	< 0.001	**0.027**	< 0.0001	**0.005**	< 0.01	< 0.01	**0.022**
	18-Nov-19	< 0.001	**0.031**	< 0.001	< 0.05	< 0.0001	**0.001**	< 0.001	< 0.001	**2.6**	< 0.001	**0.026**	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
	17-Dec-19	<0.001	**0.041**	<0.001	<0.05	<0.0001	**0.002**	<0.001	**0.003**	**1.42**	<0.001	**0.026**	<0.0001	**0.001**	<0.01	<0.01	<0.005
SW4	23-Apr-19	< 0.001	**0.059**	< 0.001	< 0.05	< 0.0001	< 0.001	**0.003**	**0.003**	**2.09**	< 0.001	**0.037**	< 0.0001	**0.005**	< 0.01	< 0.01	**0.03**
	16-May-19	< 0.001	**0.047**	< 0.001	< 0.05	< 0.0001	< 0.001	**0.002**	< 0.001	**1.12**	< 0.001	**0.03**	< 0.0001	**0.003**	< 0.01	< 0.01	**0.019**
	14-Jun-19	< 0.001	**0.041**	< 0.001	< 0.05	< 0.0001	< 0.001	**0.002**	**0.003**	**0.79**	< 0.001	**0.034**	< 0.0001	**0.003**	< 0.01	< 0.01	**0.014**
	16-Jul-19	< 0.001	**0.044**	< 0.001	< 0.05	< 0.0001	< 0.001	**0.002**	**0.002**	**0.96**	< 0.001	**0.043**	< 0.0001	**0.003**	< 0.01	< 0.01	**0.014**
	15-Aug-19	< 0.001	**0.04**	< 0.001	< 0.05	< 0.0001	< 0.001	**0.001**	**0.001**	**0.57**	< 0.001	**0.032**	< 0.0001	**0.002**	< 0.01	< 0.01	**0.009**
	16-Sep-19	< 0.001	**0.046**	< 0.001	< 0.05	< 0.0001	< 0.001	**0.002**	**0.02**	**0.7**	**0.001**	**0.039**	< 0.0001	**0.017**	< 0.01	< 0.01	**0.085**
	15-Oct-19	< 0.001	**0.037**	< 0.001	< 0.05	< 0.0001	< 0.001	**0.002**	**0.004**	**0.66**	< 0.001	**0.031**	< 0.0001	**0.003**	< 0.01	< 0.01	**0.018**
	18-Nov-19	< 0.001	**0.035**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	**6.32**	< 0.001	**0.032**	< 0.0001	**0.002**	< 0.01	< 0.01	< 0.005

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
mg/L - Milligrams per litre
Bold indicates a detection above the laboratory limit of reporting
"*" denotes duplicate/triplicate sample result adopted for analytical use due to RPD >50%
RPD - Relative Percentage Difference

** 95% Level of protection in freshwater
[1] value for CR VI
[2] as inorganioc
[3] Aesthetic

Table C
Groundwater and Surface Water Analytical Data - PFAS
Williamtown Sand Syndicate

Analyte		Perfluoroalkyl Sulfonic Acids						Perfluoroalkyl Carboxylic Acids									
		Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonate (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecanes ulfonic acid (PFDS)	Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorotridecanoic acid (PFTrDA)
LOR		0.02	0.02	0.02	0.02	0.01	0.02	0.1	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
NHMRC ADWG 6												0.56					
HEPA NEMP 2018***						0.00023						19					
HEPA NEMP 2018[4]												5.6					
Sample Name	Sample Date																
BH11	21-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
BH2	22-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
BH3	21-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
BH4	21-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	15-Mar-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	23-Apr-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-May-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	14-Jun-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-Jul-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	15-Aug-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-Sep-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	**0.02**	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	25-Sep-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	<0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	15-Oct-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	18-Nov-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	17-Dec-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-Jan-20	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
BH5	22-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
BH6	22-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	14-Mar-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	23-Apr-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-May-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	14-Jun-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-Jul-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	15-Aug-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-Sep-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	15-Oct-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	18-Nov-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	17-Dec-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-Jan-20	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
BH7	22-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	14-Mar-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	23-Apr-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-May-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	14-Jun-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-Jul-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	15-Aug-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-Sep-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	15-Oct-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	18-Nov-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	17-Dec-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-Jan-20	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
BH8	21-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	14-Mar-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	23-Apr-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-May-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	14-Jun-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-Jul-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	15-Aug-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-Sep-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	15-Oct-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	18-Nov-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	17-Dec-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-Jan-20	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
MW239S	22-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
SW1	16-May-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-Sep-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	18-Nov-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
SW3	22-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-May-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-Sep-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	18-Nov-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
SW4	16-May-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	16-Sep-19	< 0.02	< 0.02	< 0.02	< 0.02	**0.03 ***	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	25-Sep-19	< 0.02	< 0.02	< 0.02	< 0.02	**0.05**	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
	18-Nov-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
µg/L - Micrograms per litre

*** 99% Level of protection in freshwater
[4] Recreation water

Table C
Groundwater and Surface Water Analytical Data - PFAS
Williamtown Sand Syndicate

Analyte			Perfluoroalkyl Sulfonamides							(n:2) Fluorotelomer Sulfonic Acids				Sum of PFAS	
		Perfluorotetradecanoic acid (PFTeDA)	Perfluorooctane sulfonamide (FOSA)	N-Methyl-perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	Sum of PFHxS and PFOS	Sum of PFAS (WA DER List)
LOR		0.05	0.02	0.05	0.05	0.05	0.05	0.02	0.02	0.05	0.05	0.05	0.05	0.01	0.01
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
NHMRC ADWG 6														0.07	
HEPA NEMP 2018***															
HEPA NEMP 2018[4]														0.7	
Sample Name	Sample Date														
BH11	21-Feb-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
BH2	22-Feb-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
BH3	21-Feb-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
BH4	21-Feb-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	15-Mar-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	23-Apr-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-May-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	14-Jun-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-Jul-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	15-Aug-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-Sep-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	25-Sep-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	15-Oct-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	18-Nov-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	17-Dec-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-Jan-20	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
BH5	22-Feb-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
BH6	22-Feb-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	14-Mar-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	23-Apr-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-May-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	14-Jun-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-Jul-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	15-Aug-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-Sep-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	15-Oct-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	18-Nov-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	17-Dec-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	**0.19**	< 0.05	< 0.05	< 0.01	< 0.01
	16-Jan-20	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
BH7	22-Feb-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	14-Mar-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	23-Apr-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-May-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	14-Jun-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-Jul-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	15-Aug-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-Sep-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	15-Oct-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	18-Nov-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	17-Dec-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-Jan-20	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
BH8	21-Feb-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	14-Mar-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	23-Apr-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-May-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	14-Jun-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-Jul-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	15-Aug-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-Sep-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	15-Oct-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	18-Nov-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	17-Dec-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-Jan-20	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
MW239S	22-Feb-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
SW1	16-May-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-Sep-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	18-Nov-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
SW3	22-Feb-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-May-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-Sep-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	18-Nov-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
SW4	16-May-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01
	16-Sep-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	**0.03 ***	**0.01**
	25-Sep-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	**0.05**	**0.05**
	18-Nov-19	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01

Notes:
- - Not analysed
< - Less than laboratory limit of reporti
µg/L - Micrograms per litre

*** 99% Level of protection in freshwa
[4] Recreation water

Analyte		Sum of PFAS
LOR		0.01
Units		µg/L
NHMRC ADWG 6		
HEPA NEMP 2018***		
HEPA NEMP 2018[4]		
Sample Name	Sample Date	
BH11	21-Feb-19	< 0.01
BH2	22-Feb-19	< 0.01
BH3	21-Feb-19	< 0.01
BH4	21-Feb-19	< 0.01
	15-Mar-19	< 0.01
	23-Apr-19	< 0.01
	16-May-19	< 0.01
	14-Jun-19	< 0.01
	16-Jul-19	< 0.01
	15-Aug-19	< 0.01
	16-Sep-19	**0.02**
	25-Sep-19	**0.02**
	15-Oct-19	< 0.01
	18-Nov-19	< 0.01
	17-Dec-19	< 0.01
	16-Jan-20	< 0.01
BH5	22-Feb-19	< 0.01
BH6	22-Feb-19	< 0.01
	14-Mar-19	< 0.01
	23-Apr-19	< 0.01
	16-May-19	< 0.01
	14-Jun-19	< 0.01
	16-Jul-19	< 0.01
	15-Aug-19	< 0.01
	16-Sep-19	< 0.01
	15-Oct-19	< 0.01
	18-Nov-19	< 0.01
	17-Dec-19	**0.19**
	16-Jan-20	< 0.01
BH7	22-Feb-19	< 0.01
	14-Mar-19	< 0.01
	23-Apr-19	< 0.01
	16-May-19	< 0.01
	14-Jun-19	< 0.01
	16-Jul-19	< 0.01
	15-Aug-19	< 0.01
	16-Sep-19	< 0.01
	15-Oct-19	< 0.01
	18-Nov-19	< 0.01
	17-Dec-19	< 0.01
	16-Jan-20	< 0.01
BH8	21-Feb-19	< 0.01
	14-Mar-19	< 0.01
	23-Apr-19	< 0.01
	16-May-19	< 0.01
	14-Jun-19	< 0.01
	16-Jul-19	< 0.01
	15-Aug-19	< 0.01
	16-Sep-19	< 0.01
	15-Oct-19	< 0.01
	18-Nov-19	< 0.01
	17-Dec-19	< 0.01
	16-Jan-20	< 0.01
MW239S	22-Feb-19	< 0.01
SW1	16-May-19	< 0.01
	16-Sep-19	< 0.01
	18-Nov-19	< 0.01
SW3	22-Feb-19	< 0.01
	16-May-19	< 0.01
	16-Sep-19	< 0.01
	18-Nov-19	< 0.01
SW4	16-May-19	< 0.01
	16-Sep-19	**0.01**
	25-Sep-19	**0.05**
	18-Nov-19	< 0.01

Notes:
- - Not analysed
< - Less than laboratory limit of reporti
µg/L - Micrograms per litre

*** 99% Level of protection in freshwa
[4] Recreation water

Table D
Groundwater and Surface Water Analytical Data - Inorganics
Williamtown Sand Syndicate

Analyte		Anions and Cations															Total Cations	Total Anions	Ionic Balance
		Sodium	Calcium	Magnesium	Potassium	Sulphate	Chloride	Fluoride	Reactive phosphorus as P	Total Phosphorus	Nitrite as N	Nitrate as N	Nitrite + Nitrate as N	Ammonia as N	Total Nitrogen as N	Total Kjeldahl Nitrogen as N			
LOR		1	1	1	1	1	1	0.1	0.01	0.01	0.01	0.01	0.01	0.01	0.1	0.1	0.01	0.01	
Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	%
ANZECC 2000 Trigger Values									0.02*	0.05*		0.7**		0.9**	0.35*				
NHMRC ADWG 6		180[3]				250[3]	250[3]	1.5			3	50		0.5[3]					
Sample Name	Sample Date																		
BH1	15-Mar-19	11	2.0	1.0	< 1.0	< 1.0	25	< 0.1	-	-	-	-	-	-	-	-	0.66	0.88	-
	23-Apr-19	14	1.0	2.0	< 1.0	4.0	25	< 0.1	-	-	-	-	-	-	-	-	0.82	0.99	-
	16-May-19	12	< 1.0	2.0	< 1.0	5.0	25	< 0.1	0.03	< 0.01	< 0.01	< 0.01	< 0.01	0.11	0.3	0.3	0.69	1.01	-
	14-Jun-19	10	< 1.0	2.0	< 1.0	3.0	24	< 0.1	-	-	-	-	-	-	-	-	0.6	0.94	-
	16-Jul-19	15	< 1.0	2.0	< 1.0	4.0	23	< 0.1	-	-	-	-	-	-	-	-	0.82	0.95	-
	15-Aug-19	14	< 1.0	2.0	< 1.0	2.0	21	< 0.1	-	-	-	-	-	-	-	-	0.77	0.91	-
	16-Sep-19	13	< 1.0	2.0	< 1.0	2.0	20	< 0.1	< 0.01	0.06	< 0.01	< 0.01	< 0.01	0.12	0.3	0.3	0.73	0.76	-
	15-Oct-19	13	< 1.0	2.0	< 1.0	2.0	21	< 0.1	-	-	-	-	-	-	-	-	0.73	0.71	-
	18-Nov-19	16	< 1.0	2.0	< 1.0	3.0	23	0.1	< 0.01	< 0.01	< 0.01	0.01	0.01	0.13	0.3	0.3	0.86	1.19	-
	17-Dec-19	14	<1	2	<1	5	23	<0.1	-	-	-	-	-	-	-	-	0.77	1.05	-
	16-Jan-20	16	<1	3	<1	3	25	<0.1	-	-	-	-	-	-	-	-	0.94	1.21	-
BH11	21-Feb-19	48	< 1.0	10	< 1.0	24	80	0.1	< 0.01	0.03	< 0.01	0.04	0.04	0.06	1.8	1.8	2.91	2.76	-
	15-Mar-19	26	< 1.0	2.0	< 1.0	2.0	52	< 0.1	-	-	-	-	-	-	-	-	1.3	1.51	-
	23-Apr-19	32	< 1.0	5.0	< 1.0	2.0	57	< 0.1	-	-	-	-	-	-	-	-	1.8	1.65	-
	16-May-19	29	< 1.0	4.0	< 1.0	2.0	55	< 0.1	< 0.01	0.01	< 0.01	< 0.01	< 0.01	0.12	0.4	0.4	1.59	1.59	-
	14-Jun-19	26	< 1.0	3.0	< 1.0	< 1.0	53	< 0.1	-	-	-	-	-	-	-	-	1.38	1.5	-
	16-Jul-19	49	< 1.0	8.0	< 1.0	8.0	73	0.2	-	-	-	-	-	-	-	-	2.79	2.22	-
	15-Aug-19	28	< 1.0	3.0	< 1.0	4.0	47	< 0.1	-	-	-	-	-	-	-	-	1.46	1.41	-
	16-Sep-19	27	< 1.0	3.0	< 1.0	5.0	46	< 0.1	< 0.01	0.12	< 0.01	< 0.01	< 0.01	0.15	0.7	0.7	1.42	1.4	-
	15-Oct-19	28	< 1.0	3.0	< 1.0	3.0	44	< 0.1	-	-	-	-	-	-	-	-	1.46	1.3	-
	18-Nov-19	28	< 1.0	3.0	< 1.0	< 1.0	53	< 0.1	< 0.01	2.11	< 0.01	0.06	0.06	0.18	5.9	5.8	1.46	1.5	-
	17-Dec-19	26	<1	4	<1	<1	48	<0.1	-	-	-	-	-	-	-	-	1.46	1.39	-
	16-Jan-20	25	<1	3	<1	<1	46	<0.1	-	-	-	-	-	-	-	-	1.33	1.34	-
BH2	22-Feb-19	12	2.0	2.0	< 1.0	6.0	22	0.1	< 0.01	0.28	< 0.01	2.76	2.76	0.05	4.0	1.2	0.79	0.74	-
	15-Mar-19	10	3.0	2.0	< 1.0	7.0	23	< 0.1	-	-	-	-	-	-	-	-	0.75	0.79	-
	23-Apr-19	14	2.0	2.0	< 1.0	6.0	23	< 0.1	-	-	-	-	-	-	-	-	0.87	0.77	-
	16-May-19	12	2.0	2.0	< 1.0	21	22	< 0.1	< 0.01	0.26	< 0.01	0.38	0.38	0.01	1.3	0.9	0.79	1.06	-
	14-Jun-19	11	1.0	2.0	< 1.0	5.0	23	< 0.1	-	-	-	-	-	-	-	-	0.69	0.75	-
	16-Jul-19	13	2.0	2.0	< 1.0	9.0	20	< 0.1	-	-	-	-	-	-	-	-	0.83	0.75	-
	15-Aug-19	12	1.0	2.0	< 1.0	8.0	20	< 0.1	-	-	-	-	-	-	-	-	0.74	0.73	-
	16-Sep-19	11	2.0	2.0	< 1.0	8.0	18	< 0.1	< 0.01	0.28	< 0.01	1.07	1.07	0.04	2.7	1.6	0.74	0.67	-
	15-Oct-19	12	2.0	2.0	< 1.0	5.0	20	< 0.1	-	-	-	-	-	-	-	-	0.79	0.67	-
	18-Nov-19	14	2.0	1.0	< 1.0	7.0	19	< 0.1	< 0.01	0.21	< 0.01	1.01	1.01	0.05	2.1	1.1	0.79	0.68	-
	17-Dec-19	13	2	2	<1	8	17	<0.1	-	-	-	-	-	-	-	-	0.83	0.69	-
	16-Jan-20	13	2	2	<1	6	17	<0.1	-	-	-	-	-	-	-	-	0.83	0.72	-
BH3	21-Feb-19	4.0	4.0	1.0	< 1.0	4.0	10	< 0.1	< 0.01	2.76	< 0.01	0.78	0.78	0.3	5.9	5.1	0.46	0.54	-
BH4	21-Feb-19	8.0	2.0	1.0	1.0	5.0	17	< 0.1	< 0.01	0.19	< 0.01	0.35	0.35	0.04	0.6	0.3	0.56	0.7	-
	15-Mar-19	9.0	2.0	< 1.0	< 1.0	5.0	18	< 0.1	-	-	-	-	-	-	-	-	0.49	0.61	-
	23-Apr-19	10	2.0	1.0	1.0	3.0	19	< 0.1	-	-	-	-	-	-	-	-	0.64	0.6	-
	16-May-19	9.0	2.0	1.0	1.0	22	19	< 0.1	< 0.01	0.97	< 0.01	0.29	0.29	< 0.01	1.0	0.7	0.6	0.99	-
	14-Jun-19	6.0	1.0	1.0	< 1.0	4.0	18	< 0.1	-	-	-	-	-	-	-	-	0.39	0.59	-
	16-Jul-19	10	2.0	2.0	1.0	6.0	18	< 0.1	-	-	-	-	-	-	-	-	0.72	0.63	-
	15-Aug-19	8.0	2.0	1.0	1.0	5.0	16	< 0.1	-	-	-	-	-	-	-	-	0.56	0.56	-
	16-Sep-19	11	2.0	2.0	< 1.0	8.0	19	< 0.1	< 0.01	0.4	< 0.01	0.24	0.24	0.02	0.6	0.4	0.74	0.7	-
	15-Oct-19	10	1.0	1.0	< 1.0	4.0	18	< 0.1	-	-	-	-	-	-	-	-	0.57	0.59	-
	18-Nov-19	11	1.0	1.0	< 1.0	6.0	18	< 0.1	< 0.01	0.08	< 0.01	0.29	0.29	< 0.01	0.3	< 0.1	0.61	0.63	-
	17-Dec-19	9	1	1	1	6	16	<0.1	-	-	-	-	-	-	-	-	0.55	0.64	-
	16-Jan-20	13	2	2	2	6	18	<0.1	-	-	-	-	-	-	-	-	0.88	0.71	-
BH5	22-Feb-19	42	< 1.0	6.0	1.0	19	69	0.2	< 0.01	0.34	< 0.01	< 0.01	< 0.01	0.09	3.0	3.0	2.35	2.34	-
BH6	22-Feb-19	28	3.0	4.0	1.0	28	42	< 0.1	< 0.01	0.05	< 0.01	0.09	0.09	0.14	0.5	0.4	1.72	1.77	-
	14-Mar-19	23	2.0	4.0	1.0	17	37	< 0.1	-	-	-	-	-	-	-	-	1.46	1.44	-
	23-Apr-19	25	3.0	4.0	1.0	18	42	< 0.1	-	-	-	-	-	-	-	-	1.59	1.56	-
	16-May-19	23	3.0	4.0	1.0	18	45	< 0.1	< 0.01	0.13	< 0.01	< 0.01	< 0.01	0.14	0.6	0.6	1.5	1.64	-
	14-Jun-19	20	2.0	4.0	1.0	16	42	< 0.1	-	-	-	-	-	-	-	-	1.32	1.52	-
	16-Jul-19	23	2.0	4.0	1.0	20	35	< 0.1	-	-	-	-	-	-	-	-	1.46	1.4	-
	15-Aug-19	23	2.0	3.0	1.0	21	38	< 0.1	-	-	-	-	-	-	-	-	1.37	1.51	-
	16-Sep-19	25	3.0	3.0	1.0	21	38	< 0.1	< 0.01	0.15	< 0.01	0.07	0.07	0.19	0.8	0.7	1.51	1.55	-
	15-Oct-19	25	2.0	4.0	1.0	13	41	< 0.1	-	-	-	-	-	-	-	-	1.54	1.43	-
	18-Nov-19	27	3.0	3.0	1.0	18	45	< 0.1	< 0.01	0.06	< 0.01	< 0.01	< 0.01	0.23	0.4	0.4	1.6	1.64	-
	17-Dec-19	26	2	4	1	16	42	<0.1	-	-	-	-	-	-	-	-	1.58	1.62	-
	16-Jan-20	30	3	4	2	15	50	0.2	-	-	-	-	-	-	-	-	1.83	1.86	-
BH7	22-Feb-19	34	< 1.0	5.0	2.0	12	64	0.2	< 0.01	0.13	< 0.01	0.02	0.02	0.34	2.2	2.2	1.94	2.06	-
	14-Mar-19	36	< 1.0	6.0	2.0	16	61	< 0.1	-	-	-	-	-	-	-	-	2.11	2.05	1.37
	23-Apr-19	38	< 1.0	6.0	2.0	17	62	< 0.1	-	-	-	-	-	-	-	-	2.2	2.1	-
	16-May-19	35	< 1.0	5.0	2.0	15	68	0.2	< 0.01	0.06	< 0.01	< 0.01	< 0.01	0.27	0.9	0.9	1.98	2.23	-
	14-Jun-19	31	< 1.0	4.0	2.0	11	56	0.1	-	-	-	-	-	-	-	-	1.73	1.81	-
	16-Jul-19	36	< 1.0	5.0	2.0	12	46	< 0.1	-	-	-	-	-	-	-	-	2.03	1.55	-
	15-Aug-19	32	< 1.0	4.0	2.0	15	49	0.1	-	-	-	-	-	-	-	-	1.77	1.85	-
	16-Sep-19	27	< 1.0	4.0	1.0	13	53	< 0.1	< 0.01	0.09	< 0.01	0.06	0.06	0.2	1.2	1.1	1.53	1.86	-
	15-Oct-19	34	< 1.0	5.0	2.0	12	53	< 0.1	-	-	-	-	-	-	-	-	1.94	1.74	-
	18-Nov-19	31	< 1.0	5.0	1.0	15	56	0.1	< 0.01	0.02	< 0.01	< 0.01	< 0.01	0.17	0.5	0.5	1.78	1.89	-
	17-Dec-19	26	<1	5	1	15	44	<0.1	-	-	-	-	-	-	-	-	1.57	1.59	-
	16-Jan-20	27	<1	4	1	13	46	0.2	-	-	-	-	-	-	-	-	1.53	1.63	-

	Alkalinity						Inorganics		
Sodium Adsorption Ratio	Bicarbonate Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Hydroxide Alkalinity as CaCO3	Total Alkalinity as CaCO3	Total Hardness as CaCO3	Electrical Conductivity @ 25°C*	Total Dissolved Solids	Total Dissolved Solids	pH
0.01	1	1	1	1	1	1	1	10	0.01
-	mg/L	mg/L	mg/L	mg/L	mg/L	µS/cm	mg/L	mg/L	pH units
						125-2200			6.5 - 8.0*
					200[3]		600[3]		6.5-8.5[3]
-	**9.0**	< 1.0	< 1.0	**9.0**	**9.0**	**104**	**68**	**129**	**5.67**
-	**10**	< 1.0	< 1.0	**10**	**11**	**84**	**55**	**97**	**5.83**
1.7	**10**	< 1.0	< 1.0	**10**	**8.0**	**105**	**68**	**164**	**5.82**
-	**10**	< 1.0	< 1.0	**10**	**8.0**	**99**	**64**	**72**	**5.52**
-	**11**	< 1.0	< 1.0	**11**	**8.0**	**102**	**66**	**84**	**5.62**
-	**14**	< 1.0	< 1.0	**14**	**8.0**	**128**	**83**	**82**	**6.22**
1.84	**8.0**	< 1.0	< 1.0	**8.0**	**8.0**	**102**	**66**	**88**	**5.44**
-	**4.0**	< 1.0	< 1.0	**4.0**	**8.0**	**98**	**64**	-	**5.5**
2.26	**24**	< 1.0	< 1.0	**24**	**8.0**	**126**	**82**	-	**6.29**
-	**15**	<1	<1	**15**	**8**	**118**	**77**	-	**6.05**
-	**22**	<1	<1	**22**	**12**	**112**	**73**	-	**6.23**
3.21	< 1.0	< 1.0	< 1.0	< 1.0	**41**	**346**	**278**	-	**4.67**
-	< 1.0	< 1.0	< 1.0	< 1.0	**8.0**	**186**	**121**	**144**	**4.82**
-	< 1.0	< 1.0	< 1.0	< 1.0	**20**	**150**	**98**	**135**	**4.99**
3.0	< 1.0	< 1.0	< 1.0	< 1.0	**16**	**188**	**122**	**216**	**4.91**
-	< 1.0	< 1.0	< 1.0	< 1.0	**12**	**175**	**114**	**107**	**4.84**
-	< 1.0	< 1.0	< 1.0	< 1.0	**33**	**318**	**207**	**192**	**4.68**
-	< 1.0	< 1.0	< 1.0	< 1.0	**12**	**197**	**128**	**135**	**4.88**
3.18	< 1.0	< 1.0	< 1.0	< 1.0	**12**	**195**	**127**	**140**	**4.66**
-	< 1.0	< 1.0	< 1.0	< 1.0	**12**	**194**	**126**	-	**4.92**
3.3	< 1.0	< 1.0	< 1.0	< 1.0	**12**	**193**	**125**	-	**5.12**
-	**2**	<1	<1	**2**	**16**	**196**	**127**	-	**5.03**
-	**2**	<1	<1	**2**	**12**	**168**	**109**	-	**5.09**
1.44	< 1.0	< 1.0	< 1.0	< 1.0	**13**	**91**	**128**	-	**4.87**
-	< 1.0	< 1.0	< 1.0	< 1.0	**16**	**101**	**66**	**90**	**4.71**
-	< 1.0	< 1.0	< 1.0	< 1.0	**13**	**70**	**46**	**84**	**4.82**
1.44	< 1.0	< 1.0	< 1.0	< 1.0	**13**	**94**	**61**	**144**	**4.85**
-	< 1.0	< 1.0	< 1.0	< 1.0	**11**	**91**	**59**	**51**	**4.76**
-	< 1.0	< 1.0	< 1.0	< 1.0	**13**	**90**	**58**	**63**	**4.84**
-	< 1.0	< 1.0	< 1.0	< 1.0	**11**	**110**	**72**	**61**	**5.2**
1.32	< 1.0	< 1.0	< 1.0	< 1.0	**13**	**96**	**62**	**60**	**4.72**
-	< 1.0	< 1.0	< 1.0	< 1.0	**13**	**102**	**66**	-	**5.06**
2.02	< 1.0	< 1.0	< 1.0	< 1.0	**9.0**	**102**	**66**	-	**5.47**
-	**2**	<1	<1	**2**	**13**	**106**	**69**	-	**5.43**
-	**6**	<1	<1	**6**	**13**	**102**	**66**	-	**5.61**
0.46	**9.0**	< 1.0	< 1.0	**9.0**	**14**	**60**	**438**	-	**5.55**
1.15	**6.0**	< 1.0	< 1.0	**6.0**	**9.0**	**73**	**96**	-	**5.4**
-	< 1.0	< 1.0	< 1.0	< 1.0	**5.0**	**77**	**50**	**70**	**5.12**
-	< 1.0	< 1.0	< 1.0	< 1.0	**9.0**	**54**	**35**	**61**	**5.05**
1.3	< 1.0	< 1.0	< 1.0	< 1.0	**9.0**	**73**	**47**	**100**	**4.99**
-	< 1.0	< 1.0	< 1.0	< 1.0	**7.0**	**69**	**45**	**36**	**4.84**
-	< 1.0	< 1.0	< 1.0	< 1.0	**13**	**75**	**49**	**42**	**4.96**
-	< 1.0	< 1.0	< 1.0	< 1.0	**9.0**	**85**	**55**	**49**	**5.01**
1.32	< 1.0	< 1.0	< 1.0	< 1.0	**13**	**95**	**62**	**58**	**4.83**
-	< 1.0	< 1.0	< 1.0	< 1.0	**7.0**	**85**	**55**	-	**4.93**
1.86	< 1.0	< 1.0	< 1.0	< 1.0	**7.0**	**86**	**56**	-	**5.34**
-	**3**	<1	<1	**3**	**7**	**85**	**55**	-	**5.44**
-	**4**	<1	<1	**4**	**13**	**85**	**55**	-	**5.5**
3.59	< 1.0	< 1.0	< 1.0	< 1.0	**25**	**250**	**211**	-	**4.87**
2.49	< 1.0	< 1.0	< 1.0	< 1.0	**24**	**177**	**144**	-	**4.37**
-	**2.0**	< 1.0	< 1.0	**2.0**	**21**	**179**	**116**	**146**	**4.95**
-	< 1.0	< 1.0	< 1.0	< 1.0	**24**	**136**	**88**	**115**	**4.64**
2.04	< 1.0	< 1.0	< 1.0	< 1.0	**24**	**175**	**114**	**214**	**4.88**
-	< 1.0	< 1.0	< 1.0	< 1.0	**21**	**174**	**113**	**90**	**4.82**
-	< 1.0	< 1.0	< 1.0	< 1.0	**21**	**161**	**105**	**82**	**4.73**
-	< 1.0	< 1.0	< 1.0	< 1.0	**17**	**201**	**131**	**104**	**4.87**
2.44	**2.0**	< 1.0	< 1.0	**2.0**	**20**	**197**	**128**	**124**	**4.68**
-	< 1.0	< 1.0	< 1.0	< 1.0	**21**	**202**	**131**	-	**5.17**
2.64	< 1.0	< 1.0	< 1.0	< 1.0	**20**	**204**	**133**	-	**5.32**
-	**5**	<1	<1	5	**21**	**207**	**134**	-	**5.58**
-	**7**	<1	<1	7	**24**	**218**	**142**	-	**5.51**
3.16	< 1.0	< 1.0	< 1.0	< 1.0	**20**	**213**	**196**	-	**4.76**
-	< 1.0	< 1.0	< 1.0	< 1.0	**25**	**271**	**176**	**212**	**4.73**
-	< 1.0	< 1.0	< 1.0	< 1.0	**25**	**205**	**133**	**185**	**4.51**
3.26	< 1.0	< 1.0	< 1.0	< 1.0	**20**	**235**	**153**	**310**	**4.87**
-	< 1.0	< 1.0	< 1.0	< 1.0	**16**	**213**	**138**	**145**	**4.91**
-	< 1.0	< 1.0	< 1.0	< 1.0	**20**	**202**	**131**	**164**	**5.0**
-	**8.0**	< 1.0	< 1.0	**8.0**	**16**	**232**	**151**	**168**	**5.53**
2.79	**5.0**	< 1.0	< 1.0	**5.0**	**16**	**222**	**144**	**181**	**5.07**
-	< 1.0	< 1.0	< 1.0	< 1.0	**20**	**252**	**164**	-	**4.95**
2.89	< 1.0	< 1.0	< 1.0	< 1.0	**20**	**239**	**155**	-	**4.97**
-	**2.0**	<1	<1	**2.0**	**20**	**210**	**136**	-	**5.14**
-	**3**	<1	<1	**3**	**16**	**202**	**131**	-	**5.27**

Table D
Groundwater and Surface Water Analytical Data - Inorganics
Williamtown Sand Syndicate

Analyte		Anions and Cations																	
		Sodium	Calcium	Magnesium	Potassium	Sulphate	Chloride	Fluoride	Reactive phosphorus as P	Total Phosphorus	Nitrite as N	Nitrate as N	Nitrite + Nitrate as N	Ammonia as N	Total Nitrogen as N	Total Kjeldahl Nitrogen as N	Total Cations	Total Anions	Ionic Balance
LOR		1	1	1	1	1	1	0.1	0.01	0.01	0.01	0.01	0.01	0.01	0.1	0.1	0.01	0.01	
Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	%
ANZECC 2000 Trigger Values									0.02*	0.05*		0.7**		0.9**	0.35*				
NHMRC ADWG 6		180[3]				250[3]	250[3]	1.5			3	50		0.5[3]					
BH8	21-Feb-19	**52**	< 1.0	**6.0**	< 1.0	**11**	**90**	< 0.1	< 0.01	**1.97**	< 0.01	< 0.01	< 0.01	**0.5**	**2.4**	**2.4**	**2.76**	**2.77**	-
	14-Mar-19	**45**	< 1.0	**6.0**	< 1.0	**6.0**	**76**	< 0.1	-	-	-	-	-	-	-	-	**2.45**	**2.27**	-
	23-Apr-19	**53**	< 1.0	**7.0**	< 1.0	**8.0**	**89**	< 0.1	-	-	-	-	-	-	-	-	**2.88**	**2.68**	-
	16-May-19	**47**	< 1.0	**4.0**	< 1.0	**6.0**	**81**	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	**0.12**	**0.4**	**0.4**	**2.37**	**2.43**	-
	14-Jun-19	**47**	< 1.0	**5.0**	< 1.0	**4.0**	**89**	< 0.1	-	-	-	-	-	-	-	-	**2.46**	**2.59**	-
	16-Jul-19	**57**	< 1.0	**5.0**	< 1.0	**70**	**121**	**0.1**	-	-	-	-	-	-	-	-	**2.89**	**4.87**	**26**
	15-Aug-19	**42**	< 1.0	**3.0**	< 1.0	**4.0**	**63**	< 0.1	-	-	-	-	-	-	-	-	**2.07**	**1.86**	-
	16-Sep-19	**46**	< 1.0	**3.0**	< 1.0	**4.0**	**70**	< 0.1	< 0.01	**0.43**	< 0.01	< 0.01	< 0.01	**0.13**	**1.1**	**1.1**	**2.25**	**2.06**	-
	15-Oct-19	**45**	< 1.0	**4.0**	< 1.0	**4.0**	**70**	< 0.1	-	-	-	-	-	-	-	-	**2.29**	**2.06**	-
	18-Nov-19	**49**	< 1.0	**4.0**	< 1.0	**8.0**	**80**	< 0.1	< 0.01	**0.58**	< 0.01	**0.01**	**0.01**	**0.17**	**1.3**	**1.3**	**2.46**	**2.42**	-
	17-Dec-19	**50**	<1	**4**	<1	**10**	**75**	<0.1	-	-	-	-	-	-	-	-	**2.5**	**2.36**	-
	16-Jan-20	**49**	<1	**4**	<1	**13**	**78**	<0.1	-	-	-	-	-	-	-	-	**2.46**	**6.61**	-
MW239S	22-Feb-19	**61**	< 1.0	**6.0**	< 1.0	**6.0**	**104**	< 0.1	< 0.01	**0.56**	< 0.01	< 0.01	< 0.01	**0.18**	**3.9**	**3.9**	**3.15**	**3.06**	**1.43**
	14-Mar-19	**64**	< 1.0	**6.0**	< 1.0	**2.0**	**126**	< 0.1	-	-	-	-	-	-	-	-	**3.28**	**3.64**	**5.18**
	23-Apr-19	**64**	< 1.0	**7.0**	**1.0**	**9.0**	**97**	< 0.1	-	-	-	-	-	-	-	-	**3.38**	**2.92**	**7.32**
	16-May-19	**52**	< 1.0	**6.0**	< 1.0	**13**	**88**	< 0.1	< 0.01	**0.43**	< 0.01	< 0.01	< 0.01	**0.09**	**1.7**	**1.7**	**2.76**	**2.75**	-
	14-Jun-19	**50**	< 1.0	**6.0**	< 1.0	**13**	**87**	< 0.1	-	-	-	-	-	-	-	-	**2.67**	**2.86**	-
	16-Jul-19	**52**	< 1.0	**7.0**	**1.0**	**16**	**73**	< 0.1	-	-	-	-	-	-	-	-	**2.86**	**2.39**	-
	15-Aug-19	**54**	< 1.0	**7.0**	< 1.0	**11**	**88**	< 0.1	-	-	-	-	-	-	-	-	**2.92**	**2.71**	-
	16-Sep-19	**55**	< 1.0	**6.0**	**1.0**	**14**	**85**	< 0.1	< 0.01	**0.32**	< 0.01	< 0.01	< 0.01	**0.1**	**1.4**	**1.4**	**2.91**	**2.69**	-
	15-Oct-19	**58**	< 1.0	**6.0**	< 1.0	**8.0**	**108**	< 0.1	-	-	-	-	-	-	-	-	**3.02**	**3.21**	**3.15**
	18-Nov-19	**63**	< 1.0	**6.0**	**1.0**	**8.0**	**118**	< 0.1	< 0.01	**0.23**	< 0.01	< 0.01	< 0.01	**0.17**	**1.2**	**1.2**	**3.26**	**3.5**	**3.48**
	17-Dec-19	**65**	<1	**8**	<1	**6**	**127**	<0.1	-	-	-	-	-	-	-	-	**3.48**	**3.75**	**3.62**
	16-Jan-20	**67**	<1	**8**	<1	**7**	**120**	<0.1	-	-	-	-	-	-	-	-	**3.57**	**3.57**	**0.03**
SW1	23-Apr-19	**94**	**34**	**52**	**6.0**	**310**	**95**	**0.5**	-	-	-	-	-	-	-	-	**10**	**9.13**	**5.6**
	16-May-19	**86**	**24**	**42**	**6.0**	**324**	**112**	**0.3**	< 0.01	**0.13**	< 0.01	< 0.01	< 0.01	< 0.01	**1.8**	**1.8**	**8.94**	**9.9**	**5.13**
	14-Jun-19	**77**	**20**	**34**	**5.0**	**182**	**112**	**0.4**	-	-	-	-	-	-	-	-	**7.27**	**6.95**	**2.28**
	16-Jul-19	**90**	**20**	**35**	**4.0**	**240**	**130**	**0.4**	-	-	-	-	-	-	-	-	**7.9**	**8.66**	**4.64**
	15-Aug-19	**97**	**18**	**32**	**4.0**	**212**	**134**	**0.4**	-	-	-	-	-	-	-	-	**7.85**	**8.19**	**2.12**
	16-Sep-19	**117**	**21**	**39**	**4.0**	**244**	**193**	**0.7**	< 0.01	**0.05**	< 0.01	**0.02**	**0.02**	< 0.01	**1.2**	**1.2**	**9.45**	**11**	**5.38**
	15-Oct-19	**124**	**16**	**31**	**3.0**	**127**	**191**	**0.6**	-	-	-	-	-	-	-	-	**8.82**	**8.03**	**4.68**
	18-Nov-19	**142**	**14**	**30**	**4.0**	**165**	**234**	**0.5**	< 0.01	**0.02**	< 0.01	< 0.01	< 0.01	**0.03**	**1.1**	**1.1**	**9.45**	**10**	**3.03**
SW3	22-Feb-19	**40**	**4.0**	**4.0**	**1.0**	**16**	**82**	< 0.1	< 0.01	**0.06**	< 0.01	< 0.01	< 0.01	**0.16**	**1.0**	**1.0**	**2.55**	**2.87**	-
	14-Mar-19	**45**	**6.0**	**6.0**	**2.0**	**44**	**64**	< 0.1	-	-	-	-	-	-	-	-	**2.8**	**2.8**	-
	23-Apr-19	**37**	**8.0**	**6.0**	**1.0**	**42**	**53**	< 0.1	-	-	-	-	-	-	-	-	**2.53**	**2.37**	-
	16-May-19	**35**	**7.0**	**5.0**	< 1.0	**34**	**54**	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	**0.1**	**0.1**	**2.28**	**2.25**	-
	14-Jun-19	**32**	**7.0**	**6.0**	< 1.0	**41**	**55**	< 0.1	-	-	-	-	-	-	-	-	**2.24**	**2.4**	-
	16-Jul-19	**46**	**8.0**	**12**	< 1.0	**104**	**57**	**0.2**	-	-	-	-	-	-	-	-	**3.39**	**3.77**	**5.38**
	15-Aug-19	**38**	**6.0**	**7.0**	< 1.0	**54**	**56**	**0.1**	-	-	-	-	-	-	-	-	**2.53**	**2.7**	-
	16-Sep-19	**42**	**7.0**	**8.0**	< 1.0	**48**	**57**	**0.1**	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	**0.01**	**0.1**	**0.1**	**2.83**	**2.61**	-
	15-Oct-19	**40**	**5.0**	**7.0**	< 1.0	**42**	**57**	**0.2**	-	-	-	-	-	-	-	-	**2.56**	**2.48**	-
	18-Nov-19	**36**	**5.0**	**5.0**	< 1.0	**29**	**56**	< 0.1	< 0.01	**0.04**	< 0.01	**0.01**	**0.01**	**0.03**	**0.6**	**0.6**	**2.23**	**2.18**	-
	17-Dec-19	**40**	**4**	**7**	**1**	**25**	**57**	<0.1	-	-	-	-	-	-	-	-	**2.54**	**2.25**	
SW4	23-Apr-19	**39**	**5.0**	**5.0**	< 1.0	**60**	**64**	**0.1**	-	-	-	-	-	-	-	-	**2.36**	**3.05**	**13**
	16-May-19	**41**	**5.0**	**5.0**	< 1.0	**41**	**59**	< 0.1	**0.01**	< 0.01	< 0.01	**0.05**	**0.05**	< 0.01	**0.2**	**0.2**	**2.44**	**2.52**	-
	14-Jun-19	**40**	**5.0**	**5.0**	< 1.0	**39**	**60**	< 0.1	-	-	-	-	-	-	-	-	**2.4**	**2.5**	-
	16-Jul-19	**46**	**7.0**	**7.0**	< 1.0	**67**	**56**	**0.2**	-	-	-	-	-	-	-	-	**2.93**	**2.97**	-
	15-Aug-19	**40**	**5.0**	**5.0**	< 1.0	**43**	**55**	**0.1**	-	-	-	-	-	-	-	-	**2.4**	**2.45**	-
	16-Sep-19	**45**	**7.0**	**6.0**	< 1.0	**45**	**58**	**0.1**	< 0.01	**0.01**	< 0.01	< 0.01	< 0.01	< 0.01	**0.1**	**0.1**	**2.8**	**2.57**	-
	15-Oct-19	**44**	**6.0**	**6.0**	< 1.0	**38**	**57**	**0.1**	-	-	-	-	-	-	-	-	**2.71**	**2.4**	-
	18-Nov-19	**41**	**4.0**	**5.0**	< 1.0	**41**	**64**	**0.2**	< 0.01	< 0.01	< 0.01	**0.02**	**0.02**	< 0.01	**0.2**	**0.2**	**2.76**	**2.66**	-

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
LOR - Laboratory limit of reporting
mg/L - Milligrams per litre
µS/cm - Microsiemens per centimeter
Bold indicates a detection above the laboratory limit of reporting

* Default trigger values for physical and chemical stressors, for slightly disturbed ecosystems in lowland rivers, Southeast Australia (value is for base flow and not storm event)
** 95% Level of protection in freshwater
[3] Aesthetic

	Alkalinity						Inorganics		
Sodium Adsorption Ratio	Bicarbonate Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Hydroxide Alkalinity as CaCO3	Total Alkalinity as CaCO3	Total Hardness as CaCO3	Electrical Conductivity @ 25°C*	Total Dissolved Solids	Total Dissolved Solids	pH
0.01	1	1	1	1	1	1	1	10	0.01
-	mg/L	mg/L	mg/L	mg/L	mg/L	µS/cm	mg/L	mg/L	pH units
						125-2200			6.5 - 8.0*
					200[3]		600[3]		6.5-8.5[3]
4.44	< 1.0	< 1.0	< 1.0	< 1.0	**25**	**352**	**258**	-	**4.46**
-	< 1.0	< 1.0	< 1.0	< 1.0	**25**	**319**	**207**	**253**	**4.77**
-	< 1.0	< 1.0	< 1.0	< 1.0	**29**	**264**	**172**	**223**	**4.76**
4.86	**1.0**	< 1.0	< 1.0	**1.0**	**16**	**302**	**196**	**354**	**4.9**
-	< 1.0	< 1.0	< 1.0	< 1.0	**20**	**315**	**205**	**194**	**4.82**
-	< 1.0	< 1.0	< 1.0	< 1.0	**20**	**353**	**229**	**226**	**4.78**
-	< 1.0	< 1.0	< 1.0	< 1.0	**12**	**260**	**169**	**140**	**5.0**
5.43	< 1.0	< 1.0	< 1.0	< 1.0	**12**	**293**	**190**	**206**	**4.85**
-	< 1.0	< 1.0	< 1.0	< 1.0	**16**	**303**	**197**	-	**5.02**
5.06	< 1.0	< 1.0	< 1.0	< 1.0	**16**	**316**	**205**	-	**5.12**
-	**2**	<1	<1	**2**	**16**	**328**	**213**	-	**5.02**
-	**7**	<1	<1	**7**	**16**	**318**	**207**	-	**5.55**
5.21	< 1.0	< 1.0	< 1.0	< 1.0	**25**	**329**	**234**	-	**4.89**
-	**2.0**	< 1.0	< 1.0	**2.0**	**25**	**410**	**266**	**232**	**5.02**
-	< 1.0	< 1.0	< 1.0	< 1.0	**29**	**294**	**191**	**208**	**4.92**
4.44	< 1.0	< 1.0	< 1.0	< 1.0	**25**	**327**	**212**	**320**	**4.87**
-	**7.0**	< 1.0	< 1.0	**7.0**	**25**	**334**	**217**	**220**	**5.39**
-	< 1.0	< 1.0	< 1.0	< 1.0	**29**	**353**	**229**	**188**	**4.85**
-	< 1.0	< 1.0	< 1.0	< 1.0	**29**	**359**	**233**	**195**	**4.83**
4.7	< 1.0	< 1.0	< 1.0	< 1.0	**25**	**373**	**242**	**224**	**4.66**
-	< 1.0	< 1.0	< 1.0	< 1.0	**25**	**404**	**263**	-	**4.86**
5.38	< 1.0	< 1.0	< 1.0	< 1.0	**25**	**419**	**272**	-	**4.76**
-	**2**	<1	<1	**2**	**33**	**439**	**285**	-	**5.01**
-	**2**	<1	<1	**2**	**33**	**423**	**275**	-	**5.02**
-	< 1.0	< 1.0	< 1.0	< 1.0	**299**	**893**	**580**	**707**	**4.01**
2.45	< 1.0	< 1.0	< 1.0	< 1.0	**233**	**947**	**616**	**715**	**4.6**
-	< 1.0	< 1.0	< 1.0	< 1.0	**190**	**847**	**550**	**512**	**4.5**
-	< 1.0	< 1.0	< 1.0	< 1.0	**194**	**876**	**569**	**568**	**4.42**
-	< 1.0	< 1.0	< 1.0	< 1.0	**177**	**813**	**528**	**548**	**4.53**
3.49	< 1.0	< 1.0	< 1.0	< 1.0	**213**	**1,080**	**702**	**689**	**4.32**
-	< 1.0	< 1.0	< 1.0	< 1.0	**168**	**1,050**	**682**	-	**5.32**
4.91	< 1.0	< 1.0	< 1.0	< 1.0	**158**	**1,090**	**708**	-	**5.06**
3.38	**11**	< 1.0	< 1.0	**11**	**26**	**262**	**228**	-	**6.21**
-	**4.0**	< 1.0	< 1.0	**4.0**	**40**	**344**	**224**	**279**	**5.42**
-	< 1.0	< 1.0	< 1.0	< 1.0	**45**	**220**	**143**	**190**	**5.2**
2.47	**1.0**	< 1.0	< 1.0	**1.0**	**38**	**271**	**176**	**300**	**5.24**
-	< 1.0	< 1.0	< 1.0	< 1.0	**42**	**300**	**195**	**170**	**4.58**
-	< 1.0	< 1.0	< 1.0	< 1.0	**69**	**451**	**293**	**246**	**4.47**
-	< 1.0	< 1.0	< 1.0	< 1.0	**44**	**338**	**220**	**192**	**4.47**
2.57	< 1.0	< 1.0	< 1.0	< 1.0	**50**	**374**	**243**	**201**	**4.3**
-	< 1.0	< 1.0	< 1.0	< 1.0	**41**	**383**	**249**	-	**4.75**
2.72	< 1.0	< 1.0	< 1.0	< 1.0	**33**	**278**	**181**	-	**5.39**
	6	<1	<1	**6**	**39**	**301**	**196**		**5.75**
-	< 1.0	< 1.0	< 1.0	< 1.0	**33**	**293**	**190**	**198**	**4.0**
3.1	< 1.0	< 1.0	< 1.0	< 1.0	**33**	**331**	**215**	**288**	**4.08**
-	< 1.0	< 1.0	< 1.0	< 1.0	**33**	**316**	**205**	**163**	**4.31**
-	< 1.0	< 1.0	< 1.0	< 1.0	**46**	**367**	**238**	**207**	**4.46**
-	< 1.0	< 1.0	< 1.0	< 1.0	**33**	**308**	**200**	**160**	**4.48**
3.01	< 1.0	< 1.0	< 1.0	< 1.0	**42**	**360**	**234**	**208**	**4.35**
-	< 1.0	< 1.0	< 1.0	< 1.0	**40**	**365**	**237**	-	**4.48**
3.22	< 1.0	< 1.0	< 1.0	< 1.0	**30**	**348**	**226**	-	**4.48**

Table E
Quality Control Sample Analysis - BTEXN
Williamtown Sand Syndicate

Analyte			BTEXN								Total Petroleum Hydrocarbons					Total Petroleum Hydrocar	
			Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene	Total Xylenes	Naphthalene	Sum of BTEX	C_6 - C_9	C_{10} - C_{14}	C_{15} - C_{28}	C_{29} - C_{36}	C_{10} - C_{36} sum	C_{10}-C_{14} - Silica Cleanup	C_{15}-C_{28} - Silica Cleanup
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
Sample Name	Sample Date	Sample Type															
TRIP BLANK_13022019	13-Feb-19	Trip Blank	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
RINSATE01_21022019	21-Feb-19	Rinsate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
BH8_21022019	21-Feb-19	Primary	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
DUP01_21022019	21-Feb-19	Duplicate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
BH8_21022019	21-Feb-19	Primary	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
TRIP01_21022019	21-Feb-19	Triplicate	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 3.0	< 10	-	< 20	< 50	< 100	< 100	< 100	< 50	< 100
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
TRIP BLANK_130319	13-Mar-19	Trip Blank	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	-	-
RINSATE02_140319	14-Mar-19	Rinsate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
BH7_140319	14-Mar-19	Primary	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
DUP02_140319	14-Mar-19	Duplicate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
TRIP BLANK_03	23-Apr-19	Trip Blank	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	-	-
RINSATE_03	23-Apr-19	Rinsate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
TRIP BLANK_04	16-May-19	Trip Blank	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	-	-
RINSATE_04	16-May-19	Rinsate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
TRIP BLANK 05_14062019	14-Jun-19	Trip Blank	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
RINSATE 05_14062019	14-Jun-19	Rinsate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
SW3_14062019	14-Jun-19	Primary	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
DUP05_14062019	14-Jun-19	Duplicate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
SW3_14062019	14-Jun-19	Primary	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
TRIP05_140619	14-Jun-19	Triplicate	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 3.0	< 10	-	< 20	-	-	-	-	< 50	< 100
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
TRIP BLANK 06_16072019	16-Jul-19	Trip Blank	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
RINSATE06_16072019	16-Jul-19	Rinsate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
RINSATE07	15-Aug-19	Rinsate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	-	-
TRIP BLANK 08_16092019	16-Sep-19	Trip Blank	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
RINSATE 08_16092019	16-Sep-19	Rinsate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
SW4_16092019	16-Sep-19	Primary	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
DUP08_16092019	16-Sep-19	Duplicate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
SW4_16092019	16-Sep-19	Primary	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
TRIP08_16092019	16-Sep-19	Triplicate	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 3.0	< 10	-	< 20	200	400	200	800	< 50	< 100
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
TRIP BLANK_15102019	15-Oct-19	Trip Blank	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
RINSATE_15102019	15-Oct-19	Rinsate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
TRIPBLANK09_181119	18-Nov-19	Trip Blank	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
RINSATE09_181119	18-Nov-19	Rinsate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
SW4_181119	18-Nov-19	Primary	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
DUP09_181119	18-Nov-19	Duplicate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
SW4_181119	18-Nov-19	Primary	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
TRIP09_18112019	18-Nov-19	Triplicate	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 3.0	< 10	-	< 20	< 50	< 100	< 100	< 100	< 50	< 100
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
TRIPBLANK10_171219	17-Dec-19	Trip Blank	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
RINSATE10_171219	17-Dec-19	Rinsate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
RIP BLANK 13_200133300	16-Jan-20	Trip Blank	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
RINSATE 13_2001333009	16-Jan-20	Rinsate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
BH6_2001333004	16-Jan-20	Primary	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
QW12_2001333012	16-Jan-20	Duplicate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
BH6_2001333004	16-Jan-20	Primary	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100
QW13_14392	16-Jan-20	Triplicate	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 3.0	< 10	-	< 20	250	300	100	650	< 50	< 100
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
NC - Not calculated
µg/L - Micrograms per litre
BTEXN - Benzene, toluene, ethylbenzene, xylenes, naphthalene

rbons - Silcia Clean up		Total Recoverable Hydrocarbons						Total Recoverable Hydrocarbons - Silcia Clean up				
C_{29}-C_{36} - Silica Cleanup	C_{10}-C_{36} Sum - Silica Cleanup	C_6 - C_{10}	C_6 - C_{10} minus BTEX (F1)	>C_{10} - C_{16}	>C_{10} - C_{16} minus Naphthalene	>C_{16} - C_{34}	>C_{34} - C_{40}	>C_{10}-C_{16} - Silica Cleanup	F2 - Silica Cleanup	>C_{16}-C_{34} - Silica Cleanup	>C_{34}-C_{40} - Silica Cleanup	>C_{10}-C_{40} - Silica Cleanup
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
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 100	< 400	< 20	< 20	< 50	< 50	< 100	< 100	< 50	-	< 100	< 100	< 100
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
-	-	< 20	< 20					-	-	-	-	-
< 50	< 50	< 20	< 20					< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20					< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20					< 100	< 100	< 100	< 100	< 100
NC	NC	NC	NC					NC	NC	NC	NC	NC
-	-	< 20	< 20					-	-	-	-	-
< 50	< 50	< 20	< 20					< 100	< 100	< 100	< 100	< 100
-	-	< 20	< 20					-	-	-	-	-
< 50	< 50	< 20	< 20					< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 100	< 100	< 20	< 20	-	-	-	-	< 50	< 50	< 100	< 100	< 100
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
-	-	< 20	< 20	< 100	< 100	< 100	< 100	-	-	-	-	-
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 100	< 400	< 20	< 20	180	180	400	100	< 50	-	< 100	< 100	-
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 100	< 100	< 20	< 20	< 50	< 50	< 100	< 100	< 50	-	< 100	< 100	-
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
< 100	< 400	< 20	< 20	210	210	400	<100	< 50	-	< 100	< 100	-
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Table F
Quality Control Sample Analysis - Metals
Williamtown Sand Syndicate

Analyte			Metals														
			Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Vanadium	Zinc
Units			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Name	Sample Date	Sample Type																
TRIP BLANK_13022019	13-Feb-19	Trip Blank	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
RINSATE01_21022019	21-Feb-19	Rinsate	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
BH8_21022019	21-Feb-19	Primary	< 0.001	0.011	< 0.001	< 0.05	< 0.0001	0.001	< 0.001	< 0.001	4.1	< 0.001	0.012	< 0.0001	0.002	< 0.01	< 0.01	0.005
DUP01_21022019	21-Feb-19	Duplicate	0.001	0.014	< 0.001	< 0.05	< 0.0001	0.001	< 0.001	< 0.001	4.09	< 0.001	0.012	< 0.0001	0.003	< 0.01	< 0.01	0.015
Relative Percentage Difference			**67%**	24%	NC	NC	NC	0%	NC	NC	0%	NC	0%	NC	40%	NC	NC	**100%**
BH8_21022019	21-Feb-19	Primary	< 0.001	0.011	< 0.001	< 0.05	< 0.0001	0.001	< 0.001	< 0.001	4.1	< 0.001	0.012	< 0.0001	0.002	< 0.01	< 0.01	0.005
TRIP01_21022019	21-Feb-19	Triplicate	0.001	< 0.02	< 0.001	< 0.05	< 0.0002	< 0.005	< 0.001	< 0.001	4.5	< 0.001	0.012	< 0.0001	0.003	-	< 0.005	0.006
Relative Percentage Difference			**67%**	10%	NC	NC	NC	**86%**	NC	NC	9%	NC	0%	NC	40%	NC	NC	18%
TRIP BLANK_130319	13-Mar-19	Trip Blank	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	-	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
TRIP BLANK02_150319	15-Mar-19	Trip Blank	< 0.001	**0.002**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
RINSATE02_140319	14-Mar-19	Rinsate	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
BH7_140319	14-Mar-19	Primary	< 0.001	0.01	< 0.001	< 0.05	< 0.0001	0.001	0.003	< 0.001	1.8	< 0.001	0.02	< 0.0001	0.004	< 0.01	< 0.01	0.009
DUP02_140319	14-Mar-19	Duplicate	< 0.001	0.01	< 0.001	< 0.05	< 0.0001	0.001	0.002	< 0.001	2.51	< 0.001	0.021	< 0.0001	0.004	< 0.01	< 0.01	0.007
Relative Percentage Difference			NC	0%	NC	NC	NC	0%	**40%**	NC	33%	NC	5%	NC	0%	NC	NC	25%
BH7_140319	14-Mar-19	Primary	< 0.001	0.01	< 0.001	< 0.05	< 0.0001	0.001	0.003	< 0.001	1.8	< 0.001	0.02	< 0.0001	0.004	< 0.01	< 0.01	0.009
TRIP02_14032019	14-Mar-19	Triplicate	< 0.001	< 0.02	< 0.001	< 0.05	< 0.0002	0.001	0.002	< 0.001	1.7	< 0.001	0.019	< 0.0001	< 0.001	-	< 0.005	< 0.005
Relative Percentage Difference			NC	0%	NC	NC	NC	0%	**40%**	NC	6%	NC	5%	NC	**156%**	NC	NC	**113%**
TRIP BLANK_03	23-Apr-19	Trip Blank	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
RINSATE_03	23-Apr-19	Rinsate	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
TRIP BLANK_04	16-May-19	Trip Blank	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
RINSATE_04	16-May-19	Rinsate	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
TRIP BLANK 05_14062019	14-Jun-19	Trip Blank	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
RINSATE 05_14062019	14-Jun-19	Rinsate	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
SW3_14062019	14-Jun-19	Primary	< 0.001	0.035	< 0.001	< 0.05	< 0.0001	< 0.001	0.003	< 0.001	1.68	< 0.001	0.038	< 0.0001	0.003	< 0.01	< 0.01	0.016
DUP05_14062019	14-Jun-19	Duplicate	< 0.001	0.036	< 0.001	< 0.05	< 0.0001	< 0.001	0.003	< 0.001	1.63	< 0.001	0.039	< 0.0001	0.003	< 0.01	< 0.01	0.013
Relative Percentage Difference			NC	3%	NC	NC	NC	NC	0%	NC	3%	NC	3%	NC	0%	NC	NC	21%
SW3_14062019	14-Jun-19	Primary	< 0.001	0.035	< 0.001	< 0.05	< 0.0001	< 0.001	0.003	< 0.001	1.68	< 0.001	0.038	< 0.0001	0.003	< 0.01	< 0.01	0.016
TRIP05_140619	14-Jun-19	Triplicate	< 0.001	-	-	-	< 0.0002	0.001	-	< 0.001	1.6	< 0.001	-	< 0.0001	0.003	-	-	0.01
Relative Percentage Difference			NC	NC	NC	NC	NC	**67%**	NC	NC	5%	NC	NC	NC	0%	NC	NC	46%
TRIP BLANK 06_16072019	16-Jul-19	Trip Blank	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
RINSATE06_16072019	16-Jul-19	Rinsate	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
RINSATE07	15-Aug-19	Rinsate	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
TRIP BLANK 08_16092019	16-Sep-19	Trip Blank	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
RINSATE 08_16092019	16-Sep-19	Rinsate	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
SW4_16092019	16-Sep-19	Primary	< 0.001	0.046	< 0.001	< 0.05	< 0.0001	< 0.001	0.002	0.02	0.7	0.001	0.039	< 0.0001	0.017	< 0.01	< 0.01	0.085
DUP08_16092019	16-Sep-19	Duplicate	< 0.001	0.041	< 0.001	< 0.05	< 0.0001	< 0.001	0.002	< 0.001	0.76	< 0.001	0.036	< 0.0001	0.003	< 0.01	< 0.01	0.012
Relative Percentage Difference			NC	11%	NC	NC	NC	NC	0%	**190%**	8%	**67%**	8%	NC	**140%**	NC	NC	**151%**
SW4_16092019	16-Sep-19	Primary	< 0.001	0.046	< 0.001	< 0.05	< 0.0001	< 0.001	0.002	0.02	0.7	0.001	0.039	< 0.0001	0.017	< 0.01	< 0.01	0.085
TRIP08_16092019	16-Sep-19	Triplicate	< 0.001	0.04	< 0.001	< 0.05	< 0.0002	< 0.001	0.002	< 0.001	0.69	< 0.001	0.037	< 0.0001	0.003	-	< 0.005	0.012
Relative Percentage Difference			NC	14%	NC	NC	NC	NC	0%	**190%**	1%	**67%**	5%	NC	**140%**	NC	NC	**151%**
TRIP BLANK_15102019	15-Oct-19	Trip Blank	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	-	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
RINSATE_15102019	15-Oct-19	Rinsate	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	-	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
TRIPBLANK09_181119	18-Nov-19	Trip Blank	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
RINSATE09_181119	18-Nov-19	Rinsate	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
SW4_181119	18-Nov-19	Primary	< 0.001	0.035	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	6.32	< 0.001	0.032	< 0.0001	0.002	< 0.01	< 0.01	< 0.005
DUP09_181119	18-Nov-19	Duplicate	< 0.001	0.034	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	5.9	< 0.001	0.036	< 0.0001	0.002	< 0.01	< 0.01	< 0.005
Relative Percentage Difference			NC	3%	NC	NC	NC	NC	NC	NC	7%	NC	12%	NC	0%	NC	NC	NC
SW4_181119	18-Nov-19	Primary	< 0.001	0.035	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	0.001	6.32	< 0.001	0.032	< 0.0001	0.002	< 0.01	< 0.01	< 0.005
TRIP09_18112019	18-Nov-19	Triplicate	< 0.001	0.04	< 0.001	< 0.05	< 0.0002	< 0.001	< 0.001	0.01	-	< 0.001	0.035	< 0.0001	0.007	-	< 0.005	0.033
Relative Percentage Difference			NC	13%	NC	NC	NC	NC	NC	2%	NC	NC	9%	NC	**111%**	NC	NC	**172%**
TRIPBLANK10_171219	17-Dec-19	Trip Blank	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
RINSATE10_171219	17-Dec-19	Rinsate	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
RIP BLANK 13_200133300	16-Jan-20	Trip Blank	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
RINSATE 13_2001333009	16-Jan-20	Rinsate	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
BH6_2001333004	16-Jan-20	Primary	<0.001	0.032	<0.001	<0.05	<0.0001	<0.001	<0.001	<0.001	2.15	<0.001	0.01	<0.0001	<0.001	<0.01	<0.01	<0.005
QW12_2001333012	16-Jan-20	Duplicate	<0.001	0.035	<0.001	<0.05	<0.0001	<0.001	<0.001	<0.001	2.18	<0.001	0.009	<0.0001	0.001	<0.01	<0.01	<0.005
Relative Percentage Difference			NC	9%	NC	NC	NC	NC	NC	NC	1%	NC	11%	NC	**67%**	NC	NC	NC
BH6_2001333004	16-Jan-20	Primary	<0.001	0.032	<0.001	<0.05	<0.0001	<0.001	<0.001	<0.001	2.15	<0.001	0.01	<0.0001	<0.001	<0.01	<0.01	<0.005
QW13_14392	16-Jan-20	Triplicate	< 0.001	0.03	< 0.001	< 0.05	< 0.0002	< 0.001	< 0.001	0.004	1.6	< 0.001	0.009	< 0.0001	< 0.001	-	< 0.005	0.012
Relative Percentage Difference			NC	6%	NC	NC	NC	NC	NC	**156%**	29%	NC	11%	NC	NC	NC	NC	**131%**

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
NC - Not calculated
mg/L - Milligrams per litre
Half the laboratory limit of reporting used when calculating RPD
RPD - Relative Percentage Difference

Table G
Quality Control Sample Analysis - PFAS
Williamtown Sand Syndicate

Analyte			Perfluoroalkyl Sulfonic Acids											Perf
			Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonate (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorodecanesulfonic acid (PFDS)	Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	
Units			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	
Sample Name	Sample Date	Sample Type												
TRIP BLANK_13022019	13-Feb-19	Trip Blank	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
RINSATE01_21022019	21-Feb-19	Rinsate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
BH8_21022019	21-Feb-19	Primary	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
DUP01_21022019	21-Feb-19	Duplicate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
BH8_21022019	21-Feb-19	Primary	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
TRIP01_21022019	21-Feb-19	Triplicate	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.02	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
TRIP BLANK_130319	13-Mar-19	Trip Blank	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
TRIP BLANK02_150319	15-Mar-19	Trip Blank	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
RINSATE02_140319	14-Mar-19	Rinsate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
BH7_140319	14-Mar-19	Primary	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
DUP02_140319	14-Mar-19	Duplicate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
BH7_140319	14-Mar-19	Primary	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
TRIP02_14032019	14-Mar-19	Triplicate	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.02	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
TRIP BLANK 03	23-Apr-19	Trip Blank	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
RINSATE 03	23-Apr-19	Rinsate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
TRIP BLANK 04	16-May-19	Trip Blank	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
RINSATE 04	16-May-19	Rinsate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
TRIP BLANK 05_14062019	14-Jun-19	Trip Blank	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
RINSATE 05_14062019	14-Jun-19	Rinsate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
TRIP BLANK 06_16072019	16-Jul-19	Trip Blank	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
RINSATE06_16072019	16-Jul-19	Rinsate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
RINSATE07	15-Aug-19	Rinsate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
TRIP BLANK 08_16092019	16-Sep-19	Trip Blank	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
RINSATE 08_16092019	16-Sep-19	Rinsate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
SW4_16092019	16-Sep-19	Primary	< 0.02	< 0.02	< 0.02	< 0.02	0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
DUP08_16092019	16-Sep-19	Duplicate	< 0.02	< 0.02	< 0.02	< 0.02	0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
Relative Percentage Difference			NC	NC	NC	NC	0%	NC	NC	NC	NC	NC	NC	
SW4_16092019	16-Sep-19	Primary	< 0.02	< 0.02	< 0.02	< 0.02	0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
TRIP08_16092019	16-Sep-19	Triplicate	< 0.01	< 0.01	< 0.01	< 0.01	0.03	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	
Relative Percentage Difference			NC	NC	NC	NC	**100%**	NC	NC	NC	NC	NC	NC	
TRIP BLANK 09_1931069	25-Sep-19	Trip Blank	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
RINSATE 09_1931069	25-Sep-19	Rinsate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
TRIPBLANK09_181119	18-Nov-19	Trip Blank	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
RINSATE09_181119	18-Nov-19	Rinsate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
SW4_181119	18-Nov-19	Primary	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
DUP09_181119	18-Nov-19	Duplicate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
SW4_181119	18-Nov-19	Primary	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
TRIP09_18112019	18-Nov-19	Triplicate	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
TRIPBLANK10_171219	17-Dec-19	Trip Blank	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
RINSATE10_171219	17-Dec-19	Rinsate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
TRIP BLANK 13_2001333008	16-Jan-20	Trip Blank	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
RINSATE 13_2001333009	16-Jan-20	Rinsate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
BH6_2001333004	16-Jan-20	Primary	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
QW12_2001333012	16-Jan-20	Duplicate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	
BH6_2001333004	16-Jan-20	Primary	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	
QW13_14392	16-Jan-20	Triplicate	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	

Notes:
< - Less than laboratory limit of reporting
NC - Not calculated
µg/L - Micrograms per litre

Table G
Quality Control Sample Analysis - PFAS
Williamtown Sand Syndicate

fluoroalkyl Carboxylic Acids						Perfluoroalkyl Sulfonamides						
Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorooctane sulfonamide (FOSA)	N-Methyl-perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)
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
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02
< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

KLEINFELDER
Bright People. Right Solutions.

(n:2) Fluorotelomer Sulfonic Acids				Sum of PFAS		
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	Sum of PFHxS and PFOS	Sum of PFAS (WA DER List)	Sum of PFAS
µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
NC	NC	NC	NC	NC	NC	NC
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.01	< 0.05	< 0.01	< 0.01	< 0.01	< 0.05	< 0.1
NC	NC	NC	NC	NC	NC	NC
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
NC	NC	NC	NC	NC	NC	NC
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.01	< 0.05	< 0.01	< 0.01	< 0.01	< 0.05	< 0.1
NC	NC	NC	NC	NC	NC	NC
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	0.01	0.01	0.01
< 0.05	< 0.05	< 0.05	< 0.05	0.01	0.01	0.01
NC	NC	NC	NC	0%	0%	0%
< 0.05	< 0.05	< 0.05	< 0.05	0.01	0.01	0.01
< 0.01	< 0.05	< 0.01	< 0.01	0.03	< 0.05	< 0.1
NC	NC	NC	NC	**100%**	**86%**	**133%**
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
NC	NC	NC	NC	NC	NC	NC
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.01	< 0.05	< 0.01	< 0.01	< 0.01	< 0.05	< 0.1
NC	NC	NC	NC	NC	NC	NC
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
NC	NC	NC	NC	NC	NC	NC
< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
< 0.01	< 0.05	< 0.01	< 0.01	< 0.01	< 0.05	< 0.1
NC	NC	NC	NC	NC	NC	NC

TREND CHARTS

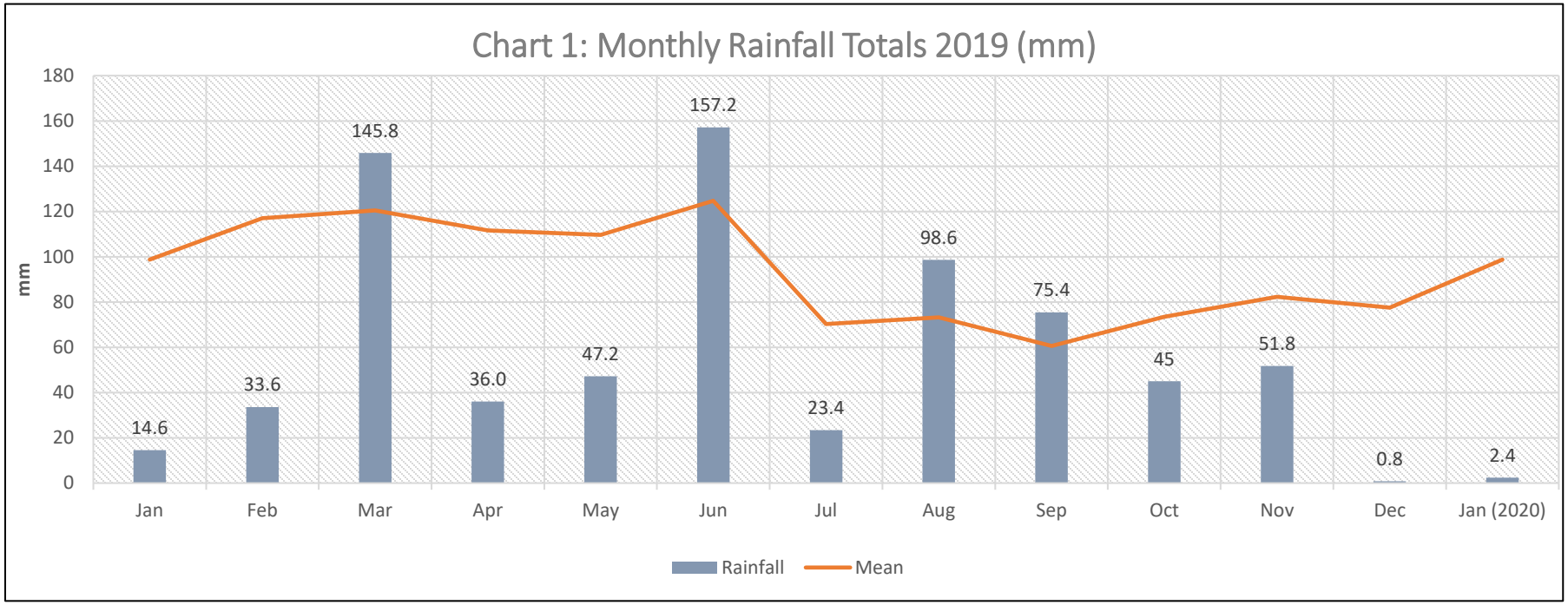


Chart 1: Monthly Rainfall Totals 2019 (mm)
mm
180
160
140
120
100
80
60
40
20
0
14.6
33.6
145.8
36.0
47.2
157.2
23.4
98.6
75.4
45
51.8
0.8
2.4
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan (2020)
Rainfall
Mean

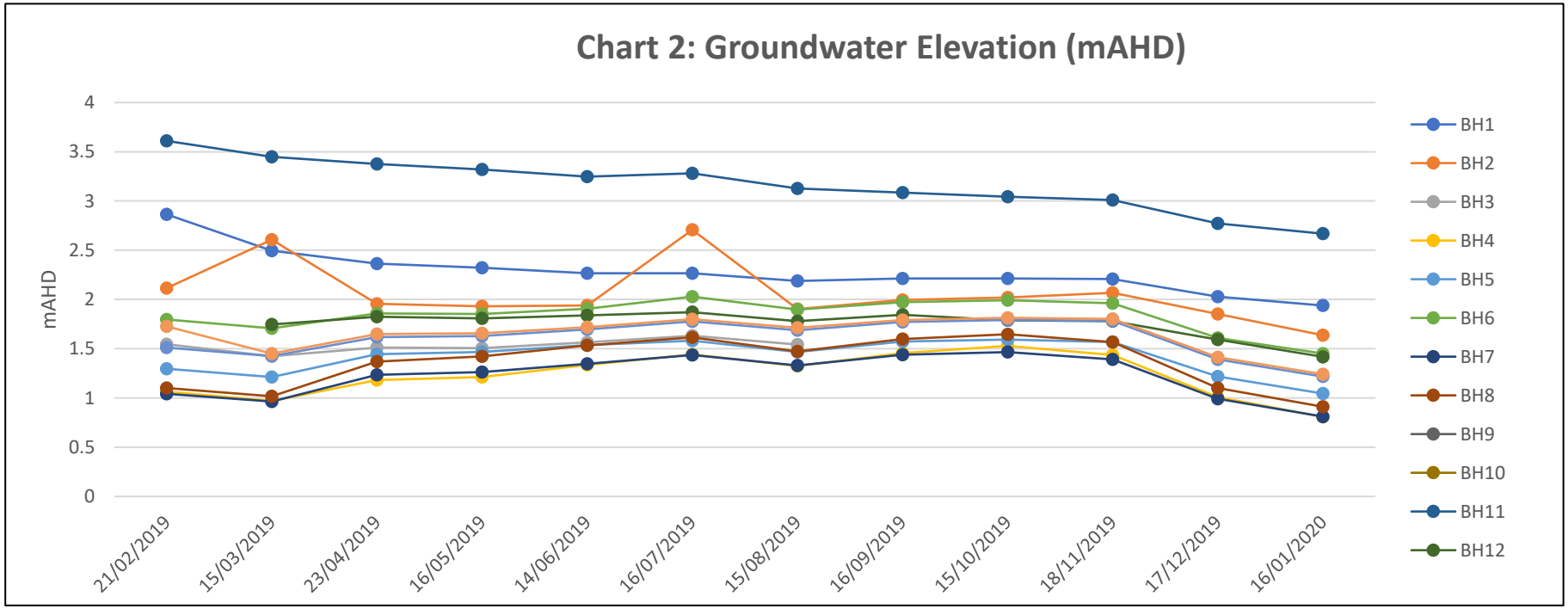


Chart 2: Groundwater Elevation (mAHD)
mAHD
4
3.5
3
2.5
2
1.5
1
0.5
0
21/02/2019
15/03/2019
23/04/2019
16/05/2019
14/06/2019
16/07/2019
15/08/2019
16/09/2019
15/10/2019
18/11/2019
17/12/2019
16/01/2020
BH1
BH2
BH3
BH4
BH5
BH6
BH7
BH8
BH9
BH10
BH11
BH12

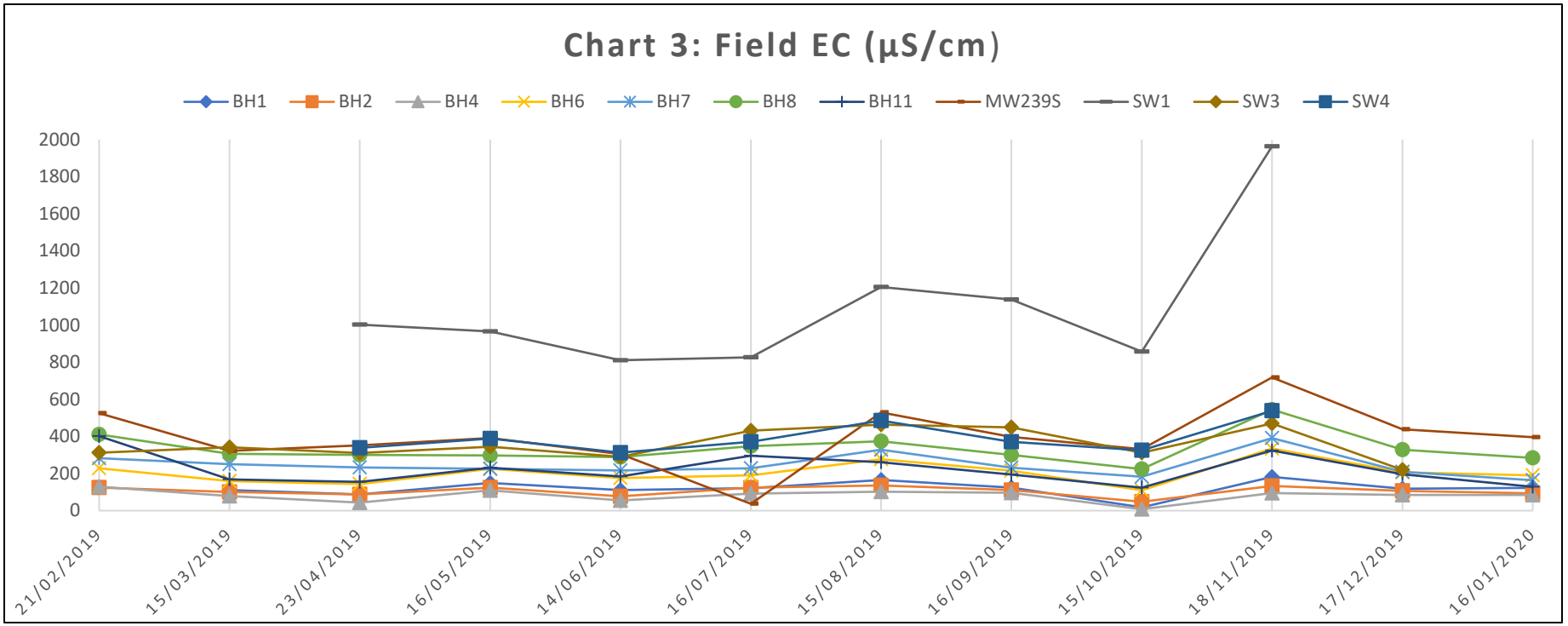


Chart 3: Field EC (µS/cm)
BH1
BH2
BH4
BH6
BH7
BH8
BH11
MW239S
SW1
SW3
SW4
2000
1800
1600
1400
1200
1000
800
600
400
200
0
21/02/2019
15/03/2019
23/04/2019
16/05/2019
14/06/2019
16/07/2019
15/08/2019
16/09/2019
15/10/2019
18/11/2019
17/12/2019
16/01/2020

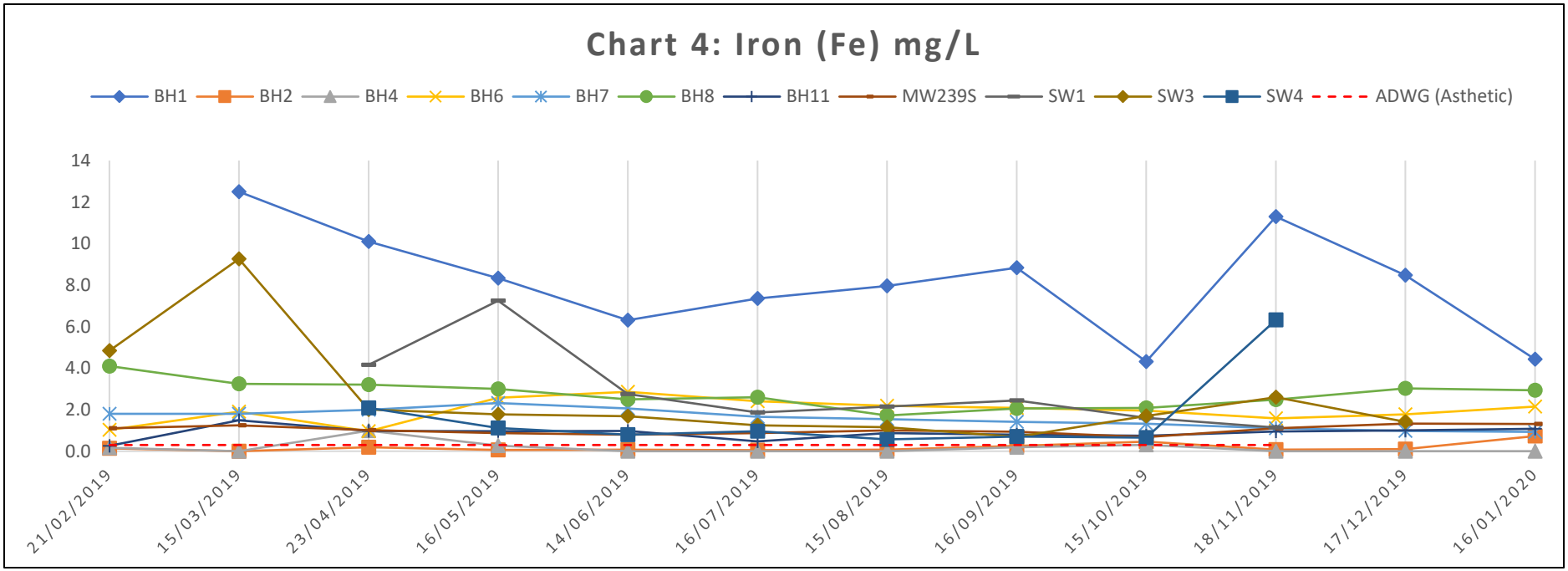


Chart 4: Iron (Fe) mg/L
BH1
BH2
BH4
BH6
BH7
BH8
BH11
MW239S
SW1
SW3
SW4
ADWG (Asthetic)
14
12
10
8.0
6.0
4.0
2.0
0.0
21/02/2019
15/03/2019
23/04/2019
16/05/2019
14/06/2019
16/07/2019
15/08/2019
16/09/2019
15/10/2019
18/11/2019
17/12/2019
16/01/2020

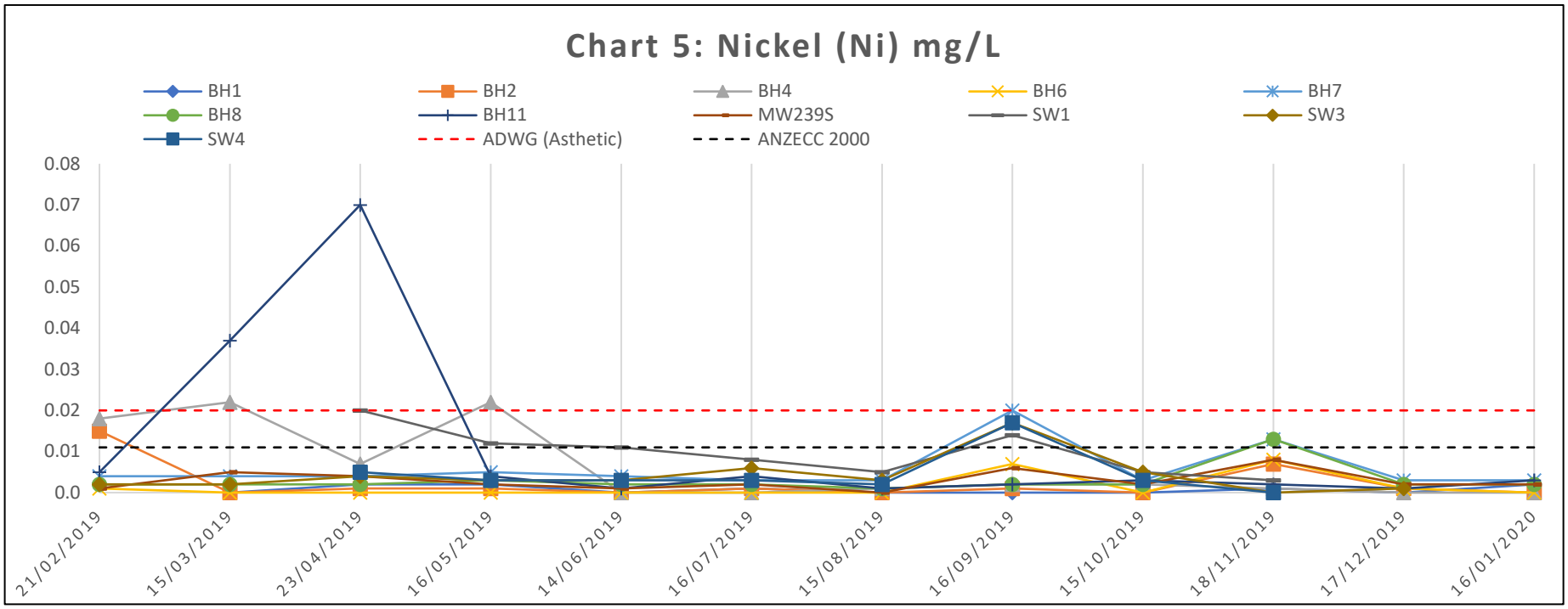


Chart 5: Nickel (Ni) mg/L
BH1
BH2
BH4
BH6
BH7
BH8
BH11
MW239S
SW1
SW3
SW4
ADWG (Asthetic)
ANZECC 2000
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.0
21/02/2019
15/03/2019
23/04/2019
16/05/2019
14/06/2019
16/07/2019
15/08/2019
16/09/2019
15/10/2019
18/11/2019
17/12/2019
16/01/2020

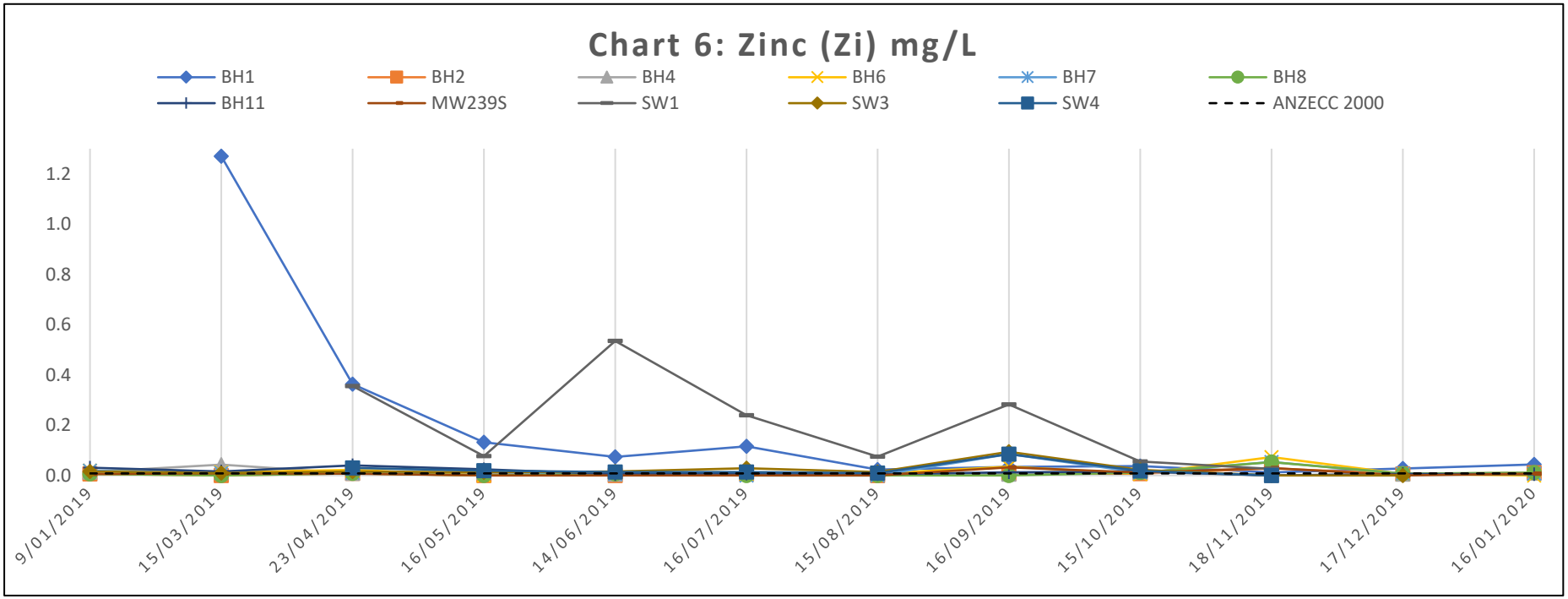


Chart 6: Zinc (Zi) mg/L
BH1
BH2
BH4
BH6
BH7
BH8
BH11
MW239S
SW1
SW3
SW4
ANZECC 2000
1.2
1.0
0.8
0.6
0.4
0.2
0.0
9/01/2019
15/03/2019
23/04/2019
16/05/2019
14/06/2019
16/07/2019
15/08/2019
16/09/2019
15/10/2019
18/11/2019
17/12/2019
16/01/2020

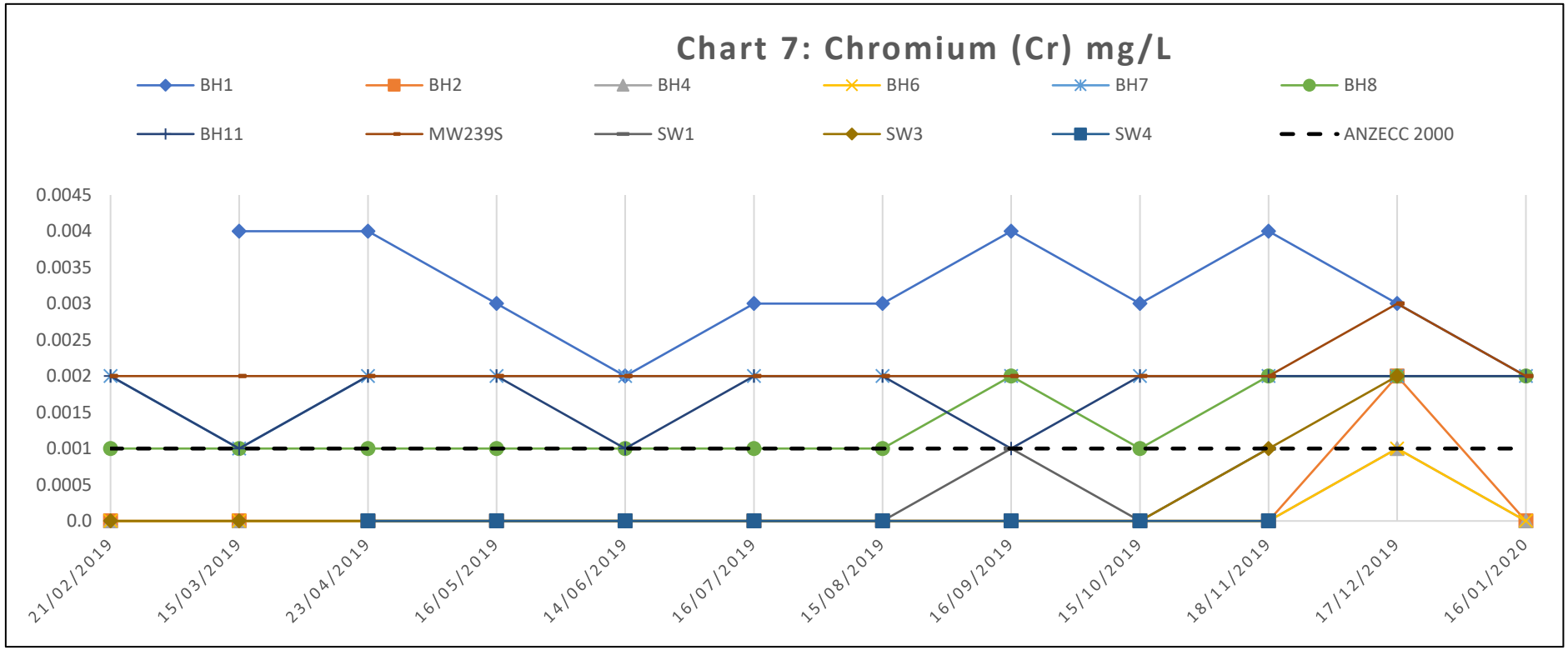


Chart 7: Chromium (Cr) mg/L
BH1
BH2
BH4
BH6
BH7
BH8
BH11
MW239S
SW1
SW3
SW4
ANZECC 2000
0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0.0
21/02/2019
15/03/2019
23/04/2019
16/05/2019
14/06/2019
16/07/2019
15/08/2019
16/09/2019
15/10/2019
18/11/2019
17/12/2019
16/01/2020

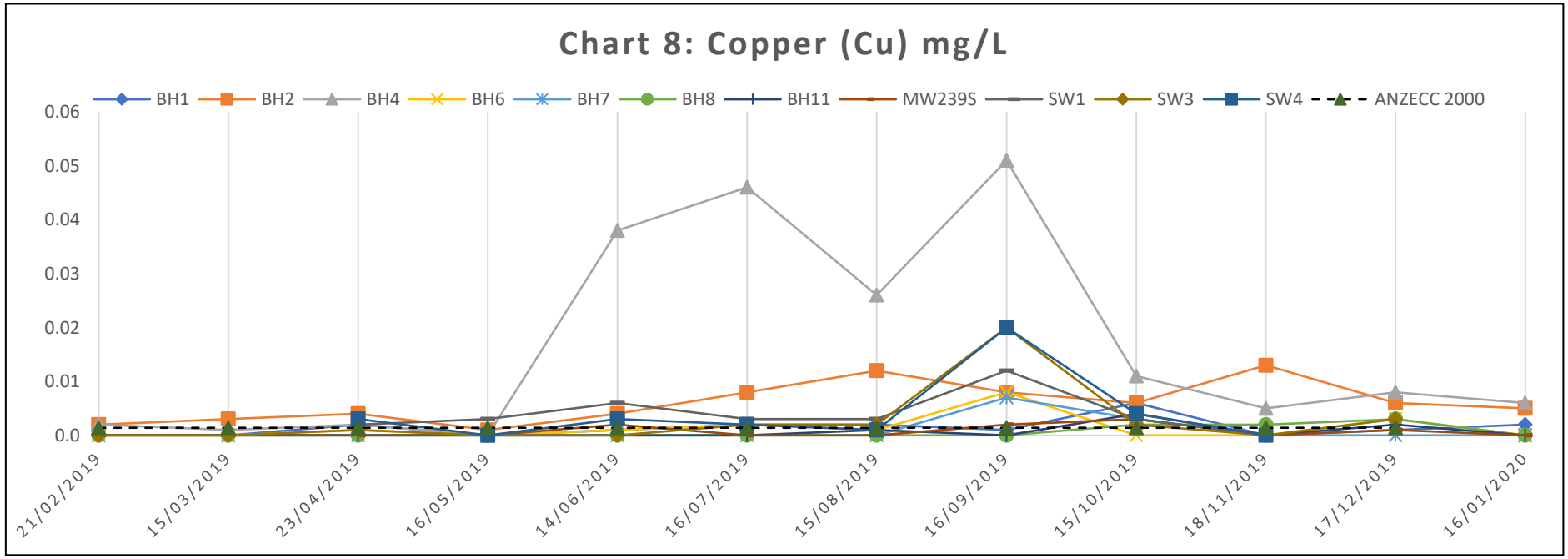


Chart 8: Copper (Cu) mg/L
BH1
BH2
BH4
BH6
BH7
BH8
BH11
MW239S
SW1
SW3
SW4
ANZECC 2000
0.06
0.05
0.04
0.03
0.02
0.01
0.0
21/02/2019
15/03/2019
23/04/2019
16/05/2019
14/06/2019
16/07/2019
15/08/2019
16/09/2019
15/10/2019
18/11/2019
17/12/2019
16/01/2020

Chart 9: Manganese (Mn) mg/L

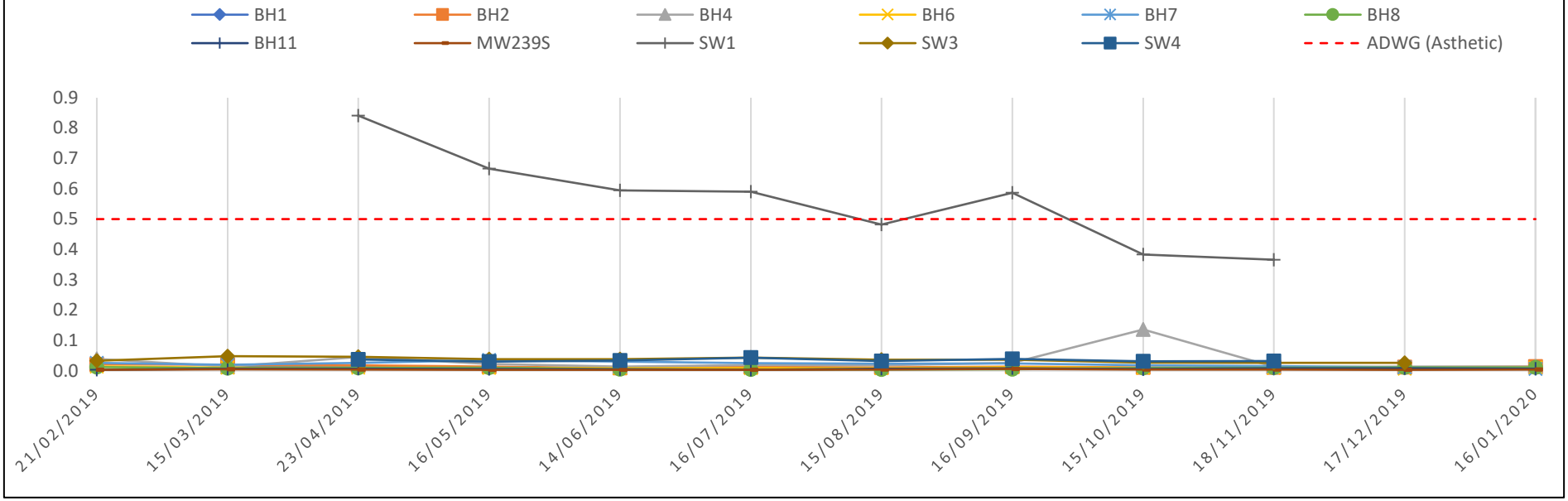


Chart: 10 Total Hardness ($CaCo_3$) mg/L

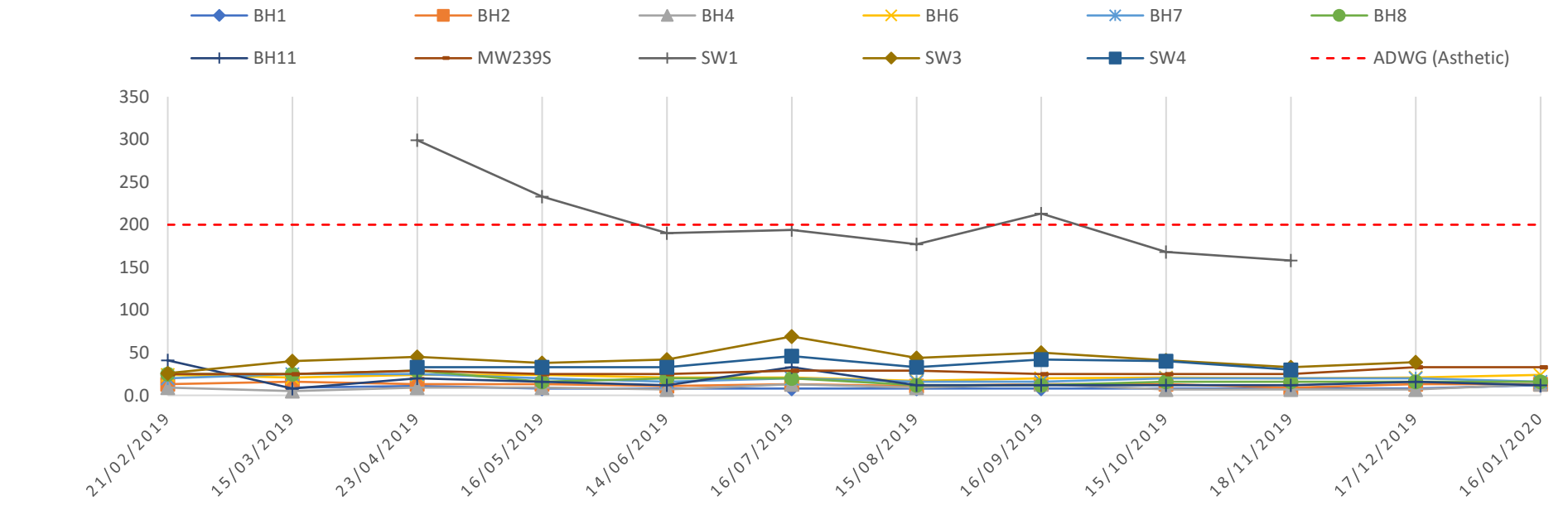


Chart 11: Total Dissolved Solids (TDS) mg/L

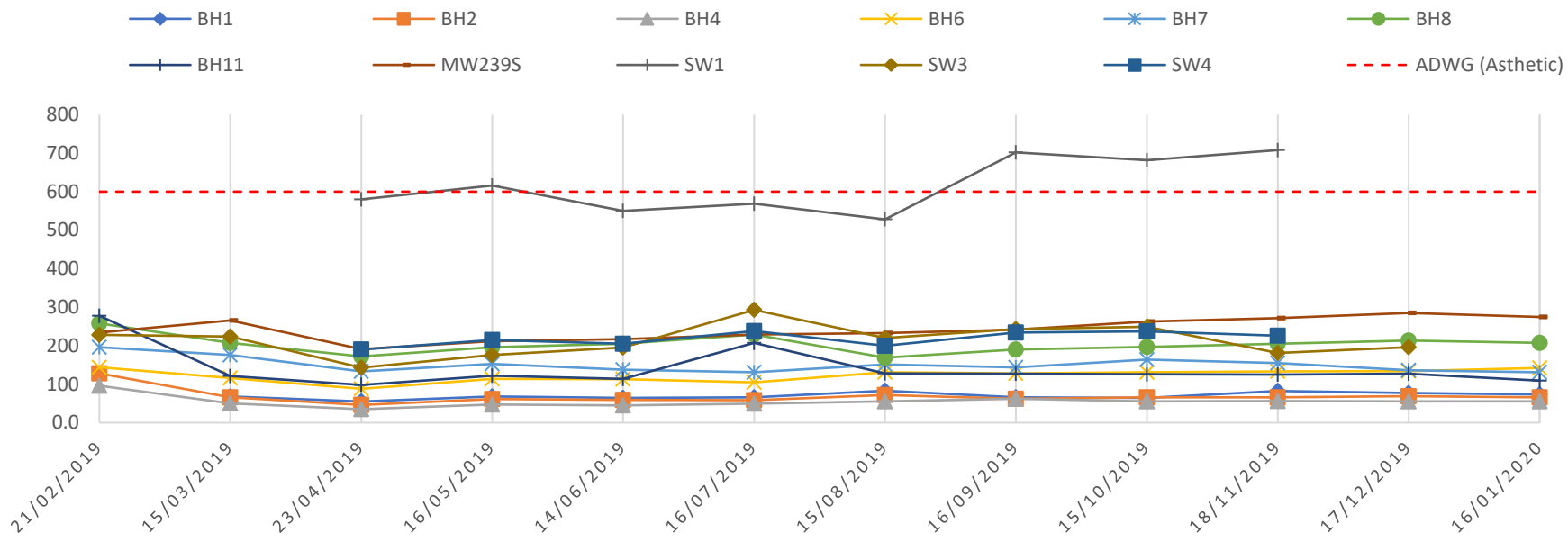


Chart 12: Sodium(Na) mg/L

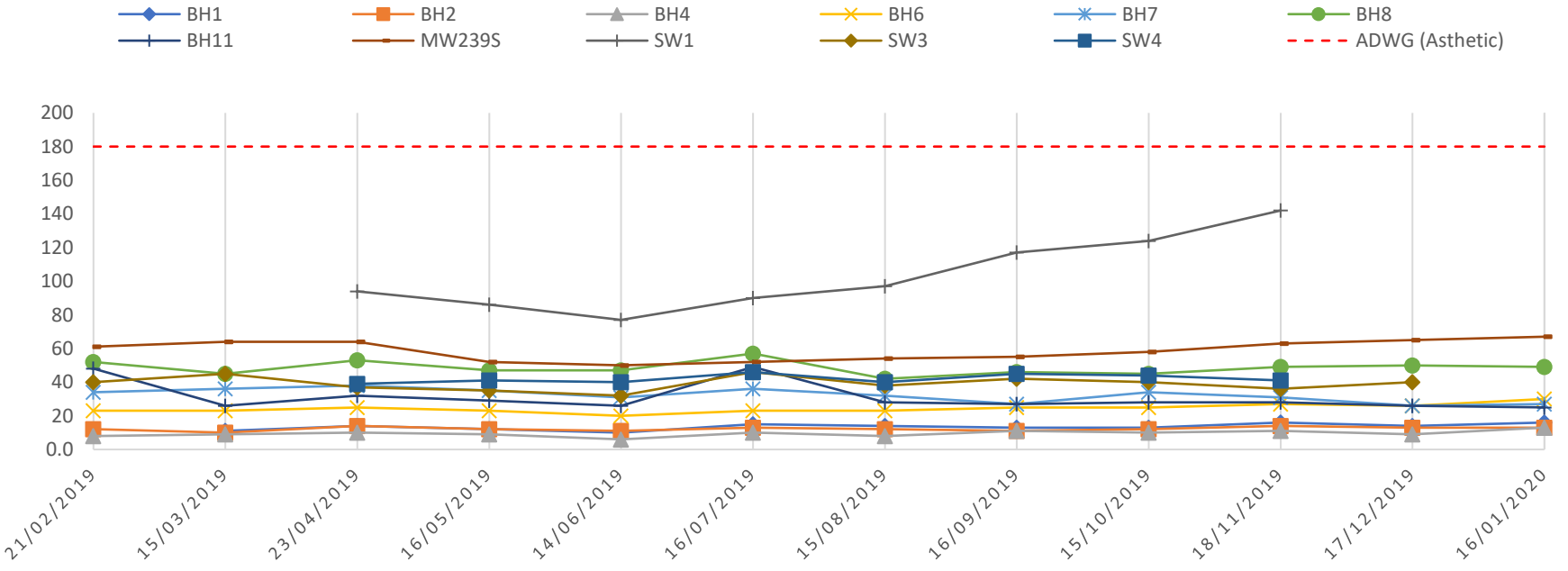


Chart 13: Calcium(Ca) mg/L

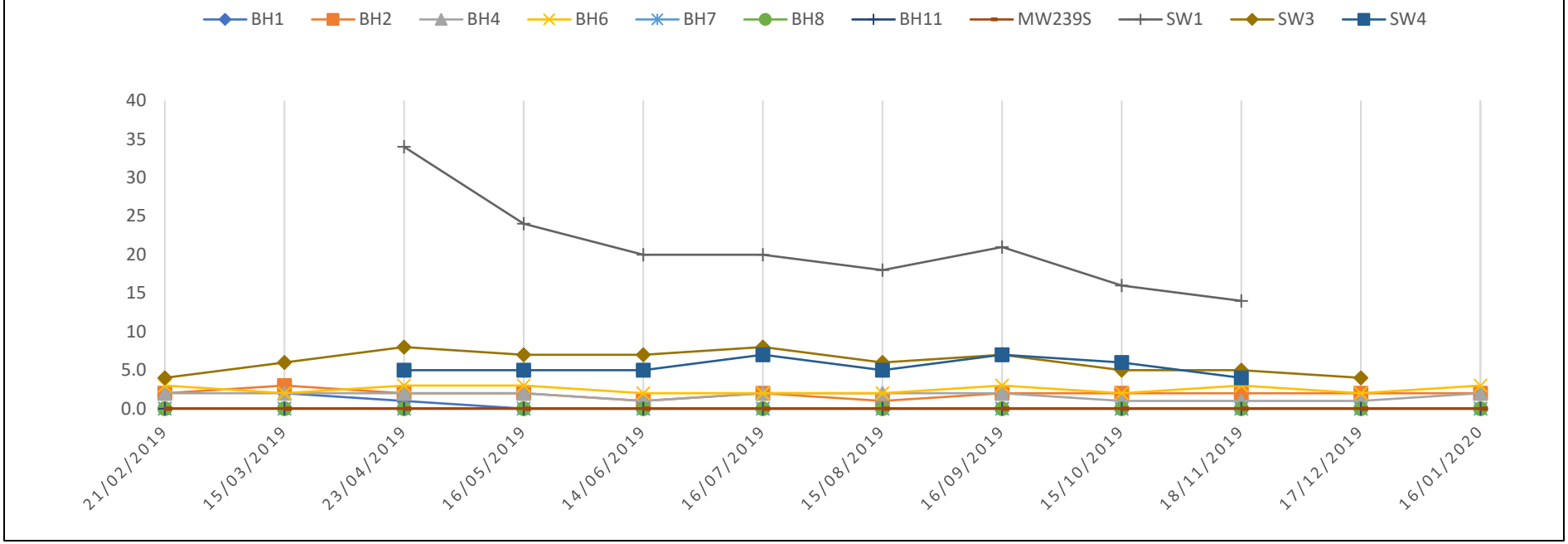
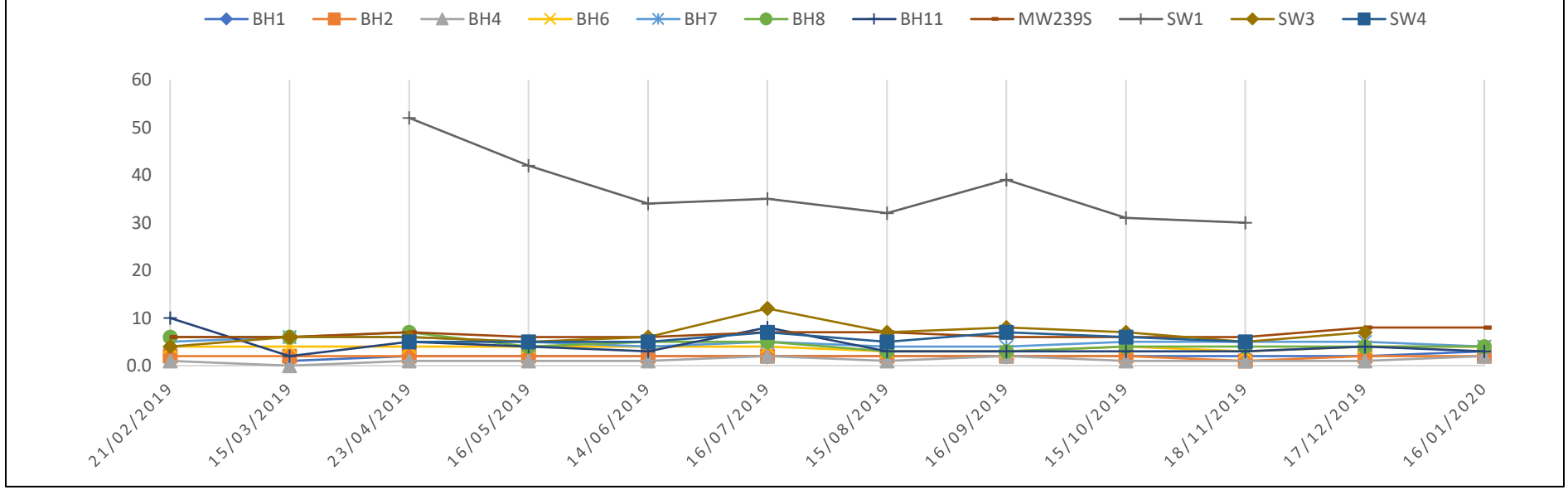


Chart 14: Magnesium(Mg) mg/L



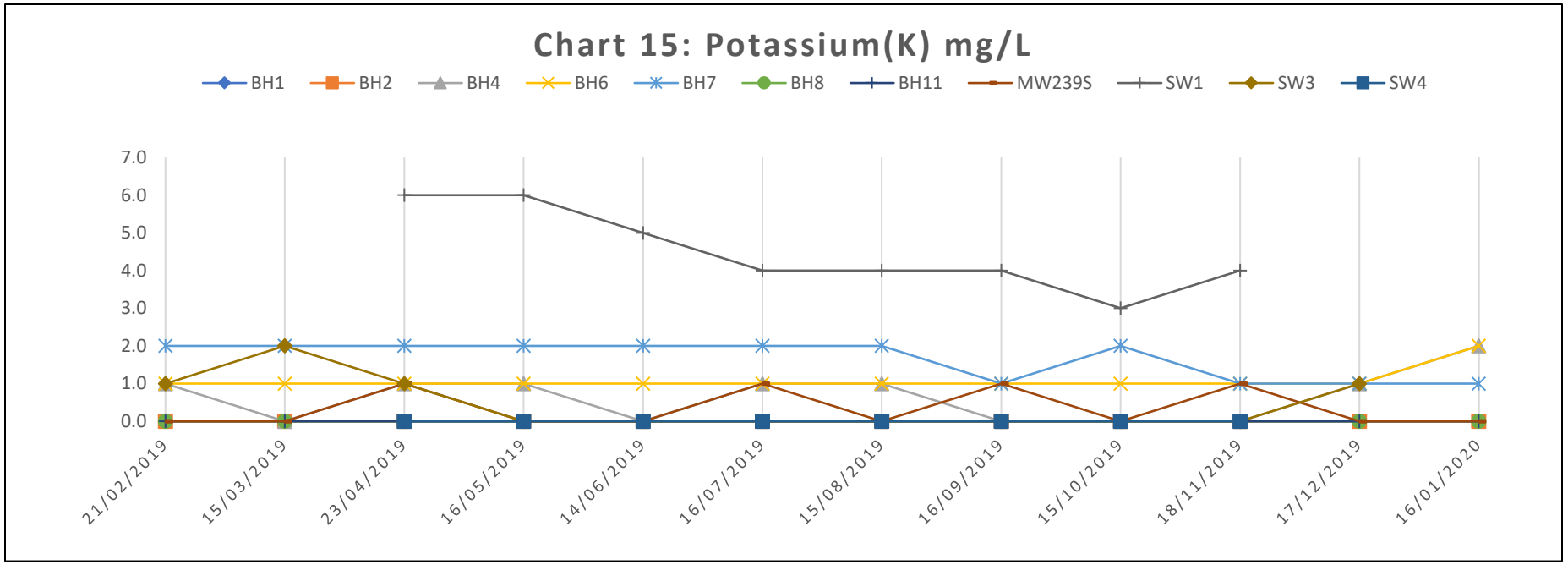


Chart 15: Potassium(K) mg/L
BH1
BH2
BH4
BH6
BH7
BH8
BH11
MW239S
SW1
SW3
SW4
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
21/02/2019
15/03/2019
23/04/2019
16/05/2019
14/06/2019
16/07/2019
15/08/2019
16/09/2019
15/10/2019
18/11/2019
17/12/2019
16/01/2020

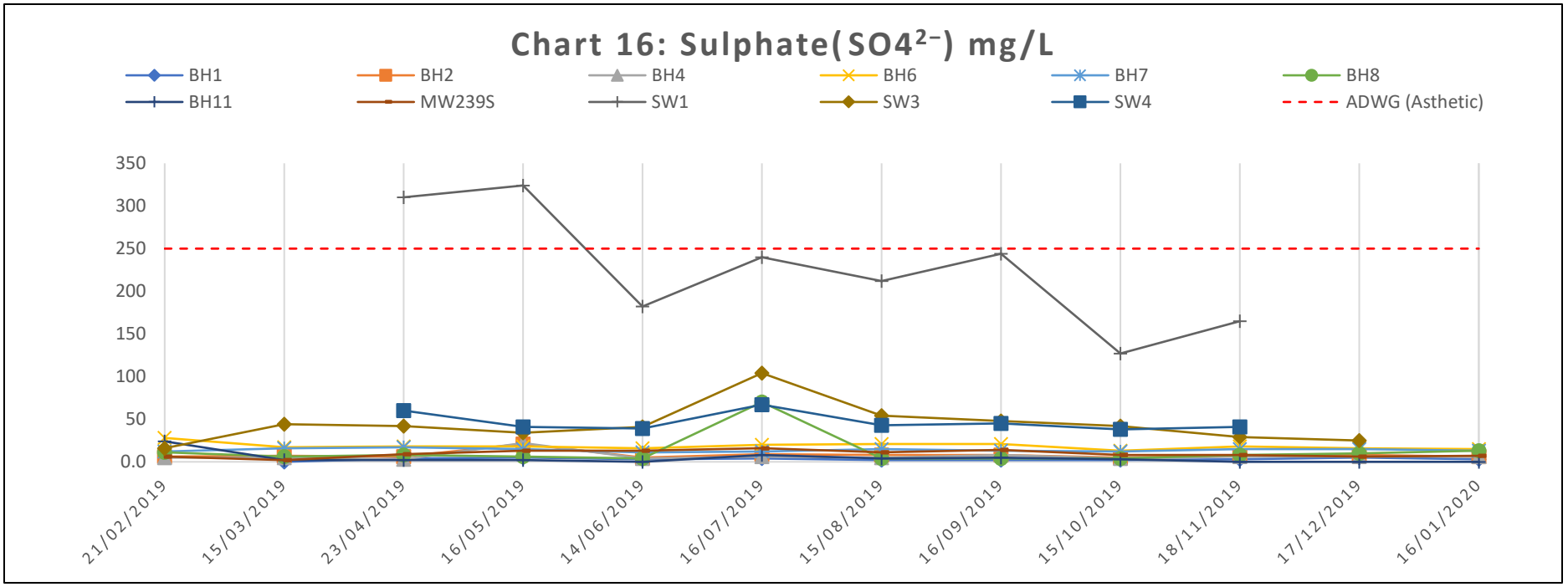


Chart 16: Sulphate($SO4^{2-}$) mg/L
BH1
BH2
BH4
BH6
BH7
BH8
BH11
MW239S
SW1
SW3
SW4
ADWG (Asthetic)
350
300
250
200
150
100
50
0.0
21/02/2019
15/03/2019
23/04/2019
16/05/2019
14/06/2019
16/07/2019
15/08/2019
16/09/2019
15/10/2019
18/11/2019
17/12/2019
16/01/2020

Chart 17: Chloride (Cl) mg/L

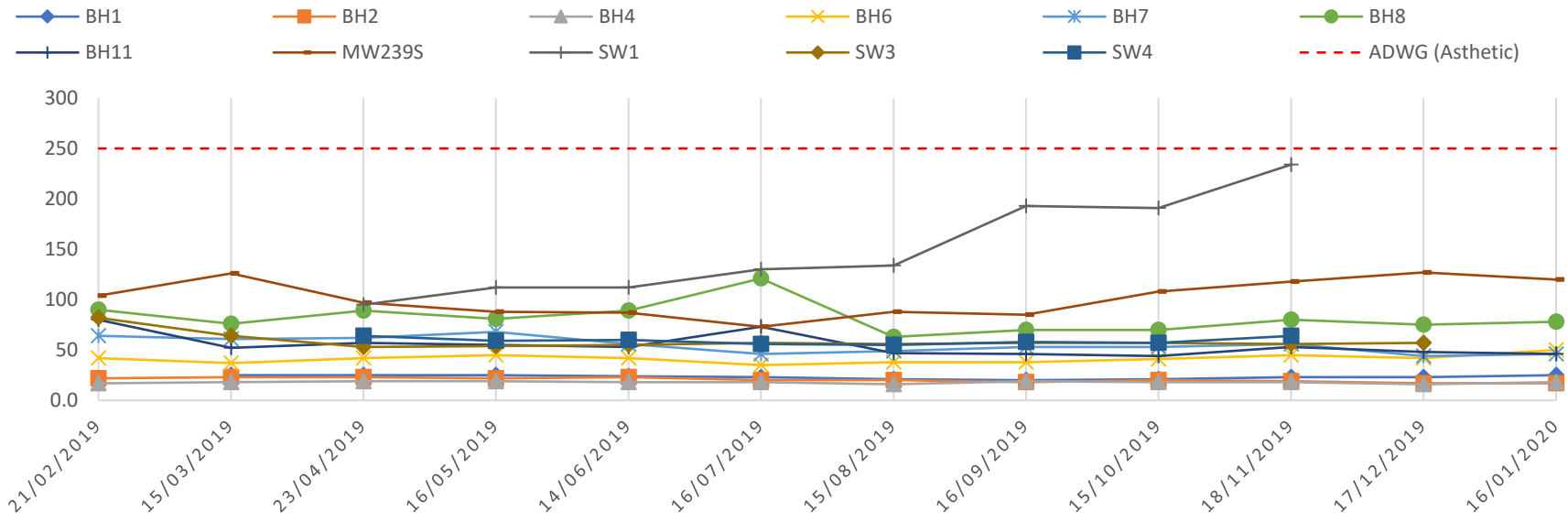
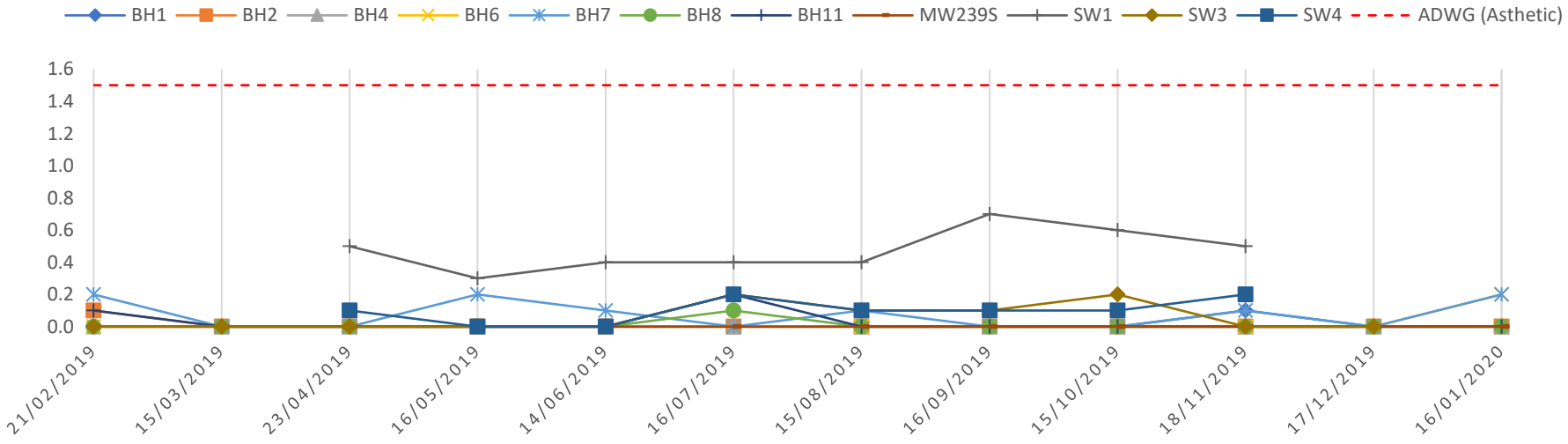


Chart 18: Fluoride (F^-) mg/L



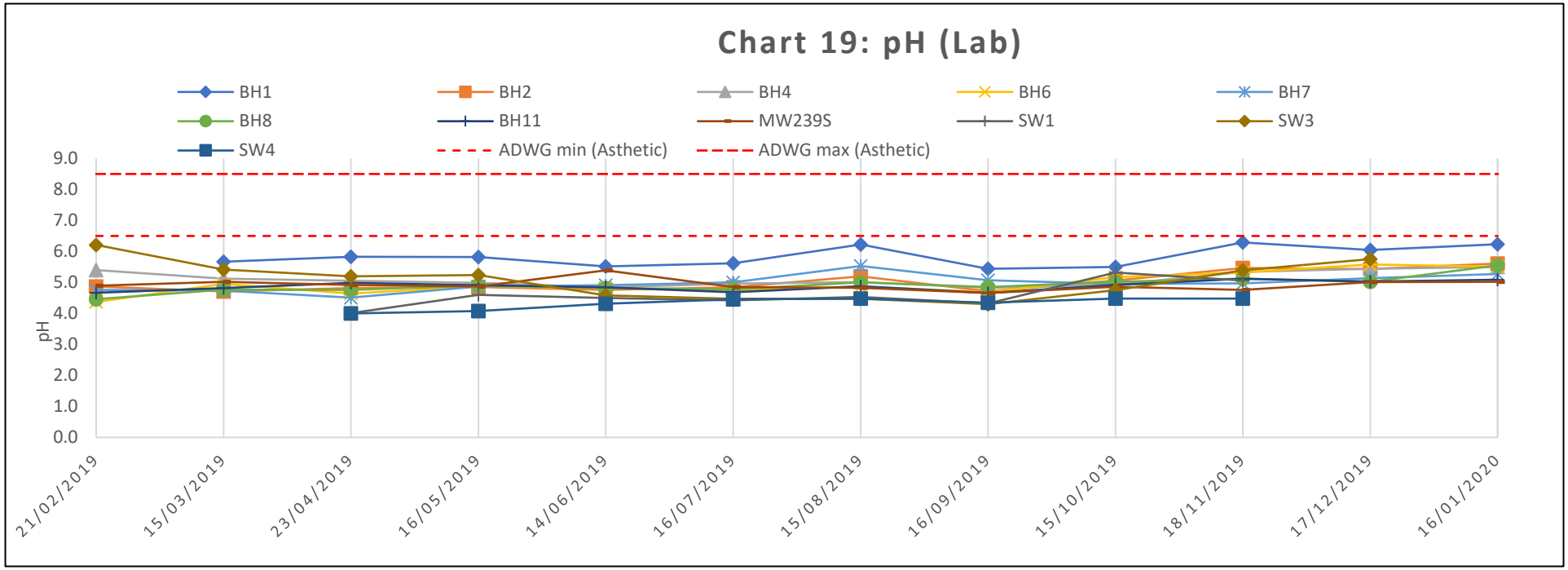


Chart 19: pH (Lab)
BH1
BH2
BH4
BH6
BH7
BH8
BH11
MW239S
SW1
SW3
SW4
ADWG min (Asthetic)
ADWG max (Asthetic)
pH
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
21/02/2019
15/03/2019
23/04/2019
16/05/2019
14/06/2019
16/07/2019
15/08/2019
16/09/2019
15/10/2019
18/11/2019
17/12/2019
16/01/2020

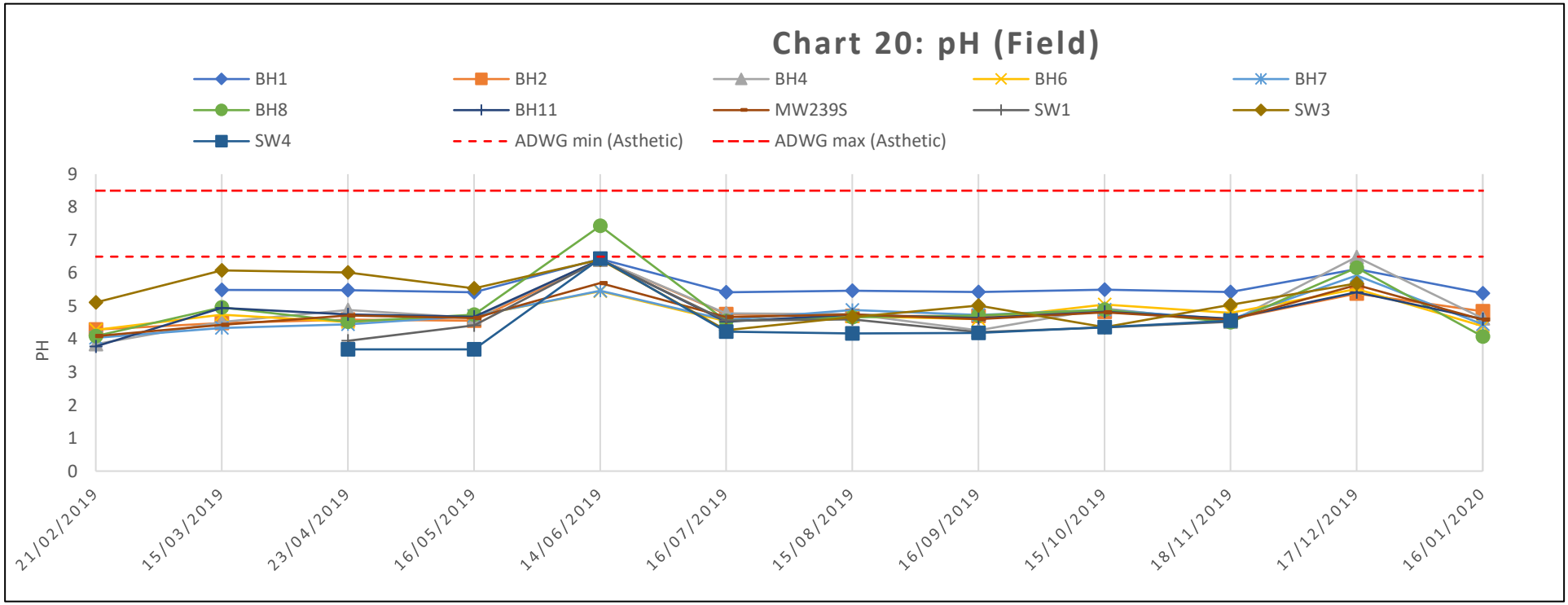


Chart 20: pH (Field)
BH1
BH2
BH4
BH6
BH7
BH8
BH11
MW239S
SW1
SW3
SW4
ADWG min (Asthetic)
ADWG max (Asthetic)
PH
9
8
7
6
5
4
3
2
1
0
21/02/2019
15/03/2019
23/04/2019
16/05/2019
14/06/2019
16/07/2019
15/08/2019
16/09/2019
15/10/2019
18/11/2019
17/12/2019
16/01/2020

Chart 21: TPH C_6 - C_9

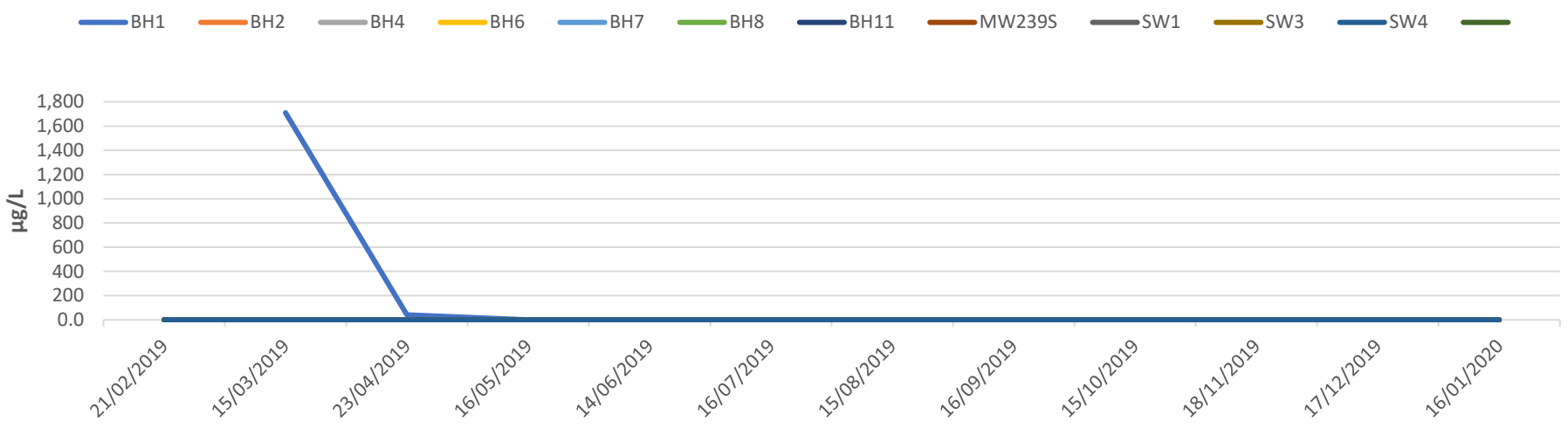


Chart 22: TPH C_{10}-C_{36} Sum - Silica Cleanup

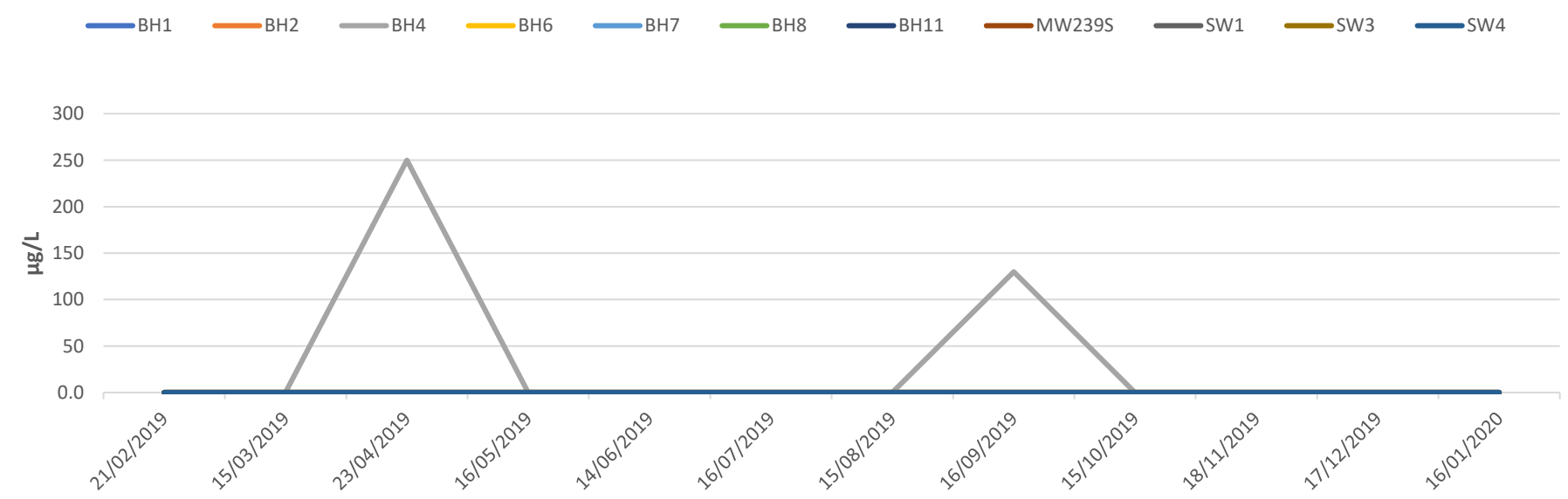


Chart 23: TRH C_{10}-C_{36} Sum - Silica Cleanup

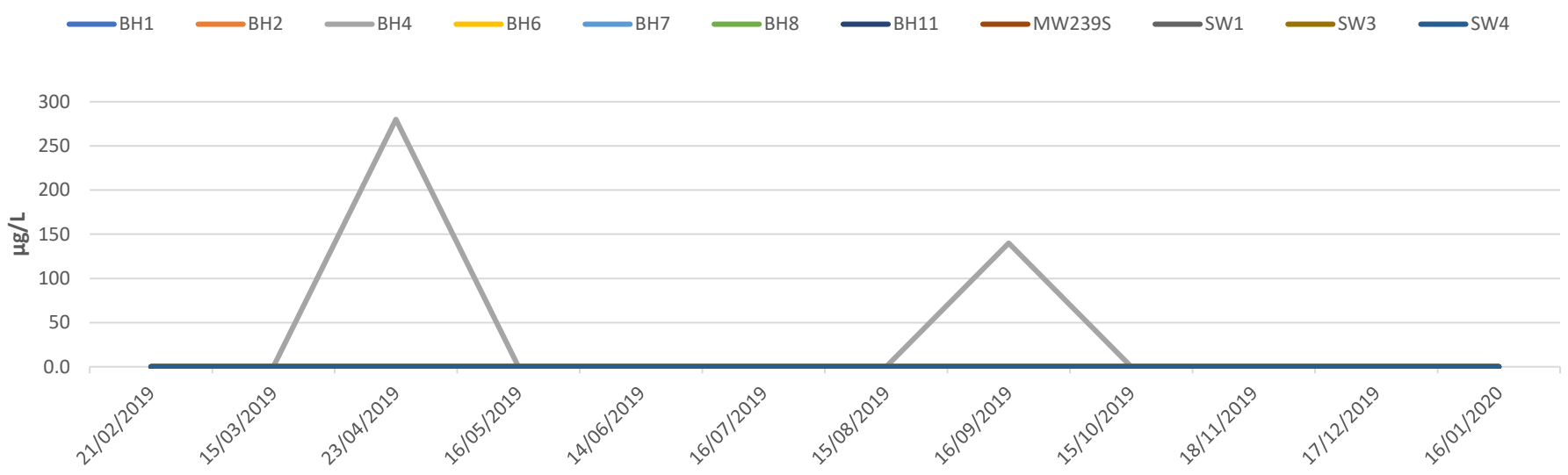
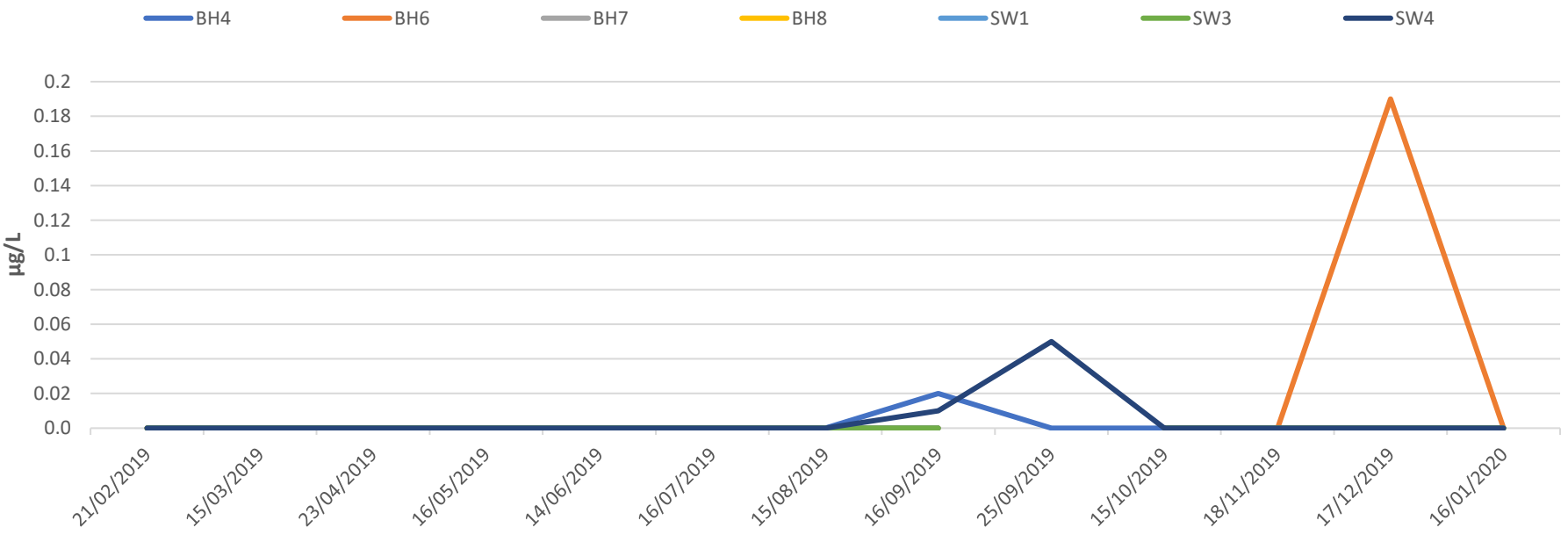


Chart 24: Sum of PFAS



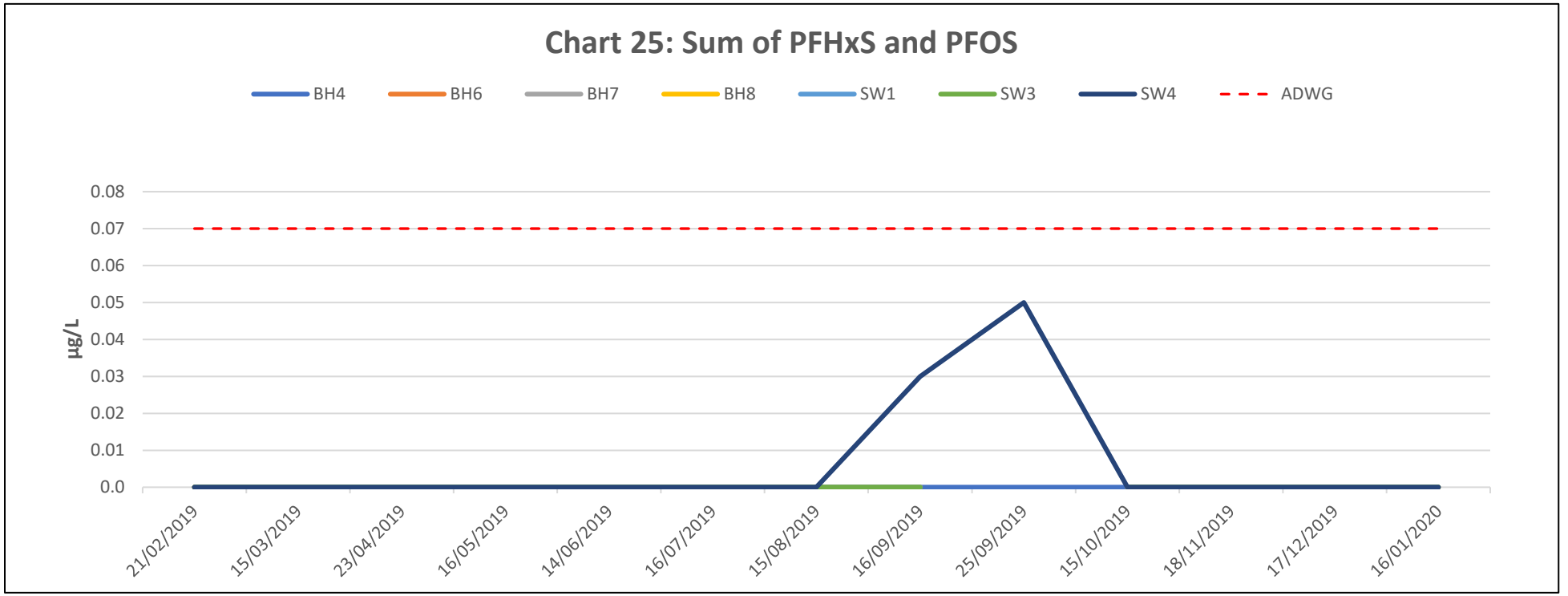


Chart 25: Sum of PFHxS and PFOS
BH4
BH6
BH7
BH8
SW1
SW3
SW4
ADWG
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.0
µg/L
21/02/2019
15/03/2019
23/04/2019
16/05/2019
14/06/2019
16/07/2019
15/08/2019
16/09/2019
25/09/2019
15/10/2019
18/11/2019
17/12/2019
16/01/2020

APPENDIX A: RCA AUSTRALIA 2015 (BORELOGS AND LABORATORY ANALYSES)

GEOTECHNICAL BOREHOLE LOG

BH1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 24/11/2014
DATE COMPLETED: 24/11/2014
SURFACE RL: 8.21 m AHD
COORDS: 387741.17 m E 6369495.82 m N MGA94 56
DRILL MODEL: 4WD Mounted Drill Rig
DRILLER NAME: Port Stephens Drilling Pty Ltd

Borehole Information						Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
AD/T				8.0	0.25		SP	TOPSOIL, SAND, medium grained, yellow-grey, trace of fine gravel, trace of organics, TOPSOIL/AEOLIAN	D - M		Concrete
		0.50m	0.50m		0.5		SP	SAND, medium grained, brown, indurated (weakly cemented), AEOLIAN	D	D - VD	Bentonite
		SPT 7, 11, 14 N=25	D	7.5	0.80		SP	SAND, medium grained, pale grey, AEOLIAN		VD - MD	
		0.95m	0.95m		1.0						
		1.50m	1.50m	7.0	1.5			Becoming grey with a trace of carbonaceous material at 1.5m	D - M	MD	
		SPT 2, 2, 4 N=6	D	6.5							
		1.95m	1.95m		2.0						
				6.0							Sand Backfill
					2.5						
		3.00m	3.00m	5.5	3.0						
		SPT 3, 6, 5 N=11	D		3.10		SP	SAND, medium grained, very dark brown, trace of silt, lightly indurated (weakly cemented), AEOLIAN			
		3.45m	3.45m	5.0	3.5						
				4.5							
					4.00		SP	SAND, medium to coarse grained, brown, trace of silt, AEOLIAN	M		
		4.50m	4.50m	4.0	4.5						
		SPT 4, 7, 7 N=14	D		4.65		SP	SAND, medium grained, white, AEOLIAN	M - W		Bentonite
		4.95m	4.95m	3.5							Sand (cave in)

LOGGED: TH | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 24/11/2014
DATE COMPLETED: 24/11/2014
SURFACE RL: 8.21 m AHD
COORDS: 387741.17 m E 6369495.82 m N MGA94 56
DRILL MODEL: 4WD Mounted Drill Rig
DRILLER NAME: Port Stephens Drilling Pty Ltd

Borehole Information | Field Material Information

METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
Hollow Flight Auger	24/11/14 ▽			3.0			SP	SAND, medium grained, white, AEOLIAN	M - W	MD	Sand (cave in)
					5.50		SP	SAND, medium grained, pale grey-brown, trace of silt, AEOLIAN	W	D	
		6.00m	6.00m	2.5	6.0						Fine Gravel Backfill
		SPT 7, 10, 15 N=25 6.45m	D 6.45m	2.0	6.5						
		7.50m	7.50m	1.5	7.0						
		SPT 14, 12, 14 N=26 7.95m	D 7.95m	1.0	7.5			SAND, as above			Screen (encapsulated in filter sock)
		9.00m	9.00m	0.5	8.0						
		SPT 3, 10, 21 N=31 9.45m	D 9.45m	0.0	8.5						
				-0.5	9.0			SAND, as above			
				-1.0	9.45						
				-1.5	9.5			BOREHOLE BH1 TERMINATED AT 9.45 m			

LOGGED: TH | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH2

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 25/11/2014
DATE COMPLETED: 25/11/2014
SURFACE RL: 7.40 m AHD
COORDS: 387704.72 m E 6369175.14 m N MGA94 56
DRILL MODEL: 4WD Mounted Drill Rig
DRILLER NAME: Port Stephens Drilling Pty Ltd

Borehole Information | Field Material Information

METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
AD/T				7.40	0.00		SP	FILL, Gravelly SAND, fine to medium grained, brown, sub rounded gravel and cobbles, up to 80-100mm size	D		Concrete
					0.30		SP	SAND, fine to medium grained, dark brown, trace of organic matter (roots), and fine to medium sub rounded-rounded gravel, AEOLIAN	D - M	MD - D	Bentonite
		0.50m	0.50m	7.0	0.5						
		SPT 2, 4, 6 N=10	D		0.80		SP	SAND, fine to medium grained, pale brown, AEOLIAN			
		0.95m	0.95m	6.5	1.0						
		1.50m	1.50m	6.0	1.5						
		SPT 3, 4, 5 N=9	D		1.80		SP	SAND, fine to medium grained, brown with some dark brown mottles, AEOLIAN			
		1.95m	1.95m	5.5	2.0						
				5.0	2.5						Sand Backfill
		3.00m	3.00m	4.5	3.0			SAND, as above, brown/dark brown			
		SPT 6, 8, 11 N=19	D		3.30		SP	SAND, fine to medium grained, very dark brown, with a trace to some silt, AEOLIAN	M	D	
		3.45m	3.45m	4.0	3.5						
				3.5	4.00		SP	SAND, medium grained, very pale brown, with a trace of silt, AEOLIAN			Bentonite
		4.50m	4.50m	3.0	4.5						
		SPT 5, 10, 11 N=21	D								Sand (cave in)
		4.95m	4.95m	2.5							

LOGGED: CJM | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH2

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 25/11/2014
DATE COMPLETED: 25/11/2014
SURFACE RL: 7.40 m AHD
COORDS: 387704.72 m E 6369175.14 m N MGA94 56
DRILL MODEL: 4WD Mounted Drill Rig
DRILLER NAME: Port Stephens Drilling Pty Ltd

Borehole Information						Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
Hollow Flight Auger	25/11/14 ▽			2.0	5.00		SP	SAND, fine to medium grained, pale brown, with a trace of silt, AEOLIAN	M W	D	Fine Gravel Backfill
		6.00m	6.00m	1.5	5.5						
		SPT 6, 10, 17 N=27	D	1.0	6.0			SAND, as above, pale brown			
		6.45m	6.45m	0.5	6.5						
				0.0	7.0			Becoming brown to dark brown at ~7.0m		VD	Screen (encapsulated in filter sock)
		7.50m	7.50m	-0.5	7.5						
		SPT 8, 23, 29 N=52	D	-1.0	8.0			SAND, fine to medium grained, brown/dark brown			
		7.95m	7.95m	-1.5	8.5						
				-2.0	9.0						
		9.00m	9.00m	-2.5	9.45						
		SPT 12, 23, 36 N=59	D		9.5			SAND, as above			
		9.45m	9.45m					BOREHOLE BH2 TERMINATED AT 9.45 m			

LOGGED: CJM | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH3

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 25/11/2014
DATE COMPLETED: 25/11/2014
SURFACE RL: 7.03 m AHD
COORDS: 387751.72 m E 6368964.39 m N MGA94 56
DRILL MODEL: 4WD Mounted Drill Rig
DRILLER NAME: Port Stephens Drilling Pty Ltd

Borehole Information						Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
AD/T		0.50m	0.50m	7.0			SP	SAND, medium grained, pale brown-brown, AEOLIAN	D - M	D	Concrete
		SPT 3, 5, 7 N=12	D	6.5	0.5			Some rock fragments, up to ~100m size encountered at 0.3m-0.4m SAND, as above, becoming pale brown at 0.4m			
		0.95m	0.95m	6.0	1.0						
		1.50m	1.50m	5.5	1.5						
		SPT 3, 4, 4 N=8	D		1.70		SP	SAND, medium grained, brown-dark brown, AEOLIAN	M	MD	
		1.95m	1.95m	5.0	2.0			Becoming grey-brown at 2.0m			
				4.5	2.5						Sand Backfill
		3.00m	3.00m	4.0	3.0						
		SPT 2, 4, 5 N=9	D		3.20		SP	SAND, fine to medium grained, very dark brown, with a trace to some silt, AEOLIAN			
		3.45m	3.45m		3.50		SP	SAND, fine to medium grained, orange-brown, with a trace to some silt, AEOLIAN			
				3.5							
				3.0	4.0			Becoming yellow-brown with depth			
		4.50m	4.50m	2.5	4.5						
		SPT 2, 3, 3 N=6	D		4.70		SP	SAND, fine to medium grained, very pale brown, AEOLIAN			
		4.95m	4.95m								Bentonite

LOGGED: CJM | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH3

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 25/11/2014
DATE COMPLETED: 25/11/2014
SURFACE RL: 7.03 m AHD
COORDS: 387751.72 m E 6368964.39 m N MGA94 56
DRILL MODEL: 4WD Mounted Drill Rig
DRILLER NAME: Port Stephens Drilling Pty Ltd

Borehole Information | Field Material Information

METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
Hollow Flight Auger	25/11/14 ▽	6.00m	6.00m	2.0	5.00		SP	SAND, fine to medium grained, pale brown, AEOLIAN	M	MD	Fine Gravel Backfill
		SPT 4, 12, 24 N=36	D	1.5	5.5				W	D - VD	
		6.45m	6.45m	1.0	6.0						
					6.20		SP	SAND, fine to medium grained, brown-dark brown, AEOLIAN			
				0.5	6.5						
		7.50m	7.50m	0.0	7.0					VD	Screen (encapsulated in filter sock)
		SPT 5, 23, 27 N=50	D	-0.5	7.5			SAND, as above, brown			
		7.95m	7.95m	-1.0	8.0						
				-1.5	8.5						
		9.00m	9.00m	-2.0	9.0						
		SPT 8, 19, 37 N=56	D								
		9.45m	9.45m		9.45						
				-2.5	9.5			BOREHOLE BH3 TERMINATED AT 9.45 m			

LOGGED: CJM | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH4

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 26/11/2014
DATE COMPLETED: 26/11/2014
SURFACE RL: 2.81 m AHD
COORDS: 387854.96 m E 6368742.80 m N MGA94 56
DRILL MODEL: 4WD Mounted Drill Rig
DRILLER NAME: Port Stephens Drilling Pty Ltd

Borehole Information | Field Material Information

METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
AD/T				2.5	0.30		SP	TOPSOIL, SAND, medium grained, brown, with silt and fine rounded-sub rounded gravel, rootlets abundant	D		Concrete
		0.50m	0.50m		0.5		SP	SAND, fine to medium grained, pale brown, trace of silt, AEOLIAN		L	Bentonite
		SPT 2, 1, 1 N=2	D	2.0							
		0.95m	0.95m		1.0						Sand Backfill
					1.10		OL	Organic Sandy SILT, low plasticity, very dark grey, fine to medium grained sand, AEOLIAN	M		
	26/11/14			1.5	1.30		SM	Silty SAND, fine to medium grained, dark brown-grey, trace of organics, AEOLIAN	M - W		
		1.50m	1.50m		1.5				W	L - MD	Bentonite
Hollow Flight Auger		SPT 1, 2, 2 N=4	D	1.0				Becoming with clay at 1.8m			
		1.95m	1.95m		2.0						Sand (cave in)
				0.5							
					2.50		SP	SAND, fine to medium grained, brown, trace of silt, AEOLIAN			Fine Gravel Backfill
		3.00m	3.00m	0.0	3.0					MD - D	
		SPT 5, 8, 13 N=21	D								
		3.45m	3.45m	-0.5	3.30		SP	SAND, fine to medium grained, pale yellow-grey, AEOLIAN		D - VD	
					3.5						Screen (encapsulated in filter sock)
				-1.0							
					4.0						
		4.50m	4.50m	-1.5							
		SPT 13, 23, 28 N=51	D		4.5					VD	
		4.95m	4.95m	-2.0				SAND, as above			

LOGGED: TH | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH4

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 26/11/2014
DATE COMPLETED: 26/11/2014
SURFACE RL: 2.81 m AHD
COORDS: 387854.96 m E 6368742.80 m N MGA94 56
DRILL MODEL: 4WD Mounted Drill Rig
DRILLER NAME: Port Stephens Drilling Pty Ltd

Borehole Information						Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
Hollow Flight Auger		6.00m	6.00m	-2.5	5.5		SP	SAND, fine to medium grained, pale yellow-grey, AEOLIAN	W	VD	Screen (encapsulated in filter sock)
		SPT 15, 19, 22 N=41	D	-3.0	6.0						
		6.45m	6.45m	-3.5	6.45						
				-4.0	6.5			BOREHOLE BH4 TERMINATED AT 6.45 m			
				-4.5	7.0						
				-5.0	7.5						
				-5.5	8.0						
				-6.0	8.5						
				-6.5	9.0						
				-7.0	9.5						

LOGGED: TH | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH5

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 26/11/2014
DATE COMPLETED: 26/11/2014
SURFACE RL: 6.76 m AHD
COORDS: 388768.52 m E 6369334.74 m N MGA94 56
DRILL MODEL: 4WD Mounted Drill Rig
DRILLER NAME: Port Stephens Drilling Pty Ltd

Borehole Information | Field Material Information

METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
AD/T	26/11/14 ▽			6.5	0.05		SP	FILL, SAND, medium grained, pale grey	D		Concrete
							SP	FILL, SAND, medium grained, pale yellow-grey	D - M		
					0.30		SM	FILL, Silty SAND, fine to medium grained, dark grey			Bentonite
		0.50m	0.50m		0.50		SP	FILL, SAND, medium grained, pale grey		MD	
		SPT 2, 4, 3 N=7	D	6.0	1.0						
		0.95m	0.95m								
		1.50m	1.50m	5.5	1.5			FILL, SAND, medium grained, white with dark grey speckles		L - MD	
		SPT 2, 2, 2 N=4	D	5.0	2.0						
		1.95m	1.95m								
			2.50m	4.5	2.50		SP	FILL, SAND, fine to medium grained, dark grey (sparkly)			Sand Backfill
		3.00m	D 3.00m	4.0	3.0						
		SPT 1, 2, 3 N=5	D	3.5	3.30		SP	SAND, fine to medium grained, white,			
		3.45m	3.45m		3.5						
		4.50m	4.50m	3.0	4.0						
				2.5	4.5				M	MD	
		SPT 5, 5, 6 N=11	D	2.0	4.80		SP	SAND, medium grained, brown, a trace of silt and clay, AEOLIAN	M - W		Bentonite
		4.95m	4.95m								

LOGGED: TH | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH5

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 26/11/2014
DATE COMPLETED: 26/11/2014
SURFACE RL: 6.76 m AHD
COORDS: 388768.52 m E 6369334.74 m N MGA94 56
DRILL MODEL: 4WD Mounted Drill Rig
DRILLER NAME: Port Stephens Drilling Pty Ltd

Borehole Information						Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
Hollow Flight Auger				1.5	5.50		SP	SAND, medium grained, brown, a trace of silt and clay, AEOLIAN	W	MD	Fine Gravel Backfill
							SP	SAND, fine to medium grained, brown, a trace of silt, AEOLIAN		MD - D	
		6.00m	6.00m	1.0	6.0						
		SPT 4, 6, 11 N=17	D	0.5	6.5						Screen (encapsulated in filter sock)
		6.45m	6.45m	0.0	7.0						
		7.50m	7.50m	-0.5	7.5					D - VD	
		SPT 10, 18, 20 N=38	D	-1.0	8.0						
		7.95m	7.95m	-1.5	8.5						
		9.00m	9.00m	-2.0	9.0					VD	
		SPT 13, 22/130mm N=R 9.28m	D 9.28m	-2.5	9.28			BOREHOLE BH5 TERMINATED AT 9.28 m			
				-3.0	9.5						

LOGGED: TH | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH6

SHEET 1 OF 1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 27/11/2014
DATE COMPLETED: 27/11/2014
SURFACE RL: 3.01 m AHD
COORDS: 388729.78 m E 6369582.26 m N MGA94 56
DRILL MODEL: 4WD Mounted Drill Rig
DRILLER NAME: Port Stephens Drilling Pty Ltd

Borehole Information | Field Material Information

METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
AD/T	27/11/14	0.50m	0.50m	2.5	0.5		SP	FILL, Gravelly SAND, fine to medium grained, pale brown, fine to medium gravel	D - M		Concrete
					0.30		SM	Silty SAND, fine to medium grained, dark grey-brown, a trace of clay, with organics, AEOLIAN	M		Bentonite
					0.40		SP	SAND, medium grained, grey-brown, with a trace to some silt, a trace of clay, AEOLIAN		MD	
		SPT 3, 3, 3 N=6	D								Sand Backfill
		0.95m	0.95m	2.0	1.0				W		Bentonite
					1.20		SP	SAND, fine to medium grained, grey-brown, with a trace to some silt, AEOLIAN			
		1.50m	1.50m	1.5	1.5						
Hollow Flight Auger		SPT 2, 2, 3 N=5	D		1.70		SP	SAND, fine to medium grained, pale yellow-brown, AEOLIAN			Sand (cave in)
		1.95m	1.95m	1.0	2.0						
				0.5	2.5						Fine Gravel Backfill
		3.00m	3.00m	0.0	3.0					D - VD	
		SPT 5, 9, 12 N=21	D					SAND, as above			Screen (encapsulated in filter sock)
		3.45m	3.45m	-0.5	3.5						
				-1.0	4.0						
		4.50m		-1.5	4.5						
		SPT 7, 10, 14 N=24						SAND, as above			
		4.95m									

BOREHOLE BH6 TERMINATED AT 4.95 m

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GEOTECHNICAL BOREHOLE LOG

BH7

SHEET 1 OF 1

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 27/11/2014
DATE COMPLETED: 27/11/2014
SURFACE RL: 2.60 m AHD
COORDS: 388827.76 m E 6369245.32 m N MGA94 56
DRILL MODEL: 4WD Mounted Drill Rig
DRILLER NAME: Port Stephens Drilling Pty Ltd

Borehole Information | Field Material Information

METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
AD/T				2.5	0.07		SM	TOPSOIL/FILL, Silty SAND, fine to medium grained, dark grey-brown, with organics, abundant roots	M	VD	Concrete
							SP	SAND, fine to medium grained, pale grey with black grains, AEOLIAN/FILL?			Bentonite
		0.50m	0.50m		0.5						
				2.0					M - W		Sand Backfill
		SPT 4, 8, 13 N=21	D								
	27/11/14	0.95m	0.95m		1.0						Bentonite
				1.5							
					1.20		SM	Silty SAND, fine to medium grained, very dark brown-grey, with organics, AEOLIAN	W	MD - D	
		1.50m	1.50m		1.5						
		SPT 3, 5, 5 N=10	D	1.0							Sand (cave in)
		1.95m	1.95m		2.0						
				0.5							
					2.50		SP	SAND, fine to medium grained, grey-brown, with trace of silt, AEOLIAN		D - VD	Fine Gravel Backfill
				0.0							
		3.00m	3.00m		3.0						
		SPT 3, 7, 15 N=22	D	-0.5							Screen (encapsulated in filter sock)
		3.45m	3.45m		3.5						
				-1.0							
					4.00		SP	SAND, fine to medium grained, pale brown, with trace of silt, AEOLIAN		VD	
				-1.5							
		4.50m	4.50m		4.5						
		SPT 6, 14, 18 N=32	D	-2.0							
		4.95m	4.95m								

Hollow Flight Auger

BOREHOLE BH7 TERMINATED AT 4.95 m

LOGGED: TH | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH8

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 28/11/2014
DATE COMPLETED: 28/11/2014
SURFACE RL: 3.28 m AHD
COORDS: 389178.27 m E 6369271.68 m N MGA94 56
DRILL MODEL: 4WD Mounted Drill Rig
DRILLER NAME: Port Stephens Drilling Pty Ltd

Borehole Information						Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
AD/T				3.0	0.35		SP	SAND, medium grained, grey, a trace of vegetation, AEOLIAN	D		Concrete
		0.50m	0.50m		0.5		SP	SAND, medium grained, white-pale grey, AEOLIAN		MD	Bentonite
		SPT 2, 2, 5 N=7	D	2.5							
		0.95m	0.95m		1.0						Sand Backfill
				2.0	1.30		SP	SAND, medium grained, dark brown, a trace of silt, AEOLIAN	M	D - VD	
		1.50m	1.50m		1.5						Bentonite
	26/11/14	SPT 11, 9, 11 N=20	D	1.5					W		
		1.95m	1.95m		2.0						Sand (cave in)
				1.0							
					2.50		SP	SAND, medium grained, grey-brown, with a trace of silt, AEOLIAN		VD	
				0.5							
		3.00m	3.00m		3.0						Fine Gravel Backfill
Hollow Flight Auger		SPT 9, 15, 17 N=32	D	0.0							
		3.45m	3.45m		3.5						
				-0.5							
					4.0						Screen (encapsulated in filter sock)
				-1.0							
		4.50m	4.50m		4.5						
		SPT 19, 19, 20/70mm N=R 4.87m	D	-1.5				SAND, as above			
			4.87m								

LOGGED: TH | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH8

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 28/11/2014
DATE COMPLETED: 28/11/2014
SURFACE RL: 3.28 m AHD
COORDS: 389178.27 m E 6369271.68 m N MGA94 56
DRILL MODEL: 4WD Mounted Drill Rig
DRILLER NAME: Port Stephens Drilling Pty Ltd

Borehole Information						Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
Hollow Flight Auger		6.00m SPT 9, 20/130mm N=R 6.28m	6.00m D 6.28m	-2.0 -2.5 -3.0	5.5 6.0 6.28		SP	SAND, medium grained, grey-brown, with a trace of silt, AEOLIAN	W	VD	Screen (encapsulated in filter sock)
								BOREHOLE BH8 TERMINATED AT 6.28 m			

-3.5 6.5
-4.0 7.0
-4.5 7.5
-5.0 8.0
-5.5 8.5
-6.0 9.0
-6.5 9.5

LOGGED: TH | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH9

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 09/12/2014
DATE COMPLETED: 10/12/2014
SURFACE RL: 17.07 m AHD
COORDS: 387520.43 m E 6368798.88 m N MGA94 56
DRILL MODEL: Track Mounted Drill Rig
DRILLER NAME: Total Drilling Pty Ltd

Borehole Information						Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
AD/T			0.20m	17.0	0.20		SP	SAND, medium grained, grey, trace of organics, AEOLIAN	M		Concrete
							SP	SAND, medium grained, pale yellow-brown, AEOLIAN		MD	Bentonite
			D	16.5	0.5						
		1.00m	1.00m		1.0					MD - L	
		SPT 2, 2, 4 N=6	D	16.0							
		1.45m	1.45m		1.5						
				15.5							
				15.0	2.0						
		2.50m	2.50m		2.5					L	
		SPT 1, 1, 1 N=2	D	14.5							Sand Backfill
		2.95m	2.95m		3.0						
				14.0							
				13.5	3.5						
		4.00m	4.00m		4.0						
		SPT 2, 2, 2 N=4	D	13.0				SAND, as above			
		4.45m	4.45m		4.5						
				12.5							

LOGGED: TH | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH9

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 09/12/2014
DATE COMPLETED: 10/12/2014
SURFACE RL: 17.07 m AHD
COORDS: 387520.43 m E 6368798.88 m N MGA94 56
DRILL MODEL: Track Mounted Drill Rig
DRILLER NAME: Total Drilling Pty Ltd

Borehole Information						Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
AD/T				12.0	5.00		SP	SAND, medium grained, pale yellow-brown, AEOLIAN	M	L	
		5.50m	5.50m								
		SPT 2, 3, 3 N=6 5.95m	D 5.95m	11.5	5.5					L - MD	
				11.0	6.0						
				10.5	6.5						
		7.00m	7.00m								
		SPT 3, 3, 4 N=7 7.45m	D 7.45m	10.0	7.0						
				9.5	7.5						Sand Backfill
		8.50m	8.50m								
		SPT 3, 3, 3 N=6 8.95m	D 8.95m	9.0	8.0			Becoming darker in colour (orange-brown) at 8.8m		L	
				8.5	8.5						
				8.0	9.0						
				7.5	9.5						
		10.00m	10.00m								

LOGGED: TH | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH9

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 09/12/2014
DATE COMPLETED: 10/12/2014
SURFACE RL: 17.07 m AHD
COORDS: 387520.43 m E 6368798.88 m N MGA94 56
DRILL MODEL: Track Mounted Drill Rig
DRILLER NAME: Total Drilling Pty Ltd

Borehole Information						Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
AD/T		SPT 2, 3, 6 N=9 10.45m	D 10.45m	7.0	10.00		SP	SAND, medium grained, grey-brown, some zones of brown and pale yellow sand, AEOLIAN	M	L - MD	Sand Backfill
		13.00m	13.00m	4.0	13.00		SP	SAND, medium grained, grey-brown, AEOLIAN		MD - D	Bentonite
Hollow Flight Auger		SPT 5, 14, 15 N=29 13.45m	D 13.45m								Sand Backfill
		14.50m	14.50m	3.0				Becoming pale yellow-grey at ~14.0m			
		SPT 6, 14, 18 N=32 14.95m	D 14.95m	2.5							Fine Gravel Backfill

LOGGED: TH | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH9

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 09/12/2014
DATE COMPLETED: 10/12/2014
SURFACE RL: 17.07 m AHD
COORDS: 387520.43 m E 6368798.88 m N MGA94 56
DRILL MODEL: Track Mounted Drill Rig
DRILLER NAME: Total Drilling Pty Ltd

Borehole Information						Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
Hollow Flight Auger	09/12/14	16.10m SPT 3, 8, 17 N=25 16.55m 17.90m SPT 7, 25/130mm N=R 18.18m		2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5 -2.0 -2.5	15.00 15.5 16.0 16.5 17.0 17.5 18.0 18.18 18.5 19.0 19.5		SP	SAND, medium grained, pale yellow-grey, AEOLIAN	M W	MD - D D - VD	Screen (encapsulated in filter sock) Sand Backfill (cave in)
								BOREHOLE BH9 TERMINATED AT 18.18 m			

LOGGED: TH | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH10

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 10/12/2014
DATE COMPLETED: 10/12/2014
SURFACE RL: 6.09 m AHD
COORDS: 387931.22 m E 6369744.44 m N MGA94 56
DRILL MODEL: Track Mounted Drill Rig
DRILLER NAME: Total Drilling Pty Ltd

Borehole Information						Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
AD/T			0.20m	6.0	0.20		SP	SAND, medium grained, pale grey, with organics, AEOLIAN/TOPSOIL	D - M		Concrete
			D		0.5		SP	SAND, fine to medium grained, pale grey, AEOLIAN		MD	Bentonite
		1.00m	1.00m	5.5							
					1.0						Sand Backfill
		SPT 3, 3, 4 N=7	D	5.0	1.20		SM	Silty SAND, fine to medium grained, brown, slightly indurated (weakly cemented), AEOLIAN			
		1.45m	1.45m		1.30		SP	SAND, fine to medium grained, yellow-brown, with a trace of silt, AEOLIAN			
				4.5	1.5						Bentonite
					2.00						Fine Gravel backfill
		2.50m	2.50m	4.0			SP	SAND, fine to medium grained, pale grey, AEOLIAN	M		
Hollow Flight Auger	10/12/14	SPT 3, 4, 6 N=10	D	3.5	2.5				W		
		2.95m	2.95m								
				3.0	3.0						
					3.50		SP	SAND, fine to medium grained, yellow-brown, slightly indurated (weakly cemented), slight organic odour, AEOLIAN		D	Screen (encapsulated in filter sock)
		4.00m	4.00m	2.5							
					4.0						
		SPT 10, 17, 21 N=38	D	2.0	4.10		SP	SAND, fine to medium grained, dark grey-brown, with a trace to some silt, AEOLIAN		D - VD	
		4.45m	4.45m								
				1.5	4.5						
		5.00m									

LOGGED: TH | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH10

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 10/12/2014
DATE COMPLETED: 10/12/2014
SURFACE RL: 6.09 m AHD
COORDS: 387931.22 m E 6369744.44 m N MGA94 56
DRILL MODEL: Track Mounted Drill Rig
DRILLER NAME: Total Drilling Pty Ltd

Borehole Information						Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
		SPT 2, 11, 20 N=31 5.45m		1.0			SP	SAND, fine to medium grained, dark grey-brown, with a trace to some silt, AEOLIAN	W	D - VD	
				0.5	5.5			BOREHOLE BH10 TERMINATED AT 5.45 m			
				0.0	6.0						
				-0.5	6.5						
				-1.0	7.0						
				-1.5	7.5						
				-2.0	8.0						
				-2.5	8.5						
				-3.0	9.0						
				-3.5	9.5						

LOGGED: TH | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH11

SHEET 1 OF 2

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 11/12/2014
DATE COMPLETED: 11/12/2014
SURFACE RL: 6.02 m AHD
COORDS: 387650.66 m E 6369979.77 m N MGA94 56
DRILL MODEL: Track Mounted Drill Rig
DRILLER NAME: Total Drilling Pty Ltd

Borehole Information | Field Material Information

METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
AD/T			0.10m				SP	SAND, medium grained, pale grey-white, trace of silt, AEOLIAN Trace of organics from 0.0-0.1m	M		Concrete
			D	5.5	0.5						Bentonite
											Sand Backfill
		1.00m	1.00m								Bentonite
				5.0	1.0			Becoming white at 1.0m		MD - D	
		SPT 3, 6, 6 N=12	D								Sand Backfill
		1.45m	1.45m	4.5	1.5						
				4.0	2.00		SP	SAND, fine to medium grained, pale grey-brown, with a trace of silt, slight organic odour, AEOLIAN	M - W	MD	
Hollow Flight Auger	11/12/14								W		
		2.50m	2.50m	3.5	2.5						Fine Gravel Backfill
		SPT 2, 4, 6 N=10	D					SAND, as above			
		2.95m	2.95m	3.0	3.0						
				2.5	3.5						
		4.00m	4.00m	2.0	4.0			SAND, as above		D - VD	Screen (encapsulated in filter sock)
		SPT 5, 10, 17 N=27	D								
		4.45m	4.45m	1.5	4.5						

LOGGED: TH | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH11

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 11/12/2014
DATE COMPLETED: 11/12/2014
SURFACE RL: 6.02 m AHD
COORDS: 387650.66 m E 6369979.77 m N MGA94 56
DRILL MODEL: Track Mounted Drill Rig
DRILLER NAME: Total Drilling Pty Ltd

Borehole Information						Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
				0.5	5.00 5.5		SP	SAND, fine to medium grained, pale grey-brown, with a trace of silt, slight organic odour, AEOLIAN	W	D - VD	
		5.50m SPT 2, 8, 15 N=23 5.95m								D	
				0.0 -0.5 -1.0 -1.5 -2.0 -2.5 -3.0 -3.5	5.95 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5			BOREHOLE BH11 TERMINATED AT 5.95 m			

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GEOTECHNICAL BOREHOLE LOG

BH12

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 11/12/2014
DATE COMPLETED: 11/12/2014
SURFACE RL: 8.06 m AHD
COORDS: 388202.99 m E 6369332.97 m N MGA94 56
DRILL MODEL: Track Mounted Drill Rig
DRILLER NAME: Total Drilling Pty Ltd

Borehole Information						Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
AD/T			0.50m	8.0	0.50		SP	SAND, fine to medium grained, yellow-brown, AEOLIAN Trace of organics 0.0-0.1m	M		Concrete
			D	7.5	0.90		SP	SAND, fine to medium grained, white, AEOLIAN			Bentonite
		1.00m	1.00m		1.0		SM	Silty SAND, fine to medium grained, dark brown, slightly indurated (weakly cemented), AEOLIAN		L - MD	
		SPT 2, 1, 2 N=3	D	7.0	1.10		SP	SAND, fine to medium grained, white, AEOLIAN			
		1.45m	1.45m		1.5						
				6.5							Sand Backfill
					2.0						
		2.50m	2.50m	6.0							
					2.5					MD - D	
		SPT 3, 4, 9 N=13	D	5.5							
		2.95m	2.95m		3.0						
				5.0				Becoming pale yellow-brown at ~3.0m			
					3.5						
				4.5				Becoming pale grey at ~3.5m			Bentonite
		4.00m	4.00m		4.0						
		SPT 6, 9, 10 N=19	D	4.0				Becoming yellow-brown at 4.2m			Sand Backfill
		4.45m	4.45m		4.5						
				3.5							

LOGGED: TH | CHECKED: CJM | DATE: 18/02/2015

GEOTECHNICAL BOREHOLE LOG

BH12

RCA AUSTRALIA
GEOTECHNICAL • ENVIRONMENTAL

PROJECT No: 10059
CLIENT: Benelli Equity Pty Ltd
PROJECT: Proposed Sand Extraction
LOCATION: Cabbage Tree Road, Williamtown

DATE COMMENCED: 11/12/2014
DATE COMPLETED: 11/12/2014
SURFACE RL: 8.06 m AHD
COORDS: 388202.99 m E 6369332.97 m N MGA94 56
DRILL MODEL: Track Mounted Drill Rig
DRILLER NAME: Total Drilling Pty Ltd

Borehole Information | Field Material Information

METHOD	WATER	FIELD TEST	SAMPLE	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	BORE CONSTRUCTION
AD/T				3.0	5.00		SP	SAND, fine to medium grained, pale grey-brown, with a trace of silt, AEOLIAN	M	MD - D	
		5.50m	5.50m	2.5	5.5					MD	
Hollow Flight Auger	11/12/14	SPT 4, 7, 6 N=13	D						W		Fine Gravel Backfill
		5.95m	5.95m	2.0	6.0						
				1.5	6.5						
		7.00m		1.0	7.0						Screen (encapsulated in filter sock)
		SPT 3, 2, 7 N=9									
		7.45m		0.5	7.5						
		8.00m		0.0	8.0					VD	
		SPT 9, 25, 25/90mm N=R 8.39m			8.39			BOREHOLE BH12 TERMINATED AT 8.39 m			
				-0.5	8.5						
				-1.0	9.0						
				-1.5	9.5						

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Explanatory Notes – Soil Description

In engineering terms soil includes every type of uncemented or partially cemented inorganic material found in the ground. In practice, if the material can be remoulded by hand in its field condition or in water it is described as a soil. The dominant soil constituent is given in capital letters, with secondary textures in lower case. The dominant feature is assessed from the Unified Soil Classification system and a soil symbol is used to define a soil layer.

METHOD

Method	Description
AS	Auger Screwing
AD/V	Auger Drilling with V Bit
AD/T	Auger Drilling with TC bit
BH	Backhoe
CT	Cable Tool Rig
N	Natural Exposure
X	Existing Excavation
E	Excavator
EH	Excavator with Hammer
HA	Hand Auger
HQ	Diamond Core-63mm
NMLC	Diamond Core-52mm
NQ	Diamond Core-47mm
PT	Push Tube
RR	Rock Roller
DB	Washbore Drag Bit
WS	Washbore
AT	Air Track
DT	Diatube
Percussion	Percussion Drilling

Water

Water level at date shown

Seepage

NOT ENCOUNTERED: The borehole/test pit was dry soon after excavation. Inflow may have been observed had the borehole/test pit been left open for a longer period.

NOT OBSERVED: The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.

SAMPLING

Sample	Description
B	Bulk Disturbed Sample
D	Disturbed Sample
SPT	Standard Penetration Test
U50	Undisturbed Sample-50mm
ES	Soil Sample, Environmental
EW	Water Sample, Environmental
G	Gas Sample

UNIFIED SOIL CLASSIFICATION

The appropriate symbols are selected on the result of visual examination, field tests and available laboratory tests, such as sieve analysis, liquid limit and plasticity index.

USC Symbol	Description
GW	Well graded gravel
GP	Poorly graded gravel
GM	Silty gravel
GC	Clayey gravel
SW	Well graded sand
SP	Poorly graded sand
SM	Silty sand
SC	Clayey sand
ML	Silt of low plasticity
CL	Clay of low plasticity
OL	Organic soil of low plasticity
CI	Clay of medium plasticity
MH	Silt of high plasticity
CH	Clay of high plasticity
OH	Organic soil of high plasticity
Pt	Peaty soil

MOISTURE CONDITION

Dry	Cohesive soils are friable or powdery Cohesionless soil grains are free-running.
Moist	Soil feels cool, darkened in colour Cohesive soils can be moulded Cohesionless soil grains tend to adhere.
Wet	Cohesive soils usually weakened Free water forms on hands when handling.

For cohesive soils the following codes may also be used:

MC>PL	Moisture Content greater than the Plastic Limit.
MC-PL	Moisture Content near the Plastic Limit.
MC<PL	Moisture Content less than the Plastic Limit.

PLASTICITY

The potential for soil to undergo change in volume with moisture change is assessed from its degree of plasticity. The classification of the degree of plasticity in terms of the Liquid Limit (LL) is as follows.

Description of Plasticity	LL(%)
Low	<35
Medium	35 to 50
High	>50

COHESIVE SOILS – CONSISTENCY

The consistency of a cohesive soil is defined by descriptive terminology such as very soft, soft, firm, stiff, very stiff and hard. These terms are assessed by the shear strength of the soil as observed visually, by hand penetrometer values and by resistance to deformation to hand moulding. A Hand Penetrometer may be used in the field or the laboratory to provide an approximate assessment of the unconfined compressive strength (UCS) of cohesive soils. Undrained shear strength Cu = 0.5×UCS. The UCS values are recorded in kPa as follows:

Strength	Symbol	Unconfined Compressive Strength, q_u (kPa)
Very Soft	VS	< 25
Soft	S	25 to 50
Firm	F	50 to 100
Stiff	St	100 to 200
Very Stiff	VSt	200 to 400
Hard	H	> 400

COHESIONLESS SOILS – RELATIVE DENSITY

Relative density terms such as very loose, loose, medium, dense and very dense are used to describe silty and sandy material, and these are usually assessed based on penetration test results (eg Standard Penetration Test (SPT) N values) in conjunction with published correlations. Other condition terms, such as friable, powdery or crumbly may also be used.

Term	Symbol	Density Index
Very Loose	VL	0 to 15
Loose	L	15 to 35
Medium Dense	MD	35 to 65
Dense	D	65 to 85
Very Dense	VD	>85

COHESIONLESS SOILS PARTICLE SIZE DESCRIPTIVE TERMS

Name	Subdivision	Size
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	Coarse	20 mm to 63 mm
	medium	6 mm to 20 mm
	Fine	2.36 mm to 6 mm
Sand	Coarse	0.6 mm to 2.36 mm
	medium	0.2 mm to 0.6 mm
	fine	0.075 mm to 0.2 mm

Explanatory Notes - Rock Description

METHOD

Refer soil description sheet.

WATER

Refer soil description sheet.

ROCK QUALITY

The fracture spacing is shown where applicable and the Rock Quality Designation (RQD) or Total Core Recovery (TCR) is given where:

TCR (%) = $\frac{\text{length of core recovered}}{\text{length of core run}}$

RQD (%) = $\frac{\text{sum of axial lengths of core > 100mm long}}{\text{length of core run.}}$

ROCK MATERIAL WEATHERING

Rock weathering is described using the abbreviations and definitions used in AS1726.

Term	Symbol	Definition
Residual soil	RS	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
Extremely weathered rock	XW	Rock is weathered to such an extent that it has 'soil' properties, ie, it either disintegrates or can be remoulded in water.
Distinctly weathered rock	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Slightly weathered rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh rock	FR	Rock shows no sign of decomposition or staining.

ROCK STRENGTH

Rock strength is described using AS1726 and ISRM – Commission on Standardisation of Laboratory and Field Tests, 'Suggested method of determining the Uniaxial Compressive Strength of Rock materials and the Point Load Index' as follows:

Term	Symbol	Point Load Index Is_{50} (MPa)
Extremely Low	EL	≤0.03
Very Low	VL	>0.03 to ≤0.1
Low	L	>0.1 to ≤0.3
Medium	M	>0.3 to ≤1.0
High	H	>1 to ≤3
Very High	VH	>3 to ≤10
Extremely High	EH	>10

◀ Diametral Point Load Index test.

▼ Axial Point Load Index test.

DEFECT SPACING/BEDDING THICKNESS

Measured at right angles to defects of same set or bedding.

Term	Defect Spacing	Bedding
Extremely closely spaced	<6 mm	Thinly laminated
	6 to 20 mm	Laminated
Very closely spaced	20 to 60 mm	Very thin
Closely spaced	0.06 to 0.2 m	Thin
Moderately widely spaced	0.2 to 0.6 m	Medium
Widely spaced	0.6 to 0.2 m	Thick
Very widely spaced	>2 m	Very thick

DEFECT DESCRIPTION

Type	Definition
JT	Joint
BP	Bed Parting
CO	Contact
CS	Clay Seam
CZ	Crush Zone
DK	Dyke
DZ	Decomposed Zone
FC	Fracture
FZ	Fracture Zone
FL	Foliation
FLT	Fault
VN	Vein
SM	Seam
IS	Infilled Seam
SZ	Shear Zone
DB	Drill Break
HB	Handling Break

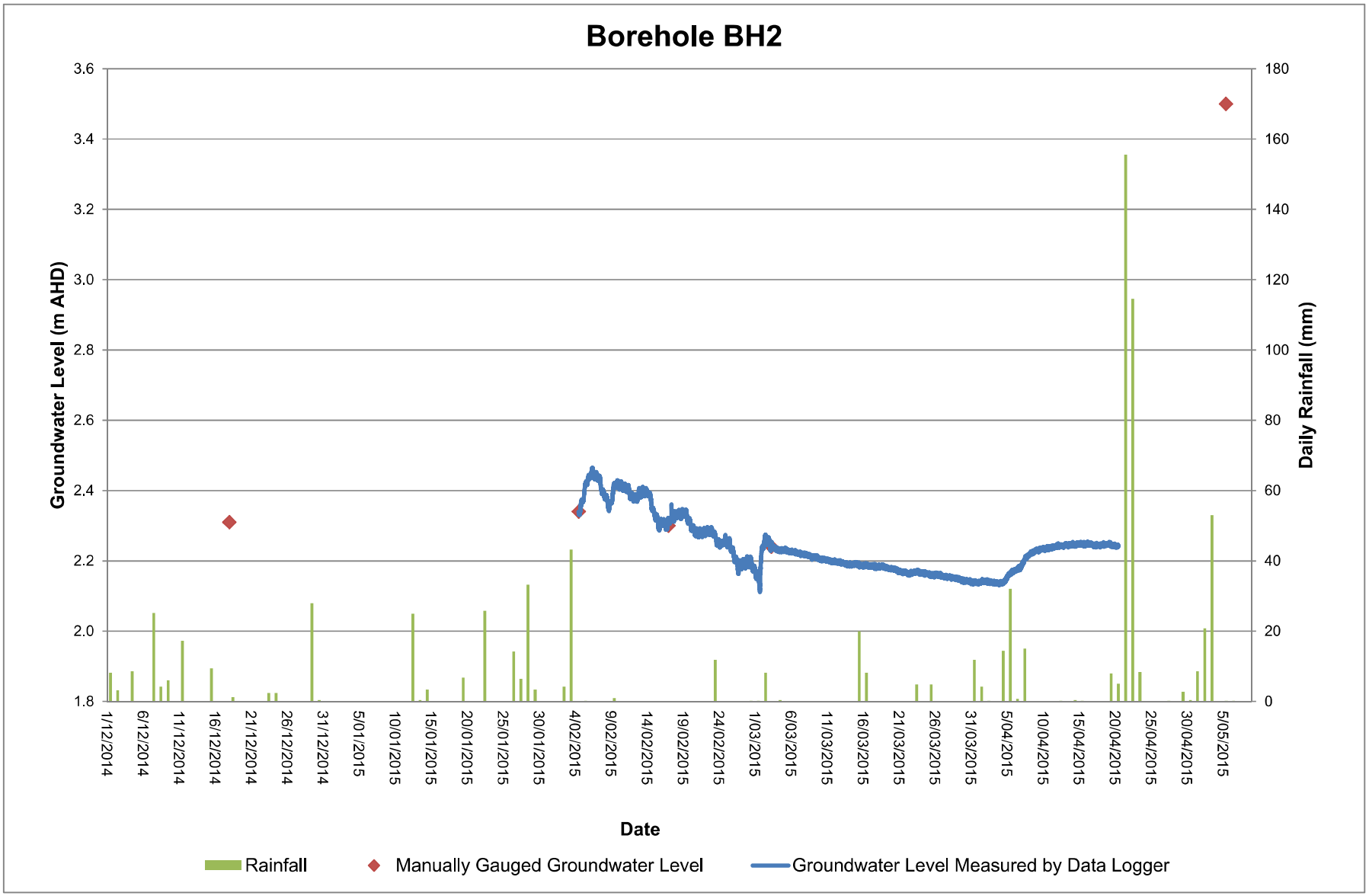
Planarity	Roughness
PR – Planar	RF – Rough
IR – Irregular	VR – Very Rough
ST – stepped	S – Smooth
U – Undulating	SL – Slickensides
CU - Curved	POL – Polished

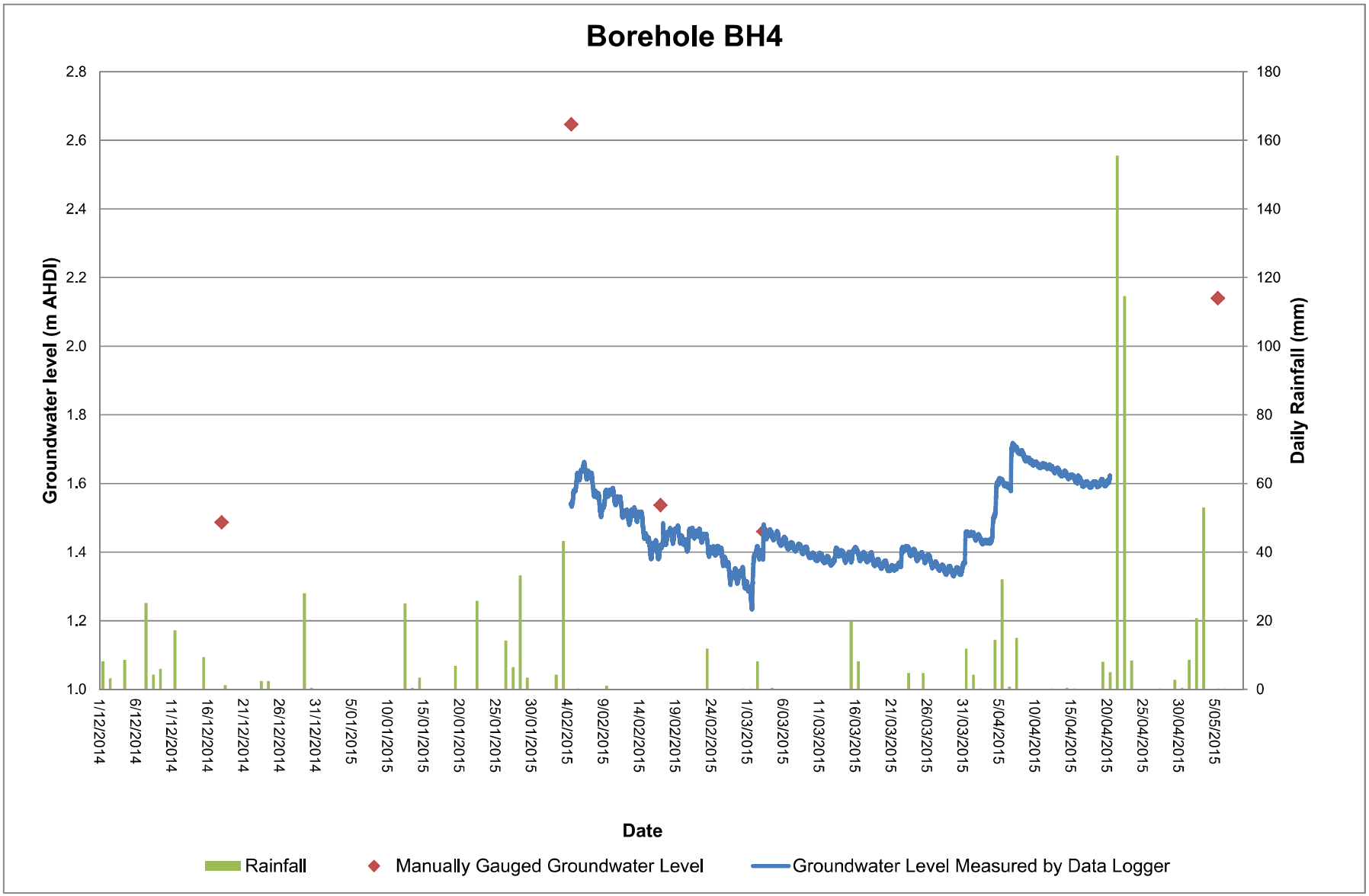
Symbol	Coating or infill
X	Carbonaceous
CA	Calcite
Fe	Iron oxide
KT	Chlorite
Clay	Clay
CN	Clean
Qz	Quartz
SN	Stain
VNR	Veneer

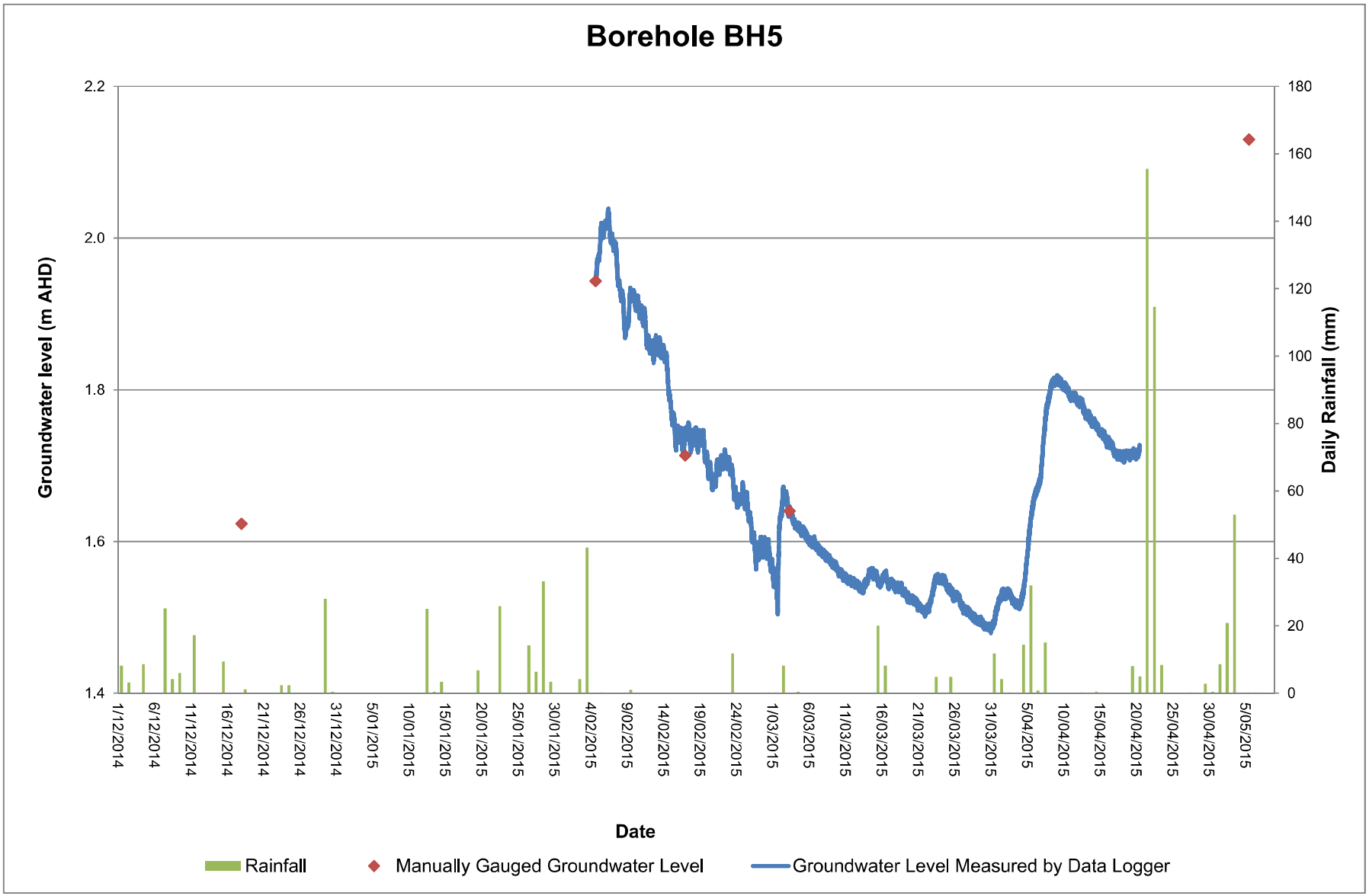
The inclinations of defects are measured from perpendicular to the core axis.

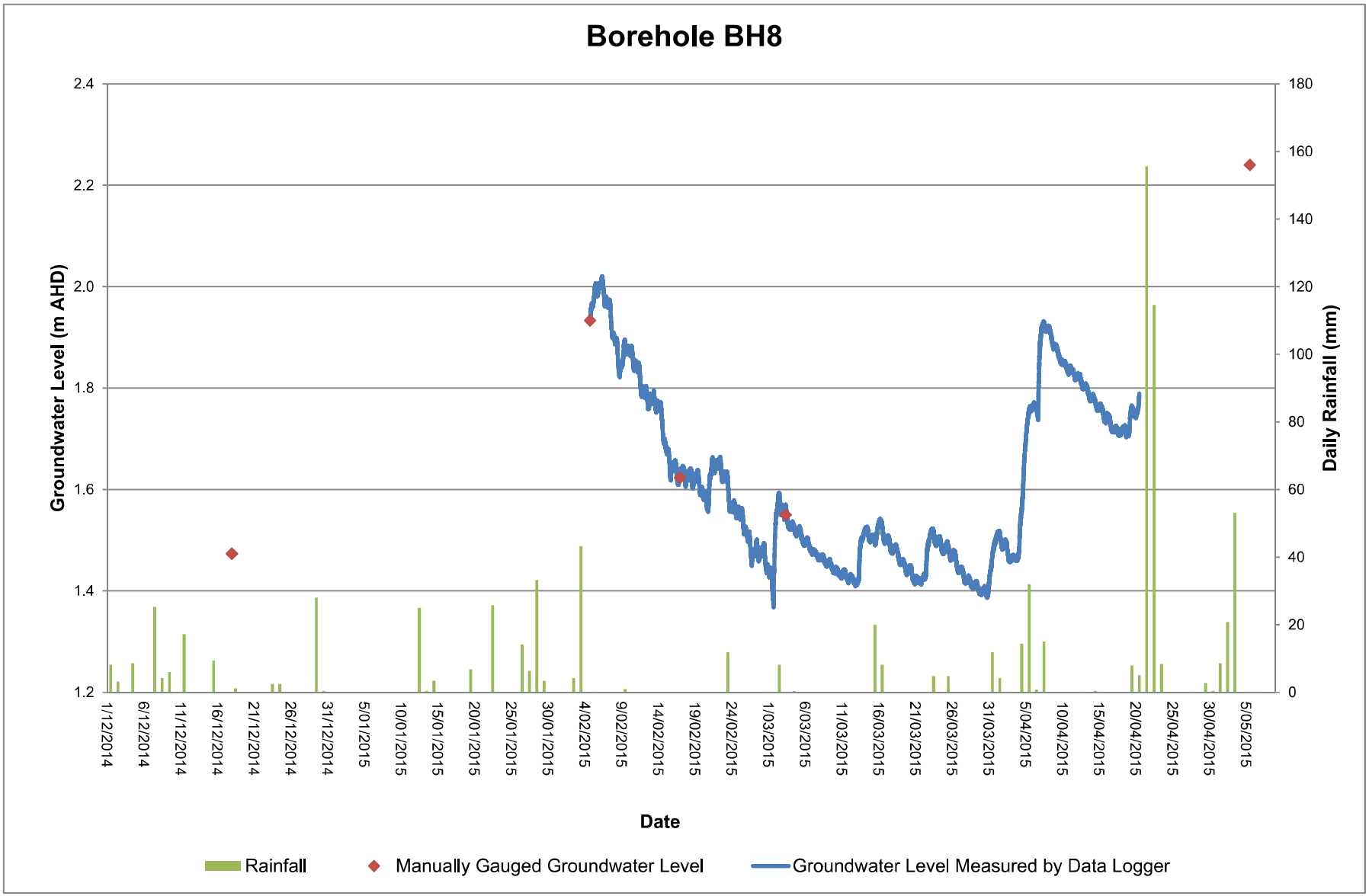
Appendix C

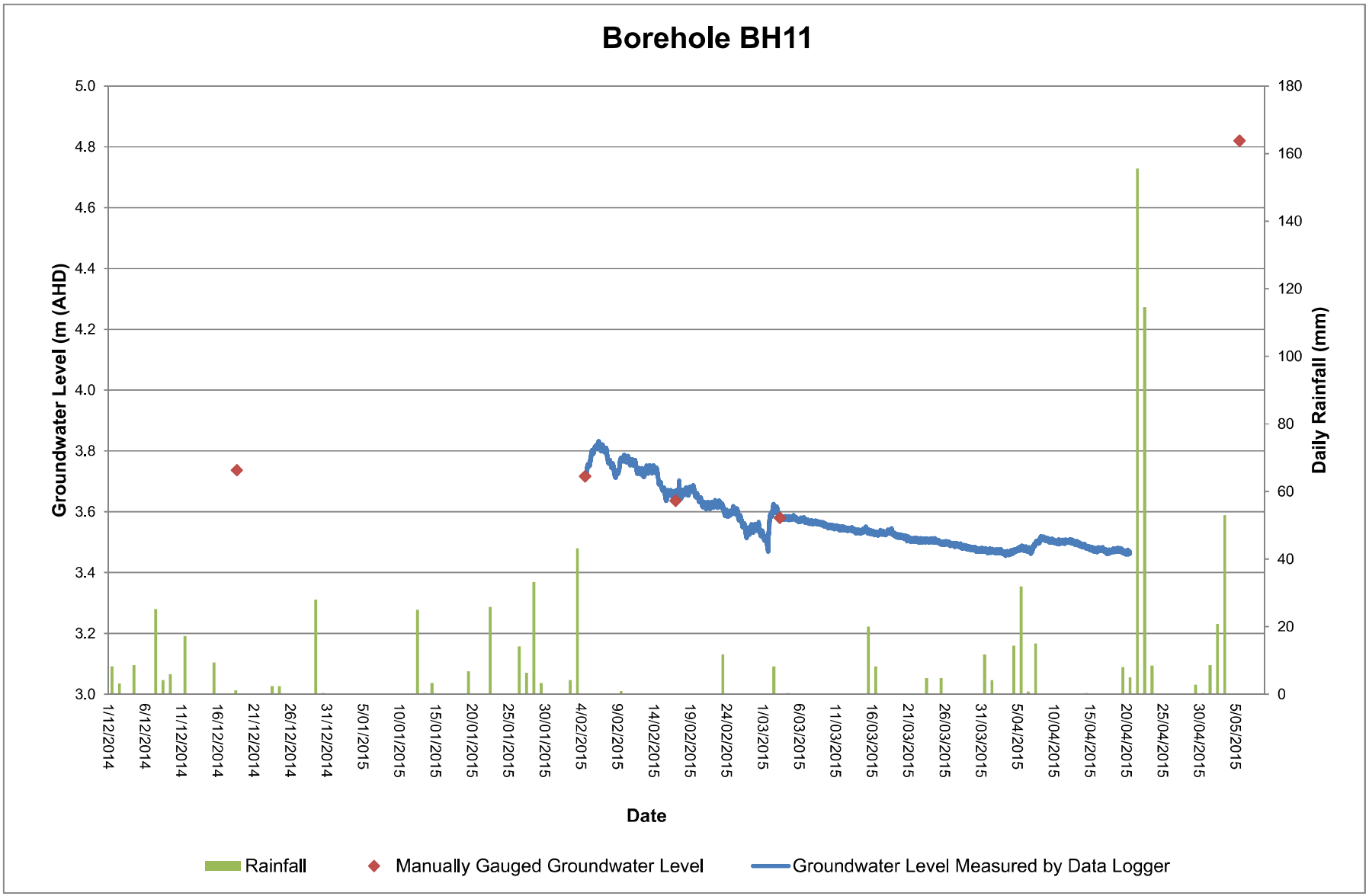
Groundwater Level Monitoring Results


Borehole BH2
Groundwater Level (m AHD)
Daily Rainfall (mm)
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
180
160
140
120
100
80
60
40
20
0
1/12/2014
6/12/2014
11/12/2014
16/12/2014
21/12/2014
26/12/2014
31/12/2014
5/01/2015
10/01/2015
15/01/2015
20/01/2015
25/01/2015
30/01/2015
4/02/2015
9/02/2015
14/02/2015
19/02/2015
24/02/2015
1/03/2015
6/03/2015
11/03/2015
16/03/2015
21/03/2015
26/03/2015
31/03/2015
5/04/2015
10/04/2015
15/04/2015
20/04/2015
25/04/2015
30/04/2015
5/05/2015
Date
Rainfall
Manually Gauged Groundwater Level
Groundwater Level Measured by Data Logger


Borehole BH4
Groundwater level (m AHDl)
Daily Rainfall (mm)
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
180
160
140
120
100
80
60
40
20
0
1/12/2014
6/12/2014
11/12/2014
16/12/2014
21/12/2014
26/12/2014
31/12/2014
5/01/2015
10/01/2015
15/01/2015
20/01/2015
25/01/2015
30/01/2015
4/02/2015
9/02/2015
14/02/2015
19/02/2015
24/02/2015
1/03/2015
6/03/2015
11/03/2015
16/03/2015
21/03/2015
26/03/2015
31/03/2015
5/04/2015
10/04/2015
15/04/2015
20/04/2015
25/04/2015
30/04/2015
5/05/2015
Date
Rainfall
Manually Gauged Groundwater Level
Groundwater Level Measured by Data Logger


Borehole BH5
Groundwater level (m AHD)
Daily Rainfall (mm)
2.2
2.0
1.8
1.6
1.4
180
160
140
120
100
80
60
40
20
0
1/12/2014
6/12/2014
11/12/2014
16/12/2014
21/12/2014
26/12/2014
31/12/2014
5/01/2015
10/01/2015
15/01/2015
20/01/2015
25/01/2015
30/01/2015
4/02/2015
9/02/2015
14/02/2015
19/02/2015
24/02/2015
1/03/2015
6/03/2015
11/03/2015
16/03/2015
21/03/2015
26/03/2015
31/03/2015
5/04/2015
10/04/2015
15/04/2015
20/04/2015
25/04/2015
30/04/2015
5/05/2015
Date
Rainfall
Manually Gauged Groundwater Level
Groundwater Level Measured by Data Logger


Borehole BH8
Groundwater Level (m AHD)
Daily Rainfall (mm)
2.4
2.2
2.0
1.8
1.6
1.4
1.2
180
160
140
120
100
80
60
40
20
0
1/12/2014
6/12/2014
11/12/2014
16/12/2014
21/12/2014
26/12/2014
31/12/2014
5/01/2015
10/01/2015
15/01/2015
20/01/2015
25/01/2015
30/01/2015
4/02/2015
9/02/2015
14/02/2015
19/02/2015
24/02/2015
1/03/2015
6/03/2015
11/03/2015
16/03/2015
21/03/2015
26/03/2015
31/03/2015
5/04/2015
10/04/2015
15/04/2015
20/04/2015
25/04/2015
30/04/2015
5/05/2015
Date
Rainfall
Manually Gauged Groundwater Level
Groundwater Level Measured by Data Logger


Borehole BH11
Groundwater Level (m (AHD)
Daily Rainfall (mm)
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
180
160
140
120
100
80
60
40
20
0
1/12/2014
6/12/2014
11/12/2014
16/12/2014
21/12/2014
26/12/2014
31/12/2014
5/01/2015
10/01/2015
15/01/2015
20/01/2015
25/01/2015
30/01/2015
4/02/2015
9/02/2015
14/02/2015
19/02/2015
24/02/2015
1/03/2015
6/03/2015
11/03/2015
16/03/2015
21/03/2015
26/03/2015
31/03/2015
5/04/2015
10/04/2015
15/04/2015
20/04/2015
25/04/2015
30/04/2015
5/05/2015
Date
Rainfall
Manually Gauged Groundwater Level
Groundwater Level Measured by Data Logger

Appendix D

Laboratory Test Reports

RCA LABORATORIES
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CONSTRUCTION MATERIALS TESTING

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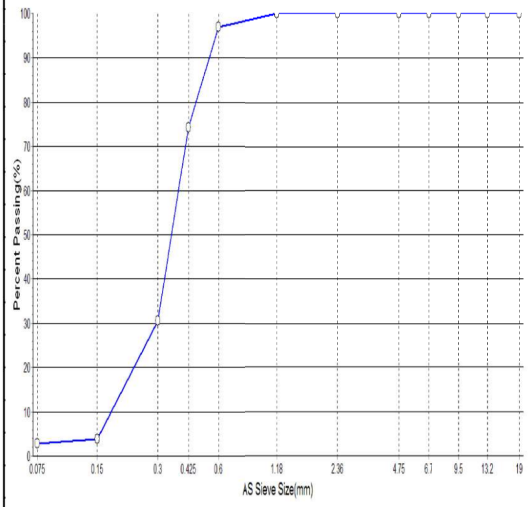
WEB www.rca.com.au
ABN 53 063 515 711
NATA Accredited Laboratory: 9811
Corporate Site No: 9804
Construction Materials Testing

Particle Size Distribution Report

Client :	**Benelli Equity Pty Ltd**	Report Number:	**10059 - 001**
Client Address :	**101 Hannell Street Wickham NSW 2293**		
Job Number:	**10059**	Report Date:	**11/02/2015**
Project:	**Proposed Sand Extraction**	Order Number:	-
Location	**Cabbage Tree Road , Williamtown**	**Page 1 of 1**	
Lab No:	**15-216**	Sample Location	
Date Sampled:	**24/11/2014**	BH1	
Date Tested:	**10/02/2015**	6.0m-6.45m	
Sampled By:	**RCA Geotech**		
Sample Method:	**AS 1289.1.2.1-6.5.3**		
Material Source:	**-**	Spec Description:	
For Use As:	**-**	Lot Number:	-
Remarks:	**-**	Spec Number:	-

Test Method: **AS 1289.3.6.1 (washed),2.1.1**



A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
75.00 mm			
53.00 mm			
37.50 mm			
26.50 mm			
19.00 mm		**100**	
13.20 mm		**100**	
9.50 mm		**100**	
6.70 mm		**100**	
4.75 mm		**100**	
2.36 mm		**100**	
1.18 mm		**100**	
0.600 mm		**97**	
0.425 mm		**74**	
0.300 mm		**31**	
0.150 mm		**4**	
0.075 mm		**3**	
Flakiness Index(%)		-	

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Approved Signatory
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Senior Technician

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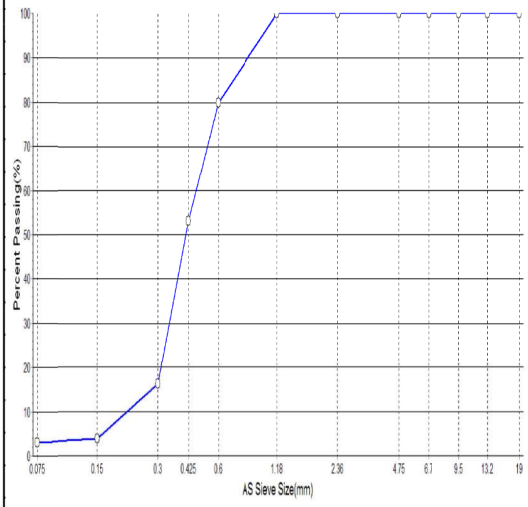
NATA Accredited Laboratory: 9811
Corporate Site No: 9804
Construction Materials Testing

Particle Size Distribution Report

Client :	**Benelli Equity Pty Ltd**	Report Number:	**10059 - 002**
Client Address :	**101 Hannell Street Wickham NSW 2293**		
Job Number:	**10059**	Report Date:	**11/02/2015**
Project:	**Proposed Sand Extraction**	Order Number:	-
Location	**Cabbage Tree Road , Williamtown**	**Page 1 of 1**	
Lab No:	**15-217**	Sample Location	
Date Sampled:	**25/11/2014**	BH2	
Date Tested:	**10/02/2015**	4.5m-4.95m	
Sampled By:	**RCA Geotech**		
Sample Method:	**AS 1289.1.2.1-6.5.3**		
Material Source:	**-**	Spec Description:	
For Use As:	**-**	Lot Number:	-
Remarks:	**-**	Spec Number:	-

Test Method: **AS 1289.3.6.1 (washed),2.1.1**



A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
75.00 mm			
53.00 mm			
37.50 mm			
26.50 mm			
19.00 mm		**100**	
13.20 mm		**100**	
9.50 mm		**100**	
6.70 mm		**100**	
4.75 mm		**100**	
2.36 mm		**100**	
1.18 mm		**100**	
0.600 mm		**80**	
0.425 mm		**53**	
0.300 mm		**16**	
0.150 mm		**4**	
0.075 mm		**3**	
Flakiness Index(%)		**-**	

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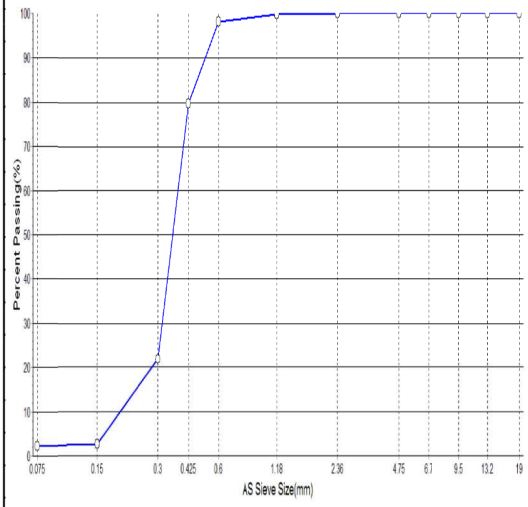
Construction Materials Testing

Particle Size Distribution Report

Client :	**Benelli Equity Pty Ltd**	Report Number:	**10059 - 003**
Client Address :	**101 Hannell Street Wickham NSW 2293**		
Job Number:	**10059**	Report Date:	**11/02/2015**
Project:	**Proposed Sand Extraction**	Order Number:	-
Location	**Cabbage Tree Road , Williamtown**	**Page 1 of 1**	
Lab No:	**15-218**	Sample Location	
Date Sampled:	**25/11/2014**	BH3	
Date Tested:	**10/02/2015**	1.5m-1.95m	
Sampled By:	**RCA Geotech**		
Sample Method:	**AS 1289.1.2.1-6.5.3**		
Material Source:	**-**	Spec Description:	
For Use As:	**-**	Lot Number:	-
Remarks:	**-**	Spec Number:	-

Test Method: **AS 1289.3.6.1 (washed),2.1.1**



A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
75.00 mm			
53.00 mm			
37.50 mm			
26.50 mm			
19.00 mm		**100**	
13.20 mm		**100**	
9.50 mm		**100**	
6.70 mm		**100**	
4.75 mm		**100**	
2.36 mm		**100**	
1.18 mm		**100**	
0.600 mm		**98**	
0.425 mm		**80**	
0.300 mm		**22**	
0.150 mm		**3**	
0.075 mm		**2**	
Flakiness Index(%)		-	

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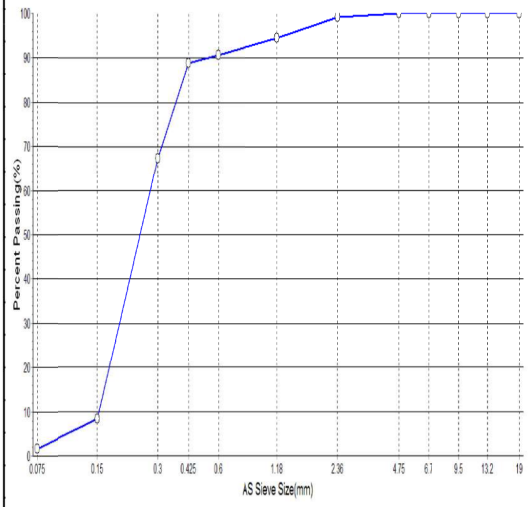
Corporate Site No: 9804
Construction Materials Testing

Particle Size Distribution Report

Client :	**Benelli Equity Pty Ltd**	Report Number:	**10059 - 004**
Client Address :	**101 Hannell Street Wickham NSW 2293**		
Job Number:	**10059**	Report Date:	**11/02/2015**
Project:	**Proposed Sand Extraction**	Order Number:	-
Location	**Cabbage Tree Road , Williamtown**	**Page 1 of 1**	
Lab No:	**15-219**	Sample Location	
Date Sampled:	**26/11/2014**	BH5	
Date Tested:	**10/02/2015**	1.5m-1.95m	
Sampled By:	**RCA Geotech**		
Sample Method:	**AS 1289.1.2.1-6.5.3**		
Material Source:	**-**	Spec Description:	
For Use As:	**-**	Lot Number:	-
Remarks:	**-**	Spec Number:	-

Test Method: **AS 1289.3.6.1 (washed),2.1.1**



A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
75.00 mm			
53.00 mm			
37.50 mm			
26.50 mm			
19.00 mm		**100**	
13.20 mm		**100**	
9.50 mm		**100**	
6.70 mm		**100**	
4.75 mm		**100**	
2.36 mm		**99**	
1.18 mm		**95**	
0.600 mm		**91**	
0.425 mm		**89**	
0.300 mm		**67**	
0.150 mm		**8**	
0.075 mm		**2**	
Flakiness Index(%)		**-**	

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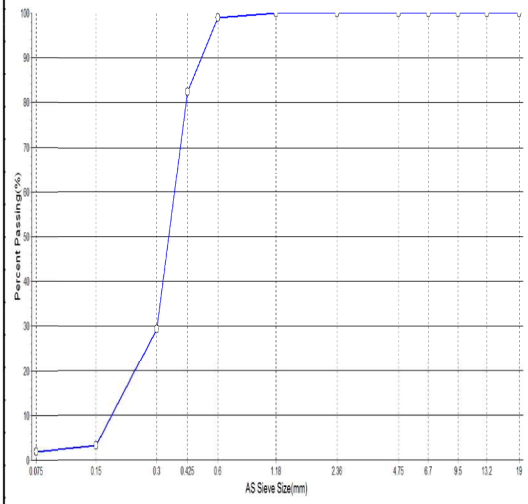
Corporate Site No: 9804
Construction Materials Testing

Particle Size Distribution Report

Client :	**Benelli Equity Pty Ltd**	Report Number:	**10059 - 005**
Client Address :	**101 Hannell Street Wickham NSW 2293**		
Job Number:	**10059**	Report Date:	**11/02/2015**
Project:	**Proposed Sand Extraction**	Order Number:	-
Location	**Cabbage Tree Road , Williamtown**	**Page 1 of 1**	
Lab No:	**15-220**	Sample Location	
Date Sampled:	**28/11/2014**	BH8	
Date Tested:	**10/02/2015**	3.0m-3.45m	
Sampled By:	**RCA Geotech**		
Sample Method:	**AS 1289.1.2.1-6.5.3**		
Material Source:	**-**	Spec Description:	
For Use As:	**-**	Lot Number:	-
Remarks:	**-**	Spec Number:	-

Test Method: **AS 1289.3.6.1 (washed),2.1.1**



A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
75.00 mm			
53.00 mm			
37.50 mm			
26.50 mm			
19.00 mm		**100**	
13.20 mm		**100**	
9.50 mm		**100**	
6.70 mm		**100**	
4.75 mm		**100**	
2.36 mm		**100**	
1.18 mm		**100**	
0.600 mm		**99**	
0.425 mm		**83**	
0.300 mm		**29**	
0.150 mm		**3**	
0.075 mm		**2**	
Flakiness Index(%)		-	

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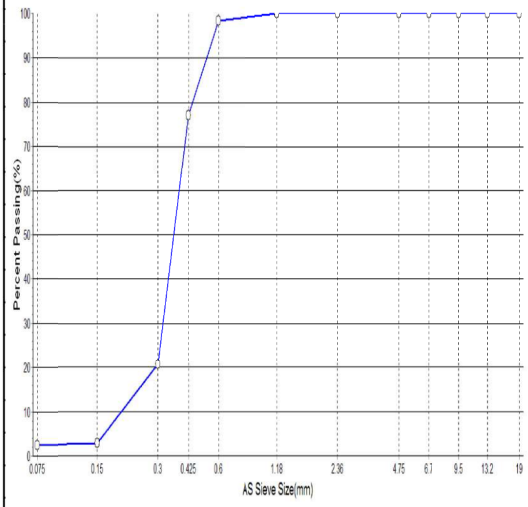
Construction Materials Testing

Particle Size Distribution Report

Client :	**Benelli Equity Pty Ltd**	Report Number:	**10059 - 006**
Client Address :	**101 Hannell Street Wickham NSW 2293**		
Job Number:	**10059**	Report Date:	**11/02/2015**
Project:	**Proposed Sand Extraction**	Order Number:	-
Location	**Cabbage Tree Road , Williamtown**	**Page 1 of 1**	
Lab No:	**15-221**	Sample Location	
Date Sampled:	**9/12/2014**	BH9	
Date Tested:	**10/02/2015**	1.0m-1.45m	
Sampled By:	**RCA Geotech**		
Sample Method:	**AS 1289.1.2.1-6.5.3**		
Material Source:	**-**	Spec Description:	
For Use As:	**-**	Lot Number:	-
Remarks:	**-**	Spec Number:	-

Test Method: **AS 1289.3.6.1 (washed),2.1.1**



A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
75.00 mm			
53.00 mm			
37.50 mm			
26.50 mm			
19.00 mm		**100**	
13.20 mm		**100**	
9.50 mm		**100**	
6.70 mm		**100**	
4.75 mm		**100**	
2.36 mm		**100**	
1.18 mm		**100**	
0.600 mm		**98**	
0.425 mm		**77**	
0.300 mm		**21**	
0.150 mm		**3**	
0.075 mm		**2**	
Flakiness Index(%)		-	

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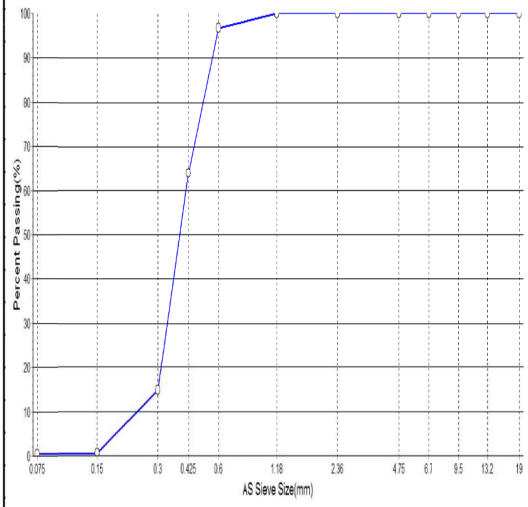
Construction Materials Testing

Particle Size Distribution Report

Client :	**Benelli Equity Pty Ltd**	Report Number:	**10059 - 007**
Client Address :	**101 Hannell Street Wickham NSW 2293**		
Job Number:	**10059**	Report Date:	**11/02/2015**
Project:	**Proposed Sand Extraction**	Order Number:	-
Location	**Cabbage Tree Road , Williamtown**	**Page 1 of 1**	
Lab No:	**15-222**	Sample Location	
Date Sampled:	**9/12/2014**	BH9	
Date Tested:	**10/02/2015**	4.0m-4.45m	
Sampled By:	**RCA Geotech**		
Sample Method:	**AS 1289.1.2.1-6.5.3**		
Material Source:	**-**	Spec Description:	
For Use As:	**-**	Lot Number:	-
Remarks:	**-**	Spec Number:	-

Test Method: **AS 1289.3.6.1 (washed),2.1.1**



A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
75.00 mm			
53.00 mm			
37.50 mm			
26.50 mm			
19.00 mm		**100**	
13.20 mm		**100**	
9.50 mm		**100**	
6.70 mm		**100**	
4.75 mm		**100**	
2.36 mm		**100**	
1.18 mm		**100**	
0.600 mm		**97**	
0.425 mm		**64**	
0.300 mm		**15**	
0.150 mm		**1**	
0.075 mm		**0**	
Flakiness Index(%)		**-**	

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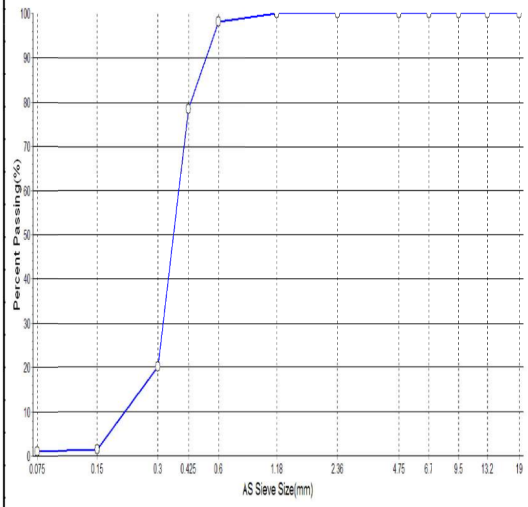
Construction Materials Testing

Particle Size Distribution Report

Client :	**Benelli Equity Pty Ltd**	Report Number:	**10059 - 008**
Client Address :	**101 Hannell Street Wickham NSW 2293**		
Job Number:	**10059**	Report Date:	**11/02/2015**
Project:	**Proposed Sand Extraction**	Order Number:	-
Location	**Cabbage Tree Road , Williamtown**	**Page 1 of 1**	
Lab No:	**15-223**	Sample Location	
Date Sampled:	**9/12/2014**	BH9	
Date Tested:	**10/02/2015**	8.5m-8.95m	
Sampled By:	**RCA Geotech**		
Sample Method:	**AS 1289.1.2.1-6.5.3**		
Material Source:	**-**	Spec Description:	
For Use As:	**-**	Lot Number:	-
Remarks:	**-**	Spec Number:	-

Test Method: **AS 1289.3.6.1 (washed),2.1.1**



A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
75.00 mm			
53.00 mm			
37.50 mm			
26.50 mm			
19.00 mm		**100**	
13.20 mm		**100**	
9.50 mm		**100**	
6.70 mm		**100**	
4.75 mm		**100**	
2.36 mm		**100**	
1.18 mm		**100**	
0.600 mm		**98**	
0.425 mm		**78**	
0.300 mm		**20**	
0.150 mm		**1**	
0.075 mm		**1**	
Flakiness Index(%)		**-**	

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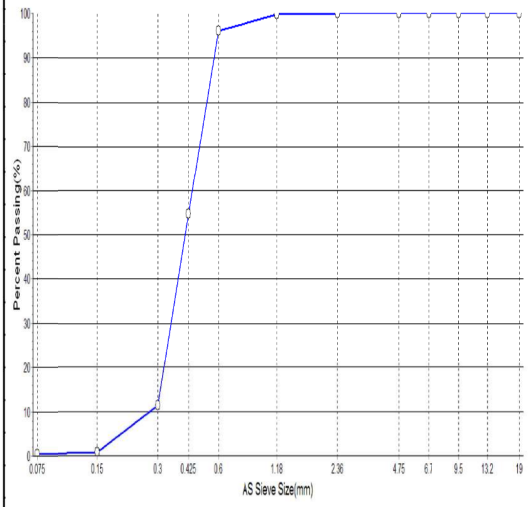
Corporate Site No: 9804
Construction Materials Testing

Particle Size Distribution Report

Client :	**Benelli Equity Pty Ltd**	Report Number:	**10059 - 009**
Client Address :	**101 Hannell Street Wickham NSW 2293**		
Job Number:	**10059**	Report Date:	**11/02/2015**
Project:	**Proposed Sand Extraction**	Order Number:	-
Location	**Cabbage Tree Road , Williamtown**	**Page 1 of 1**	
Lab No:	**15-224**	Sample Location	
Date Sampled:	**9/12/2014**	BH9	
Date Tested:	**10/02/2015**	13.0m-13.45m	
Sampled By:	**RCA Geotech**		
Sample Method:	**AS 1289.1.2.1-6.5.3**		
Material Source:	**-**	Spec Description:	
For Use As:	**-**	Lot Number:	-
Remarks:	**-**	Spec Number:	-

Test Method: **AS 1289.3.6.1 (washed),2.1.1**



A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
75.00 mm			
53.00 mm			
37.50 mm			
26.50 mm			
19.00 mm		**100**	
13.20 mm		**100**	
9.50 mm		**100**	
6.70 mm		**100**	
4.75 mm		**100**	
2.36 mm		**100**	
1.18 mm		**100**	
0.600 mm		**96**	
0.425 mm		**55**	
0.300 mm		**11**	
0.150 mm		**1**	
0.075 mm		**0**	
Flakiness Index(%)		**-**	

NATA
WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025.

Approved Signatory

Matt Flood
Senior Technician

Form Number

RP131-7

RCA LABORATORIES
• ENVIRONMENTAL •
CONSTRUCTION MATERIALS TESTING

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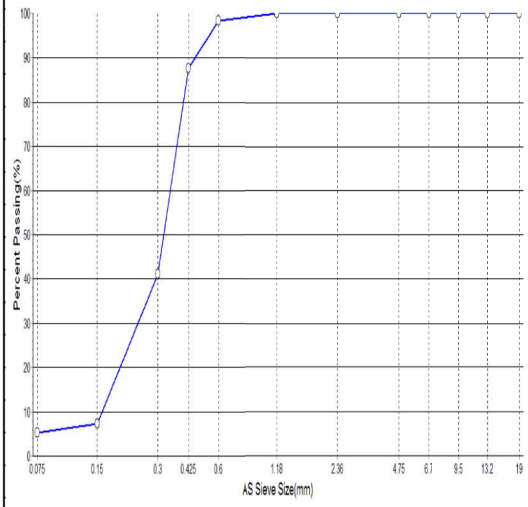
FAX +61 2 4902 9299
WEB www.rca.com.au
ABN 53 063 515 711
NATA Accredited Laboratory: 9811
Corporate Site No: 9804
Construction Materials Testing

Particle Size Distribution Report

Client :	**Benelli Equity Pty Ltd**	Report Number:	**10059 - 010**
Client Address :	**101 Hannell Street Wickham NSW 2293**		
Job Number:	**10059**	Report Date:	**11/02/2015**
Project:	**Proposed Sand Extraction**	Order Number:	-
Location	**Cabbage Tree Road , Williamtown**	**Page 1 of 1**	
Lab No:	**15-225**	Sample Location	
Date Sampled:	**10/12/2014**	BH10	
Date Tested:	**10/02/2015**	4.0m-4.45m	
Sampled By:	**RCA Geotech**		
Sample Method:	**AS 1289.1.2.1-6.5.3**		
Material Source:	**-**	Spec Description:	
For Use As:	**-**	Lot Number:	-
Remarks:	**-**	Spec Number:	-

Test Method: **AS 1289.3.6.1 (washed),2.1.1**



A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
75.00 mm			
53.00 mm			
37.50 mm			
26.50 mm			
19.00 mm		**100**	
13.20 mm		**100**	
9.50 mm		**100**	
6.70 mm		**100**	
4.75 mm		**100**	
2.36 mm		**100**	
1.18 mm		**100**	
0.600 mm		**98**	
0.425 mm		**88**	
0.300 mm		**41**	
0.150 mm		**7**	
0.075 mm		**5**	
Flakiness Index(%)		-	

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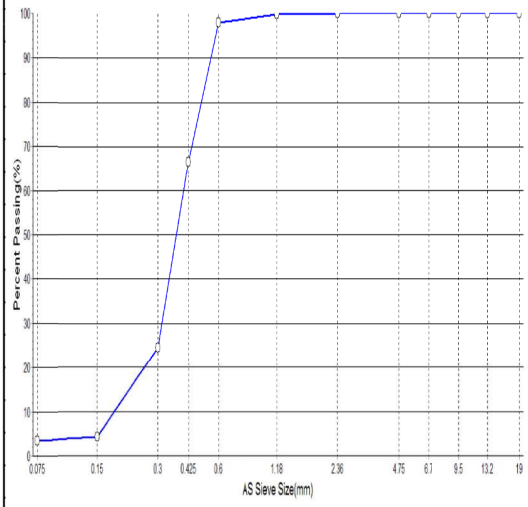
Construction Materials Testing

Particle Size Distribution Report

Client :	**Benelli Equity Pty Ltd**	Report Number:	**10059 - 011**
Client Address :	**101 Hannell Street Wickham NSW 2293**		
Job Number:	**10059**	Report Date:	**11/02/2015**
Project:	**Proposed Sand Extraction**	Order Number:	-
Location	**Cabbage Tree Road , Williamtown**	**Page 1 of 1**	
Lab No:	**15-226**	Sample Location	
Date Sampled:	**11/12/2014**	BH11	
Date Tested:	**10/02/2015**	0.1m-1.0m	
Sampled By:	**RCA Geotech**		
Sample Method:	**AS 1289.1.2.1-6.5.3**		
Material Source:	**-**	Spec Description:	
For Use As:	**-**	Lot Number:	-
Remarks:	**-**	Spec Number:	-

Test Method: **AS 1289.3.6.1 (washed),2.1.1**



A.S. Sieve Sizes	Specification Minimum	Percent Passing	Specification Maximum
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53.00 mm			
37.50 mm			
26.50 mm			
19.00 mm		**100**	
13.20 mm		**100**	
9.50 mm		**100**	
6.70 mm		**100**	
4.75 mm		**100**	
2.36 mm		**100**	
1.18 mm		**100**	
0.600 mm		**98**	
0.425 mm		**67**	
0.300 mm		**24**	
0.150 mm		**4**	
0.075 mm		**3**	
Flakiness Index(%)		-	

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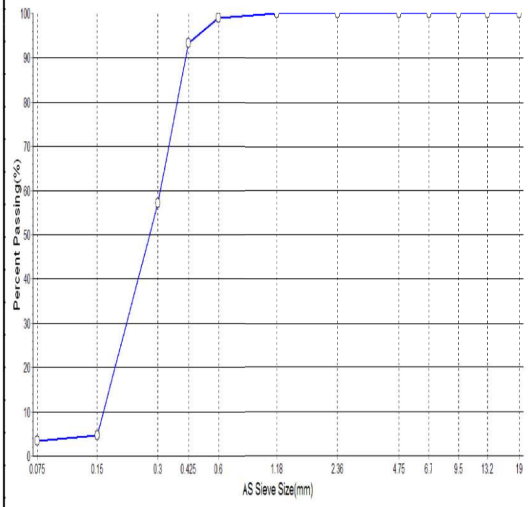
Construction Materials Testing

Particle Size Distribution Report

Client :	**Benelli Equity Pty Ltd**	Report Number:	**10059 - 012**
Client Address :	**101 Hannell Street Wickham NSW 2293**		
Job Number:	**10059**	Report Date:	**11/02/2015**
Project:	**Proposed Sand Extraction**	Order Number:	-
Location	**Cabbage Tree Road , Williamtown**	**Page 1 of 1**	
Lab No:	**15-227**	Sample Location	
Date Sampled:	**11/12/2014**	BH11	
Date Tested:	**10/02/2015**	2.5m-2.95m	
Sampled By:	**RCA Geotech**		
Sample Method:	**AS 1289.1.2.1-6.5.3**		
Material Source:	**-**	Spec Description:	
For Use As:	**-**	Lot Number:	-
Remarks:	**-**	Spec Number:	-

Test Method: **AS 1289.3.6.1 (washed),2.1.1**



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9.50 mm		**100**	
6.70 mm		**100**	
4.75 mm		**100**	
2.36 mm		**100**	
1.18 mm		**100**	
0.600 mm		**99**	
0.425 mm		**93**	
0.300 mm		**57**	
0.150 mm		**5**	
0.075 mm		**4**	
Flakiness Index(%)		-	

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Approved Signatory

Matt Flood
Senior Technician

Form Number

RP131-7

Robert Carr & Associates Pty Ltd Trading as RCA Laboratories – Environmental
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NATA Accredited Laboratory 9811
Corporate Site Number 18077
Accredited for compliance with ISO/IEC 17025

RCA Australia
92 Hill Street
CARRINGTON 2294

Attention: Mr Calvin Mickan

This report supersedes Report 10059-701/0 which was sent on 9/1/2015

This report was reissued due to some sample descriptions revised based on results of particle distribution tests.

Project:	RCA ref 10059-701/1		
Date:	11/3/15		
Client reference:	Cabbage Tree Road, Williamtown ASS Screen Testing		
Received date:	7/1/15	**Number of samples:**	42
Client order number:	Not Supplied	**Testing commenced:**	9/1/15

CERTIFICATE OF ANALYSIS

1 ANALYTICAL TEST METHODS

ANALYSIS	METHOD	UNITS	ANALYSING LABORATORY	NATA ANALYSIS/NON-NATA
Acid Sulfate Soil Screening Testing	ENV-LAB032*	pH	RCA Laboratories - Environmental	NATA

* The analytical procedures used by RCA Laboratories - Environmental are based on established internationally recognised procedures such as APHA and Australian Standards

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2 RESULTS

ANALYSIS	UNITS	BH1 0.5-0.95	BH1 1.5-1.95	BH1 3-3.45	BH1 4.5-4.95	BH1 6-6.45	BH2 0.5-0.95
Acid Sulfate Soil Screening Test							
Sample Number	-	011510059001	011510059002	011510059003	011510059004	011510059005	011510059006
Date Sampled	-	24/11/2014	24/11/2014	24/11/2014	24/11/2014	24/11/2014	25/11/2014
pH_F	pH unit	5.21	4.60	4.78	4.93	5.27	5.26
pH_{FOX}	pH unit	3.60	2.29	2.87	3.89	4.15	4.17
$pH_F - pH_{FOX}$	pH unit	1.61	2.31	1.91	1.04	1.12	1.09
Reaction Rate^	-	0	0	0	0	0	0
Soil Type	-	sand, brown and pale grey	sand, grey	sand, grey/sand, very dark brown with a trace of silt	sand, brown with a trace of silt/sand, white	sand, pale grey-brown, with a trace of silt	sand, dark-brown, trace of gravel/sand, pale brown

ANALYSIS	UNITS	BH2 1.5-1.95	BH2 3-3.45	BH2 4.5-4.95	BH2 6-6.45	BH3 0.5-0.95	BH3 1.5-1.95
Acid Sulfate Soil Screening Test							
Sample Number	-	011510059007	011510059008	011510059009	011510059010	011510059011	011510059012
Date Sampled	-	25/11/2014	25/11/2014	25/11/2014	25/11/2014	25/11/2014	25/11/2014
pH_F	pH unit	4.96	4.86	5.14	5.48	6.61	5.45
pH_{FOX}	pH unit	3.40	3.78	4.45	4.64	4.98	4.21
$pH_F - pH_{FOX}$	pH unit	1.56	1.08	0.69	0.84	1.63	1.24
Reaction Rate^	-	0	0	0	0	0	0
Soil Type	-	sand, pale brown/sand, brown with dark brown mottles	sand, brown-dark brown/sand, very dark-brown, trace to some silt	sand, very pale brown	sand, pale brown	sand, pale brown	sand, pale brown/sand, brown-dark brown

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ANALYSIS	UNITS	BH3 3-3.45	BH3 4.5-4.95	BH3 6-6.45	BH4 0.5-0.95	BH5 0.5-0.95	BH5 1.5-1.95
Acid Sulfate Soil Screening Test							
Sample Number	-	011510059013	011510059014	011510059015	011510059016	011510059017	011510059018
Date Sampled	-	25/11/2014	25/11/2014	25/11/2014	26/11/2014	26/11/2014	26/11/2014
pH_F	pH unit	4.98	4.86	5.67	4.98	6.17	5.80
pH_{FOX}	pH unit	3.73	3.97	5.18	4.14	4.58	4.60
$pH_F - pH_{FOX}$	pH unit	1.25	0.89	0.49	0.84	1.59	1.20
Reaction Rate^	-	0	0	0	0	0	0
Soil Type	-	sand, grey-brown/sand very dark brown, with a trace to some silt	sand, yellow-brown/sand, very pale brown	sand, pale brown/sand, brown-dark brown	sand, pale brown, with a trace of silt	sand, pale grey	sand, pale greywhite with very dark grey speckles

ANALYSIS	UNITS	BH5 2.5-3	BH5 4.5-4.95	BH5 6-6.45	BH7 0.5-0.95	BH8 0.5-0.95	BH8 1.5-1.95
Acid Sulfate Soil Screening Test							
Sample Number	-	011510059019	011510059020	011510059021	011510059022	011510059023	011510059024
Date Sampled	-	26/11/2014	26/11/2014	26/11/2014	27/11/2014	28/11/2014	28/11/2014
pH_F	pH unit	5.86	5.38	5.05	5.09	4.55	4.57
pH_{FOX}	pH unit	4.20	4.31	4.44	4.21	3.10	3.99
$pH_F - pH_{FOX}$	pH unit	1.66	1.07	0.61	0.88	1.45	0.58
Reaction Rate^	-	1	0	0	0	0	0
Soil Type	-	sand, dark grey	sand, white/sand, brown with a trace of silt and clay	sand, brown with a trace of silt	sand, pale grey with black grains	sand, white-pale grey	sand, dark brown with a trace of silt

ANALYSIS	UNITS	BH9 0.2-1	BH9 2.5-2.95	BH9 4-4.45	BH9 7-7.45	BH9 8.5-8.95	BH9 10-10.45
Acid Sulfate Soil Screening Test							
Sample Number	-	011510059025	011510059026	011510059027	011510059028	011510059029	011510059030
Date Sampled	-	9/12/2014	9/12/2014	9/12/2014	9/12/2014	9/12/2014	9/12/2014
pH_F	pH unit	5.38	5.52	5.48	5.65	5.68	5.55
pH_{FOX}	pH unit	4.75	4.70	4.58	4.35	4.47	4.42
$pH_F - pH_{FOX}$	pH unit	0.63	0.82	0.90	1.30	1.21	1.13
Reaction Rate^	-	0	0	0	0	0	0
Soil Type	-	sand, pale yellow-brown	sand, pale yellow-brown	sand, pale yellow-brown	sand, pale yellow-brown	sand, orange-brown	sand, grey-brown with brown and pale yellow zones

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ANALYSIS	UNITS	BH9 13-13.45	BH9 14.5-14.95	BH10 0.2-1	BH10 1-1.45	BH10 2.5-2.95	BH10 4-4.45
Acid Sulfate Soil Screening Test							
Sample Number	-	011510059031	011510059032	011510059033	011510059034	011510059035	011510059036
Date Sampled	-	9/12/2014	9/12/2014	10/12/2014	10/12/2014	10/12/2014	10/12/2014
pH_F	pH unit	5.48	5.75	4.51	4.40	5.40	5.58
pH_{FOX}	pH unit	4.71	4.83	2.90	3.81	4.45	4.85
$pH_F - pH_{FOX}$	pH unit	0.77	0.92	1.61	0.59	0.95	0.73
Reaction Rate^	-	0	0	0	0	0	0
Soil Type	-	sand, grey-brown	sand, pale yellow-grey	sand, pale grey	sand, pale grey/silty sand brown/sand, yellow-brown, with a trace of silt	sand, pale grey	sand, yellow-brown/sand with silt, dark grey brown
ANALYSIS	**UNITS**	**BH11 1-1.45**	**BH11 2.5-2.95**	**BH12 0.5-1**	**BH12 1-1.45**	**BH12 2.5-2.95**	**BH12 4-4.45**
Acid Sulfate Soil Screening Test							
Sample Number	-	011510059037	011510059038	011510059039	011510059040	011510059041	011510059042
Date Sampled	-	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014	11/12/2014
pH_F	pH unit	5.45	5.29	4.15	4.30	5.33	4.88
pH_{FOX}	pH unit	3.74	4.97	2.99	3.10	2.69	3.00
$pH_F - pH_{FOX}$	pH unit	1.71	0.32	1.16	1.20	2.64	1.88
Reaction Rate^	-	0	0	0	0	0	0
Soil Type	-	sand, white	sand, pale grey-brown, with a trace of silt	sand, white/silty sand, dark brown	silty sand, dark brown/sand white	sand, white	sand, pale grey/sand, yellow-brown

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

Acid Sulfate Soil Screening

Note: This screening test only provides an indication of the likely presence and severity of Acid Sulfate Soils. This test should not be used as a substitute for laboratory analysis which would positively identify the presence of Acid Sulfate Soils (ASS) for assessment purposes.

NATA Scope of Accreditation does not cover the sampling of soils by the client or by RCA Employees.

Analysis for pH and Acid Sulphate Screen Testing is covered by RCA Laboratories – Environmental NATA Scope of Accreditation.

Analysis on samples is on an as received basis.

Acid Sulfate Soil Screening Test Reaction Rate

^Reaction Rate: 0 = No Reaction, 1 = Slight, 2 = Moderate, 3 = High, 4 = Very Vigorous

Note: Due to the subjectivity the assessment of the Reaction Rate is not covered by our NATA Scope of Accreditation.

3 QUALITY CONTROL RESULTS

Acid Sulfate Soil Screening Test Quality Control

DATE	ANALYSIS	METHOD	UNITS	QUALITY CONTROL STANDARD VALUE	QUALITY CONTROL ACCEPTANCE CRITERIA	QUALITY CONTROL STANDARD RESULT
9/1/15	pH – Acid Sulfate Soil Screen Testing	ENV-LAB032	pH	7.00	6.95 - 7.05	7.01

Acid Sulfate Soil Screening Test Duplicate Analysis

SAMPLE NUMBER	DATE	ANALYSIS	METHOD	UNITS	LOR	SAMPLE RESULT	SAMPLE DUPLICATE RESULT	ACCEPTANCE CRITERIA RESULT
011510059010	9/1/15	pH – Acid Sulfate Soil Screen Testing	ENV-LAB032	pH	N/A	5.48	5.48	0.0%
011510059020	9/1/15	pH – Acid Sulfate Soil Screen Testing	ENV-LAB032	pH	N/A	5.38	5.30	1.5%
011510059030	9/1/15	pH – Acid Sulfate Soil Screen Testing	ENV-LAB032	pH	N/A	5.55	5.59	0.7%
011510059040	9/1/15	pH – Acid Sulfate Soil Screen Testing	ENV-LAB032	pH	N/A	4.30	4.21	2.1%

Please contact the undersigned if you have any queries.

Yours sincerely

Chad South
Environmental Technician
Robert Carr & Associates Pty Ltd Trading as
RCA Laboratories - Environmental
Approved Signatory

Laura Schofield
Environmental Laboratory Manager
Robert Carr & Associates Pty Ltd Trading as
RCA Laboratories - Environmental

Robert Carr & Associates Pty Ltd Trading as RCA Laboratories – Environmental
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RCA Internal Quality Review

General

1. Laboratory QC results for Method Blanks, Duplicates and Laboratory Control Samples are included in this QC report where applicable. Additional QC data maybe available on request.
2. RCA QC Acceptance / Rejection Criteria are available on request.
3. Proficiency Trial results are available on request.
4. Actual PQLs are matrix dependant. Quoted PQLs may be raised where sample extracts are diluted due to interferences.
5. When individual results are qualified in the body of a report, refer to the qualifier descriptions that follow.
6. Samples were analysed on an 'as received' basis.
7. Sampled dates in this report are those listed on the COC or sample jars; if no sample dates are noted, the date the samples are received at the laboratory have been used.
8. All soil results are reported on a dry basis, unless otherwise stated. (ACID SULFATE SOILS)
9. This report replaces any interim results previously issued.

Holding Times.

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 Acknowledgment.

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

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%

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. Duplicate RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Glossary

UNITS

mg/kg: milligrams per Kilogram

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100ml: Organisms per 100 millilitres

NTU: Units

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

mg/L: milligrams per Litre

TERMS

Dry Where moisture has been determined on a solid sample the result is expressed on a dry basis.

LOR Limit of Reporting.

RPD Relative Percent Difference between two Duplicate pieces of analysis can be obtained upon request.

QCS Quality Control Sample - reported as value 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.

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.

USEPA United States Environment Protection Authority

APHA American Public Health Association

COC Chain of Custody

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

< indicates less than

> Indicates greater than

ND Not Detected

Appendix 1

Chain of Custody Documentation

RCA LABORATORIES
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Ph: (02) 4902 9200 Fax: 02 4902 9299
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www.rca.com.au Email: labenviro@rca.com.au

ENV-F103-4

Client Name: Benelli Equity Pty Ltd
Client Site: Cabbage Tree Road, Williamtown

Contact Name:
Phone Number:

Email Report To: calvinm@rca.com.au
Project Manager: Calvin Mickan

Turnaround Required: ☐ Urgent ☑ Standard (5 Day)

Date Required: (low priority)

Expected Reporting Date:
(Laboratory Use Only)

RCA Job Number: 10059

ANALYSIS REQUIRED

SAMPLE INFORMATION

RCA Laboratories Environmental Sample Number	Client ID / Description	Date	Matrix	Total Samples	ASS Screen												Notes: **Please minimise sample use as select samples will be used for CMT testing after ASS screen completed**
01510059001	BH1 0.5-0.95m. SAND, brown and pale grey	24/11/14	S	1	x												
" 002	BH1 1.5-1.95m. SAND, grey	24/11/14	S	1	x												
" 003	BH1 3.0-3.45m. SAND, grey/SAND, very dark brown, with a trace of silt	24/11/14	S	1	x												
" 004	BH1 4.5-4.95m. SAND, brown with a trace of silt/SAND, white	24/11/14	S	1	x												
" 005	BH1 6.0-6.45m. SAND, pale grey-brown, with a trace of silt	24/11/14	S	1	x												
" 006	BH2 0.5-0.95m. SAND, dark brown, trace of gravel / SAND, pale brown	25/11/14	S	1	x												
" 007	BH2 1.5-1.95m. SAND, pale brown / SAND, brown with dark brown mottles	25/11/14	S	1	x												
" 008	BH2 3.0-3.45m. SAND, brown-dark brown / SAND, very dark brown, trace to some silt	25/11/14	S	1	x												
" 009	BH2 4.5-4.95m. SAND, very pale brown	25/11/14	S	1	x												
" 010	BH2 6.0-6.45m. SAND, pale brown	25/11/14	S	1	x												
" 011	BH3 0.5-0.95m. SAND, pale brown	25/11/14	S	1	x												
" 012	BH3 1.5-1.95m. SAND, pale brown / SAND, brown - dark brown	25/11/14	S	1	x												
" 013	BH3 3.0-3.45m. SAND, grey-brown / SAND, very dark brown, with a trace to some silt	25/11/14	S	1	x												
" 014	BH3 4.5-4.95m. SAND, yellow-brown / SAND, very pale brown	25/11/14	S	1	x												
" 015	BH3 6.0-6.45m. SAND, pale brown / SAND, brown-dark brown	25/11/14	S	1	x												
" 016	BH4 0.5-0.95m. SAND, pale brown with a trace of silt	26/11/14	S	1	x												

RELINQUISHED BY		RECEIVED BY		Laboratory use only (circle appropriate)
Name: TH	Date: 7/1/15	Name: [illegible]	Date: 7/1/14	**Received in good condition:** Yes No
Of: RCA	Time:	Of: RCALE	Time: 2:00pm	**Chilled:** Yes No

RCA Job Number:

SAMPLE INFORMATION

ANALYSIS REQUIRED

RCA Laboratories Environmental Sample Number	Client ID / Description	Date	Matrix	Total Samples	ASS Screen												Notes: **Please minimise sample use as select samples will be used for CMT testing after ASS screen completed**
415100590 17	BH5 0.5-0.95m. SAND, pale grey	26/11/14	S	1	x												
" 018	BH5 1.5-1.95m. SAND, pale grey / white with very dark grey speckles	26/11/14	S	1	x												
" 019	BH5 2.5-3.0m. SAND, dark grey	26/11/14	S	1	x												
" 020	BH5 4.5-4.95m. SAND, white / SAND, brown with trace of silt and clay	26/11/14	S	1	x												
" 021	BH5 6.0-6.45m. SAND, brown, with a trace of silt	26/11/14	S	1	x												
" 022	BH7 0.5-0.95m. SAND, pale grey with black grains	27/11/14	S	1	x												
" 023	BH8 0.5-0.95m. SAND, white - pale grey	28/11/14	S	1	x												
" 024	BH8 1.5-1.95m. SAND, dark brown with a trace of silt	28/11/14	S	1	x												
" 025	BH9 0.2-1.0m. SAND, pale yellow-brown	9/12/14	S	1	x												
" 026	BH9 2.5-2.95m. SAND, pale yellow-brown	9/12/14	S	1	x												
" 027	BH9 4.0-4.45m. SAND, pale yellow-brown, with a trace of silt	9/12/14	S	1	x												
" 028	BH9 7.0-7.45m. SAND, pale yellow-brown, with a trace of silt	9/12/14	S	1	x												
" 029	BH9 8.5-8.95m. SAND, orange-brown, with a trace of silt	9/12/14	S	1	x												
" 030	BH9 10.0-10.45m. SAND, grey-brown with brown and pale yellow zones, with silt	9/12/14	S	1	x												
" 031	BH9 13.0-13.45m. SAND, grey-brown, with silt	9/12/14	S	1	x												
" 032	BH9 14.5-14.95m. SAND, pale yellow-grey	9/12/14	S	1	x												
" 033	BH10 0.2-1.0m. SAND, pale grey	10/12/14	S	1	x												
" 034	BH10 1.0-1.45m. SAND, pale grey / Silty SAND, brown / SAND, yellow -brown, with silt	10/12/14	S	1	x												
" 035	BH10 2.5-2.95m. SAND, pale grey	10/12/14	S	1	x												
" 036	BH10 4.0-4.45m. SAND, yellow-brown / Silty SAND, dark grey-brown	10/12/14	S	1	x												
" 037	BH11 1.0-1.45m. SAND, white	11/12/14	S	1	x												
" 038	BH11 2.5-2.95m. SAND, pale grey-brown, with silt	11/12/14	S	1	x												
" 039	BH12 0.5-1.0m. SAND, white / Silty SAND, dark brown	11/12/14	S	1	x												
" 040	BH12 1.0-1.45m. Silty SAND, dark brown / SAND, white	11/12/14	S	1	x												
" 041	BH12 2.5-2.95m. SAND white	11/12/14	S	1	x												

RELINQUISHED BY See Previous Page		RECEIVED BY		Laboratory use only (circle appropriate)
Name:	Date:	Name:	Date:	**Received in good condition:** Yes No
Of:	Time:	Of:	Time:	**Chilled:** Yes No

RCA Job Number:

SAMPLE INFORMATION

Notes: **Please minimise sample use as select samples will be used for CMT testing after ASS screen completed**

RCA Laboratories Environmental Sample Number	Client ID / Description	Date	Matrix	Total Samples	ASS Screen
0115100594C4V	BH12 4.0-4.45m. SAND, pale grey / SAMD, yellow brown	11/12/14	S	1	x

RELINQUISHED BY See Previous Page

Name:
Of:
Date:
Time:

RECEIVED BY

Name:
Of:
Date:
Time:

Laboratory use only (circle appropriate)

Received in good condition: Yes No

Chilled: Yes No

CERTIFICATE OF ANALYSIS

Work Order	: **EB1511988**	Page	: 1 of 10
Client	: **ROBERT CARR & ASSOCIATES P/L**	Laboratory	: Environmental Division Brisbane
Contact	: MR CALVIN MICKAN	Contact	: Customer Services EB
Address	: P O BOX 175 CARRINGTON NSW, AUSTRALIA 2294	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: calvinm@rca.com.au	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 02 4902 9200	Telephone	: +61-7-3243 7222
Facsimile	: +61 02 4902 9299	Facsimile	: +61-7-3243 7218
Project	: 10059	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 03-Feb-2015 08:20
C-O-C number	: ----	Date Analysis Commenced	: 10-Feb-2015
Sampler	: CALVIN MICKAN, THOMAS HOSKING	Issue Date	: 12-Feb-2015 11:52
Site	: ----		
		No. of samples received	: 19
Quote number	: ----	No. of samples analysed	: 19

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils

General Comments

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

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

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

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

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

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.

- ASS: EA029 (SPOCAS): Excess ANC not required because pH OX less than 6.5.
- ASS: EA029 (SPOCAS): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime ($CaCO_3$) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from kg/t dry weight to kg/m3 in-situ soil, multiply reported results x wet bulk density of soil in t/m3.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	011510059001 (BH1 0.5-0.95m)	011510059003 (BH1 3.0-3.45m)	011510059004 (BH1 4.5-4.95m)	011510059007 (BH2 1.5-1.95m)	011510059008 (BH2 3.0-3.45m)
			Client sampling date / time	[24-Nov-2014]	[24-Nov-2014]	[24-Nov-2014]	[25-Nov-2014]	[25-Nov-2014]
Compound	CAS Number	LOR	Unit	EB1511988-001	EB1511988-002	EB1511988-003	EB1511988-004	EB1511988-005
				Result	Result	Result	Result	Result
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	<0.005	<0.005	<0.005	<0.005	<0.005
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	5.3	4.8	6.1	5.2	5.0
pH OX (23B)	----	0.1	pH Unit	4.0	4.0	4.6	4.2	4.0
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	6	29	<2	4	12
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	24	90	4	13	34
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	18	61	4	9	22
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	0.05	<0.02	<0.02	<0.02
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	0.04	0.14	<0.02	0.02	0.06
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	0.03	0.10	<0.02	<0.02	0.04
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Sulfur (23De)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	<10	<10	<10	<10
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.02	% Ca	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Calcium (23Wh)	----	0.02	% Ca	<0.02	<0.02	<0.02	<0.02	<0.02
Acid Reacted Calcium (23X)	----	0.02	% Ca	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Magnesium (23Tm)	----	0.02	% Mg	<0.02	<0.02	<0.02	<0.02	<0.02
Acid Reacted Magnesium (23U)	----	0.02	% Mg	<0.02	<0.02	<0.02	<0.02	<0.02
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
EA029-G: Retained Acidity								
HCl Extractable Sulfur (20Be)	----	0.02	% S	----	----	----	----	----
Net Acid Soluble Sulfur (20Je)	----	0.02	% S	----	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	011510059001 (BH1 0.5-0.95m)	011510059003 (BH1 3.0-3.45m)	011510059004 (BH1 4.5-4.95m)	011510059007 (BH2 1.5-1.95m)	011510059008 (BH2 3.0-3.45m)
				Client sampling date / time	[24-Nov-2014]	[24-Nov-2014]	[24-Nov-2014]	[25-Nov-2014]	[25-Nov-2014]
Compound	CAS Number	LOR	Unit		EB1511988-001	EB1511988-002	EB1511988-003	EB1511988-004	EB1511988-005
					Result	Result	Result	Result	Result
EA029-G: Retained Acidity - Continued									
sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S		---	---	---	---	---
EA029-H: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S		<0.02	**0.05**	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t		<10	**29**	<10	<10	**12**
Liming Rate	----	1	kg CaCO3/t		<1	**2**	<1	<1	<1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	011510059011 (BH3 0.5-0.95m)	011510059013 (BH3 3.0-3.45m)	011510059019 (BH5 2.5-3.0m)	01150059020 (BH5 4.5-4.95m)	011510059023 (BH8 0.5-0.95m)
			Client sampling date / time	[25-Nov-2014]	[25-Nov-2014]	[26-Nov-2014]	[26-Nov-2014]	[28-Nov-2014]
Compound	CAS Number	LOR	Unit	EB1511988-006	EB1511988-007	EB1511988-008	EB1511988-009	EB1511988-010
				Result	Result	Result	Result	Result
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	<0.005	<0.005	<0.005	0.005	<0.005
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	6.0	4.9	5.5	5.5	5.6
pH OX (23B)	----	0.1	pH Unit	4.8	3.7	3.9	4.2	3.7
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	12	<2	3	<2
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	4	31	27	15	15
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	5	18	27	12	15
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	<0.02
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	<0.02	0.05	0.04	0.02	0.02
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	<0.02	0.03	0.04	<0.02	0.02
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Sulfur (23De)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	<10	<10	<10	<10
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.02	% Ca	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Calcium (23Wh)	----	0.02	% Ca	<0.02	<0.02	<0.02	<0.02	<0.02
Acid Reacted Calcium (23X)	----	0.02	% Ca	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Magnesium (23Tm)	----	0.02	% Mg	<0.02	<0.02	<0.02	<0.02	<0.02
Acid Reacted Magnesium (23U)	----	0.02	% Mg	<0.02	<0.02	<0.02	<0.02	<0.02
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
EA029-G: Retained Acidity								
HCl Extractable Sulfur (20Be)	----	0.02	% S	----	----	----	----	----
Net Acid Soluble Sulfur (20Je)	----	0.02	% S	----	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	011510059011 (BH3 0.5-0.95m)	011510059013 (BH3 3.0-3.45m)	011510059019 (BH5 2.5-3.0m)	01150059020 (BH5 4.5-4.95m)	011510059023 (BH8 0.5-0.95m)
				Client sampling date / time	[25-Nov-2014]	[25-Nov-2014]	[26-Nov-2014]	[26-Nov-2014]	[28-Nov-2014]
Compound	CAS Number	LOR	Unit		EB1511988-006	EB1511988-007	EB1511988-008	EB1511988-009	EB1511988-010
					Result	Result	Result	Result	Result
EA029-G: Retained Acidity - Continued									
sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S		---	---	---	---	---
EA029-H: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S		<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)	----	10	mole H+ / t		<10	**12**	<10	<10	<10
Liming Rate	----	1	kg CaCO3/t		<1	<1	<1	<1	<1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	011510059028 (BH9 7.0-7.45m)	011510059030 (BH9 10.0-10.45m)	011510059033 (BH10 0.2-1.0m)	011510059037 (BH11 1.0-1.45m)	011510059039 (BH12 0.5-1.0m)
			Client sampling date / time	[09-Dec-2014]	[09-Dec-2014]	[10-Dec-2014]	[11-Dec-2014]	[11-Dec-2014]
Compound	CAS Number	LOR	Unit	EB1511988-011	EB1511988-012	EB1511988-013	EB1511988-014	EB1511988-015
				Result	Result	Result	Result	Result
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	<0.005	<0.005	<0.005	<0.005	<0.005
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	5.6	5.4	5.2	5.8	4.2
pH OX (23B)	----	0.1	pH Unit	4.4	4.4	3.4	3.8	2.4
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	2	2	<2	16
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	7	5	8	2	83
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	7	3	6	2	68
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	0.02
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	0.13
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	0.11
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Sulfur (23De)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	<10	<10	<10	<10
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.02	% Ca	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Calcium (23Wh)	----	0.02	% Ca	<0.02	<0.02	<0.02	<0.02	<0.02
Acid Reacted Calcium (23X)	----	0.02	% Ca	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Magnesium (23Tm)	----	0.02	% Mg	<0.02	<0.02	<0.02	<0.02	<0.02
Acid Reacted Magnesium (23U)	----	0.02	% Mg	<0.02	<0.02	<0.02	<0.02	<0.02
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
EA029-G: Retained Acidity								
HCl Extractable Sulfur (20Be)	----	0.02	% S	----	----	----	----	<0.02
Net Acid Soluble Sulfur (20Je)	----	0.02	% S	----	----	----	----	<0.02

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	011510059028 (BH9 7.0-7.45m)	011510059030 (BH9 10.0-10.45m)	011510059033 (BH10 0.2-1.0m)	011510059037 (BH11 1.0-1.45m)	011510059039 (BH12 0.5-1.0m)
				Client sampling date / time	[09-Dec-2014]	[09-Dec-2014]	[10-Dec-2014]	[11-Dec-2014]	[11-Dec-2014]
Compound	CAS Number	LOR	Unit		EB1511988-011	EB1511988-012	EB1511988-013	EB1511988-014	EB1511988-015
					Result	Result	Result	Result	Result
EA029-G: Retained Acidity - Continued									
sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S		---	---	---	---	<0.02
EA029-H: Acid Base Accounting									
ANC Fineness Factor	----	0.5	-		**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S		<0.02	<0.02	<0.02	<0.02	**0.02**
Net Acidity (acidity units)	----	10	mole H+ / t		<10	<10	<10	<10	**16**
Liming Rate	----	1	kg CaCO3/t		<1	<1	<1	<1	**1**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	011510059040 (BH12 1.0-1.45m)	011510059041 (BH12 2.5-2.95m)	011510059042 (BH12 4.0-4.45m)	011510059002 (BH1 1.5-1.95m)	----
			Client sampling date / time	[11-Dec-2014]	[11-Dec-2014]	[11-Dec-2014]	[25-Nov-2014]	----
Compound	CAS Number	LOR	Unit	EB1511988-016	EB1511988-017	EB1511988-018	EB1511988-019	------
				Result	Result	Result	Result	Result
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	<0.005	<0.005	<0.005	<0.005	---
EA029-A: pH Measurements								
pH KCl (23A)	----	0.1	pH Unit	5.2	6.1	5.0	4.8	---
pH OX (23B)	----	0.1	pH Unit	2.8	3.8	2.7	2.7	---
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)	----	2	mole H+ / t	3	<2	4	13	---
Titratable Peroxide Acidity (23G)	----	2	mole H+ / t	11	3	22	36	---
Titratable Sulfidic Acidity (23H)	----	2	mole H+ / t	8	3	18	22	---
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<0.02	0.02	---
sulfidic - Titratable Peroxide Acidity (s-23G)	----	0.02	% pyrite S	<0.02	<0.02	0.03	0.06	---
sulfidic - Titratable Sulfidic Acidity (s-23H)	----	0.02	% pyrite S	<0.02	<0.02	0.03	0.04	---
EA029-C: Sulfur Trail								
KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	---
Peroxide Sulfur (23De)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	---
Peroxide Oxidisable Sulfur (23E)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	---
acidity - Peroxide Oxidisable Sulfur (a-23E)	----	10	mole H+ / t	<10	<10	<10	<10	---
EA029-D: Calcium Values								
KCl Extractable Calcium (23Vh)	----	0.02	% Ca	<0.02	<0.02	<0.02	<0.02	---
Peroxide Calcium (23Wh)	----	0.02	% Ca	<0.02	<0.02	<0.02	<0.02	---
Acid Reacted Calcium (23X)	----	0.02	% Ca	<0.02	<0.02	<0.02	<0.02	---
acidity - Acid Reacted Calcium (a-23X)	----	10	mole H+ / t	<10	<10	<10	<10	---
sulfidic - Acid Reacted Calcium (s-23X)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	---
EA029-E: Magnesium Values								
KCl Extractable Magnesium (23Sm)	----	0.02	% Mg	<0.02	<0.02	<0.02	<0.02	---
Peroxide Magnesium (23Tm)	----	0.02	% Mg	<0.02	<0.02	<0.02	<0.02	---
Acid Reacted Magnesium (23U)	----	0.02	% Mg	<0.02	<0.02	<0.02	<0.02	---
Acidity - Acid Reacted Magnesium (a-23U)	----	10	mole H+ / t	<10	<10	<10	<10	---
sulfidic - Acid Reacted Magnesium (s-23U)	----	0.02	% S	<0.02	<0.02	<0.02	<0.02	---
EA029-G: Retained Acidity								
HCl Extractable Sulfur (20Be)	----	0.02	% S	---	---	---	---	---
Net Acid Soluble Sulfur (20Je)	----	0.02	% S	---	---	---	---	---

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	011510059040 (BH12 1.0-1.45m)	011510059041 (BH12 2.5-2.95m)	011510059042 (BH12 4.0-4.45m)	011510059002 (BH1 1.5-1.95m)	----
			Client sampling date / time	[11-Dec-2014]	[11-Dec-2014]	[11-Dec-2014]	[25-Nov-2014]	----
Compound	CAS Number	LOR	Unit	EB1511988-016	EB1511988-017	EB1511988-018	EB1511988-019	------
				Result	Result	Result	Result	Result
EA029-G: Retained Acidity - Continued								
sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S	----	----	----	----	----
EA029-H: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	**1.5**	**1.5**	**1.5**	----
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<0.02	**0.02**	----
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<10	**13**	----
Liming Rate	----	1	kg CaCO3/t	<1	<1	<1	**1**	----

CERTIFICATE OF ANALYSIS

Work Order	: **EB1513169**	Page	: 1 of 6
Client	: **ROBERT CARR & ASSOCIATES P/L**	Laboratory	: Environmental Division Brisbane
Contact	: MR CALVIN MICKAN	Contact	: Customer Services EB
Address	: P O BOX 175 CARRINGTON NSW, AUSTRALIA 2294	Address	: 2 Byth Street Stafford QLD Australia 4053
E-mail	: calvinm@rca.com.au	E-mail	: ALSEnviro.Brisbane@alsglobal.com
Telephone	: +61 02 4902 9200	Telephone	: +61-7-3243 7222
Facsimile	: +61 02 4902 9299	Facsimile	: +61-7-3243 7218
Project	: 10059	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 18-Feb-2015 15:50
C-O-C number	: ----	Date Analysis Commenced	: 20-Feb-2015
Sampler	: CALVIN MICKAN, THOMAS HOSKING	Issue Date	: 25-Feb-2015 13:39
Site	: ----		
		No. of samples received	: 17
Quote number	: ----	No. of samples analysed	: 17

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics

General Comments

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

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

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

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

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

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.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	011510059001 (BH1 0.5-0.95m) EB1511988-001	011510059002 (BH1 1.5-1.95m) EB1511988-019	011510059003 (BH1 3.0-3.45m) EB1511988-002	011510059004 (BH1 4.5-4.95m) EB1511988-003	011510059007 (BH2 1.5-1.95m) EB1511988-004
				Client sampling date / time	[24-Nov-2014]	[24-Nov-2014]	[24-Nov-2014]	[24-Nov-2014]	[25-Nov-2014]
Compound	CAS Number	LOR	Unit		EB1513169-001	EB1513169-002	EB1513169-003	EB1513169-004	EB1513169-005
					Result	Result	Result	Result	Result
EA055: Moisture Content									
^ **Moisture Content (dried @ 103°C)**	----	1	%		**3.7**	**3.1**	**6.1**	**4.3**	**8.0**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	011510059008 (BH2 3.0-3.45m) EB1511988-005	011510059011 (BH3 0.5-0.95m) EB1511988-006	011510059013 (BH3 3.0-3.45m) EB1511988-007	011510059019 (BH5 2.5-3.0m) EB1511988-008	011510059028 (BH9 7.0-7.45m) EB1511988-011
				Client sampling date / time	[25-Nov-2014]	[25-Nov-2014]	[25-Nov-2014]	[26-Nov-2014]	[09-Dec-2014]
Compound	CAS Number	LOR	Unit		EB1513169-006	EB1513169-007	EB1513169-008	EB1513169-009	EB1513169-010
					Result	Result	Result	Result	Result
EA055: Moisture Content									
^ **Moisture Content (dried @ 103°C)**	----	1	%		**6.7**	**4.6**	**5.0**	**3.8**	**3.7**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	011510059030 (BH9 10.0-10.45m) EB1511988-012	011510059033 (BH10 0.2-1.0m) EB1511988-013	011510059037 (BH11 1.0-1.45m) EB1511988-014	011510059039 (BH12 0.5-1.0m) EB1511988-015	011510059040 (BH12 1.0-1.45m) EB1511988-016
				Client sampling date / time	[09-Dec-2014]	[10-Dec-2014]	[11-Dec-2014]	[11-Dec-2014]	[11-Dec-2014]
Compound	CAS Number	LOR	Unit		EB1513169-011	EB1513169-012	EB1513169-013	EB1513169-014	EB1513169-015
					Result	Result	Result	Result	Result
EA055: Moisture Content									
^ **Moisture Content (dried @ 103°C)**	----	1	%		**4.4**	**2.6**	**3.9**	**4.6**	**4.1**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	011510059041 (BH12 2.5-2.95m) EB1511988-017	011510059042 (BH12 4.0-4.45m) EB1511988-018	---	---	---
			Client sampling date / time	[11-Dec-2014]	[11-Dec-2014]	---	---	---
Compound	CAS Number	LOR	Unit	EB1513169-016	EB1513169-017	-------	-------	-------
				Result	Result	Result	Result	Result
EA055: Moisture Content								
^ **Moisture Content (dried @ 103°C)**	----	1	%	**2.7**	**3.9**	---	---	---

Robert Carr & Associates Pty Ltd Trading as RCA Laboratories – Environmental
92 Hill Street PO Box 175, Carrington NSW 2294
ABN 53 063 515 711 Ph 02 4902 9200 – Fax 02 4902 9299
Email: administrator@rca.com.au Web www.rca.com.au

NATA Accredited Laboratory 9811
Corporate Site Number 18077
Accredited for compliance with ISO/IEC 17025

Robert Carr & Associates
92 Hill Street
CARRINGTON NSW 2294

Attention: John Gilbert

Project:	RCA ref 10059-702/0		
Date:	18/02/2015		
Client reference:	Cabbage Tree Road Williamtown		
Received date:	17/2/2015	**Number of samples:**	12
Client order number:	N/A	**Testing commenced:**	18/2/2015

CERTIFICATE OF ANALYSIS

1 ANALYTICAL TEST METHODS

ANALYSIS	METHOD	UNITS	ANALYSING LABORATORY	NATA ANALYSIS/ NON NATA
pH	ENV-LAB006*	pH	RCA Laboratories - Environmental	NATA
Conductivity	ENV-LAB010*	µS/cm	RCA Laboratories - Environmental	NATA

* The analytical procedures used by RCA Laboratories - Environmental are based on established internationally recognised procedures such as APHA and Australian Standards.

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

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2 RESULTS

ANALYSIS	UNITS	BH1	BH2	BH3	BH4	BH5	BH6
Water							
Sample Number	-	021510059001	021510059002	021510059003	021510059004	021510059005	021510059006
Date Sampled	-	17/2/2015	17/2/2015	17/2/2015	17/2/2015	17/2/2015	17/02/2015
Sampled By		JG	JG	JG	JG	JG	JG
pH Value	pH unit	5.63	5.10	5.50	5.51	5.20	5.36
Conductivity	µS/cm	127.9	130.7	112.5	150.3	240.5	266.2

ANALYSIS	UNITS	BH7	BH8	BH9	BH10	BH11	BH12
Water							
Sample Number	-	021510059007	021510059008	021510059009	021510059010	021510059011	021510059012
Date Sampled	-	17/2/2015	17/2/2015	17/2/2015	17/2/2015	17/2/2015	17/2/2015
Sampled By		JG	JG	JG	JG	JG	JG
pH Value	pH unit	5.58	5.22	4.85	4.81	4.89	5.17
Conductivity	µS/cm	145.2	252.2	103.0	236.2	131.0	166.4

Water

NATA Scope of Accreditation does not cover the sampling of surface and groundwaters by the client or by RCA.

Analysis on samples is on an as received basis.

3 QUALITY CONTROL RESULTS

Water Quality Control Sample Results

DATE	ANALYSIS	METHOD	UNITS	QUALITY CONTROL STANDARD VALUE	QUALITY CONTROL ACCEPTANCE CRITERIA	QUALITY CONTROL STANDARD RESULT
18/2/15	pH	ENV-LAB006	pH	7.00	6.95 - 7.05	6.98
18/2/15	Conductivity	ENV-LAB010	µS/cm	1413	1385 - 1441	1419

Water Duplicate Analysis Results

SAMPLE NUMBER	DATE	ANALYSIS	METHOD	UNITS	LOR	SAMPLE RESULT	SAMPLE DUPLICATE RESULT
021510059001	18/2/15	pH	ENV-LAB006	pH	-	5.63	5.62
021510059012	18/2/15	pH	ENV-LAB006	pH	-	5.17	5.17
021510059001	18/2/15	Conductivity	ENV-LAB010	µS/cm	1	127.9	128.1
021510059012	18/2/15	Conductivity	ENV-LAB010	µS/cm	1	166.4	166.2

Please contact the undersigned if you have any queries.

Yours sincerely

Laura Schofield
Environmental Laboratory Manager
Robert Carr & Associates Pty Ltd Trading as
RCA Laboratories - Environmental
Approved Signatory

Julie Fisher
Environmental Chemist
Robert Carr & Associates Pty Ltd Trading as
RCA Laboratories - Environmental
Approved Signatory

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RCA Internal Quality Review

General

1. Laboratory QC results for Method Blanks, Duplicates and Laboratory Control Samples are included in this QC report where applicable. Additional QC data maybe available on request.
2. RCA QC Acceptance / Rejection Criteria are available on request.
3. Proficiency Trial results are available on request.
4. Actual PQLs are matrix dependant. Quoted PQLs may be raised where sample extracts are diluted due to interferences.
5. When individual results are qualified in the body of a report, refer to the qualifier descriptions that follow.
6. Samples were analysed on an 'as received' basis.
7. Sampled dates in this report are those listed on the COC or sample jars; if no sample dates are noted, the date the samples are received at the laboratory have been used.
8. All soil results are reported on a dry basis, unless otherwise stated. (ACID SULPHATE SOILS)
9. This report replaces any interim results previously issued.

Holding Times.

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 Acknowledgment.

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

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%

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. Duplicate RPD's are calculated from raw analytical data thus it is possible to have two sets of data.

Glossary

UNITS

mg/kg: milligrams per Kilogram

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100ml: Organisms per 100 millilitres

NTU: Units

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

mg/L: milligrams per Litre

TERMS

Dry Where moisture has been determined on a solid sample the result is expressed on a dry basis.

LOR Limit of Reporting.

RPD Relative Percent Difference between two Duplicate pieces of analysis can be obtained upon request.

QCS Quality Control Sample - reported as value 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.

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.

USEPA United States Environment Protection Authority

APHA American Public Health Association

COC Chain of Custody

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

< indicates less than

> Indicates greater than

IS Insufficient sample for analysis

ND Not Detected

RCA LABORATORIES
• ENVIRONMENTAL • CONSTRUCTION MATERIALS TESTING

Ph: (02) 4902 9200 Fax: 02 4902 9299
92 Hill Street, Carrington NSW 2294
www.rca.com.au Email: labenviro@rca.com.au

ENV-F103-4

Client Name: RCA
Client Site: William town

Contact Name: John Gilbert
Phone Number: 49029210

Email Report To: johng@rca.com.au; tomh@rca.com.au
Project Manager: Calvin

Turnaround Required: ☐ Urgent ☒ Stancard (5 Day)

Date Required: 5 day TAT

Expected Reporting Date: *(Laboratory Use Only)*

ANALYSIS REQUIRED

Page of

RCA Job Number: 10059

SAMPLE INFORMATION

RCA Laboratories Environmental Sample Number	Client ID / Description	Date	Matrix	Total Samples	pH	EC											Notes: Please filter water and put into metals container provided.
0215100559 ee1	BH1	17/02/15	Water	1	x	x											
" ee2	BH2	17/02/15	Water	2	x	x											
" ee3	BH3	17/02/15	Water	3	x	x											
" ee4	BH4	17/02/15	Water	4	x	x											
" ee5	BH5	17/02/15	Water	5	x	x											
" ee6	BH6	17/02/15	Water	6	x	x											
" ee7	BH7	17/02/15	Water	7	x	x											
" ee8	BH8	17/02/15	Water	8	x	x											
" ee9	BH9	17/02/15	Water	9	x	x											
" e10	BH10	17/02/15	Water	10	x	x											
" e11	BH11	17/02/15	Water	11	x	x											
" e12	BH12	17/02/15	Water	12	x	x											

RELINQUISHED BY		RECEIVED BY		Laboratory use only (circle appropriate)
Name: John Gilbert	Date: 17/2/15	Name: R. DAWSON	Date: 17.2.15	**Received in good condition:** (Yes) No
Of: RCA	Time: 4:30pm	Of: RCALE	Time: 4:30	**Chilled:** (Yes) No

eurofins | mgt

Certificate of Analysis

NATA Accredited
Accreditation Number 1261
Site Number 1254

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

Robert Carr and Associates Pty Ltd
PO Box 175
Carrington
NSW 2294

Attention: **John Gilbert**

Report **447947-W**
Project name 10059
Project ID 10059
Received Date Feb 19, 2015

Client Sample ID			**BH1**	**BH2**	**BH3**	**BH4**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**S15-Fe13784**	**S15-Fe13785**	**S15-Fe13786**	**S15-Fe13787**
Date Sampled			**Feb 17, 2015**	**Feb 17, 2015**	**Feb 17, 2015**	**Feb 17, 2015**
Test/Reference	LOR	Unit				
Ammonia (as N)	0.01	mg/L	0.14	< 0.01	< 0.01	< 0.01
Major Anions						
Bicarbonate Alkalinity (as CaCO3)	5	mg/L	10	8.0	7.0	7.0
Carbonate Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5	< 5
Chloride	1	mg/L	21	20	15	24
Nitrate (as N)	0.01	mg/L	< 0.1	2.3	1.4	0.57
Sulphate (as S)	2	mg/L	< 2	< 2	< 2	< 2
Alkali Metals						
Calcium	0.5	mg/L	1.4	3.3	5.2	3.4
Magnesium	0.5	mg/L	1.8	2.4	1.9	2.0
Potassium	0.5	mg/L	0.6	< 0.5	1.0	0.8
Sodium	0.5	mg/L	11	13	8.8	17
Heavy Metals						
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium (filtered)	0.001	mg/L	0.003	< 0.001	0.001	< 0.001
Copper (filtered)	0.001	mg/L	0.005	0.002	0.005	0.002
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	0.001	mg/L	0.002	0.004	0.004	0.002
Zinc (filtered)	0.005	mg/L	0.073	0.096	0.077	0.018

Client Sample ID			**BH5**	**BH6**	**BH7**	**BH8**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**S15-Fe13788**	**S15-Fe13789**	**S15-Fe13790**	**S15-Fe13791**
Date Sampled			**Feb 17, 2015**	**Feb 17, 2015**	**Feb 17, 2015**	**Feb 17, 2015**
Test/Reference	LOR	Unit				
Ammonia (as N)	0.01	mg/L	0.05	0.03	0.01	0.11
Major Anions						
Bicarbonate Alkalinity (as CaCO3)	5	mg/L	< 5	7.0	11	< 5
Carbonate Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5	< 5
Chloride	1	mg/L	52	48	22	57
Nitrate (as N)	0.01	mg/L	< 0.1	< 0.1	< 0.01	< 0.1
Sulphate (as S)	2	mg/L	4.7	5.6	< 2	2.0

Client Sample ID			BH5	BH6	BH7	BH8
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			S15-Fe13788	S15-Fe13789	S15-Fe13790	S15-Fe13791
Date Sampled			Feb 17, 2015	Feb 17, 2015	Feb 17, 2015	Feb 17, 2015
Test/Reference	LOR	Unit				
Alkali Metals						
Calcium	0.5	mg/L	2.4	1.2	2.3	2.0
Magnesium	0.5	mg/L	3.9	8.1	2.1	3.2
Potassium	0.5	mg/L	1.0	< 0.5	0.8	< 0.5
Sodium	0.5	mg/L	26	25	16	28
Heavy Metals						
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.005
Cadmium (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	0.0003
Chromium (filtered)	0.001	mg/L	0.001	< 0.001	0.002	0.005
Copper (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.004
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	0.003
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	0.001	mg/L	0.006	0.002	0.003	0.007
Zinc (filtered)	0.005	mg/L	0.024	0.014	0.024	0.011

Client Sample ID			BH9	BH10	BH11	BH12
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			S15-Fe13792	S15-Fe13793	S15-Fe13794	S15-Fe13795
Date Sampled			Feb 17, 2015	Feb 17, 2015	Feb 17, 2015	Feb 17, 2015
Test/Reference	LOR	Unit				
Ammonia (as N)	0.01	mg/L	< 0.01	0.10	0.06	< 0.01
Major Anions						
Bicarbonate Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5	< 5
Carbonate Alkalinity (as CaCO3)	5	mg/L	< 5	< 5	< 5	< 5
Chloride	1	mg/L	18	60	27	34
Nitrate (as N)	0.01	mg/L	0.54	< 0.05	< 0.01	< 0.01
Sulphate (as S)	2	mg/L	3.7	< 2	< 2	< 2
Alkali Metals						
Calcium	0.5	mg/L	1.7	< 0.5	0.7	1.3
Magnesium	0.5	mg/L	1.5	3.5	1.6	2.4
Potassium	0.5	mg/L	< 0.5	0.7	< 0.5	0.8
Sodium	0.5	mg/L	9.8	28	15	19
Heavy Metals						
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	0.001	0.002
Copper (filtered)	0.001	mg/L	0.002	< 0.001	< 0.001	< 0.001
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	0.001	mg/L	0.002	< 0.001	0.001	< 0.001
Zinc (filtered)	0.005	mg/L	0.048	0.006	0.014	0.009

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
Major Cations			
Ammonia (as N)	Sydney	Feb 19, 2015	28 Day
- Method: E036/E050 Ammonia as N			
Alkali Metals	Sydney	Feb 19, 2015	180 Day
- Method: E022/E030 Unfiltered Cations in Water			
Major Anions			
Bicarbonate Alkalinity (as CaCO3)	Sydney	Feb 20, 2015	14 Day
- Method: E035 Alkalinity (CO3, HCO3, OH)			
Carbonate Alkalinity (as CaCO3)	Sydney	Feb 20, 2015	14 Day
- Method: E035 Alkalinity (CO3, HCO3, OH)			
Chloride	Sydney	Feb 20, 2015	28 Day
- Method: E033 /E045 /E047 Chloride			
Nitrate (as N)	Sydney	Feb 20, 2015	28 Day
- Method: E037 /E051 Nitrate as N			
Sulphate (as S)	Sydney	Feb 20, 2015	28 Day
- Method: E045 Sulphate			
Metals M8 filtered	Sydney	Feb 19, 2015	28 Day
- Method: E020/E030 Filtered Metals in Water & E026 Mercury			

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NATA # 1261 Site # 18217

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

Company Name:	Robert Carr and Associates Pty Ltd	**Order No.:**		**Received:**	Feb 19, 2015 12:00 AM
Address:	PO Box 175 Carrington NSW 2294	**Report #:**	447947	**Due:**	Feb 24, 2015
		Phone:	02 4902 9200	**Priority:**	3 Day
		Fax:	02 4902 9299	**Contact Name:**	Calvin Mickan
Project Name:	10059				
Project ID:	10059				

Eurofins | mgt Client Manager: Andrew Black

Sample Detail					Metals M8 filtered	Major Anions	Major Cations
Laboratory where analysis is conducted							
Melbourne Laboratory - NATA Site # 1254 & 14271							
Sydney Laboratory - NATA Site # 18217					X	X	X
Brisbane Laboratory - NATA Site # 20794							
External Laboratory							
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
BH1	Feb 17, 2015		Water	S15-Fe13784	X	X	X
BH2	Feb 17, 2015		Water	S15-Fe13785	X	X	X
BH3	Feb 17, 2015		Water	S15-Fe13786	X	X	X
BH4	Feb 17, 2015		Water	S15-Fe13787	X	X	X
BH5	Feb 17, 2015		Water	S15-Fe13788	X	X	X
BH6	Feb 17, 2015		Water	S15-Fe13789	X	X	X
BH7	Feb 17, 2015		Water	S15-Fe13790	X	X	X
BH8	Feb 17, 2015		Water	S15-Fe13791	X	X	X
BH9	Feb 17, 2015		Water	S15-Fe13792	X	X	X

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Company Name:	Robert Carr and Associates Pty Ltd	**Order No.:**	
Address:	PO Box 175 Carrington NSW 2294	**Report #:** **Phone:** **Fax:**	447947 02 4902 9200 02 4902 9299
Project Name:	10059		
Project ID:	10059		

Received:	Feb 19, 2015 12:00 AM	
Due:	Feb 24, 2015	
Priority:	3 Day	
Contact Name:	Calvin Mickan	

Eurofins | mgt Client Manager: Andrew Black

Sample Detail					Metals M8 filtered	Major Anions	Major Cations
Laboratory where analysis is conducted							
Melbourne Laboratory - NATA Site # 1254 & 14271							
Sydney Laboratory - NATA Site # 18217					X	X	X
Brisbane Laboratory - NATA Site # 20794							
External Laboratory							
BH10	Feb 17, 2015		Water	S15-Fe13793	X	X	X
BH11	Feb 17, 2015		Water	S15-Fe13794	X	X	X
BH12	Feb 17, 2015		Water	S15-Fe13795	X	X	X

Eurofins | mgt 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
ASLP	Australian Standard Leaching Procedure (AS4439.3)
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 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, Toxophene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxophene 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 Arochlor 1260 in Matrix Spikes and LCS's.
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 RPD's 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							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Method Blank							
Major Anions							
Bicarbonate Alkalinity (as CaCO3)	mg/L	< 5			5	Pass	
Carbonate Alkalinity (as CaCO3)	mg/L	< 5			5	Pass	
Chloride	mg/L	< 1			1	Pass	
Nitrate (as N)	mg/L	< 0.01			0.01	Pass	
Sulphate (as S)	mg/L	< 2			2	Pass	
Method Blank							
Alkali Metals							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
Method Blank							
Heavy Metals							
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)	mg/L	< 0.0001			0.0001	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Mercury (filtered)	mg/L	< 0.0001			0.0001	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Zinc (filtered)	mg/L	< 0.005			0.005	Pass	
LCS - % Recovery							
Ammonia (as N)	%	98			70-130	Pass	
LCS - % Recovery							
Major Anions							
Bicarbonate Alkalinity (as CaCO3)	%	102			70-130	Pass	
Chloride	%	108			70-130	Pass	
Nitrate (as N)	%	122			70-130	Pass	
Sulphate (as S)	%	94			70-130	Pass	
LCS - % Recovery							
Alkali Metals							
Calcium	%	99			70-130	Pass	
Magnesium	%	107			70-130	Pass	
Potassium	%	86			70-130	Pass	
Sodium	%	94			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Arsenic (filtered)	%	101			70-130	Pass	
Cadmium (filtered)	%	102			70-130	Pass	
Chromium (filtered)	%	97			70-130	Pass	
Copper (filtered)	%	101			70-130	Pass	
Lead (filtered)	%	104			70-130	Pass	
Mercury (filtered)	%	72			70-130	Pass	
Nickel (filtered)	%	103			70-130	Pass	
Zinc (filtered)	%	108			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Ammonia (as N)	S15-Fe13784	CP	%	103			70-130	Pass	
Spike - % Recovery									
Alkali Metals				Result 1					
Calcium	S15-Fe13785	CP	%	102			70-130	Pass	
Magnesium	S15-Fe13785	CP	%	111			70-130	Pass	
Potassium	S15-Fe13785	CP	%	91			70-130	Pass	
Sodium	S15-Fe13785	CP	%	94			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic (filtered)	S15-Fe13786	CP	%	96			70-130	Pass	
Cadmium (filtered)	S15-Fe13786	CP	%	106			70-130	Pass	
Chromium (filtered)	S15-Fe13786	CP	%	92			70-130	Pass	
Copper (filtered)	S15-Fe13786	CP	%	95			70-130	Pass	
Lead (filtered)	S15-Fe13786	CP	%	97			70-130	Pass	
Mercury (filtered)	S15-Fe13786	CP	%	89			70-130	Pass	
Nickel (filtered)	S15-Fe13786	CP	%	97			70-130	Pass	
Zinc (filtered)	S15-Fe13786	CP	%	117			70-130	Pass	
Spike - % Recovery									
Major Anions				Result 1					
Nitrate (as N)	S15-Fe13787	CP	%	74			70-130	Pass	
Spike - % Recovery									
				Result 1					
Ammonia (as N)	S15-Fe13794	CP	%	90			70-130	Pass	
Spike - % Recovery									
Alkali Metals				Result 1					
Calcium	S15-Fe13795	CP	%	101			70-130	Pass	
Magnesium	S15-Fe13795	CP	%	103			70-130	Pass	
Potassium	S15-Fe13795	CP	%	89			70-130	Pass	
Sodium	S15-Fe13795	CP	%	82			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Arsenic (filtered)	S15-Fe13795	CP	%	102			70-130	Pass	
Cadmium (filtered)	S15-Fe13795	CP	%	104			70-130	Pass	
Chromium (filtered)	S15-Fe13795	CP	%	96			70-130	Pass	
Copper (filtered)	S15-Fe13795	CP	%	95			70-130	Pass	
Lead (filtered)	S15-Fe13795	CP	%	93			70-130	Pass	
Mercury (filtered)	S15-Fe13795	CP	%	77			70-130	Pass	
Nickel (filtered)	S15-Fe13795	CP	%	98			70-130	Pass	
Zinc (filtered)	S15-Fe13795	CP	%	112			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	S15-Fe13784	CP	mg/L	0.14	0.14	3.0	30%	Pass	
Duplicate									
Major Anions				Result 1	Result 2	RPD			
Bicarbonate Alkalinity (as CaCO3)	S15-Fe13784	CP	mg/L	10	10	<1	30%	Pass	
Carbonate Alkalinity (as CaCO3)	S15-Fe13784	CP	mg/L	< 5	< 5	<1	30%	Pass	
Duplicate									
Alkali Metals				Result 1	Result 2	RPD			
Calcium	S15-Fe13784	CP	mg/L	1.4	1.4	3.0	30%	Pass	
Magnesium	S15-Fe13784	CP	mg/L	1.8	1.8	2.0	30%	Pass	
Potassium	S15-Fe13784	CP	mg/L	0.6	0.6	1.0	30%	Pass	
Sodium	S15-Fe13784	CP	mg/L	11	11	3.0	30%	Pass	

Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic (filtered)	S15-Fe13785	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cadmium (filtered)	S15-Fe13785	CP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Copper (filtered)	S15-Fe13785	CP	mg/L	0.002	0.002	10	30%	Pass	
Lead (filtered)	S15-Fe13785	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Mercury (filtered)	S15-Fe13785	CP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel (filtered)	S15-Fe13785	CP	mg/L	0.004	0.003	4.0	30%	Pass	
Zinc (filtered)	S15-Fe13785	CP	mg/L	0.096	0.093	3.0	30%	Pass	
Duplicate									
Major Anions				Result 1	Result 2	RPD			
Nitrate (as N)	S15-Fe13787	CP	mg/L	0.57	0.57	<1	30%	Pass	
Duplicate									
Major Anions				Result 1	Result 2	RPD			
Chloride	S15-Fe13790	CP	mg/L	22	22	<1	30%	Pass	
Sulphate (as S)	S15-Fe13790	CP	mg/L	< 2	< 2	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	S15-Fe13794	CP	mg/L	0.06	0.06	3.0	30%	Pass	
Duplicate									
Major Anions				Result 1	Result 2	RPD			
Bicarbonate Alkalinity (as CaCO3)	S15-Fe13794	CP	mg/L	< 5	< 5	<1	30%	Pass	
Carbonate Alkalinity (as CaCO3)	S15-Fe13794	CP	mg/L	< 5	< 5	<1	30%	Pass	
Duplicate									
Alkali Metals				Result 1	Result 2	RPD			
Calcium	S15-Fe13794	CP	mg/L	0.7	0.7	1.0	30%	Pass	
Magnesium	S15-Fe13794	CP	mg/L	1.6	1.7	3.0	30%	Pass	
Potassium	S15-Fe13794	CP	mg/L	< 0.5	< 0.5	<1	30%	Pass	
Sodium	S15-Fe13794	CP	mg/L	15	16	4.0	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Arsenic (filtered)	S15-Fe13794	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Cadmium (filtered)	S15-Fe13794	CP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Chromium (filtered)	S15-Fe13794	CP	mg/L	0.001	0.001	19	30%	Pass	
Copper (filtered)	S15-Fe13794	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Lead (filtered)	S15-Fe13794	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Mercury (filtered)	S15-Fe13794	CP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass	
Nickel (filtered)	S15-Fe13794	CP	mg/L	0.001	0.001	10	30%	Pass	
Zinc (filtered)	S15-Fe13794	CP	mg/L	0.014	0.016	12	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

Authorised By

Andrew Black	Analytical Services Manager
Bob Symons	Senior Analyst-Inorganic (NSW)
Ivan Taylor	Senior Analyst-Metal (NSW)

Glenn Jackson
National Laboratory Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

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

Uncertainty data is available on request

447947

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CHAIN OF CUSTODY RECORD

CLIENT DETAILS

Page 1 of ___

Company Name: RCA Australia	Contact Name: John Gilbert	Purchase Order:	COC Number:
Office Address: 92 Hill St Carrington NSW	Project Manager: Calvin Mickan	PROJECT Number: 10059	Eurofins | mgt quote ID:
	Email for results: johng@rca.com.au; thomash@rca.com.au	PROJECT Name:	Data output format:

Special Directions & Comments:

Eurofins | mgt DI water batch number:

Analytes

	Sample ID	Date	Matrix	major cations and anions	metals 8
1	BH1	17/02/15	Water	x	x
2	BH2	17/02/15	Water	x	x
3	BH3	17/02/15	Water	x	x
4	BH4	17/02/15	Water	x	x
5	BH5	17/02/15	Water	x	x
6	BH6	17/02/15	Water	x	x
7	BH7	17/02/15	Water	x	x
8	BH8	17/02/15	Water	x	x
9	BH9	17/02/15	Water	x	x
10	BH10	17/02/15	Water	x	x
11	BH11	17/02/15	Water	x	x
12	BH12	17/02/15	Water	x	x
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:

	Laboratory Staff
Relinquished By:	Received By: Andrew Black
Date & Time:	Date & Time: 18/2/15 11:30am
Signature:	Signature: [signature]

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:

Appendix E

Summary of Groundwater Test Results

Sample Identification	PQL	**Aquatic Ecosystem Guideline** [A]	**Human Health (Ingestion) Guideline** [B]	BH1	BH2	BH3
Sample Depth (m) [C]		95% Marine		5.3	5.1	5.2
Date				17/2/15	17/2/15	17/2/15
Sample Description				Pale grey/brown, very turbid, slight sulfur odour	Dark brown, very turbid, slight sulfur odour	Dark brown, very turbid, slight sulfur odour
Laboratory Report Reference				447947	447947	447947
Sample Purpose				Groundwater quality assessment	Groundwater quality assessment	Groundwater quality assessment
Sample collected by				JG	JG	JG
Metals						
Arsenic	0.001	*0.0023*	*0.01*	< 0.001	< 0.001	< 0.001
Cadmium	0.0001	0.0055	0.002	< 0.0001	< 0.0001	< 0.0001
Chromium	0.001	0.0044	0.05	0.003	< 0.001	0.001
Copper	0.001	0.0013	2	**0.005**	**0.002**	**0.005**
Lead	0.001	0.0044	0.01	< 0.001	< 0.001	< 0.001
Mercury[D]	0.0001	0.0004	0.001	< 0.0001	< 0.0001	< 0.0001
Nickel	0.001	0.07	0.02	0.002	0.004	0.004
Zinc	0.005	0.015		**0.073**	**0.096**	**0.077**
Major Anions						
Ammonia as N	0.01	0.91		0.14	< 0.01	< 0.01
Bicarbonate Alkalinity as CaCO3	5			10	8	7
Carbonate Alkalinity as CaCO3	5			< 5	< 5	< 5
Chloride	1			21	20	15
Nitrate (as N)	0.01		50	< 0.1	2.3	1.4
Sulfate as S	2		500	< 2	< 2	< 2
Major Cations						
Calcium	0.5			1.4	3.3	5.2
Magnesium	0.5			1.8	2.4	1.9
Potassium	0.5			0.6	< 0.5	1
Sodium	0.5			11	13	8.8
Parameters						
pH (pH units)	0.5			5.63	5.1	5.5
Conductivity µS/cm	0.5			127.9	130.7	112.5
TDS[E]	--			82	84	72

All results are in units of mg/L, unless otherwise stated.

Blank Cell indicates no criterion available

PQL = Practical Quantitation Limit. Where PQL is for a summation, PQL of all components is summed and may be different from that presented by laboratory

[A] ANZECC 2000 95% Protection Level for marine water

[B] NHMRC Australian Drinking Water Guidelines, 2011

[C] Sample depths presented are as encountered during sampling

[D] Bioaccummulative Compounds

[E] TDS calculated using laboratory reported electrical conductivity values

ANZECC guidelines in *italics* are low level reliability guidelines

ANZECC arsenic guideline based on As (III) for marine water, the lowest of presented guidelines.

NHMRC arsenic guidelines are based on total arsenic

ANZECC and NHMRC guidelines for chromium are based on Cr (VI)

ANZECC guidelines for mercury are based on inorganic mercury.

NHMRC guidelines for mercury are based on total mercury.

Results shown in **BOLD** are in excess of the aquatic ecosystems guidelines

Results shown in <u>underline</u> are in excess of the human health (ingestion) guideline

Sample Identification	PQL	**Aquatic Ecosystem Guideline** [A]	**Human Health (Ingestion) Guideline** [B]	BH4	BH5	BH6
Sample Depth (m) [C]		95% Marine		1.3	5.0	0.9
Date				17/2/15	17/2/15	17/2/15
Sample Description				Dark brown, very turbid, slight sulfur odour	Dark brown, very turbid, slight sulfur odour	Dark brown, turbid, slight sulfur odour
Laboratory Report Reference				447947	447947	447947
Sample Purpose				Groundwater quality assessment	Groundwater quality assessment	Groundwater quality assessment
Sample collected by				JG	JG	JG
Metals						
Arsenic	0.001	*0.0023*	*0.01*	< 0.001	< 0.001	< 0.001
Cadmium	0.0001	0.0055	0.002	< 0.0001	< 0.0001	< 0.0001
Chromium	0.001	0.0044	0.05	< 0.001	0.001	< 0.001
Copper	0.001	0.0013	2	**0.002**	< 0.001	< 0.001
Lead	0.001	0.0044	0.01	< 0.001	< 0.001	< 0.001
Mercury[D]	0.0001	0.0004	0.001	< 0.0001	< 0.0001	< 0.0001
Nickel	0.001	0.07	0.02	0.002	0.006	0.002
Zinc	0.005	0.015		**0.018**	**0.024**	0.014
Major Anions						
Ammonia as N	0.01	0.91		< 0.01	0.05	0.03
Bicarbonate Alkalinity as CaCO3	5			7	< 5	7
Carbonate Alkalinity as CaCO3	5			< 5	< 5	< 5
Chloride	1			24	52	48
Nitrate (as N)	0.01		50	0.57	< 0.1	< 0.1
Sulfate as S	2		500	< 2	4.7	5.6
Major Cations						
Calcium	0.5			3.4	2.4	1.2
Magnesium	0.5			2	3.9	8.1
Potassium	0.5			0.8	1	< 0.5
Sodium	0.5			17	26	25
Parameters						
pH (pH units)	0.5			5.51	5.2	5.36
Conductivity µS/cm	0.5			150.3	240.5	266.2
TDS[E]	--			96	154	170

All results are in units of mg/L, unless otherwise stated.

Blank Cell indicates no criterion available

PQL = Practical Quantitation Limit. Where PQL is for a summation, PQL of all components is summed and may be different from that presented by laboratory

[A] ANZECC 2000 95% Protection Level for marine water

[B] NHMRC Australian Drinking Water Guidelines, 2011

[C] Sample depths presented are as encountered during sampling

[D] Bioaccummulative Compounds

[E] TDS calculated using laboratory reported electrical conductivity values

ANZECC guidelines in *italics* are low level reliability guidelines

ANZECC arsenic guideline based on As (III) for marine water, the lowest of presented guidelines.

NHMRC arsenic guidelines are based on total arsenic

ANZECC and NHMRC guidelines for chromium are based on Cr (VI)

ANZECC guidelines for mercury are based on inorganic mercury.

NHMRC guidelines for mercury are based on total mercury.

Results shown in **BOLD** are in excess of the aquatic ecosystems guidelines

Results shown in <u>underline</u> are in excess of the human health (ingestion) guideline

Sample Identification	PQL	**Aquatic Ecosystem Guideline** [A]	**Human Health (Ingestion) Guideline** [B]	BH7	BH8	BH9
Sample Depth (m) [C]		95% Marine		1.1	1.7	15.5
Date				17/2/15	17/2/15	17/2/15
Sample Description				Dark brown, very turbid, slight sulfur odour	Dark brown, very turbid, slight sulfur odour	Dark brown, very turbid, slight sulfur odour
Laboratory Report Reference				447947	447947	447947
Sample Purpose				Groundwater quality assessment	Groundwater quality assessment	Groundwater quality assessment
Sample collected by				JG	JG	JG
Metals						
Arsenic	0.001	*0.0023*	*0.01*	< 0.001	**0.005**	< 0.001
Cadmium	0.0001	0.0055	0.002	< 0.0001	0.0003	< 0.0001
Chromium	0.001	0.0044	0.05	0.002	**0.005**	< 0.001
Copper	0.001	0.0013	2	< 0.001	**0.004**	**0.002**
Lead	0.001	0.0044	0.01	< 0.001	0.003	< 0.001
Mercury[D]	0.0001	0.0004	0.001	< 0.0001	< 0.0001	< 0.0001
Nickel	0.001	0.07	0.02	0.003	0.007	0.002
Zinc	0.005	0.015		**0.024**	0.011	**0.048**
Major Anions						
Ammonia as N	0.01	0.91		0.01	0.11	< 0.01
Bicarbonate Alkalinity as CaCO3	5			11	< 5	< 5
Carbonate Alkalinity as CaCO3	5			< 5	< 5	< 5
Chloride	1			22	57	18
Nitrate (as N)	0.01		50	< 0.01	< 0.1	0.54
Sulfate as S	2		500	< 2	2	3.7
Major Cations						
Calcium	0.5			2.3	2	1.7
Magnesium	0.5			2.1	3.2	1.5
Potassium	0.5			0.8	< 0.5	< 0.5
Sodium	0.5			16	28	9.8
Parameters						
pH (pH units)	0.5			5.58	5.22	4.85
Conductivity µS/cm	0.5			145.2	252.2	103
TDS[E]	--			93	161	66

All results are in units of mg/L, unless otherwise stated.

Blank Cell indicates no criterion available

PQL = Practical Quantitation Limit. Where PQL is for a summation, PQL of all components is summed and may be different from that presented by laboratory

[A] ANZECC 2000 95% Protection Level for marine water

[B] NHMRC Australian Drinking Water Guidelines, 2011

[C] Sample depths presented are as encountered during sampling

[D] Bioaccummulative Compounds

[E] TDS calculated using laboratory reported electrical conductivity values

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ANZECC arsenic guideline based on As (III) for marine water, the lowest of presented guidelines.

NHMRC arsenic guidelines are based on total arsenic

ANZECC and NHMRC guidelines for chromium are based on Cr (VI)

ANZECC guidelines for mercury are based on inorganic mercury.

NHMRC guidelines for mercury are based on total mercury.

Results shown in **BOLD** are in excess of the aquatic ecosystems guidelines

Results shown in <u>underline</u> are in excess of the human health (ingestion) guideline

Sample Identification	PQL	**Aquatic Ecosystem Guideline** [A]	**Human Health (Ingestion) Guideline** [B]	BH10	BH11	BH12
Sample Depth (m) [C]		95% Marine		3.1	2.4	6.0
Date				17/2/15	17/2/15	17/2/15
Sample Description				Dark brown, very turbid, slight sulfur odour	Dark brown, very turbid, slight sulfur odour	Dark brown, very turbid, slight sulfur odour
Laboratory Report Reference				447947	447947	447947
Sample Purpose				Groundwater quality assessment	Groundwater quality assessment	Groundwater quality assessment
Sample collected by				JG	JG	JG
Metals						
Arsenic	0.001	*0.0023*	*0.01*	< 0.001	< 0.001	< 0.001
Cadmium	0.0001	0.0055	0.002	< 0.0001	< 0.0001	< 0.0001
Chromium	0.001	0.0044	0.05	< 0.001	0.001	0.002
Copper	0.001	0.0013	2	< 0.001	< 0.001	< 0.001
Lead	0.001	0.0044	0.01	< 0.001	< 0.001	< 0.001
Mercury[D]	0.0001	0.0004	0.001	< 0.0001	< 0.0001	< 0.0001
Nickel	0.001	0.07	0.02	< 0.001	0.001	< 0.001
Zinc	0.005	0.015		0.006	0.014	0.009
Major Anions						
Ammonia as N	0.01	0.91		0.1	0.06	< 0.01
Bicarbonate Alkalinity as CaCO3	5			< 5	< 5	< 5
Carbonate Alkalinity as CaCO3	5			< 5	< 5	< 5
Chloride	1			60	27	34
Nitrate (as N)	0.01		50	< 0.05	< 0.01	< 0.01
Sulfate as S	2		500	< 2	< 2	< 2
Major Cations						
Calcium	0.5			< 0.5	0.7	1.3
Magnesium	0.5			3.5	1.6	2.4
Potassium	0.5			0.7	< 0.5	0.8
Sodium	0.5			28	15	19
Parameters						
pH (pH units)	0.5			4.81	4.89	5.17
Conductivity µS/cm	0.5			236.2	131	166.4
TDS[E]	--			151	84	106

All results are in units of mg/L, unless otherwise stated.

Blank Cell indicates no criterion available

PQL = Practical Quantitation Limit. Where PQL is for a summation, PQL of all components is summed and may be different from that presented by laboratory

[A] ANZECC 2000 95% Protection Level for marine water

[B] NHMRC Australian Drinking Water Guidelines, 2011

[C] Sample depths presented are as encountered during sampling

[D] Bioaccummulative Compounds

[E] TDS calculated using laboratory reported electrical conductivity values

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ANZECC arsenic guideline based on As (III) for marine water, the lowest of presented guidelines.

NHMRC arsenic guidelines are based on total arsenic

ANZECC and NHMRC guidelines for chromium are based on Cr (VI)

ANZECC guidelines for mercury are based on inorganic mercury.

NHMRC guidelines for mercury are based on total mercury.

Results shown in **BOLD** are in excess of the aquatic ecosystems guidelines

Results shown in <u>underline</u> are in excess of the human health (ingestion) guideline

APPENDIX B: MONTHLY REPORTS

APPENDIX B1: FEBRUARY 2019

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NEWCASTLE OFFICE

11 March 2019
Document Ref: NCA19R_20190320

Williamtown Sand Syndicate
PO Box 898
Newcastle, NSW 2300

Attention: Darren Williams
Delivered by email: darren@arbus.com.au

Subject: Water quality monitoring results at Cabbage Tree Road Sand Quarry – February 2019 monitoring

Please find enclosed the Water quality monitoring results at Cabbage Tree Road Sand Quarry for the February 2019 monitoring.

1. SCOPE OF SERVICE

The scope of work includes monthly surface and groundwater monitoring for a combined period of 12 months. **Figure 1** (attached) presents the surface water and groundwater sampling locations.

The February monitoring round was to include gauging and sampling from 13 monitoring wells (Noting that MW239D was also gauged but not was not proposed to be sampled) and sampling at four surface water locations.

2. SITE WORK

The monitoring round was conducted on 21 and 22 February 2019.

Each well location was gauged using a water level meter to determine groundwater depth (relative to the top of the well casing) and the total depth of the well, in order to calculate the volume of water in the well. Following the gauging a HydraSleeve was then placed into the well ensuring the top of the sleeve was located under the water and left in place while all remaining wells were gauged. Following the gauging each of the HydraSleeves were removed and samples taken.

The February 2019 monitoring round included:

- Gauging of all available monitoring wells (a total of 14 wells);

- Groundwater sampling from a total of 9 monitoring wells (note MW239D does not require sampling, BH1, BH09, BH10 and BH12 were dry); and
- Surface water sampling from 1 location (all remaining locations were dry on the day of sampling).

Water samples were collected in laboratory supplied containers and place in an ice chilled esky. The samples were then submitted to a NATA accredited laboratory under a chain of custody (COC) for the analytical schedule as per **Table 2-1**.

Table 2-1: Summary of initial Water Quality Analysis

Analysis	Number of Samples				
	Primary	Intra-lab (Duplicate)	Inter-lab (Triplicate)	Transport Blank	Rinsate Blank
Extended Water Suite*	10	0	0	0	0
Hydrocarbons**	10	1	1	1	1
Metals***	10	1	1	1	1
Iron (dissolved)	10	1	1	1	1
Total Dissolved Solids (TDS)	10	0	0	0	0
Total Suspended Solids (TSS)	10	0	0	0	0
PFAS (28 analytes, standard level)	10	1	1	1	1

* Extended Water Suite B: Ca, Mg, Na, K, pH, EC, Cl, F, SO_4, Alkalinity, Hardness & TDS (Calc'), Nitrate, Nitrite, Ammonia, Reactive Phosphorus, Total Phosphorus, Total Nitrogen, TKN.
** TRH (C6 – C40), BTEXN (Silica Gel)
*** NEPM Metals Suite (dissolved) - Arsenic (As), Boron (B), Barium (Ba), Beryllium (Be), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu), Lead (Pb), Manganese (Mn), Mercury (Hg), Nickel (Ni), Selenium (Se), Vanadium (V), Zinc (Zn)

3. SAMPLING RESULTS

Table 3-2 provides a summary of the gauging data and **Table 3-3** provides a summary of the field parameters taken during sampling. The full set of gauging data and field parameters for each monitoring location are provided in the **Tables** section.

Table 3-2: Summary of gauging data

Borehole	Top of Casing (mAHD)	Depth to Water (mBTOC)	Groundwater Elevation (mAHD)	Well Total Depth at point of sampling (mBTOC)	Comment
BH1	8.64	5.776	2.864	8.89	No water sample taken due to top of well casing being melted.
BH2*	7.79	5.674	2.116	8.93	Slightly Cloudy, light brown, slight sulfur odour.
BH3	7.57	6.026	1.544	8.94	Light Brown - No Odour.
BH4	3.06	1.994	1.066	5.92	light discolouration – Brown.

Borehole	Top of Casing (mAHD)	Depth to Water (mBTOC)	Groundwater Elevation (mAHD)	Well Total Depth at point of sampling (mBTOC)	Comment
BH5	7.36	6.063	1.297	8.63	Roots evident. Brown slight sulfur odour.
BH6	3.62	1.823	1.797	4.43	Clear to slightly cloudy, sulfur odour.
BH7	2.98	1.938	1.042	4.42	Slightly Cloudy, light brown, slight sulfur odour.
BH8	3.88	2.78	1.1	6.08	Sulfur smell - Dark Brown.
BH9	17.75	Dry	-	15.82	Well was dry.
BH10	6.69	Dry	-	3.58	Well was dry.
BH11	6.63	3.02	3.61	5.21	Brown - No Odour.
BH12	8.67	Dry	-	6.17	Well was dry.
MW239S	3.04	1.529	1.511	3.89	Light Brown - Slight Sulfur odour.
MW239D	3.04	1.312	1.728	20.21	-
SW01*	2.5	Dry	-	N/A	Location was dry.
SW02*	3.3	Dry	-	N/A	Location was dry.
SW03*	2.1	1.1	1	N/A	Water was at a low level and was not seen to be flowing.
SW04*	2	Dry	-	N/A	Location was dry.

* Surface water levels measured from measuring tape installed

Table 3-3: Summary of field parameters

Sample ID	Time	Temp (°C)	EC (us/cm)	pH	Redox (mV)
BH02	1030	22.7	124.1	4.29	111.00
BH03	1440	22.1	82.4	4.54	94.00
BH04	1420	20.4	129.2	3.85	135.00
BH05	830	20.1	320	4.06	122.00
BH06	850	23.1	228	4.28	111.00
BH07	920	23.7	283	4.04	125.00
BH08	1330	21.8	411	4.09	121.00
BH11	1530	22.3	402	3.78	136.00
MW239S	730	21.7	526	4.09	121.00
SW03	1615	26	313	5.11	62.00

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Table 3.4 presents a summary of the water monitoring results and comparison with identified trigger values. Full results tables are provided in the Tables Section. Full Laboratory results, including copies for the COC are provided in Attachment A

Table 3.4 Water screening levels

Analytical Groupings	Analyte	Limit of reporting (mg/L)	Number of Samples	Minimum (mg/L)	Maximum (mg/L)	Criteria Exceeded	Relative to previous monitoring
Physical and Chemical Stressors	Sodium	0.01	10	4	61	No	N/A
	Sulphate	1	10	4	28	No	N/A
	Chloride	1	10	10	104	No	N/A
	Flouride	0.1	10	<0.1	0.2	No	N/A
	Reactive Phosphorous	0.01	10	<0.01	<0.01	No	N/A
	Total Phosphorous	0.01	10	0.03	2.76	All above ANZECC 2000 Trigger Values[1]	N/A
	Nitrite	0.01	10	<0.01	<0.01	No	N/A
	Nitrate	0.01	10	<0.01	2.76	2 above ANZECC 2000 Trigger Values[1]	N/A
	Ammonia	0.01	10	0.04	0.5	No	N/A
	Total Nitrogen	0.1	10	0.5	5.9	All above ANZECC 2000 Trigger Values[1]	N/A
	Total Hardness	1	10	9.0	41	No	N/A
	Total Dissolved Solids	1	10	96	438	No	N/A
	pH	0.01	10	4.46	6.21	All outside All above ANZECC 2000 Trigger range[1] and drinking water guidelines	N/A
Dissolved Metals	As	0.005-0.1	10	<0.001	0.003	No	N/A
	B	0.005-0.1	10	<0.05	<0.05	No	N/A
	Ba	0.005-0.1	10	0.003	0.075	No	N/A
	Be	0.005-0.1	10	<0.001	<0.001	No	N/A
	Cd	0.005-0.1	10	<0.0001	<0.0001	No	N/A

Analytical Groupings	Analyte	Limit of reporting (mg/L)	Number of Samples	Minimum (mg/L)	Maximum (mg/L)	Criteria Exceeded	Relative to previous monitoring
	Cr	0.005-0.1	10	<0.001	0.002	4 above ANZECC 2000 Trigger Values[2]	N/A
	Co	0.005-0.1	10	<0.001	0.003	No	N/A
	Cu	0.005-0.1	10	<0.001	0.002	2 above ANZECC 2000 Trigger Values[2]	N/A
	Fe	0.005-0.1	10	0.06	4.84	6 above drinking water aesthetic criteria	N/A
	Mn	0.005-0.1	10	0.003	0.039	No	N/A
	Ni	0.005-0.1	10	0.001	0.053	2 above ANZECC 2000 Trigger Values[2], and 1 above NHMRC ADWG 6	N/A
	Pb	0.005-0.1	10	<0.001	<0.001	No	N/A
	Se	0.005-0.1	10	<0.01	<0.01	No	N/A
	V	0.005-0.1	10	<0.01	<0.01	No	N/A
	Zn	0.005-0.1	10	<0.005	0.031	5 above ANZECC 2000 Trigger Values[2]	N/A
	Hg	0.0001	10	<0.0001	<0.0001	No	N/A
TRH – Silica Clean up	C_6-C_{10}	0.02	10	<0.02	<0.02	No	N/A
	>C_{10}-C_{16}	0.1	10	<0.1	<0.1	No	N/A
	>C_{16}-C_{34}	0.1	10	<0.1	<0.1	No	N/A
	>C_{34}-C_{40}	0.1	10	<0.1	<0.1	No	N/A
	Total >C_{10}-C_{40}	0.1	10	<0.1	<0.1	No	N/A
	C_6-C_{10} minus BTEX (F1)	0.02	10	<0.02	<0.02	No	N/A

Analytical Groupings	Analyte	Limit of reporting (mg/L)	Number of Samples	Minimum (mg/L)	Maximum (mg/L)	Criteria Exceeded	Relative to previous monitoring
	$>C_{10}$-C_{16} minus Naphthalene (F2)	0.1	10	<0.1	<0.1	No	N/A
BTEX	Benzene	0.001-0.005	10	<0.001	<0.001	No	N/A
	Toluene	0.001-0.005	10	<0.002	<0.002	No	N/A
	Ethylbenzene	0.001-0.005	10	<0.002	<0.002	No	N/A
	Total Xylene	0.001-0.005	10	<0.002	<0.002	No	N/A
	Naphthalene	0.001	10	<0.005	<0.005	No	N/A
PFAS	PFOS	0.00001-0.0001	10	<0.00001	<0.00001	HEPA NEMP 2018*	N/A
	PFOA	0.00001-0.0001	10	<0.00001	<0.00001	No	N/A
	PFOS/PFHxS	0.00001-0.0001	10	<0.00001	<0.00001	No	N/A

* The LOR is above the Heads of EPA Australia and New Zealand – National Environmental Management Plan (HEPA NEMP) 2018 99% Level of protection in freshwater. No concentrations were found to be above the LOR.

[1]Australian and New Zealand Environmental Conservation Council (ANZECC) 2000 Trigger Values – Default trigger values for physical and chemical stressors, for slightly disturbed ecosystems in lowland rivers, Southeast Australia (value is for base flow and not storm event)

[2]ANZECC 2000 Trigger Values – 95% Level of protection in freshwater

National Health and Medical Research Council Australian Drinking Water Guidelines (NHMRC ADWG) 6 2011 Version 3.5 Updated August 2018

4. RAINWATER DATA

Table 4.5 presents the rainfall data from Williamtown RAAF base. The mean monthly rainfall indicates that there has been significantly less rainfall in January and February than the mean.

Table 4.5 2019 Rainfall data

2019	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1st	2.0	0.8	0									
2nd	0	12.8	0									
3rd	0	0.4										
4th	0	0	0									
5th	0	0	0									
6th	0	0	0									
7th	5.0	0										
8th	0	0										
9th	0	6.6										
10th	0.2	0										
11th	0	0										
12th	3.0	0										
13th	0	0										
14th	0	0										
15th	0	0										
16th	0	0										
17th	0	0										
18th	0	0										
19th	0	0										
20th	2.4											
21st	1.0	1.4										
22nd	0	1.0										
23rd	0	1.4										
24th	0	9.2										
25th	0	0										
26th	0	0										
27th	0	0										
28th	1.0	0										
29th	0											
30th	0											
31st	0											
Monthly Total	**14.6**	**33.6**										
Mean	**98.7**	**117.0**	**120.5**	**111.6**	**109.6**	**124.7**	**70.9**	**72.9**	**60.4**	**73.9**	**82.3**	**78.6**

Based on the rainfall data, it is expected that the current groundwater and surface water levels would be low.

5. THANKYOU

We trust the information presented is acceptable. If you have any questions, please do not hesitate in contacting the undersigned.

Sincerely,

Kleinfelder Australia Pty Ltd

Tom Overton MSc, BSc (Hons), Dip

Senior Project Manager
Contaminated Land Management
toverton@kleinfelder.com

Mobile: 0415 170 312

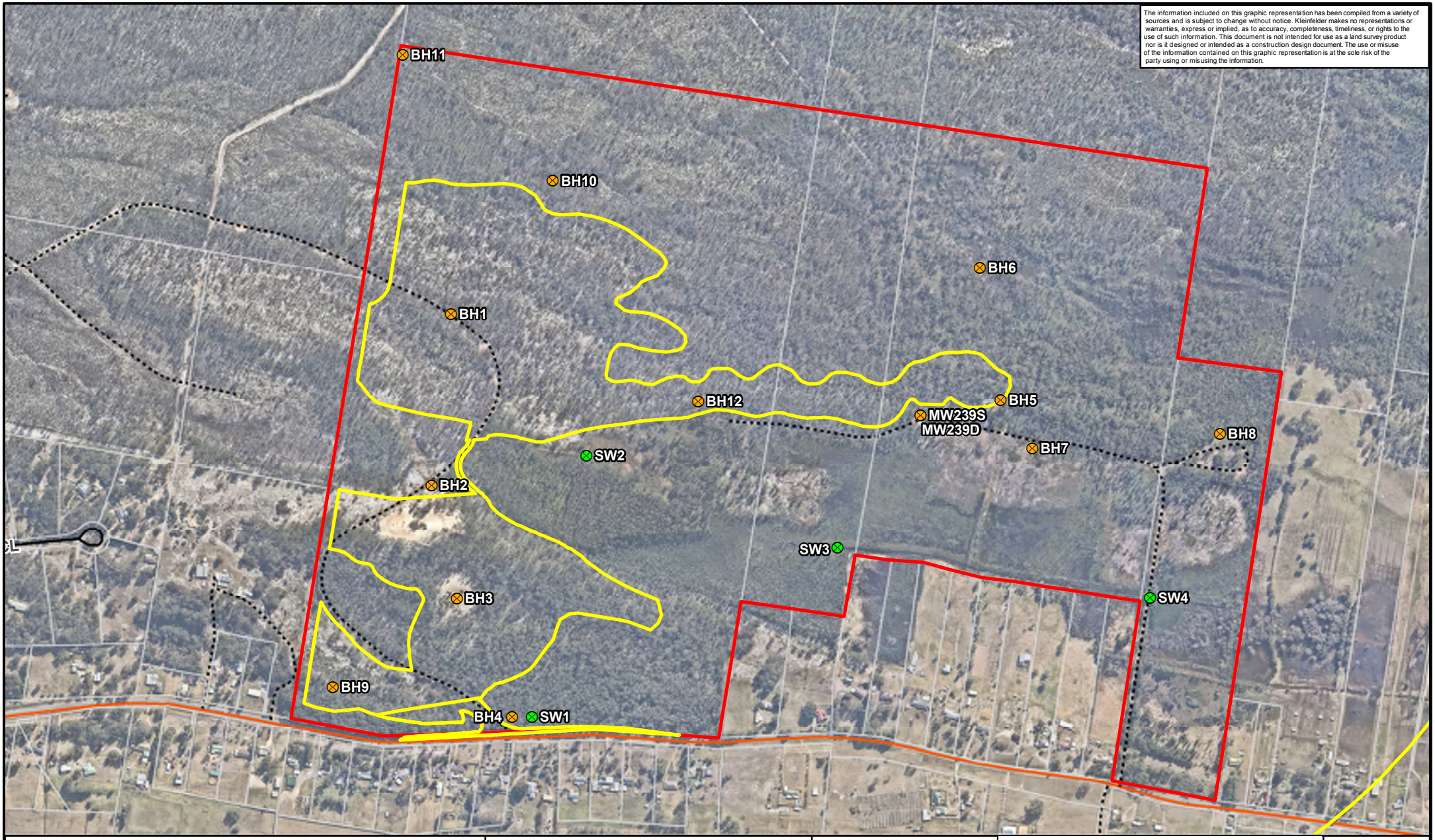
Attached:

Figure 1

Data Tables

Attachment A – Laboratory reports

FIGURE 1



- Groundwater Sample Site
- Surface Water Sample Site
- Subject Land Boundary
- Quarry Project Area
- Arterial Road
- Local Road
- Track

Metres
0 50 100 200 300 400 500
N

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www.kleinfelder.com

PROJECT REFERENCE: 20170448
DATE DRAWN: 13/02/2019 09:48 Version 1
DRAWN BY: gjoyce

DATA SOURCE:
NSW DFSI - 2017
Nearmap - 2018

Water monitoring locations February 2019 Monitoring

Williamtown Sand Syndicate
Proposed Sand Quarry
Cabbage Tree Road, Williamtown

FIGURE:
1

L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_WMP_Fig2_WaterMonitoringPlan.mxd

DATA TABLES

Table BH01
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Borehole	Easting (MGA)	Northing (MGA)	Ground Surface RL (mAHD)	Top of Casing (mAHD)	Bore Depth prior to monitoring (mBTOC)	Screen Top (mBG)	Screen Bottom (mBG)	Well Diameter (mm)
BH1	387741.2	6369495.8	8.21	8.64	9.45	6.45	8.6	50

Date	Depth to Water (mBTOC)	Water Elevation (mAHD)	Well Total Depth at point of sampling (mBTOC)	Well Base Elevation (mAHD)	Temp (°C)	EC (us/cm)	pH	Redox (mV)	Description
21/02/2019	5.776	2.864	8.89	-0.25	-	-	-	-	No water sample taken due to top of well being melted

Table BH02
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Borehole	Easting (MGA)	Northing (MGA)	Ground Surface RL (mAHD)	Top of Casing (mAHD)	Bore Depth prior to monitoring (mBTOC)	Screen Top (mBG)	Screen Bottom (mBG)	Well Diameter (mm)
BH2	387704.7	6369175.1	7.4	7.79	9.45	5.6	8.6	50

Date	Depth to Water (mBTOC)	Water Elevation (mAHD)	Well Total Depth at point of sampling (mBTOC)	Well Base Elevation (mAHD)	Temp (°C)	EC (us/cm)	pH	Redox (mV)	Description
21/02/2019	5.674	2.116	8.93	-1.14	22.7	124.1	4.29	111	Slightly Cloudy, light brown, slight sulfur odour

Table BH03
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Borehole	Easting (MGA)	Northing (MGA)	Ground Surface RL (mAHD)	Top of Casing (mAHD)	Bore Depth prior to monitoring (mBTOC)	Screen Top (mBG)	Screen Bottom (mBG)	Well Diameter (mm)
BH3	387751.7	6368964.3	7.03	7.57	9.45	5.45	8.45	50

Date	Depth to Water (mBTOC)	Water Elevation (mAHD)	Well Total Depth at point of sampling (mBTOC)	Well Base Elevation (mAHD)	Temp (°C)	EC (us/cm)	pH	Redox (mV)	Description
21/02/2019	6.026	1.544	8.94	-1.37	22.1	82.4	4.54	94	Light Brown - No Odour

Table BH04
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Borehole	Easting (MGA)	Northing (MGA)	Ground Surface RL (mAHD)	Top of Casing (mAHD)	Bore Depth prior to monitoring (mBTOC)	Screen Top (mBG)	Screen Bottom (mBG)	Well Diameter (mm)
BH4	387854.9	6368742.8	2.81	3.06	6.45	2.65	5.65	50

Date	Depth to Water (mBTOC)	Water Elevation (mAHD)	Well Total Depth at point of sampling (mBTOC)	Well Base Elevation (mAHD)	Temp (°C)	EC (us/cm)	pH	Redox (mV)	Description
21/02/2019	1.994	1.066	5.92	-2.86	20.4	129.2	3.85	135	light discolouration - Brown

Table BH05
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Borehole	Easting (MGA)	Northing (MGA)	Ground Surface RL (mAHD)	Top of Casing (mAHD)	Bore Depth prior to monitoring (mBTOC)	Screen Top (mBG)	Screen Bottom (mBG)	Well Diameter (mm)
BH5	388768.5	6369334.7	6.76	7.36	9.28	8.1	5.1	50

Date	Depth to Water (mBTOC)	Water Elevation (mAHD)	Well Total Depth at point of sampling (mBTOC)	Well Base Elevation (mAHD)	Temp (°C)	EC (us/cm)	pH	Redox (mV)	Description
21/02/2019	6.063	1.297	8.63	-1.27	20.1	320	4.06	122	Roots evident. Brown slight sulfur odour

Table BH06
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Borehole	Easting (MGA)	Northing (MGA)	Ground Surface RL (mAHD)	Top of Casing (mAHD)	Bore Depth prior to monitoring (mBTOC)	Screen Top (mBG)	Screen Bottom (mBG)	Well Diameter (mm)
BH6	388729.7	6369582.2	3.01	3.62	4.95	3.9	2.4	50

Date	Depth to Water (mBTOC)	Water Elevation (mAHD)	Well Total Depth at point of sampling (mBTOC)	Well Base Elevation (mAHD)	Temp (°C)	EC (us/cm)	pH	Redox (mV)	Description
21/02/2019	1.823	1.797	4.43	-0.81	23.1	228	4.28	111	Clear to slightly cloudy, sulfur odour

Table BH07
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Borehole	Easting (MGA)	Northing (MGA)	Ground Surface RL (mAHD)	Top of Casing (mAHD)	Bore Depth prior to monitoring (mBTOC)	Screen Top (mBG)	Screen Bottom (mBG)	Well Diameter (mm)
BH7*	388827.7	6369245.3	2.6	2.98	4.95	2.6	4.1	50

Date	Depth to Water (mBTOC)	Water Elevation (mAHD)	Well Total Depth at point of sampling (mBTOC)	Well Base Elevation (mAHD)	Temp (°C)	EC (us/cm)	pH	Redox (mV)	Description
21/02/2019	1.938	1.042	4.42	-1.44	23.7	283	4.04	125	Slightly Cloudy, light brown, slight sulfur odour

Table BH08
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Borehole	Easting (MGA)	Northing (MGA)	Ground Surface RL (mAHD)	Top of Casing (mAHD)	Bore Depth prior to monitoring (mBTOC)	Screen Top (mBG)	Screen Bottom (mBG)	Well Diameter (mm)
BH8	389178.2	6369271.6	3.28	3.88	6.28	3	5.5	50

Date	Depth to Water (mBTOC)	Water Elevation (mAHD)	Well Total Depth at point of sampling (mBTOC)	Well Base Elevation (mAHD)	Temp (°C)	EC (us/cm)	pH	Redox (mV)	Description
21/02/2019	2.78	1.1	6.08	-2.2	21.8	411	4.09	121	Sulfur smell - Dark Brown

Table BH09
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Borehole	Easting (MGA)	Northing (MGA)	Ground Surface RL (mAHD)	Top of Casing (mAHD)	Bore Depth prior to monitoring (mBTOC)	Screen Top (mBG)	Screen Bottom (mBG)	Well Diameter (mm)
BH9	387520.4	6368798.8	17.07	17.75	18.18	14.6	17.6	50

Date	Depth to Water (mBTOC)	Water Elevation (mAHD)	Well Total Depth at point of sampling (mBTOC)	Well Base Elevation (mAHD)	Temp (°C)	EC (us/cm)	pH	Redox (mV)	Description
21/02/2019	Dry	-	15.82	1.93	-	-	-	-	Well was dry

Table BH10
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Borehole	Easting (MGA)	Northing (MGA)	Ground Surface RL (mAHD)	Top of Casing (mAHD)	Bore Depth prior to monitoring (mBTOC)	Screen Top (mBG)	Screen Bottom (mBG)	Well Diameter (mm)
BH10	387931.2	6369744.4	6.09	6.69	5.45	2	5	50

Date	Depth to Water (mBTOC)	Water Elevation (mAHD)	Well Total Depth at point of sampling (mBTOC)	Well Base Elevation (mAHD)	Temp (°C)	EC (us/cm)	pH	Redox (mV)	Description
21/02/2019	Dry	-	3.58	3.11	-	-	-	-	Well was dry

Table BH11
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Borehole	Easting (MGA)	Northing (MGA)	Ground Surface RL (mAHD)	Top of Casing (mAHD)	Bore Depth prior to monitoring (mBTOC)	Screen Top (mBG)	Screen Bottom (mBG)	Well Diameter (mm)
BH11	387650.6	6369979.7	6.02	6.63	5.95	1.6	4.6	50

Date	Depth to Water (mBTOC)	Water Elevation (mAHD)	Well Total Depth at point of sampling (mBTOC)	Well Base Elevation (mAHD)	Temp (°C)	EC (us/cm)	pH	Redox (mV)	Description
21/02/2019	3.02	3.61	5.21	1.42	22.3	402	3.78	136	Brown - No Odour

Table BH12
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Borehole	Easting (MGA)	Northing (MGA)	Ground Surface RL (mAHD)	Top of Casing (mAHD)	Bore Depth prior to monitoring (mBTOC)	Screen Top (mBG)	Screen Bottom (mBG)	Well Diameter (mm)
BH12	388202.9	6369332.9	8.06	8.67	8.39	4.8	7.8	50

Date	Depth to Water (mBTOC)	Water Elevation (mAHD)	Well Total Depth at point of sampling (mBTOC)	Well Base Elevation (mAHD)	Temp (°C)	EC (us/cm)	pH	Redox (mV)	Description
21/02/2019	Dry	-	6.166	2.504	-	-	-	-	Well was dry

Table BH239S
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Borehole	Easting (MGA)	Northing (MGA)	Ground Surface RL (mAHD)	Top of Casing (mAHD)	Bore Depth prior to monitoring (mBTOC)	Screen Top (mBG)	Screen Bottom (mBG)	Well Diameter (mm)
MW239S	388619.1	-	2.98	3.04	4	1	4	50

Date	Depth to Water (mBTOC)	Water Elevation (mAHD)	Well Total Depth at point of sampling (mBTOC)	Well Base Elevation (mAHD)	Temp (°C)	EC (us/cm)	pH	Redox (mV)	Description
21/02/2019	1.529	1.511	3.89	-0.85	21.7	526	4.09	121	Light Brown - Slight Sulfur odour

Table BH239D
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Borehole	Easting (MGA)	Northing (MGA)	Ground Surface RL (mAHD)	Top of Casing (mAHD)	Bore Depth prior to monitoring (mBTOC)	Screen Top (mBG)	Screen Bottom (mBG)	Well Diameter (mm)
MW239D	388619.1	-	2.98	3.04	21	-	-	50

Date	Depth to Water (mBTOC)	Water Elevation (mAHD)	Well Total Depth at point of sampling (mBTOC)	Well Base Elevation (mAHD)	Description
21/02/2019	1.312	1.728	20.21	-17.17	

Table SW01
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Location	Easting (MGA)	Northing (MGA)	Top of Measuring Tape (mAHD)
SW01	387886.7	6368734	2.5

Date	Water Lavel (Reading on tape)	Water Elevation (mAHD)	Temp (°C)	EC (us/cm)	pH	Redox (mV)	Description
21/02/2019	0	2.5	-	-	-	-	No water present

Table SW02
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Location	Easting (MGA)	Northing (MGA)	Top of Measuring Tape (mAHD)
SW02	387988.3	6369234	3.3

Date	Water Lavel (Reading on tape)	Water Elevation (mAHD)	Temp (°C)	EC (us/cm)	pH	Redox (mV)	Description
21/02/2019	0	3.3	-	-	-	-	No water present

Table SW03
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Location	Easting (MGA)	Northing (MGA)	Top of Measuring Tape (mAHD)
SW03	388464.6	6369057	2.1

Date	Water Lavel (Reading on tape)	Water Elevation (mAHD)	Temp (°C)	EC (us/cm)	pH	Redox (mV)	Description
21/02/2019	1.1	1	26	313	5.11	62	Water level low, slight sulfur odour

Table SW04
Groundwater gauging data and field parameters
Williamtown Sand Syndicate

Location	Easting (MGA)	Northing (MGA)	Top of Measuring Tape (mAHD)
SW04	389049	6368969	2

Date	Water Lavel (Reading on tape)	Water Elevation (mAHD)	Temp (°C)	EC (us/cm)	pH	Redox (mV)	Description
21/02/2019	0	2	-	-	-	-	No water present

Table 1
Groundwater Analytical Data - BTEXN
Williamtown Sand Syndicate

Analyte		BTEXN								Total Petroleum Hydrocarbons	Total Petroleum Hydrocarbons - Silcia Clean up				Total Recoverable Hydrocarbons		Total Recoverable Hydrocarbons - Silcia Clean up				
		Benzene**	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene**	Total Xylenes	Naphthalene **	Sum of BTEX	C_6 - C_9	C_{10}-C_{14} - Silica Cleanup	C_{15}-C_{28} - Silica Cleanup	C_{29}-C_{36} - Silica Cleanup	C_{10}-C_{36} Sum - Silica Cleanup	C_6 - C_{10}	C_6 - C_{10} minus BTEX (F1)	>C_{10}-C_{16} - Silica Cleanup	F2 - Silica Cleanup	>C_{16}-C_{34} - Silica Cleanup	>C_{34}-C_{40} - Silica Cleanup	>C_{10}-C_{40} - Silica Cleanup
LOR		1	2	2	2	2	2	5	1	20	50	100	50	50	20	20	100	100	100	100	100
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
ANZECC 2000 Trigger Values		950	-	-	-	350		16													
NHMRC ADWG 6		1	800	300	-	350	600														
Sample Name	Sample Date																				
BH11	21-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
BH2	22-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
BH3	21-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
BH4	21-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
BH5	22-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
BH6	22-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
BH7	22-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
BH8	21-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
MW2395	22-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100
SW3	22-Feb-19	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	< 50	< 100	< 50	< 50	< 20	< 20	< 100	< 100	< 100	< 100	< 100

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
µg/L - Micrograms per litre
BTEXN - Benzene, toluene, ethylbenzene, xylenes, naphthalene

** 95% Level of protection in freshwater

Table 2
Groundwater Analytical Data - Metals
Williamtown Sand Syndicate

Analyte		Metals															
		Arsenic**	Barium	Beryllium	Boron**	Cadmium**	Chromium**[1]	Cobalt	Copper**	Iron	Lead**	Manganese**	Mercury**[2]	Nickel**	Selenium**	Vanadium	Zinc**
LOR		0.001	0.001	0.001	0.05	0.0001	0.001	0.001	0.001	0.05	0.001	0.001	0.0001	0.001	0.01	0.01	0.005
Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
ANZECC 2000 Trigger Values		0.013		-	0.37	0.0002	0.001	-	0.0014	-	0.0034	1.9	0.0006	0.011	0.011	-	0.008
NHMRC ADWG 6		0.01		0.06	4	0.002	0.05	-	2	0.3[3]	0.01	0.5	0.001	0.02	0.01	-	3[3]
Sample Name	Sample Date																
BH11	21-Feb-19	< 0.001	**0.008**	< 0.001	< 0.05	< 0.0001	**0.002**	**0.001**	< 0.001	**0.26**	< 0.001	**0.003**	< 0.0001	**0.005**	< 0.01	< 0.01	**0.031**
BH2	22-Feb-19	< 0.001	**0.005**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.002**	**0.14**	< 0.001	**0.021**	< 0.0001	**0.015**	< 0.01	< 0.01	**0.006**
BH3	21-Feb-19	< 0.001	**0.003**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	< 0.001	**0.06**	< 0.001	**0.005**	< 0.0001	**0.053**	< 0.01	< 0.01	< 0.005
BH4	21-Feb-19	< 0.001	**0.014**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	**0.002**	**0.16**	< 0.001	**0.039**	< 0.0001	**0.018**	< 0.01	< 0.01	**0.014**
BH5	22-Feb-19	< 0.001	**0.01**	< 0.001	< 0.05	< 0.0001	**0.001**	< 0.001	< 0.001	**1.4**	< 0.001	**0.005**	< 0.0001	**0.003**	< 0.01	< 0.01	**0.008**
BH6	22-Feb-19	< 0.001	**0.03**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	**1.03**	< 0.001	**0.014**	< 0.0001	**0.001**	< 0.01	< 0.01	**0.019**
BH7	22-Feb-19	< 0.001	**0.004**	< 0.001	< 0.05	< 0.0001	**0.002**	**0.003**	< 0.001	**1.8**	< 0.001	**0.026**	< 0.0001	**0.004**	< 0.01	< 0.01	**0.019**
BH8	21-Feb-19	**0.001 ***	**0.011**	< 0.001	< 0.05	< 0.0001	**0.001**	< 0.001	< 0.001	**4.1**	< 0.001	**0.012**	< 0.0001	**0.002**	< 0.01	< 0.01	**0.006**
MW2395	22-Feb-19	< 0.001	**0.007**	< 0.001	< 0.05	< 0.0001	**0.002**	< 0.001	< 0.001	**1.11**	< 0.001	**0.003**	< 0.0001	**0.001**	< 0.01	< 0.01	**0.006**
SW3	22-Feb-19	**0.003**	**0.075**	< 0.001	< 0.05	< 0.0001	< 0.001	< 0.001	< 0.001	**4.84**	< 0.001	**0.033**	< 0.0001	**0.002**	< 0.01	< 0.01	**0.016**

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
mg/L - Milligrams per litre
Bold indicates a detection above the laboratory limit of reporting
"*" denotes duplicate/triplicate sample result adopted for analytical use due to RPD >50%
RPD - Relative Percentage Difference

** 95% Level of protection in freshwater
[1] value for CR VI
[2] as inorganioc
[3] Aesthetic

Table 3
Groundwater Analytical Data - PFAS
Williamtown Sand Syndicate

Analyte		Perfluoroalkyl Sulfonic Acids					Perfluoroalkyl Carboxylic Acids										Perfluoroalkyl Sulfonamides							(n:2) Fluorotelomer Sulfonic Acids				Sum of PFAS		
		Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonate (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorooctane sulfonamide (FOSA)	N-Methyl-perfluorooctane sulfonamide (MeFOSA)	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	N-Methyl perfluorooctane sulfonamidoacetic acid (MeFOSAA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (EtFOSAA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	Sum of PFHxS and PFOS	Sum of PFAS (WA DER List)	Sum of PFAS
LOR		0.02	0.02	0.02	0.02	0.01	0.1	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.01	0.01	0.01
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	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
NHMRC ADWG 6											0.56																		0.07		
HEPA NEMP 2018**						0.00023					19																				
HEPA NEMP 2018*											5.6																		0.7		
Sample Name	Sample Date																														
BH11	21-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
BH2	22-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
BH3	21-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
BH4	21-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
BH5	22-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
BH6	22-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
BH7	22-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
BH8	21-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
MW2395	22-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
SW3	22-Feb-19	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
µg/L - Micrograms per litre

*** 99% Level of protection in freshwater
* Recreation water

Table 4
Groundwater Analytical Data - Inorganics
Williamtown Sand Syndicate

KLEINFELDER
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Analyte		Anions and Cations																		Alkalinity						Inorganics	
		Sodium	Calcium	Magnesium	Potassium	Sulphate	Chloride	Fluoride	Reactive phosphorus as P	Total Phosphorus	Nitrite as N	Nitrate as N	Nitrite + Nitrate as N	Ammonia as N	Total Nitrogen as N	Total Kjeldahl Nitrogen as N	Total Cations	Total Anions	Ionic Balance	Sodium Adsorption Ratio	Bicarbonate Alkalinity as CaCO3	Carbonate Alkalinity as CaCO3	Hydroxide Alkalinity as CaCO3	Total Alkalinity as CaCO3	Total Hardness as CaCO3	Electrical Conductivity @ 25°C*	Total Dissolved Solids	pH
LOR		1	1	1	1	1	1	0.1	0.01	0.01	0.01	0.01	0.01	0.01	0.1	0.1	0.01	0.01		0.01	1	1	1	1	1	1	1	0.01
Units		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	%	-	mg/L	mg/L	mg/L	mg/L	mg/L	µS/cm	mg/L	pH units
ANZECC 2000 Trigger Values									0.02*	0.025*		0.7**		0.9**	0.35*											125-2200		6.5 - 8.0*
NHMRC ADWG 6		180[3]				250[3]	250[3]	1.5			3	50		0.5[3]											200[3]		600[3]	6.5-8.5[3]
Sample Name	Sample Date																											
BH11	21-Feb-19	48	< 1.0	10	< 1.0	24	80	0.1	< 0.01	0.03	< 0.01	0.04	0.04	0.06	1.8	1.8	2.91	2.76	-	3.21	< 1.0	< 1.0	< 1.0	< 1.0	41	346	278	4.67
BH2	22-Feb-19	12	2.0	2.0	< 1.0	6.0	22	0.1	< 0.01	0.28	< 0.01	2.76	2.76	0.05	4.0	1.2	0.79	0.74	-	1.44	< 1.0	< 1.0	< 1.0	< 1.0	13	91	128	4.87
BH3	21-Feb-19	4.0	4.0	1.0	< 1.0	4.0	10	< 0.1	< 0.01	2.76	< 0.01	0.78	0.78	0.3	5.9	5.1	0.46	0.54	-	0.46	9.0	< 1.0	< 1.0	9.0	14	60	438	5.55
BH4	21-Feb-19	8.0	2.0	1.0	1.0	5.0	17	< 0.1	< 0.01	0.19	< 0.01	0.35	0.35	0.04	0.6	0.3	0.56	0.7	-	1.15	6.0	< 1.0	< 1.0	6.0	9.0	73	96	5.4
BH5	22-Feb-19	42	< 1.0	6.0	1.0	19	69	0.2	< 0.01	0.34	< 0.01	< 0.01	< 0.01	0.09	3.0	3.0	2.35	2.34	-	3.59	< 1.0	< 1.0	< 1.0	< 1.0	25	250	211	4.87
BH6	22-Feb-19	28	3.0	4.0	1.0	28	42	< 0.1	< 0.01	0.05	< 0.01	0.09	0.09	0.14	0.5	0.4	1.72	1.77	-	2.49	< 1.0	< 1.0	< 1.0	< 1.0	24	177	144	4.37
BH7	22-Feb-19	34	< 1.0	5.0	2.0	12	64	0.2	< 0.01	0.13	< 0.01	0.02	0.02	0.34	2.2	2.2	1.94	2.06	-	3.16	< 1.0	< 1.0	< 1.0	< 1.0	20	213	196	4.76
BH8	21-Feb-19	52	< 1.0	6.0	< 1.0	11	90	< 0.1	< 0.01	1.97	< 0.01	< 0.01	< 0.01	0.5	2.4	2.4	2.76	2.77	-	4.44	< 1.0	< 1.0	< 1.0	< 1.0	25	352	258	4.46
MW2395	22-Feb-19	61	< 1.0	6.0	< 1.0	6.0	104	< 0.1	< 0.01	0.56	< 0.01	< 0.01	< 0.01	0.18	3.9	3.9	3.15	3.06	1.43	5.21	< 1.0	< 1.0	< 1.0	< 1.0	25	329	234	4.89
SW3	22-Feb-19	40	4.0	4.0	1.0	16	82	< 0.1	< 0.01	0.06	< 0.01	< 0.01	< 0.01	0.16	1.0	1.0	2.55	2.87	-	3.38	11	< 1.0	< 1.0	11	26	262	228	6.21

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
LOR - Laboratory limit of reporting
mg/L - Milligrams per litre
uS/cm - Microsiemens per centimeter
Bold indicates a detection above the laboratory limit of reporting

* Default trigger values for physical and chemical stressors, for slightly disturbed ecosystems in lowland rivers, Southeast Australia (value is for base flow and not storm event)
** 95% Level of protection in freshwater
[3] Aesthetic

Table 5
Quality Control Sample Analysis - BTEXN
Williamtown Sand Syndicate

Analyte			BTEXN								Total Petroleum Hydrocarbons					Total Petroleum Hydrocarbons - Silicia Clean up				Total Recoverable Hydrocarbons						Total Recoverable Hydrocarbons - Silicia Clean up				
			Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene	Total Xylenes	Naphthalene	Sum of BTEX	C_6 - C_9	C_{10} - C_{14}	C_{15} - C_{28}	C_{29} - C_{36}	C_{10} - C_{36} sum	C_{10}-C_{14} - Silica Cleanup	C_{15}-C_{28} - Silica Cleanup	C_{29}-C_{36} - Silica Cleanup	C_{10}-C_{36} Sum - Silica Cleanup	C_6 - C_{10}	C_6 - C_{10} minus BTEX (F1)	>C_{10} - C_{16}	>C_{10} - C_{16} minus Naphthalene (F2)	>C_{16} - C_{34}	>C_{34} - C_{40}	>C_{10}-C_{16} - Silica Cleanup	F2 - Silica Cleanup	>C_{16}-C_{34} - Silica Cleanup	>C_{34}-C_{40} - Silica Cleanup	>C_{10}-C_{40} - Silica Cleanup
Units			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
Sample Name	Sample Date	Sample Type																												
TRIP BLANK_13022019	13-Feb-19	Trip Blank	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100	< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
RINSATE01_21022019	21-Feb-19	Rinsate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100	< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
BH8_21022019	21-Feb-19	Primary	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100	< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
DUP01_21022019	21-Feb-19	Duplicate	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100	< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
BH8_21022019	21-Feb-19	Primary	< 1.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 5.0	< 1.0	< 20	-	-	-	-	< 50	< 100	< 50	< 50	< 20	< 20	-	-	-	-	< 100	< 100	< 100	< 100	< 100
TRIP01_21022019	21-Feb-19	Triplicate	< 1.0	< 1.0	< 1.0	< 2.0	< 1.0	< 3.0	< 10	-	< 20	< 50	< 100	< 100	< 100	< 50	< 100	< 100	< 400	< 20	< 20	< 50	< 50	< 100	< 100	< 50	-	< 100	< 100	< 100
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
NC - Not calculated
µg/L - Micrograms per litre
BTEXN - Benzene, toluene, ethylbenzene, xylenes, naphthalene

Table 6
Quality Control Sample Analysis - Metals
Williamtown Sand Syndicate

Analyte			Metals															
			Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Chromium VI	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Vanadium	Zinc
Units			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sample Name	Sample Date	Sample Type																	
TRIP BLANK_13022019	13-Feb-19	Trip Blank	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	-	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
RINSATE01_21022019	21-Feb-19	Rinsate	< 0.001	< 0.001	< 0.001	< 0.05	< 0.0001	< 0.001	-	< 0.001	< 0.001	< 0.05	< 0.001	< 0.001	< 0.0001	< 0.001	< 0.01	< 0.01	< 0.005
BH8_21022019	21-Feb-19	Primary	< 0.001	0.011	< 0.001	< 0.05	< 0.0001	0.001	-	< 0.001	< 0.001	4.1	< 0.001	0.012	< 0.0001	0.002	< 0.01	< 0.01	0.005
DUP01_21022019	21-Feb-19	Duplicate	0.001	0.014	< 0.001	< 0.05	< 0.0001	0.001	-	< 0.001	< 0.001	4.09	< 0.001	0.012	< 0.0001	0.003	< 0.01	< 0.01	0.015
Relative Percentage Difference			**67%**	24%	NC	NC	NC	0%	NC	NC	NC	0%	NC	0%	NC	40%	NC	NC	**100%**
BH8_21022019	21-Feb-19	Primary	< 0.001	0.011	< 0.001	< 0.05	< 0.0001	0.001	-	< 0.001	< 0.001	4.1	< 0.001	0.012	< 0.0001	0.002	< 0.01	< 0.01	0.005
TRIP01_21022019	21-Feb-19	Triplicate	0.001	< 0.02	< 0.001	< 0.05	< 0.0002	< 0.005	< 0.005	< 0.001	< 0.001	4.5	< 0.001	0.012	< 0.0001	0.003	-	< 0.005	0.006
Relative Percentage Difference			**67%**	10%	NC	NC	NC	**86%**	NC	NC	NC	9%	NC	0%	NC	40%	NC	NC	18%

Notes:
- - Not analysed
< - Less than laboratory limit of reporting
NC - Not calculated
mg/L - Milligrams per litre
Half the laboratory limit of reporting used when calculating RPD
RPD - Relative Percentage Difference

Table 7
Quality Control Sample Analysis - PFAS
Williamtown Sand Syndicate

KLEINFELDER
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Analyte			Perfluoroalkyl Sulfonic Acids					Perfluoroalkyl Carboxylic Acids											Perfluoroalkyl Sulfonamides							(n:2) Fluorotelomer Sulfonic Acids				Sum of PFAS		
			Perfluorobutane sulfonic acid (PFBS)	Perfluoropentane sulfonic acid (PFPeS)	Perfluorohexane sulfonic acid (PFHxS)	Perfluoroheptane sulfonate (PFHpS)	Perfluorooctane sulfonic acid (PFOS)	Perfluorobutanoic acid (PFBA)	Perfluoropentanoic acid (PFPeA)	Perfluorohexanoic acid (PFHxA)	Perfluoroheptanoic acid (PFHpA)	Perfluorooctanoic acid (PFOA)	Perfluorononanoic acid (PFNA)	Perfluorodecanoic acid (PFDA)	Perfluoroundecanoic acid (PFUnDA)	Perfluorododecanoic acid (PFDoDA)	Perfluorotridecanoic acid (PFTrDA)	Perfluorotetradecanoic acid (PFTeDA)	Perfluorooctane sulfonamide (FOSA)	N-Methyl-perfluorooctane sulfonamide (NMeFOSA)	N-Ethyl perfluorooctane sulfonamide (NEtFOSA)	N-Methyl perfluorooctane sulfonamidoethanol (NMeFOSE)	N-Ethyl perfluorooctane sulfonamidoethanol (NEtFOSE)	N-Methyl perfluorooctane sulfonamidoacetic acid (NMeFOSAA)	N-Ethyl perfluorooctane sulfonamidoacetic acid (NEtFOSAA)	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	10:2 Fluorotelomer sulfonic acid (10:2 FTS)	Sum of PFHxS and PFOS	Sum of PFAS (WA DER List)	Sum of PFAS
Units			ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Sample Name	Sample Date	Sample Type																													
TRIP BLANK_13022019	13-Feb-19	Trip Blank	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
RINSATE01_21022019	21-Feb-19	Rinsate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
BH8_21022019	21-Feb-19	Primary	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
DUP01_21022019	21-Feb-19	Duplicate	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
BH8_21022019	21-Feb-19	Primary	< 0.02	< 0.02	< 0.02	< 0.02	< 0.01	< 0.1	< 0.02	< 0.02	< 0.02	< 0.01	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.05	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.02	< 0.02	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.01	< 0.01
TRIP01_21022019	21-Feb-19	Triplicate	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.01	< 0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.05	< 0.1
Relative Percentage Difference			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Notes:
< - Less than laboratory limit of reporting
NC - Not calculated
ug/L - Micrograms per litre