AGL Upstream Investments Pty Ltd

2014-2015 Groundwater and Surface Water Monitoring Status Report

Camden Gas Project

8 October 2015

PARSONS BRINCKERHOFF

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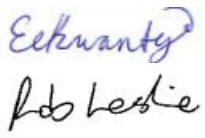
Reviewed by:	Ellen Kwantes, David Whiting	Date: 08/10/2015	Signature: 
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Glossary

Acidity	Base neutralising capacity.
Alkalinity	Acid neutralising capacity.
Alluvium	Unconsolidated sediments (clays, sands, gravels and other materials) deposited by flowing water. Deposits can be made by streams on river beds, floodplains, and alluvial fans.
Alluvial aquifer	Permeable zones that store and produce groundwater from unconsolidated alluvial sediments. Shallow alluvial aquifers are generally unconfined aquifers.
Ammonia	A compound of nitrogen and hydrogen (NH_3) that is a common by-product of animal waste and landfills but is also found naturally in reduced environments. Ammonia readily converts to nitrate in soils and streams.
Anion	An ion with a negative charge – usually non-metal ions when disassociated and dissolved in water.
Aquatic ecosystem	The stream channel, lake or estuary bed, water, and (or) biotic communities and the habitat features that occur therein.
Aquiclude	An impermeable unit that acts as a barrier to the flow of groundwater from one formation to another.
Aquifer	Rock or sediment in a formation, group of formations, or part of a formation that is saturated and sufficiently permeable to transmit economic quantities of water.
Aquifer properties	The characteristics of an aquifer that determine its hydraulic behaviour and its response to abstraction.
Aquifer, confined	An aquifer that is overlain by low permeability strata. The hydraulic conductivity of the confining bed is significantly lower than that of the aquifer.
Aquifer, semi-confined	An aquifer overlain by a low-permeability layer that permits water to slowly flow through it. During pumping, recharge to the aquifer can occur across the leaky confining layer – also known as a leaky artesian or leaky confined aquifer.
Aquifer, unconfined	Also known as a water table aquifer. An aquifer in which there are no confining beds between the zone of saturation and the surface. The water table is the upper boundary of an unconfined aquifer.
Aquitard	A low permeability unit that can store groundwater and also transmit it slowly from one formation to another. Aquitards retard but do not prevent the movement of water to or from adjacent aquifers.
Australian Height Datum (AHD)	The reference point (very close to mean sea level) for all elevation measurements, and used for correlating depths of aquifers and water levels in bores.

Beneficial aquifer	An aquifer with a water resource of sufficient quality and quantity to provide either ecosystem protection, raw water for drinking water supply, and agricultural or industrial water.
Bore	A structure drilled below the surface to obtain water from an aquifer or series of aquifers.
Boundary	A lateral discontinuity or change in the aquifer resulting in a significant change in hydraulic conductivity, storativity or recharge.
Cation	An ion with a positive charge – usually metal ions when disassociated and dissolved in water.
Claystone	A non-fissile rock of sedimentary origin composed primarily of clay-sized particles (less than 0.004 mm).
Coal	A sedimentary rock derived from the compaction and consolidation of vegetation or swamp deposits to form a fossilised carbonaceous rock.
Coal seam	A layer of coal within a sedimentary rock sequence.
Coal seam gas (CSG)	Coal seam gas is a form of natural gas (predominantly methane) that is extracted from coal seams.
Concentration	The amount or mass of a substance present in a given volume or mass of sample, usually expressed as milligram per litre (water sample) or micrograms per kilogram (sediment sample).
Conceptual model	A simplified and idealised representation (usually graphical) of the physical hydrogeologic setting and the hydrogeological understanding of the essential flow processes of the system. This includes the identification and description of the geologic and hydrologic framework, media type, hydraulic properties, sources and sinks, and important aquifer flow and surface-groundwater interaction processes.
Confining layer	Low permeability strata that may be saturated but will not allow water to move through it under natural hydraulic gradients.
Datalogger	A digital recording instrument that is inserted in monitoring and pumping bores to record pressure measurements and water level variations.
Dual permeability aquifer	An aquifer in which groundwater flow is through both the primary porosity of the rock matrix and the secondary porosity of fractures and fissures.
Electrical conductivity (EC)	A measure of a fluid's ability to conduct an electrical current and is an estimation of the total ions dissolved. It is often used as a measure of water salinity.
Facies	An assemblage or association of mineral, rock, or fossil features reflecting the environment and conditions of origin of the rock. It refers to the appearance and peculiarities that distinguish a rock unit from associated or adjacent units.
Fault	A fracture in rock along which there has been an observable amount of displacement. Faults are rarely single planar units; normally they occur as

	parallel to sub-parallel sets of planes along which movement has taken place to a greater or lesser extent. Such sets are called fault or fracture zones.
Groundwater	The water contained in interconnected pores or fractures located below the water table in the saturated zone.
Groundwater level	The water level measured in a bore; this may be at or close to the water table in unconfined aquifers, or represent the average piezometric level across the screened interval in confined aquifers.
Groundwater flow	The movement of water through openings in sediment and rock within the zone of saturation.
Groundwater system	A system that is hydrogeologically more similar than different in regard to geological province, hydraulic characteristics and water quality, and may consist of one or more geological formations.
Hydraulic conductivity	The rate at which water of a specified density and kinematic viscosity can move through a permeable medium (notionally equivalent to the permeability of an aquifer to fresh water).
Hydraulic gradient	The change in total hydraulic head with a change in distance in a given direction.
Hydraulic head	A specific measurement of water pressure above a datum. It is usually measured as a water surface elevation, expressed in units of length. In an aquifer, it can be calculated from the depth to water in a monitoring bore. The hydraulic head can be used to determine a hydraulic gradient between two or more points.
Hydrochemistry	Chemical characterisation of water (both surface water and groundwater).
Hydrogeology	The study of the interrelationships of geologic materials and processes with water, especially groundwater.
Hydrology	The study of the occurrence, distribution, and chemistry of all surface waters.
Ion	An ion is an atom or molecule where the total number of electrons is not equal to the total number of protons, giving it a net positive or negative electrical charge.
Limit or reporting (LOR)	The concentration below which a particular analytical method cannot determine, with a high degree of certainty, a concentration.
Lithology	The study of rocks and their depositional or formational environment on a large specimen or outcrop scale.
Major ions	Constituents commonly present in concentrations exceeding 10 milligram per litre. Dissolved cations generally are calcium, magnesium, sodium, and potassium; the major anions are sulphate, chloride, fluoride, nitrate, and those contributing to alkalinity, most generally assumed to be bicarbonate and carbonate.
Methane (CH_4)	An odourless, colourless, flammable gas, which is the major constituent of natural gas. It is used as a fuel and is an important source of hydrogen and a wide variety of organic compounds.

MicroSiemens per centimetre (µS/cm)	A measure of water salinity commonly referred to as EC (see also electrical conductivity). Most commonly measured in the field with calibrated field meters.
Monitoring bore	A non-pumping bore, is generally of small diameter that is used to measure the elevation of the water table and/or water quality. Bores generally have a short well screen against a single aquifer through which water can enter.
Monitoring period	Refers to data collected between October 2011 and June 2015.
Monitoring year	Refers to data collected between July 2014 and June 2015.
Normal faulting	Where the fault plane is vertical or dips towards the downthrow side of a fault.
Oxidising conditions	Conditions in which a species loses electrons and is present in oxidised form.
Permeability	The property or capacity of a porous rock, sediment, clay or soil to transmit a fluid. It is a measure of the relative ease of fluid flow under unequal pressure. The hydraulic conductivity is the permeability of a material for water at the prevailing temperature.
Permeable material	Material that permits water to move through it at perceptible rates under the hydraulic gradients normally present.
Permian	The last period of the Palaeozoic era that finished approximately 252 million years before present.
pH	Potential of Hydrogen; the logarithm of the reciprocal of hydrogen-ion concentration in gram atoms per litre; provides a measure on a scale from 0 to 14 of the acidity or alkalinity of a solution (where 7 is neutral, greater than 7 is alkaline and less than 7 is acidic).
Porosity	The proportion of open space within an aquifer, comprised of intergranular space, pores, vesicles and fractures.
Porosity, primary	The porosity that represents the original pore openings when a rock or sediment formed.
Porosity, secondary	The porosity caused by fractures or weathering in a rock or sediment after it has been formed.
Quaternary	The most recent geological period extending from approximately 2.6 million years ago to the present day.
Quality assurance	Evaluation of quality-control data to allow quantitative determination of the quality of chemical data collected during a study. Techniques used to collect, process, and analyse water samples are evaluated.
Recharge	The process which replenishes groundwater, usually by rainfall infiltrating from the ground surface to the water table and by river water reaching the water table or exposed aquifers. The addition of water to an aquifer.
Recharge area	A geographic area that directly receives infiltrated water from surface and in which there are downward components of hydraulic head in the aquifer. Recharge generally moves downward from the water table into the deeper

	parts of an aquifer then moves laterally and vertically to recharge other parts of the aquifer or deeper aquifer zones.
Recovery	The difference between the observed water level during the recovery period after cessation of pumping and the water level measured immediately before pumping stopped.
Redox potential (ORP or Eh)	The redox potential is a measure (in volts) of the affinity of a substance for electrons – its electronegativity – compared with hydrogen (which is set at 0). Substances more strongly electronegative than (i.e. capable of oxidising) hydrogen have positive redox potentials. Substances less electronegative than (i.e. capable of reducing) hydrogen have negative redox potentials. Also known as oxidation-reduction potential and Eh.
Redox reaction	Redox reactions, or oxidation-reduction reactions, are a family of reactions that are concerned with the transfer of electrons between species, and are mediated by bacterial catalysis. Reduction and oxidation processes exert an important control on the distribution of species like O_2, Fe^{2+}, H_2S and CH_4 etc. in groundwater.
Salinity	The concentration of dissolved salts in water, usually expressed in EC units or milligrams of total dissolved solids per litre (mg/L TDS).
Salinity classification	Fresh water quality – water with a salinity <800 µS/cm. Marginal water quality – water that is more saline than freshwater and generally waters between 800 and 1,600 µS/cm. Brackish quality – water that is more saline than freshwater and generally waters between 1,600 and 4,800 µS/cm. Slightly saline quality – water that is more saline than brackish water and generally waters with a salinity between 4,800 and 10,000 µS/cm. Moderately saline quality – water that is more saline than slightly saline water and generally waters between 10,000 and 20,000 µS/cm. Saline quality – water that is almost as saline as seawater and generally waters with a salinity greater than 20,000 µS/cm. Seawater quality – water that is generally around 55,000 µS/cm. (Australian Water Resources Council 1988)
Sandstone	Sandstone is a sedimentary rock composed mainly of sand-sized minerals or rock grains (predominantly quartz).
Screen	A type of bore lining or casing of special construction, with apertures designed to permit the flow of water into a bore while preventing the entry of aquifer or filter pack material.
Sedimentary rock aquifer	These occur in consolidated sediments such as porous sandstones and conglomerates, in which water is stored in the intergranular pores, and limestone, in which water is stored in solution cavities and joints. These aquifers are generally located in sedimentary basins that are continuous over large areas and may be tens or hundreds of metres thick. In terms of quantity, they contain the largest volumes of groundwater.
Shale	A laminated sedimentary rock in which the constituent particles are predominantly of clay size.

Siltstone	A fine-grained rock of sedimentary origin composed mainly of silt-sized particles (0.004 to 0.06 mm).
Standing water level (SWL)	The height to which groundwater rises in a bore after it is drilled and completed, and after a period of pumping when levels return to natural atmospheric or confined pressure levels.
Stratigraphy	The depositional order of sedimentary rocks in layers.
Surface water-groundwater interaction	This occurs in two ways: (1) streams gain water from groundwater through the streambed when the elevation of the water table adjacent to the streambed is greater than the water level in the stream; and (2) streams lose water to groundwater through streambeds when the elevation of the water table is lower than the water level in the stream.
Tertiary	Geologic time at the beginning of the Cainozoic era, 65 to 2.6 million years ago, after the Cretaceous and before the Quaternary.
Total Dissolved Solids (TDS)	A measure of the salinity of water, usually expressed in milligrams per litre (mg/L). See also EC.
Water quality	Term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.
Water quality data	Chemical, biological, and physical measurements or observations of the characteristics of surface and ground waters, atmospheric deposition, potable water, treated effluents, and waste water and of the immediate environment in which the water exists.
Well	Pertaining to a gas exploration well or gas production well.

Abbreviations

AGL	AGL Upstream Investments Pty Ltd
BoM	Bureau of Meteorology
BTEX	Benzene, toluene, ethyl benzene and xylenes
CDFM	Cumulative deviation from mean
CGP	Camden Gas Project
CSG	Coal seam gas
DO	Dissolved oxygen
EC	Electrical conductivity
LOR	Limit of reporting
ORP	Oxidation reduction potential
PAH	Polycyclic aromatic hydrocarbons
SCA	Sydney Catchment Authority
TDS	Total dissolved solids
TPH	Total petroleum hydrocarbons
VWP	Vibrating wire piezometer

Units

°C	degrees Celsius
L/s	litres per second
m	metres
mAHD	metres Australian Height Datum
mbgl	metres below ground level
m/d	metres per day
mg/L	milligrams per litre
mV	millivolt
µg/L	micro grams per litre
µS/cm	microSiemens per centimetre

Executive Summary

AGL Upstream Investments Pty Ltd (AGL) owns and operates the Camden Gas Project (CGP) located in the Macarthur region, 65 km southwest of Sydney, NSW. The CGP has been producing natural gas from coal seams for the Sydney region since 2001 and currently consists of 144 gas wells (of which, approximately 95 were operational on 30 June 2015). The target coal seams are the Bulli and Balgownie Coal Seams within the Illawarra Coal Measures at depths of approximately 550 – 700 metres below ground level (mbgl).

The CGP monitoring network comprises three nested groundwater monitoring sites (11 monitoring bores): Denham Court (monitored since 2011), Menangle Park (monitored since June 2013) and Glenlee (monitored since February 2014). One monitoring bore is installed in the alluvium near the Nepean River, two in the Ashfield Shale and eight monitoring bores at different depths in the Hawkesbury Sandstone. Groundwater levels have been recorded at six-hourly intervals and water quality data has been collected on a quarterly basis since installation. Surface water is monitored annually at one monitoring location along the Nepean River next to the Menangle Park site. This report presents an assessment of water level and water quality data from the groundwater monitoring network and from the Nepean River for the period up to 30 June 2015, with an emphasis on data obtained during the past 12 months.

The groundwater level in the Nepean River alluvium is shallow and shows a direct response to rainfall and flood events during the monitoring period. Groundwater levels in the Ashfield Shale are deep (~80 mbgl) and show no apparent response to rainfall over the monitoring period. Groundwater levels appear to follow similar trends in each of the screened Hawkesbury Sandstone water bearing zones (defined as upper, middle and lower). There is no apparent response to individual rainfall events over the monitoring period at the Denham Court and Glenlee sites, while a clear response to rainfall and flood events can be observed at the three uppermost monitoring bores at the Menangle Park site. Groundwater levels during the 2014/15 monitoring year were comparable to groundwater levels as recorded during previous monitoring years.

Groundwater sampled from the alluvium at the Menangle Park site is characterised as fresh to marginally saline. Dissolved metal concentrations were generally low and no dissolved gases were detected. Hydrocarbons (polycyclic aromatic hydrocarbons, total petroleum hydrocarbons and toluene) were detected at low levels. Groundwater sampled from the Hawkesbury Sandstone is fresh to marginal at the Menangle Park site and slightly saline at the Denham Court and Glenlee sites. Salinity decreases with depth at the Denham Court and Glenlee sites. Dissolved metal concentrations are generally low and minor detections of hydrocarbons were present at the three monitoring sites. Dissolved methane was detected at all Hawkesbury Sandstone bores, although concentrations at the Menangle Park and Glenlee sites were comparable to the control site at Denham Court. Low concentrations of dissolved ethane was detected at the Denham Court and Glenlee sites and low concentrations of propane and butane were detected only at the Glenlee site.

Groundwater quality during the 2014/15 monitoring year was overall comparable to groundwater quality as measured during the previous monitoring years.

The Nepean River water is characterised as fresh, neutral pH and dissolved metal concentrations were comparably lower than occurring in groundwater in the alluvium and underlying Hawkesbury Sandstone. Ammonia concentrations in Nepean River water exceeded the ANZECC (2000) guideline value and minor dissolved methane concentrations and no hydrocarbons were detected.

From assessment of the available data, there are no observable impacts to groundwater levels or quality that could be attributable to the CSG operations. There is also no evidence of connectivity between the shallower monitored zones and the coal seams and this is in agreement with the conceptual model (Parsons Brinckerhoff 2011), that indicates the presence of extensive and thick claystone formations (aquitards and aquicludes) between the Hawkesbury Sandstone and coal seams restricting upward depressurisation and impeding the vertical flow of groundwater.

1. Introduction

1.1 Background

AGL Upstream Investments Pty Ltd (AGL) owns and operates the Camden Gas Project (CGP) located in the Macarthur region, 65 km southwest of Sydney, NSW. The CGP has been producing natural gas from coal seams for the Sydney region since 2001 and currently consists of 144 gas wells (of which, approximately 95 were operational on 30 June 2015) within the Stage 1 and Stage 2 areas (Figure 1.1). A proposal for the expansion of the project into Stage 3 (Northern Expansion) was suspended in 2013 and was officially withdrawn in July 2015. The target coal seams are the Bulli and Balgownie Coal Seams within the Illawarra Coal Measures at depths of approximately 550 –700 metres below ground level (mbgl).

Parsons Brinckerhoff was engaged by AGL to characterise the hydrogeological environment and conduct routine groundwater monitoring and interpretation in relation to the CGP activities. Installation of a dedicated water monitoring network of 11 monitoring bores occurred between October 2011 and February 2014. The groundwater monitoring network comprises dedicated monitoring bores in the alluvium, the Ashfield Shale, and the Hawkesbury Sandstone as well as one surface water monitoring location that is monitored annually. The collection of groundwater level and groundwater quality data commenced in October 2011. Groundwater levels have been recorded at six-hourly intervals and following one initial baseline sample in November 2011, water quality data was collected on a quarterly basis between May 2013 and April 2015. From April 2015 onwards, water quality data is collected at six-monthly intervals. This reporting provides an emphasis on evaluation of data obtained during the past 12 months (July 2014 to June 2015 monitoring year) with comparison to the data obtained during the past monitoring years (Parsons Brinckerhoff 2012, 2013a, 2014a and 2014b).

Monitoring is undertaken at three sites located within the Camden-Campbelltown area, NSW (Figure 1.1). The Denham Court site is located to the north, outside of the CGP area, and can be considered as a control site given the distance from the operating CGP. The Menangle Park and Glenlee sites are located within the existing CGP wellfield (Stage 1 and 2, Figure 1.1).

The objective of the groundwater monitoring program is to provide water levels and water quality attributes for each of the monitored groundwater systems of the region, in areas within and distant from the currently operating CGP.

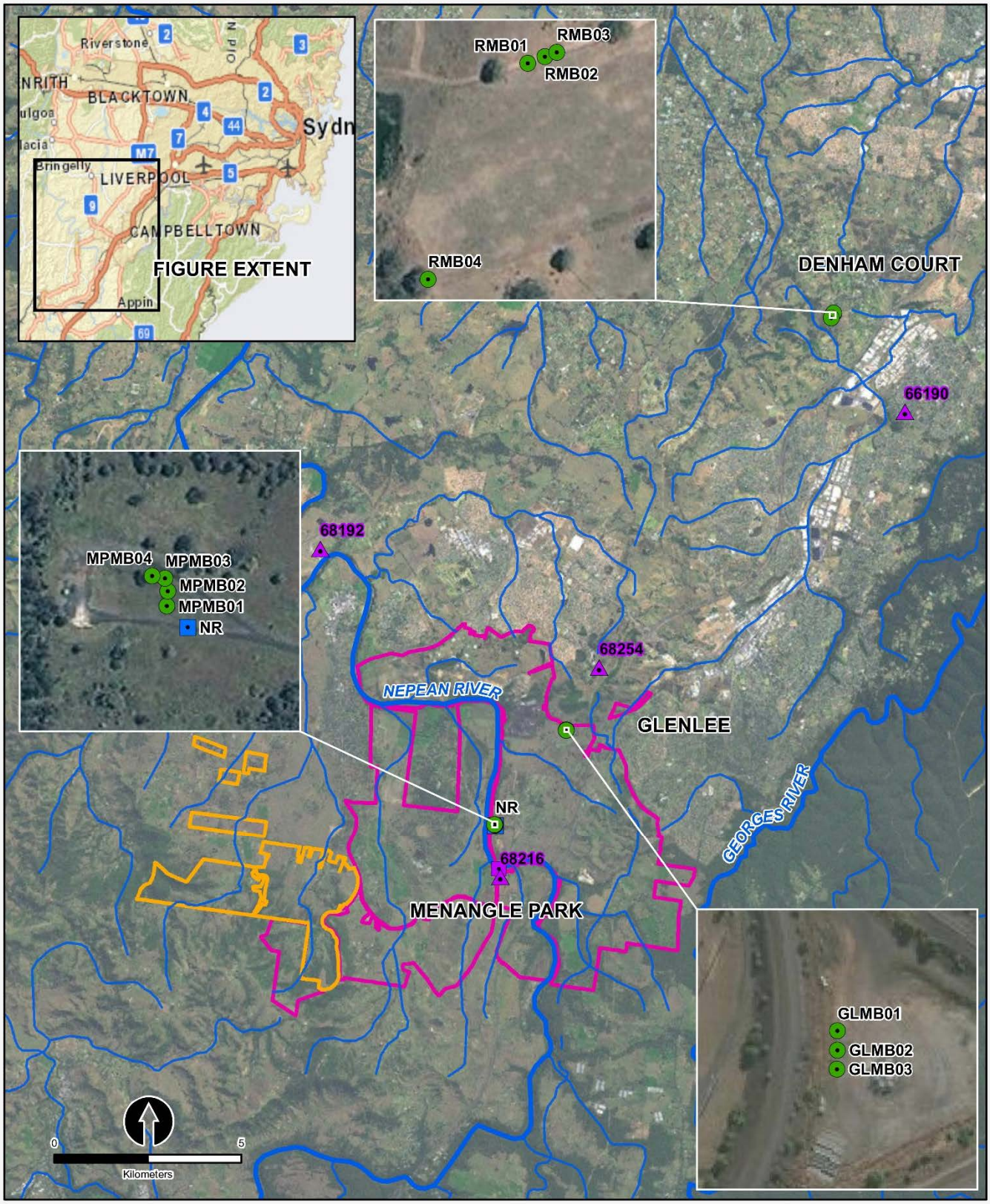
1.2 Scope of works

This report presents and interprets groundwater level data collected at six-hourly intervals and groundwater quality data collected since monitoring began at each of the established sites up to 30 June 2015, with emphasis on the data obtained during the past 12 months.

The scope of works was to:

- Conduct groundwater monitoring, including six-hourly groundwater level measurements and three groundwater quality sampling events testing for field parameters, major cations and anions, dissolved metals, nutrients, dissolved methane and hydrocarbons.
- Conduct surface water quality sampling on one occasion (September 2014) at one location (the Nepean River near the Menangle Park site as shown on Figure 1.1).
- Analyse and interpret water level and hydrochemical results with reference to the conceptual model where relevant.

- Establish whether there are any observable impacts from CSG activities within the shallow aquifers.



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Camden Gas Project areas
- Stage 1
- Stage 2

- Groundwater monitoring bore
- Surface water sampling location
- BoM surface water gauging station
- BoM weather station
- Rivers
- Streams

Figure 1.1: Groundwater monitoring locations Camden Gas Project

2. Site characterisation

2.1 Rainfall

The nearest Bureau of Meteorology (BoM) weather station with consistent historical climate measurements is located at Camden airport (BoM site number 68192), approximately 2.5 km northwest of the Stage 2 area (Figure 1.1). Mean temperatures at Camden airport range from 17.3°C in July to 29.5°C in January (based on records from 1971 to 2015). The average annual rainfall is 788 mm (based on records from 1972 to 2015). On average, July receives the least rain, with a mean rainfall of 36.8 mm, while February receives the most rain, with a mean of 98.8 mm (BoM 2015).

The long-term, annual cumulative deviation from mean (CDFM) rainfall for Camden airport is plotted in Figure 2.1. Annual rainfall data for BoM site number 68216 (located approximately 10 km southeast from the Camden airport 68192 station) is presented from 2009 onwards as rainfall records at Camden airport were incomplete for that period. The long-term CDFM is generated by subtracting the long-term average annual rainfall for the recorded period from the actual annual rainfall and then accumulating these residuals over the assessment period. Periods of below average rainfall are represented as downward trending slopes while periods of above average rainfall are represented as upward trending slopes.

The cumulative deviation plot for Camden airport (Figure 2.1) shows a relatively wet period between 1972 and 1992, followed by a relatively dry period between 1998 and 2007. From 2007 onwards the rainfall has been typically close to the mean rainfall of 776 mm per year.

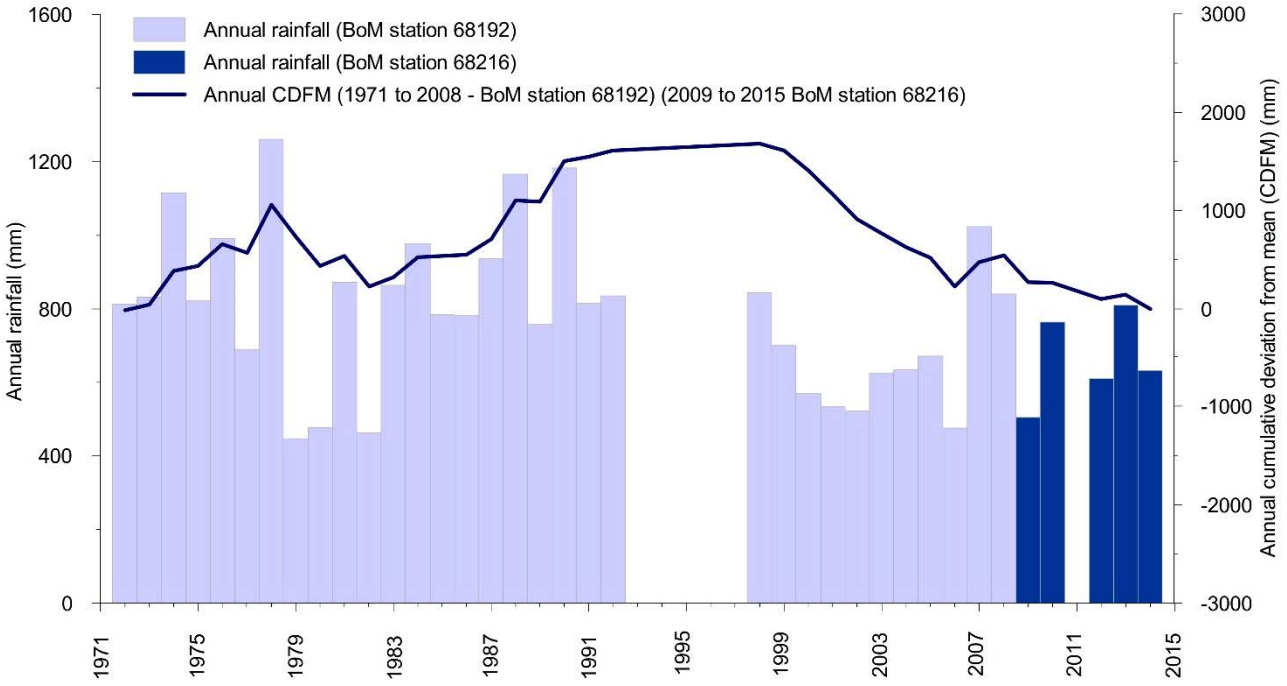


Figure 2.1 Cumulative deviation from annual mean rainfall at Camden airport (BoM station 068192)

The monitoring bore sites are separated by up to a distance of 16 km and therefore groundwater level data for each site have been compared with rainfall data from the closest BoM station (Figure 1.1) as follows:

- Denham Court: 66190 Ingleburn Station.
- Menangle Park: 68216 Menangle Bridge.

- Glenlee: 68254 Mount Annan Botanic Garden.

The rainfall characteristics are broadly similar between these BoM stations during the monitoring period, as presented in Figure 2.2. Total monthly rainfall for this monitoring period was overall higher than the long-term average.

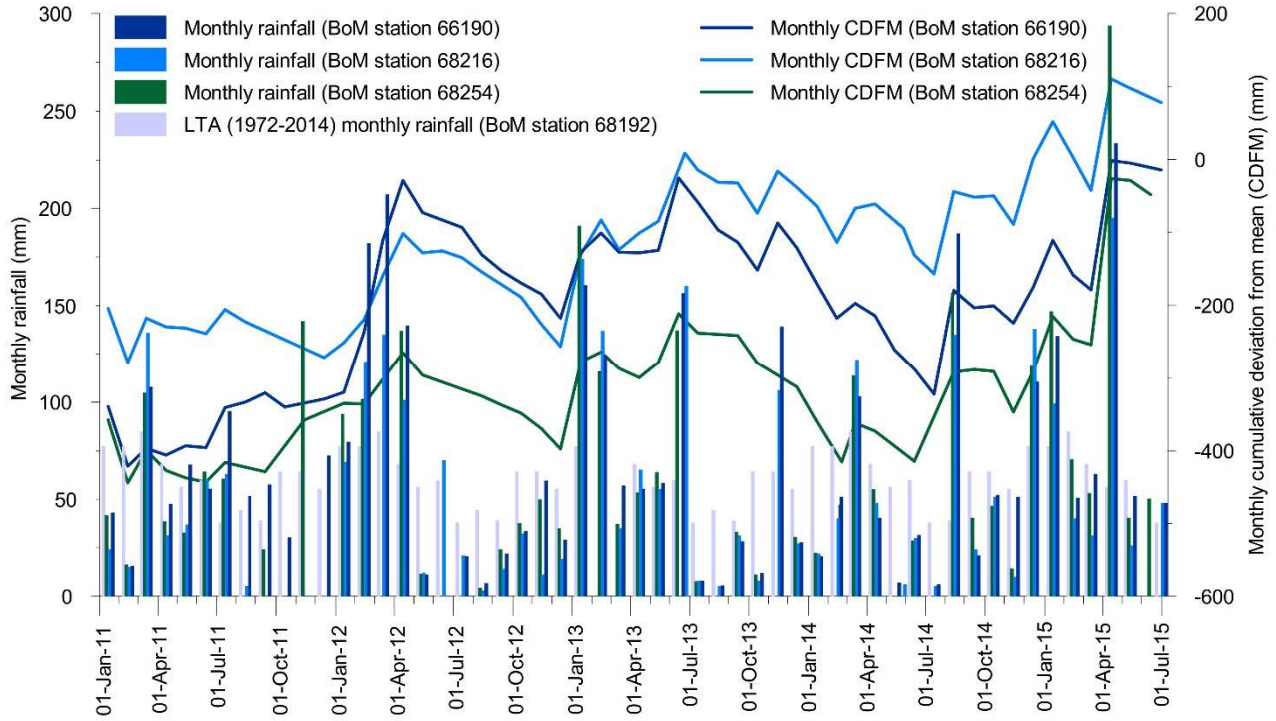


Figure 2.2 Monthly rainfall for the monitoring period (2011-2015)

2.2 Surface hydrology

The CGP includes two catchment areas: the Hawkesbury Nepean Catchment and the Sydney Metropolitan Catchment. The major surface hydrology features in the CGP are the Nepean River and its tributaries, which meander in a south to north direction within the project area; and the Georges River, which flows in a northerly direction, in the south-east of the project area.

Small farm dams are common in rural areas and provide water for stock, limited garden and irrigation purposes. Dams are replenished by rainfall and runoff, although some seepage flow through weathered soil profiles occurs after long wet periods. Dams and seepage flows are not related to the regional groundwater systems. There are no known springs in the CGP area.

2.3 Geological setting

The CGP is part of the Southern Coalfield of the Sydney Geological Basin. The Basin is primarily a Permo-Triassic sedimentary rock sequence (Parkin 2002) and is underlain by undifferentiated sediments of Carboniferous and Devonian age. The stratigraphy of the CGP in the Camden-Campbelltown area is summarised in Table 2.1. The geology and structure of the CGP is shown on Figure 2.3.

Table 2.1 Summary of regional Permo-Triassic geological stratigraphy

Period	Group	Sub-group	Formation	Description	Average thickness (m)[a]
Quaternary			Alluvium	Quartz and lithic 'fluvial' sand, silt and clay.	<20
Tertiary			Alluvium	High level alluvium.	
Triassic	Wianamatta Group		Bringelly Shale	Shale, carbonaceous claystone, laminate, lithic sandstone, rare coal.	80 (top eroded)
			Minchinbury Shale	Fine to medium-grained lithic sandstone.	-
			Ashfield Shale[b]	Black to light grey shale and laminate (Bembrick *et al*. 1987).	-
			Mittagong Formation	Dark grey to grey alternating beds of shale laminate, siltstone and quartzose sandstone (Alder *et al.* 1991).	11
			Hawkesbury Sandstone	Massive or thickly bedded quartzose sandstone with siltstone, claystone and grey shale lenses up to several metres thick (Bowman 1974; Moffitt 2000).	173
	Narrabeen Group	Gosford Subgroup	Newport Formation	Fine-grained sandstone (less than 3 m thick) interbedded with light to dark grey, fine-grained sandstones, siltstones and minor claystones (Bowman 1974).	35
			Garie Formation	Cream, massive, kaolinite-rich pelletal claystone, which grades upwards to grey, slightly carbonaceous claystone containing plant fossils at the base of the Newport Formation (Moffitt 2000).	8
		Clifton Subgroup	Bald Hill Claystone[b]	Massive chocolate coloured and cream pelletal claystones and mudstones, and occasional fine-grained channel sand units (Moffitt 2000).	34
			Bulgo Sandstone	Thickly bedded sandstone with intercalated siltstone and claystone bands up to 3 m thick (Moffitt 2000).	251
			Stanwell Park Claystone[b]	Red-green-grey shale and quartz sandstone (Moffitt 1999).	36
			Scarborough Sandstone	Quartz-lithic sandstone, pebbly in part (Moffitt 1999).	20
			Wombarra Claystone[b]	Grey shale and minor quartz-lithic sandstone (Moffitt 1999).	32
Permian	Illawarra Coal Measures	Sydney Subgroup	Bulli Coal Seam	Coal interbedded with shale, quartz-lithic sandstone, conglomerate, chert, torbanite seams and occasionally carbonaceous mudstone (Moffitt 2000).	4
			Loddon Sandstone		12
			Balmain Coal Member		24
			Balgownie Coal Seam		2
			(Remaining Sydney Subgroup)		-
		Cumberland Subgroup			-
	Shoalhaven Group			Sandstone, siltstone, shale, polymictic conglomerate, claystone; rare tuff, carbonate, evaporate.	-
Palaeozoic	Lachlan Fold Belt			Intensely folded and faulted slates, phyllites, quartzite sandstones and minor limestones of Ordovician to Silurian age (Moffitt 2000).	-

Notes:

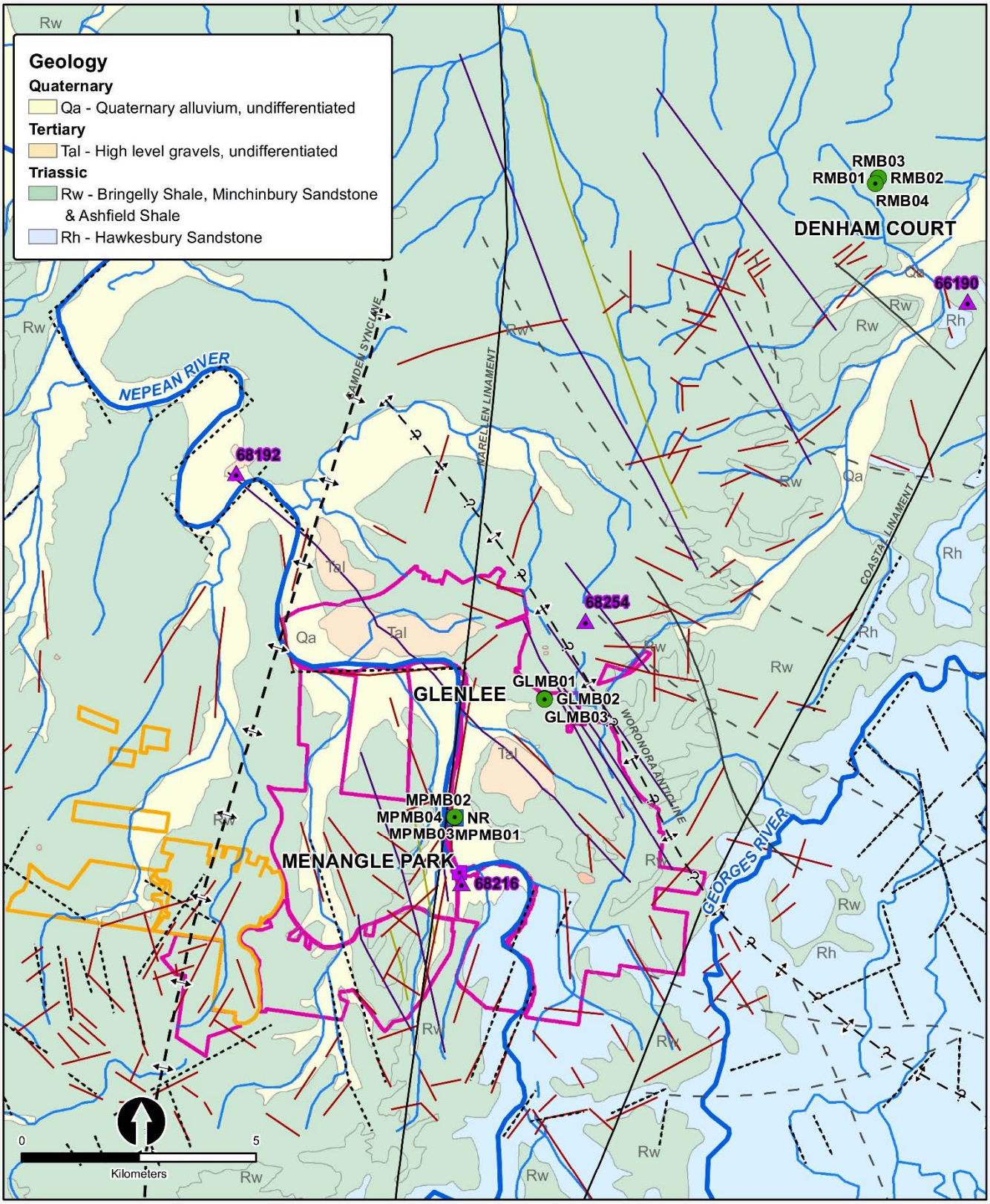
(a) Average thickness from available well data within CGP (AGL 2013); (b) Aquitard or aquiclude

The Illawarra Coal Measures is the economic sequence of interest for CSG development in the area, and consists of interbedded sandstone, shale and coal seams, with a thickness of approximately 300 m. The upper sections of the Permian Illawarra Coal Measures (Sydney Subgroup) contain the major coal seams: Bulli Coal Seam, Balgownie Coal Seam, Wongawilli Coal Seam, and Tongarra Coal Seam. The seams targeted for CSG production within the CGP are the Bulli and Balgownie coal seams, both of which are 2 to 5 m thick within the CGP.

The Illawarra Coal Measures is overlain by Triassic sandstones, siltstones and claystones of the Narrabeen Group and the Hawkesbury Sandstone. Overlying the Hawkesbury Sandstone is the Triassic Wianamatta Group shales which comprises the majority of the surficial geology (where thin alluvial deposits are not present).

Structurally, the CGP area and surrounds are dominated by the north-northeast plunging Camden Syncline, which is a broad and gentle warp structure (Alder *et al.* 1991 and Bray *et al.* 2010). The Camden Syncline is bounded in the west and truncated in the southwest by the north-south trending Nepean Structural Zone, part of the Lapstone Structural Complex.

The CGP is relatively unaffected by major faulting apart from a set of NW-NNW trending faults associated with the Lapstone Monocline Structure (Alder *et al.* 1991 and Blevin *et al*. 2007). These faults have been identified from exploration and 2D seismic studies and they have been identified as high-angle, low to moderate displacement normal faults (Blevin *et al.* 2007). Many of these features intersect coal seams however very few, if any, affect the entire stratigraphic sequence and display no expression at surface.



Camden Gas Project areas
- Stage 1
- Stage 2
- Groundwater monitoring bore
- Surface water sampling location
- BoM weather station
- BoM surface water gauging station
- Rivers
- Streams

Geological structure
- Fold - Camden syncline *
- Fold - anticline *
- Fault *
- Fault - interpreted *
- Lineaments - Landsat interpreted (CSIRO) **
- Lineaments - air photo interpreted (CSIRO) **

Faults ***
- Certain fault
- Possible fault

Figure 2.3:
Surface geology

2.4 Hydrogeological setting

The Southern Coalfield is located within the Sydney Basin sedimentary rock groundwater system. The recognised hydrogeological units within the CGP are shown in Table 2.2.

Table 2.2 Hydrogeological units within the CGP area

Hydrogeological unit	Aquifer type	Hydraulic conductivity – horizontal (m/d)	Hydraulic conductivity – vertical (m/d)	TDS (mg/L)
Alluvium	Unconfined aquifer	0.15 - 10	1 - 10	<3,000
Ashfield Shale (Wianamatta Group)	Aquitard or unconfined/perched	Very low	0.05	>3,000
Hawkesbury Sandstone	Unconfined/semi-confined aquifer	0.0009 - 0.69	0.05 - 6 x 10^{-4}	<500 - 10,000
Bald Hill Claystone (Narrabeen Group)	Aquitard/aquiclude	1 x 10^{-5}	2 x 10^{-6}	-
Bulgo Sandstone (Narrabeen Group)	Confined aquifer	5 x 10^{-4}	1 x 10^{-4}	1,500 - 5,000
Stanwell Park Claystone (Narrabeen Group)	Aquitard/aquiclude	3 x 10^{-5}	6 x 10^{-6}	-
Scarborough Sandstone (Narrabeen Group)	Confined aquifer	0.01	5 x 10^{-3}	-
Wombarra Claystone (Narrabeen Group)	Aquitard/aquiclude	3 x 10^{-5}	6 x 10^{-6}	-
Illawarra Coal Measures	Confined water bearing zones	5 x 10^{-2} (Bulli Coal Seam)	2.5 x 10^{-2} (Bulli Coal Seam)	>2,000

Note: table summarises data from a number of investigations including SCA (2005); GHD (2007); Broadstock (2011); Parsons Brinckerhoff (2011); AGL (2013); Parsons Brinckerhoff (2014a).

Alluvium occurs along the floodplain of the Nepean River and its tributaries. Alluvial deposits are generally thin, discontinuous (except along the Nepean River) and relatively permeable. The unconfined aquifers within the alluvium are responsive to rainfall and stream flow and form a minor beneficial aquifer. There are also small terrace areas of Tertiary alluvium within the CGP area that contain localised aquifers of variable quality (Figure 2.3).

The Ashfield Shale (which outcrops across the majority of the CGP) is generally of low permeability and yield; however small water bearing zones are sometimes present. Water is typically brackish to saline, especially in low relief areas of western Sydney (due to the marine depositional environment of the shales) (Old 1942). Average bore yields are 1.3 litres per second (L/s) (AGL 2013).

The Hawkesbury Sandstone and Narrabeen Group form part of an extensive generally semi-confined regional aquifer system within the Sydney Basin sequence. The Hawkesbury Sandstone is more widely exploited for groundwater than the overlying and underlying formations, being of generally higher yield, better water quality and either outcropping or buried to shallow depths over the basin. Groundwater flow within the Hawkesbury Sandstone and Narrabeen Group aquifers at a regional scale has a major horizontal

component, due to the alternation of sheet and massive facies, with some vertical leakage. The Hawkesbury Sandstone and Narrabeen Group are characterised by dual porosity. The primary porosity is imparted by connected void space between sand grains and the secondary porosity is due to the interconnected rock defects such as joints, fractures, faults and bedding planes. Superior bore yield in the sandstone aquifers of the Hawkesbury Sandstone is often associated with major fractures or a high fracture zone density, and yields of up to 40 L/s have been recorded in bores intercepting these zones within deformed areas of the Sydney Basin (McLean and Ross 2009). Typically within the CGP area bore yields within the Hawkesbury Sandstone rarely exceed 2 L/s (SCA 2007 and Ross 2014). The Narrabeen Group aquifer is generally not used as a water source as it is considered to be poorer quality and lower permeability compared to the overlying Hawkesbury Sandstone aquifer (Madden 2009).

There is a lack of major fracturing and fault systems intersecting the Hawkesbury Sandstone within the CGP. Yields in the Hawkesbury Sandstone are highest and salinities are freshest south of the Nepean River due to the proximity to recharge areas. North of the Nepean River, the groundwater within the Hawkesbury Sandstone is characterised by higher salinity, becoming moderately saline. Groundwater is used for irrigation and domestic purposes to the south and immediately to the north of the Nepean River; however, further north of the river, groundwater quality is typically only suitable for stock (AGL 2013).

The coal seams present in the Illawarra Coal Measures are both regionally and locally minor water bearing zones. Due to the greater depth of burial of the coal measures and fine-grained nature of the sedimentary rocks, the permeability is generally lower than the overlying sandstone aquifers. Recharge to the Permian water bearing zones is likely to occur where formations are outcropping, which occurs a significant distance to the south of the CGP. Salinity of the water bearing zones is typically brackish to moderately saline.

Within the CGP, there is limited rainfall recharge to the Ashfield Shale with most rainfall generating runoff and overland flow. Some leakage through the Ashfield Shale into the Hawkesbury Sandstone is expected where there is adequate fracture spacing, however, it is anticipated that most recharge to the sandstone aquifers occurs via lateral groundwater through-flow from upgradient and updip areas to the south. There is insufficient data within the CGP to define local flow paths and natural discharge zones; however, regionally, groundwater flow is predominantly towards the north or northeast, eventually discharging via the Georges, Parramatta or Hawkesbury River systems, and ultimately offshore to the east. Locally, there may be a small base flow or interflow discharge component to local stream headwaters during wet periods; however groundwater-surface water interactions are not well defined within the area (Parsons Brinckerhoff 2010).

3. Monitoring program

3.1 Monitoring network

Table 3.1 and Figure 3.1 provide construction details for the 11 monitoring bores within the CGP area (Figure 1.1).

Table 3.1 Groundwater monitoring bore details

Monitoring bore	Location	Total depth (mbgl)	Screened interval (mbgl)	Lithology	Formation
RMB01	Denham Court	84.0	69.0 – 81.0	Siltstone	Ashfield Shale
RMB02	Denham Court	150.0	135.0 – 147.0	Sandstone	Hawkesbury Sandstone (upper)
RMB03	Denham Court	300.0	290.0 – 299.0	Sandstone	Hawkesbury Sandstone (lower)
RMB04	Denham Court	8.5	4.5 – 7.5	Clay/siltstone	Ashfield Shale (weathered)
MPMB01	Menangle Park	18.5	10.0 – 16.0	Clay	Alluvium
MPMB02	Menangle Park	42.0	27.4 – 39.4	Sandstone	Hawkesbury Sandstone (upper)
MPMB03	Menangle Park	108.5	97.0 – 106.0	Sandstone	Hawkesbury Sandstone (middle)
MPMB04	Menangle Park	192.6	182.6 – 191.6	Sandstone	Hawkesbury Sandstone (lower)
GLMB01	Glenlee	102.2	87.0 – 99.0[a]	Sandstone	Hawkesbury Sandstone (upper)
GLMB02	Glenlee	190.3	168.0 – 180.0[a]	Sandstone	Hawkesbury Sandstone (middle)
GLMB03	Glenlee	228.3	212.0 – 224.0	Sandstone	Hawkesbury Sandstone (lower)

Note:

(a) Monitoring bores GLMB01 and GLMB02 were converted to vibrating wire piezometers (VWP) on 12 March 2015 to maintain borehole integrity (Parsons Brinckerhoff 2015b); the VWP sensors are installed at 93.0 mbgl and 174 mbgl respectively.

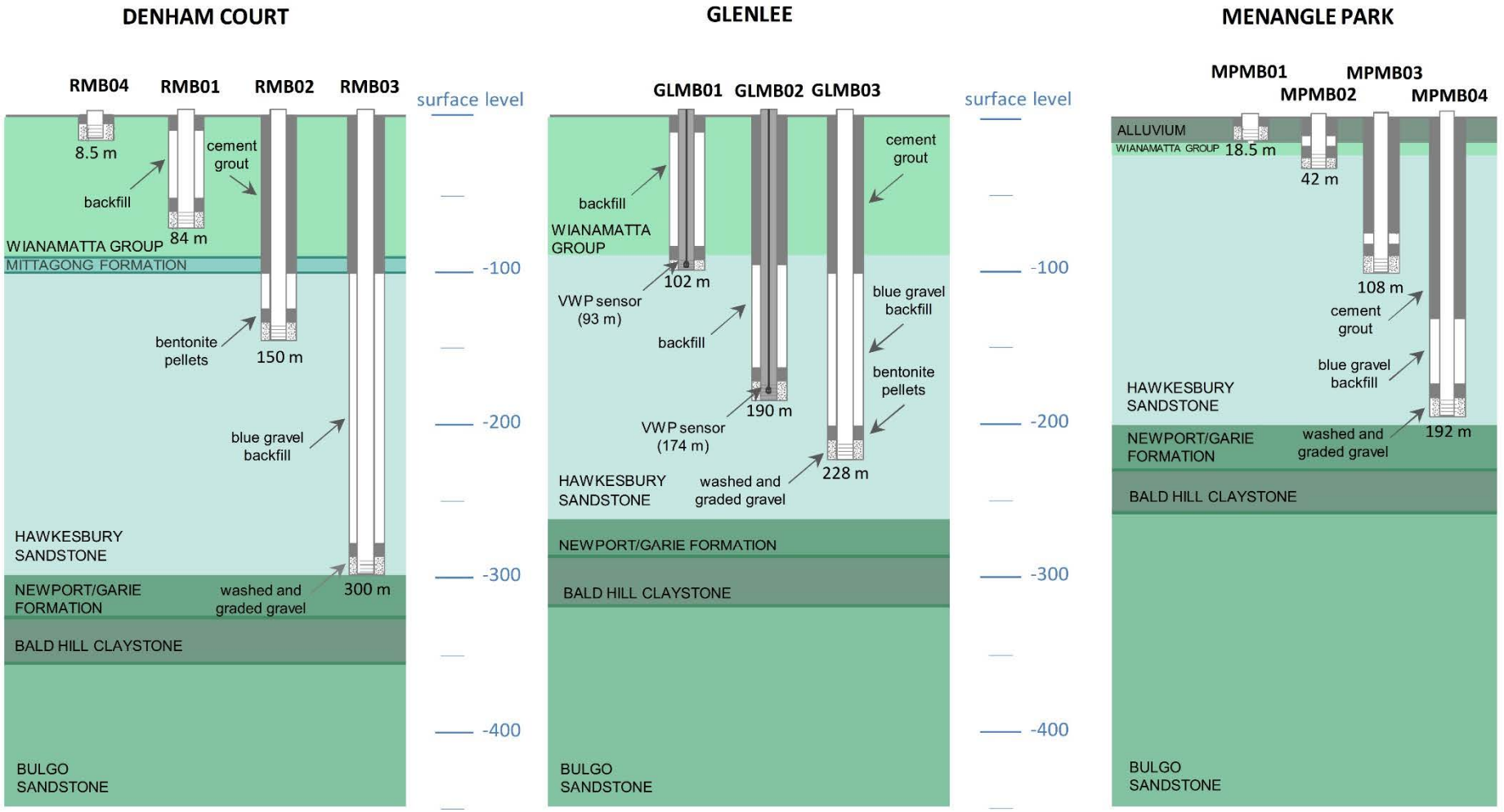


Figure 3.1 Nested groundwater monitoring bores at the Denham Court, Glenlee (following conversion to VWPs in March 2015) and Menangle Park sites

3.2 Water level monitoring

3.2.1 Groundwater levels

Following completion of each monitoring bore, pressure transducers (Solinist Levelogger (M30) dataloggers) were suspended from a galvanised steel wire in the water column and programmed to record a groundwater level every six hours. To verify the level recorded by the dataloggers, manual measurements are recorded periodically using an electronic dip meter. The monitoring start date of the datalogger data at each monitoring bore is shown in Table 3.2.

Barometric loggers installed above the water table at monitoring bores RMB01 and MPMB01 record changes in atmospheric pressure. Data from these loggers is used to correct for the effects of changing barometric pressure on water level loggers in the adjacent monitoring bores.

Table 3.2 Summary of current water level monitoring locations and data collection periods

Monitoring location	Monitoring start date
Denham Court (RMB01, RMB02, RMB03, RMB04)	November 2011 (and June 2013 for RMB04)
Menangle Park (MPMB01, MPMB02, MPMB03, MPMB04))	June 2013
Glenlee (GLMB01, GLMB02, GLMB03)	February 2014

The VWP sensors at GLMB01 and GLMB02, which were installed in March 2015, have not stabilised since installation. As such, the data has not been presented in this report; however, groundwater level data that was collected from these bores prior to their conversion to VWPs is included in this report.

3.2.2 Surface water levels

Water levels in the Nepean River are monitored by the BoM (gauging station 68216) using automatic dataloggers close to the Menangle Park site (Figure 1.1). These water levels have been included in the hydrograph for the Menangle Park site for comparison (refer to Section 4 Groundwater levels; Figure 4.2). The river height data is real-time operational data from automated telemetry systems and has been processed to remove erroneous data.

3.3 Water quality monitoring

3.3.1 Overview

Groundwater sampling has been undertaken on nine occasions at Denham Court (since November 2011), seven occasions at Menangle Park (since August 2013) and five occasions at Glenlee (since February 2014) with details provide in Table 3.3. Three sampling events occurred in the 2014/15 monitoring year.

Table 3.3 Groundwater quality sampling program

Sampling event	Denham Court	Menangle Park	Glenlee	Reference report
November 2011	√[a]	-	-	Parsons Brinckerhoff (2012)
May 2013	√[a]	-	-	Parsons Brinckerhoff (2013a)
August 2013	√[b]	√[c]	-	Parsons Brinckerhoff (2013c)
November 2013	√[d]	√	-	Parsons Brinckerhoff (2014c)
February 2014	√ [b]	√	√	Parsons Brinckerhoff (2014d)
May 2014	√[b]	√	√	Parsons Brinckerhoff (2014e)
August 2014	√[b]	√	√	Parsons Brinckerhoff (2014f)
January 2015	√[b]	√	√	Parsons Brinckerhoff (2015a)
April 2015	√[b]	√	√[e]	Parsons Brinckerhoff (2015b)

Notes:
(a) RMB01 not sampled due to insufficient water in monitoring bore.
(b) RMB01 and RMB04 not sampled due to insufficient water in monitoring bores.
(c) MPMB04 not sampled due to blockage in monitoring bore (Parsons Brinckerhoff 2013b).
(d) RMB04 not sampled due to insufficient water in monitoring bore.
(e) GLMB01 and GLMB02 not sampled as converted to vibrating wire piezometer in March 2015 (Parsons Brinckerhoff 2015b).
- = monitoring locations not yet installed.

Surface water quality sampling was undertaken on one occasion (9 September 2014) at the Nepean River site next to the Menangle Park groundwater monitoring site.

3.3.2 Sampling techniques

Two methods were used to obtain groundwater quality samples from the monitoring bores. The methods were selected based on the permeability of the screened formation of each bore, which was determined during hydraulic conductivity testing. Higher yielding bores were purged and sampled using a submersible pump. Lower yielding bores and selected deeper bores with high purge volumes were sampled using a low flow pump. In summary:

- A submersible 12V pump was used in monitoring bores MPMB01 and MPMB02 (higher yielding bores).
- A micro-purge™ low flow sampling pump was used in monitoring bores RMB02, RMB03, MPMB03, MPMB04, GLMB01, GLMB02 and GLMB03 (lower yielding bores).
- RMB01 was not sampled during this monitoring year due to insufficient water in the monitoring bore at each sampling event.
- RMB04 has never been sampled because no perched water has ever been detected within the bore.

Where a submersible pump was used, a minimum of three well volumes was purged from the monitoring bore prior to sampling to allow a representative groundwater sample to be collected. Water quality parameters were measured during and immediately after purging to monitor water quality changes and to indicate representative groundwater suitable for sampling and analysis.

The micro-purge™ system allows groundwater to be drawn into the pump intake directly from the screened portion of the aquifer, eliminating the need to purge relatively large volumes of groundwater from these bores. Water quality parameters were monitored during the micro-purge™ pumping to ensure that a representative groundwater sample was collected.

Physiochemical parameters (pH, electrical conductivity (EC), temperature, total dissolved solids (TDS), dissolved oxygen (DO) and oxidation reduction potential (ORP)) were measured during and following purging using a calibrated hand-held water quality meter.

The surface water sample was taken at the river bank using a telescopic sampler. The sample was collected from just below the water surface and approximately 1 m away from the river bank.

3.3.3 Chemical analysis of water

Groundwater samples collected in the field were analysed for a broad chemical suite designed specifically to assess the chemical characteristics of the different water bearing zones at the monitoring sites. Table 3.4 details the groundwater analytical suite.

Table 3.4 Groundwater analytical suite

Category	Parameters	
Physiochemical parameters (measured in the field)	EC Temperature DO	pH ORP TDS
General parameters	EC[a] TDS	pH[a,c]
Major ions	Calcium Magnesium Sodium Potassium	Chloride Bicarbonate Sulphate Fluoride Silica
Metals and minor/trace elements	Aluminium Antimony[a] Arsenic Barium Boron Bromine Beryllium Cadmium Cobalt Copper Cyanide[a]	Iron Lead Manganese Molybdenum Mercury[b] Nickel Selenium Strontium Zinc Uranium Vanadium
Nutrients	Ammonia Nitrite Nitrate	Total organic carbon (TOC) Phosphorus (total) Phosphorus (reactive)
Hydrocarbons	Phenol compounds Polycyclic aromatic hydrocarbons (PAH)	Total petroleum hydrocarbons (TPH) Benzene, toluene, ethyl benzene and xylenes (BTEX)
Dissolved gases	Methane Ethene Ethane Propene	Propane Butene Butane

Notes:
(a) For samples collected since the May 2013 sampling event.
(b) For samples collected since the August 2013 sampling event.
(c) Generally analysed outside of recommended holding times.

Groundwater samples for laboratory analysis were collected in sample bottles specified by the laboratory, with appropriate preservation where required. Samples undergoing dissolved metal analysis were filtered through 0.45 µm filters in the field prior to collection.

3.3.4 Quality assurance

3.3.4.1 Field QA/QC

The field sampling procedures conformed to Parsons Brinckerhoff's quality assurance/quality control protocols to prevent cross-contamination and preserve sample integrity. The following QA/QC procedures were applied:

- samples were collected in clearly labelled bottles with appropriate preservation solutions
- samples were delivered to the laboratories within the specified holding times (except for pH).
- unstable parameters were analysed in the field (physiochemical parameters).

3.3.4.2 Laboratory QA/QC

The laboratories conduct their own internal QA/QC program to assess the repeatability of the analytical procedures and instrument accuracy. These programs include analysis of laboratory sample duplicates, spike samples, certified reference standards, surrogate standards/spikes and laboratory blanks. In addition, a duplicate sample is collected in the field for every ten samples collected to assess sampling and laboratory analysis accuracy.

4. Groundwater levels

Hydrographs showing groundwater levels and rainfall from the start of monitoring until the end of June 2015 are presented for Denham Court in Figure 4.1, Menangle Park in Figure 4.2 and Glenlee in Figure 4.3. The Menangle Park site is located close to the Nepean River and river levels from BoM gauging station 68216 have also been included in the hydrograph for comparison (Figure 4.2). Individual hydrographs for each monitoring bore are included in Appendix A.

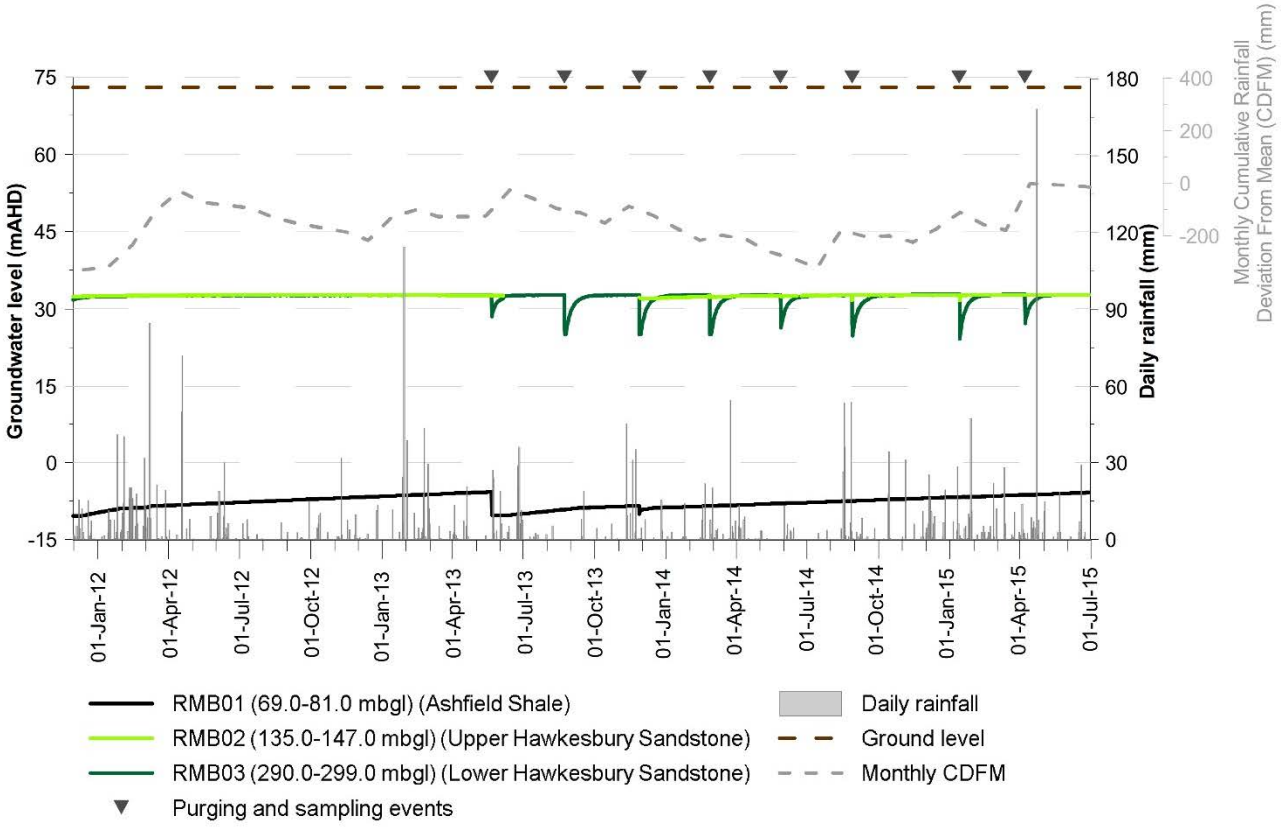


Figure 4.1 Groundwater levels at the Denham Court site

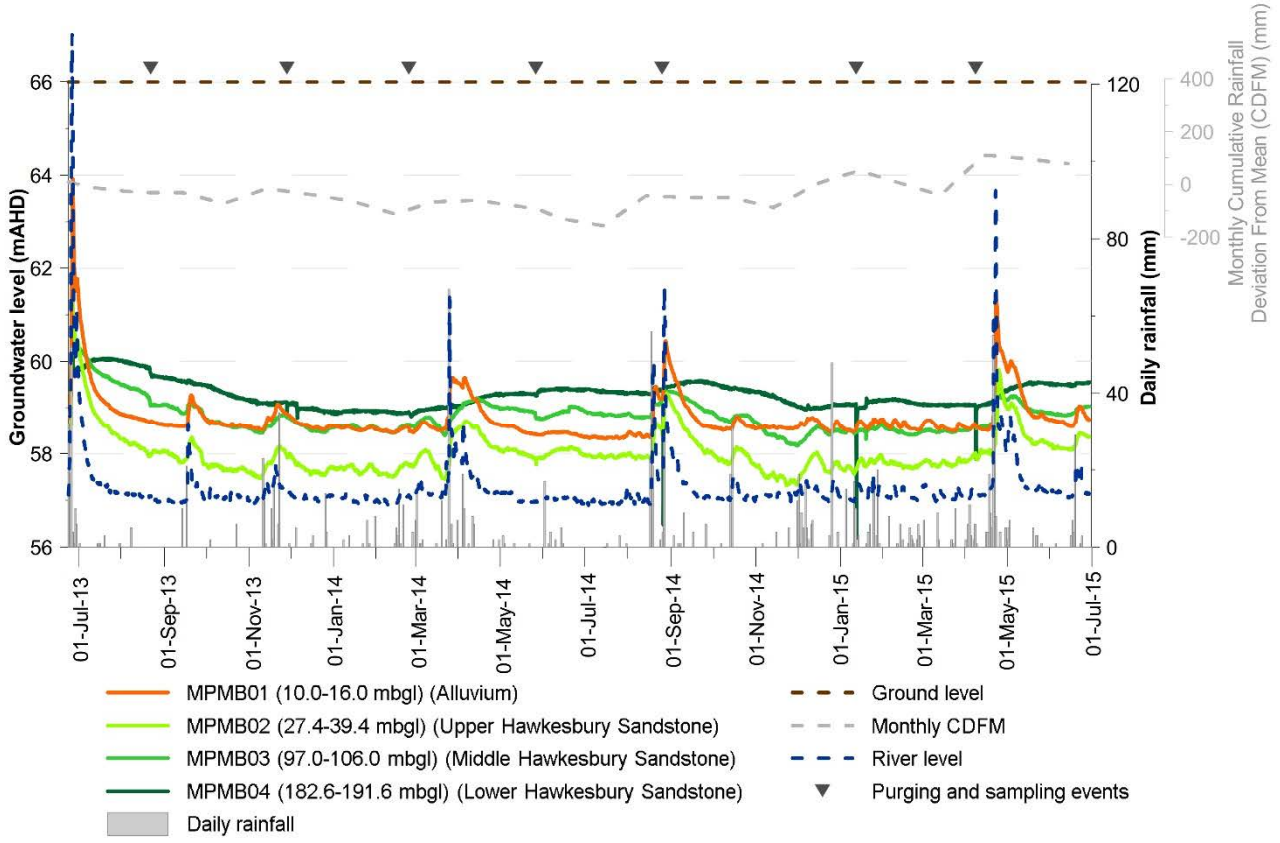


Figure 4.2 Groundwater levels and Nepean River level at the Menangle Park site

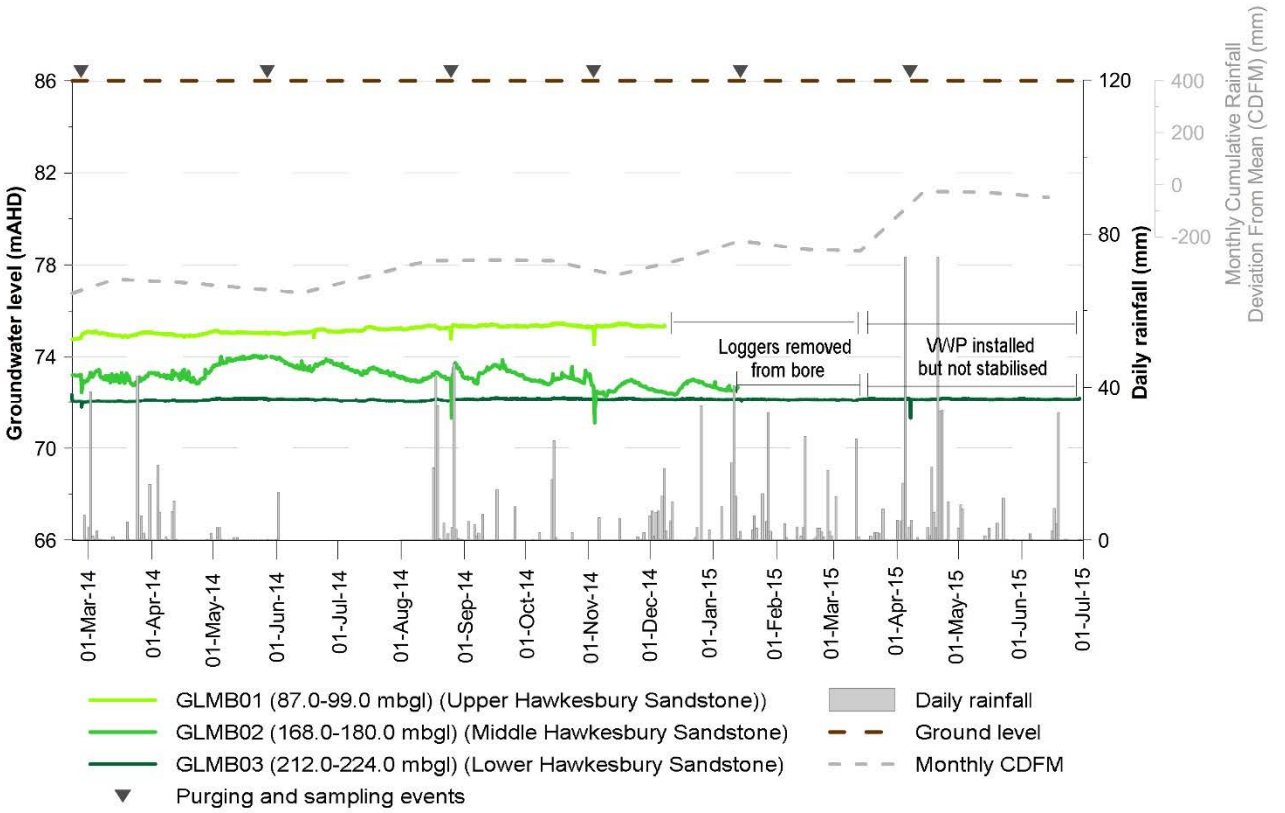


Figure 4.3 Groundwater levels at the Glenlee site

4.1 Temporal trends

4.1.1 Alluvium

The groundwater level in the alluvium (MPMB01) is shallow (less than 10 mbgl) and shows a direct response to rainfall and flood events during the monitoring year (Figure 4.1). The groundwater level increased in response to high rainfall events in August 2014 and April 2015, after which it receded to pre-rainfall level, approximately 1.5 m above river height. The time taken for the water level to recede to pre-rainfall events was over a period of up to two months.

4.1.2 Ashfield Shale

Groundwater levels in RMB01 located in the Ashfield Shale are deep (~80 mbgl) and show no apparent response to rainfall over the monitoring year as shown in Figure 4.1.

The groundwater level in RMB01 shows very slow recovery (longer than 1 year) after installation and after purging and sampling. This slow recovery is due to the very low permeability of the formation. Because of the slow recovery in RMB01 the observed water levels do not reflect the regional groundwater level or trends during the monitoring year.

Since its installation in June 2013, there has been insufficient perched water present in shallow bore RMB04 to allow for water level data to be collected. This monitoring bore was installed to monitor the presence of perched water that may sustain the adjacent Cumberland Plain Woodlands' vegetation.

4.1.3 Hawkesbury Sandstone

Groundwater levels in the Hawkesbury Sandstone show no apparent response to individual rainfall events over the monitoring year at the Denham Court and Glenlee sites (Figure 4.1 and Figure 4.3 respectively), while at the Menangle Park site, located next to the Nepean River, a definite response to rainfall and flood events is observed at the upper and middle Hawkesbury Sandstone monitoring bores (MPMB02 and MPMB03) and a subdued and delayed response in the lower Hawkesbury Sandstone monitoring bore (MPMB04) (Figure 4.2).

Groundwater levels are deep (~40 mbgl) at the Denham Court site and are above the base of the Ashfield Shale indicating confining conditions. The groundwater levels remained fairly constant with fluctuations of less than ~0.5 m throughout the monitoring year. Sudden decreases and slow recovery of groundwater level in the lower Hawkesbury Sandstone (RMB03) are related to sampling events and are consistent with the low permeability of the Hawkesbury Sandstone at this location.

Groundwater levels are shallow (less than 15 mbgl) in the Hawkesbury Sandstone at the Glenlee site. Groundwater levels have been stable over the monitoring year in the upper and lower Hawkesbury Sandstone (GLMB01 and GLMB03) and show a slight decrease in the middle Hawkesbury Sandstone (GLMB02) since the start of this monitoring year. The erratic nature of the data from GLMB02 was investigated and appears to be a natural (Parsons Brinckerhoff 2015a).

At Menangle Park the groundwater level for each of the water bearing zones monitored in the Hawkesbury Sandstone is shallow (less than 10 mbgl). Groundwater levels at the upper and middle Hawkesbury Sandstone monitoring bores (MPMB02 and MPMB03) increased in response to rainfall events in August 2014 and April 2015, followed by a decrease in groundwater levels over a period of two months. The response to rainfall in the lower Hawkesbury Sandstone (MPMB04) indicates slow and delayed recharge after high rainfall periods.

4.2 Spatial trends in the Hawkesbury Sandstone

The conceptual model (AGL 2013) and hydrogeological setting (Section 2.4) suggest that regional groundwater flow within the Hawkesbury Sandstone is from south to north towards the incised river systems of the Sydney Basin.

The groundwater level elevations in the Hawkesbury Sandstone aquifer can be compared between each of the three monitoring sites. The data collected at the CGP suggests that groundwater flow (in the Hawkesbury Sandstone at least) is more complex than the regional conceptual model. The data suggests that:

- The Nepean River in the vicinity of the Menangle Park site is a probable groundwater discharge area (as there is upward groundwater flow within the Hawkesbury Sandstone and there is no Ashfield Shale to act as a cap rock) - groundwater elevations here are between 58 and 61 mAHD and the Nepean River height is typically between 57 and 58 mAHD;
- The Glenlee site may be close to a groundwater divide as groundwater elevations are between 72 and 75 mAHD; and
- The Denham Court site may be on the other side of the groundwater divide as groundwater elevations are lower at around 31 mAHD.

Further studies and data from a larger number of monitoring sites would be required to further understand the regional flow patterns in the Hawkesbury Sandstone.

4.3 Groundwater-surface water interaction

Hydraulic connection between surface water and groundwater exists where the river is in direct contact with the underlying aquifer (Bouwer and Maddock 1997). A ‘gaining’ stream exists where the water table or groundwater level in a connected aquifer is higher than the running level in a stream and groundwater will flow or discharge to the stream (Land and Water Australia 2007).

The Nepean River level shows a clear response to rainfall (Figure 4.2). The river level is usually lower than the level in the alluvium and Hawkesbury Sandstone units, indicating the river is a gaining river at the Menangle Park site during most of the monitoring period, except for short periods during extremely high rainfall events, when recharge to the alluvial groundwater system occurs.

It is noted that the location of the Nepean River level monitoring station is approximately 1.5 km south of the MPMB bores. This distance, and potential differences in elevation at each site, has not been taken into consideration during this analysis.

4.4 Vertical gradients

Vertical gradients provide an indication of the potential for groundwater to flow vertically upward or downward at that particular location. A downward hydraulic gradient indicates a potential for downward flow from the shallower unit to the deeper unit, while an upward gradient indicates the opposite. It is noted that the actual flow direction and velocity is also governed by permeability.

Potential vertical gradients between the various hydrogeological units were assessed and vary between sites:

- Groundwater levels are comparable in the upper and lower Hawkesbury Sandstone at the Denham Court site indicating no vertical gradient between these monitored zones. Although the sandstone is confined, there is an apparent upward gradient between the upper Hawkesbury Sandstone and the Ashfield Shale.
- There is an apparent upward hydraulic gradient at the Menangle Park site within the monitored zones of the Hawkesbury Sandstone; however a downward gradient exists between the alluvium and the upper

Hawkesbury Sandstone. The similar response to rainfall and flooding events between the alluvial monitoring bore and the Hawkesbury Sandstone monitoring bores indicates connectivity between the two formations at this location, which is expected given the lack of a substantial confining layer (for example shale) between the formations.

- There is an apparent downward hydraulic gradient within the Hawkesbury Sandstone at the Glenlee site.

Vertical gradients can be influenced by structural geological features (*i.e.* faults, folds and lineaments) and differences in local porosity, as described in sections 2.3 and 2.4 respectively.

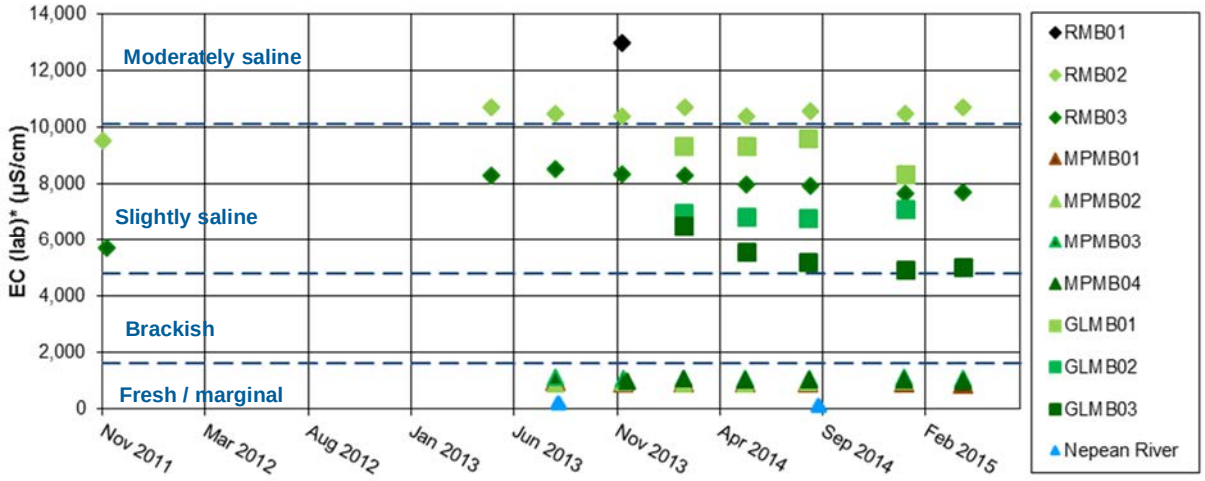
5. Water quality

Water quality monitoring was undertaken between November 2011 and April 2015. Water quality results for the 2014/15 monitoring year are summarised in this chapter and compared to previous monitoring years (Parsons Brinckerhoff 2014a and 2014b). The 2014/15 monitoring year full water quality results are presented in Appendix B and laboratory results in Appendix C.

5.1 Groundwater quality

5.1.1 Field parameters

Time series of field EC and pH for the CGP monitoring bores are presented in Figure 5.1 and Figure 5.2.



* Field EC is used for RMB02 and RMB03 in November 2011.

Figure 5.1 EC time series for CGP monitoring bores and Nepean River sample

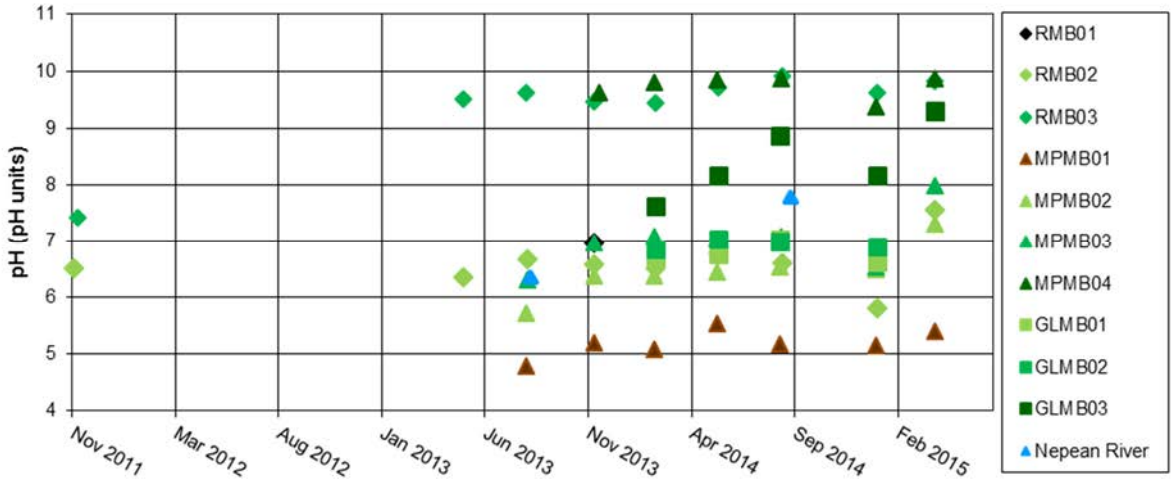


Figure 5.2 pH time series for CGP monitoring bores and Nepean River sample

Groundwater sampled from the alluvium at Menangle Park (MPMB01) is classified as fresh to marginally saline and has a pH of approximately 4.5 to 5.5. The Menangle Park site is a former sand and gravel quarry

that has been subsequently rehabilitated. The observed low pH may be related to these previous land use activities.

No groundwater sample was collected from the Ashfield Shale monitoring bore at Denham Court (RMB01) due to insufficient water in the monitoring bore during the 2014/15 monitoring year.

Groundwater in the Hawkesbury Sandstone at the Menangle Park site (MPMB02-04) is classified as fresh to marginal, while slightly saline conditions are observed at the Glenlee site (GLMB01-03) and slightly saline to moderately saline conditions are observed at the Denham Court site (RMB02-03). The fresh to marginal conditions at the Menangle Park site are likely due to the influence of rainfall recharge and connectivity with the Nepean River.

Salinity within the Hawkesbury Sandstone does not show a clear depth related trend at Menangle Park, however, salinity decreases with depth at the Denham Court and Glenlee sites. This decrease is likely a result of saline groundwater within the Ashfield Shale migrating into the underlying aquifer as a result of the leakage. The pH generally increases with depth within the Hawkesbury Sandstone. The pH has increased in the Hawkesbury Sandstone at the Menangle Park and Glenlee sites over the monitoring period.

5.1.2 Major ions

The major ion characteristics of groundwater samples for this monitoring year are shown in a piper diagram and representative bivariate plots in Figure 5.3. A piper diagram is a graphical representation of the relative concentrations of major ions (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, Cl^{-}, HCO_3^{-}, CO_3^{2-} and SO_4^{2-}). The ratios of sodium/chloride and magnesium/chloride versus chloride concentrations are also presented in two bivariate plots. Chloride is typically assumed to be a conservative (non-reactive) ion in groundwater systems. Evapotranspiration of the initial water with low chloride concentration would therefore be expected to result in a horizontal trend in a major ion/chloride versus chloride plot.

Groundwater at monitoring bores is typically dominated by sodium and chloride, although, groundwater at the Menangle Park site is a mixed ion, Na-Mg-Ca-HCO_3 type water. Interestingly the water type at each of the four nested monitoring bores at the Menangle Park site is different.

Major ion/chloride ratios of groundwater at the Denham Court and Glenlee sites are similar and generally close to those of typical sea water (Turekian 1968). The Hawkesbury Sandstone at the Menangle Park site has a different geochemical signature to the Denham Court and Glenlee sites, which may be related to local recharge and connectivity with the overlying alluvium at this site.

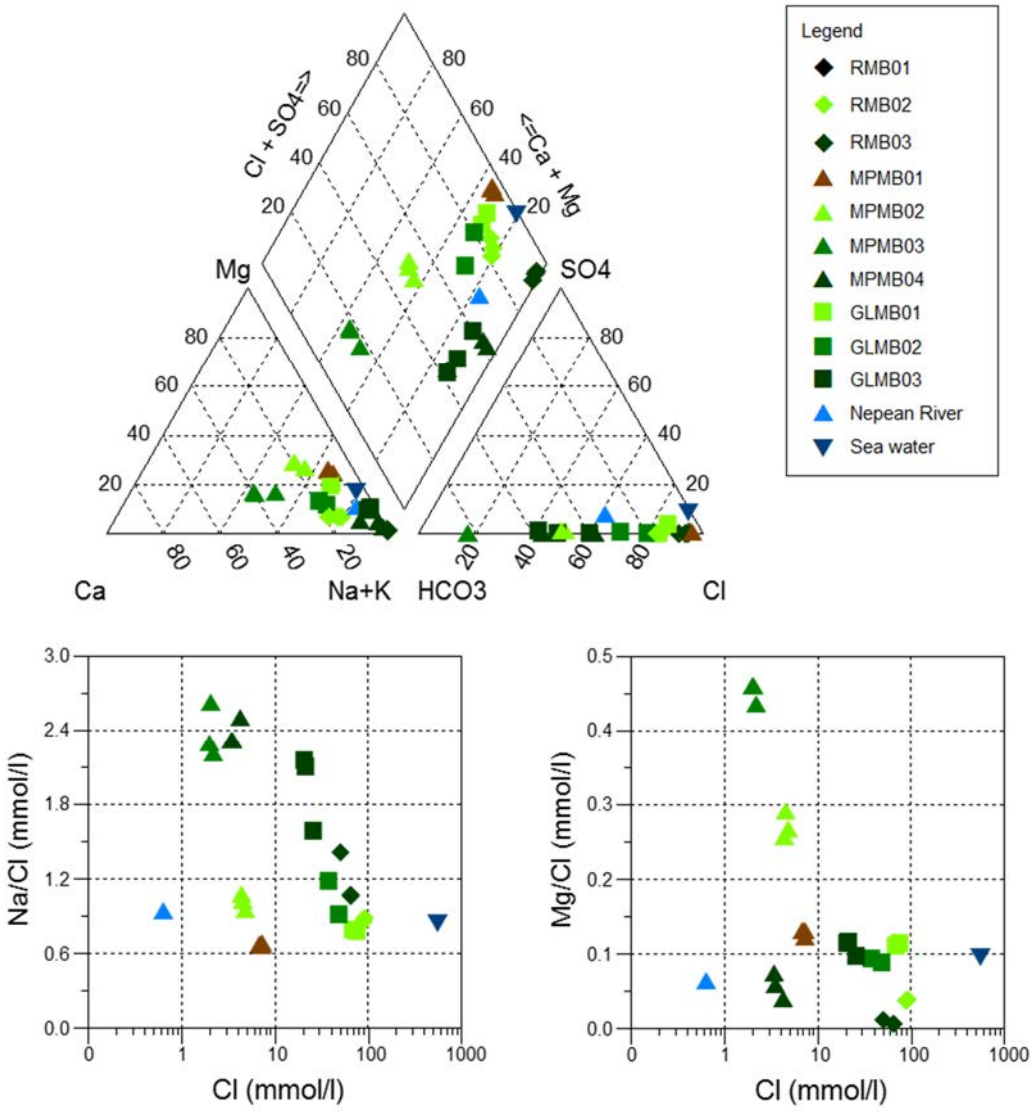


Figure 5.3 Major ion chemistry of groundwater for CGP monitoring bores and Nepean River sample (2014/15 monitoring year)

5.1.3 Dissolved metals

Concentrations of dissolved metals in groundwater are presented in Figure 5.4. The major findings for dissolved metals for this monitoring year are as follows:

- Dissolved metal concentrations are generally similar in the alluvium and the Hawkesbury Sandstone. The exceptions are copper, cobalt, nickel and lead concentrations, which are higher in the alluvium compared to the other hydrogeological units. Dissolved metal concentrations in the alluvium were generally comparable to previous monitoring years.
- Slightly elevated dissolved metal concentrations were detected in the Hawkesbury Sandstone at the Denham Court and Glenlee sites (*e.g.* barium, bromine and strontium) compared with other locations. This is not unexpected given the higher salinity at these locations and the influence from the overlying Ashfield Shale. Elevated concentrations of barium, cadmium, molybdenum, strontium and zinc are not uncommon for groundwater in the Hawkesbury Sandstone (Parsons Brinckerhoff 2006 and 2013b). Dissolved metal concentrations in the Hawkesbury Sandstone were generally comparable to previous monitoring years, with the exception of decreasing iron concentrations at RMB02, decreasing molybdenum concentrations at MPMB04 and GLMB03. Mercury was also detected at MPMB04 just above the laboratory LOR in April 2015 at 0.0003 mg/L.

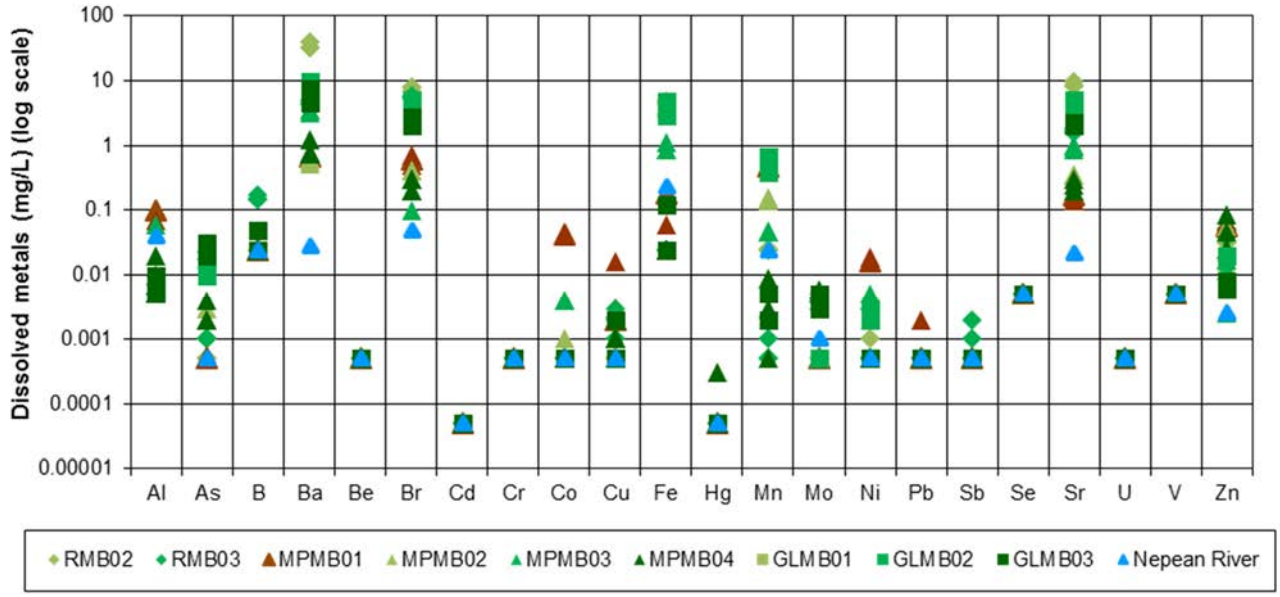


Figure 5.4 Dissolved metal concentrations in groundwater for CGP monitoring bores (2014/15 monitoring year)

5.1.4 Nutrients

A plot showing ammonia versus nitrate in groundwater is presented in Figure 5.5.

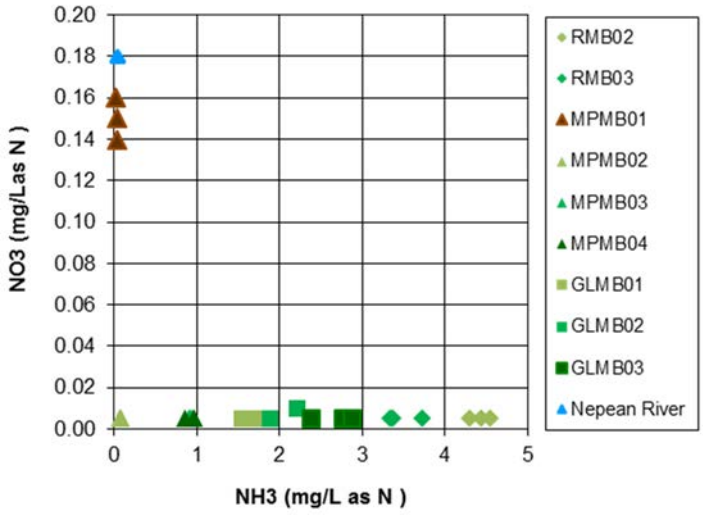


Figure 5.5 Ammonia versus nitrate concentrations in groundwater for CGP monitoring bores and the Nepean River sample (2014/15 monitoring year)

The major findings for nutrients are as follows:

- Nitrate (NO_3) concentrations in groundwater remained low at all CGP monitoring bores (<0.2 mg/L as N) compared to previous monitoring years. The highest concentrations continued to be recorded in the alluvial aquifer (MPMB01) (Figure 5.5).
- Ammonia (NH_3) concentrations were the lowest at Menangle Park and the highest at Denham Court, which is consistent with previous monitoring years (Figure 5.5).
- Nitrite concentrations remained below the laboratory LOR at all monitoring bores with the exception of a detection in the Hawkesbury Sandston at Denham Court (RMB02-03) in August 2014.

- Total organic carbon (TOC) concentrations differ between hydrogeological units, being generally the highest in the lower Hawkesbury Sandstone at all sites and comparable in the middle and upper Hawkesbury Sandstone and alluvium.

5.1.5 Dissolved gases

A time series plot of dissolved methane concentrations in groundwater is presented in Figure 5.6.

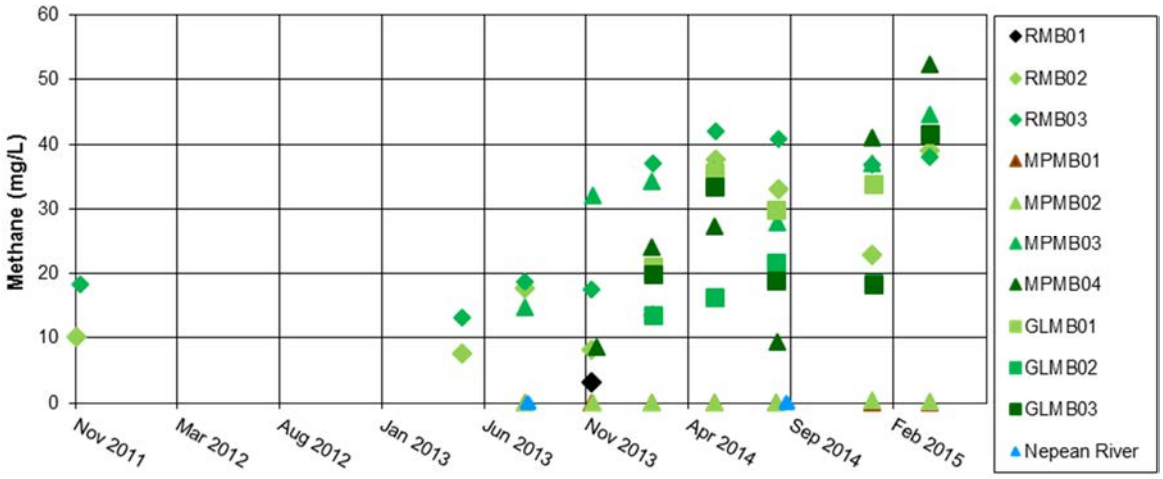


Figure 5.6 Dissolved methane (CH_4) in groundwater time series for CGP monitoring bores

The major findings for dissolved gases are as follows:

- Dissolved gases were not detected in the alluvium (MPMB01).
- Dissolved methane was detected in the Hawkesbury Sandstone at all monitoring sites, with increased concentrations at depth. Dissolved methane was also detected at the control site (RMB) remote from development activities. Dissolved methane concentrations continued to be the lowest at MPMB02. Dissolved methane concentrations at the majority of sites in the Hawkesbury Sandstone continued to increase during this monitoring year and the April 2015 concentrations were the highest concentrations recorded at most monitoring bores since monitoring commenced (Figure 5.6).
- Ethane continued to be detected at low concentrations in groundwater from the Hawkesbury Sandstone at the Denham Court and Glenlee sites and propane and butane continued to be detected at low concentrations at the Glenlee site only. Concentrations of these dissolved gases overall decreased at the Glenlee site since monitoring commenced in February 2014.

Dissolved methane is shown to be of mostly thermogenic origin (Parsons Brinckerhoff 2014). The presence of dissolved hydrocarbons observed in the groundwater within the Hawkesbury Sandstone and Ashfield Shale is assessed to be naturally occurring, based on the values present within the groundwater at the control site (Denham Court, RMB) located at significant distance from the CGP gas production wells. It is likely that the increasing dissolved methane trends are related to degassing of naturally occurring methane after purging during groundwater sampling events. Future trends will be monitored.

5.1.6 Dissolved hydrocarbons

The Menangle Park site is a former sand and gravel quarry that has been subsequently rehabilitated, and hydrocarbon detections (PAHs and TPH/TRH) at this site in the alluvium may be related to these previous land use activities.

Toluene continued to be present in most sandstone units at all sites in variable concentrations. No other BTEX compounds (*i.e.* benzene, xylenes and ethyl benzene) were detected during this monitoring year. Toluene is assessed to be naturally occurring, given that it has been detected in groundwater at all

monitoring sites since monitoring began, including the control site (Denham Court, RMB) located at a significant distance from development activities.

Dissolved hydrocarbons can occur naturally in groundwater, with concentrations derived from any carbonaceous material (CSIRO 2011). Detections of PAHs, phenols and heavy chain hydrocarbons in both upper and lower Hawkesbury Sandstone across all sites are most likely natural, however possible residues from monitoring bore drilling (*e.g.* lubricating oils) cannot be excluded. Future trends will be monitored.

5.2 Surface water quality

Surface water quality results from a single sample collected from the Nepean River on 9 September 2014 were compared to ANZECC (2000) guidelines for freshwater ecosystems (95% protection level) and it was found that:

- pH is neutral, within the ANZECC (2000) guideline range (6.5 – 8.0 pH units) and higher than the pH of groundwater in the alluvium.
- Salinity is fresh, and within the ANZECC (2000) guideline range (125 – 2,200 µS/cm) and lower than groundwater in the alluvium. The low salinity is likely the result of the rainfall that preceded the collection of the sample.
- Dominant major ions are sodium, chloride and bicarbonate (Figure 5.3).
- Dissolved metal concentrations were lower than those of groundwater in the alluvium and underlying Hawkesbury Sandstone units, except for iron and molybdenum concentrations. All dissolved metal concentrations were below the ANZECC (2000) guideline values.
- Ammonia concentrations were above the ANZECC (2000) guideline (0.02 mg/L) and are similar to the alluvial groundwater. Total phosphorus concentration was lower than the August 2013 concentration and was below the ANZECC (2000) guideline value (0.05 mg/L).
- Dissolved methane was detected at low concentrations (0.01 mg/L).
- No other dissolved hydrocarbons were detected.

The water quality of the Nepean River was overall comparable to that of the sample collected in August 2013.

6. Discussion and conclusions

Monitoring of groundwater levels at three nested monitoring bore sites was undertaken using dataloggers, allowing water level trends to be identified in the alluvium, Ashfield Shale and Hawkesbury Sandstone. Sampling of water quality at all sites also established useful trends.

The main findings for this monitoring year in regards to **water levels** are:

- The groundwater level in the alluvium at Menangle Park is less than 10 mbgl and shows a direct response to rainfall and flood events.
- Groundwater levels appear to follow similar trends in each of the Hawkesbury Sandstone units (upper, middle and lower) at each site. There is no apparent response to individual rainfall events at the Denham Court and Glenlee sites, while a clear response to rainfall and flood events can be observed at most monitoring bores at the Menangle Park site even though this is an apparent groundwater discharge area.
- Groundwater levels are deep (~40 mbgl) at the Denham Court site, although they are above the base of the Ashfield Shale indicating confining conditions. In contrast, groundwater levels are shallow (less than 15 mbgl) at the Menangle Park and Glenlee sites.
- For the regional Hawkesbury Sandstone aquifer, groundwater elevations are highest at the Glenlee site (~75 mAHD); lower at the Menangle Park site (~60 mAHD); and lowest at the Denham Court site (~31 mAHD).
- Vertical gradients vary between sites; no vertical gradient is apparent between the lower and upper Hawkesbury Sandstone at the Denham Court site, whereas upward and downward gradients are evident at Menangle Park and Glenlee respectively.
- The Nepean River elevation is usually lower than the water elevation in the alluvium and Hawkesbury Sandstone units, indicating the river is a gaining stream around the Menangle Park site, except for short periods during extremely high rainfall events when recharge to the underlying groundwater systems is observed.
- The groundwater level data collected in the alluvium and Hawkesbury Sandstone is indicative of natural systems in long-term equilibrium with occasional seasonal responses to recharge when there is a connection with surface features, as evident at the Menangle site within the alluvium and Hawkesbury Sandstone.

No downward temporal trends have been observed in the groundwater level data at any of the monitored locations and therefore it can be assumed that no depressurisation due to CSG operations (which involve dewatering of the coal seam) is occurring within the monitored zones.

The main findings for this monitoring year in regards to **water quality** are:

- Groundwater quality in the alluvium at the Menangle Park site is characterised as fresh to marginally saline and slightly acidic pH. Dissolved metal concentrations are typically low and no dissolved gases were detected. Minor dissolved hydrocarbons were detected and may be related to previous land use activities.
- No sample was collected from the Ashfield Shale at Denham Court due to insufficient water in the monitoring bore.
- Groundwater quality in the Hawkesbury Sandstone ranges from fresh to marginally saline at the Menangle Park site and is slightly to moderately saline at the Denham Court and Glenlee sites. Salinity decreases with depth at the Denham Court and Glenlee sites. Minor detections of dissolved hydrocarbons were present in the Hawkesbury Sandstone. Dissolved methane was detected at all

Hawkesbury Sandstone bores and it is likely related to degassing of naturally occurring methane after purging during groundwater sampling events. Dissolved ethane was detected at the Denham Court and Glenlee sites and propane and butane were detected at the Glenlee site only. These compounds are assessed to be naturally occurring given that methane has been observed to occur at all sites, including the control site (Denham Court) which is located at a significant distance from any development activities.

- Toluene was present at all sites (except the alluvium and the shallowest sandstone interval at Menangle Park) at variable concentrations. No other BTEX compounds were detected. Toluene is assessed to be naturally occurring given that it has been detected at all sites, including the control site (Denham Court) which is located at a significant distance from the CGP gas production wells.
- The Nepean River at the Menangle Park site is of neutral pH and fresh water quality. Dissolved metal concentrations were typically lower for the surface water than the alluvium and underlying Hawkesbury Sandstone. Ammonia concentrations were above the ANZECC (2000) guideline values and similar to alluvial groundwater. Minor dissolved methane concentrations were detected however no other hydrocarbons were detected.
- No significant change in water quality was detected during the 2014/15 monitoring year compared to the previous monitoring year (Parsons Brinckerhoff 2014b).

No adverse water quality impacts that can be attributed to CSG operations were observed at any of the monitored locations. Water quality results are not significantly different between the control site (Denham Court) and the Stage 2 area where CSG operations are occurring (Menangle Park and Glenlee).

From the available data, there are no observable impacts to groundwater levels or quality that could be attributable to the CSG operations. There is also no evidence of connectivity between the shallower monitored zones and the coal seams. This is in agreement with the conceptual model developed during the Phase 1 studies (Parsons Brinckerhoff 2011). The presence of extensive and thick claystone formations (aquitards and aquicludes) between the Hawkesbury Sandstone and the targeted coal seams restricts upward depressurisation and impedes the vertical flow of groundwater.

7. Statement of limitations

7.1 Scope of services

This report has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client (AGL) and Parsons Brinckerhoff (scope of services). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

7.2 Reliance on data

In preparing the report, Parsons Brinckerhoff has relied upon data, surveys, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, Parsons Brinckerhoff has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Parsons Brinckerhoff will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Parsons Brinckerhoff.

7.3 Environmental conclusions

In accordance with the scope of services, Parsons Brinckerhoff has relied upon the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

On all sites, varying degrees of non-uniformity of the vertical and horizontal soil or groundwater conditions are encountered. Hence no monitoring, common testing or sampling technique can eliminate the possibility that monitoring or testing results/samples are not totally representative of soil and/or groundwater conditions encountered. The conclusions are based upon the data and the environmental field monitoring and/or testing and are therefore merely indicative of the environmental condition of the site at the time of preparing the report, including the presence or otherwise of contaminants or emissions.

Within the limitations imposed by the scope of services, the monitoring, testing, sampling and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

7.4 Report for benefit of client

The report has been prepared for the benefit of the client (and no other party). Parsons Brinckerhoff assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of Parsons Brinckerhoff or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Parties other than the client should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

7.5 Other limitations

Parsons Brinckerhoff will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

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Appendix A

Groundwater hydrographs

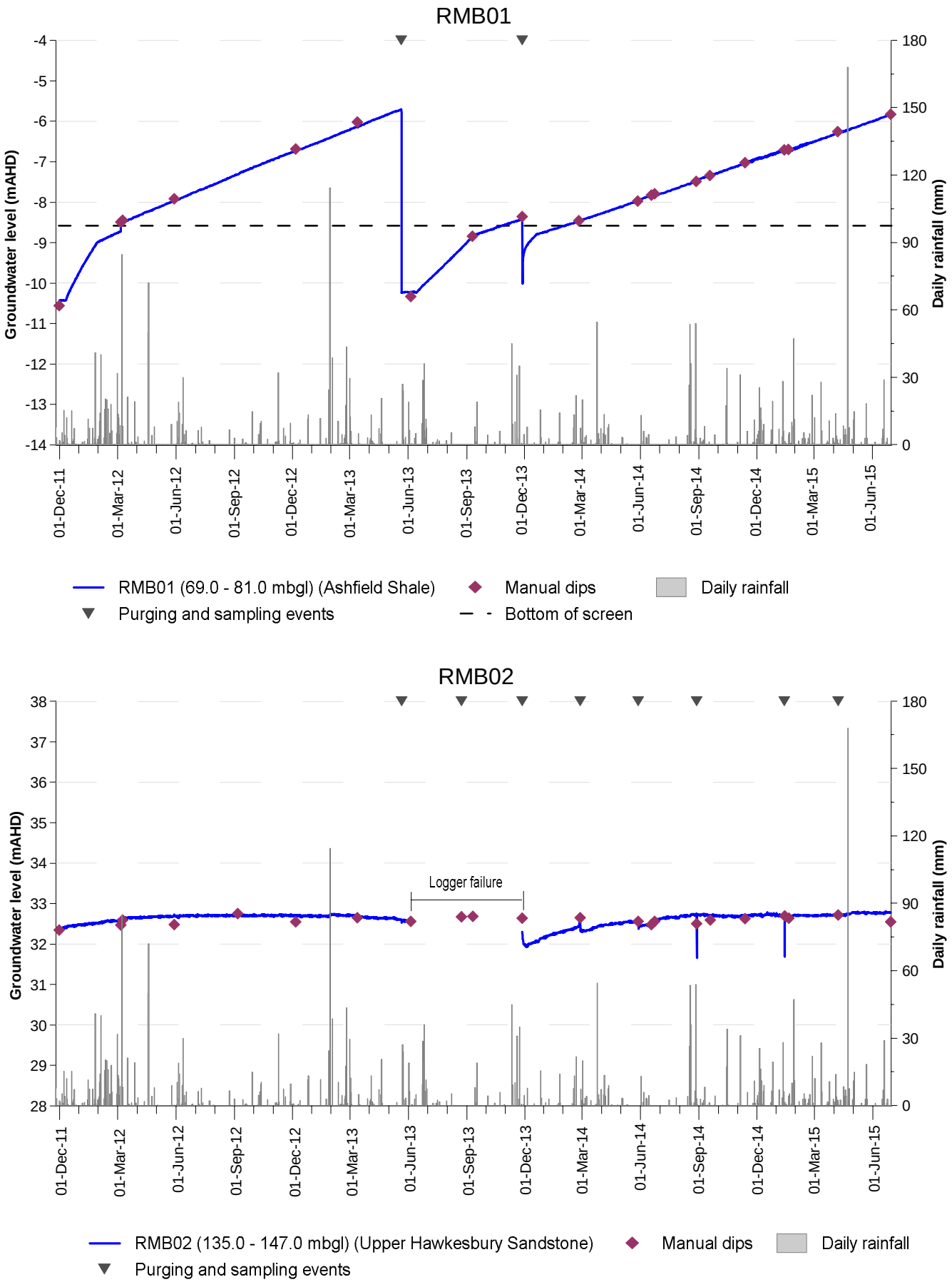


Figure A.1: RMB01 and RMB02 monitoring bores

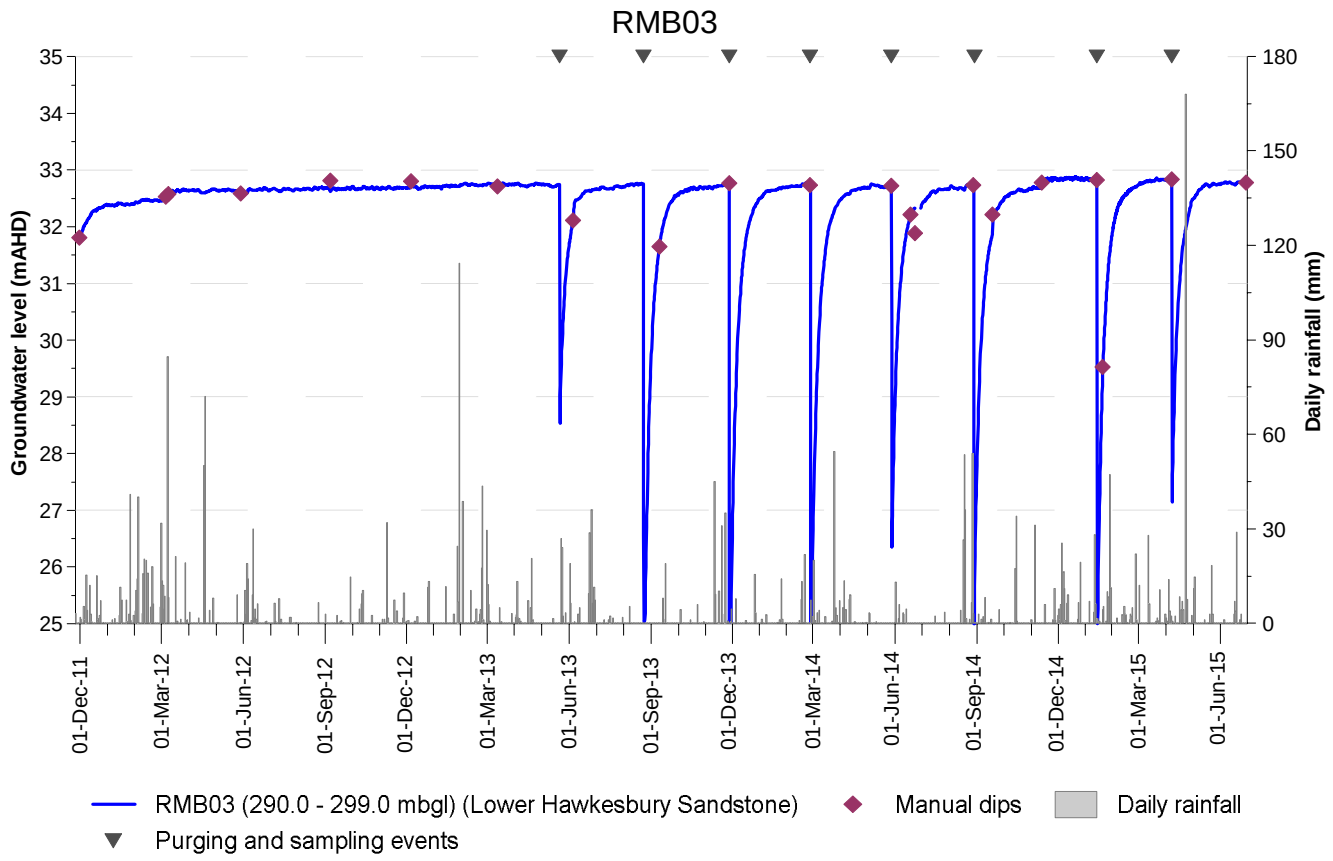


Figure A.2: RMB03 monitoring bore

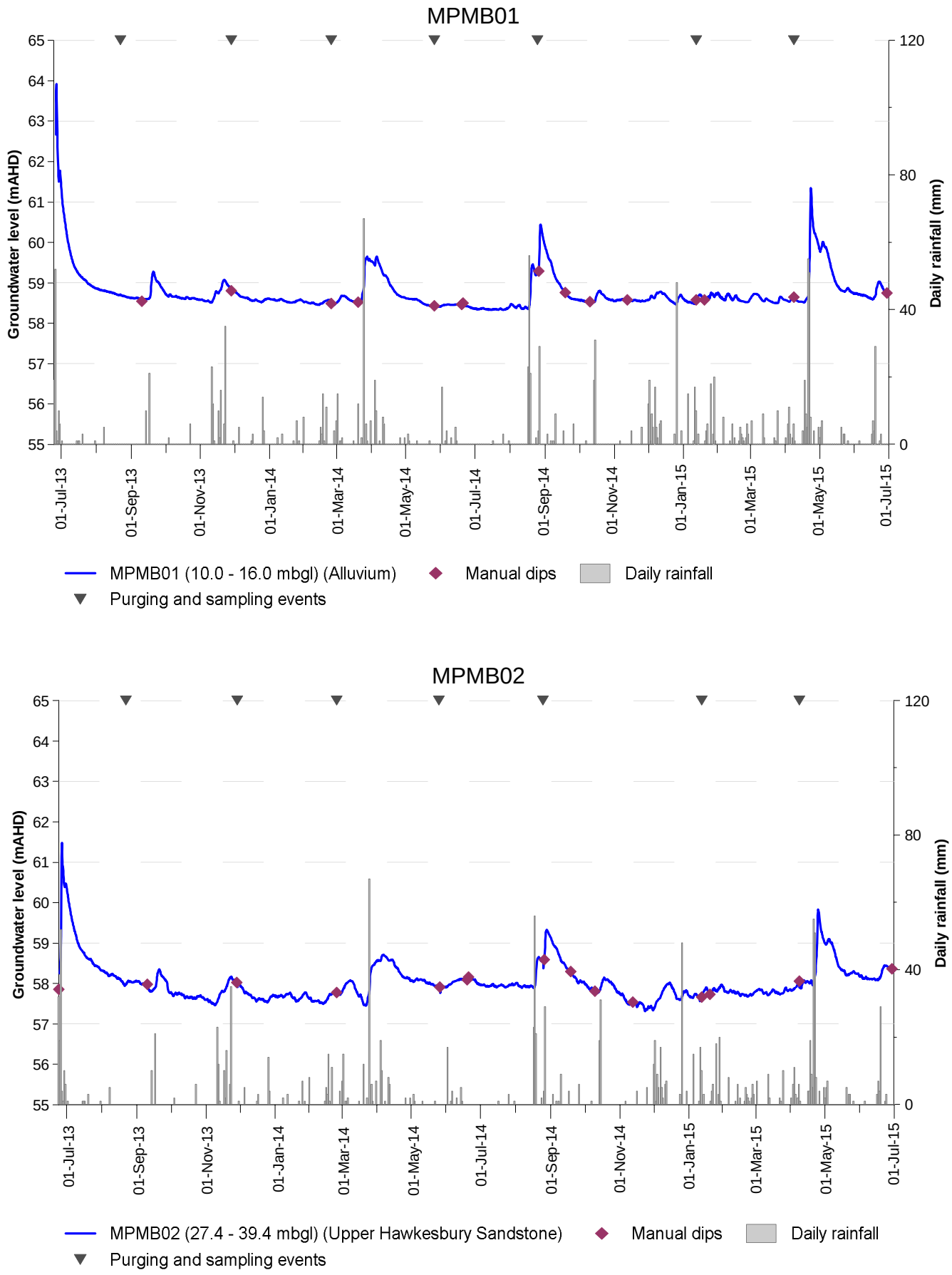


Figure A.3: MPMB01 and MPMB02 monitoring bores

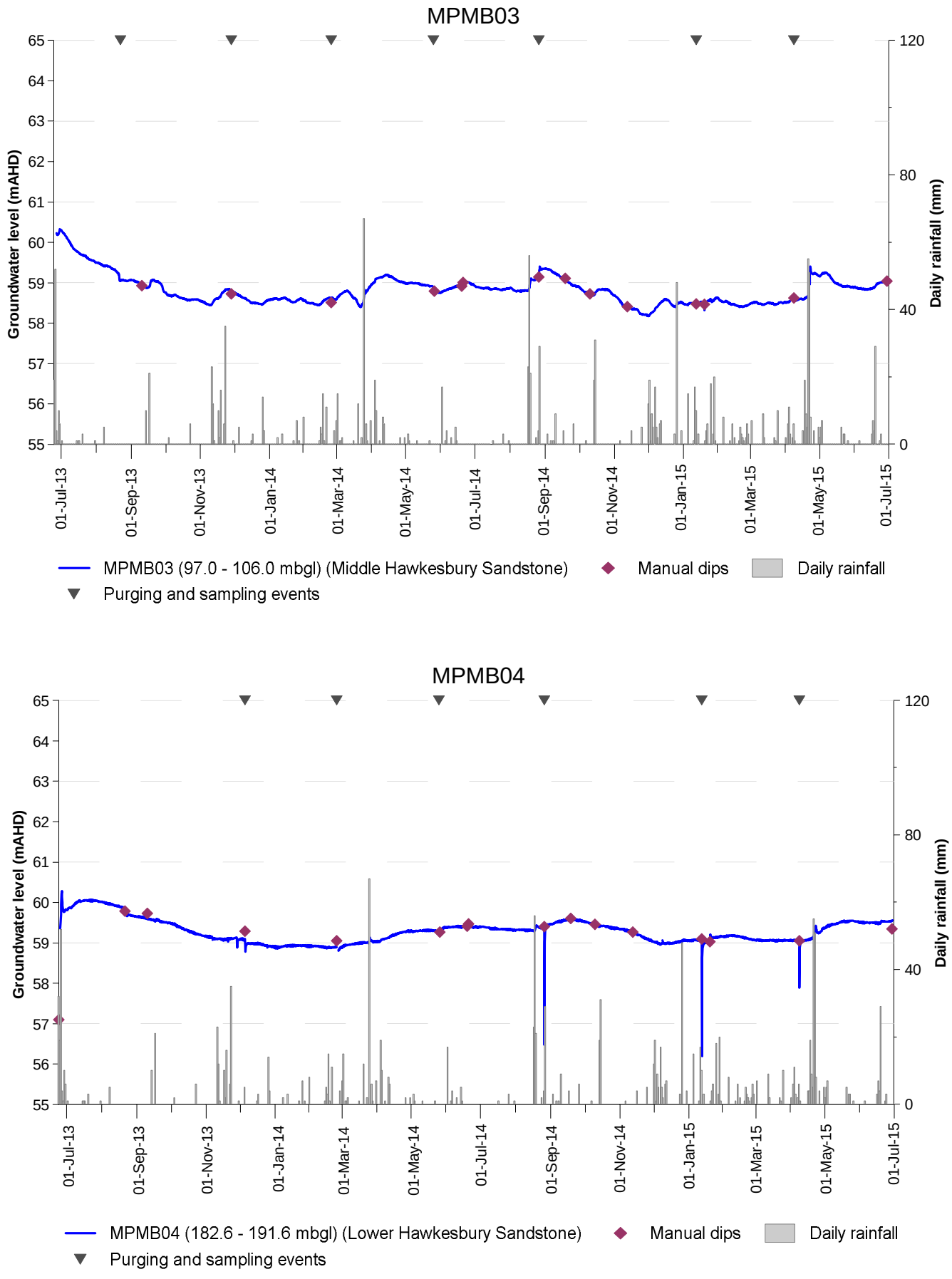
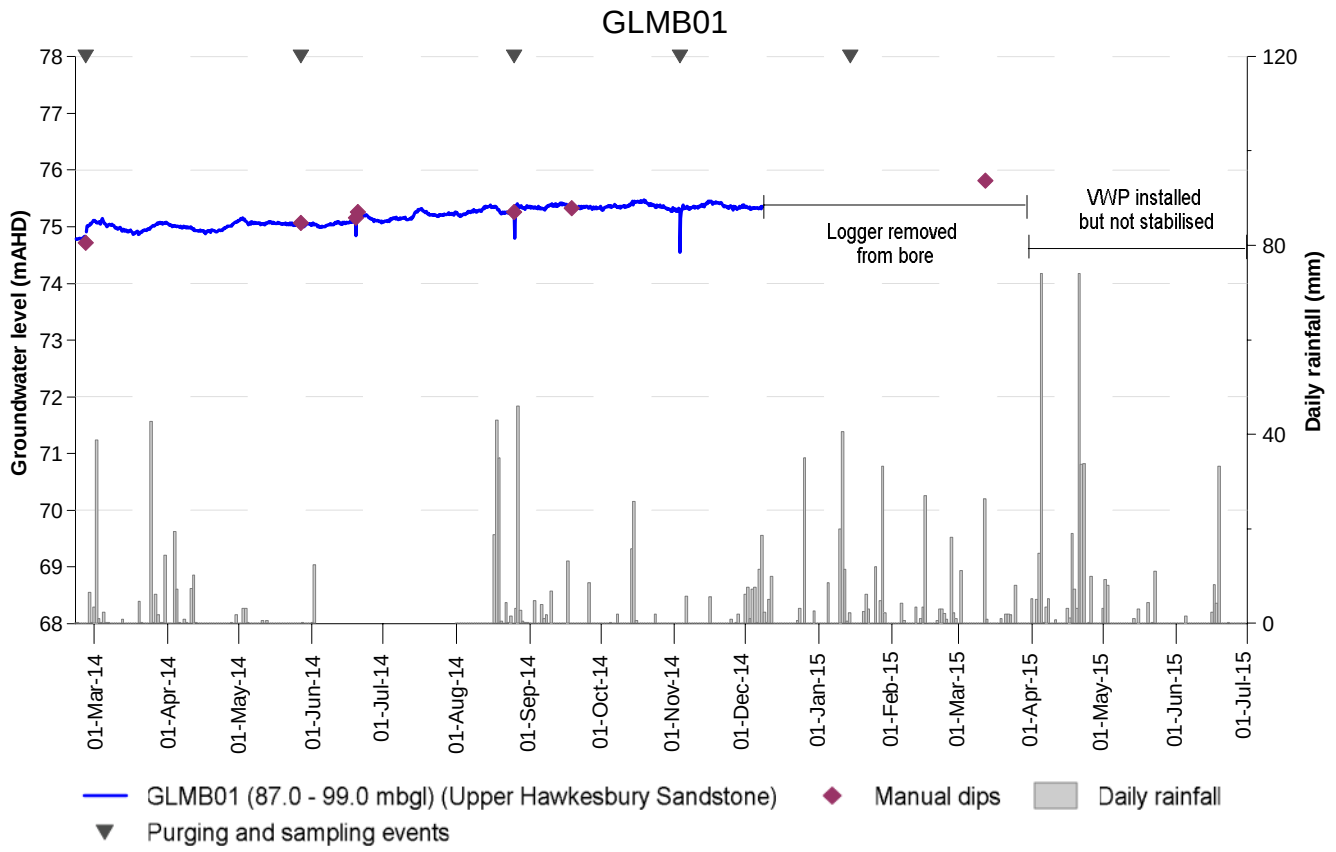


Figure A.4: MPMB03 and MPMB04 monitoring bores



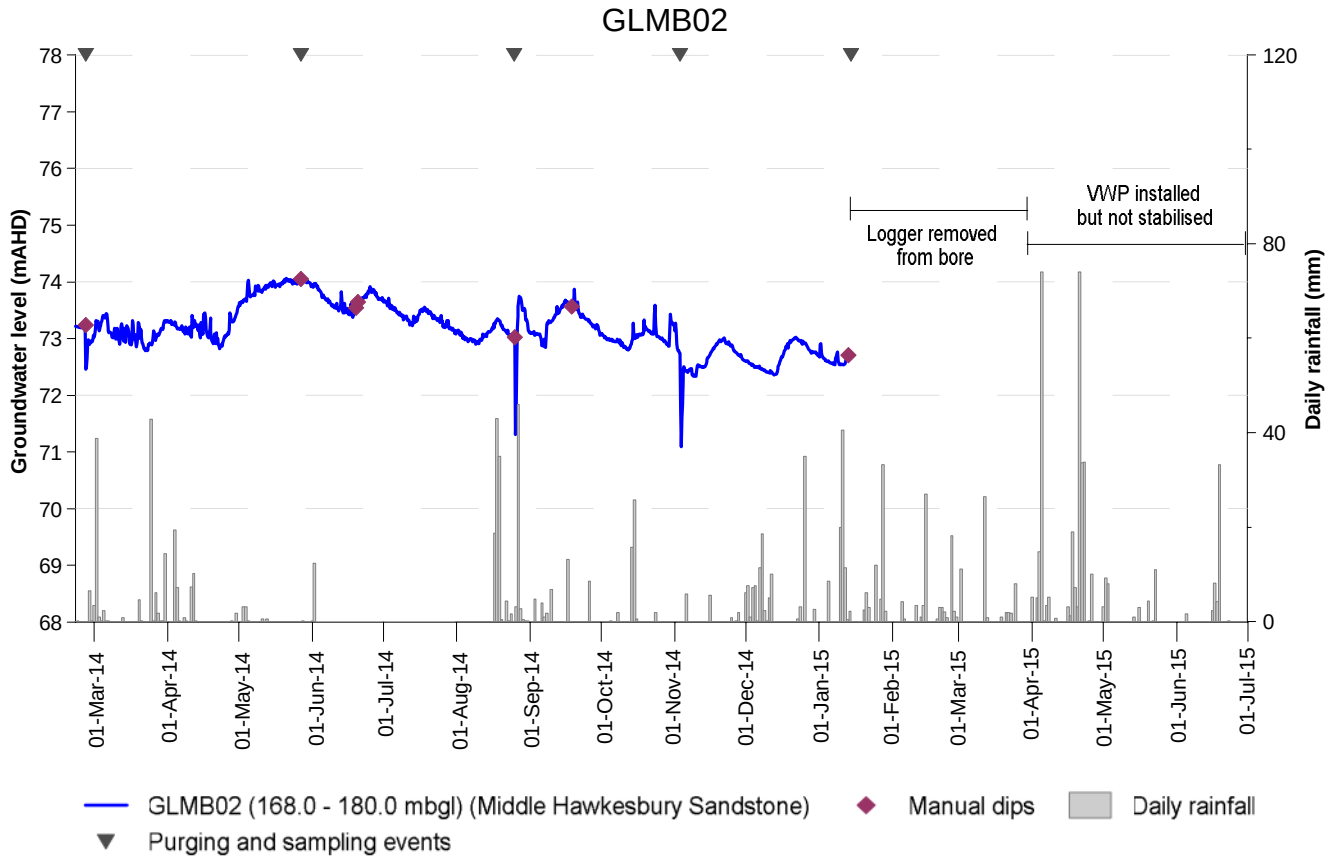


Figure A.5: GLMB01 and GLM02 monitoring bores

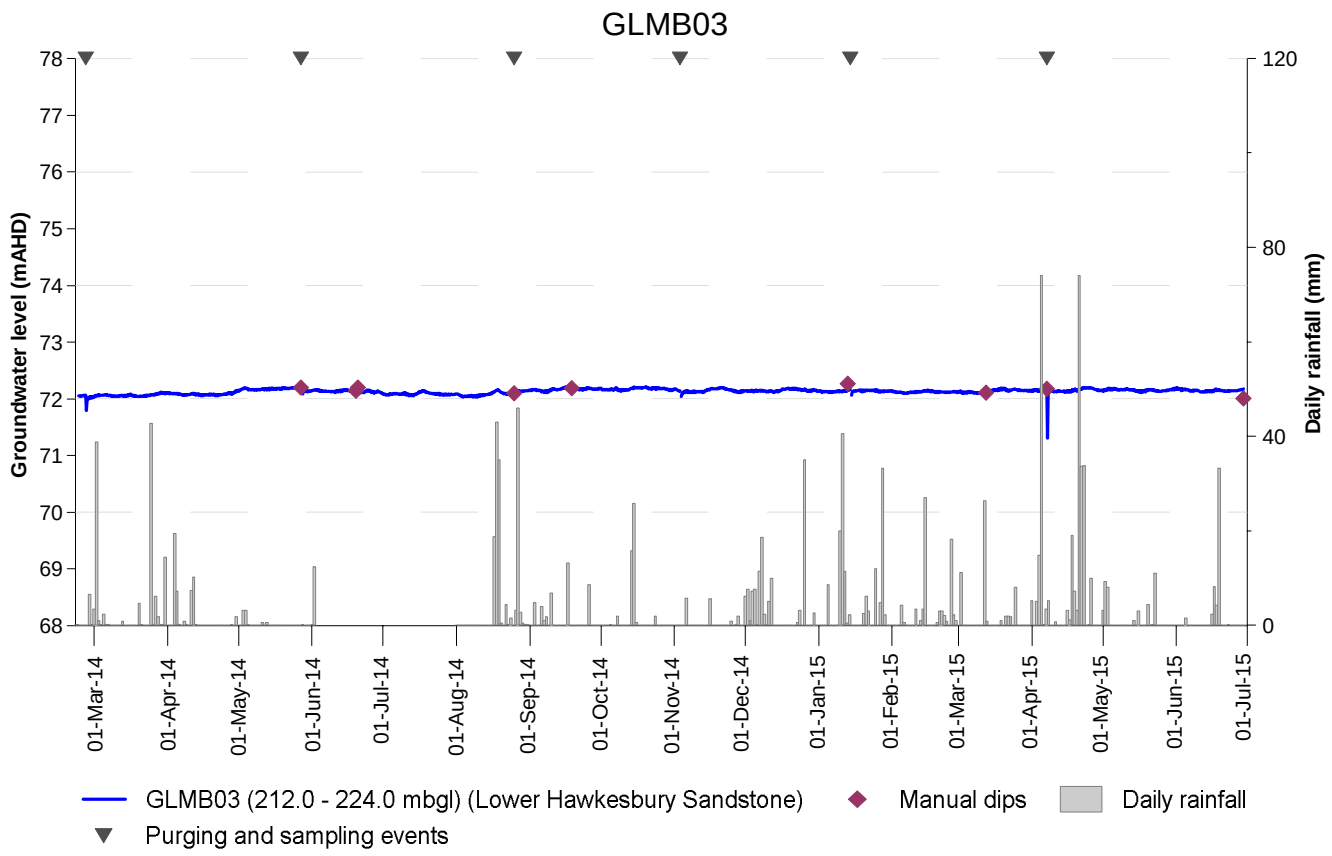


Figure A.6: GLM03 monitoring bore

Appendix B

Water quality summary tables

SUMMARY TABLE B.1: Water quality results Denham Court and Glenlee sites (2014-2015)

			Denham Court						Glenlee						
			RMB02			RMB03			GLMB01		GLMB02		GLMB03		
Hydrogeological unit			Hawkesbury Sandstone (upper)			Hawkesbury Sandstone (lower)			Hawkesbury Sandstone (upper)		Hawkesbury Sandstone (middle)		Hawkesbury Sandstone (lower)		
Sample date		Typical LOR	29/08/2014	13/01/2015	7/04/2015	29/08/2014	13/01/2015	7/04/2015	25/08/2014	14/01/2015	25/08/2014	14/01/2015	25/08/2014	14/01/2015	7/04/2015
General parameters	**Units**														
pH (field)	pH units	0.01	6.60	5.81	7.55	9.92	9.61	9.81	7.03	6.63	7.00	6.90	8.87	8.17	9.31
pH (lab)			7.18	7.39	7.19	9.48	9.60	9.63	7.40	7.48	7.39	7.66	8.77	8.85	8.60
Electrical conductivity (field)	µS/cm	1	10,959	9,831	10,390	8,296	7,522	7,486	9,332	7,675	6,545	6,902	5,017	4,704	4,842
Electrical conductivity (lab)			10,600	10,500	10,700	7,940	7,690	7,730	9,640	8,360	6,810	7,140	5,200	4,930	5,010
Temperature	ºC	0.01	20.55	22.30	19.46	20.46	20.96	19.45	19.73	24.53	20.82	27.41	20.25	24.53	20.47
Dissolved oxygen	% sat	0.01	10.30	6.30	-	20.10	2.40	5.10	42.90	3.60	1.40	5.00	2.70	1.40	2.40
Total dissolved solids (field)	mg/L		7,123	6,391	6,753	5,389	4,889	4,865	6,066	4,986	4,253	4,484	3,260	3,057	3,151
Total dissolved solids (lab)		10	5,440	5,980	6,170	3,830	4,130	4,140	5,320	5,110	3,360	4,320	2,460	2,560	2,750
Total suspended solids	mg/L	5	<5	<5	<5	<5	<5	<5	<5	22	36	41	<5	6	<5
Redox	mV	0.1	-164.1	-132.1	-41.5	25.8	-157.1	-94.1	-305.5	-168.9	-241.8	-204.7	-221.4	-243.1	-209.0
Water type[a]	-		Na-Cl	Na-Cl	Na-Cl	Na-Cl	Na-Cl	Na-Cl	Na-Cl	Na-Cl	Na-Cl-HCO_3	Na-Cl	Na-Cl-HCO_3	Na-HCO_3-Cl	Na-HCO_3-Cl
Laboratory analytes															
Hydroxide alkalinity as $CaCO_3$	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate alkalinity as $CaCO_3$	mg/L	1	<1	<1	<1	298	229	252	<1	<1	<1	<1	184	309	129
Bicarbonate alkalinity as $CaCO_3$	mg/L	1	972	792	895	239	189	224	683	434	793	595	876	1,070	1,510
Total alkalinity as $CaCO_3$	mg/L	1	972	792	895	537	418	476	683	434	793	595	1,060	1,380	1,640
Sulfate as SO_4^{2-}	mg/L	1	<10	<1	<10	<1	<1	<1	<1	135	5	<1	<1	<1	19
Chloride	mg/L	1	3,120	3,170	3,280	1,760	2,290	2,310	2,710	2,470	1,370	1,760	934	734	774
Calcium	mg/L	1	270	382	326	6	14	10	174	182	210	246	16	24	31
Magnesium	mg/L	1	81	83	88	14	11	11	211	186	87	105	61	57	61
Sodium	mg/L	1	1,740	1,770	1,890	1,610	1,570	1,600	1,360	1,260	1,040	1,040	957	1,020	1,050
Potassium	mg/L	1	37	30	30	22	16	16	24	19	29	24	32	36	39
Silica (reactive)	mg/L	0.05	11.6	9.66	10.4	7.30	6.24	6.68	10.6	7.38	21.2	16.0	9.77	11.0	11.8
Fluoride	mg/L	0.1	0.2	0.2	0.1	0.4	0.4	0.6	0.3	0.2	0.3	0.3	0.2	<0.1	<0.1
Bromide	mg/L	0.01	5.88	8.89	6.79	4.71	6.05	4.68	6.06	8.30	3.98	5.75	2.35	2.25	1.98
Total cyanide	mg/L	0.0004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Dissolved metals															
Aluminium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	<0.01
Antimony	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	mg/L	0.001	<0.001	<0.001	<0.001	0.001	0.001	0.001	<0.001	0.010	0.014	0.010	0.020	0.020	0.032
Barium	mg/L	0.001	40.0	33.2	33.0	4.35	5.07	4.64	2.64	0.362	9.7800	8.78	4.49	6.28	7.63
Beryllium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	0.001	<0.001	<0.001	<0.001	0.002	0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
Lead	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	0.001	0.026	0.024	0.024	<0.001	0.001	<0.001	0.300	0.390	0.666	0.384	0.002	0.003	0.005
Mercury	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum	mg/L	0.001	<0.001	<0.001	<0.001	0.004	0.004	0.005	<0.001	<0.001	<0.001	<0.001	0.005	0.004	0.003
Nickel	mg/L	0.001	<0.001	0.003	0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.002	0.003	<0.001	<0.001	<0.001
Selenium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	mg/L	0.001	8.18	9.97	8.47	1.64	1.83	1.58	6.33	4.08	5.14	3.97	2.06	1.54	2.23
Uranium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	0.005	0.017	0.033	0.031	0.053	0.039	0.051	<0.005	<0.005	0.020	0.006	0.006	<0.005	0.008
Boron	mg/L	0.05	<0.05	<0.05	<0.05	0.15	0.15	0.17	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05
Iron	mg/L	0.05	4.81	4.73	4.42	<0.05	<0.05	<0.05	0.19	4.28	2.97	4.87	<0.05	0.10	0.12
Bromine	mg/L	0.1	7.9	7.8	7.0	5.8	5.7	5.4	7.2	6.4	4.5	5.1	2.7	2.2	2.0
Nutrients															
Ammonia as N	mg/L	0.01	4.30	4.55	4.43	3.73	3.36	3.33	1.71	1.54	1.88	2.20	2.37	2.76	2.87
Nitrite as N	mg/L	0.01	0.04	<0.01	<0.01	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01
Total phosphorus	mg/L	0.01	<0.01	0.02	0.04	<0.01	<0.01	0.01	0.08	0.04	0.12	0.07	0.04	<0.01	0.04
Reactive phosphorus	mg/L	0.01	<0.01	0.03	0.03	<0.01	<0.01	0.01	0.06	<0.01	0.06	0.05	<0.01	0.03	0.05
Total organic carbon	mg/L	1	<1	<1	5	28	38	40	3	<1	9	<1	10	<1	10
Dissolved gases															
Methane	mg/L	0.01	33.10	22.80	39.10	40.90	36.80	38.10	29.90	33.90	21.70	18.40	18.80	18.20	41.70
Ethane	mg/L	0.01	0.01	<0.01	<0.01	<0.01	0.01	0.01	1.48	1.65	0.93	0.80	0.12	0.06	0.11
Ethene	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Propane	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.42	0.38	0.19	0.20	0.03	0.02	0.02
Propene	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Butane	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.07	0.06	0.04	0.04	<0.01	<0.01	<0.01
Butene	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenolic compounds															
Phenol	µg/L	1	<1	<1	<1	<1	<1	<1	2	<1	1.8	<1	1.5	<1	<1
2-Chlorophenol	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2-Methylphenol	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
3-&4-Methylphenol	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
2-Nitrophenol	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2.4-Dimethylphenol	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2.4-Dichlorophenol	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2.6-Dichlorophenol	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
4-Chloro-3-Methylphenol	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2.4.6-Trichlorophenol	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2.4.5-Trichlorophenol	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pentachlorophenol	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Polycyclic aromatic hydrocarbons															
Acenaphthylene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acenaphthene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluorene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenanthrene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Anthracene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluoranthene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pyrene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benz(a)anthracene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chrysene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo(b)fluoranthene	µg/L	1	<1	-	-	<1	-	-	<1	-	<1	-	<1	-	-
Benzo(k)fluoranthene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo(a)pyrene	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibenz(a.h)anthracene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo(g.h.i)perylene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum of PAHs	ug/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total petroleum hydrocarbons															
C_6-C_9 fraction	µg/L	20	<20	<20	<20	70	90	70	210	110	210	80	310	210	190
C_{10}-C_{14} fraction	µg/L	50	<50	<50	<50	90	<50	<50	<50	<50	<50	<50	<50	<50	<50
C_{15}-C_{28} fraction	µg/L	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
C_{29}-C_{36} fraction	µg/L	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
C_{10}-C_{36} fraction (sum)	µg/L	50	<50	<50	<50	90	<50	<50	<50	<50	<50	<50	<50	<50	<50
Total recoverable hydrocarbons															
C_6-C_{10} fraction	µg/L	20	<20	<20	<20	70	90	70	290	110	220	80	310	210	190
C_6-C_{10} fraction minus BTEX	µg/L	20	<20	<20	<20	20	40	30	290	90	210	80	170	100	70
>C_{10}-C_{16} fraction	µg/L	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C_{16}-C_{34} fraction	µg/L	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C_{34}-C_{40} fraction	µg/L	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C_{10}-C_{40} fraction (sum)	µg/L	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Aromatic hydrocarbons															
Benzene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/L	2	8	<2	<2	48	46	39	<2	19	10	<2	139	106	124
Ethylbenzene	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
m&p-Xylenes	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
o-Xylenes	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total xlyenes	µg/L	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Sum of BTEX	µg/L	1	8	<1	<1	48	46	39	<1	19	10	<1	139	106	124
Naphthalene	µg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Note:
(a) Calculated using AQUACHEM.

PARSONS BRINCKERHOFF

SUMMARY TABLE B.2: Water quality results Menangle Park site and Nepean River (2014-2015)

			ANZECC 2000 guidelines[b]	Menangle Park												Nepean River
				MPMB01			MPMB02			MPMB03			MPMB04			
Hydrogeological unit				Alluvium			Hawkesbury Sandstone (upper)			Hawkesbury Sandstone (middle)			Hawkesbury Sandstone (lower)			
Sample date		**Typical LOR**		25/08/2014	12/01/2015	8/04/2015	25/08/2014	12/01/2015	8/04/2015	26/08/2014	12/01/2015	8/04/2015	26/08/2014	12/01/2015	8/04/2015	9/09/2014*
General parameters	**Units**															
pH (field)	pH units	0.01	6.5 - 8.0[c]	5.17	5.16	5.41	6.54	6.50	7.31	7.08	6.54	7.99	9.87	9.37	9.86	7.78
pH (lab)				5.58	5.65	5.54	6.92	6.86	6.86	7.47	7.54	7.44	9.70	9.23	9.73	7.37
Electrical conductivity (field)	µS/cm	1	125 - 2,200[c]	908	882	896	925	935	953	1,024	1,045	1,059	1,020	1,000	956	129
Electrical conductivity (lab)				945	930	912	958	967	963	1,090	1,110	1,090	1,050	1,030	984	**114**
Temperature	ºC	0.01	-	17.74	18.77	19.60	18.02	21.84	20.18	17.35	19.20	18.67	16.51	21.78	19.91	16.20
Dissolved oxygen	% sat	0.01	80 - 110%*	9.10	20.20	21.00	15.10	34.90	9.40	13.50	3.30	4.70	1.00	2.60	1.70	102.00
Total dissolved solids (field)	mg/L		-	509	574	584	601	608	620	666	678	689	663	650	621	84
Total dissolved solids (lab)		10		507	514	526	440	455	420	536	564	528	540	586	540	47
Total suspended solids	mg/L	5	-	190	82	74	14	13	5	<5	7	6	24	10	<5	<5
Redox	mV	0.1	-	2.0	85.9	88.9	-151.2	-84.9	-101.9	-121.1	-110.0	-138.1	-31.1	-111.9	-2.1	153.5
Water type[a]	-		-	Na-Mg-Cl	Na-Mg-Cl	Na-Mg-Cl	Na-Mg-HCO_3-Cl	Na-Mg-Ca-Cl-HCO_3	Na-Mg-Cl-HCO_3	Na-Ca-HCO_3	Na-Ca-HCO_3	Na-Ca-HCO_3	Na-Cl-HCO_3	Na-HCO_3-Cl	Na-Cl-HCO_3	Na-Cl-HCO_3
Laboratory analytes																
Hydroxide alkalinity as $CaCO_3$	mg/L	1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate alkalinity as $CaCO_3$	mg/L	1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	156	88	209	<1
Bicarbonate alkalinity as $CaCO_3$	mg/L	1	-	16	17	14	230	213	238	493	468	522	133	222	110	16
Total alkalinity as $CaCO_3$	mg/L	1	-	16	17	14	230	213	238	493	468	522	289	310	319	16
Sulfate as SO_4^{2-}	mg/L	1	-	3	3	2	5	4	4	<1	<1	<1	<1	<1	<1	4
Chloride	mg/L	1	-	262	245	258	159	161	170	73	70	77	152	120	126	23
Calcium	mg/L	1	-	12	13	13	29	37	34	74	88	91	3	15	4	1
Magnesium	mg/L	1	-	22	22	23	28	32	31	23	22	23	4	6	5	1
Sodium	mg/L	1	-	115	106	110	110	107	105	124	104	110	246	180	189	14
Potassium	mg/L	1	-	2	1	1	4	4	3	20	12	14	26	13	15	1
Silica (reactive)	mg/L	0.05	-	19.4	18.3	19.2	13.7	12.3	12.7	8.63	8.50	8.82	3.59	4.25	3.48	3.06
Fluoride	mg/L	0.1	-	<0.1	<0.1	<0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.6	0.5	0.6	<0.1
Bromide	mg/L	0.01	-	0.597	0.764	0.601	0.354	0.596	0.409	0.145	0.868	0.213	0.299	0.365	0.275	0.024
Total cyanide	mg/L	0.004	0.01	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Dissolved metals																
Aluminium	mg/L	0.01	0.06	0.10	0.07	0.01	<0.01	<0.01	<0.01	0.06	<0.01	<0.01	0.02	<0.01	<0.01	0.04
Antimony	mg/L	0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	mg/L	0.001	0.013 (As V)	<0.001	<0.001	<0.001	0.003	0.003	0.002	0.031	0.025	0.018	0.002	0.004	0.002	<0.001
Barium	mg/L	0.001	-	0.667	0.691	0.664	0.515	0.629	0.584	3.54	3.48	3.27	0.795	1.23	0.753	0.029
Beryllium	mg/L	0.001	ID	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	mg/L	0.0001	0.00	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	mg/L	0.001	ID	0.042	0.045	0.041	0.001	<0.001	<0.001	0.004	0.004	0.004	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	0.001	0.001	0.002	0.016	0.003	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	0.001	0.001	0.001	<0.001
Lead	mg/L	0.001	0.003	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	0.001	1.900	0.472	0.517	0.488	0.149	0.160	0.144	0.047	0.047	0.047	0.003	0.009	<0.001	0.024
Mercury	mg/L	0.0001	0.00	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00	<0.0001
Molybdenum	mg/L	0.001	ID	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.006	0.004	0.005	0.001
Nickel	mg/L	0.001	0.011	0.016	0.019	0.016	0.002	<0.001	<0.001	0.005	0.004	0.004	<0.001	<0.001	<0.001	<0.001
Selenium	mg/L	0.01	0.011 (total)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	mg/L	0.001	-	0.175	0.155	0.143	0.359	0.355	0.352	1.03	0.957	0.887	0.245	0.30	0.198	0.022
Uranium	mg/L	0.001	ID	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	mg/L	0.01	ID	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	0.005	0.008	0.057	0.062	0.066	0.015	0.058	0.018	0.017	<0.005	0.012	0.026	0.086	0.047	<0.005
Boron	mg/L	0.05	0.37	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	mg/L	0.05	ID	0.18	<0.05	0.06	3.76	4.04	4.21	0.87	0.86	1.13	<0.05	<0.05	<0.05	0.23
Bromine	mg/L	0.1	ID	0.6	0.5	0.7	0.4	0.4	0.4	0.1	0.2	0.2	0.3	0.2	0.3	<0.1
Nutrients																
Ammonia as N	mg/L	0.01	0.02[c]	0.04	0.04	0.02	0.08	0.08	0.06	0.90	0.94	0.92	0.96	0.97	0.86	**0.03**
Nitrite as N	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/L	0.01	0.70	0.14	0.15	0.16	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.18
Total phosphorus	mg/L	0.01	0.05[c]	0.14	0.15	0.05	0.03	0.11	0.02	0.02	0.07	<0.01	0.02	<0.01	<0.01	<0.01
Reactive phosphorus	mg/L	0.01	0.02[c]	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Total organic carbon	mg/L	1	-	3	<1	<1	4	<1	<1	<1	<1	4	20	14	22	4
Dissolved gases																
Methane	mg/L	0.01	-	<0.01	<0.01	<0.01	0.092	0.323	0.273	28.000	37.000	44.600	9.390	41.100	52.300	0.010
Ethane	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ethene	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Propane	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Propene	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Butane	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Butene	mg/L	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenolic compounds																
Phenol	µg/L	1	320	1.2	<1	<1	<1	<1	<1	<1	<1	<1	8.1	3.1	2.8	<1
2-Chlorophenol	µg/L	1	490	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2-Methylphenol	µg/L	1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
3-&4-Methylphenol	µg/L	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
2-Nitrophenol	µg/L	1	ID	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2.4-Dimethylphenol	µg/L	1	ID	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2.4-Dichlorophenol	µg/L	1	160	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2.6-Dichlorophenol	µg/L	1	ID	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
4-Chloro-3-Methylphenol	µg/L	1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2.4.6-Trichlorophenol	µg/L	1	20	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2.4.5-Trichlorophenol	µg/L	1	ID	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pentachlorophenol	µg/L	2	ID	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Polycyclic aromatic hydrocarbons																
Acenaphthylene	µg/L	1	16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acenaphthene	µg/L	1	-	<1	<1	1.1	<1	4.4	1.9	<1	<1	<1	<1	<1	<1	<1
Fluorene	µg/L	1	-	<1	<1	1.3	<1	3.7	1.7	<1	<1	<1	<1	<1	<1	<1
Phenanthrene	µg/L	1	-	<1	<1	1.8	<1	5.6	4.7	<1	<1	<1	<1	<1	<1	<1
Anthracene	µg/L	1	ID	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluoranthene	µg/L	1	ID	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pyrene	µg/L	1	ID	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benz(a)anthracene	µg/L	1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chrysene	µg/L	1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo(b)fluoranthene	µg/L	1	-	<1	-	-	<1	-	-	<1	-	-	<1	-	-	-
Benzo(k)fluoranthene	µg/L	1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo(a)pyrene	µg/L	0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	µg/L	1	ID	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibenz(a.h)anthracene	µg/L	1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo(g.h.i)perylene	µg/L	1	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum of PAHs	ug/L	0.5	-	<0.5	<0.5	4.2	<0.5	17	8.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total petroleum hydrocarbons																
C_6-C_9 fraction	µg/L	20	ID	<20	<20	<20	<20	<20	<20	190	<20	<20	200	80	110	<20
C_{10}-C_{14} fraction	µg/L	50	ID	<50	<50	<50	<50	450	70	<50	<50	<50	<50	<50	<50	<50
C_{15}-C_{28} fraction	µg/L	100	ID	<100	<100	<100	<100	120	<100	<100	<100	<100	<100	<100	<100	<100
C_{29}-C_{36} fraction	µg/L	50	ID	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
C_{10}-C_{36} fraction (sum)	µg/L	50	ID	<50	<50	<50	<50	570	70	<50	<50	<50	<50	<50	<50	<50
Total recoverable hydrocarbons																
C_6-C_{10} fraction	µg/L	20	-	<20	<20	<20	<20	<20	<20	200	<20	<20	210	90	110	<20
C_6-C_{10} fraction minus BTEX	µg/L	20	-	<20	<20	<20	<20	<20	<20	110	<20	<20	110	<20	40	<20
>C_{10}-C_{16} fraction	µg/L	100	-	<100	<100	<100	<100	490	<100	<100	<100	<100	<100	<100	<100	<100
>C_{16}-C_{34} fraction	µg/L	100	-	<100	<100	<100	<100	100	<100	<100	<100	<100	<100	<100	<100	<100
>C_{34}-C_{40} fraction	µg/L	100	-	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
>C_{10}-C_{40} fraction (sum)	µg/L	100	-	<100	<100	<100	<100	590	<100	<100	<100	<100	<100	<100	<100	<100
Aromatic hydrocarbons																
Benzene	µg/L	1	950	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/L	2	ID	<2	<2	<2	<2	<2	<2	94	<2	<2	97	79	66	<2
Ethylbenzene	µg/L	2	ID	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
m&p-Xylenes	µg/L	2	ID	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
o-Xylenes	µg/L	2	ID	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total xlyenes	µg/L	2	350	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Sum of BTEX	µg/L	1	-	<1	<1	<1	<1	<1	<1	94	<1	<1	97	79	66	<1
Naphthalene	µg/L	1	16	<1	<1	<1	<1	<5 - 3.3	<1	<1	<1	<1	<1	<1	<1	<1

Notes:
Bold - Outside guideline range
* Field parameters collected on 18/09/14
(a) Calculated using AQUACHEM.
(b) ANZECC 2000 - Water Quality Guidelines: 95% protection levels (trigger values) for the protection of freshwater aquatic ecosystems.
(c) ANZECC 2000 - Water Quality Guidelines: 95% protection levels (trigger values) for the protection of freshwater aquatic ecosystems, South-East Australia, low lying river ecosystems.

PARSONS BRINCKERHOFF

Appendix C

ALS laboratory reports

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1418991**	Page	: 1 of 13
Client	: **PARSONS BRINCKERHOFF AUST P/L**	Laboratory	: Environmental Division Sydney
Contact	: MS ANDREA MADDEN	Contact	: Client Services
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: amadden@pb.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 9272 5100	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 9272 5101	Facsimile	: +61-2-8784 8500
Project	: 2193361A	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 26-AUG-2014
Sampler	: CR	Issue Date	: 02-SEP-2014
Site	: ----		
		No. of samples received	: 8
Quote number	: EN/008/14	No. of samples analysed	: 8

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
- Surrogate Control Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Dian Dao		Sydney Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics

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

- **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.**
- **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **Ionic Balance out of acceptable limits due to analytes not quantified in this report.**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	GLMB01	GLMB02	GLMB03	MPMB01	MPMB02
				Client sampling date / time	25-AUG-2014 11:45	25-AUG-2014 13:30	25-AUG-2014 12:15	25-AUG-2014 16:00	25-AUG-2014 15:00
					ES1418991-001	ES1418991-002	ES1418991-003	ES1418991-004	ES1418991-005
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**7.40**	**7.39**	**8.77**	**5.58**	**6.92**
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**9640**	**6810**	**5200**	**945**	**958**
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	10	mg/L		**5320**	**3360**	**2460**	**507**	**440**
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		<5	**36**	<5	**190**	**14**
ED009: Anions									
Bromide	24959-67-9	0.010	mg/L		**6.06**	**3.98**	**2.35**	**0.597**	**0.354**
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	**184**	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**683**	**793**	**876**	**16**	**230**
Total Alkalinity as CaCO3	----	1	mg/L		**683**	**793**	**1060**	**16**	**230**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		<1	**5**	<1	**3**	**5**
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		**2710**	**1370**	**934**	**262**	**159**
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**174**	**210**	**16**	**12**	**29**
Magnesium	7439-95-4	1	mg/L		**211**	**87**	**61**	**22**	**28**
Sodium	7440-23-5	1	mg/L		**1360**	**1040**	**957**	**115**	**110**
Potassium	7440-09-7	1	mg/L		**24**	**29**	**32**	**2**	**4**
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	<0.01	**0.01**	**0.10**	<0.01
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L		<0.001	**0.014**	**0.020**	<0.001	**0.003**
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Barium	7440-39-3	0.001	mg/L		**2.64**	**9.78**	**4.49**	**0.667**	**0.515**
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
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		<0.001	<0.001	<0.001	**0.002**	<0.001
Cobalt	7440-48-4	0.001	mg/L		<0.001	<0.001	<0.001	**0.042**	**0.001**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	GLMB01	GLMB02	GLMB03	MPMB01	MPMB02
				Client sampling date / time	25-AUG-2014 11:45	25-AUG-2014 13:30	25-AUG-2014 12:15	25-AUG-2014 16:00	25-AUG-2014 15:00
					ES1418991-001	ES1418991-002	ES1418991-003	ES1418991-004	ES1418991-005
EG020F: Dissolved Metals by ICP-MS - Continued									
Nickel	7440-02-0	0.001	mg/L		**0.002**	**0.002**	<0.001	**0.016**	**0.002**
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L		<0.005	**0.020**	**0.006**	**0.057**	**0.015**
Manganese	7439-96-5	0.001	mg/L		**0.300**	**0.666**	**0.002**	**0.472**	**0.149**
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	**0.005**	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	7440-24-6	0.001	mg/L		**6.33**	**5.14**	**2.06**	**0.175**	**0.359**
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L		**0.19**	**2.97**	<0.05	**0.18**	**3.76**
Bromine	7726-95-6	0.1	mg/L		**7.2**	**4.5**	**2.7**	**0.6**	**0.4**
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		**10.6**	**21.2**	**9.77**	**19.4**	**13.7**
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	<0.004	<0.004	<0.004	<0.004
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.3**	**0.3**	**0.2**	<0.1	**0.2**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**1.71**	**1.88**	**2.37**	**0.04**	**0.08**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	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		<0.01	<0.01	<0.01	**0.14**	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	<0.01	<0.01	**0.14**	<0.01
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.08**	**0.12**	**0.04**	**0.14**	**0.03**
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		**0.06**	**0.06**	<0.01	<0.01	<0.01
EN055: Ionic Balance									

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	GLMB01	GLMB02	GLMB03	MPMB01	MPMB02
				Client sampling date / time	25-AUG-2014 11:45	25-AUG-2014 13:30	25-AUG-2014 12:15	25-AUG-2014 16:00	25-AUG-2014 15:00
					ES1418991-001	ES1418991-002	ES1418991-003	ES1418991-004	ES1418991-005
EN055: Ionic Balance - Continued									
Total Anions	----	0.01	meq/L		**90.1**	**54.6**	**47.5**	**7.77**	**9.18**
Total Cations	----	0.01	meq/L		**85.8**	**63.6**	**48.3**	**7.46**	**8.64**
Ionic Balance	----	0.01	%		**2.44**	**7.62**	**0.73**	**2.04**	**3.08**
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		**3**	**9**	**10**	**3**	**4**
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L		**29900**	**21700**	**18800**	<10	**92**
Ethene	74-85-1	10	µg/L		<10	<10	<10	<10	<10
Ethane	74-84-0	10	µg/L		**1480**	**931**	**118**	<10	<10
Propene	115-07-1	10	µg/L		<10	<10	<10	<10	<10
Propane	74-98-6	10	µg/L		**419**	**194**	**28**	<10	<10
Butene	25167-67-3	10	µg/L		<10	<10	<10	<10	<10
Butane	106-97-8	10	µg/L		**72**	**44**	<10	<10	<10
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1.0	µg/L		**2.0**	**1.8**	**1.5**	**1.2**	<1.0
2-Chlorophenol	95-57-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2-Methylphenol	95-48-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
3- & 4-Methylphenol	1319-77-3	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	<2.0
2-Nitrophenol	88-75-5	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4-Dimethylphenol	105-67-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4-Dichlorophenol	120-83-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.6-Dichlorophenol	87-65-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Pentachlorophenol	87-86-5	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	<2.0
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: GLMB01	GLMB02	GLMB03	MPMB01	MPMB02
				Client sampling date / time: 25-AUG-2014 11:45	25-AUG-2014 13:30	25-AUG-2014 12:15	25-AUG-2014 16:00	25-AUG-2014 15:00
				ES1418991-001	ES1418991-002	ES1418991-003	ES1418991-004	ES1418991-005
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Fluoranthene	206-44-0	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	129-00-0	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Chrysene	218-01-9	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(b+j)fluoranthene	205-99-2	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	**210**	**210**	**310**	<20	<20
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50
^ **C10 - C36 Fraction (sum)**	----	50	µg/L	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013								
C6 - C10 Fraction	C6_C10	20	µg/L	**290**	**220**	**310**	<20	<20
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L	**290**	**210**	**170**	<20	<20
>C10 - C16 Fraction	>C10_C16	100	µg/L	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L	<100	<100	<100	<100	<100
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L	<100	<100	<100	<100	<100
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	<2	**10**	**139**	<2	<2
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	<2

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	GLMB01	GLMB02	GLMB03	MPMB01	MPMB02
				Client sampling date / time	25-AUG-2014 11:45	25-AUG-2014 13:30	25-AUG-2014 12:15	25-AUG-2014 16:00	25-AUG-2014 15:00
					ES1418991-001	ES1418991-002	ES1418991-003	ES1418991-004	ES1418991-005
EP080: BTEXN - Continued									
^ **Total Xylenes**	1330-20-7	2	µg/L		<2	<2	<2	<2	<2
^ **Sum of BTEX**	----	1	µg/L		<1	**10**	**139**	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		**25.3**	**31.3**	**22.4**	**29.5**	**27.2**
2-Chlorophenol-D4	93951-73-6	0.1	%		**48.5**	**61.2**	**46.3**	**60.6**	**56.3**
2.4.6-Tribromophenol	118-79-6	0.1	%		**58.8**	**81.2**	**54.7**	**58.8**	**56.4**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		**58.2**	**72.5**	**58.8**	**81.6**	**75.2**
Anthracene-d10	1719-06-8	0.1	%		**91.6**	**95.2**	**67.8**	**91.4**	**82.9**
4-Terphenyl-d14	1718-51-0	0.1	%		**76.4**	**96.6**	**66.5**	**90.9**	**80.3**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		**111**	**105**	**102**	**106**	**108**
Toluene-D8	2037-26-5	0.1	%		**98.8**	**97.9**	**95.6**	**95.6**	**94.9**
4-Bromofluorobenzene	460-00-4	0.1	%		**102**	**97.3**	**96.1**	**97.2**	**95.7**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: MPMB03	MPMB04	QA	----	----
				Client sampling date / time: 26-AUG-2014 11:30	26-AUG-2014 12:40	25-AUG-2014 15:00	----	----
				ES1418991-006	ES1418991-007	ES1418991-008	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.47**	**9.70**	**7.45**	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1090**	**1050**	**9650**	----	----
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	**536**	**540**	**4540**	----	----
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	<5	**24**	<5	----	----
ED009: Anions								
Bromide	24959-67-9	0.010	mg/L	**0.145**	**0.299**	**7.11**	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	**156**	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**493**	**133**	**679**	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**493**	**289**	**679**	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	<1	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	**73**	**152**	**2730**	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**74**	**3**	**185**	----	----
Magnesium	7439-95-4	1	mg/L	**23**	**4**	**220**	----	----
Sodium	7440-23-5	1	mg/L	**124**	**246**	**1460**	----	----
Potassium	7440-09-7	1	mg/L	**20**	**26**	**27**	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.06**	**0.02**	**0.01**	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.031**	**0.002**	<0.001	----	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Barium	7440-39-3	0.001	mg/L	**3.54**	**0.795**	**2.67**	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Copper	7440-50-8	0.001	mg/L	**0.003**	**0.001**	<0.001	----	----
Cobalt	7440-48-4	0.001	mg/L	**0.004**	<0.001	<0.001	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MPMB03	MPMB04	QA	----	----
				Client sampling date / time	26-AUG-2014 11:30	26-AUG-2014 12:40	25-AUG-2014 15:00	----	----
					ES1418991-006	ES1418991-007	ES1418991-008	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Nickel	7440-02-0	0.001	mg/L		**0.005**	<0.001	**0.004**	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Zinc	7440-66-6	0.005	mg/L		**0.017**	**0.026**	**0.009**	----	----
Manganese	7439-96-5	0.001	mg/L		**0.047**	**0.003**	**0.298**	----	----
Molybdenum	7439-98-7	0.001	mg/L		<0.001	**0.006**	<0.001	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	----	----
Strontium	7440-24-6	0.001	mg/L		**1.03**	**0.245**	**6.43**	----	----
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	----	----
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	----	----
Iron	7439-89-6	0.05	mg/L		**0.87**	<0.05	**0.20**	----	----
Bromine	7726-95-6	0.1	mg/L		**0.1**	**0.3**	**7.4**	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	----
EG052G: Silica by Discrete Analyser									
Reactive Silica	----	0.05	mg/L		**8.63**	**3.59**	**10.3**	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	<0.004	<0.004	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	**0.6**	**0.3**	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.90**	**0.96**	**1.66**	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	<0.01	<0.01	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	<0.01	<0.01	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	<0.01	<0.01	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.02**	**0.02**	**0.13**	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		<0.01	<0.01	**0.06**	----	----
EN055: Ionic Balance									

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MPMB03	MPMB04	QA	----	----
				Client sampling date / time	26-AUG-2014 11:30	26-AUG-2014 12:40	25-AUG-2014 15:00	----	----
					ES1418991-006	ES1418991-007	ES1418991-008	----	----
EN055: Ionic Balance - Continued									
Total Anions	----	0.01	meq/L		**11.9**	**10.1**	**90.6**	----	----
Total Cations	----	0.01	meq/L		**11.5**	**11.8**	**91.5**	----	----
Ionic Balance	----	0.01	%		**1.80**	**8.10**	**0.51**	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		<1	**20**	**4**	----	----
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L		**28000**	**9390**	**28800**	----	----
Ethene	74-85-1	10	µg/L		<10	<10	<10	----	----
Ethane	74-84-0	10	µg/L		<10	<10	**1480**	----	----
Propene	115-07-1	10	µg/L		<10	<10	<10	----	----
Propane	74-98-6	10	µg/L		<10	<10	**402**	----	----
Butene	25167-67-3	10	µg/L		<10	<10	<10	----	----
Butane	106-97-8	10	µg/L		<10	<10	**90**	----	----
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1.0	µg/L		<1.0	**8.1**	<1.0	----	----
2-Chlorophenol	95-57-8	1.0	µg/L		<1.0	<1.0	<1.0	----	----
2-Methylphenol	95-48-7	1.0	µg/L		<1.0	<1.0	<1.0	----	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L		<2.0	<2.0	<2.0	----	----
2-Nitrophenol	88-75-5	1.0	µg/L		<1.0	<1.0	<1.0	----	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L		<1.0	<1.0	<1.0	----	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L		<1.0	<1.0	<1.0	----	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L		<1.0	<1.0	<1.0	----	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L		<1.0	<1.0	<1.0	----	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L		<1.0	<1.0	<1.0	----	----
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Pentachlorophenol	87-86-5	2.0	µg/L		<2.0	<2.0	<2.0	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	<1.0	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: MPMB03	MPMB04	QA	----	----
				Client sampling date / time: 26-AUG-2014 11:30	26-AUG-2014 12:40	25-AUG-2014 15:00	----	----
				ES1418991-006	ES1418991-007	ES1418991-008	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Fluoranthene	206-44-0	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Pyrene	129-00-0	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Chrysene	218-01-9	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Benzo(b+j)fluoranthene	205-99-2	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	<0.5	<0.5	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	<1.0	<1.0	----	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L	<0.5	<0.5	<0.5	----	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L	<0.5	<0.5	<0.5	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	**190**	**200**	**240**	----	----
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	----	----
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	----	----
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	----	----
^ **C10 - C36 Fraction (sum)**	----	50	µg/L	<50	<50	<50	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013								
C6 - C10 Fraction	C6_C10	20	µg/L	**200**	**210**	**290**	----	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L	**110**	**110**	**290**	----	----
>C10 - C16 Fraction	>C10_C16	100	µg/L	<100	<100	<100	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	----	----
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L	<100	<100	<100	----	----
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L	<100	<100	<100	----	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	<1	----	----
Toluene	108-88-3	2	µg/L	**94**	**97**	<2	----	----
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	----	----
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MPMB03	MPMB04	QA	----	----
				Client sampling date / time	26-AUG-2014 11:30	26-AUG-2014 12:40	25-AUG-2014 15:00	----	----
Compound	CAS Number	LOR	Unit		ES1418991-006	ES1418991-007	ES1418991-008	----	----
EP080: BTEXN - Continued									
^ **Total Xylenes**	1330-20-7	2	µg/L		<2	<2	<2	----	----
^ **Sum of BTEX**	----	1	µg/L		**94**	**97**	<1	----	----
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		**27.6**	**27.8**	**25.9**	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%		**58.6**	**55.0**	**52.4**	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%		**51.2**	**64.2**	**61.8**	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		**74.4**	**73.7**	**65.7**	----	----
Anthracene-d10	1719-06-8	0.1	%		**86.6**	**83.5**	**100**	----	----
4-Terphenyl-d14	1718-51-0	0.1	%		**81.5**	**82.1**	**80.6**	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		**105**	**107**	**104**	----	----
Toluene-D8	2037-26-5	0.1	%		**93.7**	**95.8**	**94.4**	----	----
4-Bromofluorobenzene	460-00-4	0.1	%		**94.9**	**97.3**	**95.3**	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10.0	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27.4	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

CERTIFICATE OF ANALYSIS

Work Order	: **ES1419407**	Page	: 1 of 8
Client	: **PARSONS BRINCKERHOFF AUST P/L**	Laboratory	: Environmental Division Sydney
Contact	: MS ANDREA MADDEN	Contact	: Client Services
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: amadden@pb.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 9272 5100	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 9272 5101	Facsimile	: +61-2-8784 8500
Project	: 2193361A	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 29-AUG-2014
Sampler	: CR	Issue Date	: 04-SEP-2014
Site	: ----		
		No. of samples received	: 2
Quote number	: SY/743/14 V2	No. of samples analysed	: 2

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
- Surrogate Control Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Dian Dao		Sydney Inorganics
Phalak Inthakesone	Laboratory Manager - Organics	Sydney Organics
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

- **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.**
- **ED041G: LOR raised for Sulfate analysis on sample ID:RMB02 due to matrix interferences.**
- **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **Ionic Balance out of acceptable limits due to analytes not quantified in this report.**
- **It has been noted that Nitrite is greater than NOx on sample ID (RMB02 ,RMB03), however this difference is within the limits of experimental variation.**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	RMB02	RMB03	----	----	----
			Client sampling date / time	[29-AUG-2014]	[29-AUG-2014]	----	----	----
Compound	CAS Number	LOR	Unit	ES1419407-001	ES1419407-002	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.18**	**9.48**	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**10600**	**7940**	----	----	----
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	**5440**	**3830**	----	----	----
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	<5	----	----	----	----
Suspended Solids (SS)	----	5	mg/L	----	<5	----	----	----
ED009: Anions								
Bromide	24959-67-9	0.010	mg/L	**5.88**	**4.71**	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	**298**	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**972**	**239**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**972**	**537**	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<10	<1	----	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	**3120**	**1760**	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**270**	**6**	----	----	----
Magnesium	7439-95-4	1	mg/L	**81**	**14**	----	----	----
Sodium	7440-23-5	1	mg/L	**1740**	**1610**	----	----	----
Potassium	7440-09-7	1	mg/L	**37**	**22**	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	**0.001**	----	----	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	----	----	----
Barium	7440-39-3	0.001	mg/L	**40.0**	**4.35**	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	RMB02	RMB03	----	----	----
				Client sampling date / time	[29-AUG-2014]	[29-AUG-2014]	----	----	----
Compound	CAS Number	LOR	Unit		ES1419407-001	ES1419407-002	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Copper	7440-50-8	0.001	mg/L		<0.001	**0.002**	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L		**0.026**	<0.001	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		<0.001	**0.004**	----	----	----
Nickel	7440-02-0	0.001	mg/L		<0.001	<0.001	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	----	----	----
Strontium	7440-24-6	0.001	mg/L		**8.18**	**1.64**	----	----	----
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	----	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	----	----	----
Zinc	7440-66-6	0.005	mg/L		**0.017**	**0.053**	----	----	----
Boron	7440-42-8	0.05	mg/L		<0.05	**0.15**	----	----	----
Iron	7439-89-6	0.05	mg/L		**4.81**	<0.05	----	----	----
Bromine	7726-95-6	0.1	mg/L		**7.9**	**5.8**	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	----	----	----
EG052G: Silica by Discrete Analyser									
Reactive Silica	----	0.05	mg/L		**11.6**	**7.30**	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	<0.004	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	**0.4**	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**4.30**	**3.73**	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		**0.04**	**0.04**	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	<0.01	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.03**	**0.02**	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		<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	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	RMB02	RMB03	----	----	----
				Client sampling date / time	[29-AUG-2014]	[29-AUG-2014]	----	----	----
Compound	CAS Number	LOR	Unit		ES1419407-001	ES1419407-002	----	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**107**	**60.4**	----	----	----
Total Cations	----	0.01	meq/L		**96.8**	**72.0**	----	----	----
Ionic Balance	----	0.01	%		**5.23**	**8.78**	----	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		<1	**28**	----	----	----
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L		**33100**	**40900**	----	----	----
Ethene	74-85-1	10	µg/L		<10	<10	----	----	----
Ethane	74-84-0	10	µg/L		**11**	<10	----	----	----
Propene	115-07-1	10	µg/L		<10	<10	----	----	----
Propane	74-98-6	10	µg/L		<10	<10	----	----	----
Butene	25167-67-3	10	µg/L		<10	<10	----	----	----
Butane	106-97-8	10	µg/L		<10	<10	----	----	----
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1.0	µg/L		<1.0	<1.0	----	----	----
2-Chlorophenol	95-57-8	1.0	µg/L		<1.0	<1.0	----	----	----
2-Methylphenol	95-48-7	1.0	µg/L		<1.0	<1.0	----	----	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L		<2.0	<2.0	----	----	----
2-Nitrophenol	88-75-5	1.0	µg/L		<1.0	<1.0	----	----	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L		<1.0	<1.0	----	----	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L		<1.0	<1.0	----	----	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L		<1.0	<1.0	----	----	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L		<1.0	<1.0	----	----	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L		<1.0	<1.0	----	----	----
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L		<1.0	<1.0	----	----	----
Pentachlorophenol	87-86-5	2.0	µg/L		<2.0	<2.0	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	----	----	----
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	----	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	RMB02	RMB03	----	----	----
			Client sampling date / time	[29-AUG-2014]	[29-AUG-2014]	----	----	----
Compound	CAS Number	LOR	Unit	ES1419407-001	ES1419407-002	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Fluoranthene	206-44-0	1.0	µg/L	<1.0	<1.0	----	----	----
Pyrene	129-00-0	1.0	µg/L	<1.0	<1.0	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	<1.0	----	----	----
Chrysene	218-01-9	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(b+j)fluoranthene	205-99-2	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	<1.0	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	<1.0	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	<0.5	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	**70**	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	**90**	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	<100	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	<50	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	**90**	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	**70**	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	**20**	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
>C10 - C16 Fraction	>C10_C16	100	µg/L	<100	<100	----	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	<100	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	<100	----	----	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	----	----	----
Toluene	108-88-3	2	µg/L	**8**	**48**	----	----	----
Ethylbenzene	100-41-4	2	µg/L	<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	RMB02	RMB03	----	----	----
				Client sampling date / time	[29-AUG-2014]	[29-AUG-2014]	----	----	----
Compound	CAS Number	LOR	Unit		ES1419407-001	ES1419407-002	----	----	----
EP080: BTEXN - Continued									
ortho-Xylene	95-47-6	2	µg/L		<2	<2	----	----	----
^ Total Xylenes	1330-20-7	2	µg/L		<2	<2	----	----	----
^ Sum of BTEX	----	1	µg/L		8	48	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	<5	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		25.6	29.7	----	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%		53.3	62.7	----	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%		46.8	80.8	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		62.0	74.7	----	----	----
Anthracene-d10	1719-06-8	0.1	%		74.8	81.4	----	----	----
4-Terphenyl-d14	1718-51-0	0.1	%		75.7	85.5	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		100	96.9	----	----	----
Toluene-D8	2037-26-5	0.1	%		105	102	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%		86.9	81.7	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10.0	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27.4	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1420206**	Page	: 1 of 8
Amendment	: **1**		
Client	: **PARSONS BRINCKERHOFF AUST P/L**	Laboratory	: Environmental Division Sydney
Contact	: MS ANDREA MADDEN	Contact	: Client Services
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: amadden@pb.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 9272 5100	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 9272 5101	Facsimile	: +61-2-8784 8500
Project	: 2193361A	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 09-SEP-2014
Sampler	: CR	Issue Date	: 03-AUG-2015
Site	: ----		
		No. of samples received	: 1
Quote number	: SY/743/14 V2	No. of samples analysed	: 1

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
- Surrogate Control Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Dian Dao	Inorganic Chemist	Sydney Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics
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

- **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.**
- **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **This report has been amended as a result of a request to change sample identification numbers (IDs) received by ALS from Carolina Sardella on the 3rd August 2015. All analysis results are as per the previous report.**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	NR	----	----	----	----
			Client sampling date / time	[09-SEP-2014]	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1420206-001	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.37**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**114**	----	----	----	----
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	**47**	----	----	----	----
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	<5	----	----	----	----
ED009: Anions								
Bromide	24959-67-9	0.010	mg/L	**0.024**	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**16**	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**16**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**4**	----	----	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	**23**	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**1**	----	----	----	----
Magnesium	7439-95-4	1	mg/L	**1**	----	----	----	----
Sodium	7440-23-5	1	mg/L	**14**	----	----	----	----
Potassium	7440-09-7	1	mg/L	**1**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.04**	----	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	----	----	----	----
Barium	7440-39-3	0.001	mg/L	**0.029**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	NR	----	----	----	----
				Client sampling date / time	[09-SEP-2014]	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1420206-001	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.024**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	**0.001**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Strontium	7440-24-6	0.001	mg/L	**0.022**	----	----	----	----
Uranium	7440-61-1	0.001	mg/L	<0.001	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	----	----	----	----
Boron	7440-42-8	0.05	mg/L	<0.05	----	----	----	----
Iron	7439-89-6	0.05	mg/L	**0.23**	----	----	----	----
Bromine	7726-95-6	0.1	mg/L	<0.1	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
EG052G: Silica by Discrete Analyser									
Reactive Silica	----	0.05	mg/L	**3.06**	----	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L	<0.004	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	<0.1	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	**0.03**	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	14797-65-0	0.01	mg/L	<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	**0.18**	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	**0.18**	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	<0.01	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	----	----	----	----
EN055: Ionic Balance									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	NR	----	----	----	----
				Client sampling date / time	[09-SEP-2014]	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1420206-001	----	----	----	----
EN055: Ionic Balance - Continued									
Total Anions	----	0.01	meq/L	**1.05**	----	----	----	----
Total Cations	----	0.01	meq/L	**0.83**	----	----	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L	**4**	----	----	----	----
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L	**10**	----	----	----	----
Ethene	74-85-1	10	µg/L	<10	----	----	----	----
Ethane	74-84-0	10	µg/L	<10	----	----	----	----
Propene	115-07-1	10	µg/L	<10	----	----	----	----
Propane	74-98-6	10	µg/L	<10	----	----	----	----
Butene	25167-67-3	10	µg/L	<10	----	----	----	----
Butane	106-97-8	10	µg/L	<10	----	----	----	----
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1.0	µg/L	<1.0	----	----	----	----
2-Chlorophenol	95-57-8	1.0	µg/L	<1.0	----	----	----	----
2-Methylphenol	95-48-7	1.0	µg/L	<1.0	----	----	----	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L	<2.0	----	----	----	----
2-Nitrophenol	88-75-5	1.0	µg/L	<1.0	----	----	----	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L	<1.0	----	----	----	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L	<1.0	----	----	----	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L	<1.0	----	----	----	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L	<1.0	----	----	----	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L	<1.0	----	----	----	----
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L	<1.0	----	----	----	----
Pentachlorophenol	87-86-5	2.0	µg/L	<2.0	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L	<1.0	----	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	----	----	----	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	----	----	----	----
Fluorene	86-73-7	1.0	µg/L	<1.0	----	----	----	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	----	----	----	----
Anthracene	120-12-7	1.0	µg/L	<1.0	----	----	----	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	NR	----	----	----	----
				Client sampling date / time	[09-SEP-2014]	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1420206-001	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Pyrene	129-00-0	1.0	µg/L	<1.0	----	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	----	----	----	----
Chrysene	218-01-9	1.0	µg/L	<1.0	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	<1.0	----	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	----	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	----	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L	<20	----	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	----	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	----	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	----	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	----	----	----	----
>C10 - C16 Fraction	>C10_C16	100	µg/L	<100	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	----	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	----	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L	<1	----	----	----	----
Toluene	108-88-3	2	µg/L	<2	----	----	----	----
Ethylbenzene	100-41-4	2	µg/L	<2	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	----	----	----	----
ortho-Xylene	95-47-6	2	µg/L	<2	----	----	----	----
^ Total Xylenes	1330-20-7	2	µg/L	<2	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	NR	----	----	----	----
				Client sampling date / time	[09-SEP-2014]	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1420206-001	----	----	----	----
EP080: BTEXN - Continued									
^ Sum of BTEX	----	1	µg/L	<1	----	----	----	----
Naphthalene	91-20-3	5	µg/L	<5	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%	**31.7**	----	----	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%	**62.6**	----	----	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%	**74.6**	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%	**72.3**	----	----	----	----
Anthracene-d10	1719-06-8	0.1	%	**87.2**	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.1	%	**79.4**	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%	**104**	----	----	----	----
Toluene-D8	2037-26-5	0.1	%	**95.2**	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	**90.1**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	Recovery Limits (%) High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10.0	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27.4	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1500565**	Page	: 1 of 8
Amendment	: **3**		
Client	: **PARSONS BRINCKERHOFF AUST P/L**	Laboratory	: Environmental Division Sydney
Contact	: MS ANDREA MADDEN	Contact	: Loren Schiavon
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
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Project	: 2268518A	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 13-JAN-2015
Sampler	: CS	Issue Date	: 19-MAR-2015
Site	: ----		
		No. of samples received	: 4
Quote number	: SY/743/14 V2	No. of samples analysed	: 4

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
- Surrogate Control Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Edwandy Fadjar	Organic Coordinator	Sydney Organics

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

- **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.**
- **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **This report has been amended and re-released to allow the reporting of additional analytical data.**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MPMB01	MPMB02	MPMB03	MPMB04	----
				Client sampling date / time	12-JAN-2015 12:30	12-JAN-2015 12:30	12-JAN-2015 11:30	12-JAN-2015 12:15	----
					ES1500565-001	ES1500565-002	ES1500565-003	ES1500565-004	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**5.65**	**6.86**	**7.54**	**9.23**	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**930**	**967**	**1110**	**1030**	----
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	10	mg/L		**514**	**455**	**564**	**586**	----
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		**82**	**13**	**7**	**10**	----
ED009: Anions									
Bromide	24959-67-9	0.010	mg/L		**0.764**	**0.596**	**0.868**	**0.365**	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	**88**	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**17**	**213**	**468**	**222**	----
Total Alkalinity as CaCO3	----	1	mg/L		**17**	**213**	**468**	**310**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**3**	**4**	<1	<1	----
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		**245**	**161**	**70**	**120**	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**13**	**37**	**88**	**15**	----
Magnesium	7439-95-4	1	mg/L		**22**	**32**	**22**	**6**	----
Sodium	7440-23-5	1	mg/L		**106**	**107**	**104**	**180**	----
Potassium	7440-09-7	1	mg/L		**1**	**4**	**12**	**13**	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.07**	<0.01	<0.01	<0.01	----
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Arsenic	7440-38-2	0.001	mg/L		<0.001	**0.003**	**0.025**	**0.004**	----
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Barium	7440-39-3	0.001	mg/L		**0.691**	**0.629**	**3.48**	**1.23**	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Cobalt	7440-48-4	0.001	mg/L		**0.045**	<0.001	**0.004**	<0.001	----
Copper	7440-50-8	0.001	mg/L		**0.016**	<0.001	<0.001	**0.001**	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MPMB01	MPMB02	MPMB03	MPMB04	----
				Client sampling date / time	12-JAN-2015 12:30	12-JAN-2015 12:30	12-JAN-2015 11:30	12-JAN-2015 12:15	----
					ES1500565-001	ES1500565-002	ES1500565-003	ES1500565-004	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Manganese	7439-96-5	0.001	mg/L		**0.517**	**0.160**	**0.047**	**0.009**	----
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	<0.001	**0.004**	----
Nickel	7440-02-0	0.001	mg/L		**0.019**	<0.001	**0.004**	<0.001	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----
Strontium	7440-24-6	0.001	mg/L		**0.155**	**0.355**	**0.957**	**0.300**	----
Tin	7440-31-5	0.001	mg/L		<0.001	**0.002**	<0.001	<0.001	----
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----
Zinc	7440-66-6	0.005	mg/L		**0.062**	**0.058**	<0.005	**0.086**	----
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	----
Iron	7439-89-6	0.05	mg/L		<0.05	**4.04**	**0.86**	<0.05	----
Bromine	7726-95-6	0.1	mg/L		**0.5**	**0.4**	**0.2**	**0.2**	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	----
EG052G: Silica by Discrete Analyser									
Reactive Silica	----	0.05	mg/L		**18.3**	**12.3**	**8.50**	**4.25**	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	<0.004	<0.004	<0.004	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<0.1	**0.2**	**0.2**	**0.5**	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.04**	**0.08**	**0.94**	**0.97**	----
EK055G-NH4: Ammonium as N by DA									
Ammonium as N	----	0.01	mg/L		**0.04**	**0.08**	**0.94**	**0.47**	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<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		**0.15**	<0.01	<0.01	<0.01	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.15**	<0.01	<0.01	<0.01	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.15**	**0.11**	**0.07**	<0.01	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MPMB01	MPMB02	MPMB03	MPMB04	----
				Client sampling date / time	12-JAN-2015 12:30	12-JAN-2015 12:30	12-JAN-2015 11:30	12-JAN-2015 12:15	----
Compound	CAS Number	LOR	Unit		ES1500565-001	ES1500565-002	ES1500565-003	ES1500565-004	----
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	<0.01	----
EK084: Un-ionized Hydrogen Sulfide									
Unionized Hydrogen Sulfide	----	0.1	mg/L		<0.1	<0.1	<0.1	<0.1	----
EK085M: Sulfide as S2-									
Sulfide as S2-	18496-25-8	0.1	mg/L		<0.1	<0.1	<0.1	<0.1	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**7.31**	**8.88**	**11.3**	**9.58**	----
Total Cations	----	0.01	meq/L		**7.10**	**9.24**	**11.0**	**9.40**	----
Ionic Balance	----	0.01	%		**1.52**	**1.95**	**1.32**	**0.96**	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		<1	<1	<1	**14**	----
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L		<10	**323**	**37000**	**41100**	----
Ethene	74-85-1	10	µg/L		<10	<10	<10	<10	----
Ethane	74-84-0	10	µg/L		<10	<10	<10	<10	----
Propene	115-07-1	10	µg/L		<10	<10	<10	<10	----
Propane	74-98-6	10	µg/L		<10	<10	<10	<10	----
Butene	25167-67-3	10	µg/L		<10	<10	<10	<10	----
Butane	106-97-8	10	µg/L		<10	<10	<10	<10	----
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1.0	µg/L		<1.0	<1.0	<1.0	**3.1**	----
2-Chlorophenol	95-57-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
2-Methylphenol	95-48-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	----
2-Nitrophenol	88-75-5	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Pentachlorophenol	87-86-5	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MPMB01	MPMB02	MPMB03	MPMB04	----
				Client sampling date / time	12-JAN-2015 12:30	12-JAN-2015 12:30	12-JAN-2015 11:30	12-JAN-2015 12:15	----
					ES1500565-001	ES1500565-002	ES1500565-003	ES1500565-004	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Naphthalene	91-20-3	1.0	µg/L		<1.0	**3.3**	<1.0	<1.0	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	**4.4**	<1.0	<1.0	----
Fluorene	86-73-7	1.0	µg/L		<1.0	**3.7**	<1.0	<1.0	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	**5.6**	<1.0	<1.0	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L		<0.5	**17.0**	<0.5	<0.5	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	**80**	----
C10 - C14 Fraction	----	50	µg/L		<50	**450**	<50	<50	----
C15 - C28 Fraction	----	100	µg/L		<100	**120**	<100	<100	----
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	----
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		<50	**570**	<50	<50	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		<20	<20	<20	**90**	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		<20	<20	<20	<20	----
>C10 - C16 Fraction	>C10_C16	100	µg/L		<100	**490**	<100	<100	----
>C16 - C34 Fraction	----	100	µg/L		<100	**100**	<100	<100	----
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	----
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		<100	**590**	<100	<100	----
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	**490**	<100	<100	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	MPMB01	MPMB02	MPMB03	MPMB04	----
			Client sampling date / time	12-JAN-2015 12:30	12-JAN-2015 12:30	12-JAN-2015 11:30	12-JAN-2015 12:15	----
Compound	CAS Number	LOR	Unit	ES1500565-001	ES1500565-002	ES1500565-003	ES1500565-004	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	----
Toluene	108-88-3	2	µg/L	<2	<2	<2	**79**	----
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	----
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	----
^ **Total Xylenes**	1330-20-7	2	µg/L	<2	<2	<2	<2	----
^ **Sum of BTEX**	----	1	µg/L	<1	<1	<1	**79**	----
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.1	%	**25.9**	**26.3**	**24.8**	**18.0**	----
2-Chlorophenol-D4	93951-73-6	0.1	%	**62.9**	**60.0**	**58.6**	**28.9**	----
2.4.6-Tribromophenol	118-79-6	0.1	%	**67.3**	**70.7**	**59.8**	**23.1**	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.1	%	**71.1**	**69.9**	**72.7**	**59.6**	----
Anthracene-d10	1719-06-8	0.1	%	**82.5**	**73.8**	**79.4**	**66.0**	----
4-Terphenyl-d14	1718-51-0	0.1	%	**86.2**	**86.0**	**80.7**	**68.7**	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	**112**	**112**	**112**	**111**	----
Toluene-D8	2037-26-5	0.1	%	**126**	**126**	**125**	**124**	----
4-Bromofluorobenzene	460-00-4	0.1	%	**109**	**109**	**112**	**114**	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10.0	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27.4	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

CERTIFICATE OF ANALYSIS

Work Order	: **ES1500625**	Page	: 1 of 8
Client	: **PARSONS BRINCKERHOFF AUST P/L**	Laboratory	: Environmental Division Sydney
Contact	: MS ANDREA MADDEN	Contact	: Loren Schiavon
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: amadden@pb.com.au	E-mail	: loren.schiavon@alsglobal.com
Telephone	: +61 02 9272 5100	Telephone	: +61 2 8784 8503
Facsimile	: +61 02 9272 5101	Facsimile	: +61 2 8784 8500
Project	: 2268518A	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 14-JAN-2015
Sampler	: CS	Issue Date	: 22-JAN-2015
Site	: ----		
		No. of samples received	: 2
Quote number	: SY/743/14 V2	No. of samples analysed	: 2

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.

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- General Comments
- Analytical Results
- Surrogate Control Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Edwandy Fadjar	Organic Coordinator	Sydney Organics
Shobhna Chandra	Metals Coordinator	Sydney Inorganics

General Comments

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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.**
- **EK071G: It has been noted that Reactive P is greater than Total P for sample ID(RMB02), however this difference is within the limits of experimental variation.**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	RMB02	RMB03	----	----	----
			Client sampling date / time	13-JAN-2015 14:15	13-JAN-2015 15:00	----	----	----
Compound	CAS Number	LOR	Unit	ES1500625-001	ES1500625-002	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.39**	**9.60**	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**10500**	**7690**	----	----	----
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	**5980**	**4130**	----	----	----
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	<5	<5	----	----	----
ED009: Anions								
Bromide	24959-67-9	0.010	mg/L	**8.89**	**6.05**	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	**229**	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**792**	**189**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**792**	**418**	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	<1	----	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	**3170**	**2290**	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**382**	**14**	----	----	----
Magnesium	7439-95-4	1	mg/L	**83**	**11**	----	----	----
Sodium	7440-23-5	1	mg/L	**1770**	**1570**	----	----	----
Potassium	7440-09-7	1	mg/L	**30**	**16**	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	**0.001**	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	**0.001**	----	----	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	----	----	----
Barium	7440-39-3	0.001	mg/L	**33.2**	**5.07**	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	<0.001	**0.001**	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	RMB02	RMB03	----	----	----
				Client sampling date / time	13-JAN-2015 14:15	13-JAN-2015 15:00	----	----	----
					ES1500625-001	ES1500625-002	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	----	----	----
Manganese	7439-96-5	0.001	mg/L		**0.024**	**0.001**	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		<0.001	**0.004**	----	----	----
Nickel	7440-02-0	0.001	mg/L		**0.003**	<0.001	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	----	----	----
Strontium	7440-24-6	0.001	mg/L		**9.97**	**1.83**	----	----	----
Tin	7440-31-5	0.001	mg/L		<0.001	<0.001	----	----	----
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	----	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	----	----	----
Zinc	7440-66-6	0.005	mg/L		**0.033**	**0.039**	----	----	----
Boron	7440-42-8	0.05	mg/L		<0.05	**0.15**	----	----	----
Iron	7439-89-6	0.05	mg/L		**4.73**	<0.05	----	----	----
Bromine	7726-95-6	0.1	mg/L		**7.8**	**5.7**	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	----	----	----
EG052G: Silica by Discrete Analyser									
Reactive Silica	----	0.05	mg/L		**9.66**	**6.24**	----	----	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	<0.004	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	**0.4**	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**4.55**	**3.36**	----	----	----
EK055G-NH4: Ammonium as N by DA									
Ammonium as N	----	0.01	mg/L		**4.55**	**1.23**	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	<0.01	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	<0.01	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.02**	<0.01	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	RMB02	RMB03	----	----	----
				Client sampling date / time	13-JAN-2015 14:15	13-JAN-2015 15:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1500625-001	ES1500625-002	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		**0.03**	<0.01	----	----	----
EK084: Un-ionized Hydrogen Sulfide									
Unionized Hydrogen Sulfide	----	0.1	mg/L		<0.1	<0.1	----	----	----
EK085M: Sulfide as S2-									
Sulfide as S2-	18496-25-8	0.1	mg/L		**0.3**	**0.2**	----	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**105**	**73.0**	----	----	----
Total Cations	----	0.01	meq/L		**104**	**70.3**	----	----	----
Ionic Balance	----	0.01	%		**0.77**	**1.87**	----	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		<1	**38**	----	----	----
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L		**22800**	**36800**	----	----	----
Ethene	74-85-1	10	µg/L		<10	<10	----	----	----
Ethane	74-84-0	10	µg/L		<10	**12**	----	----	----
Propene	115-07-1	10	µg/L		<10	<10	----	----	----
Propane	74-98-6	10	µg/L		<10	<10	----	----	----
Butene	25167-67-3	10	µg/L		<10	<10	----	----	----
Butane	106-97-8	10	µg/L		<10	<10	----	----	----
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1.0	µg/L		<1.0	<1.0	----	----	----
2-Chlorophenol	95-57-8	1.0	µg/L		<1.0	<1.0	----	----	----
2-Methylphenol	95-48-7	1.0	µg/L		<1.0	<1.0	----	----	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L		<2.0	<2.0	----	----	----
2-Nitrophenol	88-75-5	1.0	µg/L		<1.0	<1.0	----	----	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L		<1.0	<1.0	----	----	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L		<1.0	<1.0	----	----	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L		<1.0	<1.0	----	----	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L		<1.0	<1.0	----	----	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L		<1.0	<1.0	----	----	----
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L		<1.0	<1.0	----	----	----
Pentachlorophenol	87-86-5	2.0	µg/L		<2.0	<2.0	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	RMB02	RMB03	----	----	----
			Client sampling date / time	13-JAN-2015 14:15	13-JAN-2015 15:00	----	----	----
Compound	CAS Number	LOR	Unit	ES1500625-001	ES1500625-002	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Naphthalene	91-20-3	1.0	µg/L	<1.0	<1.0	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	<1.0	----	----	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	<1.0	----	----	----
Fluorene	86-73-7	1.0	µg/L	<1.0	<1.0	----	----	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	<1.0	----	----	----
Anthracene	120-12-7	1.0	µg/L	<1.0	<1.0	----	----	----
Fluoranthene	206-44-0	1.0	µg/L	<1.0	<1.0	----	----	----
Pyrene	129-00-0	1.0	µg/L	<1.0	<1.0	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	<1.0	----	----	----
Chrysene	218-01-9	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	<1.0	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	<1.0	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	<1.0	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	<0.5	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	**90**	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	<50	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	<100	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	<50	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	**90**	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	**40**	----	----	----
>C10 - C16 Fraction	>C10_C16	100	µg/L	<100	<100	----	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	<100	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	<100	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	<100	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	<100	----	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	RMB02	RMB03	----	----	----
				Client sampling date / time	13-JAN-2015 14:15	13-JAN-2015 15:00	----	----	----
					ES1500625-001	ES1500625-002	----	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	----	----	----
Toluene	108-88-3	2	µg/L		<2	**46**	----	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	----	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	----	----	----
^ **Total Xylenes**	1330-20-7	2	µg/L		<2	<2	----	----	----
^ **Sum of BTEX**	----	1	µg/L		<1	**46**	----	----	----
Naphthalene	91-20-3	5	µg/L		<5	<5	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		**20.6**	**19.3**	----	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%		**45.9**	**22.9**	----	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%		**45.2**	**27.6**	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		**57.9**	**70.5**	----	----	----
Anthracene-d10	1719-06-8	0.1	%		**57.0**	**71.1**	----	----	----
4-Terphenyl-d14	1718-51-0	0.1	%		**64.8**	**80.6**	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		**88.9**	**87.2**	----	----	----
Toluene-D8	2037-26-5	0.1	%		**106**	**109**	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%		**110**	**110**	----	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10.0	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27.4	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1500816**	Page	: 1 of 8
Amendment	: **1**		
Client	: **PARSONS BRINCKERHOFF AUST P/L**	Laboratory	: Environmental Division Sydney
Contact	: MS ANDREA MADDEN	Contact	: Loren Schiavon
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: amadden@pb.com.au	E-mail	: loren.schiavon@alsglobal.com
Telephone	: +61 02 9272 5100	Telephone	: +61 2 8784 8503
Facsimile	: +61 02 9272 5101	Facsimile	: +61 2 8784 8500
Project	: 2268518A	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 15-JAN-2015
Sampler	: CS	Issue Date	: 19-MAR-2015
Site	: ----		
		No. of samples received	: 4
Quote number	: SY/743/14 V2	No. of samples analysed	: 4

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
- Surrogate Control Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Edwandy Fadjar	Organic Coordinator	Sydney Organics

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

- **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.**
- **EG020: 'Bromine/Iodine' quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **EK026SF: Poor spike recovery for Total Cyanide due to matrix interferences (confirmed by re-analysis).**
- **EK071G: It has been noted that Reactive P is greater than Total P on sample 3 and 4, however this difference is within the limits of experimental variation.**
- **This report has been amended and re-released to allow the reporting of additional analytical data.**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GLMB01	GLMB02	GLMB03	QA	----
				Client sampling date / time	14-JAN-2015 12:45	14-JAN-2015 11:00	14-JAN-2015 11:15	14-JAN-2015 15:00	----
Compound	CAS Number	LOR	Unit		ES1500816-001	ES1500816-002	ES1500816-003	ES1500816-004	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		7.48	7.66	8.85	8.76	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		8360	7140	4930	4960	----
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	10	mg/L		5110	4320	2560	2740	----
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		22	41	6	10	----
ED009: Anions									
Bromide	24959-67-9	0.010	mg/L		8.30	5.75	2.25	2.31	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	309	252	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		434	595	1070	1110	----
Total Alkalinity as CaCO3	----	1	mg/L		434	595	1380	1370	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		135	<1	<1	<1	----
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		2470	1760	734	743	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		182	246	24	23	----
Magnesium	7439-95-4	1	mg/L		186	105	57	55	----
Sodium	7440-23-5	1	mg/L		1260	1040	1020	1070	----
Potassium	7440-09-7	1	mg/L		19	24	36	38	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	<0.01	0.01	0.01	----
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Arsenic	7440-38-2	0.001	mg/L		0.010	0.010	0.020	0.022	----
Beryllium	7440-41-7	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Barium	7440-39-3	0.001	mg/L		0.362	8.78	6.28	6.11	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Cobalt	7440-48-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GLMB01	GLMB02	GLMB03	QA	----
				Client sampling date / time	14-JAN-2015 12:45	14-JAN-2015 11:00	14-JAN-2015 11:15	14-JAN-2015 15:00	----
Compound	CAS Number	LOR	Unit		ES1500816-001	ES1500816-002	ES1500816-003	ES1500816-004	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Manganese	7439-96-5	0.001	mg/L		**0.390**	**0.384**	**0.003**	**0.002**	----
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	**0.004**	**0.004**	----
Nickel	7440-02-0	0.001	mg/L		<0.001	**0.003**	<0.001	<0.001	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----
Strontium	7440-24-6	0.001	mg/L		**4.08**	**3.97**	**1.54**	**1.54**	----
Tin	7440-31-5	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----
Zinc	7440-66-6	0.005	mg/L		<0.005	**0.006**	<0.005	**0.010**	----
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	----
Iron	7439-89-6	0.05	mg/L		**4.28**	**4.87**	**0.10**	**0.09**	----
Bromine	7726-95-6	0.1	mg/L		**6.4**	**5.1**	**2.2**	**2.1**	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	----
EG052G: Silica by Discrete Analyser									
Reactive Silica	----	0.05	mg/L		**7.38**	**16.0**	**11.0**	**11.2**	----
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	<0.004	<0.004	<0.004	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	**0.3**	<0.1	<0.1	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**1.54**	**2.20**	**2.76**	**2.79**	----
EK055G-NH4: Ammonium as N by DA									
Ammonium as N	----	0.01	mg/L		**1.51**	**2.19**	**2.00**	**2.02**	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<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		<0.01	**0.01**	<0.01	<0.01	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	**0.01**	<0.01	<0.01	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.04**	**0.07**	<0.01	<0.01	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	GLMB01	GLMB02	GLMB03	QA	----
			Client sampling date / time	14-JAN-2015 12:45	14-JAN-2015 11:00	14-JAN-2015 11:15	14-JAN-2015 15:00	----
Compound	CAS Number	LOR	Unit	ES1500816-001	ES1500816-002	ES1500816-003	ES1500816-004	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	**0.05**	**0.03**	**0.02**	----
EK084: Un-ionized Hydrogen Sulfide								
Unionized Hydrogen Sulfide	----	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
EK085F: Dissolved Sulfide as S2-								
Dissolved Sulfide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	**81.2**	**61.5**	**48.3**	**48.3**	----
Total Cations	----	0.01	meq/L	**79.7**	**66.8**	**51.2**	**53.2**	----
Ionic Balance	----	0.01	%	**0.93**	**4.07**	**2.87**	**4.74**	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	<1	<1	<1	<1	----
EP033: C1 - C4 Hydrocarbon Gases								
Methane	74-82-8	10	µg/L	**33900**	**18400**	**18200**	**21900**	----
Ethene	74-85-1	10	µg/L	<10	<10	<10	<10	----
Ethane	74-84-0	10	µg/L	**1650**	**798**	**60**	**77**	----
Propene	115-07-1	10	µg/L	<10	<10	<10	<10	----
Propane	74-98-6	10	µg/L	**379**	**204**	**15**	**20**	----
Butene	25167-67-3	10	µg/L	<10	<10	<10	<10	----
Butane	106-97-8	10	µg/L	**61**	**38**	<10	<10	----
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
2-Chlorophenol	95-57-8	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
2-Methylphenol	95-48-7	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L	<2.0	<2.0	<2.0	<2.0	----
2-Nitrophenol	88-75-5	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	----
Pentachlorophenol	87-86-5	2.0	µg/L	<2.0	<2.0	<2.0	<2.0	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	GLMB01	GLMB02	GLMB03	QA	----
				Client sampling date / time	14-JAN-2015 12:45	14-JAN-2015 11:00	14-JAN-2015 11:15	14-JAN-2015 15:00	----
					ES1500816-001	ES1500816-002	ES1500816-003	ES1500816-004	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		**110**	**80**	**210**	**190**	----
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	<50	----
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	----
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	----
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		<50	<50	<50	<50	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		**110**	**80**	**210**	**200**	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		**90**	**80**	**100**	**100**	----
>C10 - C16 Fraction	>C10_C16	100	µg/L		<100	<100	<100	<100	----
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	<100	----
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	----
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		<100	<100	<100	<100	----
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	<100	<100	<100	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GLMB01	GLMB02	GLMB03	QA	----
				Client sampling date / time	14-JAN-2015 12:45	14-JAN-2015 11:00	14-JAN-2015 11:15	14-JAN-2015 15:00	----
Compound	CAS Number	LOR	Unit		ES1500816-001	ES1500816-002	ES1500816-003	ES1500816-004	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	----
Toluene	108-88-3	2	µg/L		**19**	<2	**106**	**99**	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	----
^ **Total Xylenes**	1330-20-7	2	µg/L		<2	<2	<2	<2	----
^ **Sum of BTEX**	----	1	µg/L		**19**	<1	**106**	**99**	----
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		**23.6**	**24.0**	**23.1**	**22.3**	----
2-Chlorophenol-D4	93951-73-6	0.1	%		**53.2**	**56.9**	**46.5**	**40.9**	----
2.4.6-Tribromophenol	118-79-6	0.1	%		**72.2**	**76.4**	**50.1**	**42.9**	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		**82.9**	**70.8**	**79.7**	**74.2**	----
Anthracene-d10	1719-06-8	0.1	%		**69.7**	**77.1**	**72.5**	**72.8**	----
4-Terphenyl-d14	1718-51-0	0.1	%		**82.4**	**84.6**	**81.3**	**84.5**	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		**90.9**	**95.5**	**99.9**	**96.1**	----
Toluene-D8	2037-26-5	0.1	%		**98.3**	**103**	**101**	**99.4**	----
4-Bromofluorobenzene	460-00-4	0.1	%		**88.1**	**87.8**	**88.0**	**85.4**	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10.0	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27.4	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1508003**	Page	: 1 of 8
Client	: **PARSONS BRINCKERHOFF AUST P/L**	Laboratory	: Environmental Division Sydney
Contact	: MS CAROLINA SARDELLA	Contact	: Client Services
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: csardella@pb.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 92725100	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 92725101	Facsimile	: +61-2-8784 8500
Project	: 2268518A	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 08-APR-2015
Sampler	: KM & AM	Issue Date	: 15-APR-2015
Site	: ----		
		No. of samples received	: 3
Quote number	: SY/239/15	No. of samples analysed	: 3

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
- Surrogate Control Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Edwandy Fadjar	Organic Coordinator	Sydney Organics
Pabi Subba	Senior Organic Chemist	Sydney Organics

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

- **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.**
- **ED041G: LOR raised for Sulfate analysis on sample ID: RMB02, due to matrix interferences.**
- **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **EK026SF:Spike failed for Total Cyanide analysis due to matrix interference(confirmed by re analysis)**
- **EK067G: It has been noted that Reactive P is greater than Total P for sample ID(GLMB03), however this difference is within the limits of experimental variation.**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: GLMB03	RMB02	RMB03	----	----
				Client sampling date / time: 07-APR-2015 11:00	07-APR-2015 15:00	07-APR-2015 16:30	----	----
				ES1508003-001	ES1508003-002	ES1508003-003	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**8.60**	**7.19**	**9.63**	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**5010**	**10700**	**7730**	----	----
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	**2750**	**6170**	**4140**	----	----
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	<5	<5	<5	----	----
ED009: Anions								
Bromide	24959-67-9	0.010	mg/L	**1.98**	**6.79**	**4.68**	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	**129**	<1	**252**	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**1510**	**895**	**224**	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**1640**	**895**	**476**	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**19**	<10	<1	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	**774**	**3280**	**2310**	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**31**	**326**	**10**	----	----
Magnesium	7439-95-4	1	mg/L	**61**	**88**	**11**	----	----
Sodium	7440-23-5	1	mg/L	**1050**	**1890**	**1600**	----	----
Potassium	7440-09-7	1	mg/L	**39**	**30**	**16**	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	**0.01**	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	**0.002**	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.032**	<0.001	**0.001**	----	----
Boron	7440-42-8	0.05	mg/L	**0.05**	<0.05	**0.17**	----	----
Barium	7440-39-3	0.001	mg/L	**7.63**	**33.0**	**4.64**	----	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: GLMB03	RMB02	RMB03	----	----
				Client sampling date / time: 07-APR-2015 11:00	07-APR-2015 15:00	07-APR-2015 16:30	----	----
				ES1508003-001	**ES1508003-002**	**ES1508003-003**	**----**	**----**
EG020F: Dissolved Metals by ICP-MS - Continued								
Copper	7440-50-8	0.001	mg/L	**0.002**	<0.001	**0.003**	----	----
Manganese	7439-96-5	0.001	mg/L	**0.005**	**0.024**	<0.001	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	**0.001**	<0.001	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Zinc	7440-66-6	0.005	mg/L	**0.008**	**0.031**	**0.051**	----	----
Molybdenum	7439-98-7	0.001	mg/L	**0.003**	<0.001	**0.005**	----	----
Strontium	7440-24-6	0.001	mg/L	**2.23**	**8.47**	**1.58**	----	----
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Iron	7439-89-6	0.05	mg/L	**0.12**	**4.42**	<0.05	----	----
Bromine	7726-95-6	0.1	mg/L	**2.0**	**7.0**	**5.4**	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
EG052G: Silica by Discrete Analyser								
Reactive Silica	----	0.05	mg/L	**11.8**	**10.4**	**6.68**	----	----
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	0.004	mg/L	<0.004	<0.004	<0.004	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	<0.1	**0.1**	**0.6**	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	**2.87**	**4.43**	**3.33**	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	<0.01	<0.01	<0.01	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	<0.01	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	<0.01	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	**0.04**	**0.04**	**0.01**	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	**0.05**	**0.03**	**0.01**	----	----
EN055: Ionic Balance								

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: GLMB03	RMB02	RMB03	----	----
				Client sampling date / time: 07-APR-2015 11:00	07-APR-2015 15:00	07-APR-2015 16:30	----	----
				ES1508003-001	**ES1508003-002**	**ES1508003-003**	**----**	**----**
EN055: Ionic Balance - Continued								
Total Anions	----	0.01	meq/L	**55.0**	**110**	**74.7**	----	----
Total Cations	----	0.01	meq/L	**53.2**	**106**	**71.4**	----	----
Ionic Balance	----	0.01	%	**1.67**	**1.82**	**2.26**	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	**10**	**5**	**40**	----	----
EP033: C1 - C4 Hydrocarbon Gases								
Methane	74-82-8	10	µg/L	**41700**	**39100**	**38100**	----	----
Ethene	74-85-1	10	µg/L	<10	<10	<10	----	----
Ethane	74-84-0	10	µg/L	**108**	<10	**11**	----	----
Propene	115-07-1	10	µg/L	<10	<10	<10	----	----
Propane	74-98-6	10	µg/L	**19**	<10	<10	----	----
Butene	25167-67-3	10	µg/L	<10	<10	<10	----	----
Butane	106-97-8	10	µg/L	<10	<10	<10	----	----
EP075(SIM)A: Phenolic Compounds								
Phenol	108-95-2	1.0	µg/L	<1.0	<1.0	<1.0	----	----
2-Chlorophenol	95-57-8	1.0	µg/L	<1.0	<1.0	<1.0	----	----
2-Methylphenol	95-48-7	1.0	µg/L	<1.0	<1.0	<1.0	----	----
3- & 4-Methylphenol	1319-77-3	2.0	µg/L	<2.0	<2.0	<2.0	----	----
2-Nitrophenol	88-75-5	1.0	µg/L	<1.0	<1.0	<1.0	----	----
2.4-Dimethylphenol	105-67-9	1.0	µg/L	<1.0	<1.0	<1.0	----	----
2.4-Dichlorophenol	120-83-2	1.0	µg/L	<1.0	<1.0	<1.0	----	----
2.6-Dichlorophenol	87-65-0	1.0	µg/L	<1.0	<1.0	<1.0	----	----
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L	<1.0	<1.0	<1.0	----	----
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L	<1.0	<1.0	<1.0	----	----
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Pentachlorophenol	87-86-5	2.0	µg/L	<2.0	<2.0	<2.0	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Acenaphthylene	208-96-8	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Acenaphthene	83-32-9	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Fluorene	86-73-7	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Phenanthrene	85-01-8	1.0	µg/L	<1.0	<1.0	<1.0	----	----
Anthracene	120-12-7	1.0	µg/L	<1.0	<1.0	<1.0	----	----

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	GLMB03	RMB02	RMB03	----	----
				Client sampling date / time	07-APR-2015 11:00	07-APR-2015 15:00	07-APR-2015 16:30	----	----
					ES1508003-001	ES1508003-002	ES1508003-003	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	<1.0	----	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L		<0.5	<0.5	<0.5	----	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L		<0.5	<0.5	<0.5	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		**190**	<20	**70**	----	----
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	----	----
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	----	----
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	----	----
^ **C10 - C36 Fraction (sum)**	----	50	µg/L		<50	<50	<50	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L		**190**	<20	**70**	----	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L		**70**	<20	**30**	----	----
>C10 - C16 Fraction	>C10_C16	100	µg/L		<100	<100	<100	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	----	----
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L		<100	<100	<100	----	----
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L		<100	<100	<100	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	----	----
Toluene	108-88-3	2	µg/L		**124**	<2	**39**	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	GLMB03	RMB02	RMB03	----	----
				Client sampling date / time	07-APR-2015 11:00	07-APR-2015 15:00	07-APR-2015 16:30	----	----
Compound	CAS Number	LOR	Unit		ES1508003-001	ES1508003-002	ES1508003-003	----	----
EP080: BTEXN - Continued									
^ **Total Xylenes**	1330-20-7	2	µg/L		<2	<2	<2	----	----
^ **Sum of BTEX**	----	1	µg/L		**124**	<1	**39**	----	----
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		**18.5**	**22.3**	**18.9**	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%		**41.0**	**49.9**	**18.0**	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%		**40.5**	**59.0**	**22.7**	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		**52.1**	**57.3**	**70.6**	----	----
Anthracene-d10	1719-06-8	0.1	%		**76.4**	**87.0**	**80.7**	----	----
4-Terphenyl-d14	1718-51-0	0.1	%		**66.7**	**71.6**	**78.7**	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		**113**	**113**	**124**	----	----
Toluene-D8	2037-26-5	0.1	%		**118**	**120**	**122**	----	----
4-Bromofluorobenzene	460-00-4	0.1	%		**98.9**	**99.4**	**105**	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10.0	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27.4	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1508120**	Page	: 1 of 8
Client	: **PARSONS BRINCKERHOFF AUST P/L**	Laboratory	: Environmental Division Sydney
Contact	: MS CAROLINA SARDELLA	Contact	: Client Services
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: csardella@pb.com.au	E-mail	: sydney@alsglobal.com
Telephone	: +61 02 92725100	Telephone	: +61-2-8784 8555
Facsimile	: +61 02 92725101	Facsimile	: +61-2-8784 8500
Project	: 2268518A	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 09-APR-2015
Sampler	: KM.AM	Issue Date	: 16-APR-2015
Site	: ----		
		No. of samples received	: 5
Quote number	: SY/239/15	No. of samples analysed	: 5

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
- Surrogate Control Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics
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.**
- **EK026SF:Spike failed for Total Cyanide analysis due to matrix interference(confirmed by re analysis**
- **EK071G: It has been noted that Reactive P is greater than Total P for sample ID(MPMB02), however this difference is within the limits of experimental variation.**

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MPMB04	MPMB03	MPMB02	MPMB01	QA1
				Client sampling date / time	08-APR-2015 10:00	08-APR-2015 09:00	08-APR-2015 10:15	08-APR-2015 11:15	08-APR-2015 15:00
					ES1508120-001	ES1508120-002	ES1508120-003	ES1508120-004	ES1508120-005
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**9.73**	**7.44**	**6.86**	**5.54**	**6.90**
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**984**	**1090**	**963**	**912**	**950**
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	----	10	mg/L		**540**	**528**	**420**	**526**	**508**
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		<5	**6**	**5**	**74**	<5
ED009: Anions									
Bromide	24959-67-9	0.010	mg/L		**0.275**	**0.213**	**0.409**	**0.601**	**0.378**
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		**209**	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**110**	**522**	**238**	**14**	**232**
Total Alkalinity as CaCO3	----	1	mg/L		**319**	**522**	**238**	**14**	**232**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		<1	<1	**4**	**2**	**4**
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		**126**	**77**	**170**	**258**	**171**
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**4**	**91**	**34**	**13**	**32**
Magnesium	7439-95-4	1	mg/L		**5**	**23**	**31**	**23**	**30**
Sodium	7440-23-5	1	mg/L		**189**	**110**	**105**	**110**	**105**
Potassium	7440-09-7	1	mg/L		**15**	**14**	**3**	**1**	**3**
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	<0.01	<0.01	**0.01**	<0.01
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L		**0.002**	**0.018**	**0.002**	<0.001	**0.002**
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Barium	7440-39-3	0.001	mg/L		**0.753**	**3.27**	**0.584**	**0.664**	**0.571**
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	**0.004**	<0.001	**0.041**	<0.001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MPMB04	MPMB03	MPMB02	MPMB01	QA1
				Client sampling date / time	08-APR-2015 10:00	08-APR-2015 09:00	08-APR-2015 10:15	08-APR-2015 11:15	08-APR-2015 15:00
					ES1508120-001	ES1508120-002	ES1508120-003	ES1508120-004	ES1508120-005
EG020F: Dissolved Metals by ICP-MS - Continued									
Copper	7440-50-8	0.001	mg/L		**0.001**	<0.001	<0.001	**0.003**	<0.001
Manganese	7439-96-5	0.001	mg/L		<0.001	**0.047**	**0.144**	**0.488**	**0.139**
Nickel	7440-02-0	0.001	mg/L		<0.001	**0.004**	<0.001	**0.016**	<0.001
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	**0.002**	<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		**0.047**	**0.012**	**0.018**	**0.066**	**0.015**
Molybdenum	7439-98-7	0.001	mg/L		**0.005**	<0.001	<0.001	<0.001	<0.001
Strontium	7440-24-6	0.001	mg/L		**0.198**	**0.887**	**0.352**	**0.143**	**0.350**
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Iron	7439-89-6	0.05	mg/L		<0.05	**1.13**	**4.21**	**0.06**	**4.14**
Bromine	7726-95-6	0.1	mg/L		**0.3**	**0.2**	**0.4**	**0.7**	**0.4**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		**0.0003**	<0.0001	<0.0001	<0.0001	<0.0001
EG052G: Silica by Discrete Analyser									
Reactive Silica	----	0.05	mg/L		**3.48**	**8.82**	**12.7**	**19.2**	**12.9**
EK026SF: Total CN by Segmented Flow Analyser									
Total Cyanide	57-12-5	0.004	mg/L		<0.004	<0.004	<0.004	<0.004	<0.004
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.6**	**0.2**	**0.2**	<0.1	**0.3**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.86**	**0.92**	**0.06**	**0.02**	**0.09**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	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		<0.01	<0.01	<0.01	**0.16**	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	<0.01	<0.01	**0.16**	<0.01
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		<0.01	<0.01	**0.02**	**0.05**	**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	**0.03**	<0.01	<0.01
EN055: Ionic Balance									

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID	MPMB04	MPMB03	MPMB02	MPMB01	QA1
				Client sampling date / time	08-APR-2015 10:00	08-APR-2015 09:00	08-APR-2015 10:15	08-APR-2015 11:15	08-APR-2015 15:00
					ES1508120-001	ES1508120-002	ES1508120-003	ES1508120-004	ES1508120-005
EN055: Ionic Balance - Continued									
Total Anions	----	0.01	meq/L		**9.93**	**12.6**	**9.63**	**7.60**	**9.54**
Total Cations	----	0.01	meq/L		**9.22**	**11.6**	**8.89**	**7.35**	**8.71**
Ionic Balance	----	0.01	%		**3.76**	**4.25**	**4.02**	**1.66**	**4.58**
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		**22**	**4**	<1	<1	<1
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L		**52300**	**44600**	**273**	<10	**266**
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
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1.0	µg/L		**2.8**	<1.0	<1.0	<1.0	<1.0
2-Chlorophenol	95-57-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2-Methylphenol	95-48-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
3- & 4-Methylphenol	1319-77-3	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	<2.0
2-Nitrophenol	88-75-5	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4-Dimethylphenol	105-67-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4-Dichlorophenol	120-83-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.6-Dichlorophenol	87-65-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
4-Chloro-3-methylphenol	59-50-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4.6-Trichlorophenol	88-06-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
2.4.5-Trichlorophenol	95-95-4	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Pentachlorophenol	87-86-5	2.0	µg/L		<2.0	<2.0	<2.0	<2.0	<2.0
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	**1.1**
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	**1.9**	**1.1**	**2.1**
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	**1.7**	**1.3**	**2.3**
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	**4.7**	**1.8**	**3.5**
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)

Compound	CAS Number	LOR	Unit	Client sample ID: MPMB04	MPMB03	MPMB02	MPMB01	QA1
				Client sampling date / time: 08-APR-2015 10:00	08-APR-2015 09:00	08-APR-2015 10:15	08-APR-2015 11:15	08-APR-2015 15:00
				ES1508120-001	ES1508120-002	ES1508120-003	ES1508120-004	ES1508120-005
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Fluoranthene	206-44-0	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	129-00-0	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Benz(a)anthracene	56-55-3	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Chrysene	218-01-9	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	207-08-9	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L	<0.5	<0.5	**8.3**	**4.2**	**9.0**
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	**110**	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L	<50	<50	**70**	<50	**80**
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50
^ **C10 - C36 Fraction (sum)**	----	50	µg/L	<50	<50	**70**	<50	**80**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	**110**	<20	<20	<20	<20
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	20	µg/L	**40**	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	µg/L	<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100
^ **>C10 - C40 Fraction (sum)**	----	100	µg/L	<100	<100	<100	<100	<100
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	100	µg/L	<100	<100	<100	<100	<100
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	**66**	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	<2

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	MPMB04	MPMB03	MPMB02	MPMB01	QA1
				Client sampling date / time	08-APR-2015 10:00	08-APR-2015 09:00	08-APR-2015 10:15	08-APR-2015 11:15	08-APR-2015 15:00
Compound	CAS Number	LOR	Unit		ES1508120-001	ES1508120-002	ES1508120-003	ES1508120-004	ES1508120-005
EP080: BTEXN - Continued									
^ **Total Xylenes**	1330-20-7	2	µg/L		<2	<2	<2	<2	<2
^ **Sum of BTEX**	----	1	µg/L		**66**	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		**13.6**	**21.8**	**24.3**	**18.5**	**27.2**
2-Chlorophenol-D4	93951-73-6	0.1	%		**26.5**	**43.6**	**49.9**	**47.5**	**62.7**
2.4.6-Tribromophenol	118-79-6	0.1	%		**29.5**	**38.4**	**48.0**	**57.8**	**84.0**
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		**45.3**	**48.9**	**55.9**	**47.7**	**66.0**
Anthracene-d10	1719-06-8	0.1	%		**90.9**	**92.1**	**90.9**	**43.3**	**67.2**
4-Terphenyl-d14	1718-51-0	0.1	%		**60.5**	**61.9**	**72.0**	**42.0**	**66.9**
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		**79.0**	**81.1**	**80.3**	**83.0**	**76.0**
Toluene-D8	2037-26-5	0.1	%		**96.2**	**93.4**	**95.0**	**94.6**	**89.0**
4-Bromofluorobenzene	460-00-4	0.1	%		**93.1**	**91.1**	**90.9**	**90.6**	**84.9**

Surrogate Control Limits

Sub-Matrix: **WATER**

Compound	CAS Number	Recovery Limits (%) Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10.0	44
2-Chlorophenol-D4	93951-73-6	14	94
2.4.6-Tribromophenol	118-79-6	17	125
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	20	104
Anthracene-d10	1719-06-8	27.4	113
4-Terphenyl-d14	1718-51-0	32	112
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128