

AGL Upstream Investments Pty Ltd

Manning River Catchment Surface Water Quality Assessment

4 January 2016






Document information

Client: AGL Upstream Investments Pty Ltd
Title: Manning River Catchment
Subtitle: Surface Water Quality Assessment
Document No: 2200566A-WAT-LTR-001 RevB
Date: 4 January 2016

Rev	Date	Details
A	17/12/2015	Draft
B	04/01/2015	Final

Author, Reviewer and Approver details

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Reviewed by:	Sean Daykin	Date: 04/01/2016	Signature: 
Approved by:	Chris Richard	Date: 04/01/2016	Signature: 

Distribution

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Parsons Brinckerhoff Australia Pty Limited

ABN 80 078 004 798

4 January 2016

James Duggleby
Lead Business Partner, Environment

Dear James,

Manning River Catchment Surface Water Quality Assessment

1. Introduction

Parsons Brinckerhoff has been commissioned by AGL Upstream Investments Pty Ltd (AGL) to undertake surface water sampling and analysis to characterise the water quality within the Manning River catchment downstream of the Stage 1 Gas Field Development Area (GFDA) of AGL's Gloucester Gas Project (GGP), NSW. Five locations were sampled during two separate events: May 2014 and July 2015. Sampling locations, representative of downstream reaches, were chosen based on ecosystem types; freshwater, estuarine and marine. Samples were analysed for a range of physical and chemical parameters and the following report presents a summary of the surface water quality sampling program.

2. Catchment description

2.1 Manning River catchment

The Manning River catchment is located on the NSW mid-north coast (Figure 2.1). Bordered to the north-east by the Hastings catchment, to the north by the Macleay catchment, to the north-west by the Namoi catchment, south-west by the Hunter, and to the south by the Karuah catchment. The Manning River Catchment area is approximately 8,420 km². The major urban areas that lie within the Manning River catchment include Taree, Wingham and Gloucester (NOW 2013).

The Manning River has an average annual discharge to the sea of 2,530,000 ML (DWE 2009). The major tributaries of the Manning River catchment flow in a south-easterly direction through alluvial valleys before entering the Manning River which traverses the coastal riverine plains. The Manning River splits into two channels downstream of Taree, the southern arm flows into the Pacific Ocean at Old Bar, and the northern arm is joined by the Dawson and Lansdowne Rivers, flowing into the Pacific Ocean at Harrington. In the lower reaches, the river is tidal and is often saline to Abbots Falls (near Wingham). Approximately 22% of the catchment is heavily timbered and is managed by NSW State Forests. Most of the forested areas are located on relatively steep slopes (NOW 2013).

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Our ref: 2200566A-WAT-LTR-001 RevB

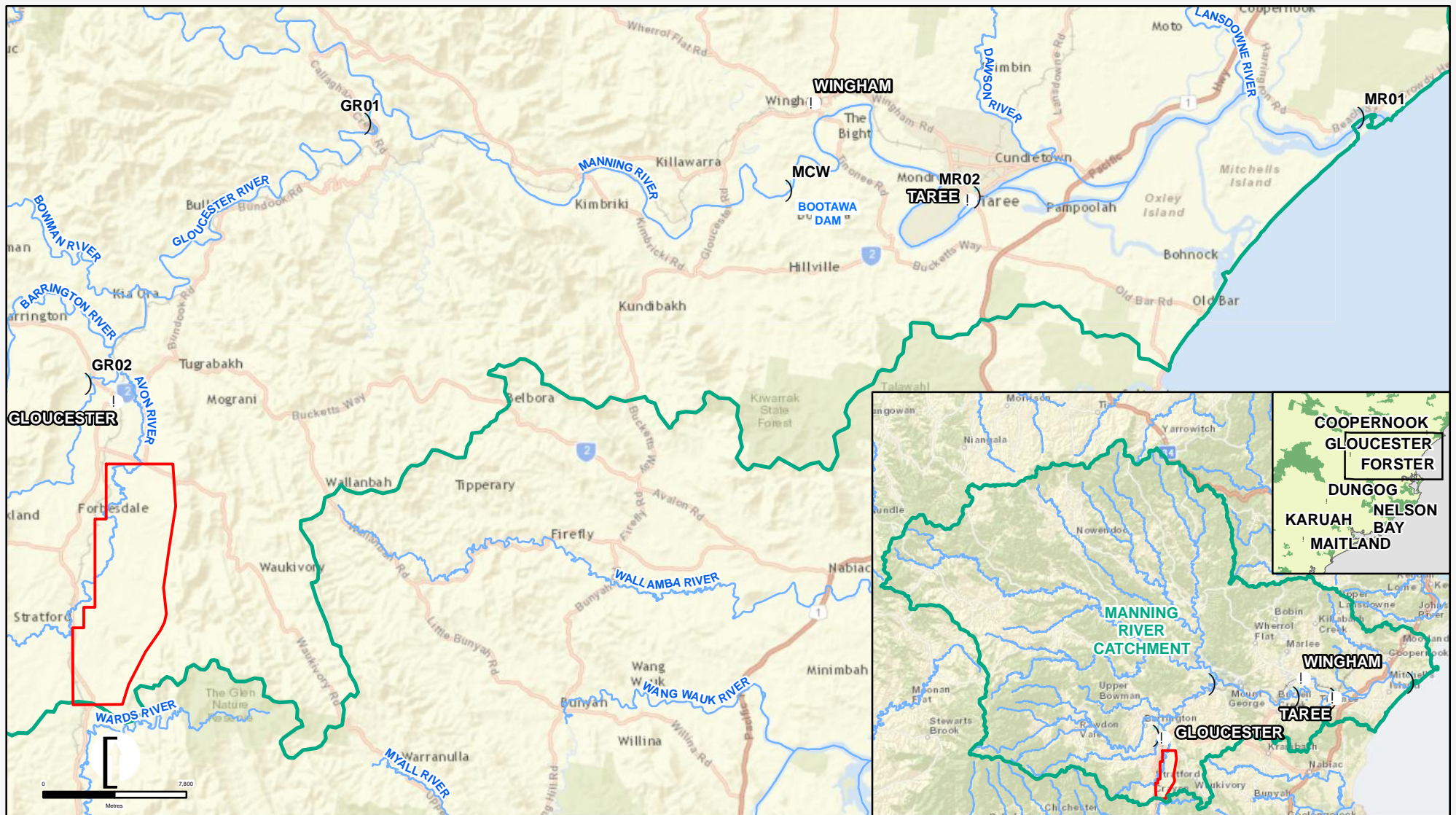
Your ref: PO4510012488

By email
jduggleby@agl.com.au

2.2 Surface hydrology of the Gloucester Basin

The Stage 1 GFDA of the GGP is located within the north of the Gloucester Basin. The Basin is a narrow, north-south trending, elongated basin approximately 40 km long and 10 km wide, extending from Gloucester in the north to Stroud in the south.

A surface water divide is located to the south of the Stage 1 GFDA dividing surface water flow between the Wards River catchment (a sub-catchment of the Karuah River catchment) to the south and the Avon River catchment (a sub-catchment of the Manning River catchment) to the north. Surface water flows within the Stage 1 GFDA discharge to the Avon River which flows to the north through the Stage 1 GFDA joining the Gloucester River in the north of the Gloucester Basin at Gloucester. Further downstream, the Gloucester River joins the Manning River upstream from the town of Mount George.



- Surface water monitoring location
- Stage 1 GFDA boundary
- Manning River Catchment boundary
- Rivers and streams

Figure 2.1
Manning River Catchment sampling locations

3. Water quality monitoring

3.1 Water quality sampling locations

Five locations were chosen to collect surface water samples to characterise the water quality in the Manning River catchment downstream of the Stage 1 GFDA of the GGP. The sampling locations chosen provide spatial representation within the catchment and are representative of the different water quality characteristics within the catchment (freshwater, estuarine (tidal) and marine) (Figure 2.1). Details of the sampling locations are provided in Table 3.1.

Table 3.1 Manning River catchment sampling locations

River	Location	Coordinates	Description ¹
Gloucester River	GR01	416048 6473010	Shallow reach of river (approx. 300mm deep), upstream of the Avon River confluence in Gloucester. Samples were taken from the public reserve upstream of Thunderbolts Way bridge.
	GR02	400834 6458855	Shallow reach of river (approx. 500mm deep) upstream of the confluence with the Manning River, near Bundook. Samples were taken beneath the Noel Devenish Memorial Bridge on Callaghans Creek Road.
Manning River	MCW	438958 6469375	Manning River upstream of the Abbots Falls tidal limit (near Wingham). Samples were collected from MidCoast Water Bootawa Dam offtake on the Manning River.
	MR01	470116 6473322	Coastal inlet to the Manning River at Harrington. Samples were collected from the breakwall along the Manning River northern inlet.
	MR02	449212 6468980	Manning River estuarine reach downstream of the Abbots Falls tidal limit. Samples were collected from a public pontoon at Queen Elizabeth Park, Taree.

(1) Photos of each monitoring location are shown in Attachment 1

3.2 Sampling methodology

Surface water samples for water quality analysis were taken from the river bank using a telescopic sampler to avoid compromised samples from river bank effects in order to be representative of water quality conditions at the time of sampling. Water quality physico-chemical parameters (pH, EC, TDS, DO and ORP) were measured at the time of sampling using a multi-parameter hand-held water quality meter. Water quality samples were collected in accordance with Parsons Brinckerhoff standard operating procedures (Parsons Brinckerhoff, 2015).

Samples were analysed for a broad chemical suite designed specifically to assess water quality. The analytical suite is shown in Table 3.2.

Table 3.2 Analytical suite

Category	Suite of analytes	
Field parameters	Electrical Conductivity (EC) Total Dissolved Solids (TDS) Temperature	pH Redox potential (ORP) Dissolved oxygen (DO)
General parameters (lab)	EC TDS (measured)	pH Total suspended solids (TSS)
Major ions	Calcium Magnesium Sodium Potassium	Chloride Carbonate Bicarbonate Sulphate Fluoride
Dissolved metals and minor/ trace elements	Aluminium Arsenic Barium Beryllium Boron Bromine Cadmium Chromium Cobalt Copper Iron	Lead Manganese Mercury Molybdenum Nickel Selenium Strontium Uranium Vanadium Zinc
Other analytes	Total organic carbon (TOC) Silica	
Nutrients	Nitrate ¹ Nitrite ¹ Total nitrogen	Ammonia ¹ Total Kjeldahl Nitrogen Reactive and total phosphorus
Dissolved gases ¹	Methane	
Hydrocarbons ¹	Phenolic compounds Polycyclic aromatic hydrocarbons (PAH) Total petroleum hydrocarbons (TPH)	Benzene, toluene, ethyl-benzene and xylenes (BTEX) Volatile organic compounds (VOC's)

(1) Only analysed during the 2015 monitoring event.

3.3 Water Quality Guidelines

Water quality samples have been compared to relevant ANZECC (2000) guidelines for freshwater, estuarine and marine water. ANZECC (2000) guidelines provide trigger values for physical and chemical stressors and toxicants.

The Gloucester River sampling locations (GR01 and GR02) and Manning River location (MCW) are situated in predominately rural locations, at elevations ranging from 95 to 180 mAHD. These monitoring locations have been characterised as 'slightly to moderately disturbed, lowland (<150 mAHD) freshwater systems' in accordance with ANZECC (2000) to ensure comparison against the most relevant guideline values. The Manning River sampling location at Taree (MR02) is estuarine, while the monitoring location at the mouth of the Manning River (MR01) is considered Marine for comparison against ANZECC (2000) guidelines.

3.3.1 Key water quality indicators

Key water quality indicators and related numerical criteria (default trigger values) selected from the ANZECC (2000) Guidelines, relevant to assessing and monitoring the health of aquatic ecosystems, are provided in Table 3.3.

Table 3.3 Key water quality indicators for assessing aquatic ecosystems

Ecosystem type	TP (mg/L)	TN (mg/L)	NOx (mg/L)	DO (%sat)	pH	Salinity (µS/cm)
Lowland River (GR01, GR02 and MCW)	0.025	0.35	0.04	85 - 110	6.5 – 7.5	125 – 2,200
Estuaries (MR02)	0.03	0.30	0.015	80 - 110	7.0 – 8.5	-
Marine (MR01)	0.025	0.12	0.005	90 – 110	8.0 – 8.4	-

Source: ANZECC (2000)

Notes: Water quality parameters not analysed have been removed from the table

Abbreviations; TN = Total Nitrogen; TP = Total Phosphorous; DO = Dissolved Oxygen; NOx = Oxides of Nitrogen

3.3.2 Toxicants

Toxicants is a term used for chemical contaminants that have the potential to exert toxic effects at concentrations that might be encountered in the environment (ANZECC 2000). ESdat Environmental Data Management Software was used to compare water quality samples with ANZECC (2000) trigger values for toxicants in freshwater (GR01, GR02 and MCW) and marine water (MR01). The 95% protection level is most commonly applied to ecosystems classified as slightly to moderately disturbed and has been used to compare against water quality samples (refer to water quality summary table). There are no trigger values for toxicants in estuarine water in the ANZECC (2000) guidelines, no direct comparisons have been made for toxicants at MR02.

4. Results and discussion

4.1 Monitoring program observations

Table 4.1 details field observations at the time of sampling.

Table 4.1 Monitoring program observations

Location	Date and time	Observations	Date and time	Observations
2014 monitoring program			2015 monitoring program	
GR01	30/5/2014 9:00 AM	Visible surface water flow. Clear water, river bed visible.	2/7/2015 8:20 AM	Visible surface water flow. Clear water, river bed visible.
GR02	29/5/2014 16:30 PM	Visible surface water flow. Clear water, river bed visible.	2/7/2015 9:40 AM	Visible surface water flow. Clear water, river bed visible.
MCW	30/5/2014 10:45 AM	Slow surface water flow. Water clarity >1 m. Water level 0.26 m on location stage board.	2/7/2015 11:10 AM	Surface water flow visible. Water clarity <1 m (overcast and cloudy). Water level 0.58 m on location stage board.
MR01	30/5/2014 12:30 PM	Falling tide. Surface water flow visible. Water clarity >3 m.	2/7/2015 12:25 PM	Falling tide (high tide 10:15 AM, 1.4 m). Surface water flow visible. Water clarity approx. 3 m.
MR02	30/5/2014 11:30 AM	Falling tide (from near high tide). No visible flow. Water clarity >3 m.	2/7/2015 13:20 PM	Run out tide (low tide 14:18 PM, 0.2 m). Water clarity >3 m. Water level below location stage board.

The following observations have been made following a comparison of water quality results against ANZECC (2000) recommended guidelines for key water quality indicators (Attachment 1):

- Total Phosphorus concentrations were below default trigger values for all corresponding ecosystem types.
- Total Nitrogen concentrations were below default trigger values for all corresponding ecosystem types with the exception of MR02 in 2014 (0.9 mg/L) and MR01 in 2015 (0.3 mg/L).
- Oxides of Nitrogen concentrations at GR01 in 2015 (0.09 mg/L) exceeded ANZECC default trigger values.
- Dissolved Oxygen (% saturation) concentrations were outside recommended guideline ranges in 6 out of 10 samples.
- Generally, pH was within recommended guidelines however pH levels above ANZECC (2000) maximum guidelines were recorded in 2014 at GR01 and MCW (8.14 and 7.84 respectively).
- Salinity concentrations were below ANZECC (2000) maximum guideline concentrations at all freshwater locations.

Dissolved metal concentrations were generally below detectable limits with the following exceptions:

- Aluminium concentrations exceeded recommended freshwater guidelines at GR01 in 2014 (0.24 mg/L).
- Copper concentrations exceeded recommended freshwater guidelines at GR01 in 2014 (0.002 mg/L).

The following parameters were assessed only during the 2015 monitoring round: phenols, hydrocarbons, BTEX and volatile organics. No concentrations above laboratory detectable limits were found for any of these parameters.

A summary table of water quality data is shown in Attachment 2 and the laboratory certificates of analysis (COA) are shown in Attachment 3.

5. References

ANZECC (2000) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality Volumes 3 and 4*, Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

Department of Water and Energy (DWE) (2009) *Water Sharing Plan for the Lower North Coast unregulated and alluvial water sources, guide*, Department of Water and Energy.

NOW (2013) Manning Catchment, <http://www.water.nsw.gov.au/Water-management/Basins-and-catchments/Manning-catchment/Manning-catchment>, NSW Government, accessed 4/1/2016.

Parsons Brinckerhoff (2015) Standard Operating Procedure Groundwater and Surface Water Sampling and Logger Download (last updated November 2015).

Yours sincerely



Chris Richard
Environmental Scientist

List of attachments

1. Photos
2. Water quality summary table.
3. ALS Certificates of Analysis

Attachment 1 - Photos



Photo 1 – GR01 – Gloucester River, Bundook



Photo 2 – GR02 – Gloucester River, Gloucester



Photo 3 – MCW Bootawa Dam Offtake



Photo 4 – MR01 – Breakwall at Harrington



Photo 5 – MR02 – Pontoon at Queen Elizabeth Park, Taree

Attachment 2 – Water quality summary table

Attachment 3 - ALS Certificates of Analysis

CERTIFICATE OF ANALYSIS

Work Order : ES1411900 Amendment : 1 Client : PARSONS BRINCKERHOFF AUST P/L Contact : MR JAMES DUGGLEBY Address : GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001 E-mail : jduggleby@pb.com.au Telephone : +61 02 9272 5100 Facsimile : +61 02 9272 5101 Project : 2201007A Order number : ---- C-O-C number : ---- Sampler : CR/JD Site : ---- Quote number : EN/008/14	Page : 1 of 4 Laboratory : Environmental Division Sydney Contact : Client Services Address : 277-289 Woodpark Road Smithfield NSW Australia 2164 E-mail : sydney@alsglobal.com Telephone : +61-2-8784 8555 Facsimile : +61-2-8784 8500 QC Level : NEPM 2013 Schedule B(3) and ALS QCS3 requirement Date Samples Received : 30-MAY-2014 Issue Date : 16-JUN-2014 No. of samples received : 5 No. of samples analysed : 5
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This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Hoa Nguyen	Senior Inorganic Chemist	Sydney Inorganics
Shobhna Chandra	Metals Coordinator	Sydney 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

- **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **EK067G/EK061G/EK062G: LOR raised for Total P, TKN and TN on sample ID(MR02) and (MR01 due to sample matrix.**
- **Ionic Balance out of acceptable limits for samples 4 and 5 due to analytes not quantified in this report.**



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

Client sampling date / time

				GR01	MCW	MR02	MR01	GR02
				30-MAY-2014 08:30	30-MAY-2014 10:30	30-MAY-2014 12:00	30-MAY-2014 13:30	29-MAY-2014 16:30
Compound	CAS Number	LOR	Unit	ES1411900-002	ES1411900-003	ES1411900-004	ES1411900-005	ES1411900-006
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	96	151	32000	53100	72
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	54	76	23000	42400	41
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	30	54	90	119	21
Total Alkalinity as CaCO3	----	1	mg/L	30	54	90	119	21
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4	5	1670	2810	3
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	9	12	10400	18700	7
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	6	9	251	464	3
Magnesium	7439-95-4	1	mg/L	2	6	796	1400	1
Sodium	7440-23-5	1	mg/L	7	10	6810	11800	7
Potassium	7440-09-7	1	mg/L	<1	<1	297	548	<1
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.24	<0.01	0.12	<0.01	0.02
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	0.002	<0.001
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	2.06	3.44	<0.05
Barium	7440-39-3	0.001	mg/L	0.005	0.010	0.018	0.005	0.006
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	0.002	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	0.002	0.005	0.015	0.002	0.008
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

Client sampling date / time

				GR01	MCW	MR02	MR01	GR02
				30-MAY-2014 08:30	30-MAY-2014 10:30	30-MAY-2014 12:00	30-MAY-2014 13:30	29-MAY-2014 16:30
Compound	CAS Number	LOR	Unit	ES1411900-002	ES1411900-003	ES1411900-004	ES1411900-005	ES1411900-006
EG020F: Dissolved Metals by ICP-MS - Continued								
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.007	0.013	<0.001
Strontium	7440-24-6	0.001	mg/L	0.056	0.070	4.60	8.15	0.046
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	0.002	0.004	<0.001
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	0.17
Bromine	7726-95-6	0.1	mg/L	<0.1	<0.1	46.4	84.9	<0.1
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG052G: Silica by Discrete Analyser								
Reactive Silica	----	0.05	mg/L	5.36	8.25	2.60	0.31	10.3
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	<0.1	0.1	0.7	1.0	<0.1
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.02	<0.01	0.02	0.04
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.2	0.3	0.9	<0.5	<0.1
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
Total Nitrogen as N	----	0.1	mg/L	0.2	0.3	0.9	<0.5	<0.1
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.01	0.01	<0.05	<0.05	<0.01
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	0.94	1.52	330	588	0.68
Total Cations	----	0.01	meq/L	0.77	1.38	382	666	0.54
Ionic Balance	----	0.01	%	----	----	7.28	6.15	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	2	6	2	1	1

CERTIFICATE OF ANALYSIS

Work Order	: ES1525408	Page	: 1 of 9
Amendment	: 1		
Client	: PARSONS BRINCKERHOFF AUST P/L	Laboratory	: Environmental Division Sydney
Contact	: MR CHRISTOPHER RICHARD	Contact	: Loren Schiavon
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
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Facsimile	: +61 02 92725101	Facsimile	: +61-2-8784 8500
Project	: 2268520B	QC Level	: NEPM 2013 B3 & ALS QC Standard
Order number	: ----	Date Samples Received	: 03-Jul-2015 16:30
C-O-C number	: ----	Date Analysis Commenced	: 03-Jul-2015
Sampler	: BECKY ROLLINS, CAROLINA SARDELLA	Issue Date	: 04-Jan-2016 12:33
Site	: ----		
Quote number	: ----	No. of samples received	: 5
		No. of samples analysed	: 5

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



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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.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ankit Joshi	Inorganic Chemist	Sydney Inorganics, Smithfield, NSW
Pabi Subba	Senior Organic Chemist	Sydney Organics, Smithfield, NSW
Phalak Inthakesone	Laboratory Manager - Organics	Sydney Organics, Smithfield, NSW
Shobhna Chandra	Metals Coordinator	Sydney Inorganics, Smithfield, NSW



General Comments

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LOR = Limit of reporting

^ = This result is computed from individual analyte detections at or above the level of reporting

∅ = ALS is not NATA accredited for these tests.

- EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.
- EG020: LORs for particular sample(s) have been raised due to matrix interference(s).
- It has been noted that Reactove P is greater than Total P for various samples, however this difference is within the limits of experimental variation.
- This report has been amended as a result of a request to change sample identification numbers (IDs) received by ALS from Chris Richard on 4/1/2016. All analysis results are as per the previous report.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GR01	GR02	MCW	MR02	MR01
Client sampling date / time				02-Jul-2015 08:20	02-Jul-2015 09:40	02-Jul-2015 11:10	02-Jul-2015 12:25	02-Jul-2015 13:20	
Compound	CAS Number	LOR	Unit	ES1525408-001	ES1525408-002	ES1525408-003	ES1525408-004	ES1525408-005	
				Result	Result	Result	Result	Result	
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	7.26	7.20	7.49	7.63	8.42	
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm	100	106	133	21300	54200	
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	10	mg/L	46	52	68	13800	35700	
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	<5	<5	
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	7	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	25	28	40	124	108	
Total Alkalinity as CaCO3	----	1	mg/L	25	28	40	124	116	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	4	4	5	1030	2650	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	10	9	10	6390	16200	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	6	8	10	165	401	
Magnesium	7439-95-4	1	mg/L	3	3	6	435	1260	
Sodium	7440-23-5	1	mg/L	9	9	9	3720	10500	
Potassium	7440-09-7	1	mg/L	<1	<1	<1	134	375	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.01	<0.01	<0.01	<0.01	<0.10	
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.010	
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	<0.05	1.46	3.48	
Strontium	7440-24-6	0.001	mg/L	0.061	0.063	0.061	3.12	9.02	
Barium	7440-39-3	0.001	mg/L	0.009	0.007	0.007	0.013	<0.010	
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.010	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0010	
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.010	
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.010	
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.010	
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	0.002	<0.010	
Manganese	7439-96-5	0.001	mg/L	0.011	0.003	0.003	0.029	<0.010	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GR01	GR02	MCW	MR02	MR01
Client sampling date / time					02-Jul-2015 08:20	02-Jul-2015 09:40	02-Jul-2015 11:10	02-Jul-2015 12:25	02-Jul-2015 13:20
Compound	CAS Number	LOR	Unit		ES1525408-001	ES1525408-002	ES1525408-003	ES1525408-004	ES1525408-005
					Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	<0.001	0.003	0.011
Nickel	7440-02-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.010
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.010
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.010
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.10
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.10
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	<0.005	<0.005	<0.050
Iron	7439-89-6	0.05	mg/L		0.14	0.07	0.07	<0.05	<0.50
Bromine	7726-95-6	0.1	mg/L		<0.1	<0.1	<0.1	25.8	83.0
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG052G: Silica by Discrete Analyser									
Reactive Silica	----	0.05	mg/L		11.6	6.28	8.67	7.24	0.77
EK010/011: Chlorine									
Chlorine - Free	----	0.2	mg/L		<0.2	<0.2	<0.2	<0.2	<0.2
Chlorine - Total Residual	----	0.2	mg/L		<0.2	<0.2	<0.2	<0.2	<0.2
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<0.1	<0.1	<0.1	0.6	1.2
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		0.01	0.06	<0.01	0.05	0.05
EK055G-NH4: Ammonium as N by DA									
Ammonium as N	14798-03-9_N	0.01	mg/L		<0.01	0.06	<0.01	0.05	0.05
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		0.09	<0.01	0.02	0.02	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		0.09	<0.01	0.02	0.02	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		0.1	0.1	0.2	0.2	0.3
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		0.2	0.1	0.2	0.2	0.3
EK067G: Total Phosphorus as P by Discrete Analyser									



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GR01	GR02	MCW	MR02	MR01
Client sampling date / time					02-Jul-2015 08:20	02-Jul-2015 09:40	02-Jul-2015 11:10	02-Jul-2015 12:25	02-Jul-2015 13:20
Compound	CAS Number	LOR	Unit	ES1525408-001	ES1525408-002	ES1525408-003	ES1525408-004	ES1525408-005	
				Result	Result	Result	Result	Result	
EK067G: Total Phosphorus as P by Discrete Analyser - Continued									
Total Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	0.02	0.01	<0.01	
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.01	0.02	0.01	
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L	2	2	2	2	<1	
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L	<10	<10	<10	<10	<10	
Ethene	74-85-1	10	µg/L	<10	<10	<10	<10	<10	
Ethane	74-84-0	10	µg/L	<10	<10	<10	<10	<10	
Propene	115-07-1	10	µg/L	<10	<10	<10	<10	<10	
Propane	74-98-6	10	µg/L	<10	<10	<10	<10	<10	
Butene	25167-67-3	10	µg/L	<10	<10	<10	<10	<10	
Butane	106-97-8	10	µg/L	<10	<10	<10	<10	<10	
EP074A: Monocyclic Aromatic Hydrocarbons									
Styrene	100-42-5	5	µg/L	<5	<5	<5	<5	<5	
Isopropylbenzene	98-82-8	5	µg/L	<5	<5	<5	<5	<5	
n-Propylbenzene	103-65-1	5	µg/L	<5	<5	<5	<5	<5	
1,3,5-Trimethylbenzene	108-67-8	5	µg/L	<5	<5	<5	<5	<5	
sec-Butylbenzene	135-98-8	5	µg/L	<5	<5	<5	<5	<5	
1,2,4-Trimethylbenzene	95-63-6	5	µg/L	<5	<5	<5	<5	<5	
tert-Butylbenzene	98-06-6	5	µg/L	<5	<5	<5	<5	<5	
p-Isopropyltoluene	99-87-6	5	µg/L	<5	<5	<5	<5	<5	
n-Butylbenzene	104-51-8	5	µg/L	<5	<5	<5	<5	<5	
EP074B: Oxygenated Compounds									
Vinyl Acetate	108-05-4	50	µg/L	<50	<50	<50	<50	<50	
2-Butanone (MEK)	78-93-3	50	µg/L	<50	<50	<50	<50	<50	
4-Methyl-2-pentanone (MIBK)	108-10-1	50	µg/L	<50	<50	<50	<50	<50	
2-Hexanone (MBK)	591-78-6	50	µg/L	<50	<50	<50	<50	<50	
EP074C: Sulfonated Compounds									
Carbon disulfide	75-15-0	5	µg/L	<5	<5	<5	<5	<5	
EP074D: Fumigants									
2,2-Dichloropropane	594-20-7	5	µg/L	<5	<5	<5	<5	<5	
1,2-Dichloropropane	78-87-5	5	µg/L	<5	<5	<5	<5	<5	
cis-1,3-Dichloropropylene	10061-01-5	5	µg/L	<5	<5	<5	<5	<5	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GR01	GR02	MCW	MR02	MR01
Client sampling date / time					02-Jul-2015 08:20	02-Jul-2015 09:40	02-Jul-2015 11:10	02-Jul-2015 12:25	02-Jul-2015 13:20
Compound	CAS Number	LOR	Unit		ES1525408-001	ES1525408-002	ES1525408-003	ES1525408-004	ES1525408-005
					Result	Result	Result	Result	Result
EP074D: Fumigants - Continued									
trans-1,3-Dichloropropylene	10061-02-6	5	µg/L		<5	<5	<5	<5	<5
1,2-Dibromoethane (EDB)	106-93-4	5	µg/L		<5	<5	<5	<5	<5
EP074E: Halogenated Aliphatic Compounds									
Dichlorodifluoromethane	75-71-8	50	µg/L		<50	<50	<50	<50	<50
Chloromethane	74-87-3	50	µg/L		<50	<50	<50	<50	<50
Vinyl chloride	75-01-4	50	µg/L		<50	<50	<50	<50	<50
Bromomethane	74-83-9	50	µg/L		<50	<50	<50	<50	<50
Chloroethane	75-00-3	50	µg/L		<50	<50	<50	<50	<50
Trichlorofluoromethane	75-69-4	50	µg/L		<50	<50	<50	<50	<50
1,1-Dichloroethene	75-35-4	5	µg/L		<5	<5	<5	<5	<5
Iodomethane	74-88-4	5	µg/L		<5	<5	<5	<5	<5
trans-1,2-Dichloroethene	156-60-5	5	µg/L		<5	<5	<5	<5	<5
1,1-Dichloroethane	75-34-3	5	µg/L		<5	<5	<5	<5	<5
cis-1,2-Dichloroethene	156-59-2	5	µg/L		<5	<5	<5	<5	<5
1,1,1-Trichloroethane	71-55-6	5	µg/L		<5	<5	<5	<5	<5
1,1-Dichloropropylene	563-58-6	5	µg/L		<5	<5	<5	<5	<5
Carbon Tetrachloride	56-23-5	5	µg/L		<5	<5	<5	<5	<5
1,2-Dichloroethane	107-06-2	5	µg/L		<5	<5	<5	<5	<5
Trichloroethene	79-01-6	5	µg/L		<5	<5	<5	<5	<5
Dibromomethane	74-95-3	5	µg/L		<5	<5	<5	<5	<5
1,1,2-Trichloroethane	79-00-5	5	µg/L		<5	<5	<5	<5	<5
1,3-Dichloropropane	142-28-9	5	µg/L		<5	<5	<5	<5	<5
Tetrachloroethene	127-18-4	5	µg/L		<5	<5	<5	<5	<5
1,1,1,2-Tetrachloroethane	630-20-6	5	µg/L		<5	<5	<5	<5	<5
trans-1,4-Dichloro-2-butene	110-57-6	5	µg/L		<5	<5	<5	<5	<5
cis-1,4-Dichloro-2-butene	1476-11-5	5	µg/L		<5	<5	<5	<5	<5
1,1,1,2,2-Tetrachloroethane	79-34-5	5	µg/L		<5	<5	<5	<5	<5
1,2,3-Trichloropropane	96-18-4	5	µg/L		<5	<5	<5	<5	<5
Pentachloroethane	76-01-7	5	µg/L		<5	<5	<5	<5	<5
1,2-Dibromo-3-chloropropane	96-12-8	5	µg/L		<5	<5	<5	<5	<5
Hexachlorobutadiene	87-68-3	5	µg/L		<5	<5	<5	<5	<5
EP074F: Halogenated Aromatic Compounds									
Chlorobenzene	108-90-7	5	µg/L		<5	<5	<5	<5	<5
Bromobenzene	108-86-1	5	µg/L		<5	<5	<5	<5	<5



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GR01	GR02	MCW	MR02	MR01
Client sampling date / time					02-Jul-2015 08:20	02-Jul-2015 09:40	02-Jul-2015 11:10	02-Jul-2015 12:25	02-Jul-2015 13:20
Compound	CAS Number	LOR	Unit		ES1525408-001	ES1525408-002	ES1525408-003	ES1525408-004	ES1525408-005
					Result	Result	Result	Result	Result
EP074F: Halogenated Aromatic Compounds - Continued									
2-Chlorotoluene	95-49-8	5	µg/L		<5	<5	<5	<5	<5
4-Chlorotoluene	106-43-4	5	µg/L		<5	<5	<5	<5	<5
1,3-Dichlorobenzene	541-73-1	5	µg/L		<5	<5	<5	<5	<5
1,4-Dichlorobenzene	106-46-7	5	µg/L		<5	<5	<5	<5	<5
1,2-Dichlorobenzene	95-50-1	5	µg/L		<5	<5	<5	<5	<5
1,2,4-Trichlorobenzene	120-82-1	5	µg/L		<5	<5	<5	<5	<5
1,2,3-Trichlorobenzene	87-61-6	5	µg/L		<5	<5	<5	<5	<5
EP074G: Trihalomethanes									
Chloroform	67-66-3	5	µg/L		<5	<5	<5	<5	<5
Bromodichloromethane	75-27-4	5	µg/L		<5	<5	<5	<5	<5
Dibromochloromethane	124-48-1	5	µg/L		<5	<5	<5	<5	<5
Bromoform	75-25-2	5	µg/L		<5	<5	<5	<5	<5
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2-Chlorophenol	95-57-8	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2-Methylphenol	95-48-7	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
3- & 4-Methylphenol	1319-77-3	2	µg/L		<2.0	<2.0	<2.0	<2.0	<2.0
2-Nitrophenol	88-75-5	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dimethylphenol	105-67-9	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2,4-Dichlorophenol	120-83-2	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2,6-Dichlorophenol	87-65-0	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
4-Chloro-3-methylphenol	59-50-7	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2,4,6-Trichlorophenol	88-06-2	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2,4,5-Trichlorophenol	95-95-4	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Pentachlorophenol	87-86-5	2	µg/L		<2.0	<2.0	<2.0	<2.0	<2.0
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	208-96-8	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	83-32-9	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	86-73-7	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	85-01-8	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	120-12-7	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	206-44-0	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	129-00-0	1	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GR01	GR02	MCW	MR02	MR01
Client sampling date / time					02-Jul-2015 08:20	02-Jul-2015 09:40	02-Jul-2015 11:10	02-Jul-2015 12:25	02-Jul-2015 13:20
Compound	CAS Number	LOR	Unit	ES1525408-001	ES1525408-002	ES1525408-003	ES1525408-004	ES1525408-005	
				Result	Result	Result	Result	Result	
EP080: BTEXN - Continued									
EP262: Ethanolamines									
Ethanolamine	141-43-5	1	µg/L	4	<1	5	<1	<1	
Diethanolamine	111-42-2	1	µg/L	<1	<1	<1	<1	<1	
Methyl diethanolamine (MDEA)	105-59-9	1	µg/L	<1	<1	<1	<1	<1	
EP074S: VOC Surrogates									
1,2-Dichloroethane-D4	17060-07-0	5	%	97.0	105	108	109	96.5	
Toluene-D8	2037-26-5	5	%	109	110	115	112	98.0	
4-Bromofluorobenzene	460-00-4	5	%	93.0	97.0	99.6	96.4	84.2	
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1	%	34.4	30.7	35.0	33.1	25.5	
2-Chlorophenol-D4	93951-73-6	1	%	64.6	56.2	61.2	58.1	48.4	
2,4,6-Tribromophenol	118-79-6	1	%	58.2	55.6	59.8	58.0	61.0	
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1	%	68.5	65.4	70.4	67.2	56.6	
Anthracene-d10	1719-06-8	1	%	80.5	75.0	82.3	80.8	78.0	
4-Terphenyl-d14	1718-51-0	1	%	91.6	85.4	95.7	87.7	97.2	
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	2	%	93.9	102	105	106	93.8	
Toluene-D8	2037-26-5	2	%	101	102	107	104	90.6	
4-Bromofluorobenzene	460-00-4	2	%	96.0	100	101	100	86.6	