

APPENDIX 6. GROUNDWATER, SURFACE WATER AND PFAS

Preliminary Documentation

Cabbage Tree Road Sand Quarry - (EPBC 2016-7852)

The following background documents are included in this Appendix:

- 1. Umwelt, November 2015. Groundwater Impact Assessment.
- 2. Umwelt, October 2016. Potential for Sand Extraction to Increase Flooding Impacts in Surrounding Area.
- 3. RCA, June 2016. Groundwater Assessment.
- 4. Umwelt, November 2016. Response to Hydro Simulation Peer Review 1.
- 5. Umwelt, January 2017. Response to Hydro Simulation Peer Review 2.
- 6. Kleinfelder, February 2017. Soil Sampling Assessment.
- 7. Kleinfelder, June 2017. Water Sampling Assessment.
- 8. Kleinfelder, June 2017. Contingency Management Plan for Potential PFAS Disturbance during Construction Activities.
- 9. Contamination Water Working Group Comments on the EIS; and Correspondence with Hunter Water Corporation: consultation to develop specific controls and management practices for the site operations.
- 10. Williamtown Contamination Expert Panel Letter.



APPENDIX 7. GROUNDWATER ANALYSIS

RESPONSE TO SUBMISSIONS CABBAGE TREE ROAD SAND QUARRY (SSD 13_6125)



RCA ref 10059b-401/0

24 June 2016

Williamtown Sand Syndicate Pty Ltd PO Box 898 NEWCASTLE NSW 2300

Attention: Murray Towndrow

Geotechnical Engineering Engineering Geology Environmental Engineering Hydrogeology Construction Materials Testing Environmental Monitoring Sound & Vibration Occupational Hygiene

GROUNDWATER ASSESSMENT CABBAGE TREE ROAD, WILLIAMTOWN

1 INTRODUCTION

This report presents the findings of groundwater monitoring that was undertaken on selected groundwater monitoring wells within the site that is located north of Cabbage Tree Road at Williamtown. The investigation was undertaken on 24 May 2016 at the request of Murray Towndrow on behalf of Williamtown Sand Syndicate.

Groundwater monitoring wells were previously installed and sampled at the site by RCA Australia (RCA) in November and December 2014 as part of a geotechnical and groundwater investigation (Ref [1]) to provide data and characterisation assisting in the development of an Environmental Impact Statement (EIS) relating to proposed sand extraction.

The site is located within the "Williamtown investigation area" as defined by the NSWEPA in October 2015 relating to per- and poly- fluorochemicals (PFC) identified in some surface waters, groundwaters and quantities of fish around the Williamtown RAAF Base and Newcastle Airport (Ref [2]). Impact from potential PFC contamination had not been considered in the EIS, and therefore the additional monitoring included within this cover is to ascertain if the site has been impacted by PFC.

It is noted that PFC may also be referred to as per- and poly-fluorinated alkyl substances (PFAS); however they do cover the same class of chemicals (Ref [3]). This report has largely used the PFAS terminology based on the literature consulted to compile and assess the results.

2 SITE IDENTIFICATION AND DESCRIPTION

The site of the proposed sand mine is situated to the north of Cabbage Tree Road, Williamtown. The approximate location of the site is shown on the locality plan on **Drawing 1**, **Attachment A**.

At the time of fieldwork the site was densely vegetated with trees and shrubs, whilst some areas were more open vegetation, grassland and bare sand dunes with unsealed access tracks and fences existing on the site. Investigation at this time inferred groundwater flow to range between south easterly in the north western portion of the site, to southerly elsewhere across the site based on the water levels encountered during previous investigation (Ref [1]).

- BH6/ WMB3 2.09m AHD.
- BH8/ SSWB8 1.62m AHD.
- BH11/WMB2 3.64m AHD.

The inferred groundwater flow directions from the assessment in 2015 are shown on **Drawing 1**, **Attachment A**.

Further description of the site is provided in RCA's initial geotechnical and groundwater investigation (Ref [1]).

The proposed sand mine is located approximately 1km south west of the Williamtown RAAF Base/Newcastle Airport, located within the "Williamtown investigation area" as determined by the NSWEPA, which is shown on the locality plan on **Drawing 1**, **Attachment A**.

3 FIELDWORK, QUALITY ASSURANCE AND LABORATORY TESTING

3.1 FIELDWORK

An environmental scientist experienced in handling potentially contaminated groundwater visited the site on 24 May 2016 to collect groundwater samples:

- Groundwater bores BH6, BH8, and BH11 were dipped to determine depth of groundwater.
- Samples were only collected from three (3) of the previously established bores due to their location in relation to the Williamtown RAAF Base/ Newcastle Airport. These bores, as shown on **Drawing 1**, **Attachment A**, are located along the site's northern boundary. They are considered appropriate for the initial screening of potential presence of PFAS compounds due to being located closest to the source, with inferred groundwater flow found to flow in a south easterly to southerly direction during the initial investigation as shown on **Drawing 1**, **Appendix A** (Ref [1]). Bores were then purged of at least one bore volume and until pH and EC readings stabilised to ensure a representative sample was obtained.
- Samples were collected by designated PVC hand bailer, in accordance with interim guidelines published as discussed further in Section 3.2. These samples were analysed for PFOS, PFOA and 1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS) compounds.



The samples collected were described as follows whilst the groundwater levels, corrected to m AHD are also included on the drawing in **Attachment A**.

- BH6/ WMB3 Dark brown, very turbid, slight sulphur odour. Depth to aquifer was 2.19m AHD.
- BH8/ SSWB8 Dark brown, very turbid, sulphur odour. Depth to aquifer was 1.63m AHD.
- BH11/WMB2 Brown, very turbid, strong sulphur odour, presence of sediment (sand and mud). Depth to aquifer was 4.09m AHD.

Field sheets are attached in Attachment B.

3.2 QUALITY ASSURANCE/QUALITY CONTROL

Decontamination solutions (including Decon 90) are prohibited on all equipment as advised by the interim document issued by the Government of Western Australia, Department of Environment Regulation (DER) (Ref [4]). Therefore the groundwater sample collection method comprised using a designated PVC hand bailer to reduce the potential for cross contamination. The water quality meter was decontaminated by scrubbing and rinsing with potable water only between sampling locations.

All samples were preserved as recommended by the analytical laboratory and stored in the field in an Esky on ice. Ice bricks were not used to chill the samples in accordance with the requirements outlined by the DER (Ref [4]). Samples were sent to the laboratory within 24 hours of sampling.

All samples were sent under Chain of Custody (COC) documentation detailing the sample identification, required analysis, the name of the sampler and date released from custody. The laboratory acknowledged the receipt of samples by signature and date and returned the COC with a sample receipt notice indicating the condition of the samples received upon receipt.

One (1) water duplicate sample was submitted blind to the laboratory for analysis with the samples representing percentage in excess of 10%, which is in accordance with the frequency recommended by RCA protocol based on Australian Standard AS 4482.1-2005 relating to soil sampling (Ref [5]). Results are summarised below in **Table 1**.

RCA omitted the equipment wash because designated hand bailers were used for each well, whilst the field blank was omitted due to the low potential for cross contamination during the sampling process.



Table 1External Quality Assurance Assessment

Sample Identification	Drimor	Sample	Duplicate		
Date		24/05/	2016		
Duplicate Type	r QL	Intralab	Intralaboratory		
Sample Description		Brown, ve strong sulp sediment (sa	Brown, very turbid, strong sulphur odour, sediment (sand & mud)		
Sample Purpose		Investi	gation		
Sample Collected by		K	S		

Per- and Polyfluorinated Alkyl Substances (PFASs)								
Perfluorooctanoic acid (PFOA)	0.01		<u>0.005</u>	<u>0.005</u>	0.0			
Perfluorooctanesulfonic acid (PFOS)	0.01	ſ	<u>0.005</u>	0.01	66.7			
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS)	0.05		<u>0.025</u>	<u>0.025</u>	0.0			

Note all units in µg/L.

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.

Results <u>underlined</u> were not detected and are reported as half the detection limit for statistical purpose.

BOLD identifies where RPD results

>50 where sample results are >10 x PQL

>75 where sample results are > 5 to ≤10 x PQL

>100 where sample results are >2 to ≤5 x PQL

AD>2.5 * PQL where sample results are ≤2 x PQL

Where results are within two of the above ranges the most conservative criteria have been used to assess duplicate performance

Eurofins mgt was chosen as the primary laboratory, and is NATA accredited and experienced in the analytical requirements for potentially contaminated groundwater.

Eurofins mgt undertook internal quality assurance testing. Results are contained within the laboratory report sheets, **Attachment C**. Examination of the quality assurance testing reveals that Eurofins mgt have undertaken laboratory quality assurance testing in accordance with the NEPM (Ref [6]) with the exception of there being no matrix spike reported with the results. This is discussed further below with a summary of the laboratory's quality assurance assessment.

- Recoveries of Surrogates were within acceptance criteria of 70-130% with the exception of:
 - d5-n-EtFOSAA in all samples which reported recoveries between 49% and 60%.
 - 13C8-PFOS in all samples which reported recoveries between 36% and 41%.

Upon consultation with the testing laboratory, the following explanation was provided: "Clean waters typically return 70-130% surrogate (extraction) recoveries, however, more complex water sources (ground waters, process waters and some surface waters, etc) tend to impact extraction efficiencies considerably. As such, acceptable recoveries are 30-130% criteria. Please note, target compounds are reported based on a surrogate recovery correction process known as isotopic dilution as referenced in USEPA method 537 (Determination of Selected Perfluorinated Alkyl Acids by Solid Phase Extraction and Liquid Chromatography/Tandem mass Spectrometry (LC-MS/MS)." The samples analysed consisted of very turbid samples which may have



impacted the recovery, however RCA considers that there may be some uncertainty with the results.

The reported concentrations were all well below the current NSW EPA endorsed US determined criteria and therefore the uncertainty with these results are unlikely to be significant under the current interim criteria. It is noted that the Australian endorsed guidelines are currently under consideration for PFOS, PFOA, or PFAS and therefore this uncertainty may become significant in future, pending the publication of future guidelines.

- Holding Times were within laboratory specified time frames.
- Recoveries of laboratory control samples were within the acceptance criteria of 70-130%.
- No matrix spikes were reported within the internal quality assurance testing. Consultation with the testing laboratory explained that the matrix spike was performed on another sample outside of the current project but within the batch, however was not reported on this occasion. Eurofins have stated that the batch matrix spike failed from *"what appeared to be matrix specific recovery issues"*. As the failed sample was outside of the project, RCA cannot provide further discussion on the uncertainty.
- Relative Percentage Differences for Duplicates were within acceptance criteria as defined for intralaboratory duplicates in **Table 1**.
- No Laboratory Blank result was detected above the PQL.

It is therefore considered that while there may be some uncertainty with the results based on the surrogate results and failed matrix spike, the uncertainty is unable to be quantified and in the absence of detected results, the uncertainty is not considered significant. It is noted that these compounds are under active consideration with regards to the health risk that are posed and guideline criteria may change, in which case the uncertainty may become significant.

4 SITE INVESTIGATION LEVELS

4.1 ADOPTED AUSTRALIAN GUIDELINES

The analytes monitored within this cover are considered to be emerging contaminants and as such currently there are no Australian guideline criteria available. The impact around the Williamtown RAAF Base/Newcastle Airport has led to the NSWEPA working with the Department of Defence as well as a range of other NSW Government Agencies to assess the situation. The "Williamtown Expert Panel" was established to explore the nature and extent of contamination from fire-fighting foams used historically at Williamtown RAAF base (Ref [7]).

These agencies/panel have adopted the provisional US Environmental Protection Agency (USEPA) Drinking Water Guidelines (DWG) for groundwater (Ref [8] and [9]). Therefore the adopted criteria are as follows:

- PFOS provisional guideline of 0.2 µg/L.
- PFOA provisional guideline of 0.4 µg/L.
- 6:2 FTS provisional guideline of 5.0 µg/L.



No criteria for ecological impact has been specified for groundwater, however the Department of Defence has stated that any impact would largely relate to the discharge of groundwater to surface water, and impact on the aquatic ecosystem of the surface water (Ref [8]). Therefore any ecological criterion could be compared against the adopted surface water guidelines once chemical flux and dilution factors have been considered and adjusted as required (Ref [8]).

4.1.1 DECISION TREE AND TRIGGER POINTS

Due to the potential for numerous sites to be impacted by these contaminants, the NSWEPA commissioned Environmental Risk Sciences Pty Ltd (enRiskS) to prepare a decision tree to prioritise sites potentially contaminated with PFAS (Ref [10]). The decision tree developed proposes to rank sites into three (3) categories depending on the concentrations found in water or soil and the categories are detailed below (Ref [10]).

Priority 1 -

- Elevated PFAS concentrations as indicated by samples that exceed the triggers as follows:
 - Groundwater samples collected from on-site bores have PFOS or PFAS (calculated as the sum of PFOS and PFOA) concentrations which are in excess of Trigger Point 1; 10 μg/L.
 - Groundwater samples collected from off site bores have PFOS or PFAS (calculated as the sum of PFOS and PFOA) concentrations which are in excess of Trigger Point 2; 0.1 μ g/L.
- Where sites with these elevated concentrations have a pathway by which people and/or the environment could be exposed to the contamination, the site may pose a risk to people or the environment.
- Require full and timely detailed investigation as soon as possible in accordance with contaminated land guidance to determine the level of risk, the potential for the chemicals to move off the site and requirements for long-term management/remediation.
- Likely need for temporary control measures at such sites while the detailed investigation is undertaken depending on what activities are occurring down gradient of the site (eg, residential, agricultural, presence of surface waters).
- Short-term management options for the contamination may also need to be implemented while the detailed investigation is underway but a full detailed plan for management/remediation of the site would be developed once the detailed investigation has been completed.

Note that there may be situations where the only elevated level found for a site cannot readily escape off site, ie, from a lined retention pond on the site. Or the site is in a remote area and there is little opportunity for contamination to move off site or to reach locations where people may be living or working. Such sites may not need to be allocated Priority 1 even if the initial samples are elevated above Trigger Point 1 values.

It is noted that the site would be considered 'off-site' to the source of the contamination for the purpose of the Priorities.



Priority 2 -

- PFAS concentrations have been shown to be present above screening guidelines but at lower concentrations than priority 1 sites. Priority 2 sites are generally classified by the following:
 - Groundwater samples collected from on site bores have PFOS or PFAS (calculated as the sum of PFOS and PFOA) concentrations which are between Trigger Point 1 and 3; therefore within the range of 0.05 and 10µg/L.
 - Groundwater samples collected from off site bores have PFOS or PFAS (calculated as the sum of PFOS and PFOA) concentrations which are in are between Trigger Point 2 and 3; therefore ranging between 0.05 and 0.1µg/L.
- The potential for these sites to pose a risk to people or the environment that requires management and/or remediation will depend on the geology/hydrogeology of the site and the land uses downgradient of the site.
- These sites will need detailed investigation after the priority 1 sites.

Priority 3 -

- PFAS chemicals are not detected or detected at concentrations below relevant thresholds. Priority 3 sites are classified as follows:
 - Concentrations of PFOS or PFAS (calculated as the sum of PFOS and PFOA) in on site or off site groundwater samples are below 0.05µg/L¹.
- Unlikely to need further investigation but a final decision on the need for such an investigation will be confirmed once Australian guidelines for these chemicals are finalised later in 2016.

4.2 USEPA

The USEPA issued health advisory (HA) limits to replace the 2009 preliminary guidelines, which are currently applied by the NSW agencies as detailed previously in Section 4.1. The updated advisory limits were published in May 2016, and relate to a lifetime HA guideline based on reference doses derived from a developmental toxicity study in rats (Ref [11] and [12]). The lifetime HA is based on the health effects information for non-cancer and cancer effects (Ref [11] and [12]) and is based on the most sensitive populations because PFAS can be transmitted via cord blood and breast milk and therefore developing foetuses and newborns are particularly sensitive.

The guidelines published by the USEPA indicate that the lifetime health advisory limits for both PFOA and PFOS is 0.07 μ g/L. Further to this, the reference doses for both PFOA and PFOS are based on similar developmental effects and are numerically identical (Ref [11] and [12]). Therefore where these two chemicals co-occur at the same time and location in a drinking water source, the USEPA recommends a conservative approach and as such the guideline criteria is 0.07 μ g/L for the sum of PFOA and PFOS (identified as PFAS within the results tables in **Attachment D**) (Ref [11] and [12]).

¹ The document (Ref [9]) notes that the current limit of reporting for testing laboratories at February 2016 ranges between $0.01 - 0.05 \mu g/L$. Therefore the Trigger 3 guideline is based on muddy/ turbid waters in which the LOR may be $0.05 \mu g/L$.



4.3 APPROPRIATENESS OF THE GUIDELINES

Limited guideline criteria are currently available for assessing sites against potential impact from PFAS contamination, especially within Australia. Therefore the guidelines which have been adopted in this assessment have been used largely to maintain consistency with sites also under assessment, whilst also taking the newest guidelines available into consideration. It is noted that the NSW agencies have not previously reported concentrations against the updated USEPA lifetime health advisory guidelines, but this is considered to be due to the limited timeframe since the guidelines have been published. The NSWEPA, Williamtown Expert Panel and Department of Defence note that the USEPA drinking water guidelines currently being used are provisional, and therefore subject to change.

For the proposed industrial use of the site, RCA considers that the drinking water guidelines may be considered conservative. However, if the proposed use is approved, operational activities, potentially including but not limited to, dewatering, processing and/or dust suppression may warrant stringent guidelines. Therefore we consider that the use of drinking water guidelines are considered appropriate whilst guideline criteria are determined in Australia by CRC Care (expected to be published in 2016 (Ref [13])), which may be more suitably comparable.

Ecological guidelines have not been used for comparison due to the limited scope of this assessment in which groundwater flux and dilution calculations were not considered. Therefore as the guidelines adopted in this assessment (human health and lifetime health advisory) are more conservative than the ecological criteria outlined in the Defence Contamination Directive #8 (Ref [8]), this is not considered to adversely impact the assessment.

At the time of issue, the guidelines used in this assessment are considered to be current, however it is noted that due to the nature of emerging contaminants, this may change in a limited period of time.

5 RESULTS

All groundwater results are compared to the relevant criteria and against the prioritisation decision tree in **Tables 1** and **2**, **Attachment D** respectively. The following presents a summary.

- All samples were reported to be below the laboratory PQL of 0.01µg/L for Perfluorooctane sulfonate (PFOS) and below the human health criteria. Concentrations reported characterise all locations sampled as *Priority 3* as detailed in the decision tree commissioned for the NSWEPA (Ref [11]).
- All samples were reported to be below the laboratory PQL, and below the human health criteria for Perfluorooctanoic acid (PFOA) with all results reported as <0.01µg/L.
- All samples were reported to be below the laboratory PQL, and below the human health criteria for perfluorooctanesulfonic acid (6:2 FTS), with all monitoring locations reported as <0.05 µg/L.



 All monitoring locations reported PFAS concentrations (as calculated by the sum of PFOS and PFOA) to be below the USEPA's lifetime health advisory limit of 0.07µg/L and characterise all locations sampled as *Priority 3* as detailed in the decision tree commissioned for the NSW EPA (Ref [11]).

When groundwater levels were compared against the initial investigation levels, differences of 0.45m, 0.01m and 0.10m were found at groundwater bores BH11/WMB2, BH8/SSWB8 and BH6/WMB3 respectively. This signifies an increase in groundwater level at all sites, with marked rises observed at BH11 and BH6.

6 CONCLUSIONS

This report has presented the findings of a targeted groundwater assessment undertaken at the request of Williamtown Sand Syndicate.

Fieldwork was conducted on 24 May 2016, and consisted of monitoring three (3) previously established groundwater monitoring bores which are located along the northern boundary of the proposed sand mine site. The monitoring was undertaken as part of initial screening for potential PFAS contamination from the Williamtown RAAF Base located approximately 1km north-east of the site.

When compared against relevant interim guidelines, all locations were found to be below the applicable criteria for PFOA, PFOS, 6:2 FTS and PFAS (calculated as the sum of PFOA and PFOS). Under the site prioritisation decision tree, commissioned on behalf of the NSWEPA, all sites were classified as Priority 3. As such RCA considers that the site will not likely need further investigation, however notes that this conclusion may alter pending the finalisation of Australian guidelines later in 2016 (Ref [10]).

Due to the inferred south easterly to southerly groundwater flow direction as shown on **Drawing 1**, **Attachment A** and discussed in the initial geotechnical and groundwater investigation (Ref [1]), further assessment of the other established groundwater bores on site is not considered warranted at present.

It is noted that although the site is considered free from PFAS contamination at the time of monitoring detailed within this report, there is still the potential for contaminant migration from off site sources through groundwater. It is therefore suggested that further PFAS and groundwater flow regime monitoring should be considered in future if any groundwater extraction is required; subject to approval of the proposed sand mine.

7 LIMITATIONS

This report has been prepared for Williamtown Sand Syndicate in accordance with an agreement with RCA. The services performed by RCA have been conducted in a manner consistent with that generally exercised by members of its profession and consulting practice.

This report has been prepared for the sole use of Williamtown Sand Syndicate for the specific purpose described within this cover. The report may not contain sufficient information for purposes of other uses or for parties other than Williamtown Sand Syndicate. This report shall only be presented in full and may not be used to support objectives other than those stated in the report without written permission from RCA.



The information in this report is considered accurate at the date of issue with regard to the current conditions of the site. Conditions can vary across any site that cannot be explicitly defined by investigation.

Environmental conditions including contaminant concentrations can change in a limited period of time. This should be considered if the report is used following a significant period of time after the date of issue.

Yours faithfully

RCA AUSTRALIA

Katy Shaw Environmental Scientist

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Fiona Brooker Associate Environmental Engineer

ATTACHMENTS

Drawing Field Sheets Laboratory report sheets Summary of results

REFERENCES

- [1] RCA Australia, Geotechnical and Groundwater Investigation, Cabbage Tree Road, Williamtown, May 2015, RCA Ref 10059-201/1.
- [2] NSWEPA. 2016, *Williamtown RAAF Base Contamination*. [ONLINE] Available at: <u>http://www.epa.nsw.gov.au/MediaInformation/williamtown.htm</u> [accessed 9 June 2016].
- [3] National Institute of Environmental Health Sciences. 2012, *PerfluorinatedChemicals (PFCs)*, [ONLINE] Available at: <u>https://www.niehs.nih.gov/health/materials/perflourinated_chemicals_508.pdf</u> [accessed 21 June 2016].
- [4] Western Australia- Department of Environment Regulation, Interim Guideline of the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS), Contaminated Site Guidelines, February 2016.
- [5] Standards Australia, *Guide to the investigation and sampling of sites with potentially contaminated soil, Part 1: Non-volatile and semi-volatile compounds,* AS 4482.1-2005.
- [6] NEPC, National Environment Protection (Assessment of Site Contamination) Measure, 1999 as amended 2013.
- [7] NSWEPA. 2016, *Williamtown Expert Panel*. [ONLINE] Available at: <u>http://www.epa.nsw.gov.au/mediainformation/expert-panel-williamtown.htm</u> [accessed 21 June 2016].



- [8] Australian Government, Department of Defence, Defence Contamination Directive #8 Interim Screening Criteria, Consistency of Toxicology or Ecotoxicology based Environmental Screening Levels for PFOS, PFOA, 6:2 FTS, May 2015.
- [9] Williamtown Contamination Expert Panel. 2015. *Preliminary Groundwater Investigation Results- Williamtown NSW*, [ONLINE] Available at: <u>http://www.epa.nsw.gov.au/resources/epa/152670-summary-groundwater-sampling-williamtown-201015.pdf</u>. [Accessed 21 June 2016].
- [10] Environmental Risk Sciences Pty Ltd, *Proposed Decision Tree for Prioritizing Sites Potentially Contaminated with PFASs*, February 2016.
- [11] USEPA, Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA), May 2016.
- [12] USEPA, Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS), May 2016.
- [13] CRC Care, Project Update-Assessment, management and remediation of perfluroctancesulfonate (PFOS) and perfluorooctanesulfonic acid (PFOA), March 2016.

GLOSSARY

AHD	Australian height datum, based on a mean sea level.				
DER	Government of Western Australia, Department of Environment Regulation				
EIL	Ecological investigation level. Relates to soil concentrations which may pose a risk to ecological health.				
EIS	Environmental Impact Statement				
Intralaboratory	A sample split into two and sent blind to the sample laboratory for comparative analysis.				
μg	microgram, 1/1000 milligram.				
NEPC	National Environment Protection Council.				
NEPM	National Environment Protection Measure.				
NSWEPA	NSW Environment Protection Authority – formerly a component of DECC, DECCW, OEH but made a separate entity in 2011 to regulates the contaminated land industry.				
OEH	NSW Office of Environment and Heritage.				
PPE	Personal Protective Equipment.				
PQL	Practical Quantitation Limit.				
QA	Quality Assurance.				
QC	Quality Control.				
RPD	Relative Percentage Difference.				



United States Environmental Protection Agency
3
Perfluoroalkyl and polyfluoroalkyl substances
Perfluorooctanoic acid
Perfluorooctane sulfonate
Perfluorochemicals and polyfluorochemicals





LEGEND

Borehole location

(2.3) Groundwater level (m, AHD) as applicable on 24/5/2016

----- Inferred groundwater flow direction 17/2/2015

<u>NOTE</u>: Drawing adapted from plan supplied by Buildev Development (NSW) Pty Ltd Dwg. CTR_Site Data

> Fluctuations in groundwater levels may be expected due to variations in rainfall and climatic conditions

Aerial image taken from Nearmap, October 4 2015 Image position approximate only



R AUSTRALIA GEOTECHNICAL . ENVIRONMENTAL

CLIENTWilliamtownDRAWN BYKAPPROVED BYF

GROUNDWATER MONITORING LOCATIONS CABBAGE TREE ROAD WILLIAMTOWN

n Sand	Syndicate		RCA Ref	1005	9b-40	1/0
(S	SCALE	1:6000 (A3)	DRAWING No	o 1	REV	0
В	DATE	23/6/2016	OFFICE	NEWCAS	TLE	



ENGINEERING FIELD SHEET

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2/ 3/ 4/ 5/ 6/ Sample Ap Duplicate/E	S-14 S-14 S-16 S-16 Equipment	0.216 0.75 0.75 0.75 0.765 e: Brown, Very nt Wash Identification a	999 999 999 <u>tutbid</u> St nd Other Réma	1.07 1.07 1.23 1.23 1.23 1.23 1.23 1.23 1.23 1.23	18.8 18.6 18.8 , sedenint (S	0.00 0.00 0.00
2/ 3/ 4/ 5/ 6/ Sample Ap Duplicate/E	S-14 S-16 S-16 S-16 Equipment	0.216 0.160 0.15 0.15 0.165 e: <u>Bown</u> , Very nt Wash Identification a	999 999 999 Eurbid Stand nd Other Réma	1.07 1.07 1.23 1.23 1.23 1.23 1.23 1.23 1.23 1.23	18.8 18.6 18.6 sedinint (S	0.00 0.00 0.00
2/ 3/ 4/ 5/ 6/ Sample Ap Duplicate/E BORE OR TIME: \(5-14 5-14 5-16 Equipment LOCATIO	0.216 0.160 0.175 0.165 0.165 0.165 0.165 0.165 0.165 0.165 0.165 0.160 0.160 0.160 0.160 0.160 0.160 0.160 0.160 0.160 0.160 0.165 0.	999 999 999 Eurloid Ste nd Other Réma	1.07 1.40. 1.23 TOTO HAS COOLS TRAST DO OFIL	18.8 18.6 18.6 , sedining (S	0.00 0.00 0.00 0.00
2/ 3/ 4/ 5/ 6/ Sample Ap Duplicate/E BORE OR TIME: ((BORE DEI	S-14 S-14 S-16 S-16 Equipment LOCATIO	0.216 0.160 0.175 0.165 0.165 0.165 0.165 0.165 0.165 0.165 0.160 0.165 0.	999 999 999 Lutbid St nd Other Réma	TABOVE GROUND LE	18.8 18.6 18.6 , sedinink (S	0.00 0.00 0.00 0.00 0.00
2/ 3/ 4/ 5/ 6/ Sample Ap Duplicate/E BORE OR TIME: \(BORE DEI DEPTH TO	S-14 S-16 S-16 G-16 Equipment LOCATIO O: 40 PTH: D AQUIFE	0.216 0.160 0.15 0.15 0.15 a: <u>Bown</u> , Very nt Wash Identification a DN ID: <u>BH8</u> TO 11:5 6.15m (TOC) R: <u>2.27m (TOC)</u>	999 999 999 Lutbid St nd Other Réma	TABOVE GROUND LE	18.8 18.6 18.6 , sedinink (S	0.00 0.00 0.00 0.00
2/ 3/ 4/ 5/ 6/ Sample Ap Duplicate/E BORE OR TIME: ((BORE DEI DEPTH TC RESULTS	S-14 S-16 S-16 S-16 Equipment LOCATIO D- 40 PTH: D- AQUIFE S- 0F WAT	0.216 0.160 0.15 0.15 0.15 0.15 0.15 0.15 TO 115 C.15 TO 115 C.15 TO 115 C.15 TO 115 C.15 TO 115 C.15 TO 115 C.15 TO 115 C.15 TO 115 C.15 C	999 999 999 Eurbid Stand nd Other Réma	TABOVE GROUND LE	18.8 18.6 18.6 18.6 18.6 Section (S) VEL: +0.62 C	0. 00 0. 00 0. 00 0. 00 0. 00 0. 00 0. 00
2/ 3/ 4/ 5/ 6/ Sample Ap Duplicate/E BORE OR TIME: \(BORE DEL DEPTH TC RESULTS Check No.	S-14 S-16 S-16 Equipment LOCATIO D- 40 PTH: D- AQUIFE S-0F WAT	0 -216 0 -160 0 -165 0 -165	999 999 999 Eurloid Stand Melight Durbidity	TABOVE GROUND LE VOLUME PURGED	18.8 18.6 18.6 18.6 Sedinink (S VEL: <u>+0.62</u> : 202 Temperature (°C) 18.2	0.00 0.00 0.00 0.00 0.00 0.00
2/ 3/ 4/ 5/ 6/ Sample Ap Duplicate/E BORE OR TIME: \(BORE DEI DEPTH TC RESULTS Check No 1/	S-14 S-14 S-16 S-16 Equipment LOCATIO D-40 PTH: D-AQUIFE S-0F WAT	0.216 0.160 0.165 0.165 0.165 0.165 0.165 0.165 0.165 $TO 115$ $C.15m (TOC)$ $ER QUALITY CHECK:$ $Conductivity (mS/cm)$ $0.25i$	999 999 999 4010 St nd Other Réma S HEIGHT	TABOVE GROUND LE VOLUME PURGED	18.8 18.6 18.6 , sedinint (S 2 VEL: <u>+0.62</u> 18.2 18.2 18.3	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0
2/ 3/ 4/ 5/ 6/ Sample Ap Duplicate/E BORE OR TIME: ((BORE DEI DEPTH TC RESULTS Check No 1/ 2/	5-14 5-14 5-16 5-16 5-16 5-16 Equipment Equipment LOCATIO 0: 40 PTH: 0 AQUIFE 5 OF WAT 5-16 5-1	0.216 0.160 0.15 0.165 0.165 0.165 0.165 0.165 $TO 115$ $C.15m (TOC)$ $ER QUALITY CHECK:$ $Conductivity (mS/cm)$ $0.25i$ 0.249	999 999 999 999 turbidity S HEIGH 2)- Turbidity 999 999	1.07 1.07 1.40. 1.23 1.23 1.23 1.23 1.25 1.25 1.25 1.26 1.25 1.26	18.8 18.6 18.6 18.8 Section (S 2 VEL: <u>+0.62</u> 18.2 Temperature (°C) 18.2	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
2/ 3/ 4/ 5/ 6/ Sample Ap Duplicate/E BORE OR TIME: \(BORE DEI DEPTH TC RESULTS Check No 1/ 2/ 2/	5-14 5-16 5-16 5-16 5-16 5-16 Equipment Equipment LOCATIO 0: 40 PTH: 0 AQUIFE 5 OF WAT 5-26 5-26 5-26	0.216 0.160 0.15 0.15 0.15 0.15 0.15 0.15 $TO 11.3$ $C.15m (Toc)$ $R: 2.27m (Toc)$ $R: 2.27m (Toc)$ $R: 2.27m (Toc)$ $Conductivity (mS/cm)$ $0.25i$ 0.249 0.248	999 999 999 5 Lutbid St nd Other Réma S HEIGH 	1.07 1.07 1.40. 1.23 1.23 1.23 1.23 1.25 1.26 1.25 1.26 1.59	18.8 18.6 18.6 18.8 Sedimint (S 2 VEL: +0.62 18.2 18.2 18.2	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
2/ 3/ 4/ 5/ 6/ Sample Ap Duplicate/E BORE OR TIME: \(BORE DEI DEPTH TC RESULTS Check No 1/ 2/ 3/ 4/ 4/	5-14 5-14 5-16 5-16 5-16 Equipment Equipment LOCATIO 0:40 PTH: 0 AQUIFE 0 AQUIFE 0 F WAT 5-28 5-26 5-26	0.216 0.160 0.15 0.15 0.15 0.15 0.15 0.15 $TO 115$ $C.15m (Toc)$ $ER QUALITY CHECK:$ $Conductivity (mS/cm)$ 0.251 0.248	999 999 999 5 Eurbid Stand nd Other Réma S HEIGH)) Turbidity 999 999	1.07 1.07 1.40. 1.23 1.23 1.23 1.23 1.23 1.25 1.25 1.25 1.25 1.26 1.59	18.8 18.6 18.6 Sedinink (S Sedinink (S 2 VEL: +0.621 : 200 Temperature (°C) 18.2 18.2 18.2	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
2/ 3/ 4/ 5/ 6/ Sample Ap Duplicate/E BORE OR TIME: \(BORE DEI DEPTH TC RESULTS Check No 1/ 2/ 3/ 4/ 5/ 5/ 5/ 6/ 2/ 3/ 4/ 5/ 5/ 5/ 5/ 5/ 5/ 5/ 5/ 5/ 5	5-14 5-14 5-16 5-16 Equipment Equipment LOCATIO 0:40 PTH: 0 AQUIFE 0 F WAT 0. PH 5-28 5-26 5-26	0.216 0.160 0.160 0.165 0.165 0.165 0.165 0.165 $TO 115$ $C.15m (TOC)$ $ER QUALITY CHECK:$ $Conductivity (mS/cm)$ $0.25i$ 0.248	999 999 999 5 5 HEIGHT 2 	1.07 1.07 1.40. 1.23 1.23 1.23 1.23 1.23 1.25 1.25 1.25 1.25 1.26 1.59	18.8 18.6 18.6 18.6 Sedinint (S Sedinint (S Sedinint (S) 18.2 18.2 18.2	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
1/ 2/ 3/ 4/ 5/ 6/ Sample Ap Duplicate/E BORE OR TIME: \(BORE DEI DEPTH TC RESULTS Check No 1/ 2/ 3/ 4/ 5/ 6/ 2/ 3/ 4/ 5/ 5/ 6/ 5/ 5/ 5/ 6/ 2/ 5/ 5/ 5/ 5/ 5/ 5/ 5/ 5/ 5/ 5	5-14 5-14 5-16 5-16 Equipment Equipment LOCATIO 0: 40 PTH: 0 AQUIFE 5 OF WAT 5-25 5-25 5-25	0.216 0.160 0.15 0.15 0.15 0.15 0.15 0.15 $TO 115$ $C.15m (TOC)$ $ER QUALITY CHECK:$ $Conductivity (mS/cm)$ 0.251 0.249 0.248	999 999 999 EUTO: 3 St nd Other Réma S HEIGH 2)- Turbidity 999 999	1.07 1.07 1.40. 1.23 1.23 1.23 1.23 1.23 1.25 1.26 1.25 1.26 1.59	18.8 18.6 18.6 18.6 Sedinint (S VEL: <u>+0.62</u> 18.2 18.2 18.2	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
1/ 2/ 3/ 4/ 5/ 6/ Sample Ap Duplicate/E BORE OR TIME: ((BORE DEI DEPTH TC RESULTS Check No 1/ 2/ 3/ 4/ 5/ 6/	5-14 5-14 5-16 5-16 5-16 Equipment Equipment LOCATIO 0: 40 PTH: 0 AQUIFE 5 OF WAT 5-26 5-26 5-26	0.216 0.160 0.175 0.165 0.165 0.165 0.165 0.165 $TO 115$ $C.15m (TOC)$ $R: 2.27m (TOC)$ $Conductivity (mS/cm)$ 0.251 0.249 0.248	999 999 999 999 40162 St nd Other Réma S HEIGH 2)- Turbidity 999 999 999	TABOVE GROUND LE VOLUME PURGED	18.8 18.6 18.6 18.8 Section (S) 2 Temperature (°C) 18.2 18.3 18.2	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
2/ 3/ 4/ 5/ 6/ Sample Ap Duplicate/E BORE OR TIME: ((BORE DEI DEPTH TC RESULTS Check No 1/ 2/ 3/ 4/ 5/ 6/ Sample /	S-14 S-16 S-16 S-16 Decarance Equipment LOCATIO O: 40 PTH: D AQUIFE S OF WAT S-25 S-26 S-26 S-26 S-26	0.216 0.160 0.15 0.15 0.15 0.15 0.15 $TO 115$ $C.15m (Toc)$ $R: 2.27m (Toc)$ $R: 2.27m (Toc)$ $R: 2.27m (Toc)$ $Conductivity (mS/cm)$ $0.25i$ 0.249 0.248	999 999 999 999 Eurbid St nd Other Réma S HEIGH)) Turbidity 999 999 999 999	1.07 1.07 1.40. 1.23 1.23 1.23 1.23 1.23 1.25 1.25 1.26 1.25 1.26 1.25 1.26 1.25 1.26 1.25 1.26 1.25 1.26 1.25 1.26 1.25 1.26	18.8 18.6 18.8 Sedimit (S 2 VEL: +0.621 : 2.0 Temperature (°C) 18.2 18.2	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

	Sampled by:	Date:
RCA Australia	Katu Stra	29/5/16.
Office: Corruction	Augstus	EFS-WSR-001/4

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JOB NO 100596

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Date 24 5/16.

I DECE NU	DH	Conductivity (mS/cm)	Turbidity	Dissolved (0 ₂)	Temperature (°C)	Salinity (%)
1/	5.70	0.229	900	1.96.	19.4	0.00
21	5.18	10.231	900	1.00	19.8	0.00
3/	5.73	0.229	000	1.11	19.7	0.00
4/	510	0.220	000 .	1.11	19.7	0.00
5/	1010			1.1		
5/ ·						
		N ID:TO	HEIGHT AB		/EL:	
ESULTS (OF WATER	R QUALITY CHECK:		OLUME FORGED.	**************************************	
Check No.	pH	Conductivity (mS/cm)	Turbidity	Dissolved (O2)	Temperature (°C)	Salinity (%)
1			÷			
ORE OR LO	DCATION H: QUIFER:	ID:TO	HEIGHT ABC	OVE GROUND LEVE	EL:	
ORE DEPT			Turbidity	Dissolved (O ₂)	Temperature (°C)	Salinity (%)
DRE DEPT	рн	Conductivity (mS/cm)	100 000 0 000 0 000 00	and the second se		
DRE DEPT PTH TO A SULTS OF heck No.	рН	Conductivity (mS/cm)				· · · · · · · · · · · · · · · · · · ·
DRE DEPT PTH TO A SULTS OF	рН	Conductivity (mS/cm)	£.			
DRE DEPT PTH TO A SULTS OF	рН	Conductivity (mS/cm)	2			
PRE DEPT PTH TO A SULTS OF	рН	Conductivity (mS/cm)				
DRE DEPTI PTH TO A SULTS OF neck No.	pH	Conductivity (mS/cm)	2			
RE DEPT PTH TO A SULTS OF eck No.	рн	Conductivity (mS/cm)				

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



Certificate of Analysis

NATA Accredited Accreditation Number 1261 Site Number 20794

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.

Attention:	Katy Shaw
Report	501892-W
Project name	
Project ID	10059b
Received Date	May 25, 20 ²

10059b May 25, 2016

Client Sample ID Sample Matrix Eurofins mgt Sample No. Date Sampled			BH6 Water B16-My24879 May 24, 2016	BH8 Water B16-My24880 May 24, 2016	BH11 Water B16-My24881 May 24, 2016	QA1 Water B16-My24882 May 24, 2016
Test/Reference	LOR	Unit				
Per- and Polyfluorinated Alkyl Substances (PFASs)						
Perfluorooctanesulfonic acid (PFOS)	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	^{N09} 0.00001
Perfluorooctanoic acid (PFOA)	0.00001	mg/L	< 0.00001	< 0.00001	< 0.00001	< 0.00001
1H.1H.2H.2H-perfluorooctanesulfonic acid (6:2 FTS)	0.00005	mg/L	< 0.00005	< 0.00005	< 0.00005	< 0.00005
d5-n-EtFOSAA (surr.)	1	%	60	52	58	49
13C-PFHxA (surr.)	1	%	109	101	120	117
13C8-PFOS (surr.)	1	%	41	36	41	40



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

Per- and Polyfluorinated Alkyl Substances (PFASs)

Testing Site Extracted Brisbane Jun 01, 2016 **Holding Time** 14 Day

- Method: LTM-ORG-2100 Analysis of PFCs in environmental samples by LC-MS/MS



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Melbourne 2-5 Kingston Town Close Oakleigh VIC 3166 Phone : +61 3 8564 5000 NATA # 1261 Site # 1254 & 14271 Sydney Unit F3, Building F 16 Mars Road Lane Cove West NSW 2066 Phone : +61 2 9900 8400 NATA # 1261 Site # 18217 Brisbane 1/21 Smallwood Place Murarrie QLD 4172 Phone : +61 7 3902 4600 NATA # 1261 Site # 20794

Col Add Pro	mpany Name: dress: pject Name:	Robert Carr a PO Box 175 Carrington NSW 2294	and Associate	s Pty Ltd			Order No.: Report #: Phone: Fax:	501892 02 4902 9200 02 4902 9299		Received: Due: Priority: Contact Name:	May 25, 2016 9:00 AM Jun 1, 2016 5 Day Katy Shaw
		100000							Eurofins	mgt Analytical Ser	vices Manager : Andrew Black
		Sar	nple Detail			Per- and Polyfluorinated Alkyl Substances (PFASs)					
Melb	ourne Laborato	ry - NATA Site	# 1254 & 142	71							
Sydn	ey Laboratory		3217								
Brisbane Laboratory - NATA Site # 20/94											
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID						
1	BH6	May 24, 2016	11110	Water	B16-My24879	x					
2	BH8	May 24, 2016		Water	B16-My24880	Х					
3	BH11	May 24, 2016		Water	B16-My24881	Х					
4	QA1	May 24, 2016		Water	B16-My24882	Х					
Test	Counts					4					



Internal Quality Control Review and Glossary

General

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

Holding Times

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

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

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported. Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

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

Units

 mg/kg: milligrams per Kilogram
 mg/l: milligrams per litre

 ug/l: micrograms per litre
 ppm: Parts per million

 ppb: Parts per billion
 %: Percentage

 org/100ml: Organisms per 100 millilitres
 NTU: Nephelometric Turbidity Units

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

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Т	eı	'n	ns

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

QC - Acceptance Criteria

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

Results <10 times the LOR : No Limit

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

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

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

QC Data General Comments

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

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Quality Control Results

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Per- and Polyfluorinated Alkyl Sub	stances (PFASs)								
Perfluorooctanesulfonic acid (PFOS)		mg/L	< 0.00001			0.00001	Pass	
Perfluorooctanoic acid (PFOA)			mg/L	< 0.00001			0.00001	Pass	
1H.1H.2H.2H-perfluorooctanesulfon	ic acid (6:2 FTS)		mg/L	< 0.00005			0.00005	Pass	
LCS - % Recovery									
Per- and Polyfluorinated Alkyl Sub	stances (PFASs)								
Perfluorooctanesulfonic acid (PFOS)		%	83			50-150	Pass	
Perfluorooctanoic acid (PFOA)		%	79			50-150	Pass		
1H.1H.2H.2H-perfluorooctanesulfon	ic acid (6:2 FTS)	%	80			50-150	Pass		
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Per- and Polyfluorinated Alkyl Sub	stances (PFASs)			Result 1	Result 2	RPD			
Perfluorooctanesulfonic acid (PFOS)	B16-My24881	СР	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
Perfluorooctanoic acid (PFOA)	B16-My24881	CP	mg/L	< 0.00001	< 0.00001	<1	30%	Pass	
1H.1H.2H.2H- perfluorooctanesulfonic acid (6:2 FTS)	B16-My24881	СР	mg/L	< 0.00005	< 0.00005	<1	30%	Pass	

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Comments

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

Qualifier Codes/Comments

Description

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Code

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

Authorised By

Andrew Black Richard Corner Analytical Services Manager Senior Analyst-Organic (QLD)

Glenn Jackson National Operations Manager Final report - this Report replaces any previously issued Report

- Indicates Not Requested

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

Uncertainty data is available on request

Eurofins | rag shall not be liable for loss, cost, damages or expenses incurred by the client, or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins | rag shall be for cost, observed in the liable for client or any other person or company, resulting from the use of any information or interpretation given in this report. In no case shall Eurofins | rag shall be for cost of the reported or experiment of the reported or experved in the liable for client or the reported or experiment of th



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Melbourne 2-5 Kingston Town Close Oakleigh VIC 3166 Phone : +61 3 8564 5000 NATA # 1261 Site # 1254 & 14271 **Sydney** Unit F3, Building F 16 Mars Road Lane Cove West NSW 2066 Phone : +61 2 9900 8400 NATA # 1261 Site # 18217 Brisbane 1/21 Smallwood Place Murarrie QLD 4172 Phone : +61 7 3902 4600 NATA # 1261 Site # 20794

Co Ad	mpany Name: dress:	Robert Carr a PO Box 175 Carrington NSW 2294	and Associate	s Pty Ltd			Order No.: Report #: Phone: Fax:	501892 02 4902 9200 02 4902 9299		Received: Due: Priority: Contact Name:	May 25, 2016 9:00 AM Jun 1, 2016 5 Day Katy Shaw
Project Name: Project ID: 10059b									Eurofin	s mgt Analytical Se	rvices Manager : Andrew Black
		Sa	mple Detail			Per- and Polyfluorinated Alkyl Substances (PFASs)					
Melb	ourne Laborato	ory - NATA Site	# 1254 & 142	71							
Sydn	ey Laboratory	- NATA Site # 1	8217								
Brisk	bane Laboratory	/ - NATA Site #	20794			X					
External Laboratory											
NO	Sample ID	Sample Date	Time	Matrix							
1	BH6	May 24, 2016		Water	B16-My24879	Х					
2	BH8	May 24, 2016		Water	B16-My24880	Х					
3	BH11	May 24, 2016		Water	B16-My24881	Х					
4	QA1	May 24, 2016		Water	B16-My24882	Х					
Test	Counts					4					



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Melbourne

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

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

Sample Receipt Advice

Robert Carr and Associates Pty Ltd								
Katy Shaw								
10059b								
Not provided								
5 Day								
May 25, 2016 9:00 AM								
501892								

Sample information

- A detailed list of analytes logged into our LIMS, is included in the attached summary table.
- \checkmark Sample Temperature of a random sample selected from the batch as recorded by Eurofins | mgt Sample Receipt : 3 degrees Celsius.
- All samples have been received as described on the above COC.
- COC has been completed correctly.
- Attempt to chill was evident.
- Appropriately preserved sample containers have been used.
- \mathbf{V} All samples were received in good condition.
- Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
- \mathbf{V} Appropriate sample containers have been used.
- Sample containers for volatile analysis received with zero headspace.
- \times Some samples have been subcontracted.
- Custody Seals intact (if used). N/A

Contact notes

If you have any questions with respect to these samples please contact:

Andrew Black on Phone : (+61) 2 9900 8490 or by e.mail: AndrewBlack@eurofins.com

Results will be delivered electronically via e.mail to Katy Shaw - katys@rca.com.au.

Note: A copy of these results will also be delivered to the general Robert Carr and Associates Pty Ltd email address.





38 Years of Environmental Analysis & Experience

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Sydney
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Office /	ddress :	92 Hill St C	arrington	NSVV	Email	or rest	ults :		kat	vs@i	rca.(om.a	ΞŪ.					PRO.	JECT	Vame	:							Data out	put forma	t:		
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Table 1- Reported concentrations compared against applicable guidelines

Sample Identification		Human Hoalth	Lifotimo Hoalth	BH6	BH8	BH11	
Sample Depth (m) ^D	PQL		Advisory ^B	0.82	1.65	1.93	
Date		Guideime	Advisory	24/5/16	24/5/16	24/5/16	
Samp	le Descrip	tion		Dark brown, very turbid, slight sulphur odour	Dark brown, very turbid, sulphur odour	Brown, very turbid, strong sulphur odour, sediment (sand and mud)	
Sam	ple Purpo	Investigation	Investigation	Investigation			
Samp	le collecte	d by		KS	KS	KS	
Per- and Polyfluorinated Alkyl Substance	s (PFAS)						
Perfluorooctane sulfonate (PFOS)	0.01	0.2	0.07	<0.01	<0.01	<0.01	
Perfluorooctanoic acid (PFOA)	0.01	0.4	0.07	<0.01	<0.01	<0.01	
perfluorooctanesulfonic acid (6:2 FTS)	0.05	5		<0.05	<0.05	<0.05	
Polyfluorinated alkyl substances (PFAS)	0.02		0.07	0.01	0.01	0.01	

Table 2- Reported concentrations compared against the potentially impacted site prioritisation decision tree

Sample Identification		enRiskS Dec	cision Tree ^C	BH6	BH8	BH11	
Sample Depth (m) ^D	PQL	Trigger Point 2	Trigger Point 3	0.82	1.65	1.93	
Date		rigger i oliti z	ringger i onit o	24/5/16	24/5/16	24/5/16	
Samp	le Descrip	tion		Dark brown, very turbid, slight sulphur odour	Dark brown, very turbid, sulphur odour	Brown, very turbid, strong sulphur odour, sediment (sand and mud)	
Sam	nple Purpo	Investigation	Investigation	Investigation			
Samp	le collecte	KS	KS	KS			
Per- and Polyfluorinated Alkyl Substance	es (PFAS)						
Perfluorooctane sulfonate (PFOS)	0.01	0.1	0.05	<0.01	<0.01	<0.01	
Perfluorooctanoic acid (PFOA)	0.01			<0.01	<0.01	<0.01	
perfluorooctanesulfonic acid (6:2 FTS)	0.05			<0.05	<0.05	<0.05	
Polyfluorinated alkyl substances (PFAS)	0.02	0.1	0.05	0.01	0.01	0.01	
Priority Decision Classification- PFOS				Priority 3	Priority 3	Priority 3	
Priority Decision Classification- PFAS				Priority 3	Priority 3	Priority 3	

All results are in units of μ g/L

Blank Cell indicates no criterion available

PQL = Practical Quantitation Limit. Where PQL is for a summation, PQL of all components is summed

Where summation required (PFAS) calculation includes components reported as non detected as 1/2 PQL.

^A USEPA Drinking Water Guidelines, Preliminary Health Advisory, 2009

^B USEPA Health Advisory, May 2016

^C Environmental Risk Sciences Pty Ltd (enRiskS) February 2016, commissioned by the NSWEPA. Applicable criteria relates to offsite groundwater bores.

^D Sample depths presented are as encountered during sampling. The depths represent the depth from surface to water level

Blank cells indicate that there is no guideline criteria available

Results shown in $\ensuremath{\textbf{BOLD}}$ are in excess of the human health DWG guidelines

Results shown in underline are in excess of the US EPA Lifetime Health Advisory Limit

Groundwater Results Summary Applicable Guideline and Decision Tree Comparison

> Prepared by: KS Checked by: FB

> > RCA Australia.