

AGL Upstream Infrastructure Investments Pty Ltd
**Tiedman Irrigation Program - Water Compliance Report for the
Period 1 January to 30 June 2015**
Gloucester Gas Project

13 August 2015






Document information

Client: AGL Upstream Infrastructure Investments Pty Ltd
Title: Tiedman Irrigation Program - Water Compliance Report for the Period 1 January to 30 June 2015
Subtitle: Gloucester Gas Project
Document No: 2268517B-WAT-RPT-001 RevD
Date: 13 August 2015

Rev	Date	Details
A	27/07/2015	First draft
B	31/07/2015	Second draft
C	07/08/2015	Final draft
D	13/08/2015	Final

Author, Reviewer and Approver details

Prepared by:	Carolina Sardella	Date: 13/08/2015	Signature: 
Reviewed by:	Andrea Madden, Ellen Kwantes	Date: 13/08/2015	Signature: 
Approved by:	Carolina Sardella	Date: 13/08/2015	Signature: 

Distribution

AGL Upstream Infrastructure Investments Pty Ltd, Parsons Brinckerhoff file, Parsons Brinckerhoff Library

©Parsons Brinckerhoff Australia Pty Limited 2013

Copyright in the drawings, information and data recorded in this document (the information) is the property of Parsons Brinckerhoff. This document and the information are solely for the use of the authorised recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that for which it was supplied by Parsons Brinckerhoff. Parsons Brinckerhoff makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.

Document owner

Parsons Brinckerhoff Australia Pty Limited

ABN 80 078 004 798

Level 27 Ernst & Young Centre
680 George Street, Sydney NSW 2000

GPO Box 5394
Sydney NSW 2001
Australia

Tel: +61 2 9272 5100
Fax: +61 2 9272 5101
Email: sydney@pb.com.au
www.pbworld.com

Certified to ISO 9001, ISO 14001, AS/NZS 4801
A GRI Rating: Sustainability Report 2011

Contents

	Page number
Glossary	iv
Abbreviations	vi
Units	vii
Executive summary	viii
1. Introduction	1
1.1 Gloucester Gas Project	1
1.2 Irrigation program	1
1.3 Objectives	4
2. Monitoring network and methodology	5
2.1 Monitoring network and purpose	5
2.2 Monitoring program	7
2.3 Approved water management plan	8
2.4 Water level monitoring	10
2.4.1 Groundwater level monitoring	10
2.4.2 Surface water level monitoring	10
2.5 Water quality monitoring	10
2.5.1 Automated monitoring	11
2.5.2 Sampling methodology	11
2.5.3 Assessment framework	13
3. Tiedman dams and seepage monitoring	18
3.1 Water quality results	18
3.2 Tiedman dams	19
3.2.1 Water quality	19
3.3 Seepage monitoring around the Tiedman dams	21
3.3.1 Water levels	21
3.3.2 Water quality	22
4. Surface water monitoring	24
4.1 Surface water levels	24
4.2 Surface water quality	24
4.2.1 Surface water	24
4.2.2 Irrigation plot runoff	30

5.	Groundwater monitoring	34
5.1	Groundwater occurrence	34
5.2	Groundwater levels	34
5.2.1	Shallow alluvium	34
5.2.2	Shallow rock	35
5.3	Groundwater quality	36
5.3.1	Shallow alluvium	36
5.3.2	Shallow rock	38
5.3.3	Soil water	39
6.	Discussion	41
6.1	Water levels	41
6.2	Water quality	41
6.2.1	Produced and blended irrigation water	41
6.2.2	Surface water	42
6.2.3	Irrigation plot runoff	42
6.2.4	Groundwater	43
6.2.5	Soil water	43
7.	Conclusions and recommendations	44
8.	Statement of limitations	45
8.1	Scope of services	45
8.2	Reliance on data	45
8.3	Environmental conclusions	45
8.4	Report for the benefit of the client	45
8.5	Other limitations	46
9.	References	47

List of tables

	Page number	
Table 2.1	Summary of the water monitoring network	5
Table 2.2	Seepage monitoring bore details	6
Table 2.3	Stream gauges	6
Table 2.4	Groundwater monitoring bore details	7
Table 2.5	Schedule of sampling and reporting events	7
Table 2.6	Groundwater and surface water monitoring locations and scope	8
Table 2.7	Analytical suite	12
Table 2.8	Water quality assessment criteria used and rationale for selection	14
Table 2.9	EPL 20358 concentration limit for overflow events at catch dams	14
Table 2.10	ANZECC (2000) guideline trigger values for aquatic ecosystems and irrigation water	16
Table 2.11	Groundwater pre-irrigation baseline water quality	17
Table 3.1	Tiedman dams and seepage monitoring bores results for February 2015	18
Table 3.2	Tiedman dams and seepage monitoring bores results for May 2015	19
Table 4.1	February and May 2015 results for surface water monitoring locations TSW01 and TSW02	25
Table 4.2	2015 results for surface water monitoring location ASW01 (upstream)	26
Table 4.3	2015 results for surface water monitoring location FSW01 (downstream)	27
Table 4.4	Major ion chemistry of surface water	29
Table 4.5	2015 results for the catch dams	31
Table 4.6	Major ion chemistry in catch dams	32
Table 5.1	February and May 2015 results for the shallow alluvium monitoring bores	37
Table 5.2	Major ion chemistry at the alluvial monitoring bores	37
Table 5.3	February and May 2015 results for the shallow rock monitoring bores	38
Table 5.4	Major ion chemistry at the shallow rock monitoring bores	39
Table 5.5	May 2015 results for the soil water piezometers	40

List of figures

	Page number	
Figure 1.1	Irrigation monitoring network	3
Figure 1.2	Daily rainfall and irrigated water	4
Figure 3.1	Continuous EC data at Tiedman south dam and Tiedman east dam	20
Figure 3.2	Groundwater levels for seepage monitoring bores (TMB04 and TMB05)	22
Figure 4.1	Surface water levels	24
Figure 4.2	Continuous EC logging results at stream gauges	28
Figure 4.3	Continuous EC data at CDE and CDW	32
Figure 5.1	Groundwater levels for alluvial monitoring bores (TMB01, TMB02 and TMB03)	35
Figure 5.2	Groundwater levels for the shallow rock monitoring bores (S4MB01, TCMB01 and TTMB02).	36

List of appendices

Appendix A	Summary tables
Appendix B	Water quality graphs
Appendix C	Piper diagrams
Appendix D	Laboratory reports

Glossary

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.
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.
Bore	A structure drilled below the surface to obtain water from an aquifer or series of aquifers.
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 can be extracted from coal seams.
Concentration	The amount or mass of a substance present in a given volume or mass of sample, usually expressed as microgram per litre (water sample) or micrograms per kilogram (sediment sample).
Datalogger	A digital recording instrument that is inserted in monitoring and pumping bores to record pressure measurements and water level variations.
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.
Groundwater	The water contained in interconnected pores or fractures located below the water table in the saturated zone.
MicroSiemens per centimetre ($\mu\text{S}/\text{cm}$)	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 water level/pressure head of an aquifer and/or water quality. Bores generally have a short well screen against a single aquifer through which water can enter.
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).

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.
Redox potential (ORP)	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.
Salinity	The concentration of dissolved salts in water, usually expressed in EC units ($\mu\text{S}/\text{cm}$) or milligrams of total dissolved solids per litre (mg/L TDS).
Salinity classification	Fresh water quality – water with a salinity $<800 \mu\text{S}/\text{cm}$. Marginal water quality – water that is more saline than freshwater and generally waters between 800 and 1,600 $\mu\text{S}/\text{cm}$. Brackish quality – water that is more saline than freshwater and generally waters between 1,600 and 4,800 $\mu\text{S}/\text{cm}$. Slightly saline quality – water that is more saline than brackish water and generally waters with a salinity between 4,800 and 10,000 $\mu\text{S}/\text{cm}$. Moderately saline quality – water that is more saline than slightly saline water and generally waters between 10,000 and 20,000 $\mu\text{S}/\text{cm}$. Saline quality – water that is almost as saline as seawater and generally waters with a salinity greater than 20,000 $\mu\text{S}/\text{cm}$. Seawater quality – water that is generally around 55,000 $\mu\text{S}/\text{cm}$.
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.
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 Infrastructure Investments Pty Ltd
BTEX	Benzene, toluene, ethyl benzene and xylenes
CDFM	Cumulative deviation from mean
CSG	Coal seam gas
DRE	Division of Resources and Energy
EC	Electrical conductivity
EPA	Environment Protection Authority
EPL	Environment Protection Licence
GFDA	Gas Field Development Area
GGP	Gloucester Gas Project
LOR	Limit of reporting
NOW	NSW Office of Water
NSW T&I	NSW Department of Trade and Investment
OCSG	Office of Coal Seam Gas
PAH	Polycyclic aromatic hydrocarbons
REF	Review of Environmental Factors
SAR	Sodium adsorption ratio
TDS	Total dissolved solids
TOC	Total organic carbon
TIP	Tiedman Irrigation Program
TPH	Total petroleum hydrocarbons
TSS	Total suspended solids
WMP	Water management plan

Units

°C	degrees Celsius
ha	hectare
m	metres
mAHD	metres Australian Height Datum
mbgl	metres below ground level
mg/L	milligrams per litre
mm	millimetres
mm/day	millimetres per day
ML	megalitres
mV	millivolt
µS/cm	microsiemens per centimetre
µm	micrometres

Executive summary

AGL Upstream Infrastructure Investments Pty Ltd (AGL) is proposing to develop the Gloucester Gas Project (GGP) which will comprise several stages of development; currently only one stage is approved, the Stage 1 Gas Field Development Area (GFDA). Surface water and groundwater investigations are ongoing.

This report specifically covers the Tiedman Irrigation Program (TIP) and the period from 1 January to 30 June 2015, and is submitted in compliance with the NSW Department of Trade and Investment (T&I) - Office of Coal Seam Gas (OCSG) approval dated 4 July 2014 and approved Water Management Plan (WMP). The report is also submitted to the Environment Protection Authority (EPA) to comply with condition R5.5 of EPL 20358 for the TIP reporting.

As part of its current exploration program, AGL proposed irrigating a maximum of 70 ML of produced water over a maximum area of 40 ha over a two to three year period across its TIP area. The original approval was for two years from 5 July 2012 to 4 July 2014, with approval extended to 30 April 2015. Blended irrigation water includes water from historical exploration programs which is stored in the Tiedman dams, together with freshwater from the Avon River as well as any rainfall which falls in the dams. Approximately 54 ML of produced water was irrigated across the whole program with an estimated 4 ML of produced water irrigated in this reporting period.

Surface water and groundwater monitoring for the TIP commenced in October 2011 and was established in accordance with the approved WMP. The monitoring ensures that the quality of the water used for irrigation is appropriate and that the application of blended water does not result in impacts on the local surface water or groundwater resources. Water level and water quality data are evaluated for each monitoring and reporting period (six months).

During the current reporting period there was 13.8 ML of blended water irrigated across the Stage 1A (12.4 ML) and Stage 1B (1.4 ML) areas. Monitoring during the six-month period to 30 June 2015 showed there was no change in stream levels, alluvial groundwater levels or shallow fractured rock groundwater levels that can be attributed to the irrigation program activities. Surface water and groundwater levels remained comparable to the results from the previous compliance period.

The quality of the blended water used for irrigation, which is stored in Tiedman south dam (TSD), was within the ANZECC (2000) irrigation guidelines with the exception of pH (both sampling events, February and May 2015) and total phosphorus (both events) which were slightly above the guidelines. However it is noted that a pH dosing system was installed in March 2015 that reduced the pH of the stored blended water to between pH 8 and 9 (to within the ANZECC guidelines). This lower pH water was irrigated during late March and April 2015. The phosphorus exceedances relate to guidelines that are set to minimise clogging of irrigation equipment. From an environmental perspective, the blended water in the TSD was suitable for irrigation.

Two catch dams captured the first flush of runoff from the irrigation area during high rainfall events. After capturing the first flush, any further rainfall overflows the catch dams as overland flow. There were four high rainfall events during the monitoring period (in January, March, April and May 2015). The runoff samples collected from the catch dams during the high rainfall events in March 2015 at one catch dam and early May 2015 at both catch dams exceeded EPL 20358 Condition L3.4 for total suspended solids (50 mg/L). The exceedances were notified to the EPA by AGL. There was no evidence of change in the surface water quality downstream of the TIP area that can be directly attributed to the 2015 high rainfall events.

A small number of surface water samples slightly exceeded the ANZECC (2000) guidelines for the protection of freshwater aquatic ecosystems during the monitoring period. However, such exceedances were noted during the baseline monitoring period (October 2011 to September 2012) and most analytes remain within

the ranges observed during the baseline period. It is concluded that there has been no detectable change in natural surface water or groundwater quality as a result of the irrigation program activities.

The TIP is considered to be successful with more than 50ML of produced water blended and irrigated and no detectable impact to adjacent surface water or underlying groundwater receptors.

1. Introduction

This report presents the level and quality data from groundwater, surface water (streams) and irrigation associated with the Tiedman Irrigation Program (TIP). The report is a six-monthly compliance report covering the period from 1 January to 30 June 2015.

1.1 Gloucester Gas Project

AGL Upstream Infrastructure Investments Pty Ltd (AGL) is proposing to build the Gloucester Gas Project (GGP) which comprises several stages of development facilitating the extraction of coal seam gas (CSG) from the Gloucester Basin. Concept Plan and Project Approval (Part 3A Approval) for the Stage 1 Gas Field Development Area (GFDA) was granted on 22 February 2011 under Part 3A of the *Environmental Planning and Assessment Act (1979)* (EP&A Act). In addition, the project received approval under the *Environment Protection and Biodiversity Conservation Act (1999)* (EPBC Act) (EPBC Approval) on 11 February 2013.

AGL holds Petroleum Exploration Licence (PEL) 285, under the *Petroleum (Onshore) Act 1991*, covering the whole of the Gloucester Basin, approximately 100 km north of Newcastle, NSW.

The GGP will involve the depressurising of deep groundwater and the extraction of gas from multiple coal seams within the Gloucester Coal Measures. Target coal seam depths will vary from site to site and are expected to range between 200 and 1,000 metres below ground level (mbgl). The current GGP within the Stage 1 GFDA includes the construction, operation, and decommissioning of 110 CSG wells and associated infrastructure, including gas and water gathering lines. A comprehensive groundwater investigation (Phase 2 Groundwater Investigations) was completed in early 2012 to confirm the hydrogeological conceptual model across the Stage 1 GFDA (Parsons Brinckerhoff 2012). Surface water and groundwater investigations are ongoing.

1.2 Irrigation program

Irrigation was identified as the preferred water management and reuse method for produced water generated from the dewatering of deep coal seams during exploration programs at Gloucester. Consequently an irrigation program was undertaken to evaluate the sustainability of irrigating salt tolerant crops on improved soils on AGL's Tiedman property at Stratford. The irrigation program involved the use of blended water for the irrigation of improved pasture, lucerne and summer/winter cereals. The produced water was derived from historical flow testing programs that were approved exploration activities. The use of blended water for irrigation was only proposed for the reuse of produced water derived from exploration program activities. AGL has committed to desalination for the reuse of extracted water from the Stage 1 GFDA.

Part V approval under the *EP&A Act* for the irrigation program was issued in July 2012 by the NSW Trade and Investment (T&I) – Division of Resources and Energy (DRE) for a period of two years (from 5 July 2012 to 4 July 2014) (DRE 2012). Approval was extended to 30 April 2015 by the NSW T&I – Office of Coal Seam Gas (OCSG) on 4 July 2014 (OCSG 2014). On 6 August 2014, the NSW Environment Protection Authority (EPA) issued Environment Protection Licence (EPL) 20358 that covers the approved CSG exploration, assessment and production activities in the GGP (EPA 2014). Soil and water monitoring and reporting associated with the TIP are captured under both these approvals.

Irrigation activities ceased at AGL's TIP on 30 April 2015, in accordance with the OCSG approval conditions.

AGL irrigated 54 ML of produced water over a 16.1 ha area over the three-year TIP period (from July 2012 to April 2015). Blended water irrigation included water from historical exploration programs, which was stored in

the Tiedman dams, together with freshwater from local AGL farm dams, the Avon River and rainfall that fell into the dams.

The 40 ha irrigation area is divided into two areas, being Stage 1A and 1B (Figure 1.1):

- Stage 1A is an intensive irrigation area serviced by a lateral move irrigator in the north-west portion of the Tiedman property. The lateral move irrigator irrigates a maximum area of 18.2 ha, including 16 x 0.75 ha plots (12 ha) incorporating four different soil improvements. A small additional (adjacent) area for enhancements to the program was proposed for the Stage 1A area; however this has not been required as part of the TIP.
- Stage 1B comprises the historical irrigation area of about 8.6 ha (of which about 4.1 ha has received irrigation). A 21 ha expansion area to the west and south was not developed under the TIP.

The irrigation water was a blended water mix with an electrical conductivity (EC) of around 1,500 $\mu\text{S}/\text{cm}$ (although 2,000 $\mu\text{S}/\text{cm}$ is the upper limit for the blended water in the Review of Environmental Factors (REF) for the irrigation program (Parsons Brinckerhoff 2011)). The blended water comprised an approximate ratio of three parts fresh water and one part produced water. Freshwater was sourced from local AGL farm dams and the Avon River. The irrigation program allows salt tolerant crops to be grown, with continuous cropping over summer and winter.

The irrigation program began on 29 April 2013 for the Stage 1A area and on 1 May 2013 for the Stage 1B area. Prior to this, lower salinity produced water was directly irrigated across the Stage 1B area from 16 October to 8 December 2012 to increase storage capability in the Tiedman south dam (TSD) for blending the remaining produced water with fresh water sources.

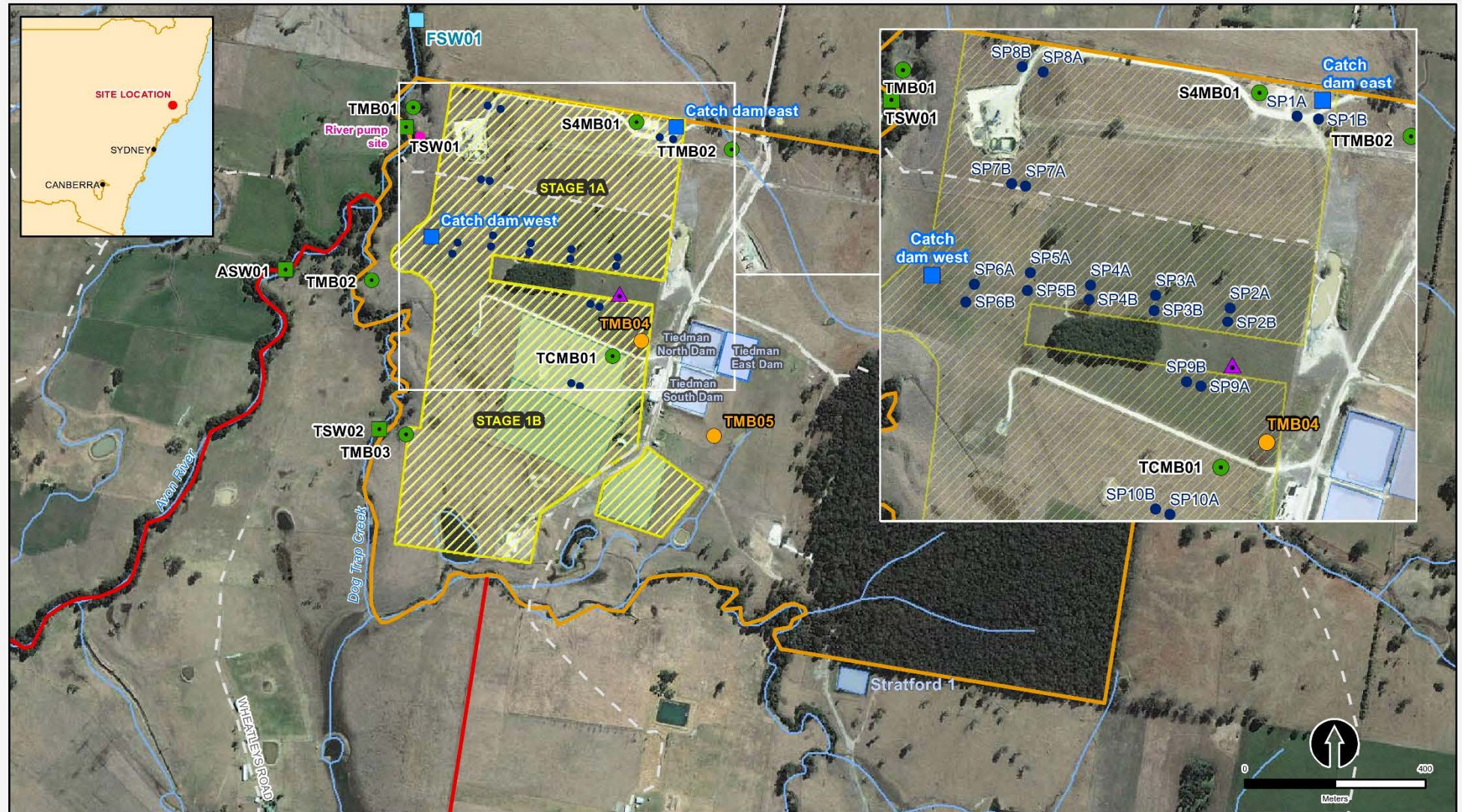
Regional groundwater level monitoring commenced in January 2011 and surface water level monitoring commenced in March 2011. A baseline groundwater and surface water monitoring program was conducted between October 2011 and September 2012 to define pre-irrigation conditions (Parsons Brinckerhoff 2013a).

This compliance report is the last in a series of five six-monthly reports required during the irrigation program period. The following compliance reports have been prepared:

- first compliance report covered the initial irrigation period to 30 June 2013 (Parsons Brinckerhoff 2013b)
- second compliance report covered the period 1 July to 31 December 2013 (Parsons Brinckerhoff 2014a)
- third compliance report covered the period 1 January to 4 July 2014 (Parsons Brinckerhoff 2014b)
- fourth compliance report covered the period 5 July to 31 December 2014 (Parsons Brinckerhoff 2015)
- fifth and final compliance report covering the period 1 January to 30 June 2015 (this report).

For the period from 1 January to 30 April 2015, 12.4 ML of blended irrigation water was applied to the 12 ha area within the Stage 1A area and 1.4 ML was applied to the 4.1 ha area within the stage 1B area. During the same period, 392.6 mm of rainfall was recorded by AGL (2015), which equates to 62.8 ML of rainfall across the two irrigation areas (Figure 1.2).

For the entire irrigation program to 30 April 2015, approximately 54 ML of produced water has been irrigated, which is less than the volume originally envisaged (70 ML) due to no additional produced water being available from the Waukivory pilot (as its commencement was delayed). Approximately 6 ML of blended water remained in TSD as of 30 April 2015, of which approximately 1 ML was produced water. It is proposed to store this water at TSD or TND until construction and commissioning of a water treatment plant. On 30 April 2015 there was approximately 5 ML of recycled stormwater/residual produced water in the Tiedman north dam (TND) and there was minimal water (adequate volume to maintain a settled liner) in the Tiedman east dam (TED).



- | | | | |
|---|--|--|--|
| ● Groundwater monitoring bore | ● Perched shallow piezometer | Produced water dam | — Roads |
| ■ Stream gauge | ● River pump site | Stage 1 irrigation area | — Tracks |
| ● Seepage monitoring bore | ■ Catch dam | Atkins Property | |
| ■ Surface water monitoring location | | Tiedman Property | |

Figure 1.1 Irrigation monitoring network

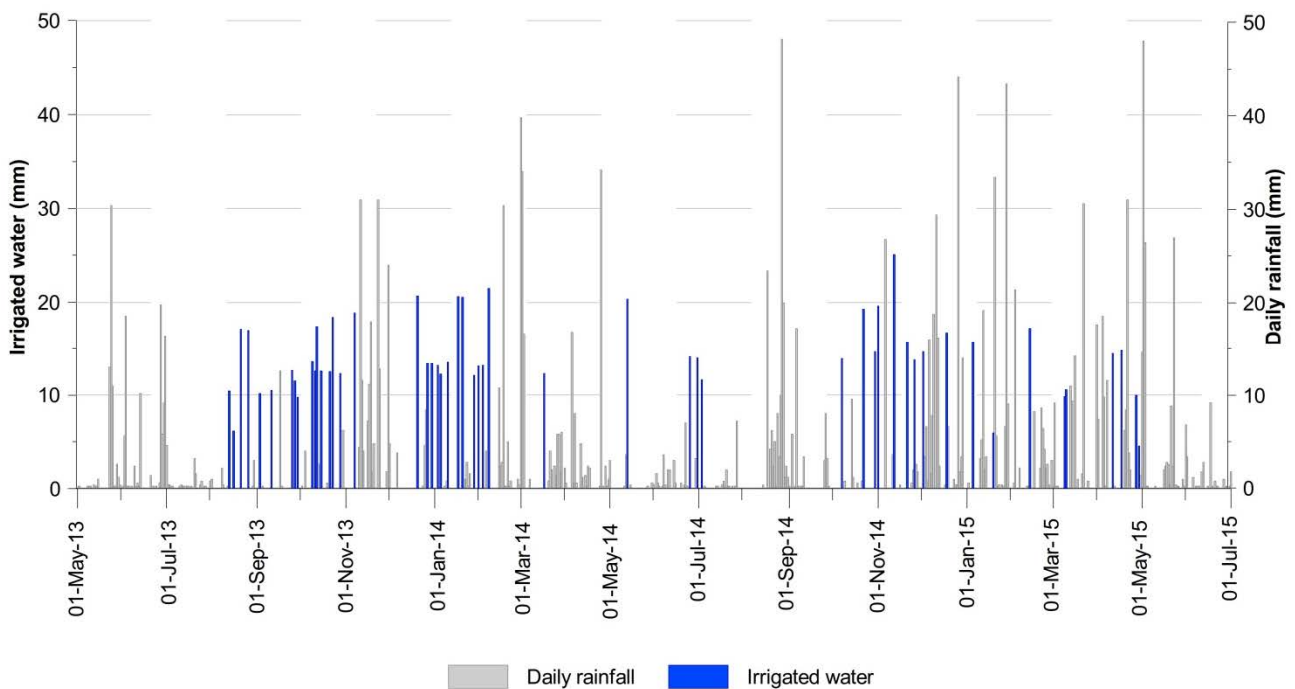


Figure 1.2 Daily rainfall and total irrigated water

1.3 Objectives

The objectives of the irrigation program and the associated water monitoring program were to ensure that the quality of the water used for irrigation was appropriate and that the application of blended water did not result in impacts to the local surface water or groundwater resources. This water monitoring program mostly focused on the Stage 1A irrigation area, as it was the intensive irrigation area for which performance data is required on salt accumulation and water application rates.

This report specifically covers the period from 1 January to 30 June 2015, and is submitted in compliance with the OCSG approval dated 4th July 2014 (OCSG 2014) and approved Water Management Plan (WMP) (AGL 2012). The report is also submitted to the EPA to comply with condition R5.5 of EPL 20358 (EPA 2014) for the TIP reporting.

Details of the approved WMP are provided in Section 2.3.

2. Monitoring network and methodology

2.1 Monitoring network and purpose

The water monitoring network for the irrigation program is summarised in Table 2.1 and shown on Figure 1.1.

Table 2.1 Summary of the water monitoring network

Category	Sub-category	Monitoring ID	Monitoring purpose	Monitoring commencement
Irrigation dams	Blended irrigation water	Tiedman south dam (TSD)	Monitor water quality of blended irrigation water	October 2011
	Produced water	Tiedman north dam (TND) Tiedman east dam (TED)	Monitor water quality of produced water	October 2011 May 2013
Groundwater	Shallow alluvial groundwater	TMB01 TMB02 TMB03	Monitor groundwater levels and quality in shallow alluvium adjacent to the Avon River and Dog Trap Creek for any potential impact from the TIP	February 2011
	Shallow rock groundwater	S4MB01 TCMB01 TTMB02	Monitor water levels and quality in fractured bedrock for any potential impact from the project	January 2011 August 2014 August 2014
	Perched groundwater (seepage monitoring bores)	TMB04 TMB05	Detect any potential leakage from the dams to form perched groundwater in the weathered rock profile adjacent to the dams	April 2011
	Perched water (soil water piezometers)	SP1A/B to SP10A/B	Monitor perched water quality in the soil profile in and near the irrigation area for any potential impact from the project	November 2013
Surface water	Surface water	ASW01 TSW01 TSW02 FSW01	Monitor water levels and quality of the Avon River and Dog Trap Creek for any potential impact from the project	March 2011 March 2011 April 2012 February 2012
Catch dams	Irrigation plot runoff	Catch dam east (CDE) Catch dam west (CDW)	Monitor water quality of any Stage 1A irrigation plot runoff	May 2013

The groundwater and surface water monitoring locations for the Stage 1A and 1B irrigation areas provide monitoring for the possible environmental receptors of blended irrigation water. Primary monitoring sites include:

- storage dams and catch dams
- surface water locations along the Avon River and Dog Trap Creek
- groundwater locations in the alluvium, adjacent and down gradient of the irrigation areas
- groundwater locations in the shallow rock below the irrigation areas.

The storage dams (TND, TSD, and TED) are a 'turkey's nest' style construction, located on high ground (beyond the floodplain), and designed to prevent ingress from surface runoff. Storage dams TND and TSD are single lined dams while TED is a double lined dam. The water used for irrigation (blended produced and fresh water) was stored in TSD.

The two catch dams (CDE and CDW) captured irrigation plot runoff (after heavy rainfall events), which was recycled to TND, and were monitored for water quality.

The two seepage monitoring bores (TMB04 and TMB05) allow for the monitoring of soil/perched water in the weathered rock profile adjacent to TND and TSD above the regional water table. The purpose of these monitoring bores is to detect leakage from the dams. Details of these monitoring bores are provided in Table 2.2.

Table 2.2 Seepage monitoring bore details

Monitoring bore	Total depth (mbgl)	Screened interval (mbgl)	Lithology
TMB04	15.0	8.0 – 14.0	Shallow rock (weathered sandstone and siltstone)
TMB05	10.0	6.0 – 9.0	

There are three stream gauges where surface water levels and quality are routinely monitored, being TSW01, TSW02 and ASW01 (Table 2.3). Until the inclusion in the routine quarterly sampling in August 2014 (as a result of new EPL conditions), the FSW01 sampling location on the Avon River, downstream of the Tiedman property, was only monitored during high rainfall events. Stream gauge ASW01 is also monitored during high rainfall events; ASW01 is considered a control site as it is located upstream of the irrigation areas and the confluence with Dog Trap Creek.

Table 2.3 Stream gauges

Gauge ID	Location
TSW01	Avon River downstream of the confluence with Dog Trap Creek and the irrigation areas, adjacent to monitoring bore TMB01
TSW02	Dog Trap Creek upstream of the irrigation areas, adjacent to monitoring bore TMB03
ASW01	Avon River upstream of the irrigation areas and the confluence with Dog Trap Creek
FSW01	Avon River downstream of the Tiedman property and the confluence with Dog Trap Creek and the irrigation areas

There are three groundwater monitoring bores screened within shallow alluvium associated with the Avon River and Dog Trap Creek (TMB01, TMB02 and TMB03) and three monitoring bores (S4MB01, TCMB01 and TTMB02) screened within the fractured bedrock underlying the irrigation area. Details are presented in Table 2.4.

Table 2.4 Groundwater monitoring bore details

Monitoring bore	Total depth (mbgl)	Screened interval (mbgl)	Lithology	Formation
TMB01	12.0	7.0 – 10.0	Clay	Avon River alluvium
TMB02	15.5	9.0 – 12.0	Mixed gravels	Avon River alluvium
TMB03	12.5	5.0 – 11.0	Mixed gravels and sand	Avon River alluvium
S4MB01	66.0	58.0 – 64.0	Sandstone	Shallow rock: Leloma Formation
TCMB01	95.0	87.0 – 93.0	Sandstone	Shallow rock: Leloma Formation
TTMB02	90.0	76.0 – 88.0	Sandstone/siltstone	Shallow rock: Leloma Formation

There are 10 paired (soil water) piezometers (SP1A/B to SP10A/B; 0.3 - 1.2 m and 1.5 m deep) within and just outside the Stage 1A and 1B irrigation areas that are typically dry. These piezometers monitor soil water in the shallow soil profile and are not groundwater monitoring locations as this soil water is generally ephemeral and does not flow in the landscape like groundwater.

2.2 Monitoring program

Quarterly water monitoring was undertaken at most sites and was subject to six-monthly compliance reporting to both the OCSG and the EPA. The water compliance reports were scheduled to align with soil compliance reports. The schedule of sampling events and reporting is provided in Table 2.5.

Table 2.5 Schedule of sampling and reporting events

Sampling event	Type	Sampling intervals	Compliance report
Baseline	Water Soil	October 2011 – September 2012 January 2013	January 2013 ^a May 2013 ^b
Irrigation 1	Water Soil	May 2013 (for period to 30 June 2013) May 2013 (for period to 30 June 2013)	August 2013 ^a August 2013 ^b
Irrigation 2	Water Soil	August 2013 and November 2013 (for period to 31 December 2013) November 2013 (for period to 31 December 2013)	January 2014 ^a January 2014 ^b
Irrigation 3	Water Soil	February 2014 and May 2014 (for period to 4 July 2014) May 2014 (for period to 4 July 2014)	August 2014 ^a August 2014 ^b
Irrigation 4	Water Soil	August 2014 and November 2014 (for period to 31 December 2014) November 2014 (for period to 31 December 2014)	February 2015 ^a February 2015 ^c
Irrigation 5	Water Soil	February 2015 and May 2015 (for period to 30 June 2015) May 2015 (for period to 30 June 2015)	August 2015 ^a (this report) August 2015 ^c

Notes:

- (a) Parsons Brinckerhoff reports.
- (b) Fodder King reports.
- (c) Jacobs reports.

Water quality was the primary monitoring requirement at all water monitoring sites, although water levels were also measured continuously at the dedicated stream gauges (ASW01, TSW02 and TSW01), the two seepage monitoring bores near the Tiedman dams (TMB04 and TMB05), the shallow alluvial monitoring bores (TMB01, TMB02 and TMB03) and fractured rock monitoring bores (S4MB01, TCMB01 and TTMB02).

Each of the three turkey nest dams (TSD, TND and TED) was monitored for water quality each quarter and salinity of the blended irrigation water was measured continuously using a salinity (EC) logger in TSD. This logger was operational from late 2011 to late 2012, when it was removed due to a lack of water in this dam. It was reinstalled in August 2013.

All ten paired piezometers (SP1A/B to SP10A/B) were dry at the time of the February 2015 sampling event. Two of the ten paired piezometers had accumulated sufficient perched (soil) water to allow for a sample to be collected in May 2015.

Catch dams CDE and CDW were monitored for water quality each quarter and the salinity of the water was measured continuously via a salinity (EC) logger in each dam. Electrical conductivity loggers were installed at catch dams CDE and CDW on 7 May 2013 and data until 30 June 2015 (when the loggers were downloaded) have been included in this compliance report.

Sampling locations FSW01 (Avon River – downstream), ASW01 (Avon River – upstream), CDW, and CDE were also monitored during high rainfall events. These locations were sampled by AGL during the high rainfall events in January, March, April and May 2015.

2.3 Approved water management plan

The approved water management plan (WMP) was titled '*Water Management Plan for the Tiedman Irrigation Program – Gloucester*' (AGL 2012). The WMP was based on the outline provided in the REF (Parsons Brinckerhoff 2011), the NSW Office of Water's (NOW) letter dated 12 August 2011, baseline monitoring initiated by AGL, discussions with NOW in December 2011, and additional information provided in February 2012.

Table 2.6 summarises the groundwater and surface water monitoring scope as outlined in the WMP. This was consistent with the monitoring requirements specified in Conditions P1.3, M2.2 and M2.5 of EPL 20358 (EPA 2014).

Table 2.6 Groundwater and surface water monitoring locations and scope

Monitoring ID (EPA ID)	Description	Water levels	Routine water quality and sampling frequency	Extra sampling
TND (27)	Tiedman north dam	Not required	Metals, nutrients, cations/anions – Quarterly Hydrocarbons – Annually	Physical parameters ^a – Monthly
TSD (28)	Tiedman south dam	Not required	Salinity logger – Continuous Metals, nutrients, cations/anions – Quarterly Hydrocarbons – Annually	Physical parameters – Monthly
TED (29)	Tiedman east dam	Not required	Metals, nutrients, cations/anions – Quarterly Hydrocarbons – Annually	Physical parameters – Monthly
CDE (33)	Catch dam located north-east of Stage 1A irrigation area	Not required	Salinity logger – Continuous	Physical parameters, metals, nutrients, cations/anions – During high rainfall events ^b

Monitoring ID (EPA ID)	Description	Water levels	Routine water quality and sampling frequency	Extra sampling
CDW (34)	Catch dam located south-west of Stage 1A irrigation area	Not required	Salinity logger – Continuous	Physical parameters, metals, nutrients, cations/anions – During high rainfall events ^b
TMB04 (30)	Seepage monitoring bore, located west of Tiedman north dam	Yes, continuous	Physical parameters then purge dry and assess inflows – Quarterly If inflow within 12-hours then physical parameters again, metals, nutrients, cations/anions	Physical inspection of surrounding area – Monthly
TMB05 (31)	Seepage monitoring bore, located south of the Tiedman dams	Yes, continuous	Physical parameters then purge dry and assess inflows – Quarterly If inflow within 12-hours then physical parameters again, metals, nutrients, cations/anions	Physical inspection of surrounding area – Monthly
ASW01 (36)	Avon River (upgradient), located on the Atkins property	Yes, continuous	Salinity logger – Continuous Nominal physical parameters, metals, nutrients, cations/anions – Quarterly Hydrocarbons – Annually	Physical parameters, metals, nutrients, cations/anions – During high rainfall events ^b
TSW02 (38)	Dog Trap Creek	Yes, continuous	Salinity logger – Continuous Physical parameters, metals, nutrients, cations/anions – Quarterly Hydrocarbons – Annually	None planned
TSW01 (37)	Avon River, located downgradient of the Tiedman boundary	Yes, continuous	Salinity logger – Continuous Nominal physical parameters, metals, nutrients, cations/anions – Quarterly Hydrocarbons – Annually	None planned
FSW01 (35)	Avon River, located downgradient, on the Farley property	Not required	Physical parameters, metals, nutrients, cations/anions – Quarterly Hydrocarbons – Annually	Physical parameters, metals, nutrients, cations/anions – During high rainfall events ^b
TMB01 (39)	Avon River alluvium, located downgradient (northern site)	Yes, continuous	Nominal physical parameters, metals, cations/anions – Quarterly Hydrocarbons and nutrients – Annually	None planned
TMB02 (40)	Avon River/Dog Trap Creek alluvium (mid site)	Yes, continuous	Nominal physical parameters, metals, cations/anions – Quarterly Hydrocarbons and nutrients – Annually	None planned
TMB03 (41)	Dog Trap Creek alluvium (southern site)	Yes, continuous	Nominal physical parameters, metals, cations/anions – Quarterly Hydrocarbons and nutrients – Annually	None planned

Monitoring ID (EPA ID)	Description	Water levels	Routine water quality and sampling frequency	Extra sampling
S4MB01 (42)	Northern site boundary of Stage 1A area (shallow rock)	Yes, continuous	Nominal physical parameters, metals, cations/anions – Quarterly Hydrocarbons and nutrients – Annually	None planned
TCMB01 ^c (43)	Located west of Tiedman dams (shallow rock)	Yes, continuous	Nominal physical parameters, metals, cations/anions – Quarterly Hydrocarbons and nutrients – Annually	None planned
TTMB02 ^c (44)	Located east of Stage 1A area (shallow rock)	Yes, continuous	Nominal physical parameters, metals, cations/anions – Quarterly Hydrocarbons and nutrients – Annually	None planned

Notes:

- (a) Physical parameters defined in Table 2.7.
- (b) High rainfall event samples are collected by AGL.
- (c) Not included in WMP.

The WMP states that the water intended for irrigation will meet the ANZECC (2000) water quality criteria for irrigation purposes. There were no other commitments in the WMP regarding guidelines or thresholds. The assessment criteria used in these water compliance reports (see Sections 2.5.2 and 2.5.3) were for comparative purposes only.

2.4 Water level monitoring

2.4.1 Groundwater level monitoring

Groundwater levels are electronically and manually measured in all monitoring bores. Dataloggers are suspended in the water column of each monitoring bore and are programmed to record a groundwater level measurement every six hours; this has been defined as ‘continuous’ monitoring. Manual measurements using an electronic dip meter were recorded every monitoring round and used to calibrate the logger data.

A barometric datalogger installed above the water table at WKMB02 (part of the original Stage 1 groundwater monitoring network), located approximately 2 km to the north of the irrigation area, records changes in atmospheric pressure. Data from this logger were used to correct for the effects of changing barometric pressure on groundwater levels.

2.4.2 Surface water level monitoring

Surface water monitoring locations include dataloggers to continuously monitor water levels and salinity and gauge boards. Loggers installed at the stream gauges are set to take a water level reading every 15 minutes; this has been defined as ‘continuous’ monitoring. Measurements were verified and calibrated by manual gauge readings and salinity (EC) measurements.

2.5 Water quality monitoring

Routine water quality sampling was completed at all of the sites listed in Table 2.6, as per EPL 20358 Condition P1.3.

2.5.1 Automated monitoring

Salinity (EC) loggers are installed at three surface water locations (ASW01, TSW02 and TSW01), the blended water irrigation dam (TSD) (October 2011 to March 2013 and from August 2013 onwards), TED (March to August 2013) and in the two catch dams (CDW and CDE).

Electrical conductivity measurements were recorded electronically, and manually verified during quarterly sampling events. Salinity dataloggers record EC every 15 minutes at the surface water sites, and every six hours at the Tiedman and catch dam sites; this is defined as 'continuous' monitoring.

2.5.2 Sampling methodology

Five sampling methods were used to obtain surface water and groundwater samples:

- submersible 12V pump:
 - ▶ At groundwater monitoring bores, screened within relatively permeable geological materials, TMB01, TMB02, and TMB03. A minimum of three well volumes was purged prior to sampling.
 - ▶ At the seepage monitoring bores TMB04 and TMB05, which are screened within material of very low permeability. The physical parameters (as defined in Table 2.7) of the purged groundwater were initially tested, then the bores were purged dry, and if any inflow was observed within 12 hours, then physical parameters were tested again and a sample taken for analysis.
- disposable bailer at the shallow perched soil water piezometers. Piezometers were purged dry and if any inflow was observed within 12 hours then physical parameters were tested again and a sample taken for analysis.
- micro-purge™ low flow sampling pump for monitoring bores S4MB01, TCMB01 and TTMB02, screened within material of relatively low permeability. An in-situ snap-sampler was used at S4MB01 until November 2014.
- grab sample using a Nalgene sub-sample bottle attached to a telescopic sampling pole for surface water and dam water samples. New Nalgene bottles were used for each monitoring site.

Electrical conductivity and pH were monitored during purging and allowed to stabilise prior to sample collection. Samples were sent to a NATA accredited laboratory for analysis, under the appropriate chain-of-custody protocols for chemical analysis. An intermediate water quality monitoring suite was adopted for the February 2015 sampling event and a comprehensive suite (including hydrocarbons and dissolved gases) was adopted for the May 2015 sampling event (details provided in Table 2.7).

Table 2.7 Analytical suite

Category			Parameters	
Physical parameters (field)	Intermediate suite	Comprehensive suite	EC	Redox potential
			Temperature	pH
			Dissolved oxygen	Total dissolved solids (TDS)
Physical parameters (lab)			EC	pH
			Total suspended solids (TSS)	TDS
Major ions			Calcium	Chloride ^a
			Magnesium	Bicarbonate
			Sodium	Sulphate
			Potassium	Fluoride
			Total alkalinity	Silicon
Metals and minor/trace elements	Aluminium	Manganese		
	Arsenic	Molybdenum		
	Barium	Mercury		
	Beryllium	Nickel		
	Boron	Lead		
	Bromine	Selenium		
	Cadmium	Strontium		
	Chromium	Uranium		
	Cobalt	Vanadium		
	Copper	Zinc		
	Iron			
	Nutrients	Total nitrogen	Nitrate	
		Ammonia	Nitrite	
Phosphorus (total and reactive)		Total organic carbon (TOC)		
Dissolved gases		Methane		
Hydrocarbons		Phenol compounds	Total petroleum hydrocarbons (TPH) Benzene, toluene, ethyl benzene and xylenes (BTEX)	
		Polycyclic aromatic hydrocarbons (PAH)		

Note:

(a) Chloride was analysed using two methods since August 2014: APHA 4500-Cl (standard) and APHA/USEPA 4110 (suitable for trace analysis of chloride).

Water quality samples were collected in the sample bottles provided by the laboratory, with the appropriate preservation when required. Samples undergoing dissolved metal analysis were filtered through 0.45 µm filters in the field prior to collection.

2.5.3 Assessment framework

The ANZECC (2000) guidelines and pre-irrigation baseline groundwater quality values were used for assessing water quality in this compliance report. The Avon River catchment is predominantly located in the northern Permian Gloucester Basin (which is a shallow marine, lacustrine and fluvial deposition basin). As stated in the ANZECC (2000) guidelines, surface water quality will vary depending on the catchment geology and soils, hence some natural surface water quality characteristics exceed these guidelines. Most of the groundwater within the catchment is brackish to slightly saline and therefore the ANZECC (2000) guidelines are not appropriate for assessing groundwater quality.

The guidelines for fresh and marine water quality (ANZECC 2000) recommend developing site specific guideline values that are derived from local reference data. Section 7.4.4.1 of the ANZECC guidelines recommends a minimum of two years of continuous monthly data at the reference site to establish a valid threshold value taken at the 80th percentile. The guideline allows for the threshold value to be modified as new baseline data becomes available by applying a rolling 80th percentile value incorporating the latest 24 month monitoring period. Where data are insufficient to calculate a valid threshold value, the guideline recommends defaulting to the appropriate ANZECC (2000) guideline value.

In this study, there was insufficient baseline data with which to develop site specific trigger values strictly as described in ANZECC (2000). Accordingly monitoring data were assessed using the following criteria:

- ANZECC (2000) default trigger values for the protection of freshwater aquatic ecosystems (toxicants)
- ANZECC (2000) default trigger values for aquatic ecosystems, south-east Australia, lowland river ecosystems (for physical and chemical stressors)
- ANZECC (2000) water quality for irrigation waters and general use, long-term threshold values
- natural ranges in water quality from observations during the baseline monitoring period.

The criteria used and rationale for the selection are provided in Table 2.8.

Table 2.8 Water quality assessment criteria used and rationale for selection

Category	Monitoring ID	Assessment criteria	Rationale
Irrigation dams	Tiedman south dam (TSD)	ANZECC (2000) guidelines for Primary Industries (irrigation).	The blended water within this dam was used for irrigation.
	Tiedman north dam (TND) Tiedman east dam (TED)	None apply.	The water in these dams is not directly used for irrigation. They are raw water sources for blended water.
Groundwater	TMB01 TMB02 TMB03	None apply. Reference is made to ranges in values over the baseline monitoring period ^a .	There was insufficient baseline data with which to develop site specific trigger values strictly as described in ANZECC (2000) for these groundwater systems.
	S4MB01 TCMB01 TTMB02		
	TMB04 TMB05		
Surface water	ASW01 TSW01 TSW02 FSW01	ANZECC (2000) guidelines for the protection of freshwater aquatic ecosystems (95% protection levels (trigger values)).	These guidelines apply to natural surface water systems, with the 95% protection level most appropriate for moderately disturbed systems (see paragraph following this table for further details).
Catch dams	Catch dam east (CDE) Catch dam west (CDW)	If overflow occurs, the ANZECC (2000) guidelines for the protection of freshwater aquatic ecosystems (95% protection levels (trigger values)) together with EPL 20358 Condition L3.4 (water concentration limits for TSS).	The catch dams captured the initial runoff, which was returned to the Tiedman water storage dams (i.e. no guidelines apply). After capturing the first flush, further rainfall overflowed the catch dams as overland flow to the Avon River, hence surface water guidelines apply.

Note:

(a) Baseline data was not collected for TCMB01 and TTMB02, as these have been included in the quarterly sampling since August 2014, following the baseline period.

Guideline values are intended as a management tool for assessing water quality and protecting environmental values. The guideline values do not represent strict pass/fail criteria, rather the guideline value “triggers” management response to protect the environment or water resource. The response typically involves further assessment to determine if the water quality change is caused by the activity under assessment, and if it represents a significant threat to environmental values.

Within EPL 20358, the EPA has defined a total suspended solids (TSS) concentration limit if overflow occurs at the catch dams CDE and CDW (Table 2.9) (EPA 2014).

Table 2.9 EPL 20358 concentration limit for overflow events at catch dams

Analyte	Units	100 percentile concentration limit
Total suspended solids (TSS)	mg/L	50

The ANZECC (2000) guidelines for the protection of fresh water ecosystems (80% and 95% protection levels) and irrigation water are provided in Table 2.10. Protection level signifies the percentage of species expected to be protected. In most cases the 95% protection level trigger values apply to ecosystems that could be classified as slightly to moderately disturbed, such as rural streams receiving runoff from land disturbed to varying degrees by grazing or pastoralism. The 80% protection level relates to highly disturbed systems, such as rural streams receiving runoff from intensive horticulture and urban streams receiving road and stormwater runoff. Given these descriptions, the 95% protection level is deemed most appropriate for comparative purposes in this report for surface water and the catch dams. However for some analytes even these guideline values are exceeded because of the catchment geology and soils.

The ANZECC (2000) long-term trigger values have been used as the irrigation guidelines because deficit irrigation is practiced (*i.e.* minimal irrigation water is applied). The long-term trigger value is the maximum concentration of contaminant in the irrigation water which can be tolerated assuming 100 years of irrigation. This was adopted as a conservative approach and considers irrigation as a continuing management option.

Table 2.10 ANZECC (2000) guideline trigger values for aquatic ecosystems and irrigation water

Analyte ^a	Units	ANZECC - Aquatic ecosystems (freshwater) guideline value ^b		ANZECC – Irrigation guideline value ^d
		95% protection levels ^h	80% protection levels ^h	
pH (range)	pH unit	6.5-8.0 ^c		6.0-9.0
EC	µS/cm	125-2,200 ^c		2,000 ^e
Sodium	mg/L	-	-	460 ^f
Chloride	mg/L	-	-	700 ^{f,g}
Fluoride	mg/L	-	-	1
Total phosphorus	mg/L	0.025 ^c		0.05 ⁱ
Ammonia	mg/L	0.9	2.3	N/A
Aluminium	mg/L	0.055	0.150	5
Arsenic	mg/L	0.013 ⁱ	0.140 ^j	0.1
Boron	mg/L	0.37	1.30	0.5 ^j
Cadmium	mg/L	0.0005	0.0022	0.01
Chromium (VI)	mg/L	0.0025	0.1	0.1
Cobalt	mg/L	ID	ID	0.05
Copper	mg/L	0.0035	0.0063	0.2
Iron	mg/L	ID	ID	0.2 ^k
Lead	mg/L	0.014	0.038	2
Manganese	mg/L	1.9	3.6	0.2
Nickel	mg/L	0.028	0.043	0.2
Selenium (total)	mg/L	0.011	0.034	0.02
Uranium	mg/L	ID	ID	0.01
Zinc	mg/L	0.020	0.078	2

Notes:

- (a) All metals are dissolved.
- (b) ANZECC 2000 - Water Quality Guidelines: trigger values for the protection of freshwater aquatic ecosystems (for toxicants).
- (c) ANZECC 2000 - Water Quality Guidelines: default trigger values for aquatic ecosystems, south-east Australia, lowland river ecosystems (for physical and chemical stressors). Note that the ANZECC (2000) guidelines for salinity state that NSW coastal rivers are typically in the range 200–300 µS/cm, however the Avon River (Manning River catchment) has high salinity levels given its geology (DIPNR 2004).
- (d) ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, long-term threshold values.
- (e) Average root zone salinity threshold for Lucerne, Hunter River.
- (f) Trigger value for the prevention of foliar injury due to chloride and sodium in irrigation water in moderately tolerant crops.
- (g) Medium risk of increasing cadmium concentrations in crops due to chloride in irrigation waters.
- (h) In most cases the 95% protection level trigger values apply to ecosystems that could be classified as slightly-moderately disturbed and the 80% protection level relates to highly disturbed systems.
- (i) Arsenic species: As(V).
- (j) This value is for very sensitive plant species (short-term use, up to 20 years). For sorghum and lucerne, values in soil pore water up to 6 mg/L are acceptable for short-term use.
- (k) This value is not an environmental criterion but primarily relates to potential clogging of irrigation systems (trickle or drippers) (ANZECC 2000, Volume 3, Section 9.2.5.12).
- (l) To minimise bioclogging of irrigation equipment (ANZECC 2000, Volume 3, Section 9.2.6).

Bold values have been corrected for moderate water hardness (based on ANZECC 2000 Table 3.4.4).

ID = insufficient data to derive a reliable trigger value.

- = no guideline value.

The range of results for groundwater from the pre-irrigation baseline sampling period at TMB01-02 and S4MB01 (Parsons Brinckerhoff 2013a) is provided in Table 2.11. Groundwater quality varies spatially and with depth across the Avon River catchment. There is insufficient baseline data with which to develop site specific trigger values strictly as described in ANZECC (2000). Water quality results are provided in Appendix A and are plotted against the appropriate criteria in Appendix B.

Table 2.11 Groundwater pre-irrigation baseline water quality

Analyte ^a	Units	Groundwater pre-irrigation baseline ^b	
		min	max
pH (field)	pH units	6.32	7.77
EC (field)	µS/cm	3,199	13,848
Sodium	mg/L	484	1,350
Chloride ^d	mg/L	841	2,940
Fluoride	mg/L	0.1	0.5
Total phosphorus	mg/L	0.02	0.1
Ammonia	mg/L	<0.01	2.45
Aluminium	mg/L	<0.01	0.06
Arsenic	mg/L	0.001	0.009
Boron	mg/L	<0.05	0.27
Cadmium	mg/L	<0.0001	0.0002
Cobalt	mg/L	<0.001	0.005
Copper	mg/L	<0.001	0.006
Iron	mg/L	0.36	6.53
Lead	mg/L	all <0.001	
Manganese	mg/L	0.223	1.73
Nickel	mg/L	<0.001	0.006
Selenium	mg/L	all <0.01	
Uranium	mg/L	<0.001	0.017
Zinc	mg/L	0.01	0.146

Notes:

- (a) All metals are dissolved.
- (b) Groundwater pre-irrigation baseline data from Parsons Brinckerhoff (2013a).
- (c) Baseline ranges exclude the seepage bores TMB04 and TMB05.
- (d) Chloride analysis method: APHA 4500-Cl.

3. Tiedman dams and seepage monitoring

3.1 Water quality results

The water quality analytes for the Tiedman dams (TSD, TND and TED) and seepage monitoring bores (TMB04 and TMB05) are presented in Table 3.1, Table 3.2 and Appendix A. Time-series plots are provided in Figures B.1 to B.23 in Appendix B, piper diagrams in Appendix C and laboratory analysis reports in Appendix D. The analytical results for TSD are compared to the ANZECC (2000) guidelines for Primary Industries (irrigation) as the blended water within this dam was used for irrigation. The blended/fresh water in TND, fresh to marginal water in TED and seepage monitoring water was not directly used for irrigation and therefore a comparison with the ANZECC (2000) irrigation guidelines is not relevant for compliance purposes.

Table 3.1 Tiedman dams and seepage monitoring bores results for February 2015

Analyte ^a	Units	ANZECC (2000) irrigation ^b	TSD	TND	TED	TMB04	TMB05
pH (field)	pH units	6.0–9.0	9.43	9.48	9.20	6.88	6.93
EC (lab)	µS/cm	2,000 ^c	1,800	643	590	7,140	7,460
Chloride ^d	mg/L	700	287	97.3	74.0	2,100	2,470
Sodium	mg/L	460	318	102	106	1,100	1,040
Boron	mg/L	0.50	0.19	0.08	0.09	<0.05	<0.05
Iron	mg/L	0.20	0.10	0.15	0.09	6.85	15.0
Manganese	mg/L	0.20	0.007	0.014	0.080	9.540	18.50
Total phosphorus	mg/L	0.025	0.47	0.29	0.22	0.08	0.09
Ammonia	mg/L	–	0.03	0.15	0.05	0.14	0.38

Notes:

(a) All metals are dissolved.

(b) ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, long-term threshold values (applied to TSD only).

(c) Average root zone salinity threshold for Lucerne, Hunter River.

(d) Method USEPA 4110B.

Bold – above ANZECC 2000 guideline (applied to TSD only; TND, TED, TMB04 and TMB05 are not compared to the guideline).

- = no guideline value.

Table 3.2 Tiedman dams and seepage monitoring bores results for May 2015

Analyte ^a	Units	ANZECC (2000) irrigation ^b	TSD	TND	TED	TMB04	TMB05
pH (field)	pH units	6.0–9.0	9.13^e	9.00	7.15	5.75	5.83
EC (lab)	µS/cm	2,000 ^c	1,120	919	312	7,140	7,570
Chloride ^d	mg/L	700	167.0	80.5	36.1	2,060	2,320
Sodium	mg/L	460	200	104	51	1,020	938
Boron	mg/L	0.50	0.14	0.08	<0.05	<0.05	<0.05
Iron	mg/L	0.20	<0.05	<0.05	<0.05	1.53	32.80
Manganese	mg/L	0.20	0.004	0.004	0.004	9.640	17.20
Total phosphorus	mg/L	0.025	0.85	1.03	0.20	0.08	2.04
Ammonia	mg/L	–	<0.01	0.01	<0.01	0.04	3.06

Notes:

(a) All metals are dissolved.

(b) ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, long-term threshold values.

(c) Average root zone salinity threshold for Lucerne, Hunter River.

(d) Method USEPA 4110B.

(e) pH is slightly elevated after pHs of between 8 and 9 were achieved by dosing in March 2015. Field monitoring of the blended water irrigated after the dosing system was installed in March 2015 suggest that the irrigated water was pH compliant

Bold – above ANZECC 2000 guideline (TSD only; TND, TED and TMB04 and TMB05 are not compared to the guideline).

- = no guideline value.

3.2 Tiedman dams

Historically, TND stored produced water from the exploration programs, however during this period TND contained mostly recycled freshwater from CDW and CDE. TED (during this reporting period) stored mostly fresh water used for blending with produced water. TSD stored the final blended water batches prior to irrigation. Fresh water was sourced from local farm dams and the Avon River to optimise the water quality of the blended water to within irrigation guideline values and to minimise soil degradation.

3.2.1 Water quality

3.2.1.1 Field parameters and major ion chemistry

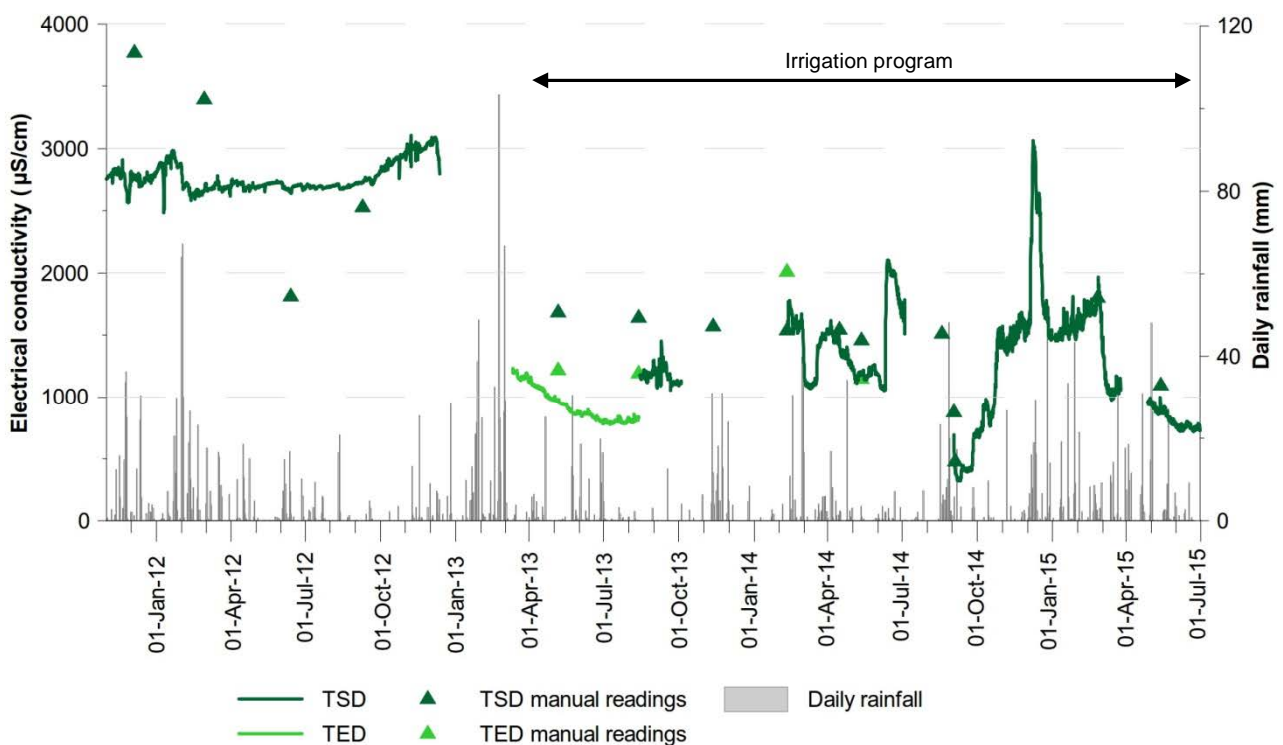
The salinity (EC) measurements in February 2015 for TSD were similar to the salinity of samples collected during the last compliance and irrigation period, and were also below the adopted ANZECC (2000) guideline value of 2,000 µS/cm. Blended water salinities decreased at TSD during the period as freshwater was recycled and the volume of produced water reduced. The EC was fresh at TED, while it decreased from slightly saline to marginal at TND compared to the samples collected during the last compliance period.

The pH measurements slightly exceeded the ANZECC guideline range of 6.0-9.0 at TSD for both monitoring events; however, an overall decrease in pH was observed compared to the measurements recorded during the last compliance period. A pH dosing system was installed in March 2015 that reduced the pH of the stored blended water in TSD to between pH 8 and 9 (to within the ANZECC guidelines). This lower pH water was irrigated during late March and April 2015. The pH increased to above pH 9 for the May 2015 sampling event after dosing was discontinued at the completion of the irrigation program. The slightly alkaline blended water in TSD is compatible with the acidic soils within the Stage 1A and 1B irrigation areas. A decrease in pH was also observed at TND and TED compared to the samples collected in the last compliance period; the

neutral pH at TED in May 2015 reflects the freshwater (mostly from rainfall) that is currently stored in this dam.

The water type for the Tiedman dams was generally sodium-chloride-bicarbonate (Na-Cl-HCO₃) as shown on the piper diagrams in Appendix C. TSD had chloride and sodium concentrations below the ANZECC (2000) irrigation guidelines (700 mg/L and 460 mg/L, respectively) for both monitoring events. The sodium adsorption ratio (SAR) of the blended water in TSD was 22.2 in February 2015 but reduced to 12.6 in May 2015; these results are discussed in more detail the soil compliance monitoring report (Jacobs 2015).

Continuous and manual EC data for TSD and TED is shown in Figure 3.1. The gaps in data relate to logger inconsistencies/failure or lack of water in the dam. The salinity in TSD changed from brackish (between October 2011 and December 2012) to marginal/brackish (from April 2013 to August 2014). Since redeployment of the logger in September 2014 (after a period of no stored water in TSD), the salinity in TSD fluctuated from fresh to slightly saline. These changes in salinity are the result of water batching to ensure that the blended irrigation water quality is below the required 2,000 µS/cm when irrigating.



Note: logger failure between 11/09/13 and 11/02/14; logger removed from TSD between 4/7/14 and 2/9/14.

Figure 3.1 Continuous EC data at Tiedman south dam and Tiedman east dam

3.2.1.2 Dissolved metals

The Tiedman dams had aluminium, arsenic, boron, manganese and zinc concentrations detected mostly above the laboratory limit of reporting (LOR) for both monitoring events. Copper and iron concentrations were detected at levels slightly above the LOR at all dams for the February 2015 monitoring event. Cadmium concentrations above the laboratory LOR were detected at TED in May 2015. Chromium, cobalt, nickel, selenium and uranium concentrations were either equivalent to or were below the laboratory LOR.

Dissolved metals in TSD were below the ANZECC (2000) guidelines for both monitoring events. Iron concentrations returned to be within the ANZECC (2000) guidelines (from November 2014).

3.2.1.3 Nutrients

Ammonia concentrations in the dams ranged from below the laboratory LOR to 0.15 mg/L in February 2015 and from below the laboratory LOR to 0.01 mg/L in May 2015. The ammonia concentration at TSD continued to be within the historical range.

The total phosphorus concentrations ranged from 0.22 mg/L to 0.47 mg/L in February 2015 and from 0.20 mg/L to 1.03 mg/L in May 2015. Total phosphorus concentrations at TSD remained above the ANZECC (2000) guideline value for irrigation (0.025 mg/L) and were comparable to baseline concentrations. It should be noted that the guideline is only set at this low concentration to minimise bioclogging of irrigation equipment (ANZECC 2000) and that the short-term irrigation trigger value is 0.8-12 mg/L.

3.2.1.4 Hydrocarbons

No total petroleum hydrocarbons (TPH), BTEX or other longer chained hydrocarbons were detected at the dams when sampled in May 2015.

3.2.1.5 Methane

TED had a methane concentration of 92 µg/L when sampled in May 2015, while TSD and TND were below the laboratory LOR (<10 µg/L).

3.3 Seepage monitoring around the Tiedman dams

3.3.1 Water levels

The groundwater levels in the seepage bores are shown in Figure 3.2 along with daily rainfall and the monthly cumulative rainfall deviation from the mean (CDFM). (A positive slope in the CDFM indicates above average rainfall and a negative slope indicates below average rainfall.) Both seepage bores around the Tiedman dams have occasionally been dry following periods of low rainfall during the baseline monitoring period; however during the irrigation program the bores have consistently indicated perched water at shallow depth (Parsons Brinckerhoff 2015).

Over the monitoring period, no clear response to rainfall (or the lack of rainfall) is visible even though perched water was present throughout this period. Both seepage bores show a fast recovery after each sampling event and return to levels consistent with the baseline monitoring period (Figure 3.2).

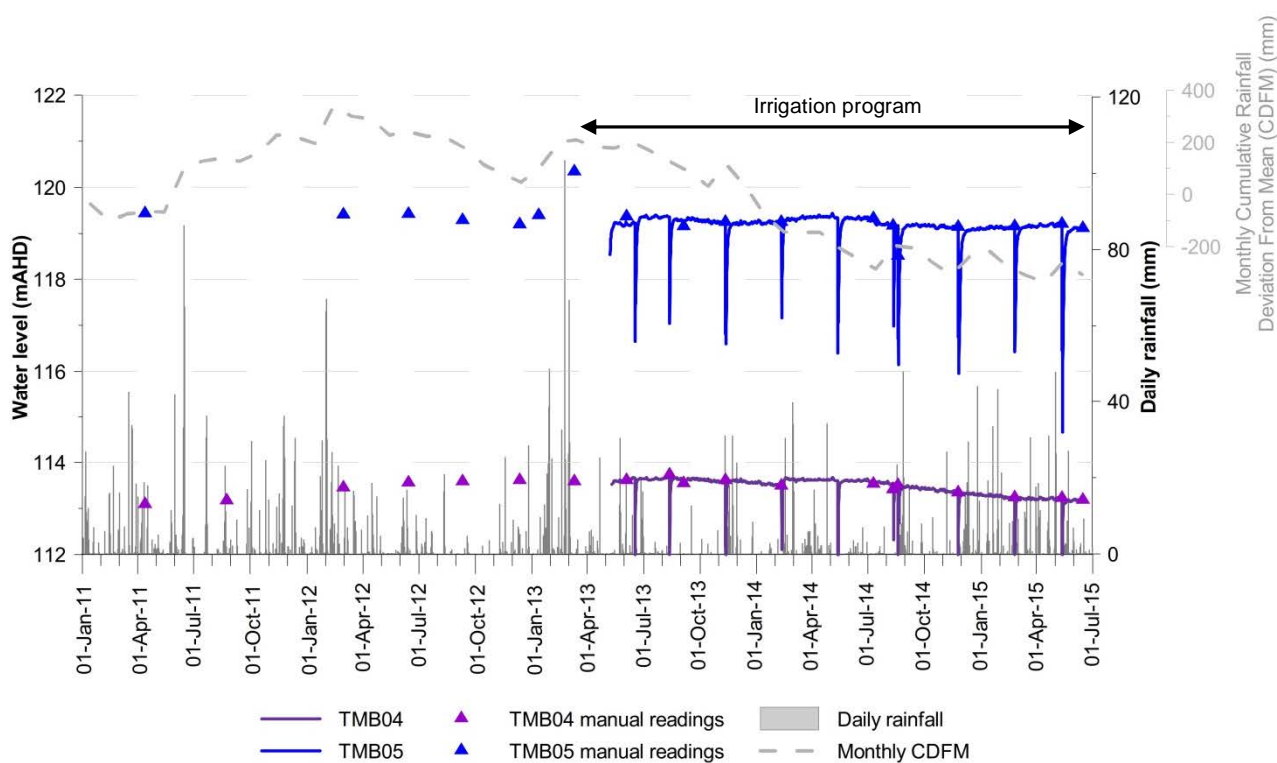


Figure 3.2 Groundwater levels for seepage monitoring bores (TMB04 and TMB05)

3.3.2 Water quality

Accumulated water in both seepage monitoring bores was sampled during the February and May 2015 sampling events.

3.3.2.1 Field parameters and major ions

The seepage water remained slightly saline over the monitoring period. The pH conditions were neutral in February 2015 and acidic in May 2015. These results are characteristic of the shallow soils. In comparison to the results from the Tiedman dams, the pH of the seepage water is lower and the EC much higher.

Analysis of major ion components indicates that the water type for the seepage bores remained as sodium-magnesium-chloride (Na-Mg-Cl) dominant (Appendix C). The proportion of chloride in the seepage bores, in particular, is notably higher than the proportion of chloride in the water within the Tiedman dams.

3.3.2.2 Dissolved metals

Aluminium, barium, beryllium, bromine, cadmium, cobalt, copper, iron, lead, manganese, nickel, strontium and zinc were detected above the laboratory LOR in at least one of the two seepage monitoring bores for the two monitoring events. In particular, iron and manganese concentrations were elevated at both seepage monitoring bores, consistent with baseline concentrations. Copper concentrations were also elevated at both seepage monitoring bores, and continued to exceed the pre-irrigation baseline conditions. Concentrations of dissolved metals were comparable to concentrations measured during the last compliance period, except for cadmium, lead and nickel concentrations which decreased at TMB05 compared to the concentrations recorded during the last compliance period. All other dissolved metal analytes were either equivalent to or below the laboratory LOR.

There are distinct differences in the concentration of metals and the ratio of different metals between the seepage bores and Tiedman dams, such as higher iron, manganese and zinc concentrations in the seepage bores. The water quality results are characteristic of the shallow soils.

3.3.2.3 Nutrients

Ammonia and total phosphorus concentrations were consistent with the previous compliance period for TMB04 and notably increased in May 2015 at TMB05.

3.3.2.4 Hydrocarbons

TPH concentrations were detected at both TMB04 and TMB05 when sampled in May 2015, with a C₁₀-C₃₆ fraction sum of 170 µg/L and 2,150 µg/L respectively. Toluene was detected at TMB05 (26 µg/L). Minor detections of phenolic compounds occurred at TMB04 and TMB05. No historical hydrocarbon data is available to be used for comparison for the seepage monitoring bores.

3.3.2.5 Methane

TMB05 had a methane concentration of 234 µg/L when sampled in May 2015, while TMB04 was below the laboratory LOR (<10 µg/L). No historical methane data is available for comparison at the seepage monitoring bores.

4. Surface water monitoring

4.1 Surface water levels

Surface water levels from stream level gauges TSW01, TSW02, and ASW01 are shown in Figure 4.1. All three stream gauges on the Avon River and Dog Trap Creek show sharp increases in water level in response to rainfall events, and relatively steep recession curves. The highest flow event during the period was in April 2015. This is consistent with a rapid runoff response from a relatively small upstream catchment with limited riverbank storage. Stream levels decrease over several weeks following each rainfall event to a relatively consistent base level that represents a small groundwater baseflow component in the Avon River.

The Avon River and its major tributaries cease to flow during prolonged dry conditions (e.g. from early July 2014 to mid-August 2014) leading to a reduction of stream flow along the Avon River and the formation of disconnected pools along Dog Trap Creek (Figure 4.1). Continuous stream flow was observed in the Avon River during this monitoring period and Dog Trap Creek returned to continuous stream flow in response to rainfall events from April 2015 onwards.

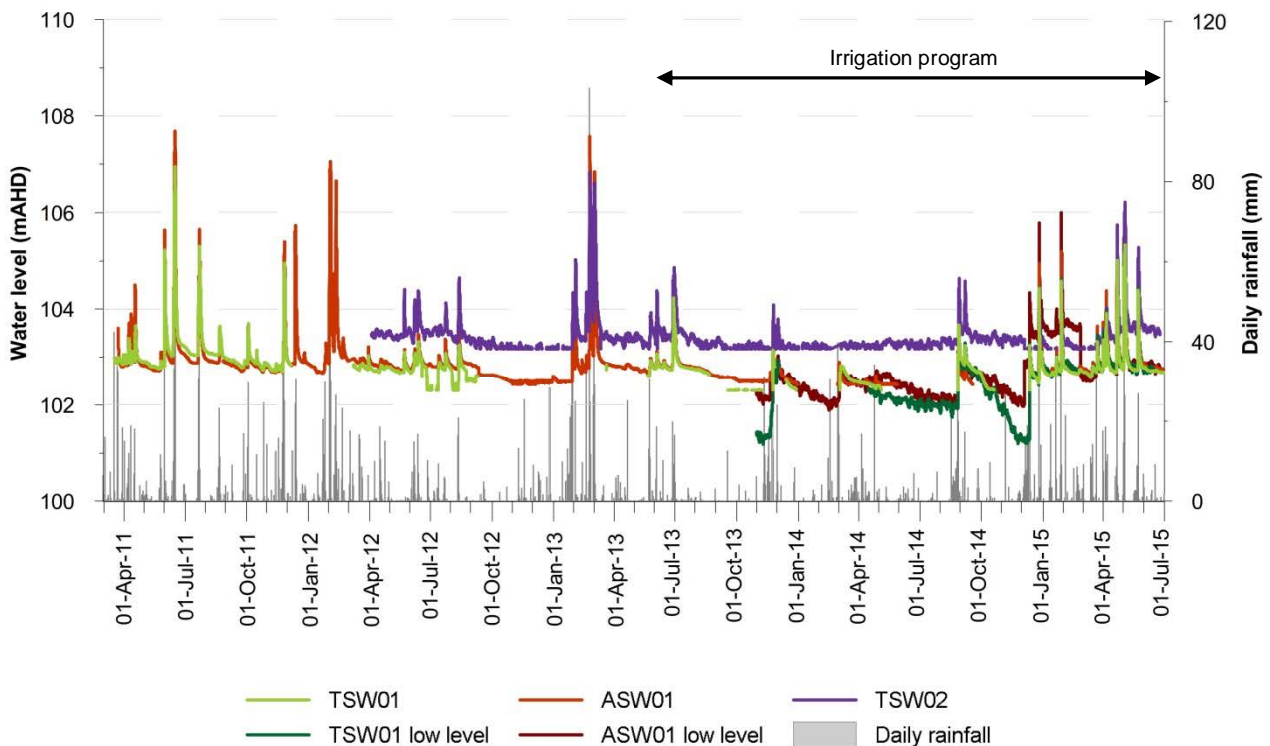


Figure 4.1 Surface water levels

4.2 Surface water quality

4.2.1 Surface water

In February and May 2015, surface water was sampled at ASW01, TSW01, TSW02 and FSW01, with FSW01 and ASW01 also sampled on 28 January, 22 March, 21 April and 1 May 2015, associated with high rainfall events. No sample could be collected at TSW02 in February 2015 as Dog Trap Creek was dry.

The surface water quality results for the main analytes for TSW01 and TSW02 are presented in Table 4.1 for the quarterly sampling events. The surface water quality results for the main analytes for ASW01 and FSW01 are presented in Table 4.2 and Table 4.3 respectively for the quarterly sampling events along with the high rainfall (catch dam overflow) events results (shaded columns).

Water quality time-series plots are provided in Figures B.1 to B.23 of Appendix B, piper diagrams in Appendix C and laboratory analysis reports in Appendix D.

Table 4.1 February and May 2015 results for surface water monitoring locations TSW01 and TSW02

Analyte ^a	Units	ANZECC 2000 guidelines ^b		TSW01		TSW02 ^f
		95% ^c	80% ^c	Feb 2015	May 2015	May 2015
pH (field)	pH units	6.5-8.0 ^d		7.54	7.10	7.00
EC (lab)	µS/cm	125-2,200 ^d		335	275	437
Sodium	mg/L	-	-	34	30	34
Chloride ^e	mg/L	-	-	58.6	50.8	55.0
Boron	mg/L	0.37	1.30	<0.05	<0.05	<0.05
Iron	mg/L	ID	ID	0.77	0.26	0.45
Manganese	mg/L	1.9	3.6	0.169	0.048	0.036
Total phosphorus	mg/L	0.025 ^d		0.08	0.04	0.07
Ammonia	mg/L	0.9	2.3	0.03	0.03	<0.01

Notes:

(a) All metals are dissolved.

(b) ANZECC 2000 – Water Quality Guidelines: trigger values for the protection of freshwater aquatic ecosystems.

(c) Protection level signifies the percentage of species expected to be protected. In most cases the 95% protection level trigger values apply to ecosystems classified as slightly-moderately disturbed and the 80% protection level relates to highly disturbed systems.

(d) ANZECC 2000 – Water Quality Guidelines: default trigger values for aquatic ecosystems, south-east Australia, lowland river ecosystems.

(e) Method USEPA 4110B.

(f) No flow at this Dog Trap Creek site in February 2015

Bold – above guideline value.

ID = insufficient data to derive a reliable trigger value.

- = no guideline value.

Table 4.2 2015 results for surface water monitoring location ASW01 (upstream)

Analyte ^a	Units	ANZECC 2000 guidelines ^b		ASW01					
		95% ^c	80% ^c	Jan 2015 ^e	Feb 2015	Mar 2015 ^e	Apr 2015 ^e	Early May 2015 ^e	May 2015
pH (field)	pH units	6.5-8.0 ^d		6.65	7.18	na	7.00	7.26	6.99
EC (lab)	µS/cm	125-2,200 ^d		129	351	195	76	246	295
Total suspended solids	mg/L	-	-	64	<5	<5	432	16	26
Sodium	mg/L	-	-	14	37	21	9	28	30
Chloride ^f	mg/L	-	-	21.2	62.3	30.0	10.5	44.0	51.8
Boron	mg/L	0.37	1.30	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	mg/L	ID	ID	0.69	1.22	0.220	0.91	0.82	0.20
Manganese	mg/L	1.9	3.6	0.026	0.083	0.029	0.033	0.003	0.051
Total phosphorus	mg/L	0.025 ^d		0.12	0.04	0.09	0.32	0.03	0.03
Ammonia	mg/L	0.9	2.3	<0.01	0.03	0.01	0.03	0.03	0.02

Notes:

- (a) All metals are dissolved.
- (b) ANZECC 2000 – Water Quality Guidelines: trigger values for the protection of freshwater aquatic ecosystems.
- (c) Protection level signifies the percentage of species expected to be protected. In most cases the 95% protection level trigger values apply to ecosystems classified as slightly-moderately disturbed and the 80% protection level relates to highly disturbed systems.
- (d) ANZECC 2000 – Water Quality Guidelines: default trigger values for aquatic ecosystems, south-east Australia, lowland river ecosystems.
- (e) High rainfall event sampling January, March, April and early May 2015 (also shaded grey to highlight differences).
- (f) Method USEPA 4110B.

Bold – above guideline value.

ID = insufficient data to derive a reliable trigger value.

- = no guideline value.

na = not analysed.

Table 4.3 2015 results for surface water monitoring location FSW01 (downstream)

Analyte ^a	Units	ANZECC 2000 guidelines ^b		FSW01					
		95% ^c	80% ^c	Jan 2015 ^e	Feb 2015	Mar 2015 ^e	Apr 2015 ^e	Early May 2015 ^e	May 2015
pH (field)	pH units	6.5-8.0 ^d		7.29	7.20	na	6.88	7.64	6.70
EC (lab)	µS/cm	125-2,200 ^d		125	297	215	81	236	269
Total suspended solids	mg/L	-	-	37	<5	5	790	26	<5
Sodium	mg/L	-	-	12	31	22	10	27	32
Chloride ^f	mg/L	-	-	19.8	51.6	34.4	12.0	40.4	49.8
Boron	mg/L	0.37	1.30	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	mg/L	ID	ID	0.60	0.43	0.220	0.84	0.69	0.26
Manganese	mg/L	1.9	3.6	0.024	0.018	0.010	0.041	0.005	0.054
Total phosphorus	mg/L	0.025 ^d		0.14	0.06	0.05	0.33	0.12	0.05
Ammonia	mg/L	0.9	2.3	0.01	0.02	0.02	0.04	0.04	0.03

Notes:

- (a) All metals are dissolved.
- (b) ANZECC 2000 – Water Quality Guidelines: trigger values for the protection of freshwater aquatic ecosystems.
- (c) Protection level signifies the percentage of species expected to be protected. In most cases the 95% protection level trigger values apply to ecosystems classified as slightly-moderately disturbed and the 80% protection level relates to highly disturbed systems.
- (d) ANZECC 2000 – Water Quality Guidelines: default trigger values for aquatic ecosystems, south-east Australia, lowland river ecosystems.
- (e) High rainfall event sampling January, March, April and early May 2015 (also shaded grey to highlight differences).
- (f) Method USEPA 4110B.

Bold – above guideline value.

ID = insufficient data to derive a reliable trigger value.

- = no guideline value.

na = not analysed.

4.2.1.1 Field parameters and major ion chemistry

Surface water salinity (EC) inversely correlates with rainfall and surface water flow. Typically surface water EC initially spikes then sharply decreases during and following rainfall events (Figure 4.2). This cyclical trend has been consistent since AGL commenced surface water monitoring in March 2011. The initial spike (sudden transient increase) in EC is often seen in the initial runoff phase as readily dissolvable salts are flushed from the ground surface and shallow soils across the catchment. Following the initial spike, the EC sharply decreases as relatively fresh runoff is routed into streams. After the initial salinity spike and sharp reduction in EC levels, the EC gradually increases as flow decreases during periods of recession. This gradual increase in EC is due to groundwater discharge becoming a more dominant component of flow, and evaporative concentration of salts taking place in residual and connected pools.

Additional low level loggers were installed at TSW01 and ASW01 in November 2013 to enable EC measurements below the initial datalogger level setting (Figure 4.2).

Surface water continued to be classified mostly as fresh. The salinity is highest in Dog Trap Creek (TSW02) and salinity is slightly decreasing along the Avon River, from upstream (ASW01) to downstream (TSW01 and

FSW01). Continuous EC logging during the first half of 2015 shows the minimum EC was approximately 24 $\mu\text{S}/\text{cm}$ (TSW01) and the maximum EC was 743 $\mu\text{S}/\text{cm}$ (ASW01).

At the time of the high rainfall events the salinity was comparable at the upstream Avon River location (ASW01) and the downstream location (FSW01). Salinity was also consistently lower during the overflow events compared to the regular monitoring rounds at these two locations. EC measurements were within the ANZECC (2000) guideline values range for the routine February and May 2015 sampling events and for all overflow events, except for ASW01 and FSW01 in April 2015, when the EC was below the guideline range.

The pH values were near neutral across the four sampling locations for the routine February and May 2015 sampling events and within the ANZECC (2000) guideline range. The pH values at TSW01 and TSW02 were slightly higher compared to both the upstream location ASW01 and the downstream location FSW01. During the overflow events in 2015, the pH at the downstream location FSW01 was generally comparable to the pH of the upstream location ASW01. The pH values were within the ANZECC (2000) guideline range for all overflow event samples.

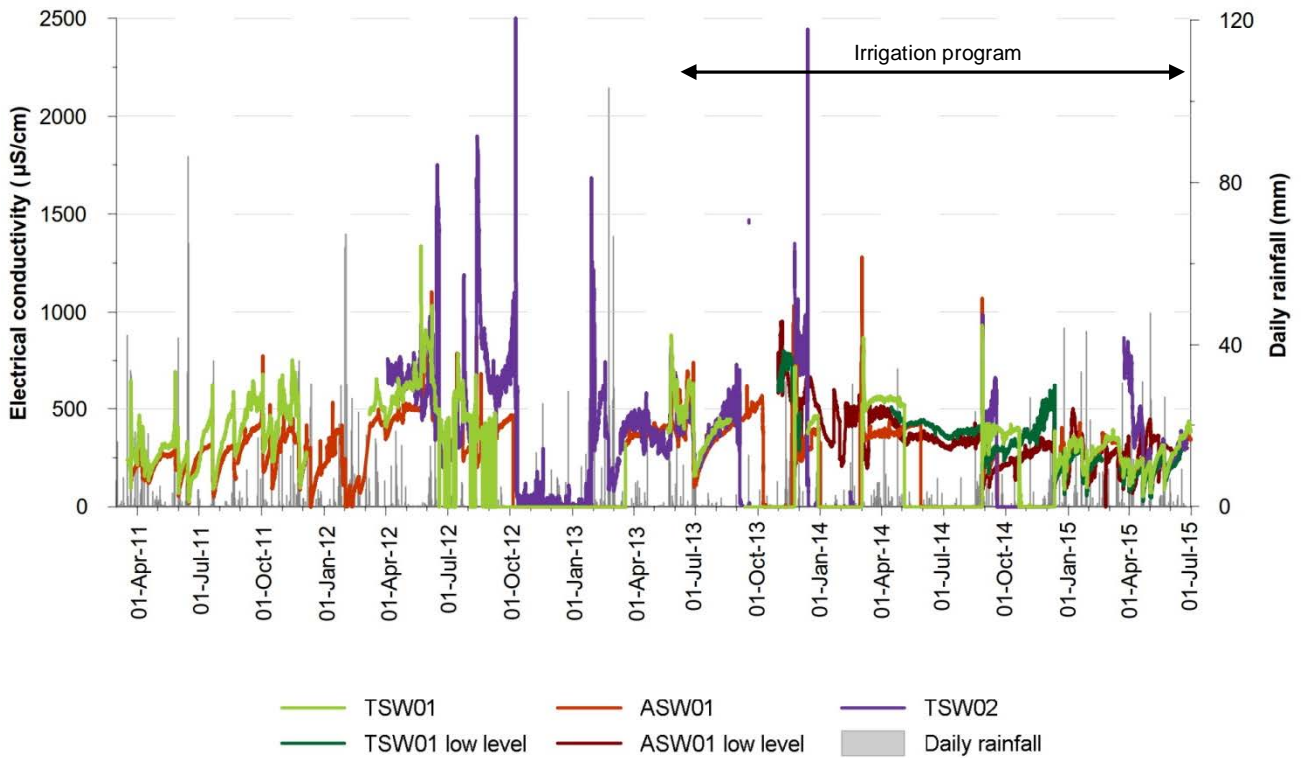


Figure 4.2 Continuous EC logging results at stream gauges

The water types for the surface water locations are presented in Table 4.4 and are displayed on the piper diagrams (Appendix C).

Table 4.4 Major ion chemistry of surface water

Location	Jan 2015	Feb 2015	Mar 2015	Apr 2015	Early May 2015 ^e	May 2015
ASW01	Na-Cl-HCO ₃	Na-Ca-Mg-Cl-HCO ₃	Na-Ca-Mg-Cl-HCO ₃	Na-Cl-SO ₄ -HCO ₃	Na-Ca-Mg-Cl-HCO ₃	Na-Ca-Mg-Cl-HCO ₃
TSW02	ns	ns	ns	ns	ns	Na-Mg-Cl-HCO ₃
TSW01	ns	Na-Ca-Mg-Cl-HCO ₃	Na-Mg-Ca-Cl-HCO ₃	ns	ns	Na-Mg-Ca-Cl-HCO ₃
FSW01	Na-Cl-HCO ₃	Na-Ca-Mg-Cl-HCO ₃	Na-Ca-Mg-Cl-HCO ₃	Na-Cl-HCO ₃	Na-Ca-Mg-Cl-HCO ₃	Na-Mg-Ca-Cl-HCO ₃

Notes:

(a) High rainfall event sampling January, March, April and early May 2015 (also shaded grey to highlight differences).
ns = not sampled.

The water types during the high rainfall events are comparable at the upstream site ASW01 and the downstream site FSW01, indicating no detectable change in water quality as a result of the catch dam overflow events from the irrigation area.

4.2.1.2 Dissolved metals

Concentration of dissolved aluminium, arsenic, cobalt, copper, iron, manganese, nickel, strontium and zinc were detected above the laboratory LOR at at least one of the four surface water sites. During the reporting period, all these values were consistently below the ANZECC (2000) guidelines, except for:

- aluminium which generally exceeded the ANZECC (2000) guideline at ASW01, TSW02 and FSW01 for both events
- copper at ASW01 in January 2015
- zinc at FSW01 in January and May 2015.

All other dissolved metal analytes were either equivalent to or below the laboratory LOR.

4.2.1.3 Nutrients

Ammonia concentrations were consistently below the ANZECC (2000) guidelines for the routine February and May 2015 sampling events. Total phosphorus concentrations exceeded the ANZECC (2000) guidelines at the majority of surface water monitoring sites during routine sampling events.

Total phosphorus concentrations at ASW01 and FSW01 continued to be generally higher during the overflow events and were particularly high during the April 2015 event (the highest flow event during the period); these concentrations are likely to be related to agricultural use of fertilisers and the nature of soils and weathered rocks across the upper Avon River catchment. Total phosphorus concentrations at ASW01 were slightly lower than at the downstream location FSW01.

4.2.1.4 Hydrocarbons

No TPH, BTEX or other longer chained hydrocarbons were detected in the comprehensive sampling event in May 2015.

4.2.1.5 Methane

Methane was detected at TSW01 (26 µg/L), ASW01 (26 µg/L) and FSW01 (32 µg/L) in May 2015 at concentrations slightly higher than in May 2014 (Parsons Brinckerhoff 2014b).

4.2.2 Irrigation plot runoff

Irrigation plot runoff was captured by CDE and CDW. These catch dams were designed to capture runoff from the Stage 1A area during larger rainfall events. They were maintained at very low storage levels to minimise the storage of poor quality water. The irrigation plan was to maintain an irrigation deficit so there would always be capacity in the treated soil profile to accept rain events in a similar manner to the surrounding soils. Subject to the frequency, intensity, and duration of larger rain events, surface runoff may occur from the irrigation area. During the TIP approval period for the irrigation of blended water, the initial runoff from the area was captured in the catch dams and returned to the Tiedman water storage dams. After capturing the first flush, any further runoff overflowed the catch dams as overland flow.

During the routine February and May 2015 sampling events, there was minimal water stored in the catch dams. In May 2015 there was insufficient water at CDW to enable sampling. Water collected in the catch dams during the TIP period was recycled back into the Tiedman dams and not released into the environment. As there was no overland flow to the Avon River, comparison of the February and May 2015 water quality data to the adopted ANZECC (2000) guidelines is not warranted.

Following the four large rainfall events during the reporting period, water samples were collected from the catch dams while they were overflowing. The January, March, April and early May 2015 results for CDW and early May 2015 results for CDE for key analytes are presented in Table 4.5 together with the available quarterly sampling event results. The ANZECC (2000) guideline for the protection of fresh water ecosystems and the EPL 20358 concentration limit for TSS are included in Table 4.5 for comparison with the overflow events only (shaded in grey).

Water quality time-series plots are provided in Figures B.1 to B.23 of Appendix B, piper diagrams in Appendix C and laboratory analysis reports in Appendix D.

Table 4.5 2015 results for the catch dams

Analyte ^a	Units	ANZECC 2000 guidelines ^b		EPL condition	CDE			CDW				
		95% ^c	80% ^c		Feb 2015	Early May 2015 ^e	May 2015	Jan 2015 ^e	Feb 2015	Mar 2015 ^e	Apr 2015 ^e	Early May 2015 ^e
pH (field)	pH units	6.5-8.0 ^d		-	7.05	7.51	8.50	8.14	7.27	na	7.47	8.17
EC (lab)	µS/cm	125-2,200 ^d		-	401	298	461	411	690	363	1,520	754
Total suspended solids	mg/L	-	-	50	56	230	58	15	25	131	36	635
Sodium	mg/L	-	-	-	50	30	36	48	96	53	106	60
Chloride ^f	mg/L	-	-	-	51.0	17.2	27.6	40.8	103	41.8	66.8	36.3
Boron	mg/L	0.37	1.30	-	<0.05	0.07	<0.05	0.06	0.06	0.06	0.10	0.06
Iron	mg/L	ID	ID	-	1.49	0.60	0.16	0.24	1.05	0.340	<0.05	0.09
Manganese	mg/L	1.9	3.6	-	0.062	0.004	0.007	0.004	0.075	0.007	0.046	0.001
Total phosphorus	mg/L	0.025 ^d		-	1.38	0.89	0.91	1.86	2.82	2.42	1.44	1.33
Ammonia	mg/L	0.9	2.3	-	0.04	0.08	0.05	0.03	0.19	0.09	0.09	0.07

Notes:

(a) All metals are dissolved.

(b) ANZECC 2000 – Water Quality Guidelines: trigger values for the protection of freshwater aquatic ecosystems.

(c) Protection level signifies the percentage of species expected to be protected. In most cases the 95% protection level trigger values apply to ecosystems classified as slightly-moderately disturbed and the 80% protection level relates to highly disturbed systems.

(d) ANZECC 2000 – Water Quality Guidelines: default trigger values for aquatic ecosystems, south-east Australia, lowland river ecosystems.

(e) High rainfall event sampling January, March, April and early May 2015 (also shaded grey to highlight differences).

(f) Method USEPA 4110B.

Bold – above guideline value (for high rainfall event sampling only).

ID = insufficient data to derive a reliable trigger value.

- = no guideline value or EPL concentration limit.

na = not analysed

4.2.2.1 Field parameters and major ion chemistry

The water in the catch dams can be classified as fresh and neutral to slightly alkaline. The slightly alkaline pH at CDW in January and early May 2015 was slightly above the ANZECC (2000) guidelines and was within historical range for CDW (and typical for Avon River catchment runoff). The EC values at CDW and CDE in the first half of 2015 were higher compared to the last compliance period, yet within the historical range.

Analysis of major ion components indicates that the water in the catch dams was dominated by sodium, calcium, sulphate and bicarbonate, as illustrated on the piper diagrams (Appendix C). The water quality of the catch dams was different from the blended irrigation because the water is predominantly runoff across the amended soil profile. Calcium and sulphate concentrations were higher in CDE and CDW waters after April 2015 because of the gypsum and lime applications across the Stage 1A area in April 2015 to improve calcium to magnesium ratios in the soil profile (Jacobs 2015).

The water types for the catch dams are presented in Table 4.6 and are displayed on piper diagrams in Appendix C.

Table 4.6 Major ion chemistry in catch dams

Location	Jan 2015	Feb 2015	Mar 2015	Apr 2015	Early May 2015 ^e	May 2015
CDE	ns	Na-HCO ₃ -Cl	ns	ns	Na-Ca-SO ₄ -HCO ₃	Ca-Na-SO ₄ -HCO ₃
CDW	Na-HCO ₃ -Cl	Na-Cl-HCO ₃	Na-HCO ₃ -Cl	Ca-Na-SO ₄	Ca-Na-SO ₄	ns

Notes:

(a) High rainfall event sampling January, March, April and early May 2015 (also shaded grey to highlight differences).

ns = not sampled.

The continuous EC logger data for CDW and CDE from 7 May 2013 to 30 June 2015 are plotted in Figure 4.3. Increases in salinity in the catch dams were mainly attributable to limited rainfall (and runoff) and evaporative concentration of stored water within each of the dams. Decreases in salinity were visible in both catch dams as a response to rainfall and in response to the recycling of the stored water back to the Tiedman dams.

Analysis of TSS indicated exceedances of EPL 20358 Condition L3.4 for the high rainfall events in March 2015 at CDW and early May 2015 at CDE and CDW. AGL reported these exceedances to the EPA as per the conditions in sections R.2 and R.3 of the EPL. Past investigations have identified that the sampling locations were not ideal as there is exposed sediment at each of the sampling points.

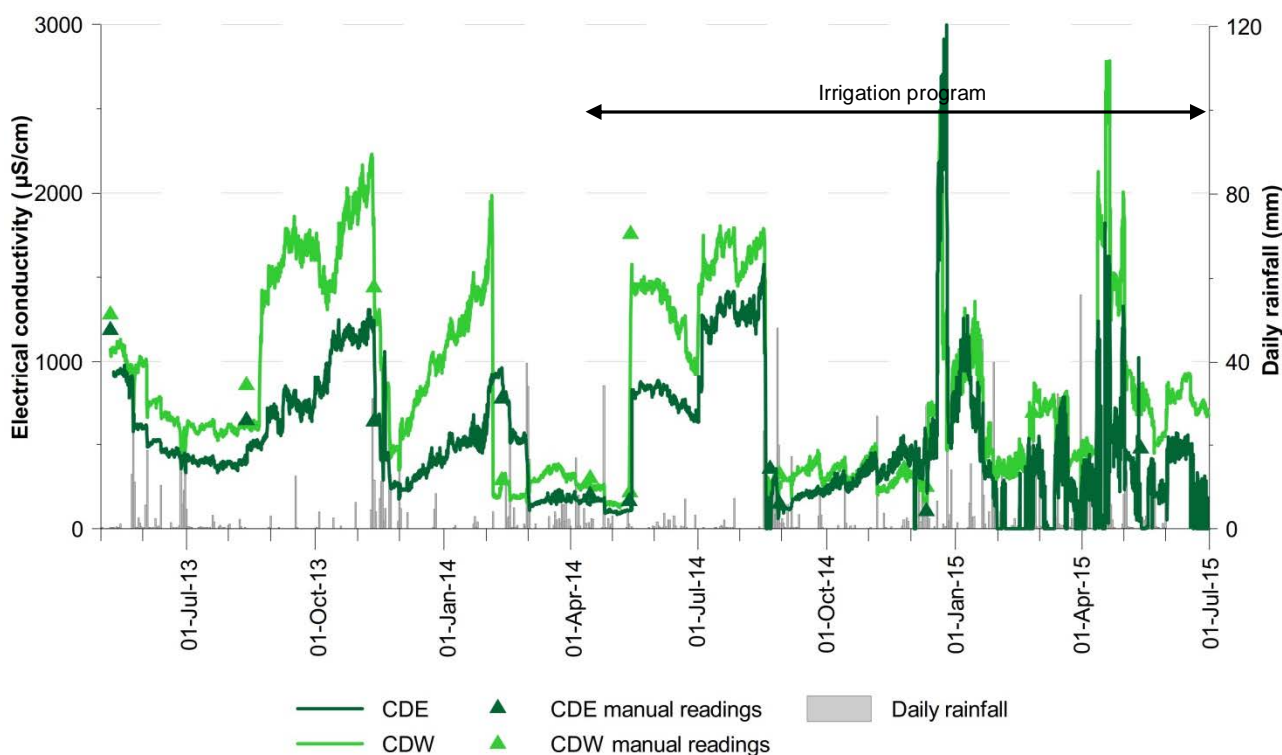


Figure 4.3 Continuous EC data at CDE and CDW

4.2.2.2 Dissolved metals

Concentrations of dissolved aluminium, arsenic, boron, barium, bromine, copper, iron, manganese, molybdenum, nickel, strontium and zinc were detected above the laboratory LOR during at least one monitoring event. All other dissolved metal analytes were either equivalent to or below the laboratory LOR. Concentrations of dissolved metals were generally comparable to the last compliance period.

For the overflow events during this monitoring period aluminium, copper and zinc concentrations were above the ANZECC (2000) guidelines at CDW and CDE during at least one monitoring event yet within the historical range for surface water runoff and the surface water quality at ASW01, TSW01, TSW02 and FSW01. These exceedances may also relate to the exposed sediment present at each of the sampling points.

4.2.2.3 Nutrients

Total phosphorus concentrations measured at the two catch dams in February 2015 were higher than during the last compliance period and the May 2015 concentrations. The concentration measured at CDW in February 2015 was the highest recorded (2.82 mg/L). Ammonia concentrations measured at the two catch dams were comparable to concentrations measured during the last compliance period.

Total phosphorus concentrations at both catch dams during the overflow events continued to exceed the ANZECC (2000) guideline values. Trends are similar to surface water quality during high rainfall events (see Section 4.2.1.3); concentrations are related to agricultural use of fertilisers and the nature of soils and weathered rocks across the catchment.

4.2.2.4 Hydrocarbons

No TPH, BTEX or other longer chained hydrocarbons were detected at CDE when sampled in the comprehensive sampling event in May 2015.

4.2.2.5 Methane

No methane was detected at CDE when sampled in May 2015.

5. Groundwater monitoring

5.1 Groundwater occurrence

This section is included to provide additional explanation of the different groundwater systems that occur in the immediate area of the TIP areas. It has been included to specifically address Condition 6a) (5) in the REF approval extension that states:

“Provide a justification for the absence of monitoring of the water table beneath the area irrigated with blended produced water.”

Groundwater in the vicinity of the Stage 1A and 1B areas occurs in two different geologies:

- the alluvial sediments beneath the alluvial floodplain (located adjacent to the western end of the Stage 1A irrigation area)
- shallow fractured rock (located beneath and adjacent to both irrigation areas on the valley sides off the floodplain).

The alluvial water table is shallow (generally less than 3 m from surface) and the hydraulic gradient is from south to north following the topography. In the vicinity of the Avon River, shallow groundwater from the alluvium discharges to the river during periods of low flow (i.e. the river is a gaining stream), while during flood events the river loses water to the alluvial groundwater system for a short time. The water table is dynamic and responds quickly to rainfall and river stage events. AGL has installed three monitoring bores into the alluvium near the irrigation areas (TMB01, TMB02 and TMB03). The trends at these locations are described in Sections 5.2.1 and 5.3.1.

The shallow fractured rock water table is deeper than the alluvial water table however there is still a general hydraulic gradient down-valley and towards the river. There is diffuse discharge from the fractured rock aquifer to the alluvial aquifer along the floor of the valley. The influence of rainfall recharge on this groundwater system is low and is lagged by weeks and months. AGL has monitored this water table at S4MB01 (adjacent Stage 1A) since the beginning of the baseline monitoring.

Additional monitoring of the water table beneath the irrigation area is not warranted given that deficit irrigation is practiced and the only recharge to this aquifer system is via large rainfall events. There is no rise or fall at any of these adjacent sites that can be attributed to irrigation so there is no justification for monitoring beneath the irrigation area at multiple sites. To further confirm this, two additional shallow rock monitoring bores in the vicinity of the irrigation area have been included in the monitoring network since the August 2014 sampling event: TCMB01 (adjacent Stage 1B) and TTMB02 (east of Stage 1A).

The only other sub-surface water is soil (pore) water in the unsaturated zone. This is monitored at the SP piezometer locations (see Section 5.3.3). This water is not groundwater, it is normally ephemeral, localised, and does not flow like the regional aquifer systems described above.

5.2 Groundwater levels

5.2.1 Shallow alluvium

In general, groundwater levels show a clear response to rainfall events and no response to irrigation events. The magnitude and rate of the response to rainfall varies between the shallow alluvial bores (Figure 5.1). The greatest groundwater level response continued to be recorded at TMB01 (located closest to the Avon River), followed by TMB02 and TMB03.

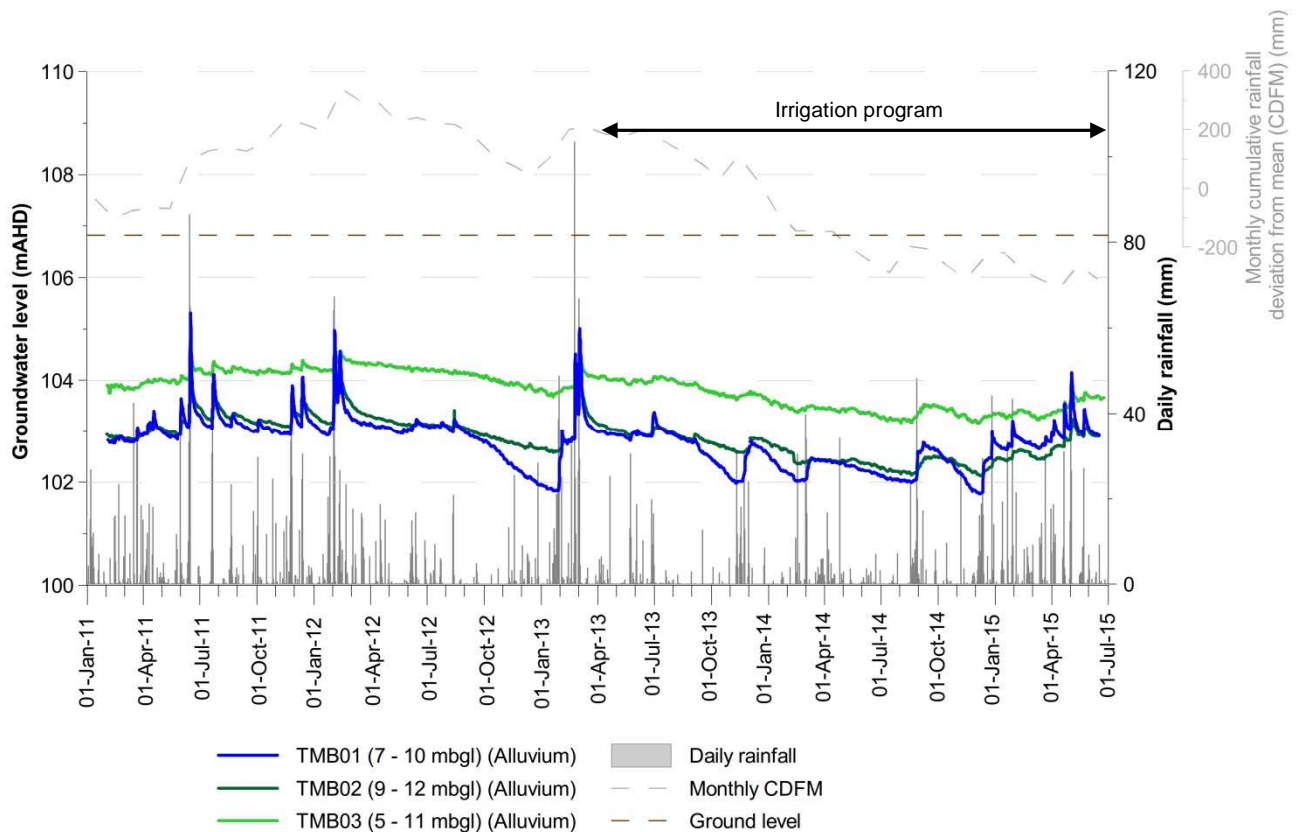


Figure 5.1 Groundwater levels for alluvial monitoring bores (TMB01, TMB02 and TMB03)

The groundwater level hydrographs can be divided into two main response types:

1. Monitoring bores TMB01 and TMB02 show a rapid response to rainfall recharge followed by a return to near-previous levels over a period of one to two months (i.e. a short-term increase in storage). These responses imply direct recharge from rainfall and/or flooding and relatively high permeability of the alluvium. TMB01 also demonstrates that groundwater (near the river) quickly drains and contributes to stream baseflows during extended dry periods, such as in Spring 2012 and Spring/Summer 2013/14.
2. Monitoring bore TMB03 shows a more subdued response to rainfall recharge. In addition, groundwater responses are more pronounced for larger rainfall events that exceed a certain threshold (> ~35 mm/day). However, smaller rainfall events show little or no obvious responses. Such responses imply relatively fast recharge during larger surface runoff and flooding events.

These observations are consistent with field observations during bore installation indicating the presence of a clay layer (approximately 1–2 m in thickness) above the alluvial mixed gravels at some locations. The clay layer would impede recharge to groundwater during small rainfall events.

There is an overall decreasing trend in groundwater levels from April 2013 to December 2014, as a result of below average rainfall for this period. During the first half of 2015, groundwater levels have increased in response to higher and more consistent rainfall.

No change in groundwater levels in the alluvial monitoring bores has been observed as a result of the irrigation program.

5.2.2 Shallow rock

The hydrographs for the shallow rock monitoring bores are presented in Figure 5.2.

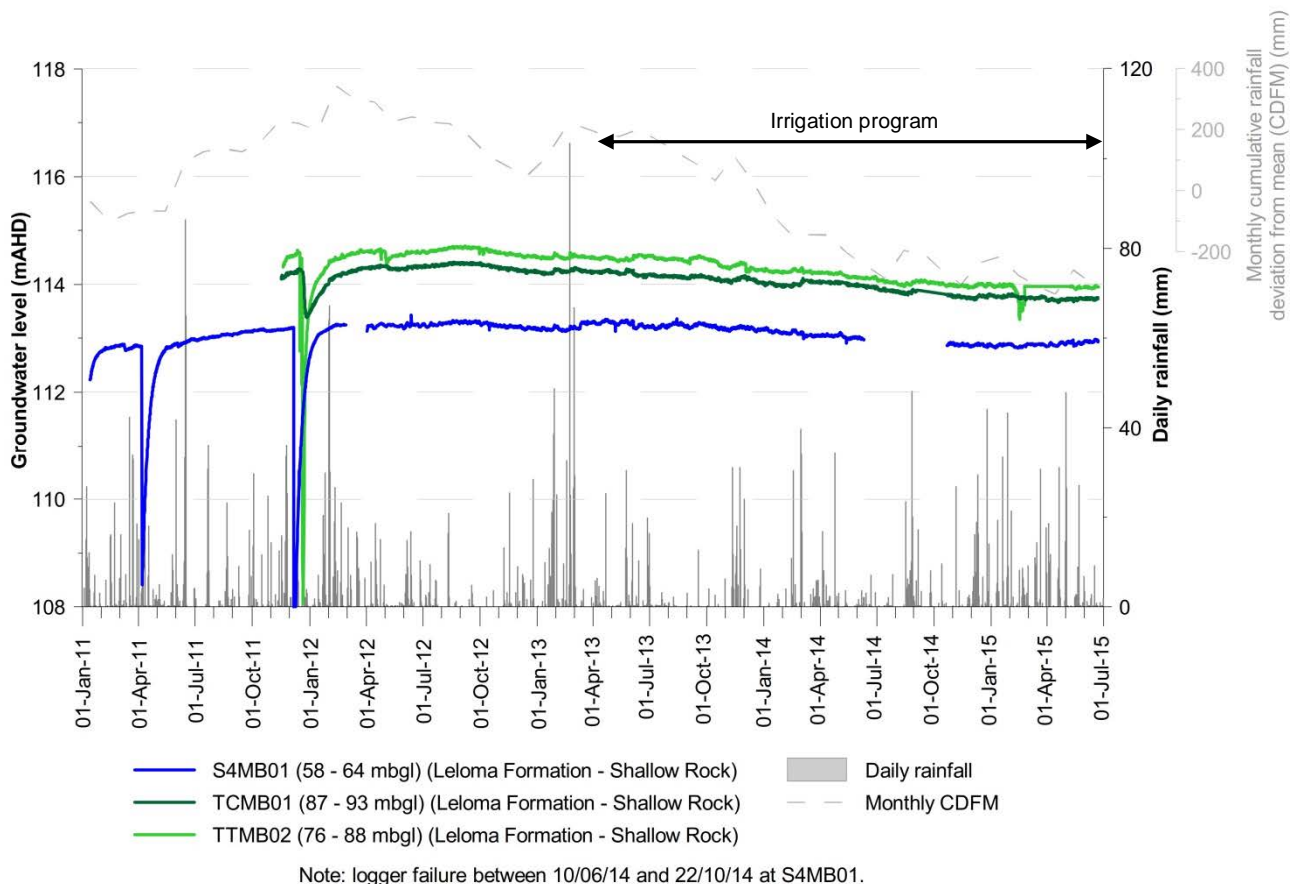


Figure 5.2 Groundwater levels for the shallow rock monitoring bores (S4MB01, TCMB01 and TTMB02).

Groundwater levels in the shallow rock are similar, with minor responses to high intensity rainfall events or events of long duration and no visible response to small rainfall events. In general, groundwater levels in the shallow rock have decreased slightly as a result of overall below average rainfall conditions for the period since April 2013. During the first half of 2015, groundwater levels have stabilised in the shallow rock; with a very minor increase in groundwater level is observed at S4MB01.

The effects of hydraulic testing ('slug' testing) and low flow sampling are visible in April 2011, December 2011 and in February 2015 at TTMB02 only. The very slow recovery of groundwater levels after these events is consistent with low permeability in this hydrogeological unit (Parsons Brinckerhoff 2012).

5.3 Groundwater quality

The water quality for shallow alluvial groundwater and shallow rock groundwater sampled in February and May 2015 is assessed in this section and is compared to the pre-irrigation baseline values (Table 2.11). Water quality data are presented in Appendix A. Time-series plots are provided in Figures B.1 to B.23 in Appendix B, piper diagrams in Appendix C and laboratory analysis reports in Appendix D.

5.3.1 Shallow alluvium

The groundwater quality results for the main analytes for the shallow alluvium monitoring bores (TMB01, TMB02 and TMB03) are presented in Table 5.1.

Table 5.1 February and May 2015 results for the shallow alluvium monitoring bores

Analyte ^a	Units	Groundwater baseline range ^b	TMB01		TMB02		TMB03	
			Feb 2015	May 2015	Feb 2015	May 2015	Feb 2015	May 2015
pH (field)	pH units	6.32 - 7.77	6.48	6.34	6.33	6.21	6.54	6.46
EC (lab)	µS/cm	3,199 - 13,848	8,350	7,500	3,740	3,720	5,820	5,780
Sodium	mg/L	484 - 1,350	1,210	1,060	454	443	802	796
Chloride ^c	mg/L	841 - 2,940	2,520	2,300	1,190	1,140	1,660	1,570
Boron	mg/L	<0.05 - 0.27	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	mg/L	0.36 - 6.53	2.43	2.31	6.47	6.70	2.31	1.28
Manganese	mg/L	0.223 - 1.730	0.907	0.891	1.03	1.08	1.42	1.74
Total phosphorus	mg/L	0.02 - 0.10	0.05	0.04	0.06	0.06	0.03	0.02
Ammonia	mg/L	<0.10 - 2.45	0.17	0.13	0.38	0.30	0.16	0.09

Notes:

(a) All metals are dissolved.

(b) Groundwater pre-irrigation baseline data from Parsons Brinckerhoff (2013a).

(c) Method USEPA 4110B.

Bold – outside groundwater baseline range.

5.3.1.1 Field parameters and major ion chemistry

Groundwater in the shallow alluvium remained slightly saline at TMB01 and TMB03 in both monitoring rounds, while groundwater was brackish at TMB02. The salinity (EC) was within the baseline range.

Groundwater was slightly acidic and the pH was within the pre-irrigation baseline range, with the exception of the pH at TMB02 in May 2015, which was slightly lower than the baseline range (Figure B.1, Appendix B).

The water types for groundwater in the alluvium are presented in Table 5.2 and are displayed on piper diagrams in Appendix C. In February and May 2015, the sodium concentration at TMB02 was slightly lower than the baseline range.

Table 5.2 Major ion chemistry at the alluvial monitoring bores

Location	Feb 2015	May 2015
TMB01	Na-Mg-Cl	Na-Mg-Cl
TMB02	Na-Ca-Mg-Cl	Na-Ca-Mg-Cl
TMB03	Na-Mg-Ca-Cl	Na-Mg-Cl-HCO ₃

5.3.1.2 Dissolved metals

The dissolved metal concentrations in the February and May 2015 sampling events were generally low and within the baseline range, with the exception of iron at TMB01 in May 2015 and manganese and zinc at TMB03 in May 2015. Aluminium concentrations returned to be within the baseline range at all alluvial monitoring bores after slightly elevated results in the last reporting period.

5.3.1.3 Nutrients

Nutrient concentrations remained within the baseline range for the February and May 2015 sampling events.

5.3.1.4 Hydrocarbons

No TPH, BTEX or other long chained hydrocarbons were detected in the comprehensive sampling event in May 2015.

5.3.1.5 Methane

Methane was detected at TMB01 (18 µg/L) and was below the laboratory LOR (<10 µg/L) at TMB02 and TMB03 in May 2015. These concentrations are comparable to the May 2014 concentrations (Parsons Brinckerhoff 2014b).

5.3.2 Shallow rock

The groundwater quality results for the main analytes for the shallow rock monitoring bores are presented in Table 5.3. The baseline range is only for the S4MB01 monitoring site.

Table 5.3 February and May 2015 results for the shallow rock monitoring bores

Analyte ^a	Units	Groundwater baseline range ^b	S4MB01		TCMB01		TTMB02	
			Feb 2015	May 2015	Feb 2015	May 2015	Feb 2015	May 2015
pH (field)	pH units	6.32 - 7.77	7.15	6.96	6.96	6.87	6.56	6.61
EC (lab)	µS/cm	3,199 - 13,848	4,840	4,790	3,040	3,000	2,350	2,490
Sodium	mg/L	484 - 1,350	643	631	291	276	244	233
Chloride ^c	mg/L	841 - 2,940 ^d	1,400	1,330	828	824	536	532
Boron	mg/L	<0.05 - 0.27	0.17	0.15	<0.05	<0.05	<0.05	<0.05
Iron	mg/L	0.36 - 6.53	1.14	1.73	1.30	1.55	2.18	2.52
Manganese	mg/L	0.223 - 1.730	0.171	0.164	0.029	0.030	0.099	0.092
Total phosphorus	mg/L	0.02 - 0.10	0.09	0.08	0.02	<0.01	0.22	0.27
Ammonia	mg/L	<0.10 - 2.45	1.85	1.74	1.39	1.20	0.62	0.53

Notes:

(a) All metals are dissolved.

(b) Groundwater pre-irrigation baseline data for S4MB01 only from Parsons Brinckerhoff (2013a). Baseline data was not collected for TCMB01 and TTMB02.

(c) Method USEPA 4110B.

(d) Method APHA 4500-Cl.

Bold – outside groundwater baseline range – for S4MB01 only.

5.3.2.1 Field parameters and major ion chemistry

Groundwater at S4MB01 was slightly saline with neutral pH. All results were within groundwater pre-irrigation baseline range (Table 2.12), except for manganese concentrations which were below the baseline range during both monitoring events. Groundwater salinity at the two additional shallow rock monitoring bores (TCMB01 and TTMB02) was brackish (fresher than S4MB01) with slightly acidic to neutral pH.

The water type at the shallow rock monitoring bores are presented in Table 5.4 and shown on piper diagrams in Appendix C. The major ion chemistry is similar for the three shallow rock monitoring bores.

Table 5.4 Major ion chemistry at the shallow rock monitoring bores

Location	Feb 2015	May 2015
S4MB01	Na-Ca-Cl	Na-Ca-Cl-HCO ₃
TCMB01	Na-Ca-Mg-Cl-HCO ₃	Ca-Na-Cl-HCO ₃
TTMB02	Na-Ca-Cl-HCO ₃	Na-Ca-Cl-HCO ₃

5.3.2.2 Dissolved metals

Most dissolved metals were below the laboratory LOR for the monitoring period, with the exception of the following metals, for which concentrations were above the laboratory LOR for at least one monitoring event in at least one of the shallow rock monitoring bores:

- Arsenic, barium, boron, bromine, copper, iron, nickel, uranium and zinc; although concentrations at S4MB01 were in line with baseline ranges and concentrations of these metals at TCMB01 and TTMB02 were similar to concentrations detected during the last compliance period.
- The manganese concentrations at S4MB01 were below the baseline range in February and May 2015.
- Strontium concentrations at S4MB01 have consistently been high throughout the baseline period and they continue to be the highest of the three rock monitoring sites for this monitoring period. High strontium concentrations were also detected at TCMB01 and TTMB02.

5.3.2.3 Nutrients

Nutrient concentrations were consistently below the baseline range for the February and May 2015 sampling events. Total phosphorus concentrations at TTMB02 continued to be slightly more elevated than at other groundwater locations. Total phosphorus in groundwater (alluvium and shallow rock) was low.

5.3.2.4 Hydrocarbons

TPH concentrations were detected at S4MB01 and TCMB01 when sampled in May 2015. Toluene was detected at S4MB01 (72 µg/L) and TCMB01 (102 µg/L). No other long chained hydrocarbons were detected. The hydrocarbon concentrations detected at S4MB01 are the highest detected since monitoring began.

5.3.2.5 Methane

Methane was detected at all shallow rock monitoring bores at these concentrations: 9,610 µg/L at S4MB01, 247 µg/L at TCMB01 and 14 µg/L at TTMB02 when sampled in May 2015. Methane concentrations at S4MB01 were higher than during the May 2014 sampling event.

5.3.3 Soil water

Soil water was present in two of the dual piezometers (SP5B and SP8B) associated with the Stage 1A irrigation area when inspected during the routine May 2015 sampling event.

Irrigation took place between January and April 2015 with no irrigation in the two weeks preceding the May 2015 sampling event. Piezometers SP5B and SP8B had accumulated enough water to allow a water sample to be collected. In the weeks preceding the sampling event, precipitation was more dominant than irrigation across the Stage 1A area.

Piezometer “A” locations are located inside the irrigation area while “B” locations are located adjacent and outside the irrigated area. Soil water was only present outside of the irrigated plots suggesting that there was no or minimal lateral migration of perched water in the soil profile and that most irrigation water was being transpired by the crops within the main irrigation area.

The water quality results for the main analytes for soil water piezometers SP5B and SP8B in the Stage 1A area are presented in Table 5.5.

Table 5.5 May 2015 results for the soil water piezometers

Analyte ^a	Units	SP5B	SP8B
		May 2015	May 2015
pH (field)	pH units	6.53	6.81
EC (lab)	µS/cm	5,650	405
Sodium	mg/L	1,060	80
Chloride ^b	mg/L	1,590	91.5
Boron	mg/L	<0.05	<0.05
Iron	mg/L	0.33	2.98
Manganese	mg/L	0.126	0.042
Total phosphorus	mg/L	0.30	0.68
Ammonia	mg/L	0.02	0.04

Notes:

(a) All metals are dissolved.

(b) Method USEPA 4110B.

5.3.3.1 Field parameters and major ion chemistry

Water from the soil water piezometer was fresh at SP8B and slightly saline at SP5B. The pH conditions were near neutral which is typical of the shallow soil profile.

Analysis of major ion components indicate that the water at SP5B is a sodium-magnesium-chloride (Na-Mg-Cl) type and water at SP8B is a sodium-chloride-sulphate (Na-Cl-SO₄) type as shown on piper diagrams in Appendix C.

5.3.3.2 Dissolved metals

Dissolved metal concentrations were detected at low concentrations in the two soil water piezometers.

5.3.3.3 Hydrocarbons

No TPH, BTEX or other long chained hydrocarbons were detected in the comprehensive sampling event in May 2015.

5.3.3.4 Methane

No methane was detected in May 2015.

6. Discussion

6.1 Water levels

Continuous monitoring indicates that the alluvial groundwater levels and surface water levels respond to rainfall events. The rainfall response is immediate and pronounced, and sharp recession curves are often observed. Such a response suggests moderate to high permeability in the shallow alluvium; and for the surface water a rapid runoff response from a relatively small upstream catchment. There appears to be limited riverbank storage and groundwater baseflow contributions.

A minimal and lagged rainfall response is observed at the shallow rock monitoring bores suggesting groundwater levels respond to rainfall recharge via slow leakage over a broad area.

During the first half of 2015, groundwater levels increased across the alluvial monitoring sites and stabilised within the shallow rock due to increased and more consistent rainfall during the monitoring period.

Water levels have not changed in the alluvium, shallow fractured rock, or the river in response to the irrigation program.

6.2 Water quality

6.2.1 Produced and blended irrigation water

6.2.1.1 Tiedman dams

Water quality monitoring in the Tiedman dams (TSD, TND and TED) indicates that the water is generally alkaline and marginal to slightly saline. The EC measurements in February and May 2015 for the blended water irrigation dam (TSD) remained below the ANZECC (2000) irrigation guideline value of 2,000 $\mu\text{S}/\text{cm}$.

pH values were slightly above the ANZECC guideline range (6.0-9.0) for TSD at the quarterly monitoring events but were below pH 9 for the irrigation program after late March 2015 (Appendix A - Summary Table A.11). Dissolved metal concentrations were mostly above the laboratory LOR, below the ANZECC (2000) guidelines, and comparable between the three dams and with previous monitoring rounds.

Total phosphorus and ammonia concentrations continued to be within historical range.

The water quality in the blended water irrigation dam (TSD) was within the ANZECC (2000) irrigation guidelines, with the exception of pH and total phosphorus. The pH exceeded the guideline in February and May 2015; however, values decreased compared to the last monitoring period. At the end of March 2015, AGL installed a pH dosing system to reduce the pH of the blended water in TSD. The pH was reduced for the final irrigation events in March and April, however pH levels rebounded prior to the May 2015 water sampling event. Further acid dosing would be required if this water was to be irrigated due to the buffering effect of the carbonate and bicarbonate in the water, although it is noted the irrigation approval has now expired. The total phosphorus concentration also continued to exceed the ANZECC irrigation guideline for both events. The irrigation guidelines for total phosphorus are set at low concentrations to minimise the potential for clogging of irrigation equipment.

Dissolved iron concentrations returned to be within the ANZECC (2000) guideline for both monitoring events. No TPH, BTEX or other longer chained hydrocarbons were detected in the Tiedman dams and methane was only detected at TED.

6.2.1.2 Seepage monitoring bores

The perched groundwater intersected by the seepage monitoring bores around the Tiedman dams remained slightly saline and acidic. The pH and salinity of this water differ from those of the Tiedman dams; salinity measurements are much higher and pH concentrations much lower in the perched water compared to the dam water.

Dissolved metals were slightly elevated, in particular iron and manganese concentrations. Overall dissolved metal concentrations were higher in the seepage bores because of the nature of the parent soils and the weathered rock. Total phosphorus was detected at concentrations different from the Tiedman dams. Petroleum hydrocarbons and methane were detected at the seepage monitoring bores at concentrations different than in the Tiedman dams suggesting a soil/weathered rock influence and no influence from the stored water.

The monitoring results suggest there have been no seepage losses from the Tiedman dams and there appears to be permanent perched water in the soil and weathered rock profile at these seepage monitoring locations. The differences in many of the major/minor ions, the ratio of different metals, and the overall dissolved metal chemistry indicate that the perched water in TMB04 and TMB05 was not derived from leakage from the Tiedman dams.

6.2.2 Surface water

The salinity of the surface water inversely correlates with rainfall and surface water flow. Typically surface water salinity sharply decreases after rainfall events (after an initial salinity spike) as relatively fresh runoff is routed into streams. The surface water can be classified as fresh and pH values were near neutral.

The majority of dissolved metals in surface water were relatively low and below the ANZECC (2000) guidelines. The main exceptions were aluminium, iron, manganese, copper and zinc concentrations which are somewhat elevated and/or exceeded the ANZECC (2000) guidelines on occasion.

Dissolved metal concentrations in surface water were typically lower than concentrations observed in the shallow alluvium and shallow rock groundwater, highlighting the dominance of surface water runoff over groundwater baseflow. Surface water consistently has different water quality compared to the blended irrigation water.

Total phosphorus concentrations typically (including during baseline sampling) exceeded the ANZECC (2000) guideline values for aquatic ecosystems (south-east Australia, lowland river ecosystems) at all locations due to agricultural use of fertilisers and the nature of soils and weathered rocks across the upper Avon River catchment.

No TPH, BTEX or other longer chained hydrocarbons were detected in the surface water and minor detections of methane were present and are assessed to be naturally occurring.

6.2.3 Irrigation plot runoff

Samples taken during the routine sampling events in February and May 2015 from the two catch dams (CDW and CDE) were taken from the residual stored waters that were later recycled back to the Tiedman dams and not released into the environment.

The water quality at CDW and CDE during the overflow events in the first half of 2015 was fresh and pH values indicate neutral to slightly alkaline conditions. The total phosphorus concentrations during the overflow events at CDW and CDE exceeded the ANZECC (2000) trigger values for aquatic ecosystems (south-east Australia, lowland river ecosystems).

The runoff samples collected from the catch dams during the high rainfall events in March 2015 at CDW and early May 2015 at CDE and CDW exceeded EPL 20358 Condition L3.4 for total suspended solids (50 mg/L). The exceedances were notified to the EPA.

There is no evidence that overflow from the catch dams resulted in a change in water quality in the Avon River, supported by the following:

- During each overflow event, the surface water salinity (EC) decreased at both monitoring locations (ASW01 (upstream) and FSW01 (downstream)), despite the EC of the water in the catch dams during the overflow events being higher than the receiving waters.
- Total phosphorus is higher in the surface runoff collected in the catch dams than in the Avon River. However, there was no consistent increase in total phosphorus at the downstream surface water sampling location (FSW01) as a result of overflow events.
- The water quality and major ion chemistry is similar at ASW01 (upstream, control site) and FSW01 (downstream).

The Avon River receives runoff from a large catchment area during high rainfall events and the contribution from the catch dams is a negligible or nil component of the river flow at FSW01.

6.2.4 Groundwater

Alluvial groundwater remained slightly saline to brackish, slightly acidic and within the pre-irrigation baseline range, except for the pH at TMB01, which was below the baseline range in May 2015. Most dissolved metals were above the laboratory LOR and generally within the pre-irrigation baseline range for all analytes. Nutrient concentrations were all within the pre-irrigation baseline range. No TPH, BTEX or other longer chained hydrocarbons were detected and methane concentrations were low or below the laboratory LOR in alluvial groundwater.

Groundwater in the shallow rock monitoring bore S4MB01 remained slightly saline with neutral pH. Dissolved metal and nutrient concentrations were within the pre-irrigation baseline range, except for manganese during both monitoring rounds. Shallow bedrock monitoring bores TCMB01 and TTMB02, which have been included in the monitoring network since August 2014 (following the baseline period), have lower salinity and major ion concentrations than S4MB01, although show similar dissolved metals and nutrient concentrations to S4MB01. Petroleum hydrocarbons (TPH and toluene only) were detected at minor concentrations at S4MB01 and TCMB01, and methane was detected at all sites. These compounds are assessed to be naturally occurring in the shallow rock.

Groundwater within the shallow alluvium and shallow rock showed no change in quality as a result of the irrigation program during the monitoring period.

6.2.5 Soil water

Most paired soil water piezometers were dry during the monitoring period. Soil (pore) water was present at two piezometers outside of the Stage 1A area in May 2015 and was fresh and slightly saline with near neutral pH. Dissolved metals concentrations were detected within the soil water. There are some chemical differences between SP5B and SP8B likely due to spatial changes in shallow soil characteristics.

7. Conclusions and recommendations

Surface water and groundwater monitoring for the TIP commenced in October 2011 and was established in accordance with the approved WMP (AGL 2012). The monitoring provides evidence that the quality of the water used for irrigation was in accordance with this plan and adopted guidelines, and that the application of blended water did not result in impacts on local surface water or groundwater resources.

The irrigation program for this six-monthly monitoring period was also regulated under EPL20358 (since 6 August 2014). The water monitoring program and reporting is compliant with the relevant conditions in the EPL.

Monitoring during the six-month period from 1 January to 30 June 2015 showed there was no change in stream levels, or alluvial and shallow fractured rock groundwater levels that can be attributed to the irrigation program. Surface water and groundwater levels remained comparable to the results from the previous compliance report (Parsons Brinckerhoff 2015) and to pre-irrigation baseline conditions, responding to climatic conditions.

The water quality of the blended water used for irrigation complied with the ANZECC (2000) irrigation guidelines, with the exception of pH and total phosphorus during both 2015 sampling events. A pH dosing system was installed in March 2015 that reduced the pH of the stored blended water in TSD to between pH 8 and 9 (to within the ANZECC guidelines). This lower pH water was irrigated during late March and April 2015. Total phosphorus exceedances relate to guidelines that are set to minimise clogging of irrigation equipment. From an environmental perspective, the blended water in the TSD was suitable for irrigation.

There were a few minor exceedances of the ANZECC (2000) guidelines during the monitoring period for surface water, however there was no change in overall surface water quality compared to natural (baseline) conditions as a result of irrigation program activities. Guideline values are intended as a management tool for assessing water quality and protecting environmental values; they do not represent strict pass/fail criteria. In the case of the exceedances noted in surface water during the current reporting period, the following observations are relevant:

- Transient, non-adverse trends in surface water quality were observed.
- The water quality was representative of the catchment geology and soils, and broad agricultural and grazing practices.
- No impact from or clear link to the blended water irrigation activities has been observed.

There has been no change in surface water quality (including total suspended solids) downstream of the irrigation program that can be directly attributed to overflow of the catch dams during high rainfall events in January, March, April and early May 2015.

The TIP is considered to be successful with more than 50ML of produced water blended and irrigated and no detectable impact to adjacent surface water or underlying groundwater receptors.

Further monitoring of the water monitoring network is not deemed necessary given AGL are not seeking to extend the blended water irrigation program. If circumstances change, and a reactivation of the TIP approval is sought, monitoring requirements would need to be reassessed at that time. An additional 'pre-irrigation' monitoring event would be necessary depending on the hiatus between irrigation activities.

8. Statement of limitations

8.1 Scope of services

This water compliance report (the report) has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client 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.

8.2 Reliance on data

In preparing the report, Parsons Brinckerhoff has relied upon data, surveys, analyses, designs, 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.

8.3 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 sites at the time of preparing the report. Also, it should be recognised that site conditions can change with time.

Within the limitations imposed by the scope of services, the monitoring 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.

8.4 Report for the benefit of the client

The report has been prepared for the benefit of the client (and no other party), but may be relied upon by the administering authority. 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). Except as provided below, 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.

8.5 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.

9. References

- AGL 2012. Water Management Plan for the Tiedman Irrigation Program – Gloucester AGL. Report dated May 2012.
- AGL 2015. Weather station data, accessed 15/01/15 <<http://www.agl.com.au/about-agl/how-we-source-energy/natural-gas/water-portal>>.
- ANZECC 2000. Australian and New Zealand Guidelines for Fresh and Marine Water Quality Volumes 3 and 4. Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand, Canberra.
- Department of Infrastructure, Planning and Natural Resources (DIPNR), 2004. NSW Coastal Salinity Audit, Salinity in the Sydney South Coast, Hunter and North Coast Regions. Dated March 2000.
- Division of Resources and Energy (DRE) 2012. PEL285: Approval to undertake Tiedman Irrigation Program, Gloucester. Letter to Ms Toni Laurie, AGL (05/07/2012), reference: OUT12/14515.
- Environmental Protection Authority (EPA) NSW 2014. Environment protection licence, number 20358, licence version date 21 October 2014.
- Jacobs 2015. Soil Quality Monitoring and Management Program - Report 6: Irrigation (Activities from 1 January to 30 June 2015). Report dated August 2015.
- Office of Coal Seam Gas (OCSG) 2014. PEL285 Tiedmans Irrigation Program – Modification to approval. Email to Ms Toni Laurie, AGL (04/07/14), reference: OUT13/36641.
- Parsons Brinckerhoff 2011. Gloucester Exploration Program – Irrigation Proposal: Review of Environmental Factors. Report dated June 2011, PR_5506 Rev B.
- Parsons Brinckerhoff 2012. Phase 2 Groundwater Investigations – Stage 1 Gas Field Development Area, Gloucester Gas Project. Report dated January 2012, PR_5630.
- Parsons Brinckerhoff 2013a. Gloucester Gas Project – Tiedman Irrigation Trial Baseline Water Monitoring Program. Report dated January 2013, 2162406D PR_6306.
- Parsons Brinckerhoff 2013b. Tiedman Irrigation Trial – August 2013 Water Compliance Report, Gloucester Gas Project. Report dated August 2013, 2162406F-WAT-RTP-7408 RevC.
- Parsons Brinckerhoff 2014a. Tiedman Irrigation Program – Water Compliance Report for the Period 1 July to 31 December 2013, Gloucester Gas Project. Report dated January 2014, 2162406F-WAT-RPT-7674 RevB.
- Parsons Brinckerhoff 2014b. Tiedman Irrigation Program – Water Compliance Report for the Period 1 January to 4 July 2014, Gloucester Gas Project. Report dated August 2014, 2162406F-WAT-RPT-001 RevD.
- Parsons Brinckerhoff 2015. Tiedman Irrigation Program – Water Compliance Report for the Period 5 July to 31 December 2014, Gloucester Gas Project. Report dated February 2015, 2268517A-WAT-RPT-001 RevC.

Appendix A

Summary tables



Summary table A7: May 2015 Water quality results - Overflow event

Table with columns: Water quality parameters, Units, EPL (20358), ANZECC (2000) aquatic ecosystems (95%), Catch dam west (CDW), Catch dam east (CDE), ASW01, FSW01. Rows include Field parameters (Temperature, EC, Dissolved Oxygen, pH, TDS, Redox), General parameters (lab) (EC, TDS, Suspended solids), Laboratory analytes (Alkalinity, Sulphate, Chloride, Calcium, Magnesium, Sodium, Potassium, Silicon, Fluoride), Dissolved metals (Aluminium, Arsenic, Beryllium, Barium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Mercury, Molybdenum, Nickel, Selenium, Strontium, Uranium, Vanadium, Zinc, Boron, Iron, Bromine), Nutrients (Ammonia as N, Nitrite as N, Nitrate as N, Total nitrogen as N, Total phosphorus, Reactive phosphorus, Total organic carbon), Total petroleum hydrocarbons, Total recoverable hydrocarbons, Aromatic hydrocarbons (Benzene, Toluene, Ethyl Benzene, m&p-Xylenes, o-Xylenes, Total xylenes, Sum of BTEX, Naphthalene), Dissolved gases (Methane), Phenolic compounds, and Polycyclic aromatic hydrocarbons (Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benz(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenz(a,h)anthracene, Benzo(g,h,i)perylene).

Notes: (a) ANZECC 2000 - Water Quality Guidelines: trigger values for the protection of freshwater aquatic ecosystems (for toxicants). Guideline only applies for ASW01 and FSW01. (b) In most cases the 95% protection level trigger values apply to ecosystems that could be classified as slightly-moderately disturbed. (c) ANZECC 2000 - Water Quality Guidelines: default trigger values for aquatic ecosystems, south-east Australia, lowland river ecosystems (for physical and chemical stressors). Note that the ANZECC (2000) guidelines for salinity state that NSW coastal rivers are typically in the range 200-300 µS/cm, however the Avon River (Manning River catchment) has high salinity levels given its geology (DIPNR 2004). (d) Arsenic species: As(V). (e) EPL TSS concentration only applies to CDE and CDW. Bold - above guideline value (also shaded grey to highlight). ID = insufficient. na - not analysed. * sample collected by AGL.



Summary table A11: Monthly water quality parameters (collected by AGL)

January 2015

WQ Parameters	Date	EC	Temp	TDS	pH	Redox
<i>Units</i>		$\mu\text{S/cm}$	$^{\circ}\text{C}$	mg/L	pH units	mV
Sites						
Tiedman North Dam	4/02/2015	624	28.81	542	7.97	-58.2
Tiedman South Dam	4/02/2015	1650	26.04	1438	8.13	-68.3
Tiedman East Dam	4/02/2015	607	26.97	528	8.31	-60.8
Pontilands Dam	4/02/2015	219	26.78	191	7.50	-33.0
Catch dam 1 (east)	4/02/2015	226	26.25	197	7.63	-42.5
Catch dam 2 (west)	4/02/2015	407	26.77	354	7.44	-34.1
Avon River at pump site	4/02/2015	247	20.84	214	8.22	-19.3

February 2015

WQ Parameters	Date	EC	Temp	TDS	pH	Redox
<i>Units</i>		$\mu\text{S/cm}$	$^{\circ}\text{C}$	mg/L	pH units	mV
Sites						
Tiedman North Dam	2/03/2015	632	24.49	550	8.68	-47.6
Tiedman South Dam	2/03/2015	1300	25.06	1134	8.31	-43.1
Tiedman East Dam	2/03/2015	567	25.17	494	7.61	-38.2
Stratford #3 Dam	2/03/2015	265	24.41	229	8.23	-15.6
Pontilands Dam	2/03/2015	218	24.25	190	7.59	-19.7
Catch Dam East	2/03/2015	364	23.92	317	7.86	-21.4
Catch Dam West	2/03/2015	584	23.28	508	8.37	-41.5
Avon River at pump site	2/03/2015	322	21.86	280	7.92	-22.9

March - April 2015 (following pH dosing of Tiedman South Dam)

WQ Parameters	Date	EC	Temp	TDS	pH	Redox
<i>Units</i>		$\mu\text{S/cm}$	$^{\circ}\text{C}$	mg/L	pH units	mV
Sites						
Tiedman South Dam	27/03/2015	1153	25.70	749	9.39	63.4
Tiedman South Dam	30/03/2015	1111	22.39	-	8.98	179.5
Tiedman South Dam	1/04/2015	1096	22.71	712	8.25	25.2
Tiedman South Dam	2/04/2015	1062	22.14	730	8.27	54.2
Tiedman South Dam	3/04/2015	1076	22.87	729	8.94	231.2
Tiedman South Dam	4/04/2015	1003	21.65	698	8.32	236.1
Tiedman South Dam	5/04/2015	1075	22.66	733	8.51	250.7
Tiedman South Dam	6/04/2015	1020	21.22	717	8.09	169.7
Tiedman South Dam	7/04/2015	1048	21.61	728	7.90	166.3
Tiedman South Dam	8/04/2015	1052	21.80	729	8.56	155.2
Tiedman South Dam	9/04/2015	1034	21.80	727	8.52	138.4

April 2015

WQ Parameters	Date	EC	Temp	TDS	pH	Redox
<i>Units</i>		$\mu\text{S/cm}$	$^{\circ}\text{C}$	mg/L	pH units	mV
Sites						
Tiedman North Dam	20/04/2015	1067	18.78	693	8.30	187.4
Tiedman South Dam	20/04/2015	1123	19.27	530	8.52	190.5
Tiedman East Dam	20/04/2015	414	18.52	269	9.75	174.2
Catch Dam East	20/04/2015	2073	18.09	1347	7.65	184.7
Catch Dam West	20/04/2015	3211	17.90	2087	8.20	191.1
Avon River at pump site	20/04/2015	252	17.60	164	7.78	176.1

May 2015

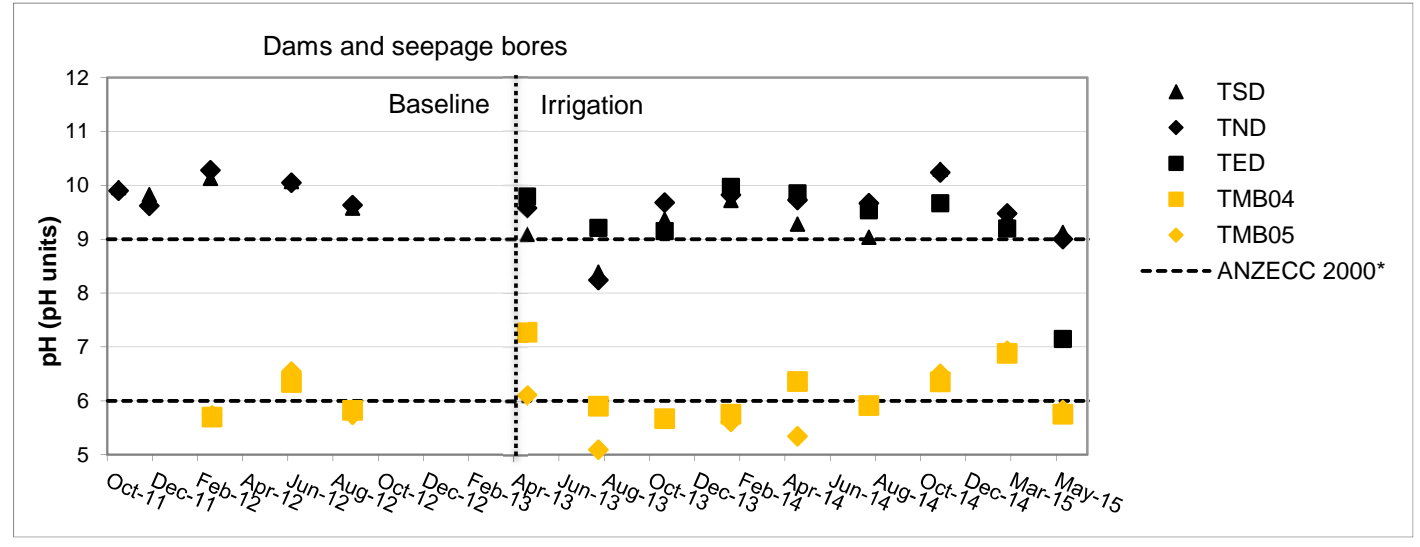
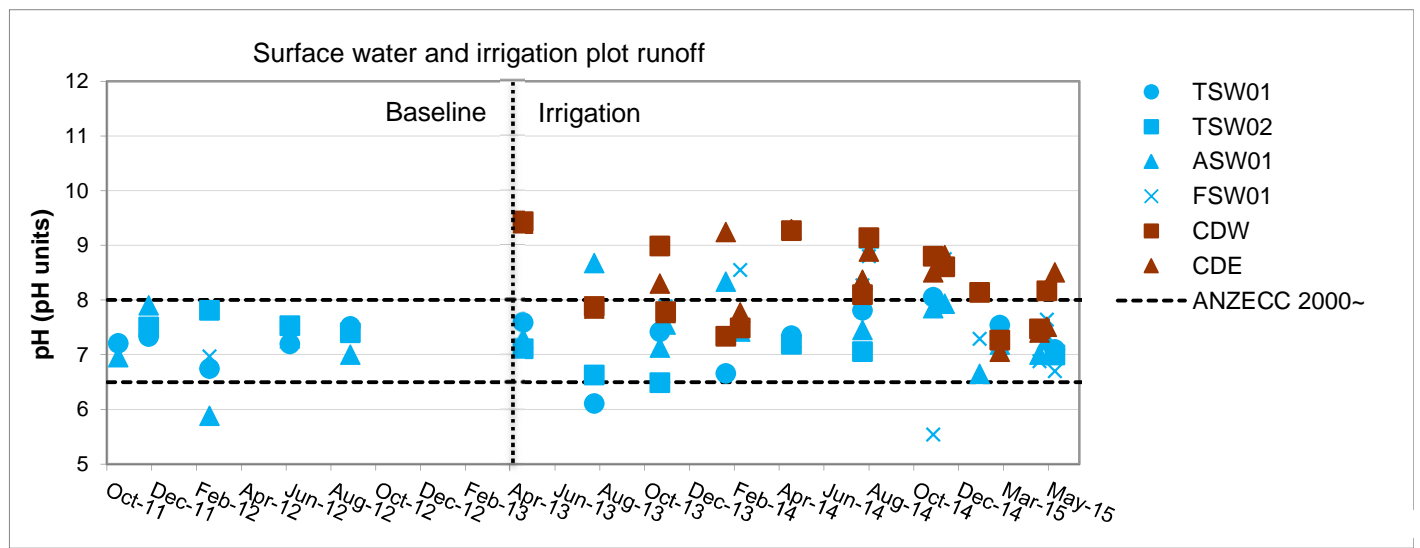
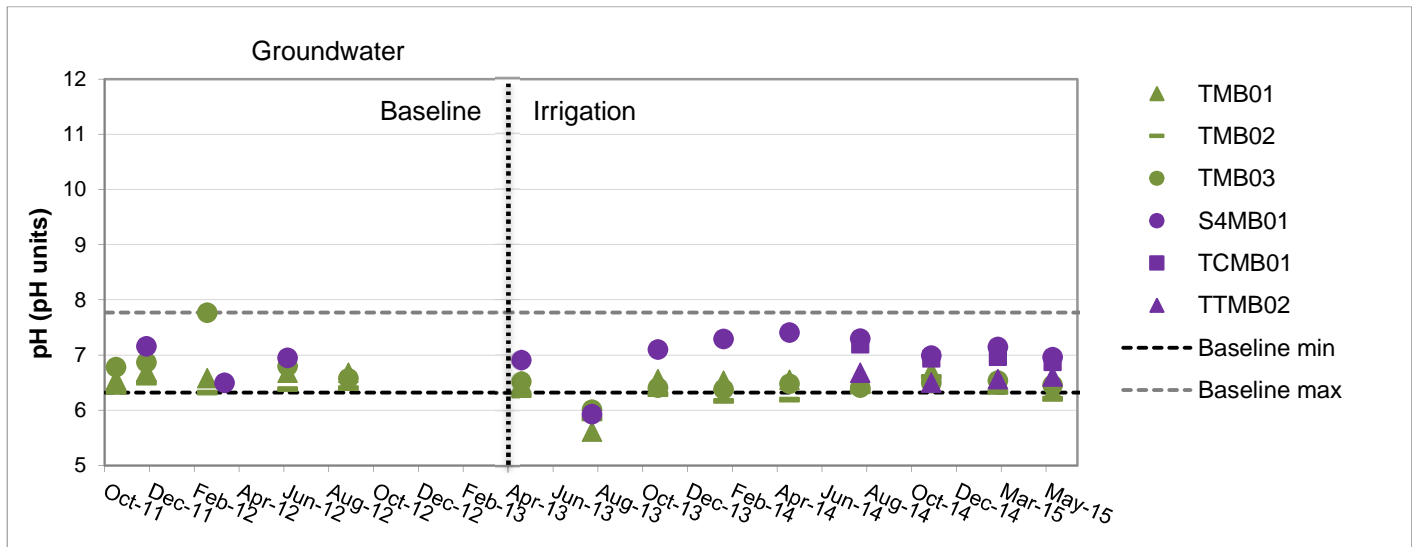
WQ Parameters	Date	EC	Temp	TDS	pH	Redox
<i>Units</i>		$\mu\text{S/cm}$	$^{\circ}\text{C}$	mg/L	pH units	mV
Sites						
Tiedman North Dam	5/05/2015	889	21.41	774	9.57	110.3
Tiedman South Dam	5/05/2015	1039	20.16	903	9.57	119.9
Tiedman East Dam	5/05/2015	274	20.91	238	9.76	90.9
Pontilands Dam	5/05/2015	105	23.66	910	7.13	100.3
Catch Dam East	5/05/2015	412	23.54	357	7.51	126.4
Catch Dam West	5/05/2015	909	23.13	790	7.59	131.8
Avon River at pump site	5/05/2015	171	17.58	148	7.45	127.5

Appendix B

Water quality graphs



Figure B.1: Field measured pH

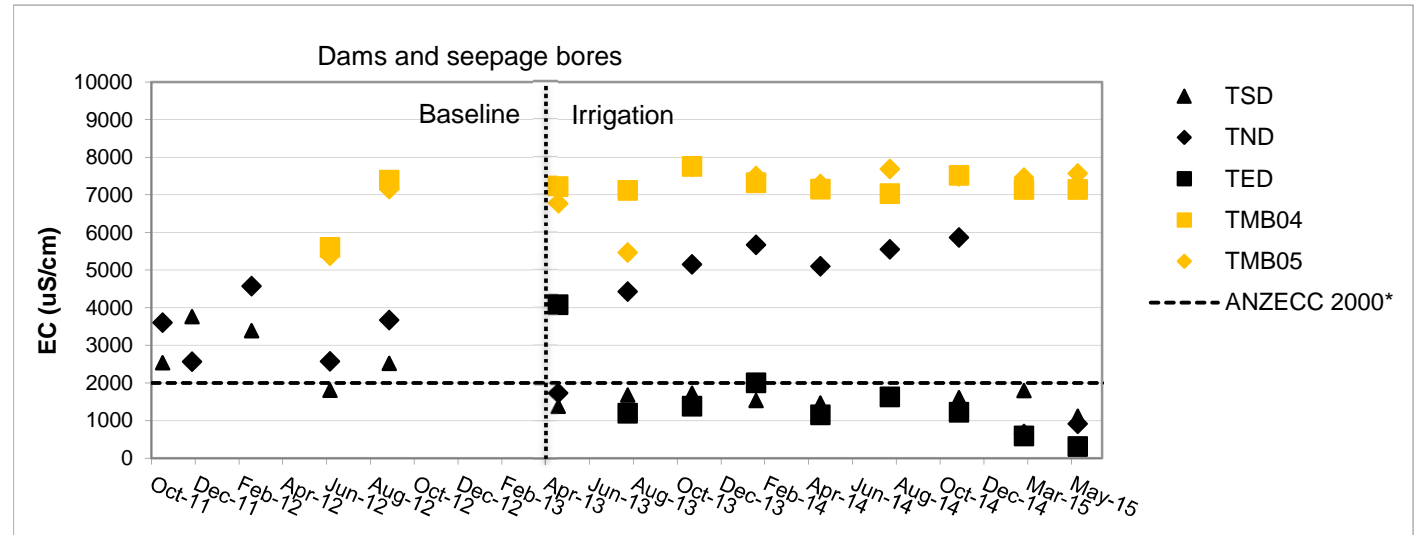
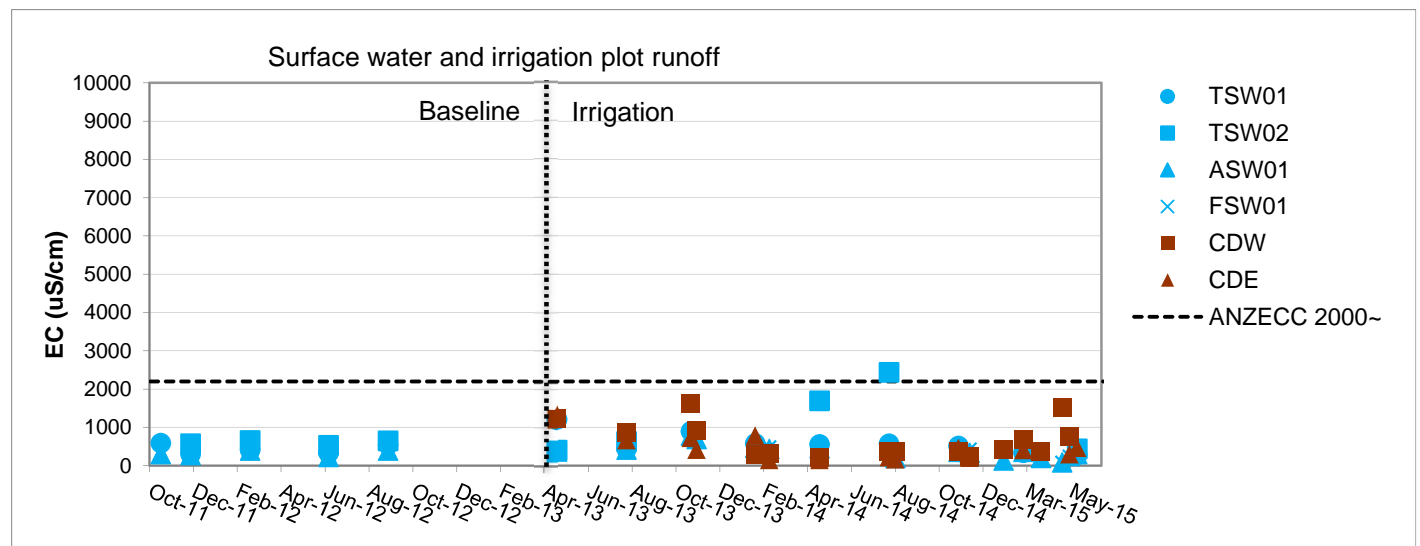
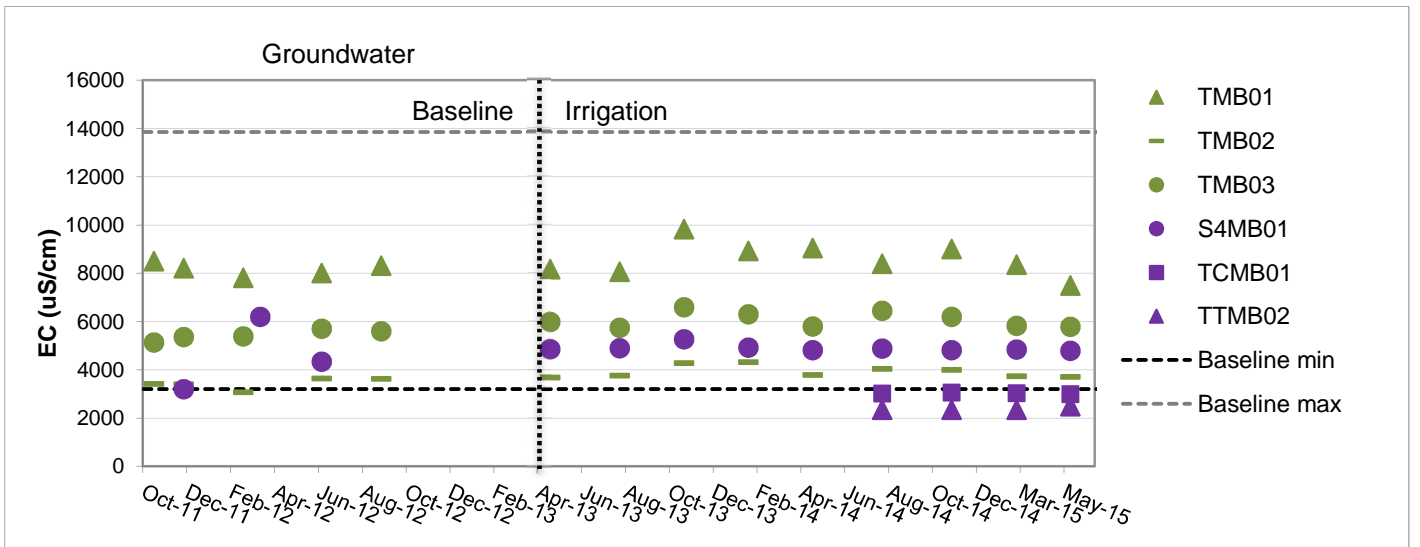


Notes:
 ~ANZECC 2000 - Water Quality Guidelines: aquatic ecosystems, south-east Australia, lowland river ecosystems (95% protection level).
 *ANZECC 2000. pH range of water for long-term irrigation and general water use.

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester Basin, NSW



Figure B.2: Field/laboratory measured EC

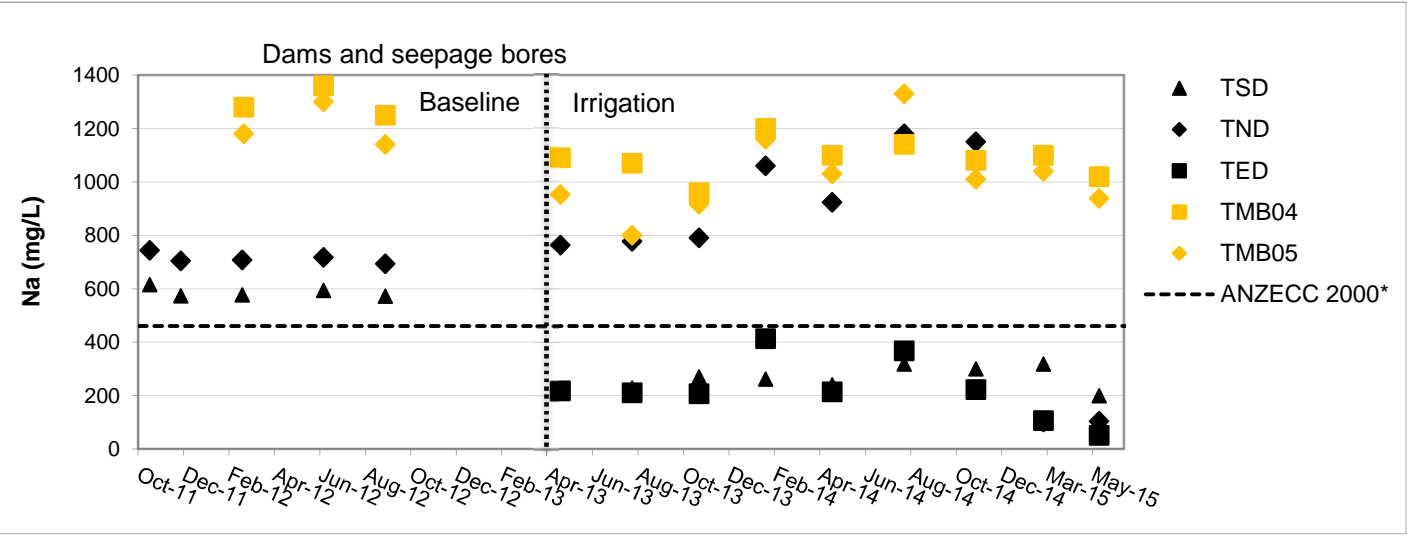
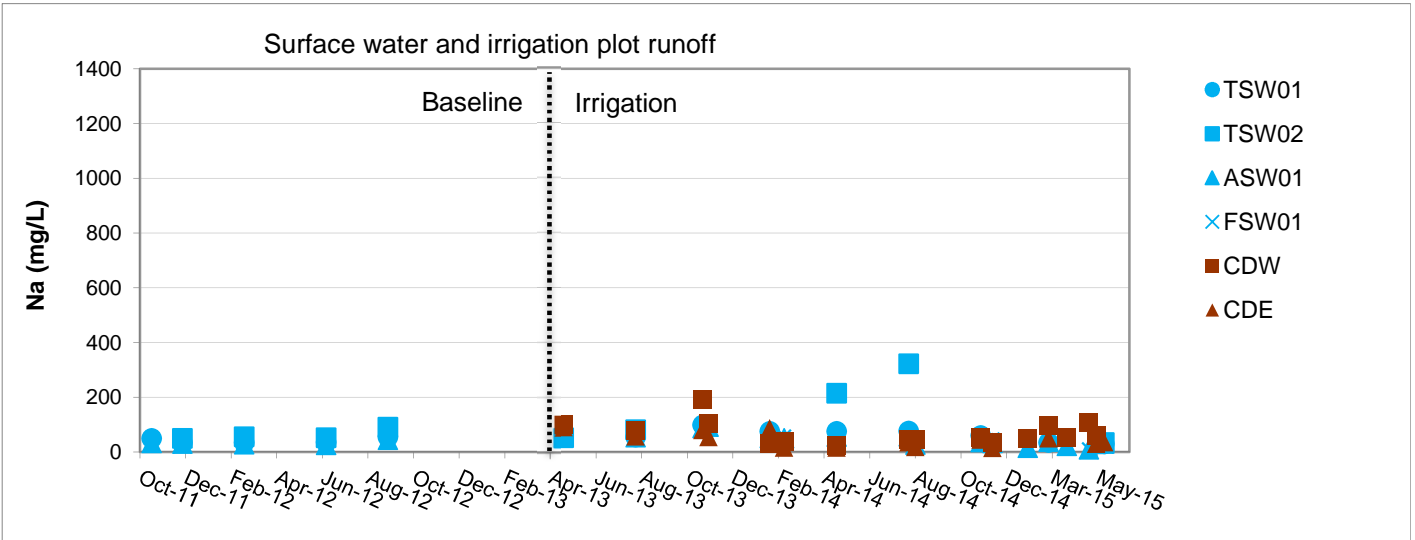
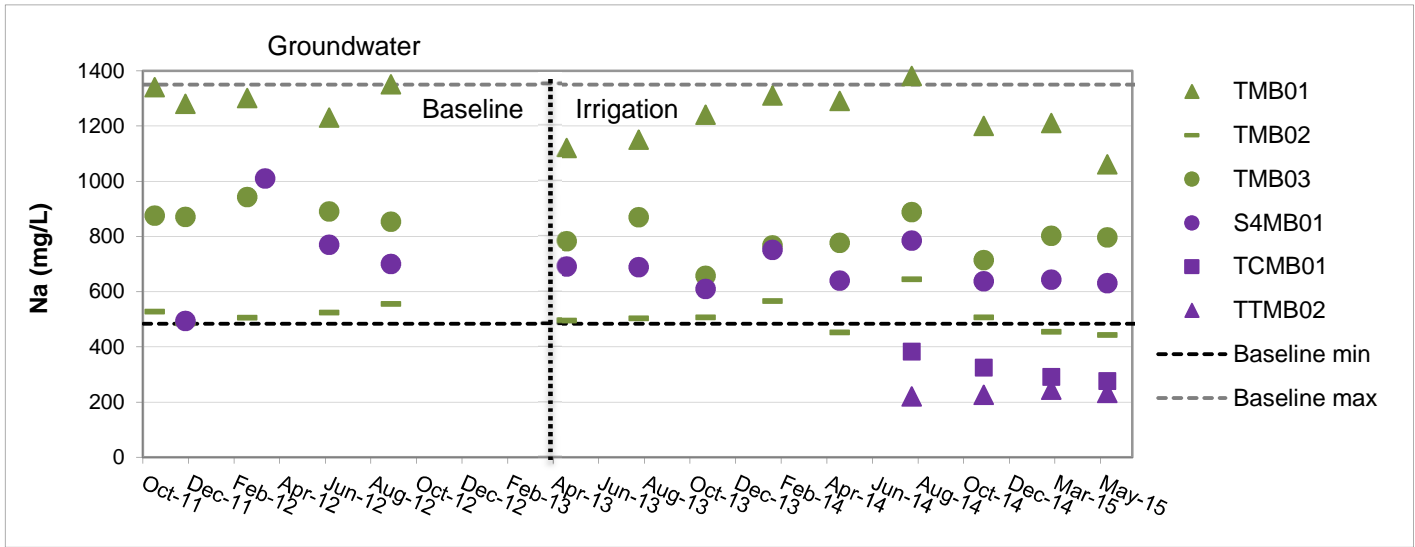


Notes:
 Field measured EC used for the baseline data and laboratory measured EC used for the data during irrigation.
 ~ANZECC 2000 - Water Quality Guidelines: aquatic ecosystems, south-east Australia, lowland river ecosystems (95% protection level).
 *ANZECC 2000. Water for long-term irrigation and general water use.

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester Basin, NSW



Figure B.3: Sodium concentrations



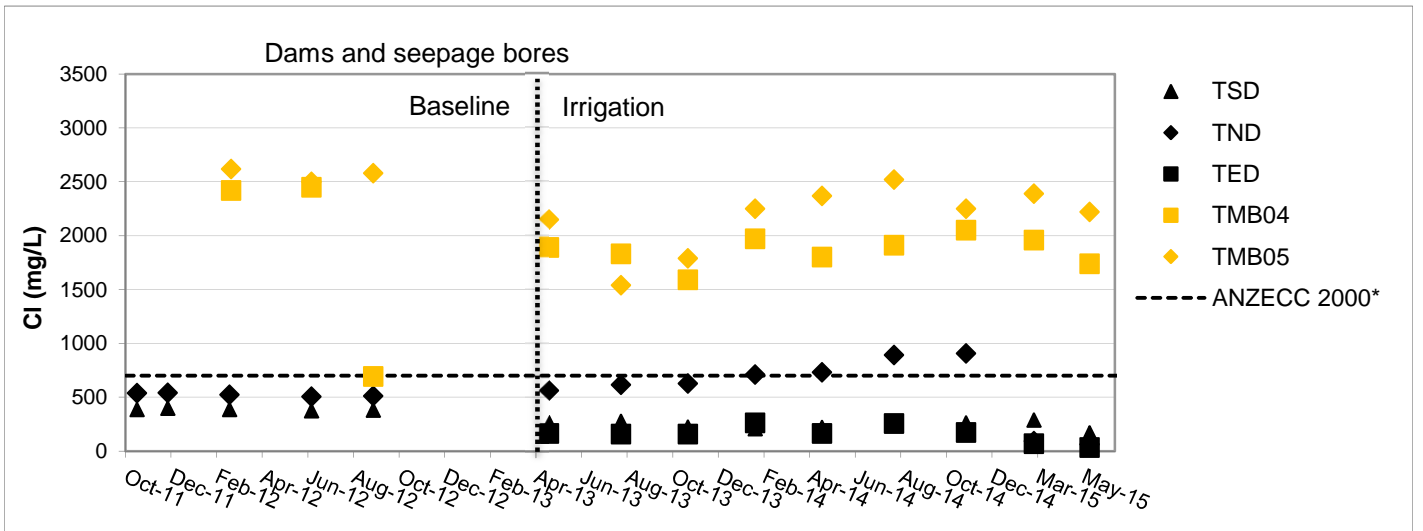
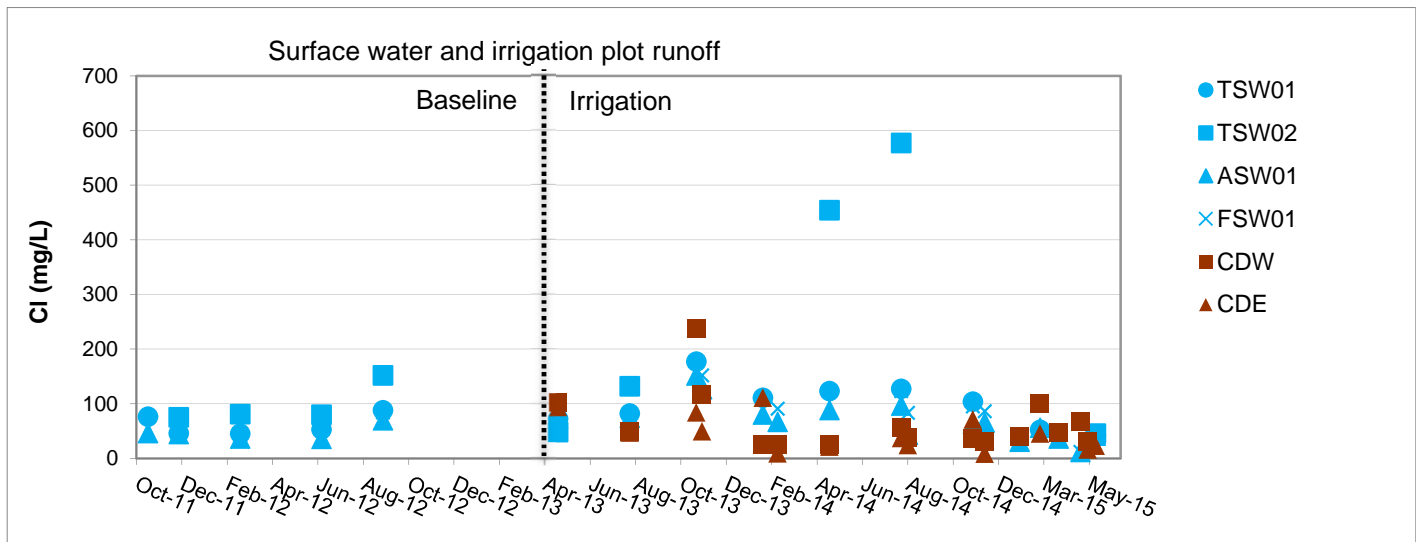
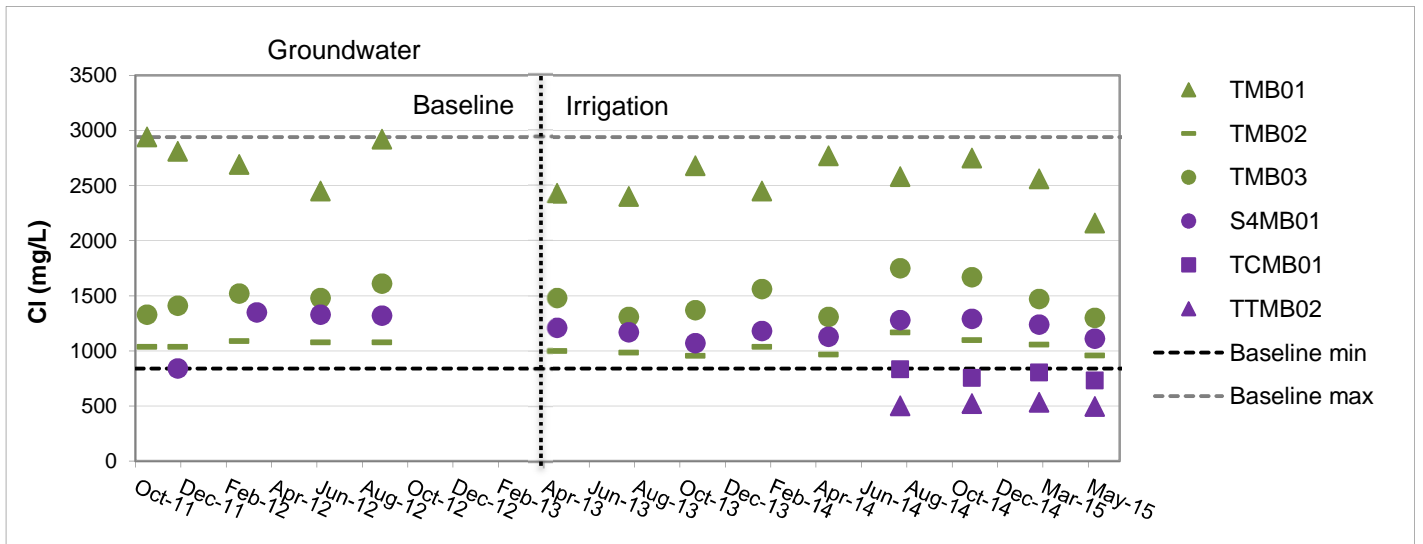
Note:

*ANZECC 2000. Water for irrigation and general water use. Moderately tolerant plants.

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester Basin, NSW



Figure B.4: Chloride concentrations

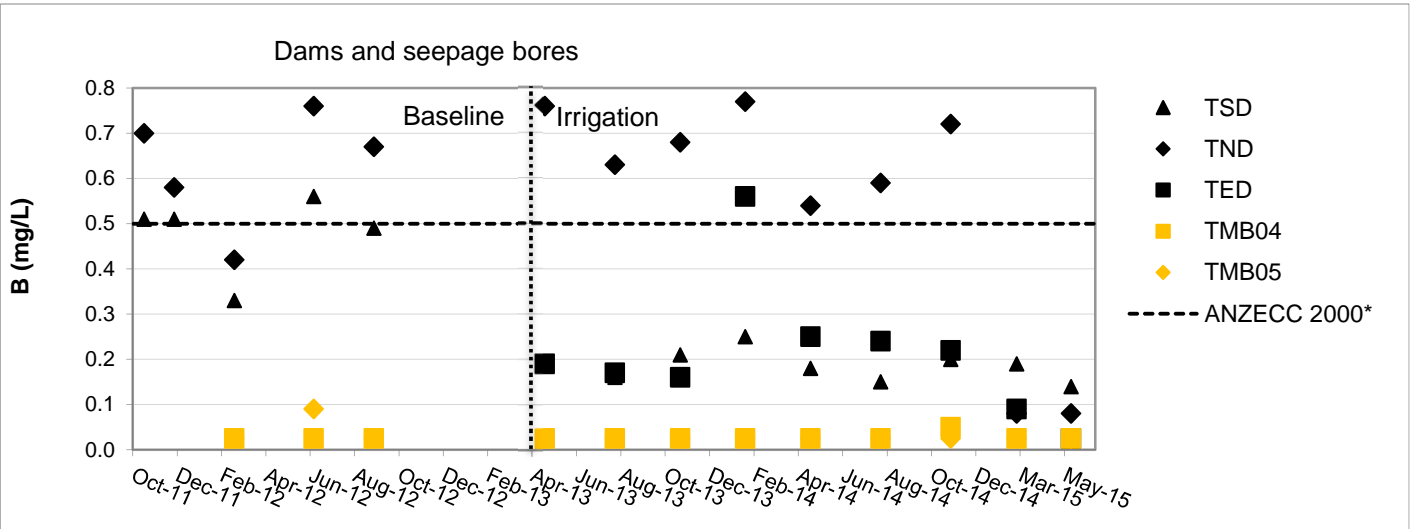
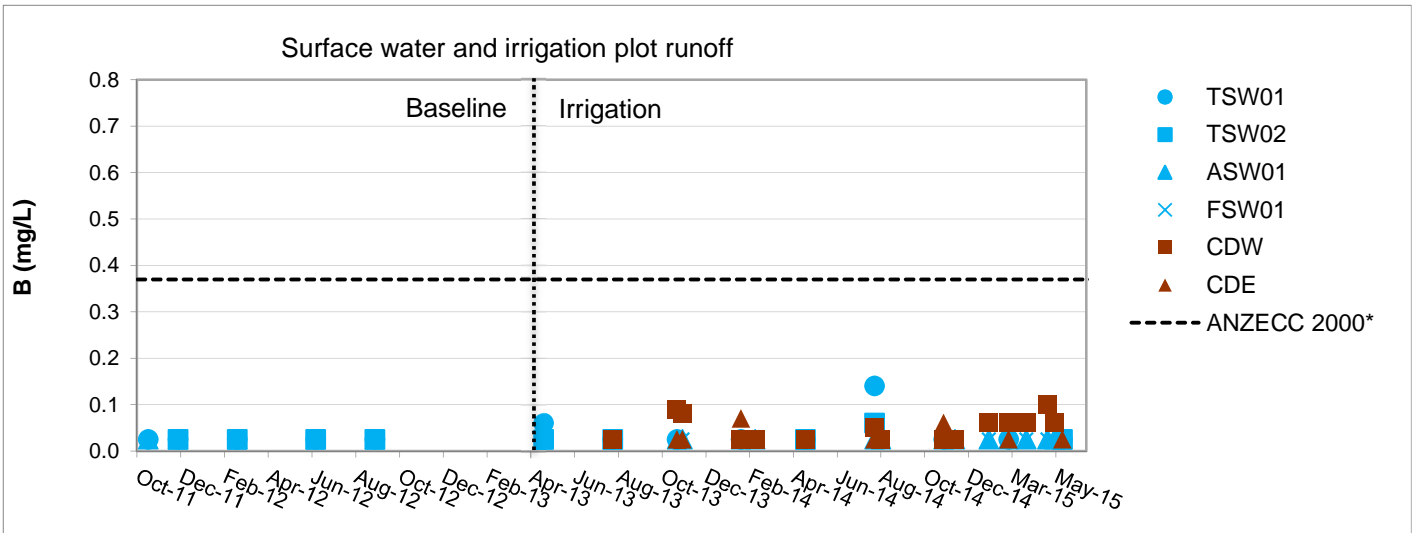
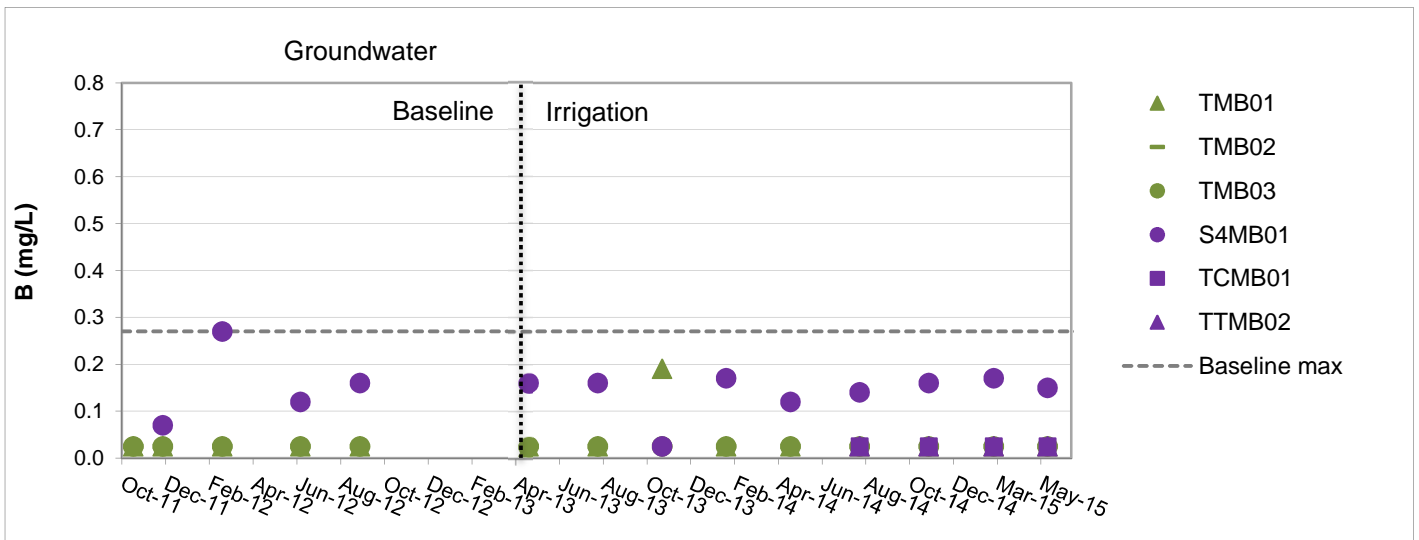


Notes:
 *ANZECC 2000. Water for irrigation and general water use. Moderately tolerant plants.
 Chloride method used - APHA 4500-Cl

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester Basin, NSW



Figure B.5: Boron concentrations

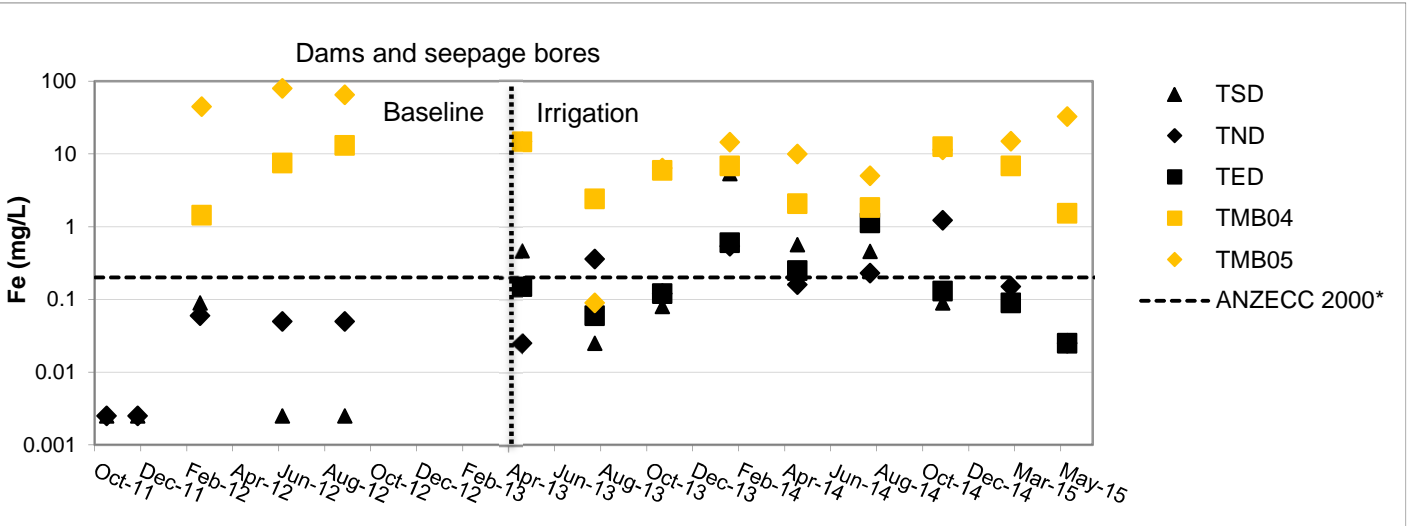
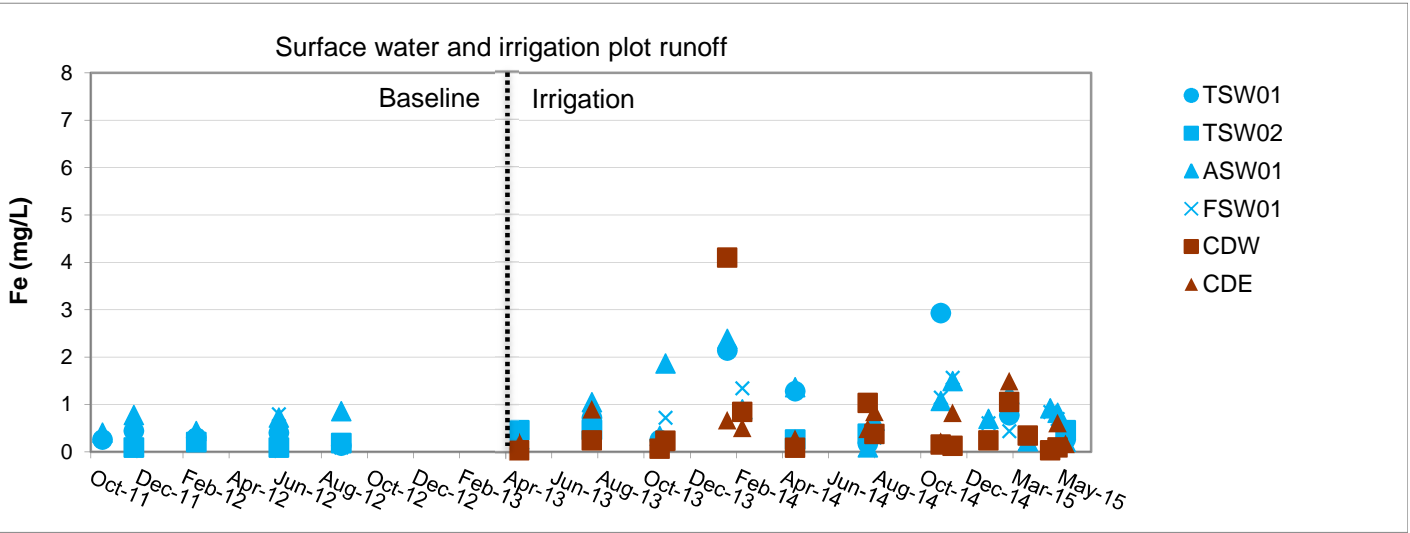
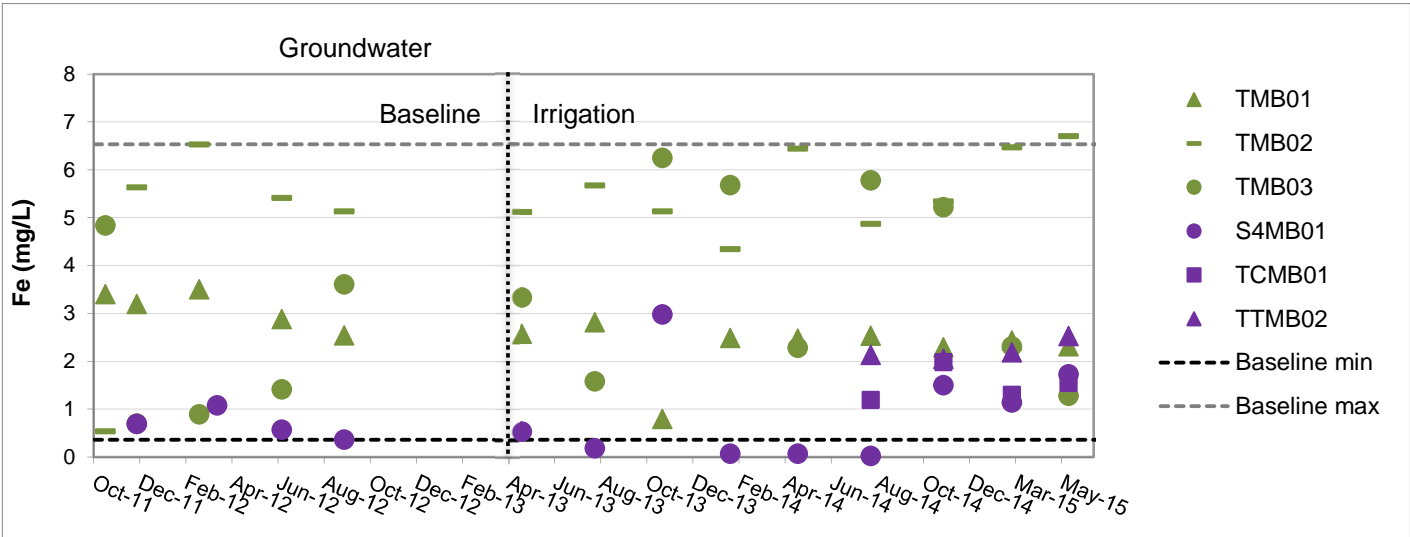


Notes:
 ~ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (95% protection levels).
 *ANZECC 2000. Water for long-term irrigation and general water use.

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester Basin, NSW



Figure B.6: Iron concentrations



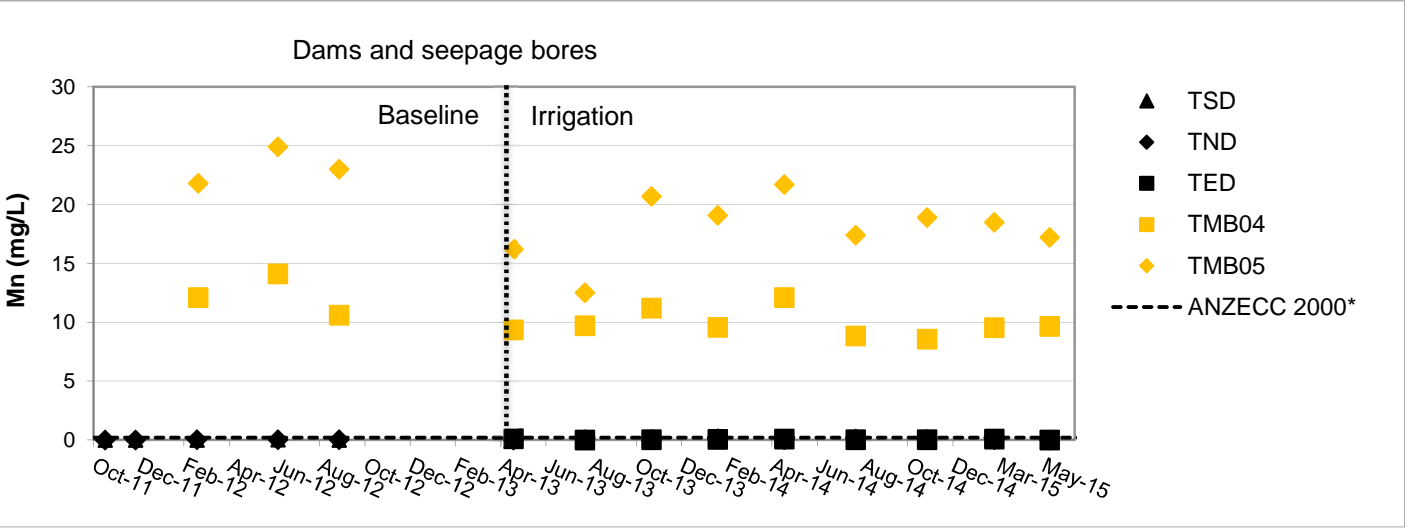
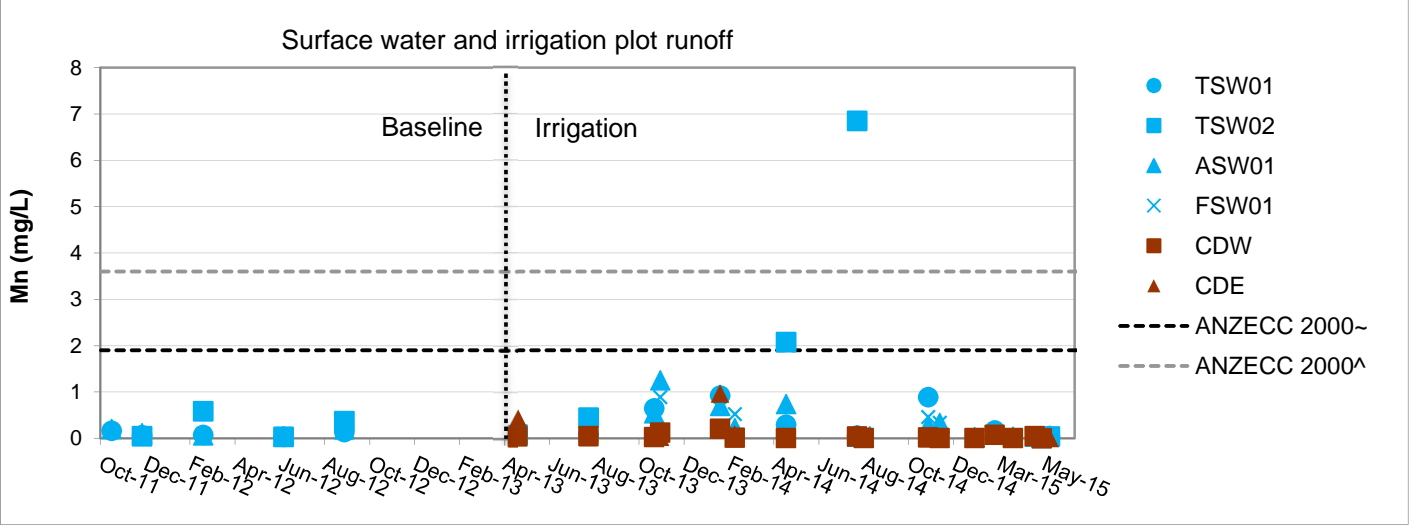
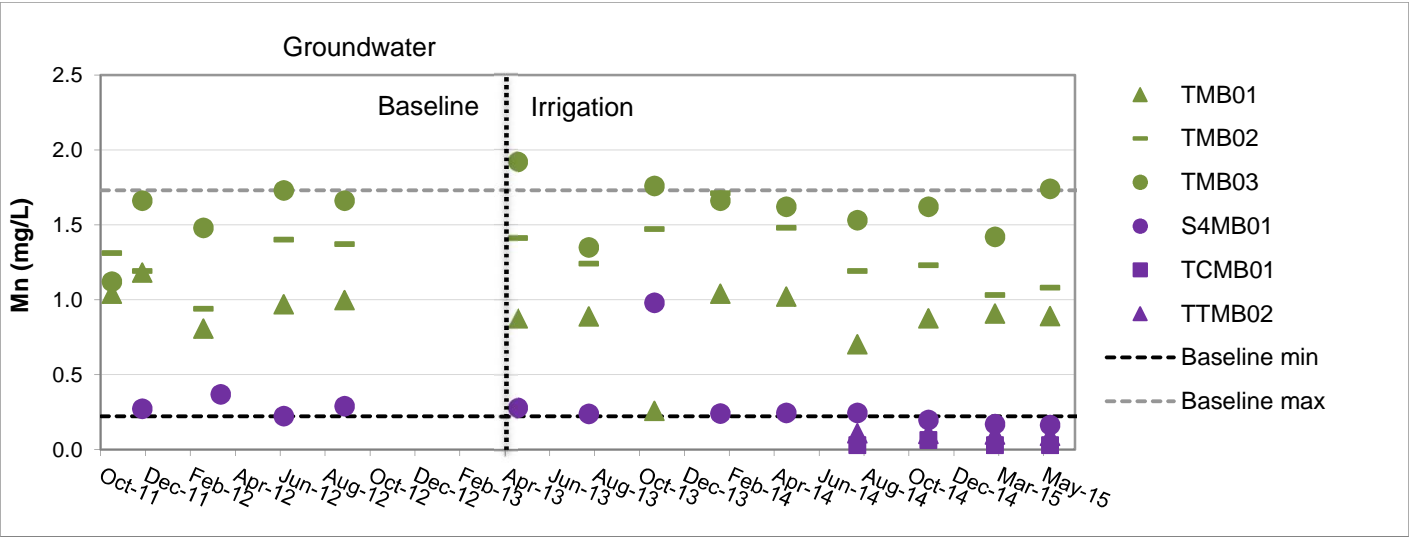
Note:

*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester Basin, NSW



Figure B.7: Manganese concentrations

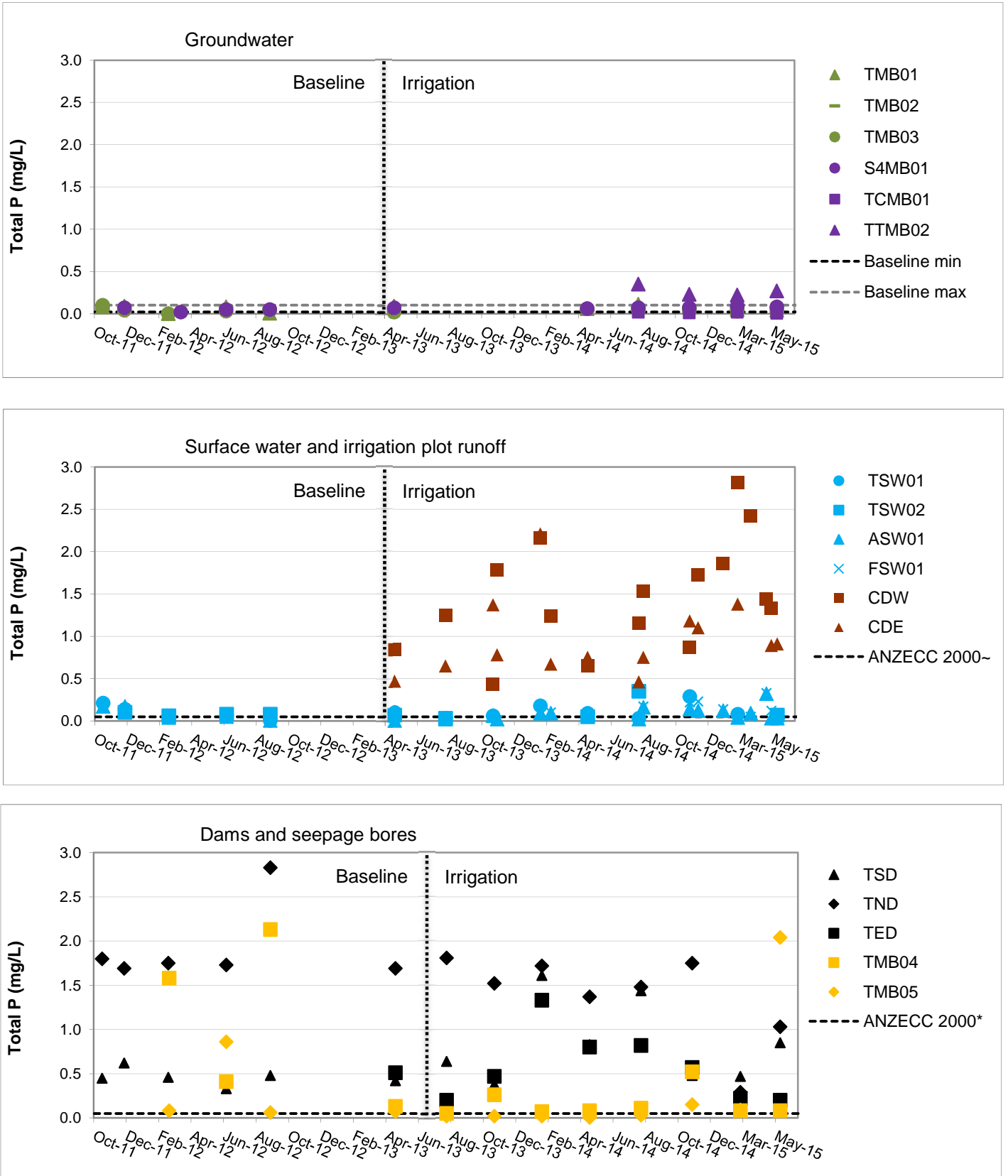


Notes:
 ~ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (95% protection levels).
 ^ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (80% protection levels).
 *ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester Basin, NSW



Figure B.8: Total Phosphorus concentrations

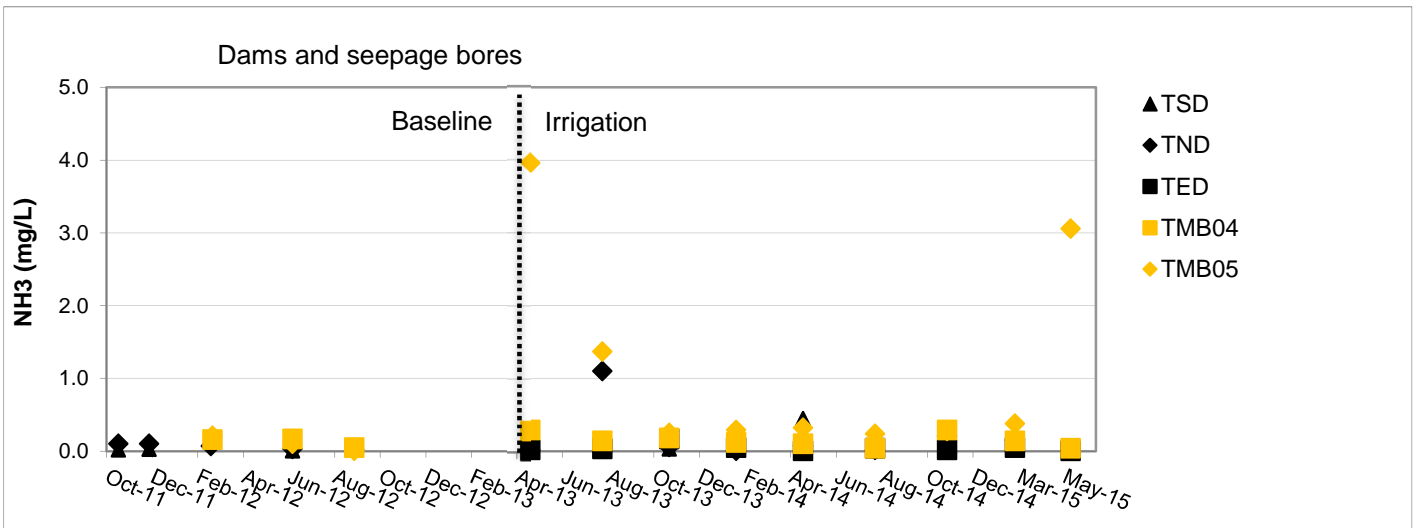
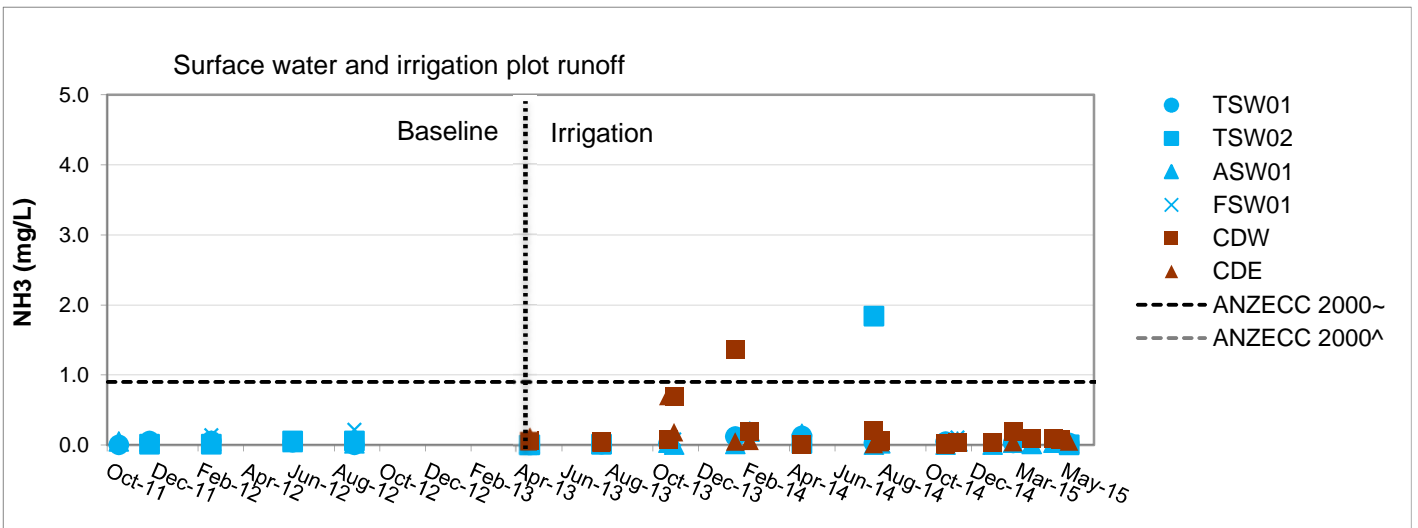
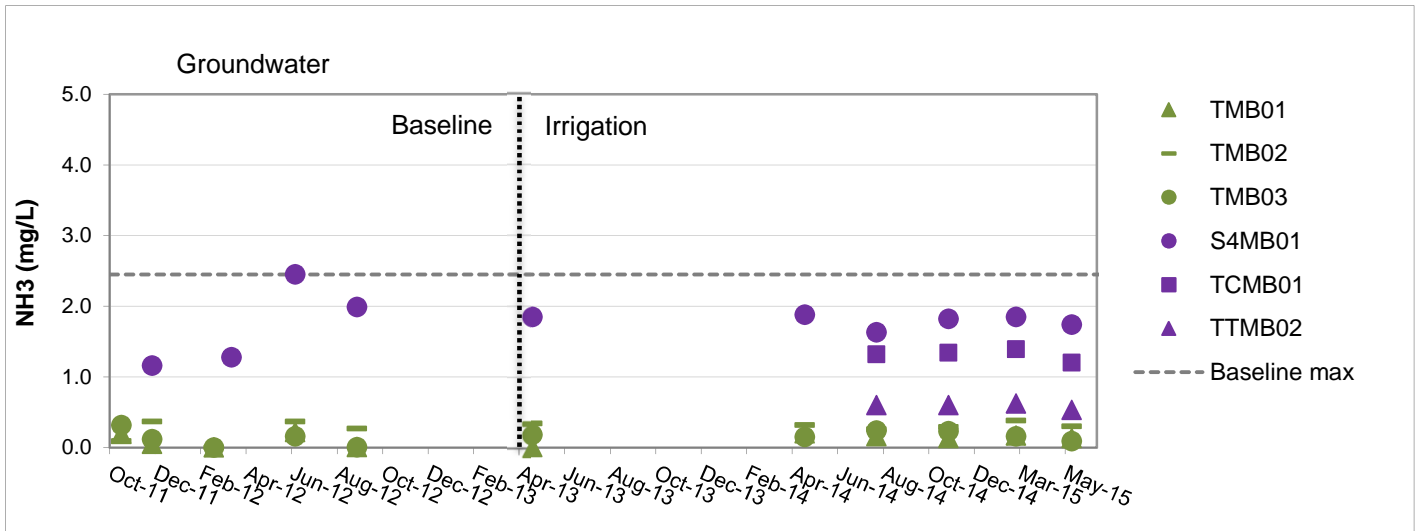


Notes:
 ~ANZECC 2000 - Water Quality Guidelines: aquatic ecosystems, south-east Australia, lowland river ecosystems (95% protection level).
 *ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester Basin, NSW



Figure B.9: Ammonia concentrations

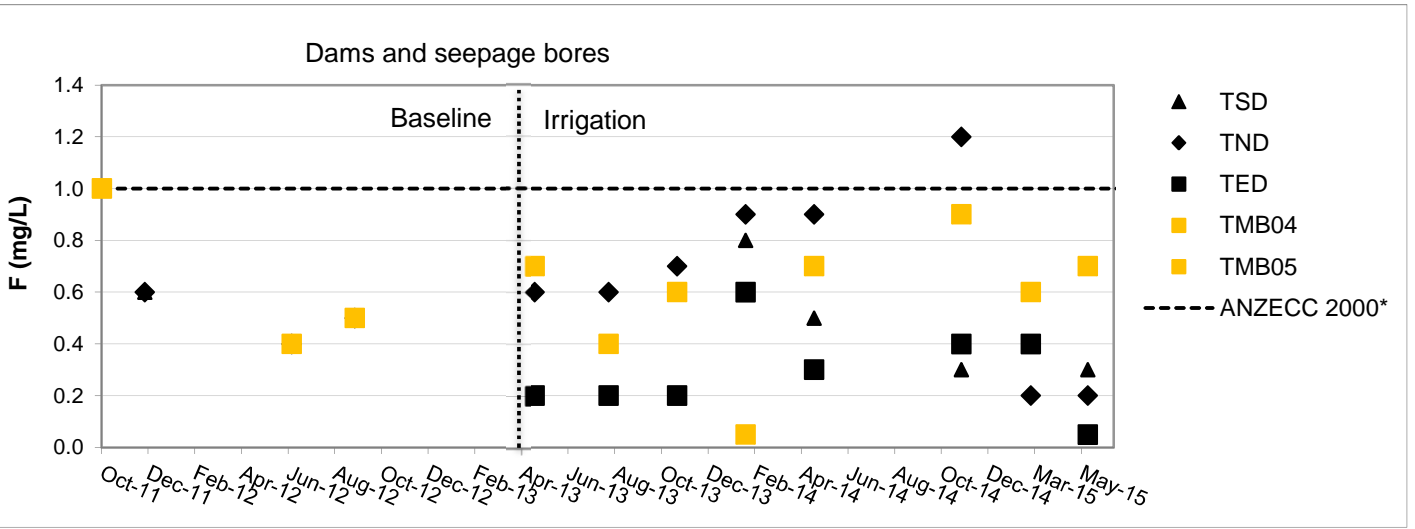
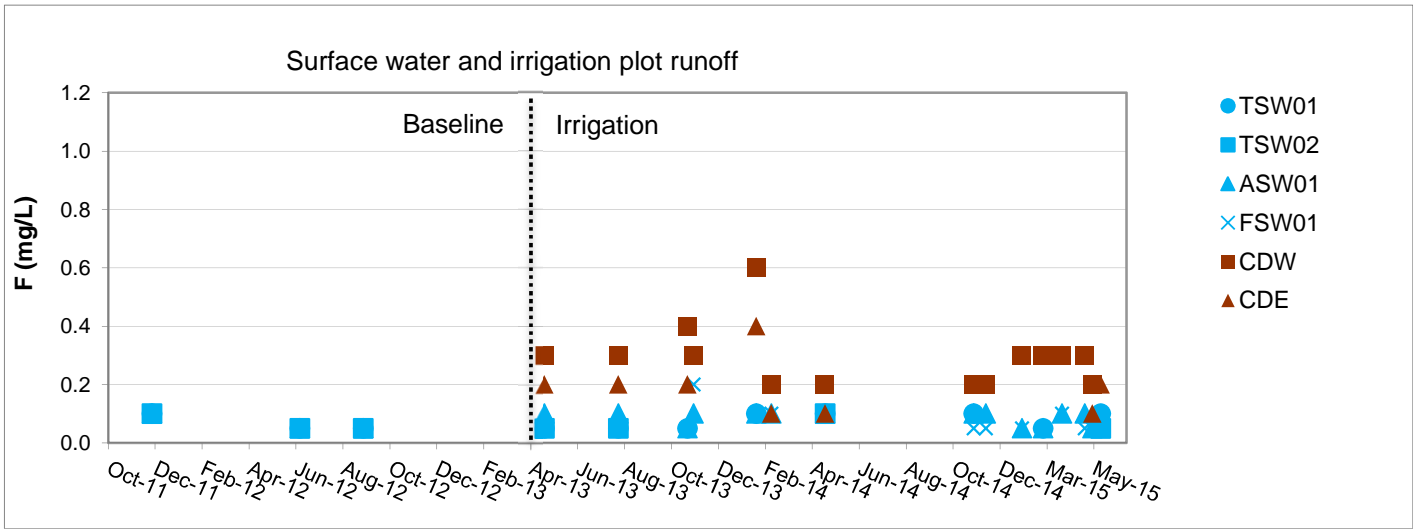
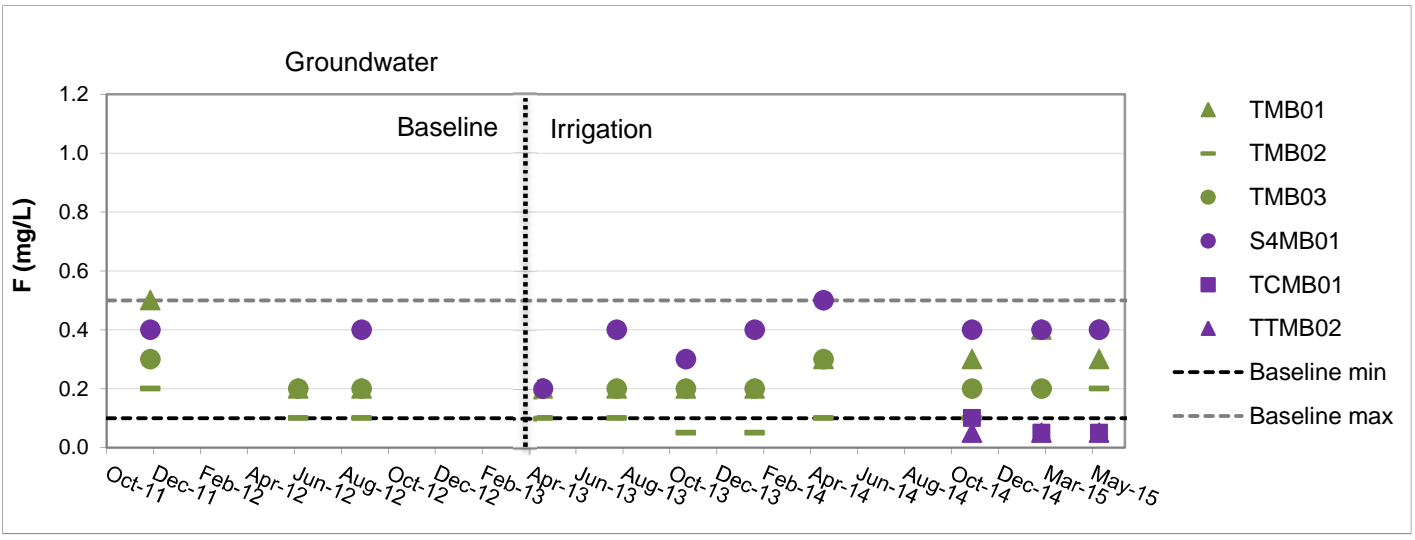


Notes:
 ~ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (95% protection levels).
 ^ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (80% protection levels).

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester Basin, NSW



Figure B.10: Fluoride concentrations



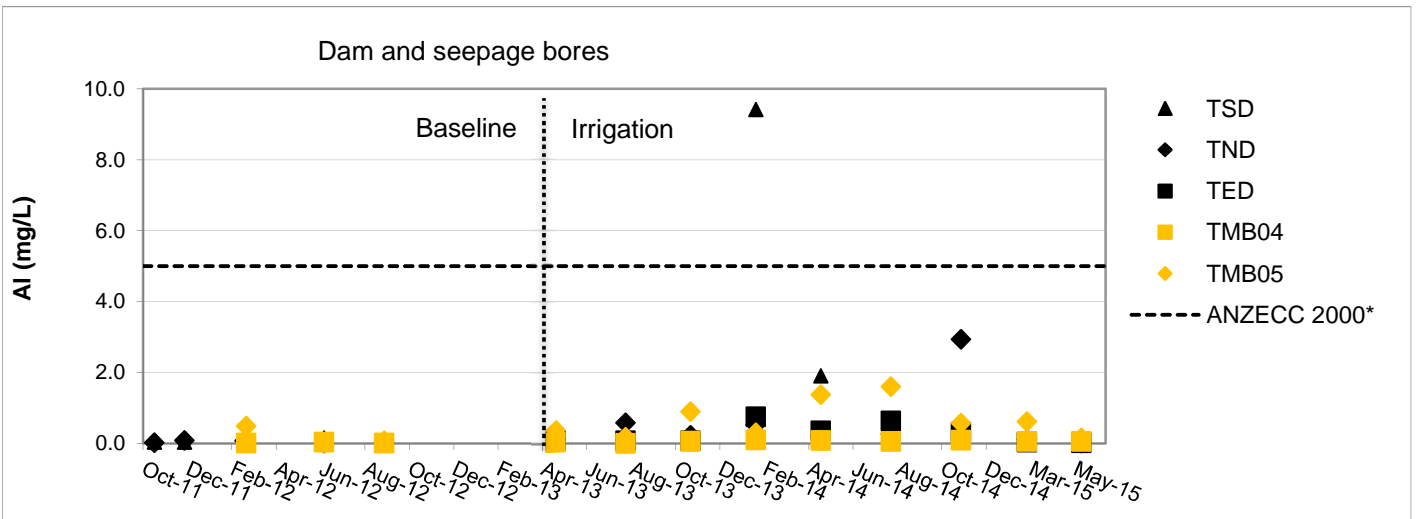
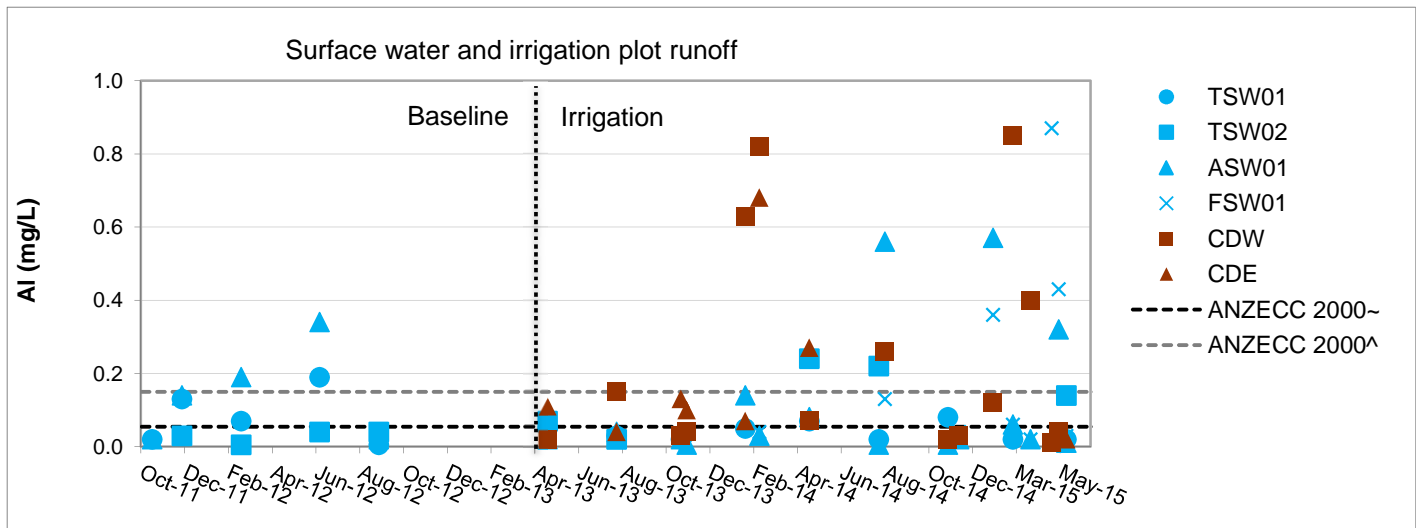
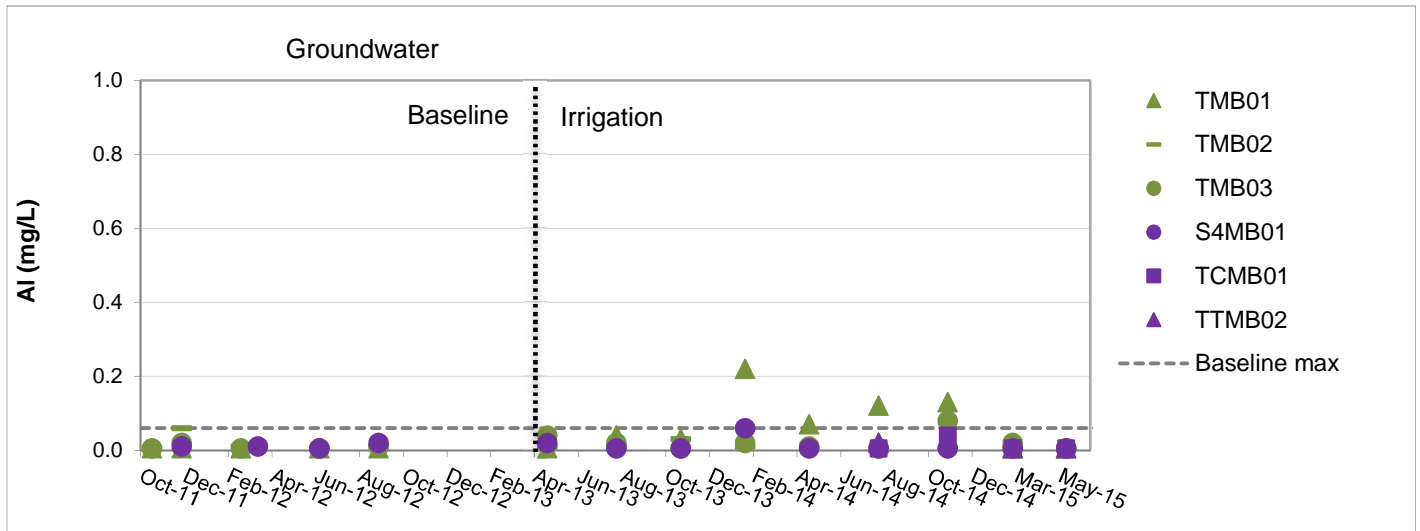
Note:

*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester Basin, NSW



Figure B.11: Aluminium concentrations

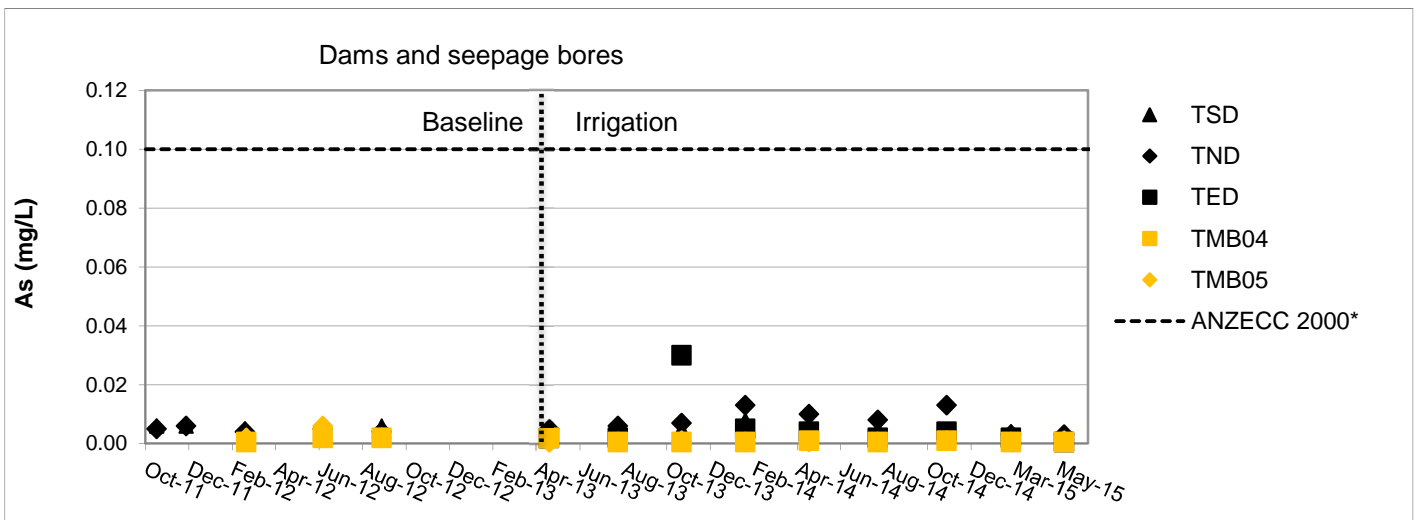
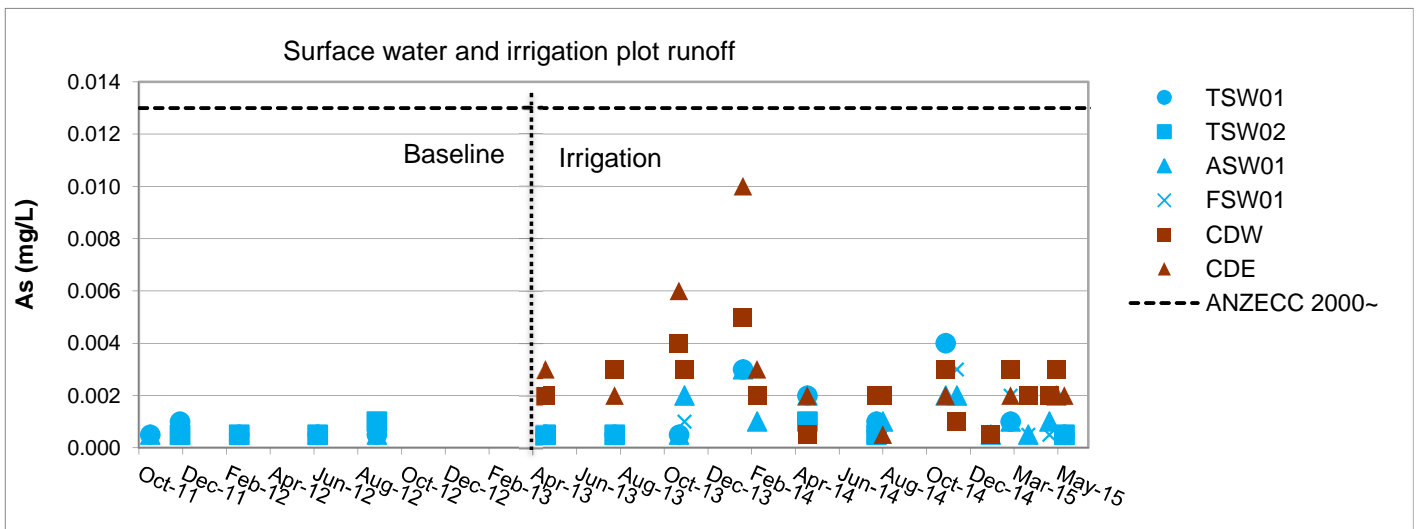
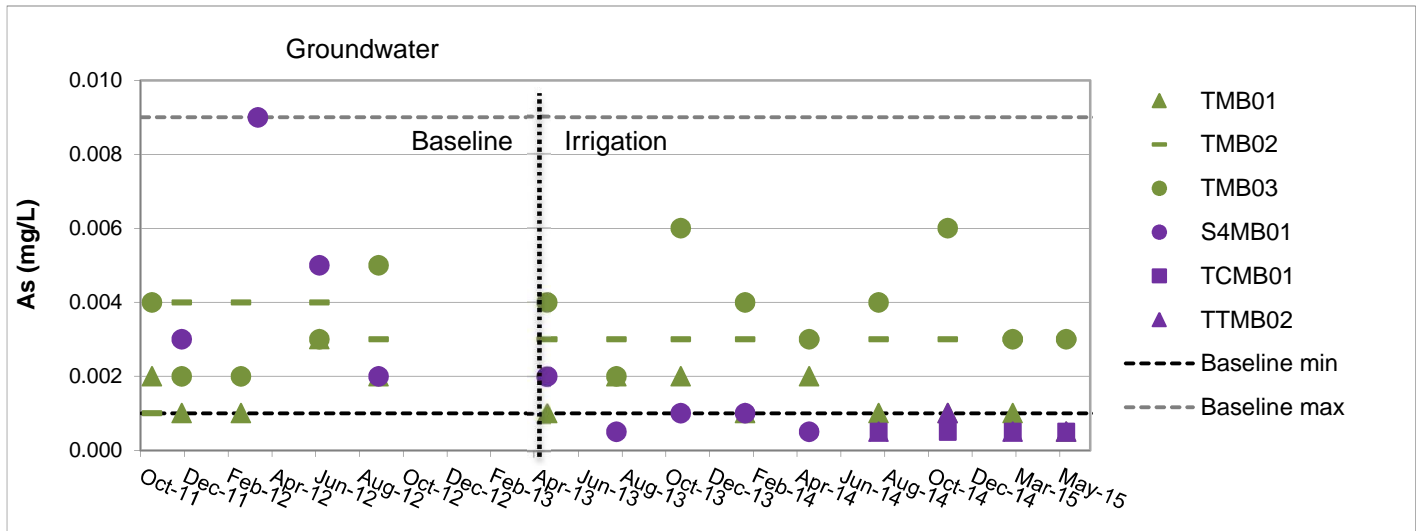


Notes:
 ~ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (95% protection levels).
 ^ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (80% protection levels).
 *ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester Basin, NSW



Figure B.12: Arsenic concentrations

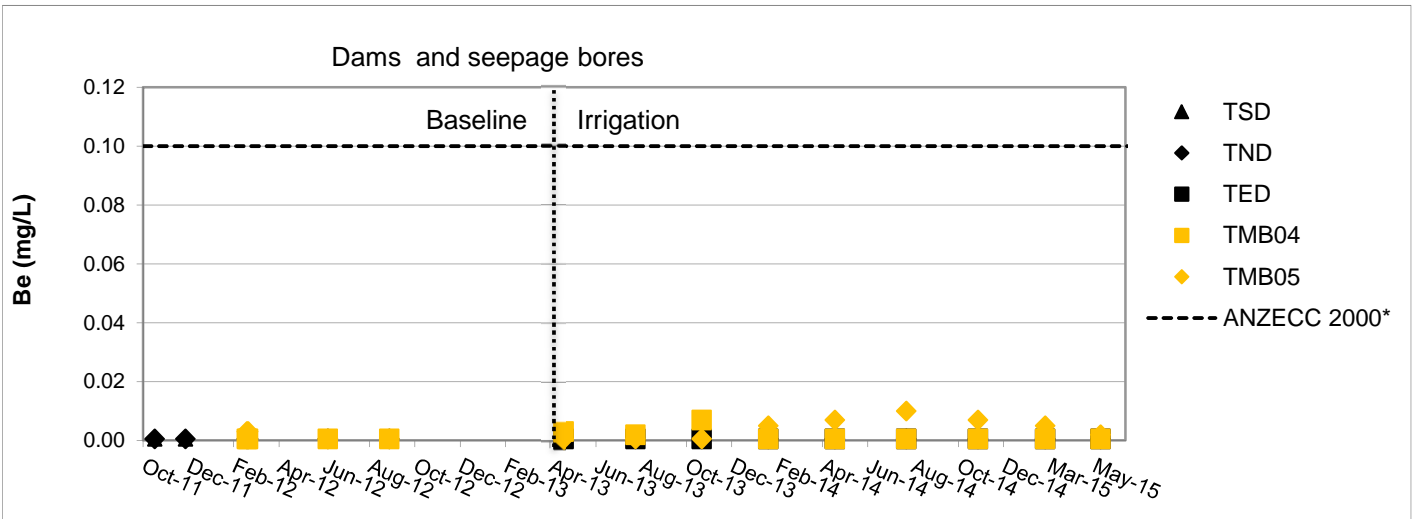
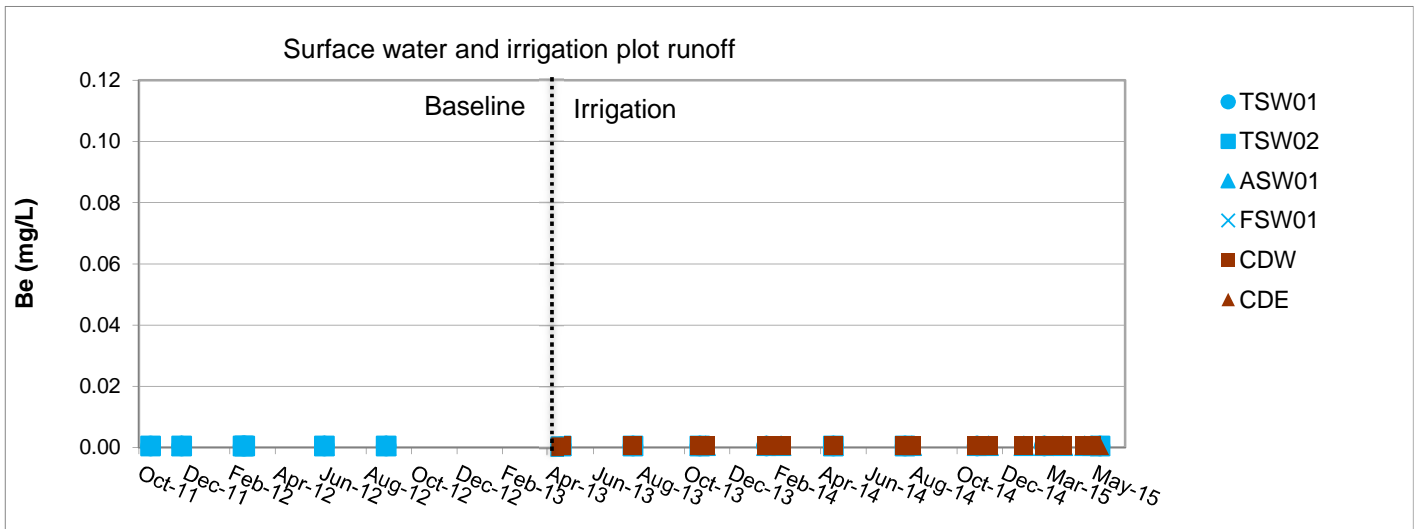
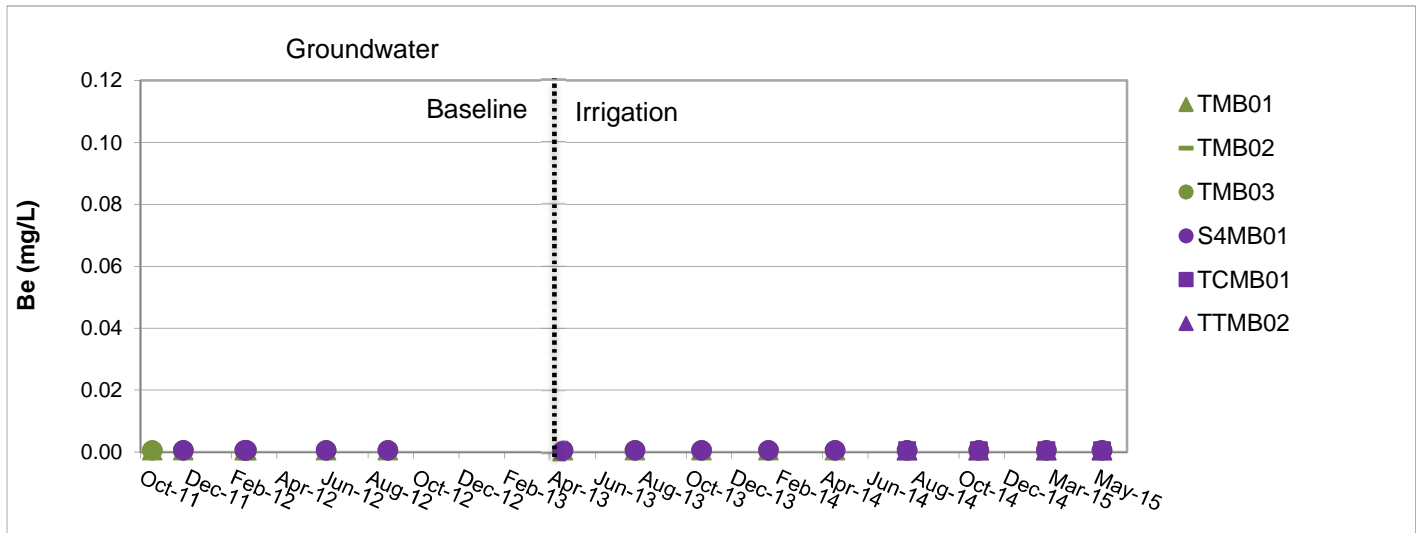


Notes:
 ~ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (95% protection levels).
 *ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester Basin, NSW

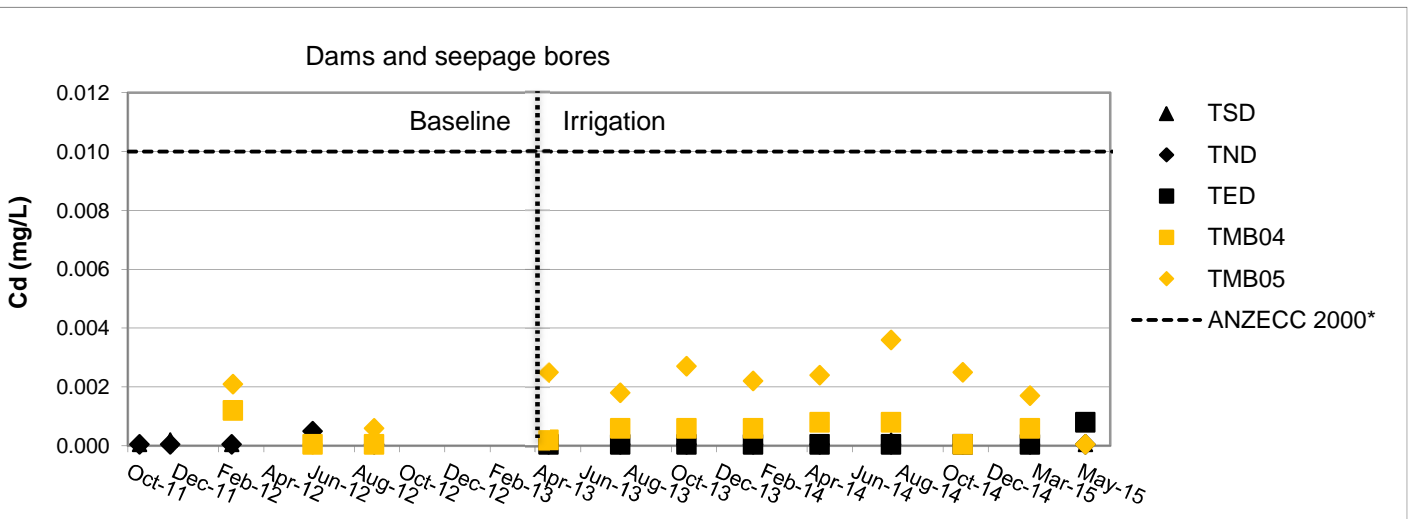
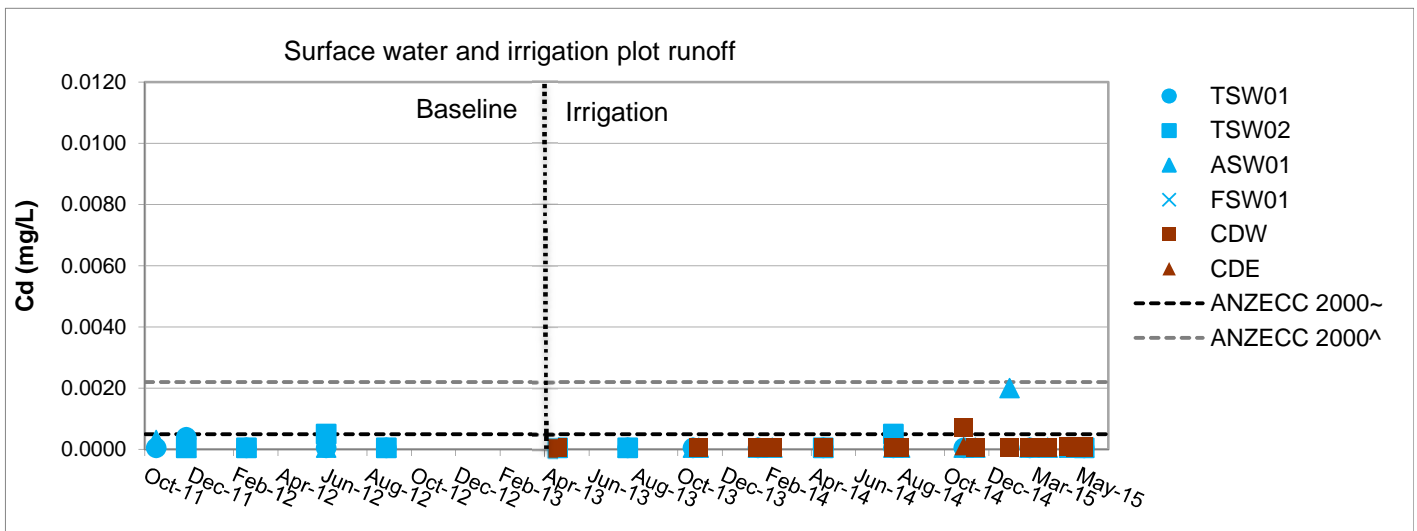
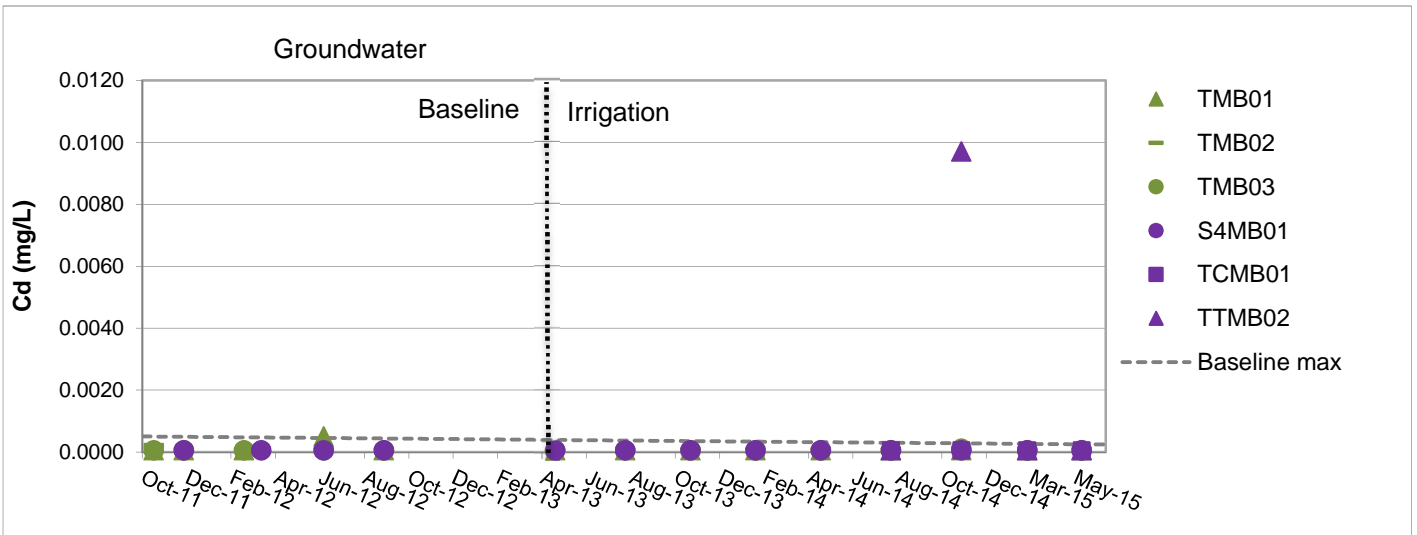


Figure B.13: Beryllium concentrations



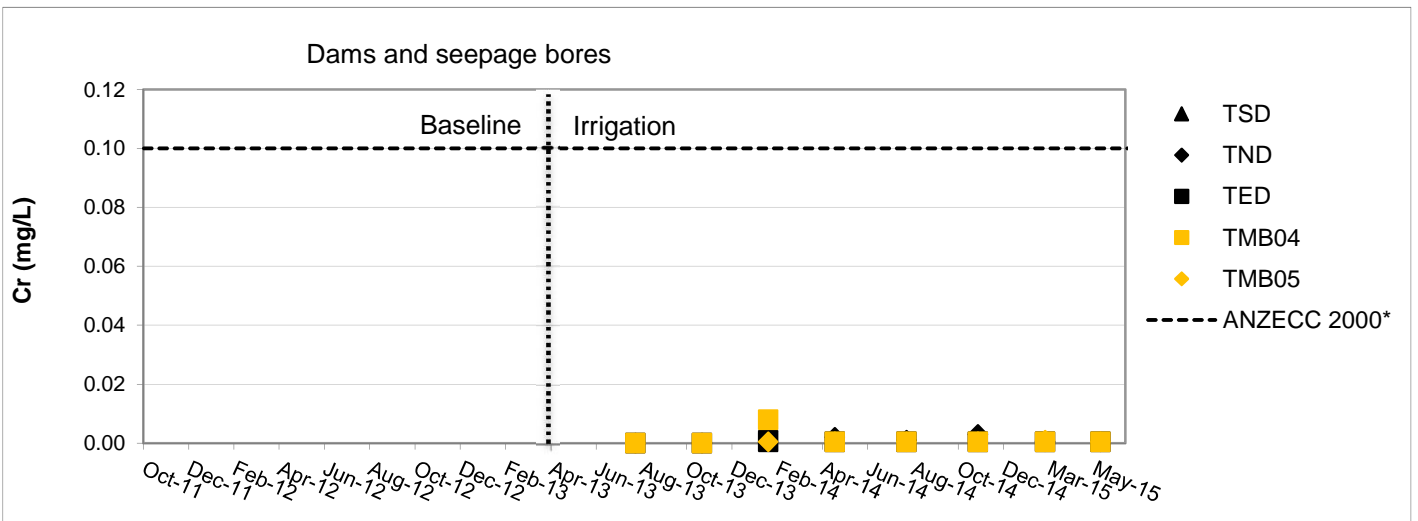
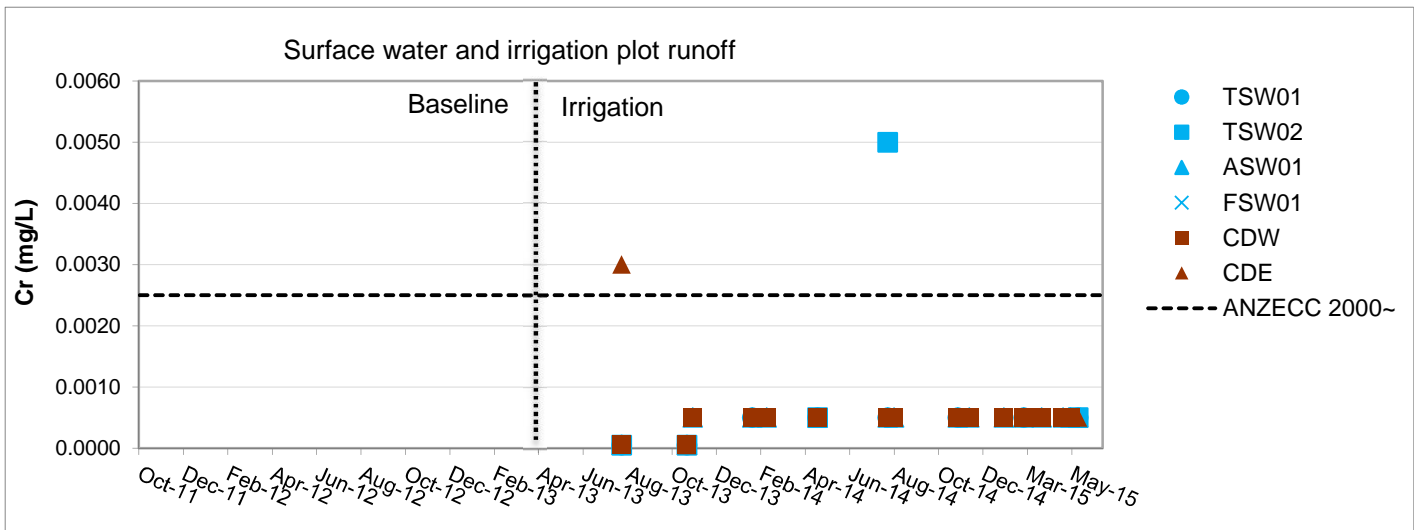
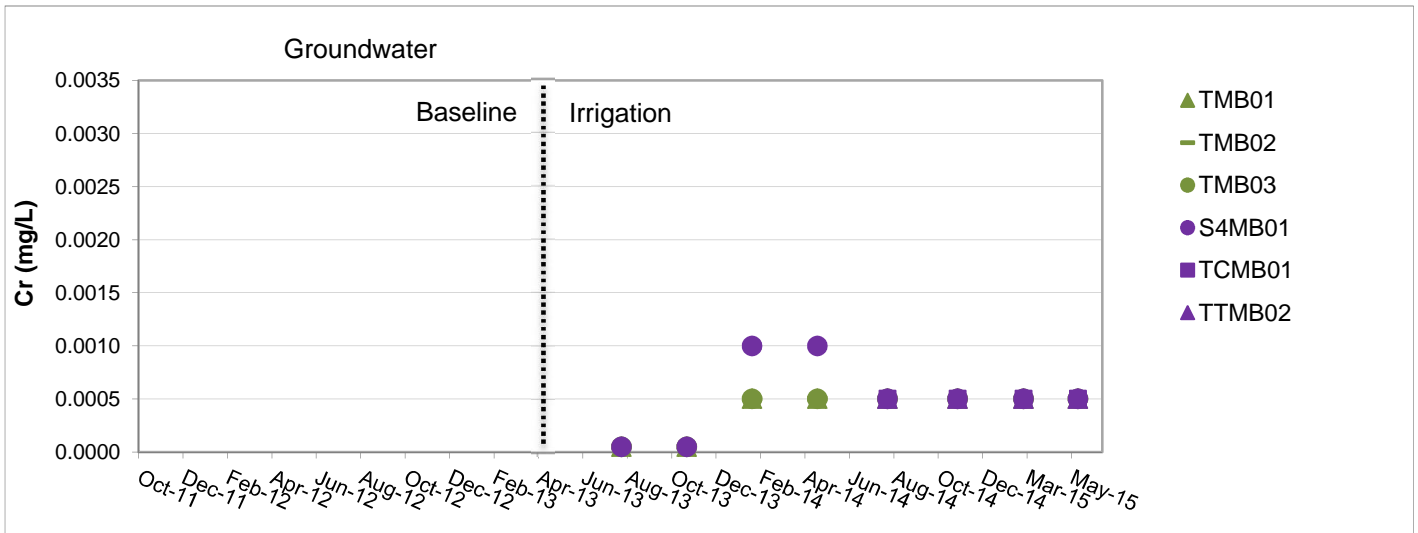
Note:
 *ANZECC 2000. Water for long term irrigation and general water use.

Figure B.14: Cadmium concentrations



Notes:
 ~ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (95% protection levels).
 ^ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (80% protection levels).
 *ANZECC 2000. Water for long term irrigation and general water use.

Figure B.15: Chromium concentrations

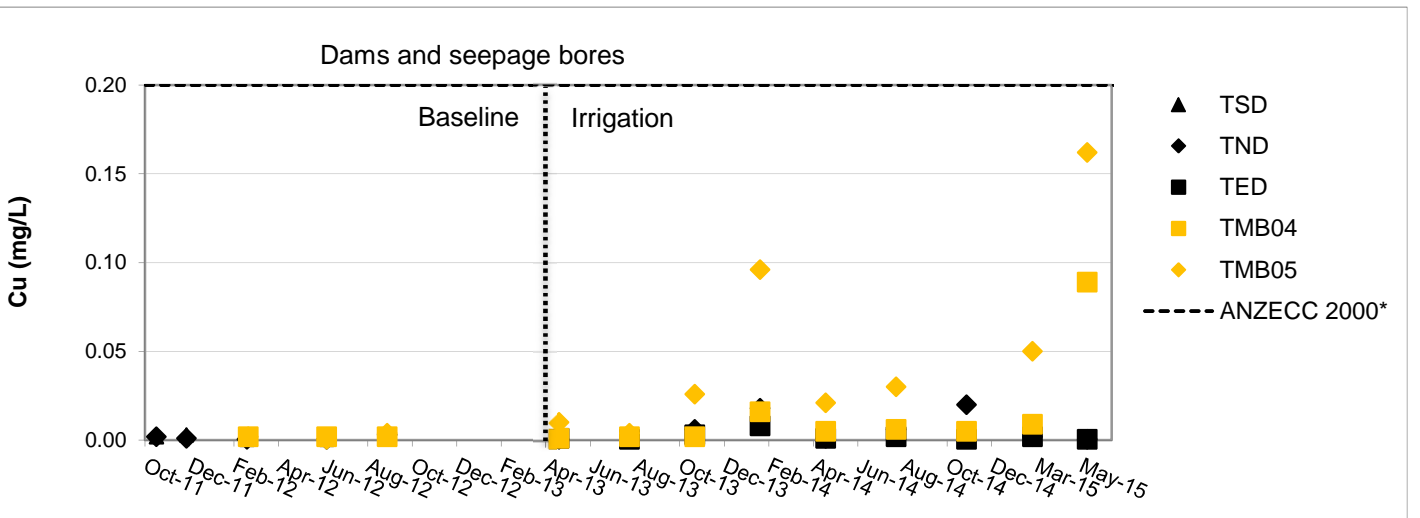
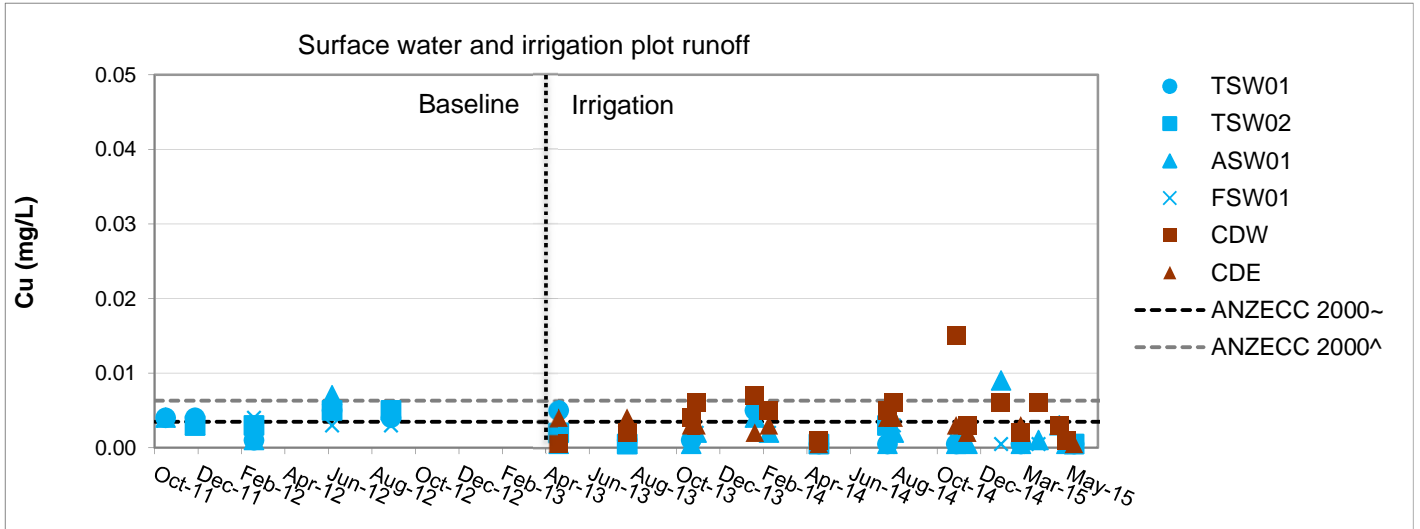
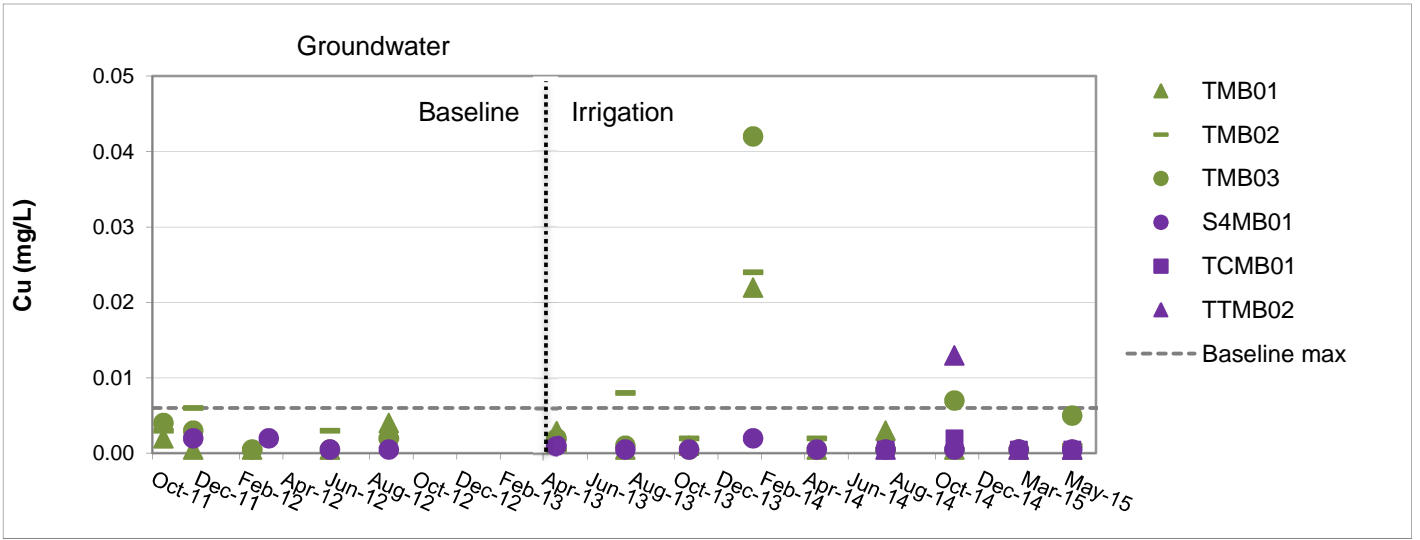


Notes:

-ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (95% protection levels).

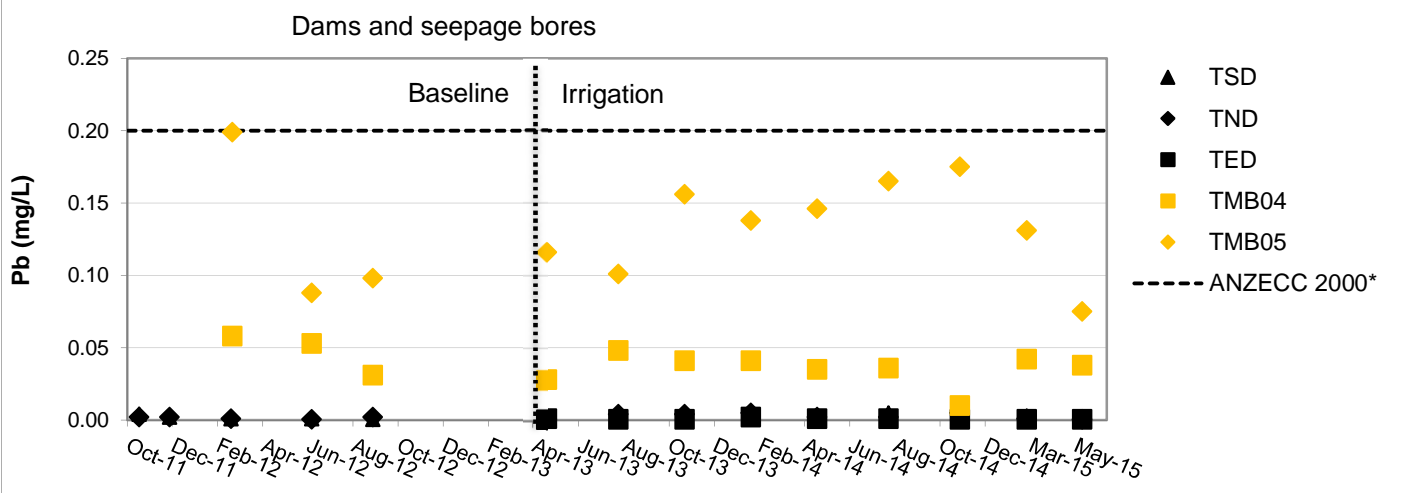
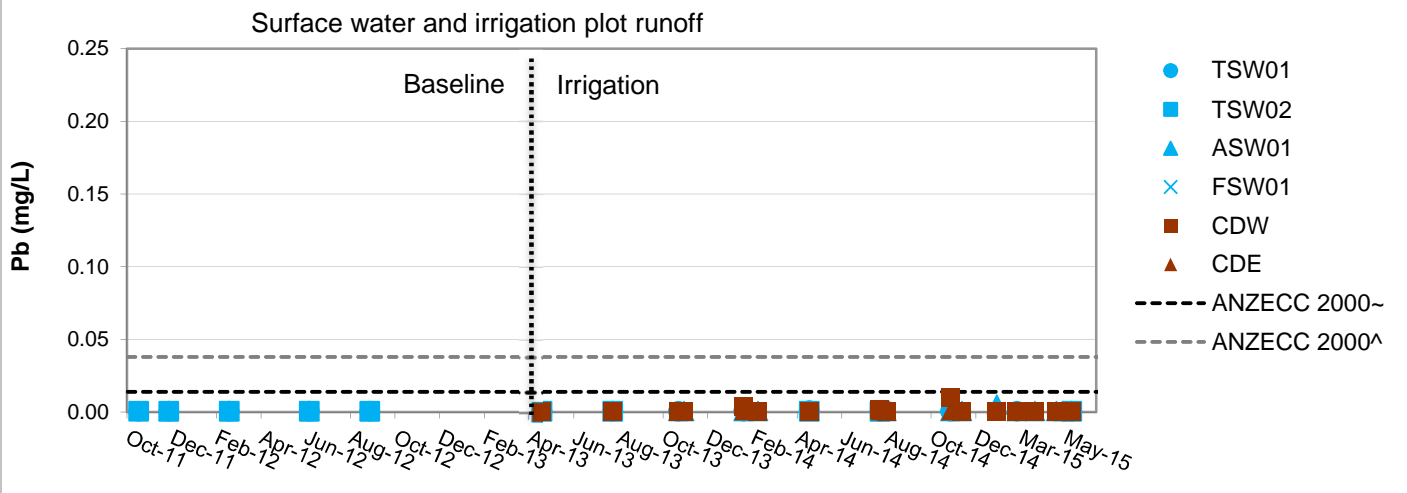
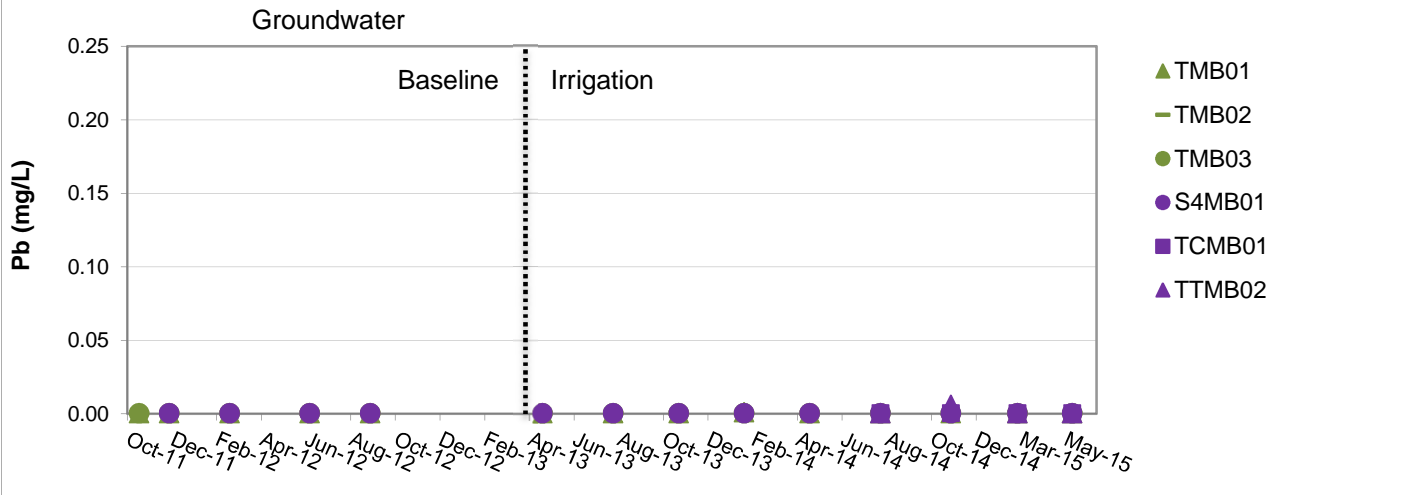
*ANZECC 2000. Water for long term irrigation and general water use.

Figure B.16: Copper concentrations



Notes:
 ~ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (95% protection levels).
 ^ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (80% protection levels).
 *ANZECC 2000. Water for long term irrigation and general water use.

Figure B.17: Lead concentrations

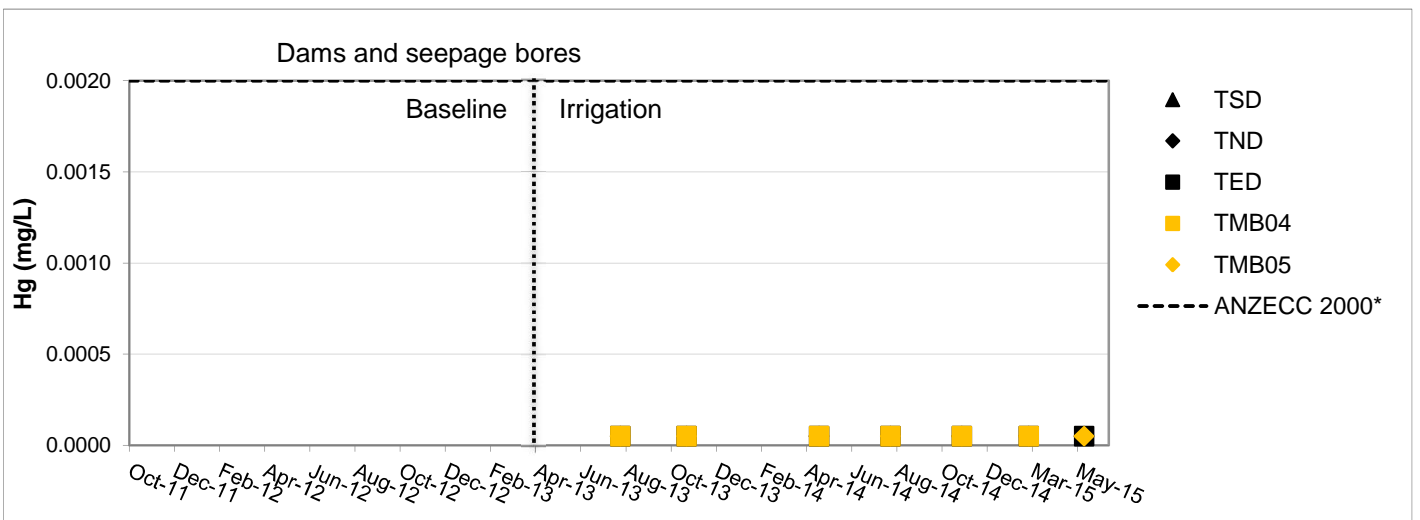
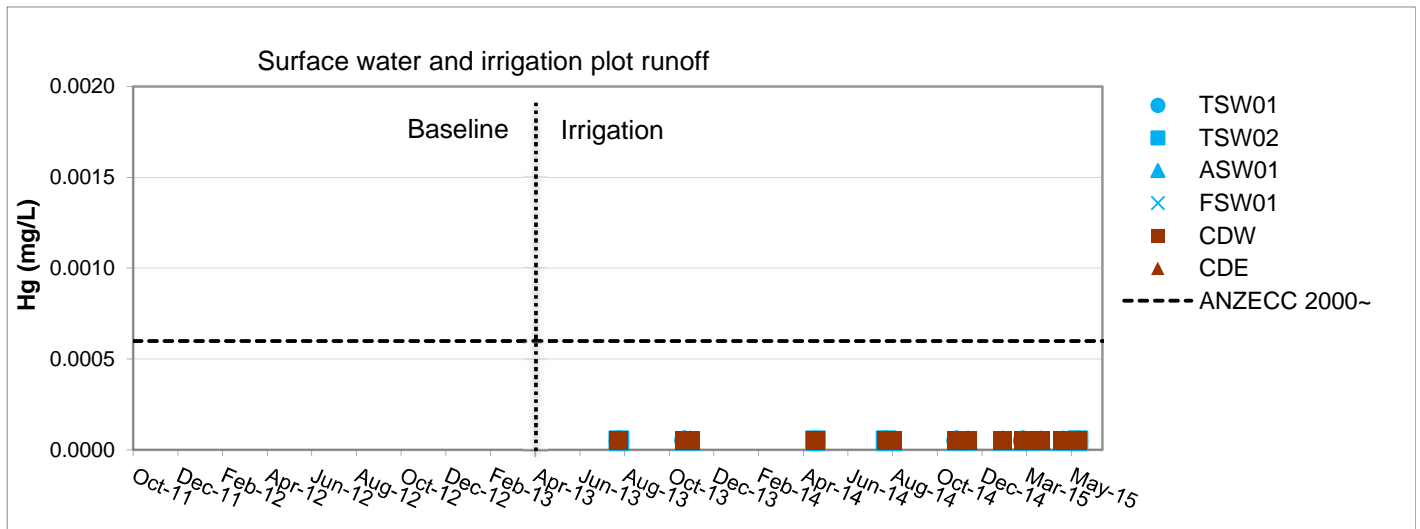
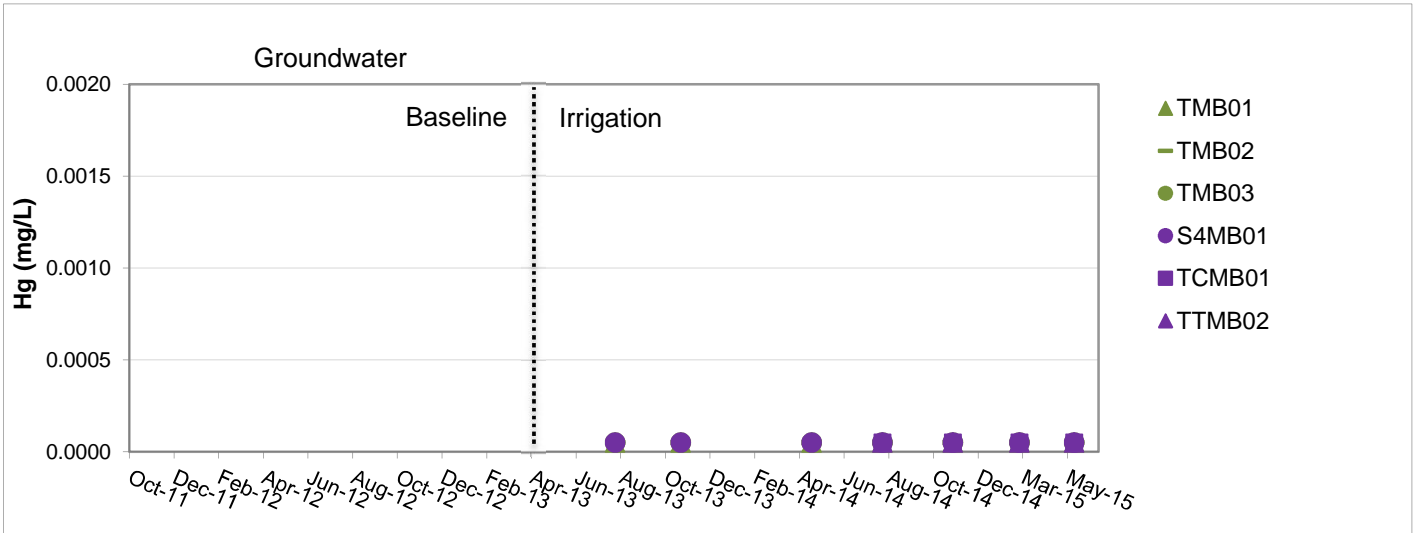


Notes:
 ~ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (95% protection levels).
 ^ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (80% protection levels).
 *ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester Basin, NSW



Figure B.18: Mercury concentrations



Notes:

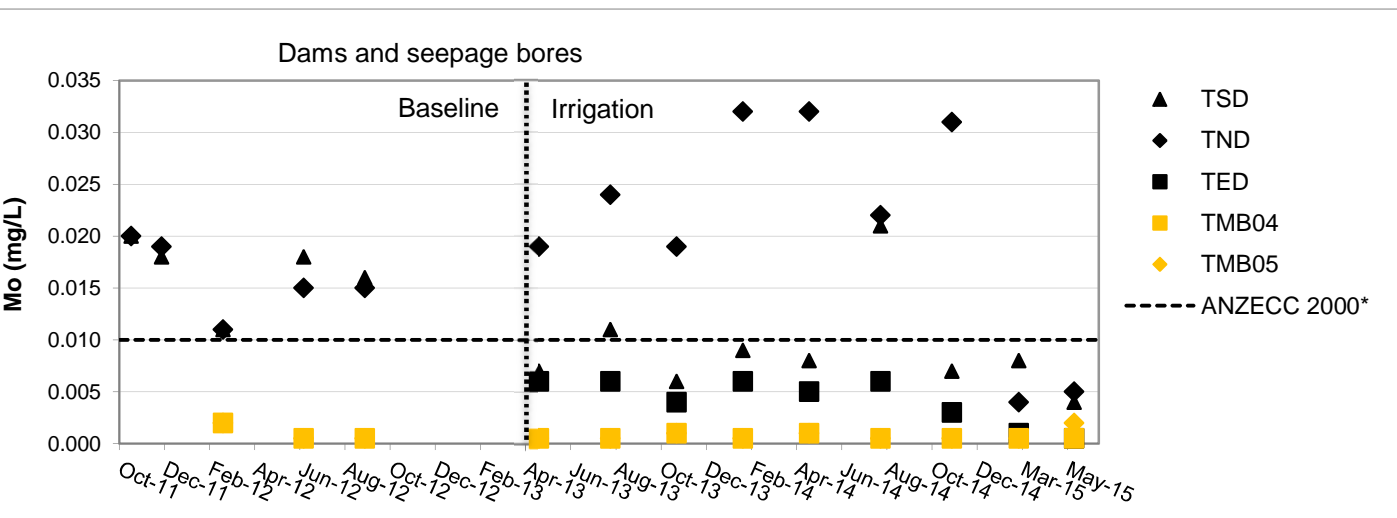
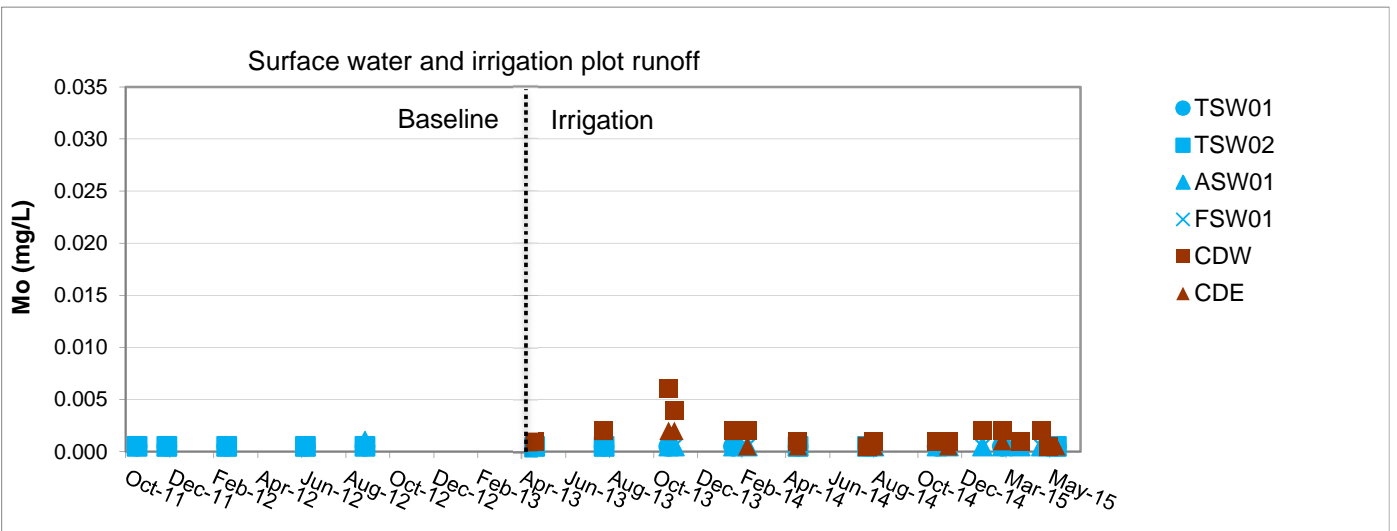
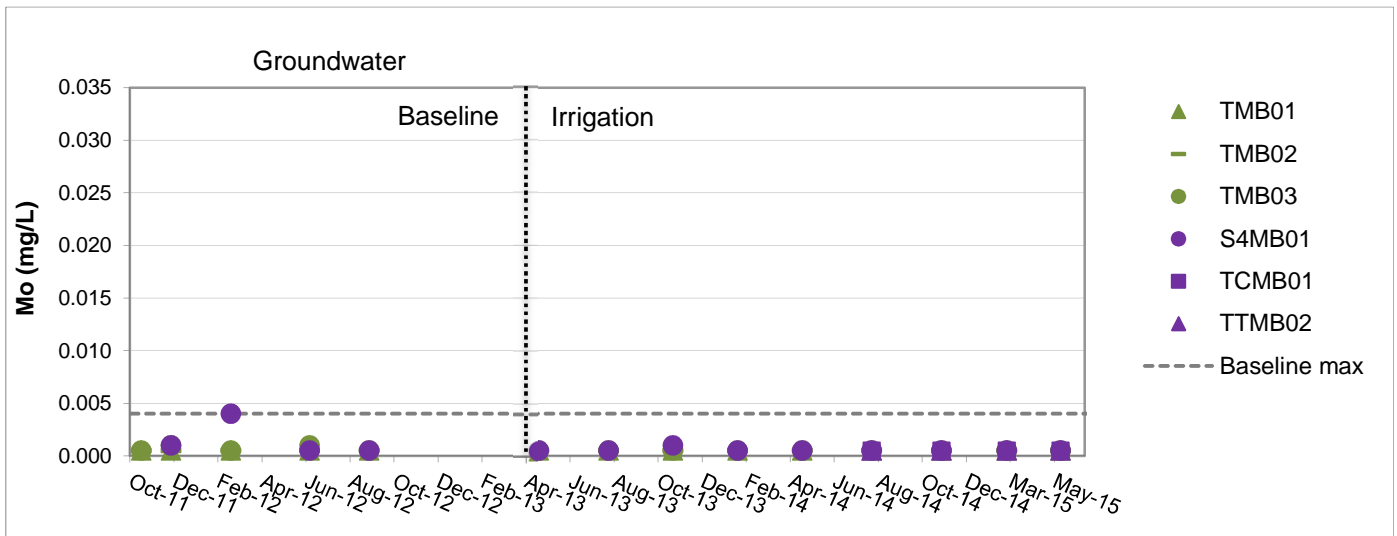
~ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (95% protection levels).

*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester Basin, NSW



Figure B.19: Molybdenum concentrations

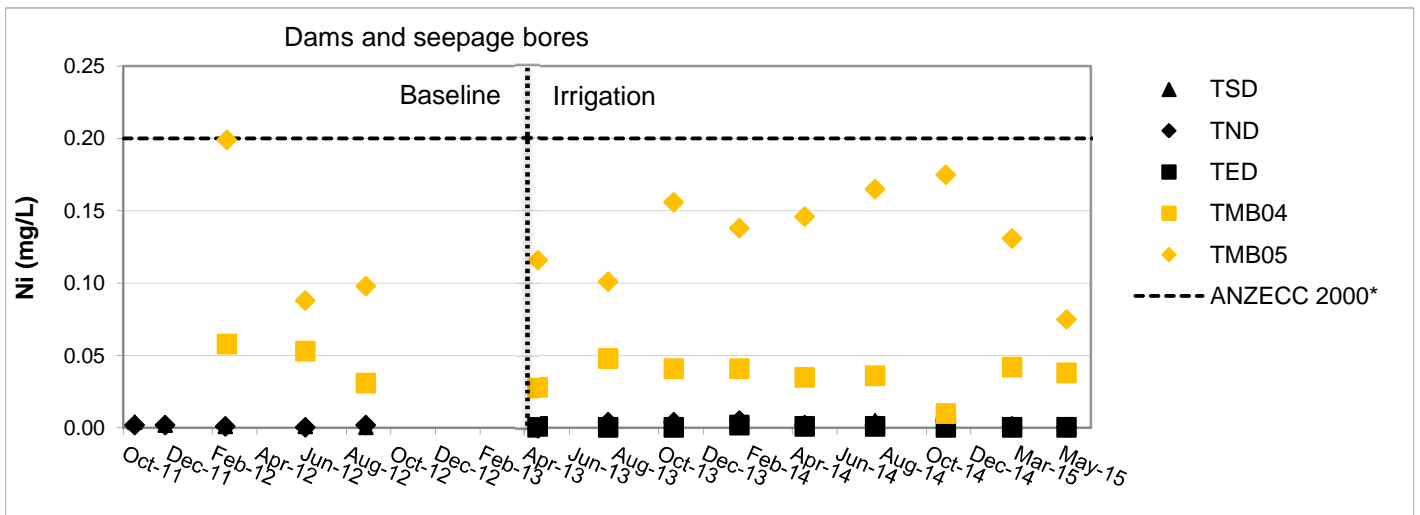
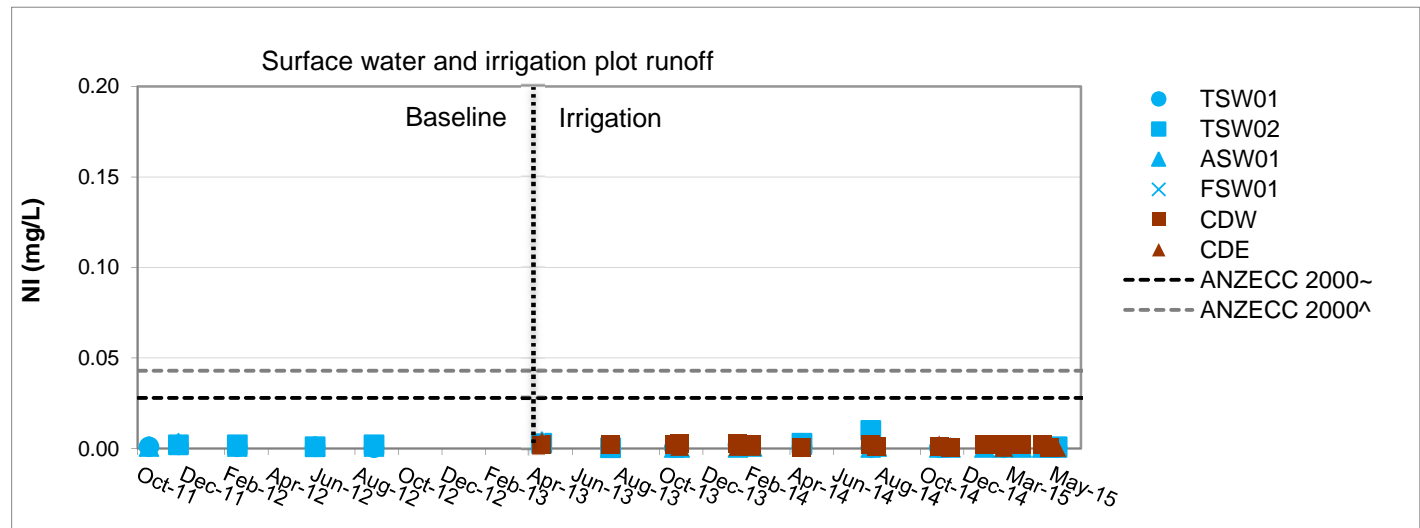
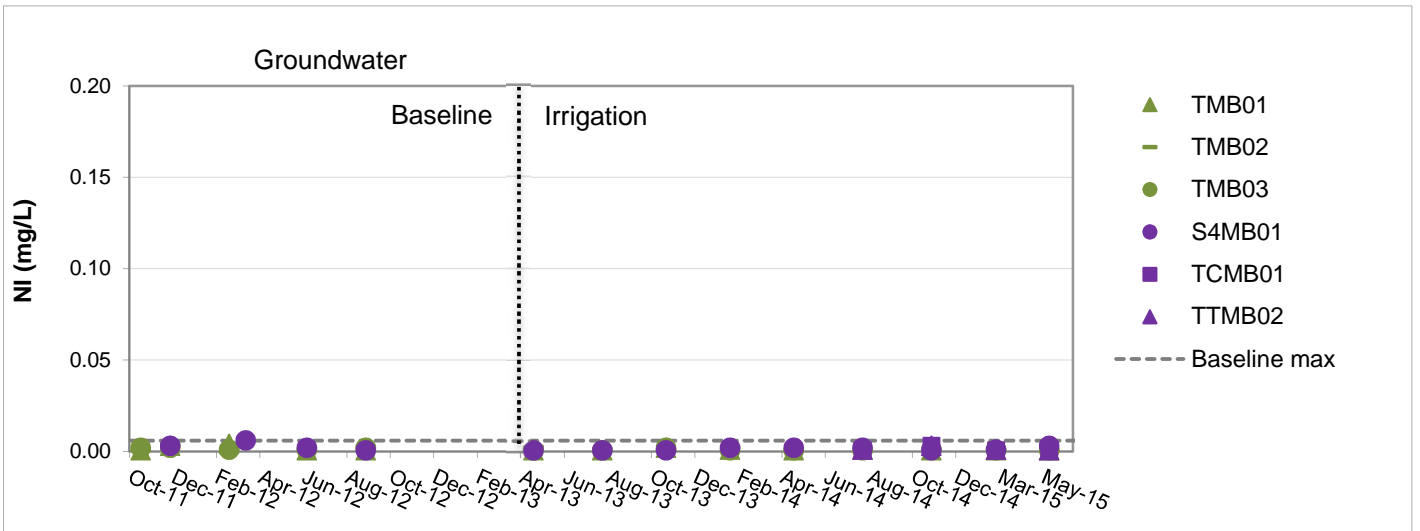


Note:
*ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester Basin, NSW

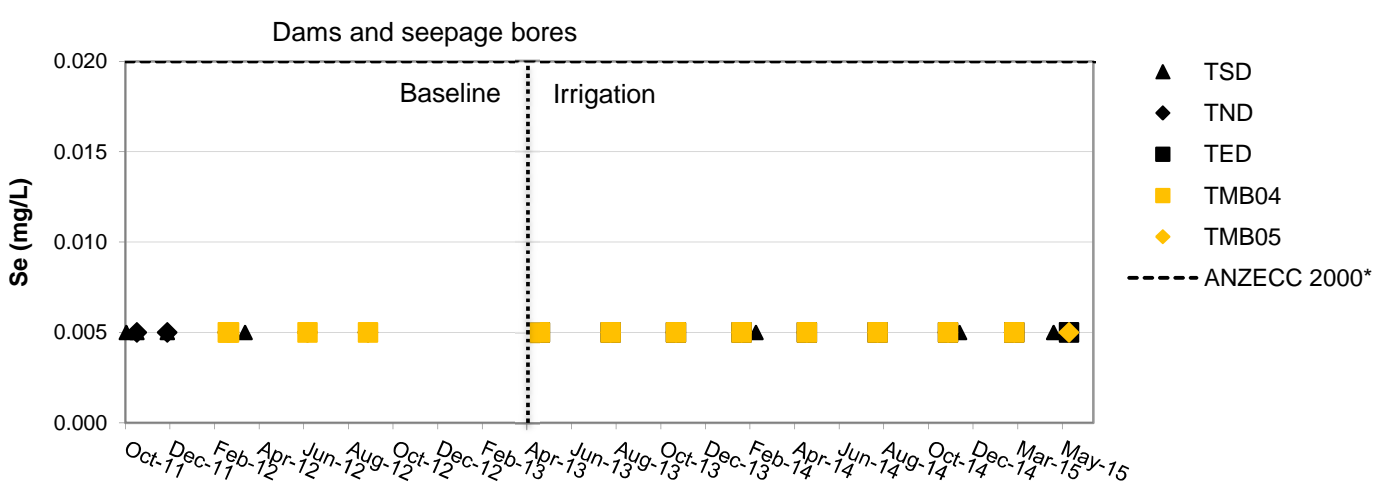
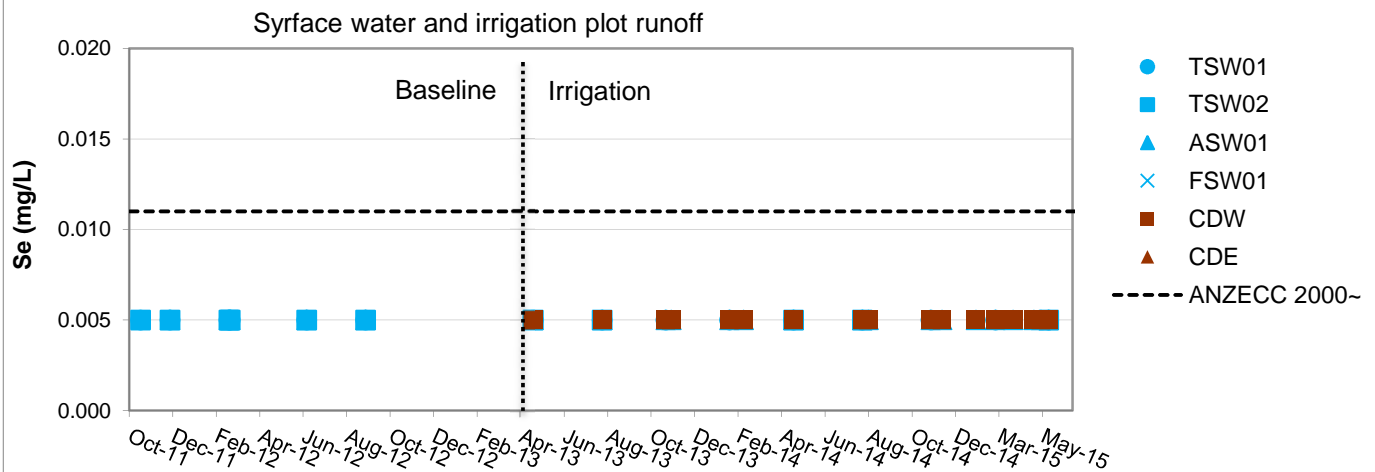
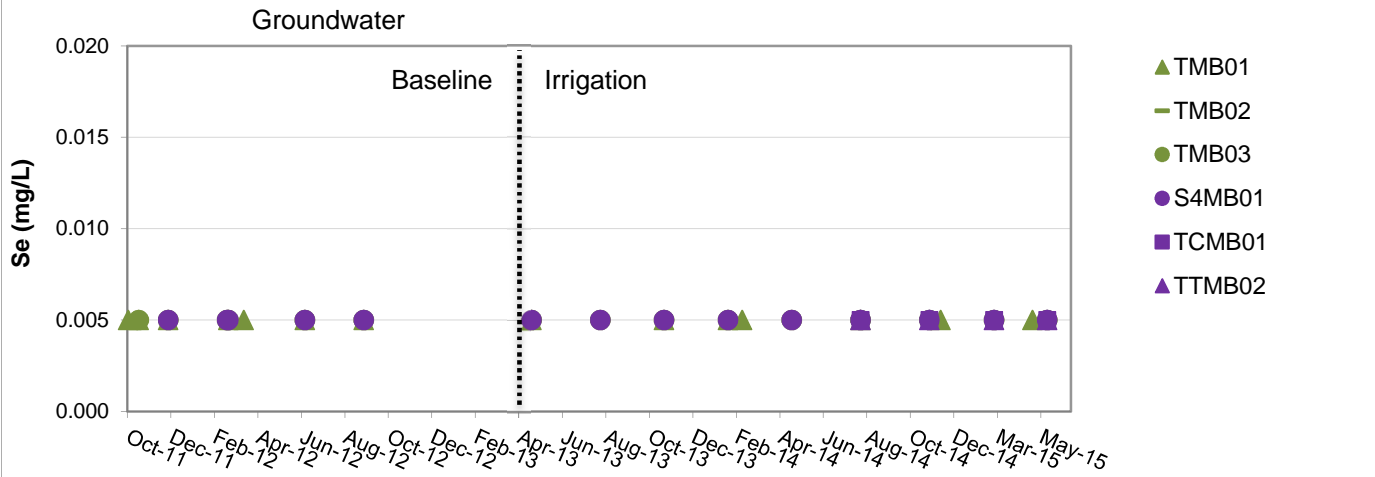


Figure B.20: Nickel concentrations



Notes:
 ~ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (95% protection levels).
 ^ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (80% protection levels).
 *ANZECC 2000. Water for long term irrigation and general water use.

Figure B.21: Selenium concentrations

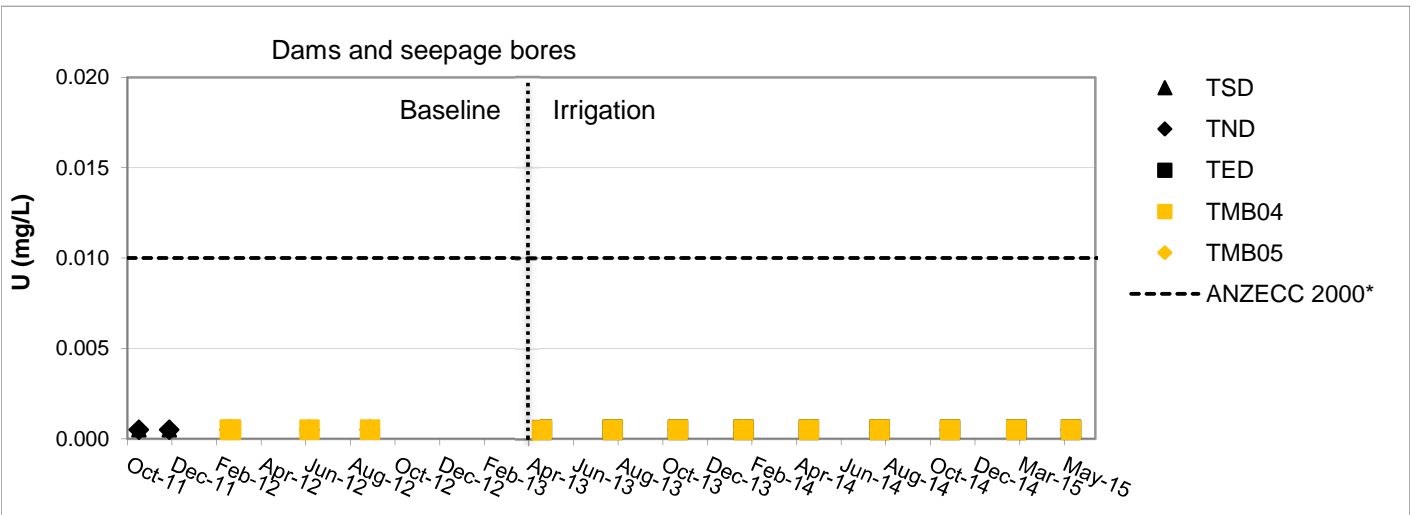
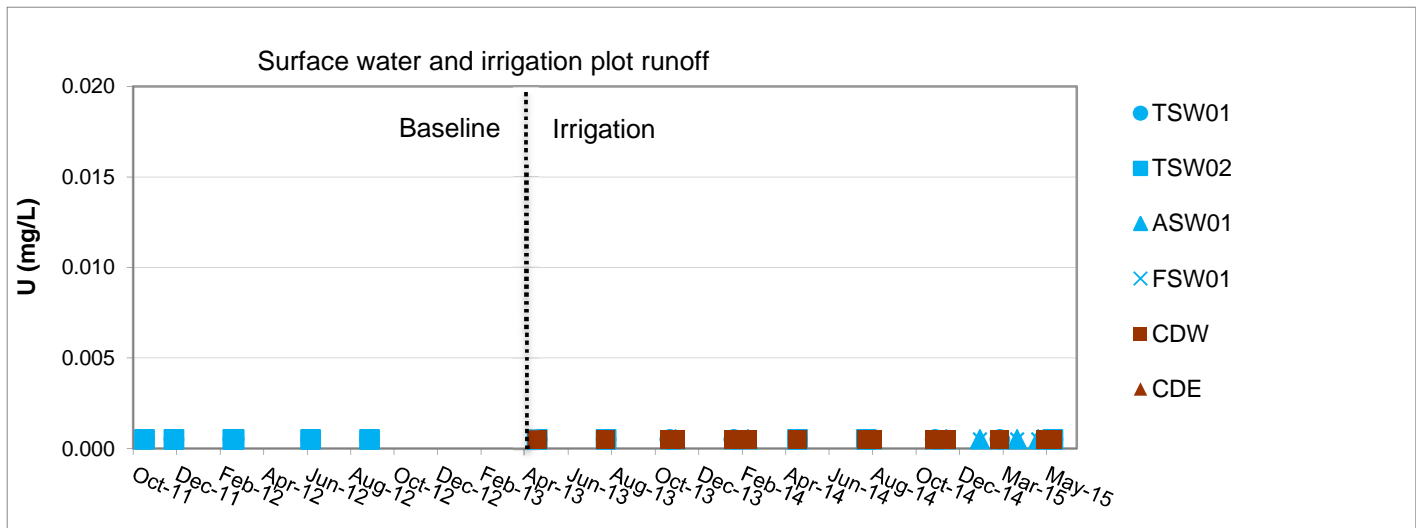
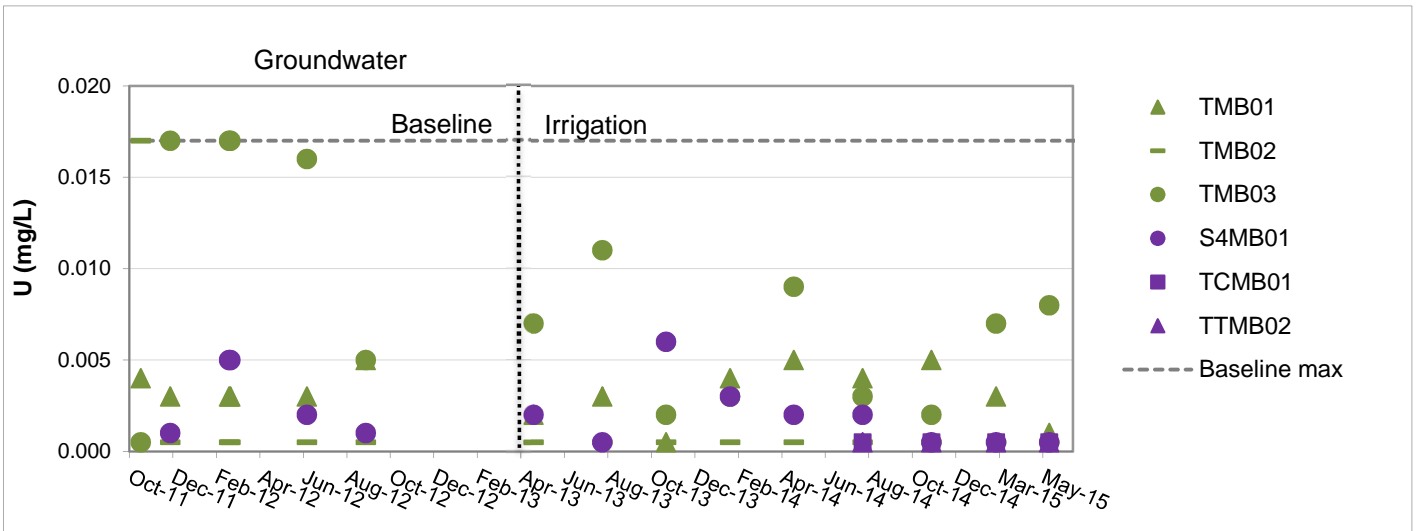


Notes:
 ~ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (95% protection levels).
 *ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester Basin, NSW



Figure B.22: Uranium concentrations

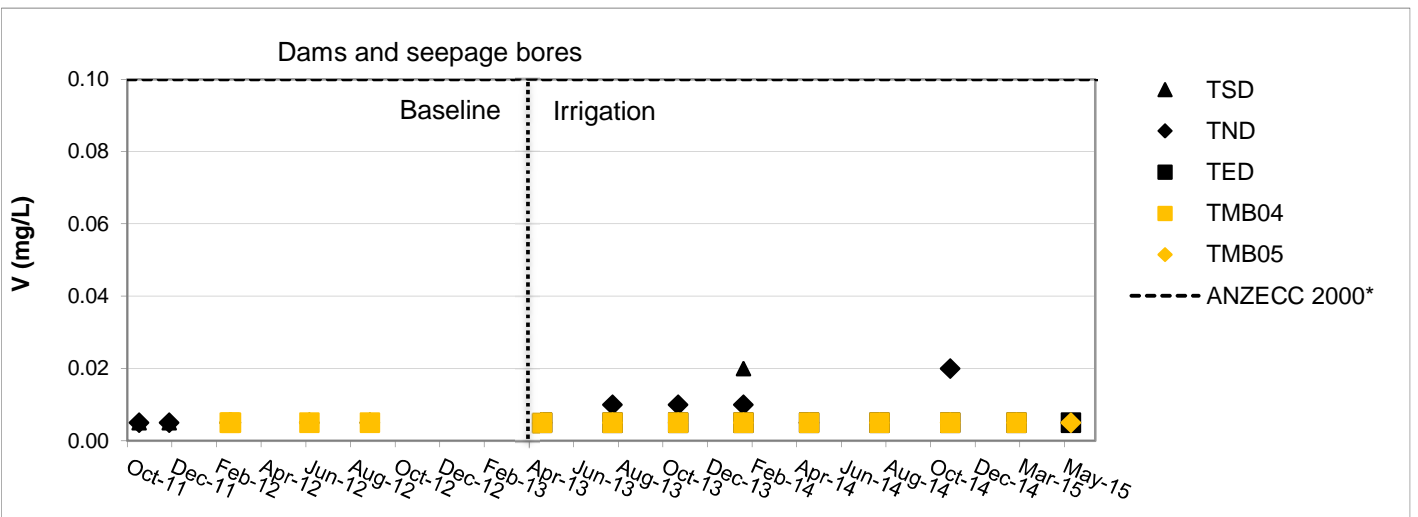
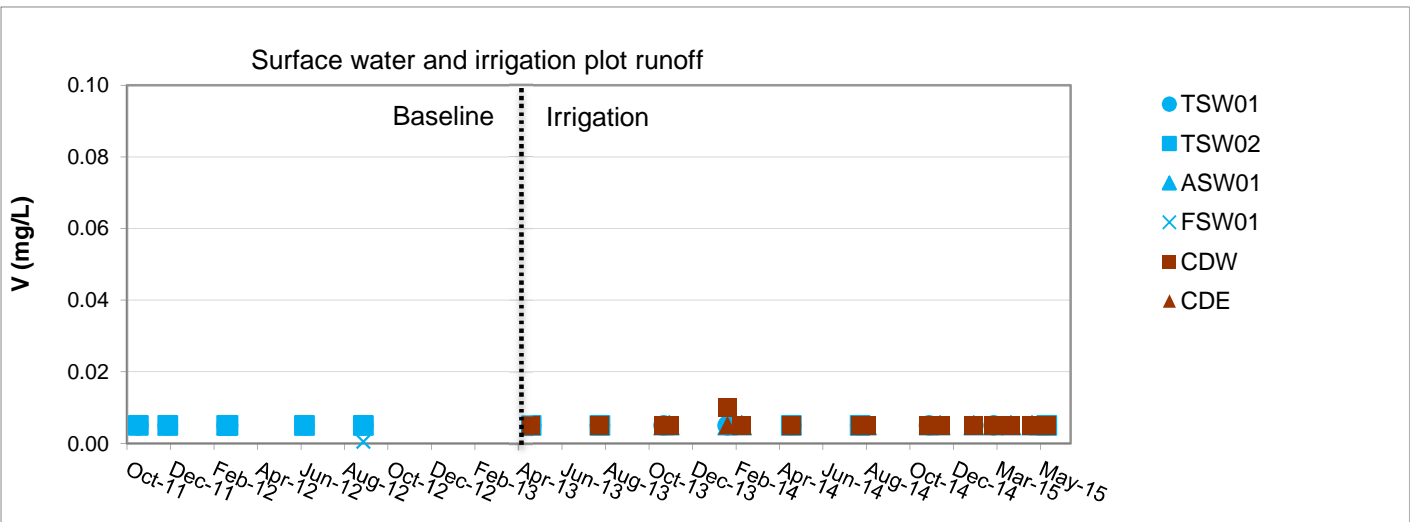
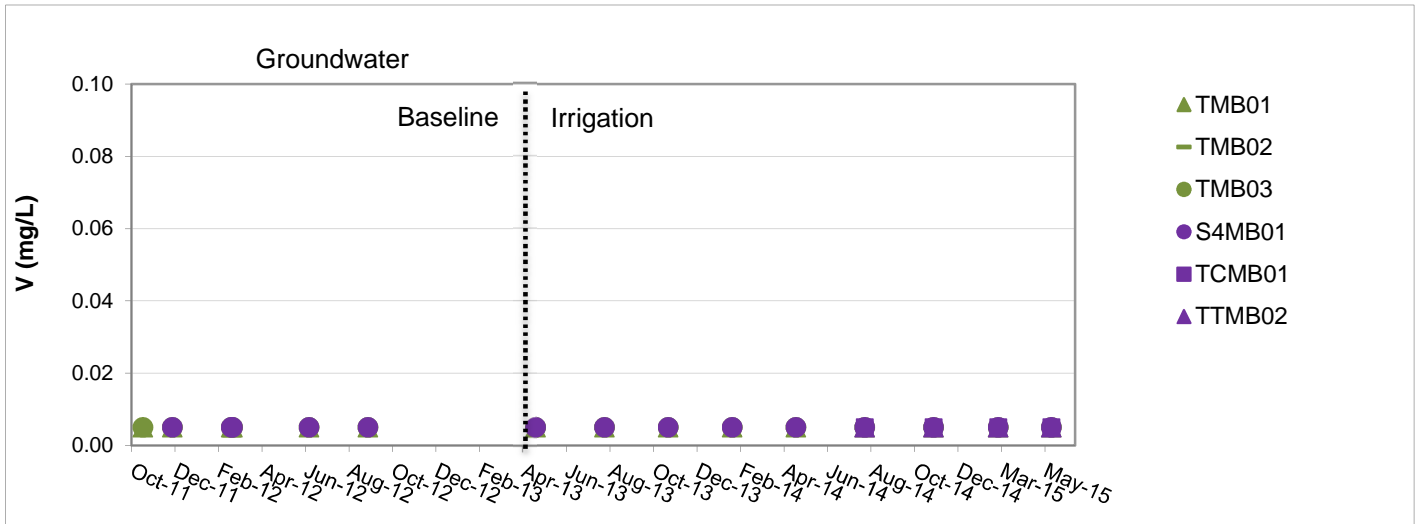


Note:
 *ANZECC 2000. Water for long term irrigation and general water use.

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester Basin, NSW

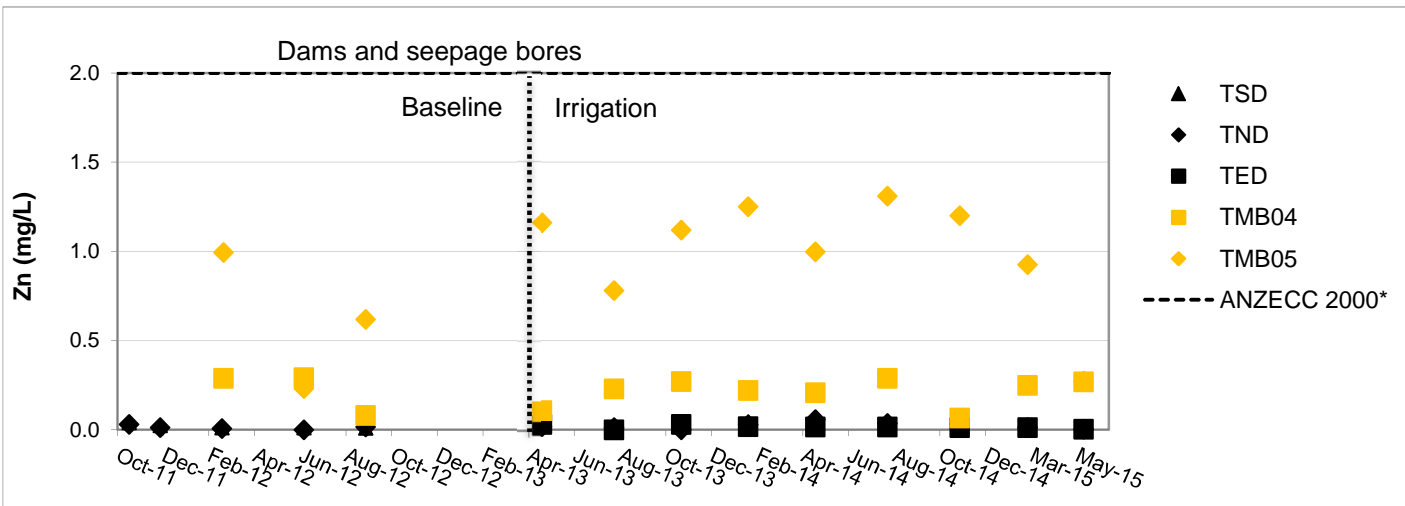
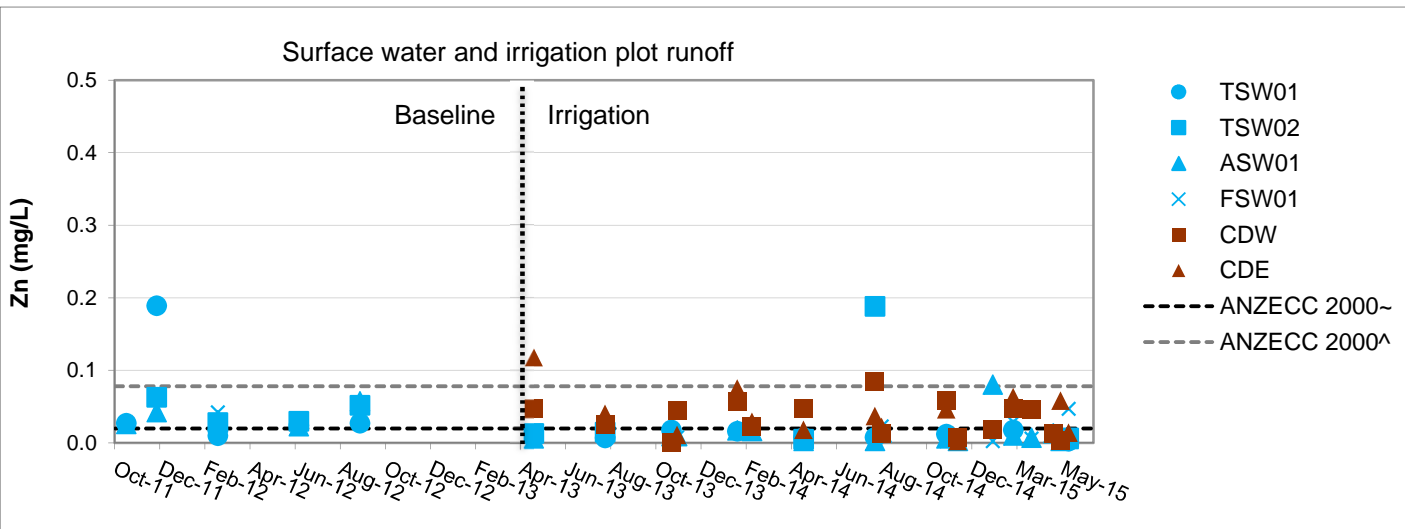
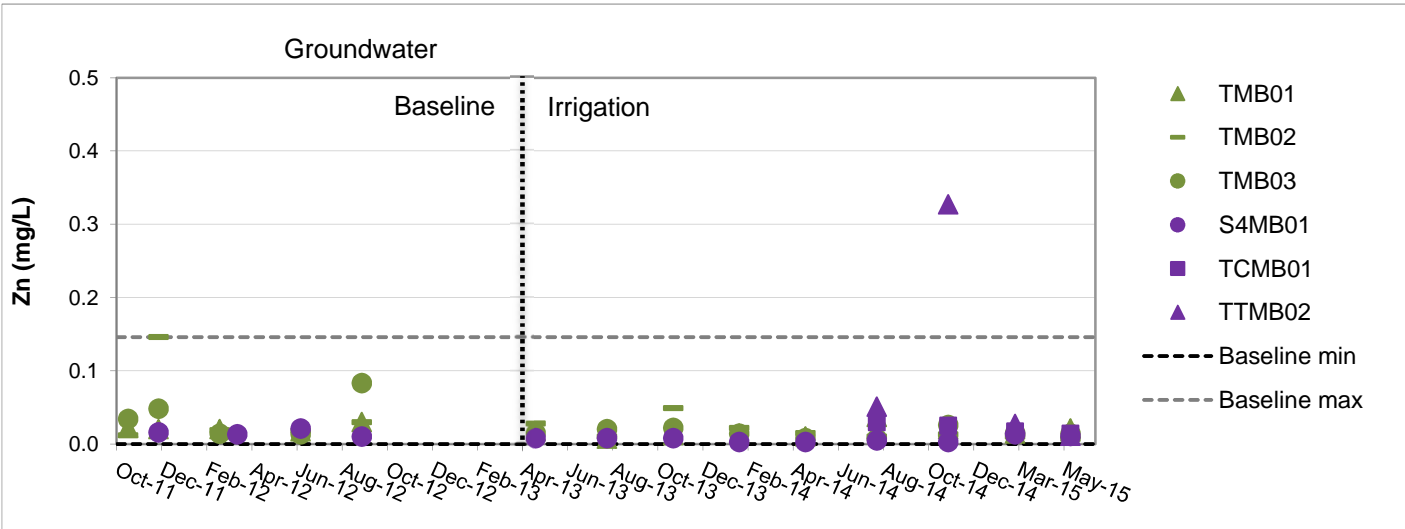


Figure B.23: Vanadium concentrations



Note:
 *ANZECC 2000. Water for long term irrigation and general water use.

Figure B.24: Zinc concentrations



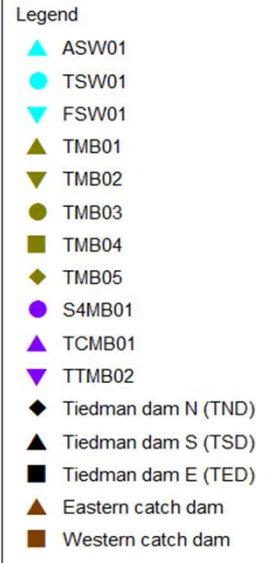
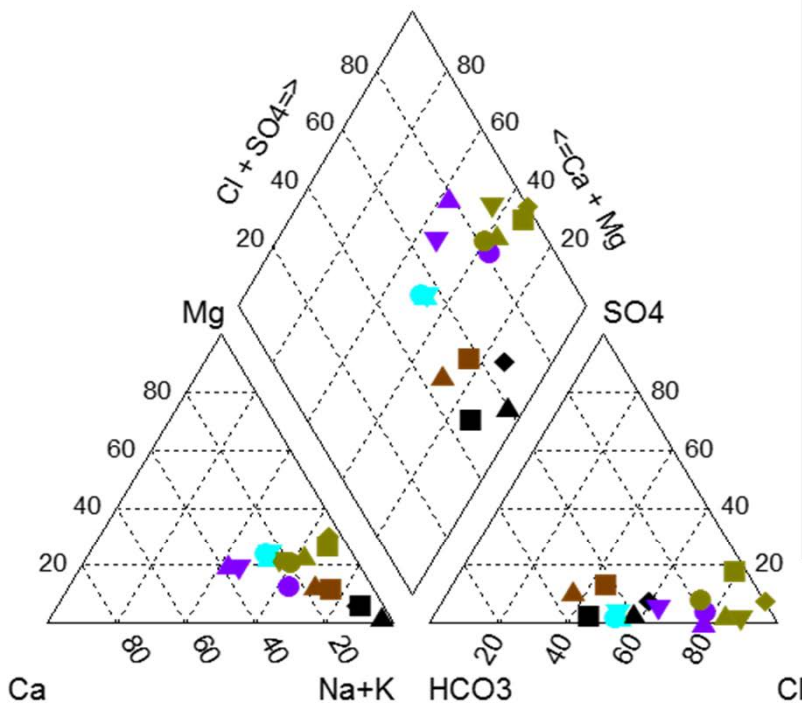
Notes:
 ~ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (95% protection levels).
 ^ANZECC 2000 - Water Quality Guidelines: for freshwater aquatic ecosystems (80% protection levels).
 *ANZECC 2000. Water for long term irrigation and general water use.

Appendix C

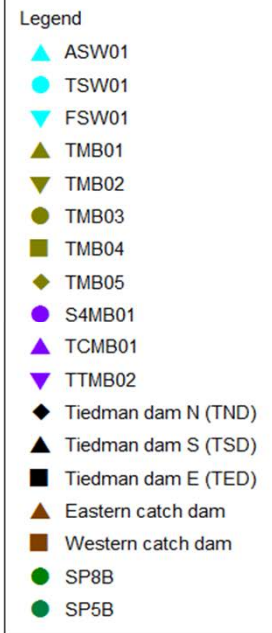
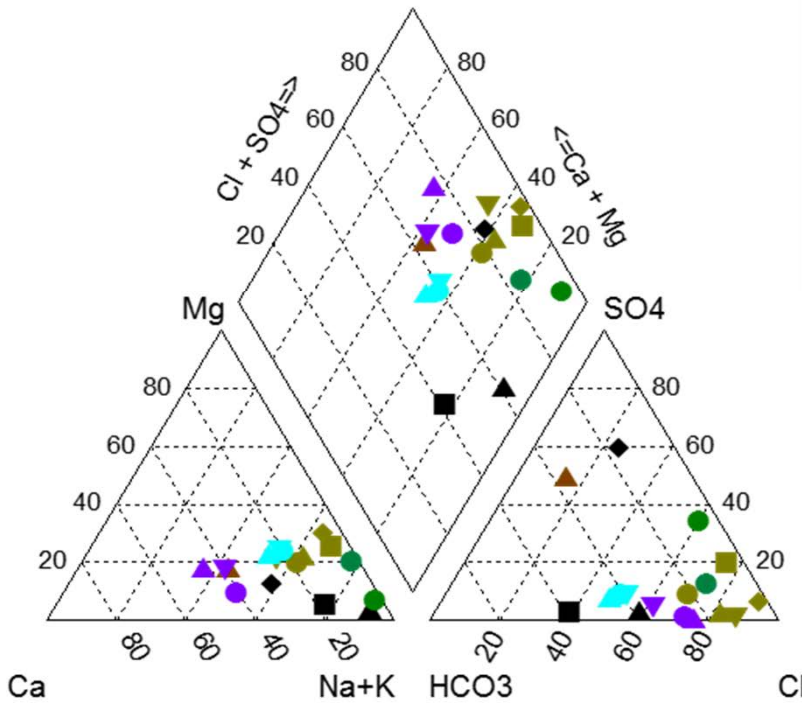
Piper diagrams



Piper Plot - February 2015



Piper Plot - May 2015



Note: blue - surface water; olive - shallow and perched groundwater; black - storage dams; brown - irrigation plot runoff; purple - shallow rock and green - perched groundwater on irrigation plot.

Client: AGL Upstream Infrastructure Investments Pty Ltd
 Project: Tiedman Irrigation Program - Gloucester Gas Project
 Location: Gloucester, NSW



Appendix D

Laboratory reports



CERTIFICATE OF ANALYSIS

Work Order : ES1501994 Client : PARSONS BRINCKERHOFF AUST P/L Contact : MS ANDREA MADDEN Address : GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001 E-mail : amadden@pb.com.au Telephone : +61 02 9272 5100 Facsimile : +61 02 9272 5101 Project : 2268517A Order number : ---- C-O-C number : ---- Sampler : CS,SR Site : ---- Quote number : SY/746/14 V2	Page : 1 of 5 Laboratory : Environmental Division Sydney Contact : Loren Schiavon Address : 277-289 Woodpark Road Smithfield NSW Australia 2164 E-mail : loren.schiavon@alsglobal.com Telephone : +61 2 8784 8503 Facsimile : +61 2 8784 8500 QC Level : NEPM 2013 Schedule B(3) and ALS QCS3 requirement Date Samples Received : 29-JAN-2015 Issue Date : 05-FEB-2015 No. of samples received : 4 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



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics
Shobhna Chandra	Metals Coordinator	Sydney Inorganics



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

- **EG020: 'Bromine/Iodine' quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **EG020: Poor matrix spike recovery was obtained for Copper and Lead on sample ES1501913 #004 due to matrix interference(s). Results have been confirmed by re-analysis.**
- **TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.**
- **TOC by EP005 is conducted by ALS Melbourne, NATA accreditation no. 825, site no 13778.**



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

Client sampling date / time

				CDW	CDW OUT	ASW01	FSW01	----
				28-JAN-2015 13:30	28-JAN-2015 13:45	28-JAN-2015 16:15	28-JAN-2015 15:15	----
Compound	CAS Number	LOR	Unit	ES1501994-001	ES1501994-002	ES1501994-003	ES1501994-004	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.46	7.67	6.95	6.78	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	411	413	129	125	----
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	395	398	156	162	----
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	15	16	64	37	----
ED009: Anions								
Chloride	16887-00-6	0.100	mg/L	40.8	40.6	21.2	19.8	----
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	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	102	105	20	17	----
Total Alkalinity as CaCO3	----	1	mg/L	102	105	20	17	----
ED040F: Dissolved Major Anions								
Silicon as SiO2	14464-46-1	0.1	mg/L	16.9	19.0	20.8	18.8	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	28	29	<1	<1	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	40	39	30	29	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	13	13	5	4	----
Magnesium	7439-95-4	1	mg/L	5	6	3	2	----
Sodium	7440-23-5	1	mg/L	48	48	14	12	----
Potassium	7440-09-7	1	mg/L	18	18	3	3	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.12	0.10	0.57	0.36	----
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	<0.001	<0.001	<0.001	----
Boron	7440-42-8	0.05	mg/L	0.06	0.06	<0.05	<0.05	----
Barium	7440-39-3	0.001	mg/L	0.029	0.027	0.054	0.027	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0020	<0.0001	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

Client sampling date / time

				CDW	CDW OUT	ASW01	FSW01	----
				28-JAN-2015 13:30	28-JAN-2015 13:45	28-JAN-2015 16:15	28-JAN-2015 15:15	----
Compound	CAS Number	LOR	Unit	ES1501994-001	ES1501994-002	ES1501994-003	ES1501994-004	----
EG020F: Dissolved Metals by ICP-MS - Continued								
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Copper	7440-50-8	0.001	mg/L	0.006	0.005	0.009	<0.001	----
Manganese	7439-96-5	0.001	mg/L	0.004	0.004	0.026	0.024	----
Nickel	7440-02-0	0.001	mg/L	0.002	0.002	<0.001	<0.001	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.005	<0.001	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
Zinc	7440-66-6	0.005	mg/L	0.018	0.022	0.080	<0.005	----
Lithium	7439-93-2	0.001	mg/L	0.013	0.013	0.005	0.001	----
Molybdenum	7439-98-7	0.001	mg/L	0.002	0.002	<0.001	<0.001	----
Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Strontium	7440-24-6	0.001	mg/L	0.065	0.066	0.080	0.055	----
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Iron	7439-89-6	0.05	mg/L	0.24	0.23	0.69	0.60	----
Bromine	7726-95-6	0.1	mg/L	0.1	0.1	<0.1	<0.1	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.3	0.3	<0.1	<0.1	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.03	0.03	<0.01	0.01	----
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	0.15	0.10	0.13	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	0.16	0.16	0.10	0.13	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	2.9	2.9	1.0	1.0	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	3.1	3.1	1.1	1.1	----
EK067G: Total Phosphorus as P by Discrete Analyser								



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

				CDW	CDW OUT	ASW01	FSW01	----
				28-JAN-2015 13:30	28-JAN-2015 13:45	28-JAN-2015 16:15	28-JAN-2015 15:15	----
Compound	CAS Number	LOR	Unit	ES1501994-001	ES1501994-002	ES1501994-003	ES1501994-004	----
EK067G: Total Phosphorus as P by Discrete Analyser - Continued								
Total Phosphorus as P	----	0.01	mg/L	1.86	1.73	0.12	0.14	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	1.70	1.68	0.03	0.03	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	3.75	3.80	1.25	1.16	----
Total Cations	----	0.01	meq/L	3.61	3.69	1.18	0.96	----
Ionic Balance	----	0.01	%	1.92	1.49	----	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	30	26	16	18	----



CERTIFICATE OF ANALYSIS

Table with 4 columns: Field, Value, Field, Value. Includes Work Order (ES1504524), Amendment (1), Client (PARSONS BRINCKERHOFF AUST P/L), Laboratory (Environmental Division Sydney), and various contact and project details.

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
• Analytical Results



NATA Accredited Laboratory 825
Accredited for compliance with ISO/IEC 17025.

Signatories

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

Table with 3 columns: Signatories, Position, Accreditation Category. Lists Ankit Joshi (Inorganic Chemist), Ashesh Patel (Inorganic Chemist), and Shobhna Chandra (Metals Coordinator).



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.**
- **TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.**
- **This report has been amended as a result of misinterpretation of sample identification numbers (IDs). All analysis results are as per the previous report**



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

Client sampling date / time

				TMB01	TMB02	TMB03	TMB04	TMB05
				25-FEB-2015 08:50	25-FEB-2015 09:30	25-FEB-2015 13:10	25-FEB-2015 12:50	25-FEB-2015 12:15
Compound	CAS Number	LOR	Unit	ES1504524-001	ES1504524-002	ES1504524-003	ES1504524-004	ES1504524-005
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.43	7.24	7.46	6.60	5.66
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	8350	3740	5820	7140	7460
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	4450	2150	3140	4720	4940
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	36	9	12	74	65
ED009: Anions								
Chloride	16887-00-6	0.100	mg/L	2520	1190	1660	2100	2470
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	582	160	518	108	6
Total Alkalinity as CaCO3	----	1	mg/L	582	160	518	108	6
ED040F: Dissolved Major Anions								
Silicon as SiO2	14464-46-1	0.1	mg/L	35.9	33.6	30.5	55.0	66.4
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	90	20	207	573	238
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	2560	1060	1470	1960	2390
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	238	156	233	87	60
Magnesium	7439-95-4	1	mg/L	238	93	144	226	248
Sodium	7440-23-5	1	mg/L	1210	454	802	1100	1040
Potassium	7440-09-7	1	mg/L	3	4	2	21	17
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.02	0.05	0.61
Arsenic	7440-38-2	0.001	mg/L	0.001	0.003	0.003	<0.001	<0.001
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	0.220	0.829	0.194	0.059	0.211
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	0.005
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	0.0006	0.0017
Cobalt	7440-48-4	0.001	mg/L	<0.001	0.002	0.004	0.087	0.274



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

Client sampling date / time

				TMB01	TMB02	TMB03	TMB04	TMB05
				25-FEB-2015 08:50	25-FEB-2015 09:30	25-FEB-2015 13:10	25-FEB-2015 12:50	25-FEB-2015 12:15
Compound	CAS Number	LOR	Unit	ES1504524-001	ES1504524-002	ES1504524-003	ES1504524-004	ES1504524-005
EG020F: Dissolved Metals by ICP-MS - Continued								
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	0.009	0.050
Manganese	7439-96-5	0.001	mg/L	0.907	1.03	1.42	9.54	18.5
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	0.042	0.131
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L	0.014	0.010	0.015	0.249	0.926
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Strontium	7440-24-6	0.001	mg/L	6.02	3.51	5.38	0.866	0.897
Uranium	7440-61-1	0.001	mg/L	0.003	<0.001	0.007	<0.001	<0.001
Iron	7439-89-6	0.05	mg/L	2.43	6.47	2.31	6.85	15.0
Bromine	7726-95-6	0.1	mg/L	4.0	1.9	2.6	3.0	1.7
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.4	0.2	0.2	0.7	0.6
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.17	0.38	0.16	0.14	0.38
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	0.08	0.07
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	<0.01	0.08	0.07
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.3	0.4	0.2	0.3	0.5
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
Total Nitrogen as N	----	0.1	mg/L	0.3	0.4	0.2	0.4	0.6
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.05	0.06	0.03	0.08	0.09
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	<0.01



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

				TMB01	TMB02	TMB03	TMB04	TMB05
				25-FEB-2015 08:50	25-FEB-2015 09:30	25-FEB-2015 13:10	25-FEB-2015 12:50	25-FEB-2015 12:15
				ES1504524-001	ES1504524-002	ES1504524-003	ES1504524-004	ES1504524-005
Compound	CAS Number	LOR	Unit					
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	85.7	33.5	56.1	69.4	72.5
Total Cations	----	0.01	meq/L	84.2	35.3	58.4	71.3	69.1
Ionic Balance	----	0.01	%	0.92	2.58	1.99	1.37	2.42
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	<1	<1	<1	<1	2



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

Client sampling date / time

				S4MB01	TND	TSD	TED	CDE
				25-FEB-2015 15:30	25-FEB-2015 10:40	25-FEB-2015 11:05	25-FEB-2015 12:30	25-FEB-2015 07:45
Compound	CAS Number	LOR	Unit	ES1504524-006	ES1504524-007	ES1504524-008	ES1504524-009	ES1504524-010
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.80	9.58	9.42	9.32	7.77
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	4840	643	1800	590	401
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	2750	418	942	326	280
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	25	12	7	32	56
ED009: Anions								
Chloride	16887-00-6	0.100	mg/L	1400	97.3	287	74.0	51.0
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	66	164	50	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	429	73	284	115	94
Total Alkalinity as CaCO3	----	1	mg/L	429	139	448	165	94
ED040F: Dissolved Major Anions								
Silicon as SiO2	14464-46-1	0.1	mg/L	25.4	16.2	15.0	6.0	21.4
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	74	15	19	4	18
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	1240	92	290	70	45
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	217	10	9	8	13
Magnesium	7439-95-4	1	mg/L	66	4	4	4	6
Sodium	7440-23-5	1	mg/L	643	102	318	106	50
Potassium	7440-09-7	1	mg/L	6	34	83	19	24
ED093F: SAR and Hardness Calculations								
Sodium Adsorption Ratio	----	0.01	-	----	----	22.2	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	0.11	0.11	0.04	1.31
Arsenic	7440-38-2	0.001	mg/L	0.001	0.003	0.004	0.002	0.002
Boron	7440-42-8	0.05	mg/L	0.17	0.08	0.19	0.09	<0.05
Barium	7440-39-3	0.001	mg/L	6.55	0.046	0.092	0.110	0.053
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

Client sampling date / time

				S4MB01	TND	TSD	TED	CDE
				25-FEB-2015 15:30	25-FEB-2015 10:40	25-FEB-2015 11:05	25-FEB-2015 12:30	25-FEB-2015 07:45
Compound	CAS Number	LOR	Unit	ES1504524-006	ES1504524-007	ES1504524-008	ES1504524-009	ES1504524-010
EG020F: Dissolved Metals by ICP-MS - Continued								
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	0.001	<0.001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	<0.001	0.002	0.002	0.002	0.003
Manganese	7439-96-5	0.001	mg/L	0.171	0.014	0.007	0.080	0.062
Nickel	7440-02-0	0.001	mg/L	0.001	0.001	0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L	0.013	0.012	0.008	0.012	0.063
Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.004	0.008	0.001	0.001
Strontium	7440-24-6	0.001	mg/L	24.7	0.122	0.161	0.182	0.083
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	1.14	0.15	0.10	0.09	1.49
Bromine	7726-95-6	0.1	mg/L	2.4	0.2	0.6	0.2	0.1
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.4	0.2	0.4	0.4	0.3
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	1.85	0.15	0.03	0.05	0.04
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	<0.01	<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	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	2.3	3.6	2.7	4.3	2.3
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
Total Nitrogen as N	----	0.1	mg/L	2.3	3.6	2.7	4.3	2.3
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.09	0.29	0.47	0.22	1.38



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

				S4MB01	TND	TSD	TED	CDE
				25-FEB-2015 15:30	25-FEB-2015 10:40	25-FEB-2015 11:05	25-FEB-2015 12:30	25-FEB-2015 07:45
				ES1504524-006	ES1504524-007	ES1504524-008	ES1504524-009	ES1504524-010
Compound	CAS Number	LOR	Unit					
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	1.36
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	45.1	5.68	17.5	5.35	3.52
Total Cations	----	0.01	meq/L	44.4	6.13	16.7	5.83	3.93
Ionic Balance	----	0.01	%	0.79	3.79	2.34	4.18	5.48
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	46	25	25	21	22



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

Client sampling date / time

				CDW	ASW01	TSW01	FSW01	QA1
				25-FEB-2015 09:50	25-FEB-2015 14:15	25-FEB-2015 09:00	25-FEB-2015 08:15	25-FEB-2015 15:00
Compound	CAS Number	LOR	Unit	ES1504524-011	ES1504524-012	ES1504524-013	ES1504524-014	ES1504524-015
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.83	7.60	7.54	7.59	5.47
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	690	351	335	297	7470
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	570	185	162	182	4860
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	25	<5	<5	<5	66
ED009: Anions								
Chloride	16887-00-6	0.100	mg/L	103	62.3	58.6	51.6	2480
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	135	65	64	54	6
Total Alkalinity as CaCO3	----	1	mg/L	135	65	64	54	6
ED040F: Dissolved Major Anions								
Silicon as SiO2	14464-46-1	0.1	mg/L	34.0	17.5	18.3	17.9	69.7
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	39	3	2	4	243
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	100	56	52	46	2380
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	16	16	16	13	54
Magnesium	7439-95-4	1	mg/L	9	9	9	8	249
Sodium	7440-23-5	1	mg/L	96	37	34	31	1060
Potassium	7440-09-7	1	mg/L	31	4	4	4	16
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.85	0.06	0.02	0.06	0.67
Arsenic	7440-38-2	0.001	mg/L	0.003	0.001	0.001	0.002	<0.001
Boron	7440-42-8	0.05	mg/L	0.06	<0.05	<0.05	<0.05	<0.05
Barium	7440-39-3	0.001	mg/L	0.051	0.052	0.051	0.037	0.164
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	0.006
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	0.0022
Cobalt	7440-48-4	0.001	mg/L	0.001	<0.001	<0.001	<0.001	0.306



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

Client sampling date / time

				CDW	ASW01	TSW01	FSW01	QA1
				25-FEB-2015 09:50	25-FEB-2015 14:15	25-FEB-2015 09:00	25-FEB-2015 08:15	25-FEB-2015 15:00
Compound	CAS Number	LOR	Unit	ES1504524-011	ES1504524-012	ES1504524-013	ES1504524-014	ES1504524-015
EG020F: Dissolved Metals by ICP-MS - Continued								
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	0.001
Copper	7440-50-8	0.001	mg/L	0.002	<0.001	<0.001	<0.001	0.051
Manganese	7439-96-5	0.001	mg/L	0.075	0.083	0.169	0.018	19.0
Nickel	7440-02-0	0.001	mg/L	0.002	<0.001	<0.001	<0.001	0.147
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.005	mg/L	0.047	0.010	0.018	0.029	1.09
Molybdenum	7439-98-7	0.001	mg/L	0.002	<0.001	<0.001	<0.001	<0.001
Strontium	7440-24-6	0.001	mg/L	0.100	0.213	0.205	0.166	0.846
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	1.05	1.22	0.77	0.43	11.7
Bromine	7726-95-6	0.1	mg/L	0.2	0.1	0.1	0.1	1.7
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.3	<0.1	<0.1	<0.1	0.7
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.19	0.03	0.03	0.02	0.40
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	<0.01	0.07
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	0.07
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	6.9	0.4	0.5	0.5	0.6
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
Total Nitrogen as N	----	0.1	mg/L	6.9	0.4	0.5	0.5	0.7
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	2.82	0.04	0.08	0.06	0.08
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	2.68	0.02	0.02	<0.01	<0.01



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

				CDW	ASW01	TSW01	FSW01	QA1
				25-FEB-2015 09:50	25-FEB-2015 14:15	25-FEB-2015 09:00	25-FEB-2015 08:15	25-FEB-2015 15:00
				ES1504524-011	ES1504524-012	ES1504524-013	ES1504524-014	ES1504524-015
Compound	CAS Number	LOR	Unit					
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	6.33	2.94	2.79	2.46	72.3
Total Cations	----	0.01	meq/L	6.51	3.25	3.12	2.76	69.7
Ionic Balance	----	0.01	%	1.37	----	----	----	1.85
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	48	7	8	9	2

CERTIFICATE OF ANALYSIS

Work Order : ES1504527 Amendment : 2 Client : PARSONS BRINCKERHOFF AUST P/L Contact : MS CAROLINA SARDELLA Address : GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001 E-mail : csardella@pb.com.au Telephone : +61 02 92725100 Facsimile : +61 02 92725101 Project : 2268517B Order number : ---- C-O-C number : ---- Sampler : CS/KH Site : ---- Quote number : SY/746/14 V2	Page : 1 of 5 Laboratory : Environmental Division Sydney Contact : Loren Schiavon Address : 277-289 Woodpark Road Smithfield NSW Australia 2164 E-mail : loren.schiavon@alsglobal.com Telephone : +61 2 8784 8503 Facsimile : +61 2 8784 8500 QC Level : NEPM 2013 Schedule B(3) and ALS QCS3 requirement Date Samples Received : 26-FEB-2015 Issue Date : 04-MAR-2015 No. of samples received : 2 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



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.

<u>Signatories</u>	<u>Position</u>	<u>Accreditation Category</u>
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Barbara Coupland	Quality Officer	Newcastle - Inorganics
Shobhna Chandra	Metals Coordinator	Sydney Inorganics



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

- **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **EK055G: It has been noted that Ammonia is greater than TKN for sample ID(TTHB02), however this difference is within the limits of experimental variation.**
- **This report has been amended as a result of misinterpretation of sample identification numbers (IDs). All analysis results are as per the previous report**



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

Client sampling date / time

				TCMB01	TTMB02	---	---	---
				26-FEB-2015 09:30	26-FEB-2015 10:00	---	---	---
Compound	CAS Number	LOR	Unit	ES1504527-001	ES1504527-002	---	---	---
EA005: pH								
pH Value	---	0.01	pH Unit	7.52	7.24	---	---	---
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	---	1	µS/cm	3040	2350	---	---	---
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	---	10	mg/L	1820	1290	---	---	---
EA025: Suspended Solids								
Suspended Solids (SS)	---	5	mg/L	10	31	---	---	---
ED009: Anions								
Chloride	16887-00-6	0.100	mg/L	828	536	---	---	---
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	<1	---	---	---
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	298	370	---	---	---
Total Alkalinity as CaCO3	---	1	mg/L	298	370	---	---	---
ED040F: Dissolved Major Anions								
Silicon as SiO2	14464-46-1	0.1	mg/L	20.8	33.2	---	---	---
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	54	---	---	---
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	805	534	---	---	---
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	226	163	---	---	---
Magnesium	7439-95-4	1	mg/L	74	53	---	---	---
Sodium	7440-23-5	1	mg/L	291	244	---	---	---
Potassium	7440-09-7	1	mg/L	4	4	---	---	---
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	---	---	---
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	---	---	---
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	---	---	---
Barium	7440-39-3	0.001	mg/L	8.19	0.722	---	---	---
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	---	---	---
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	---	---	---
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	---	---	---



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

Client sampling date / time

				TCMB01	TTMB02	---	---	---
				26-FEB-2015 09:30	26-FEB-2015 10:00	---	---	---
				ES1504527-001	ES1504527-002	---	---	---
Compound	CAS Number	LOR	Unit					
EG020F: Dissolved Metals by ICP-MS - Continued								
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	---	---	---
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	---	---	---
Manganese	7439-96-5	0.001	mg/L	0.029	0.099	---	---	---
Nickel	7440-02-0	0.001	mg/L	<0.001	0.001	---	---	---
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	---	---	---
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	---	---	---
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	---	---	---
Zinc	7440-66-6	0.005	mg/L	0.017	0.027	---	---	---
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	---	---	---
Strontium	7440-24-6	0.001	mg/L	15.2	3.20	---	---	---
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	---	---	---
Iron	7439-89-6	0.05	mg/L	1.30	2.18	---	---	---
Bromine	7726-95-6	0.1	mg/L	0.7	0.5	---	---	---
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	---	---	---
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	---	---	---
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	1.39	0.62	---	---	---
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	0.02	---	---	---
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.02	---	---	---
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.5	0.6	---	---	---
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	1.5	0.6	---	---	---
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.02	0.22	---	---	---
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

				TCMB01	TTMB02	----	----	----
				26-FEB-2015 09:30	26-FEB-2015 10:00	----	----	----
				ES1504527-001	ES1504527-002	----	----	----
Compound	CAS Number	LOR	Unit					
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	28.7	23.6	----	----	----
Total Cations	----	0.01	meq/L	30.1	23.2	----	----	----
Ionic Balance	----	0.01	%	2.51	0.78	----	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	<1	<1	----	----	----

CERTIFICATE OF ANALYSIS

Work Order : ES1506753 Client : PARSONS BRINCKERHOFF AUST P/L Contact : MS CAROLINA SARDELLA Address : GPO BOX 5394 : SYDNEY NSW, AUSTRALIA 2001 E-mail : csardella@pb.com.au Telephone : +61 02 92725100 Facsimile : +61 02 92725101 Project : 2268517B Order number : ---- C-O-C number : ---- Sampler : BE Site : ---- Quote number : SY/746/14 V2	Page : 1 of 5 Laboratory : Environmental Division Sydney Contact : Loren Schiavon Address : 277-289 Woodpark Road Smithfield NSW Australia 2164 E-mail : loren.schiavon@alsglobal.com Telephone : +61 2 8784 8503 Facsimile : +61 2 8784 8500 QC Level : NEPM 2013 Schedule B(3) and ALS QCS3 requirement Date Samples Received : 24-MAR-2015 Issue Date : 31-MAR-2015 No. of samples received : 3 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



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Dian Dao	Inorganic Chemist	Sydney Inorganics
Shobhna Chandra	Metals Coordinator	Sydney Inorganics



General Comments

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

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

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

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

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

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

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

LOR = Limit of reporting

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

- **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS**
- **TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.**



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

Client sampling date / time

				CDW	ASW01	FSW01	----	----
				22-MAR-2015 10:30	22-MAR-2015 12:00	22-MAR-2015 11:15	----	----
				ES1506753-001	ES1506753-002	ES1506753-003	----	----
Compound	CAS Number	LOR	Unit					
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.38	7.18	7.15	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	363	195	215	----	----
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	----	10	mg/L	469	166	160	----	----
EA025: Suspended Solids								
Suspended Solids (SS)	----	5	mg/L	131	<5	5	----	----
ED009: Anions								
Chloride	16887-00-6	0.100	mg/L	41.8	30.0	34.4	----	----
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	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	74	48	43	----	----
Total Alkalinity as CaCO3	----	1	mg/L	74	48	43	----	----
ED040F: Dissolved Major Anions								
Silicon as SiO2	14464-46-1	0.1	mg/L	18.5	13.6	12.3	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	35	6	7	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	47	36	40	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	9	10	10	----	----
Magnesium	7439-95-4	1	mg/L	4	5	5	----	----
Sodium	7440-23-5	1	mg/L	53	21	22	----	----
Potassium	7440-09-7	1	mg/L	14	3	2	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.40	0.02	0.02	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Arsenic	7440-38-2	0.001	mg/L	0.002	<0.001	<0.001	----	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Barium	7440-39-3	0.001	mg/L	0.021	0.030	0.028	----	----
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	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

Client sampling date / time

				CDW	ASW01	FSW01	----	----
				22-MAR-2015 10:30	22-MAR-2015 12:00	22-MAR-2015 11:15	----	----
Compound	CAS Number	LOR	Unit	ES1506753-001	ES1506753-002	ES1506753-003	----	----
EG020F: Dissolved Metals by ICP-MS - Continued								
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Copper	7440-50-8	0.001	mg/L	0.006	0.001	<0.001	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Lithium	7439-93-2	0.001	mg/L	0.009	0.001	0.001	----	----
Manganese	7439-96-5	0.001	mg/L	0.007	0.029	0.010	----	----
Molybdenum	7439-98-7	0.001	mg/L	0.001	<0.001	<0.001	----	----
Nickel	7440-02-0	0.001	mg/L	0.002	<0.001	<0.001	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----
Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Strontium	7440-24-6	0.001	mg/L	0.043	0.106	0.118	----	----
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	----	----
Zinc	7440-66-6	0.005	mg/L	0.046	0.007	0.006	----	----
Boron	7440-42-8	0.05	mg/L	0.06	<0.05	<0.05	----	----
Iron	7439-89-6	0.05	mg/L	0.34	0.22	0.22	----	----
Bromine	7726-95-6	0.1	mg/L	<0.1	<0.1	<0.1	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.3	0.1	0.1	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.09	0.01	0.02	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	0.03	<0.01	<0.01	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	4.67	<0.01	<0.01	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	4.70	<0.01	<0.01	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser								
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	4.9	0.5	0.5	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser								
^ Total Nitrogen as N	----	0.1	mg/L	9.6	0.5	0.5	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)

Client sample ID

				CDW	ASW01	FSW01	----	----
				Client sampling date / time				
Compound	CAS Number	LOR	Unit	ES1506753-001	ES1506753-002	ES1506753-003	----	----
EK067G: Total Phosphorus as P by Discrete Analyser - Continued								
Total Phosphorus as P	----	0.01	mg/L	2.42	0.09	0.05	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	2.12	0.01	<0.01	----	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	3.53	2.10	2.13	----	----
Total Cations	----	0.01	meq/L	3.44	1.90	1.92	----	----
Ionic Balance	----	0.01	%	1.32	----	----	----	----

CERTIFICATE OF ANALYSIS

Work Order	: ES1520090	Page	: 1 of 5
Client	: PARSONS BRINCKERHOFF AUST P/L	Laboratory	: Environmental Division Sydney
Contact	: MS CAROLINA SARDELLA	Contact	: Loren Schiavon
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	: loren.schiavon@alsglobal.com
Telephone	: +61 02 92725100	Telephone	: +61 2 8784 8503
Facsimile	: +61 02 92725101	Facsimile	: +61-2-8784 8500
Project	: 226851B	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 22-Apr-2015 13:55
C-O-C number	: ----	Date Analysis Commenced	: 22-Apr-2015
Sampler	: ----	Issue Date	: 29-Apr-2015 16:26
Site	: ----		
Quote number	: ----	No. of samples received	: 5
		No. of samples analysed	: 5

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
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.

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
∅ = ALS is not NATA accredited for these tests.

- EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.
- EK057G:Spike failed for Nitrite analysis due to matrix interference(confirmed by re analysis)
- TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	CDW1	CDW2	CDW3	ASW01	FSW01
Client sampling date / time				[21-Apr-2015]	[21-Apr-2015]	[21-Apr-2015]	[21-Apr-2015]	[21-Apr-2015]	
Compound	CAS Number	LOR	Unit	ES1520090-001	ES1520090-002	ES1520090-003	ES1520090-004	ES1520090-005	
				Result	Result	Result	Result	Result	
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	7.73	7.48	7.78	6.72	6.76	
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm	1520	844	1000	76	81	
EA015: Total Dissolved Solids									
^ Total Dissolved Solids @180°C	----	10	mg/L	1130	490	746	110	165	
EA025: Suspended Solids									
^ Suspended Solids (SS)	----	5	mg/L	36	44	81	432	790	
ED009: Anions									
Chloride	16887-00-6	0.1	mg/L	66.8	38.2	40.2	10.5	12.0	
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	100	59	60	13	14	
Total Alkalinity as CaCO3	----	1	mg/L	100	59	60	13	14	
ED040F: Dissolved Major Anions									
^ Silicon as SiO2	14464-46-1	0.1	mg/L	14.3	12.7	10.6	12.1	13.4	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	612	308	385	14	<1	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	67	37	38	11	12	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	171	82	111	3	3	
Magnesium	7439-95-4	1	mg/L	33	18	21	1	1	
Sodium	7440-23-5	1	mg/L	106	56	64	9	10	
Potassium	7440-09-7	1	mg/L	29	19	20	4	4	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.01	0.03	0.01	1.16	0.87	
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	0.002	0.001	0.001	<0.001	
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	0.119	0.069	0.079	0.020	0.021	
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	
Cobalt	7440-48-4	0.001	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	CDW1	CDW2	CDW3	ASW01	FSW01
Client sampling date / time				[21-Apr-2015]	[21-Apr-2015]	[21-Apr-2015]	[21-Apr-2015]	[21-Apr-2015]	
Compound	CAS Number	LOR	Unit	ES1520090-001	ES1520090-002	ES1520090-003	ES1520090-004	ES1520090-005	
				Result	Result	Result	Result	Result	
EG020F: Dissolved Metals by ICP-MS - Continued									
Copper	7440-50-8	0.001	mg/L	0.003	0.004	0.003	0.003	0.003	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Lithium	7439-93-2	0.001	mg/L	0.025	0.010	0.015	<0.001	<0.001	
Manganese	7439-96-5	0.001	mg/L	0.046	0.019	0.028	0.033	0.041	
Molybdenum	7439-98-7	0.001	mg/L	0.002	0.001	<0.001	<0.001	<0.001	
Nickel	7440-02-0	0.001	mg/L	0.002	0.001	<0.001	<0.001	0.002	
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	
Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Strontium	7440-24-6	0.001	mg/L	0.792	0.391	0.532	0.027	0.028	
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	
Zinc	7440-66-6	0.005	mg/L	0.012	0.057	0.009	0.013	0.011	
Boron	7440-42-8	0.05	mg/L	0.10	<0.05	0.06	<0.05	<0.05	
Iron	7439-89-6	0.05	mg/L	<0.05	0.09	<0.05	0.91	0.84	
Bromine	7726-95-6	0.1	mg/L	0.2	<0.1	<0.1	<0.1	<0.1	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.3	0.2	0.2	0.1	<0.1	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	0.09	0.05	0.06	0.03	0.04	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L	0.02	0.02	0.02	<0.01	<0.01	
EK058G: Nitrate as N by Discrete Analyser									
[^] Nitrate as N	14797-55-8	0.01	mg/L	1.68	1.18	1.53	0.04	0.04	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	1.70	1.20	1.55	0.04	0.04	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	2.3	2.0	1.8	1.6	2.3	
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
[^] Total Nitrogen as N	----	0.1	mg/L	4.0	3.2	3.4	1.6	2.3	
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	1.44	1.15	1.22	0.32	0.33	
EK071G: Reactive Phosphorus as P by discrete analyser									



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	CDW1	CDW2	CDW3	ASW01	FSW01
Client sampling date / time					[21-Apr-2015]	[21-Apr-2015]	[21-Apr-2015]	[21-Apr-2015]	[21-Apr-2015]
Compound	CAS Number	LOR	Unit		ES1520090-001	ES1520090-002	ES1520090-003	ES1520090-004	ES1520090-005
					Result	Result	Result	Result	Result
EK071G: Reactive Phosphorus as P by discrete analyser - Continued									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L		1.36	1.01	0.98	0.12	0.04
EN055: Ionic Balance									
^ Total Anions	----	0.01	meq/L		16.6	8.64	10.3	0.86	0.62
^ Total Cations	----	0.01	meq/L		16.6	8.50	10.6	0.72	0.77
^ Ionic Balance	----	0.01	%		0.06	0.80	1.35	----	----

CERTIFICATE OF ANALYSIS

Work Order	: ES1521139	Page	: 1 of 8
Client	: PARSONS BRINCKERHOFF AUST P/L	Laboratory	: Environmental Division Sydney
Contact	: MS CAROLINA SARDELLA	Contact	: Loren Schiavon
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	: loren.schiavon@alsglobal.com
Telephone	: +61 02 92725100	Telephone	: +61 2 8784 8503
Facsimile	: +61 02 92725101	Facsimile	: +61-2-8784 8500
Project	: 2268517b	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 05-May-2015 16:30
C-O-C number	: ----	Date Analysis Commenced	: 06-May-2015
Sampler	: ----	Issue Date	: 12-May-2015 16:21
Site	: ----		
Quote number	: ----	No. of samples received	: 8
		No. of samples analysed	: 8

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Shobhna Chandra	Metals Coordinator	Sydney Inorganics



General Comments

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

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

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

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

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

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
∅ = ALS is not NATA accredited for these tests.

- EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.
- TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	CDW1	CDW2	CDW3	CDE1	CDE2
Client sampling date / time				01-May-2015 12:15	01-May-2015 12:15	01-May-2015 12:15	01-May-2015 13:15	01-May-2015 13:15	
Compound	CAS Number	LOR	Unit	ES1521139-001	ES1521139-002	ES1521139-003	ES1521139-004	ES1521139-005	
				Result	Result	Result	Result	Result	
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	7.44	7.40	7.43	7.30	7.30	
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm	754	752	750	298	295	
EA015: Total Dissolved Solids									
^ Total Dissolved Solids @180°C	----	10	mg/L	558	585	581	388	302	
EA025: Suspended Solids									
^ Suspended Solids (SS)	----	5	mg/L	635	393	393	230	220	
ED009: Anions									
Chloride	16887-00-6	0.1	mg/L	36.3	36.6	36.2	17.2	17.8	
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	56	54	56	43	44	
Total Alkalinity as CaCO3	----	1	mg/L	56	54	56	43	44	
ED040F: Dissolved Major Anions									
^ Silicon as SiO2	14464-46-1	0.1	mg/L	6.5	6.0	6.3	7.9	8.6	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	276	276	280	70	69	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	31	31	31	16	17	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	75	76	76	22	20	
Magnesium	7439-95-4	1	mg/L	15	15	15	5	5	
Sodium	7440-23-5	1	mg/L	60	60	62	30	26	
Potassium	7440-09-7	1	mg/L	18	18	17	11	12	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.04	0.07	0.33	1.16	1.21	
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	0.003	0.003	0.003	0.002	0.001	
Boron	7440-42-8	0.05	mg/L	0.06	0.06	0.08	0.07	<0.05	
Barium	7440-39-3	0.001	mg/L	0.045	0.046	0.100	0.085	0.116	
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	CDW1	CDW2	CDW3	CDE1	CDE2
Client sampling date / time					01-May-2015 12:15	01-May-2015 12:15	01-May-2015 12:15	01-May-2015 13:15	01-May-2015 13:15
Compound	CAS Number	LOR	Unit	ES1521139-001	ES1521139-002	ES1521139-003	ES1521139-004	ES1521139-005	
				Result	Result	Result	Result	Result	
EG020F: Dissolved Metals by ICP-MS - Continued									
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	0.001	0.001	
Manganese	7439-96-5	0.001	mg/L	0.001	0.001	0.002	0.004	0.004	
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.025	0.058	0.024	
Lithium	7439-93-2	0.001	mg/L	0.017	0.017	0.018	0.016	0.016	
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Strontium	7440-24-6	0.001	mg/L	0.389	0.393	0.382	0.118	0.113	
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	0.09	0.12	0.29	0.60	0.62	
Bromine	7726-95-6	0.1	mg/L	0.1	<0.1	<0.1	<0.1	<0.1	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.2	0.3	0.2	0.1	0.1	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	0.07	0.07	0.06	0.08	0.08	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	0.02	
EK058G: Nitrate as N by Discrete Analyser									
[^] Nitrate as N	14797-55-8	0.01	mg/L	0.65	0.64	0.74	0.27	0.21	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	0.65	0.64	0.74	0.27	0.23	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	2.6	2.3	2.4	1.7	1.8	
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
[^] Total Nitrogen as N	----	0.1	mg/L	3.2	2.9	3.1	2.0	2.0	
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	1.33	1.30	1.31	0.89	0.90	
EK071G: Reactive Phosphorus as P by discrete analyser									



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	CDW1	CDW2	CDW3	CDE1	CDE2
Client sampling date / time					01-May-2015 12:15	01-May-2015 12:15	01-May-2015 12:15	01-May-2015 13:15	01-May-2015 13:15
Compound	CAS Number	LOR	Unit	ES1521139-001	ES1521139-002	ES1521139-003	ES1521139-004	ES1521139-005	
				Result	Result	Result	Result	Result	
EK071G: Reactive Phosphorus as P by discrete analyser - Continued									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	1.02	1.05	1.09	0.74	0.77	
EN055: Ionic Balance									
^ Total Anions	----	0.01	meq/L	7.74	7.70	7.82	2.77	2.80	
^ Total Cations	----	0.01	meq/L	8.05	8.10	8.16	3.10	2.85	
^ Ionic Balance	----	0.01	%	1.96	2.53	2.12	----	----	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	CDE3	ASW01	FSW01	----	----
Client sampling date / time				01-May-2015 13:15	01-May-2015 13:00	01-May-2015 12:30	----	----	
Compound	CAS Number	LOR	Unit	ES1521139-006	ES1521139-007	ES1521139-008	-----	-----	
				Result	Result	Result	Result	Result	
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	7.24	7.33	7.12	----	----	
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm	285	246	236	----	----	
EA015: Total Dissolved Solids									
^ Total Dissolved Solids @180°C	----	10	mg/L	287	172	168	----	----	
EA025: Suspended Solids									
^ Suspended Solids (SS)	----	5	mg/L	232	16	26	----	----	
ED009: Anions									
Chloride	16887-00-6	0.1	mg/L	17.2	44.0	40.4	----	----	
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	<1	<1	----	----	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	42	44	37	----	----	
Total Alkalinity as CaCO3	----	1	mg/L	42	44	37	----	----	
ED040F: Dissolved Major Anions									
^ Silicon as SiO2	14464-46-1	0.1	mg/L	8.2	18.4	16.9	----	----	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	64	7	18	----	----	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	17	36	33	----	----	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	20	11	10	----	----	
Magnesium	7439-95-4	1	mg/L	6	6	6	----	----	
Sodium	7440-23-5	1	mg/L	29	28	27	----	----	
Potassium	7440-09-7	1	mg/L	11	2	4	----	----	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	1.54	0.32	0.43	----	----	
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	----	----	
Arsenic	7440-38-2	0.001	mg/L	0.002	0.002	0.003	----	----	
Boron	7440-42-8	0.05	mg/L	0.06	<0.05	<0.05	----	----	
Barium	7440-39-3	0.001	mg/L	0.090	0.035	0.034	----	----	
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	----	----	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	CDE3	ASW01	FSW01	----	----
Client sampling date / time				01-May-2015 13:15	01-May-2015 13:00	01-May-2015 12:30	----	----	
Compound	CAS Number	LOR	Unit	ES1521139-006	ES1521139-007	ES1521139-008	-----	-----	
				Result	Result	Result	Result	Result	
EG020F: Dissolved Metals by ICP-MS - Continued									
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	----	----	
Copper	7440-50-8	0.001	mg/L	0.001	<0.001	<0.001	----	----	
Manganese	7439-96-5	0.001	mg/L	0.004	0.003	0.005	----	----	
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	0.067	<0.005	<0.005	----	----	
Lithium	7439-93-2	0.001	mg/L	0.015	0.002	0.002	----	----	
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	<0.001	----	----	
Silver	7440-22-4	0.001	mg/L	<0.001	<0.001	<0.001	----	----	
Strontium	7440-24-6	0.001	mg/L	0.103	0.131	0.115	----	----	
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----	
Iron	7439-89-6	0.05	mg/L	0.76	0.82	0.69	----	----	
Bromine	7726-95-6	0.1	mg/L	<0.1	<0.1	<0.1	----	----	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.1	<0.1	<0.1	----	----	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	0.08	0.03	0.04	----	----	
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	0.22	0.03	0.23	----	----	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	0.22	0.03	0.23	----	----	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.7	0.4	0.9	----	----	
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
[^] Total Nitrogen as N	----	0.1	mg/L	1.9	0.4	1.1	----	----	
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	0.88	0.03	0.12	----	----	
EK071G: Reactive Phosphorus as P by discrete analyser									



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	CDE3	ASW01	FSW01	----	----
Client sampling date / time				01-May-2015 13:15	01-May-2015 13:00	01-May-2015 12:30	----	----	
Compound	CAS Number	LOR	Unit	ES1521139-006	ES1521139-007	ES1521139-008	-----	-----	
				Result	Result	Result	Result	Result	
EK071G: Reactive Phosphorus as P by discrete analyser - Continued									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	0.72	0.02	0.07	----	----	
EN055: Ionic Balance									
^ Total Anions	----	0.01	meq/L	2.65	2.04	2.04	----	----	
^ Total Cations	----	0.01	meq/L	3.03	2.31	2.27	----	----	
^ Ionic Balance	----	0.01	%	----	----	----	----	----	

CERTIFICATE OF ANALYSIS

Work Order : ES1521821 Client : PARSONS BRINCKERHOFF AUST P/L Contact : MS CAROLINA SARDELLA Address : GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001 E-mail : csardella@pb.com.au Telephone : +61 02 92725100 Facsimile : +61 02 92725101 Project : 2268517B Order number : ---- C-O-C number : ---- Sampler : ---- Site : ---- Quote number : ----	Page : 1 of 7 Laboratory : Environmental Division Sydney Contact : Loren Schiavon Address : 277-289 Woodpark Road Smithfield NSW Australia 2164 E-mail : loren.schiavon@alsglobal.com Telephone : +61 2 8784 8503 Facsimile : +61-2-8784 8500 QC Level : NEPM 2013 Schedule B(3) and ALS QCS3 requirement Date Samples Received : 13-May-2015 12:45 Date Analysis Commenced : 13-May-2015 Issue Date : 20-May-2015 17:44 No. of samples received : 3 No. of samples analysed : 3
---	---

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Dian Dao		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.

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
∅ = ALS is not NATA accredited for these tests.

- EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TSD	TND	TED	----	----
Client sampling date / time				12-May-2015 15:00	12-May-2015 15:40	12-May-2015 16:30	----	----	
Compound	CAS Number	LOR	Unit	ES1521821-001	ES1521821-002	ES1521821-003	-----	-----	
				Result	Result	Result	Result	Result	
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	9.29	9.37	8.79	----	----	
EA006: Sodium Adsorption Ratio (SAR)									
^ Sodium Adsorption Ratio	----	0.01	-	12.6	----	----	----	----	
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm	1120	919	312	----	----	
EA015: Total Dissolved Solids									
^ Total Dissolved Solids @180°C	----	10	mg/L	586	560	186	----	----	
EA025: Suspended Solids									
^ Suspended Solids (SS)	----	5	mg/L	68	48	33	----	----	
ED009: Anions									
Chloride	16887-00-6	0.1	mg/L	167	80.5	36.1	----	----	
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	104	59	14	----	----	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	156	61	72	----	----	
Total Alkalinity as CaCO3	----	1	mg/L	261	120	86	----	----	
ED040F: Dissolved Major Anions									
^ Silicon as SiO2	14464-46-1	0.1	mg/L	13.7	10.2	4.0	----	----	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	12	206	3	----	----	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	169	63	34	----	----	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	11	55	11	----	----	
Magnesium	7439-95-4	1	mg/L	5	14	2	----	----	
Sodium	7440-23-5	1	mg/L	200	104	51	----	----	
Potassium	7440-09-7	1	mg/L	56	34	10	----	----	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	<0.01	0.01	0.02	----	----	
Arsenic	7440-38-2	0.001	mg/L	0.003	0.003	<0.001	----	----	
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	----	----	
Barium	7440-39-3	0.001	mg/L	0.149	0.115	0.076	----	----	
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	----	----	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TSD	TND	TED	----	----
Client sampling date / time				12-May-2015 15:00	12-May-2015 15:40	12-May-2015 16:30	----	----	
Compound	CAS Number	LOR	Unit	ES1521821-001	ES1521821-002	ES1521821-003	-----	-----	
				Result	Result	Result	Result	Result	
EG020F: Dissolved Metals by ICP-MS - Continued									
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	----	----	
Copper	7440-50-8	0.001	mg/L	0.002	0.002	<0.001	----	----	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	----	----	
Manganese	7439-96-5	0.001	mg/L	0.004	0.004	0.004	----	----	
Molybdenum	7439-98-7	0.001	mg/L	0.004	0.005	<0.001	----	----	
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	----	----	
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	----	----	
Strontium	7440-24-6	0.001	mg/L	0.201	0.345	0.120	----	----	
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	----	----	
Zinc	7440-66-6	0.005	mg/L	0.009	<0.005	<0.005	----	----	
Boron	7440-42-8	0.05	mg/L	0.14	0.08	<0.05	----	----	
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	<0.05	----	----	
Bromine	7726-95-6	0.1	mg/L	0.4	0.2	<0.1	----	----	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.3	0.2	<0.1	----	----	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.01	<0.01	----	----	
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	----	----	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	7.2	4.6	4.2	----	----	
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
[^] Total Nitrogen as N	----	0.1	mg/L	7.2	4.6	4.2	----	----	
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	0.85	1.03	0.20	----	----	
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	0.01	0.33	<0.01	----	----	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TSD	TND	TED	----	----
Client sampling date / time				12-May-2015 15:00	12-May-2015 15:40	12-May-2015 16:30	----	----	
Compound	CAS Number	LOR	Unit	ES1521821-001	ES1521821-002	ES1521821-003	-----	-----	
				Result	Result	Result	Result	Result	
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L	25	20	14	----	----	
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L	<10	<10	92	----	----	
Ethene	74-85-1	10	µg/L	<10	<10	<10	----	----	
Ethane	74-84-0	10	µg/L	<10	<10	<10	----	----	
Propene	115-07-1	10	µg/L	<10	<10	<10	----	----	
Propane	74-98-6	10	µg/L	<10	<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	µg/L	<1.0	<1.0	<1.0	----	----	
2-Chlorophenol	95-57-8	1	µg/L	<1.0	<1.0	<1.0	----	----	
2-Methylphenol	95-48-7	1	µg/L	<1.0	<1.0	<1.0	----	----	
3- & 4-Methylphenol	1319-77-3	2	µg/L	<2.0	<2.0	<2.0	----	----	
2-Nitrophenol	88-75-5	1	µg/L	<1.0	<1.0	<1.0	----	----	
2,4-Dimethylphenol	105-67-9	1	µg/L	<1.0	<1.0	<1.0	----	----	
2,4-Dichlorophenol	120-83-2	1	µg/L	<1.0	<1.0	<1.0	----	----	
2,6-Dichlorophenol	87-65-0	1	µg/L	<1.0	<1.0	<1.0	----	----	
4-Chloro-3-methylphenol	59-50-7	1	µg/L	<1.0	<1.0	<1.0	----	----	
2,4,6-Trichlorophenol	88-06-2	1	µg/L	<1.0	<1.0	<1.0	----	----	
2,4,5-Trichlorophenol	95-95-4	1	µg/L	<1.0	<1.0	<1.0	----	----	
Pentachlorophenol	87-86-5	2	µg/L	<2.0	<2.0	<2.0	----	----	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1	µg/L	<1.0	<1.0	<1.0	----	----	
Acenaphthylene	208-96-8	1	µg/L	<1.0	<1.0	<1.0	----	----	
Acenaphthene	83-32-9	1	µg/L	<1.0	<1.0	<1.0	----	----	
Fluorene	86-73-7	1	µg/L	<1.0	<1.0	<1.0	----	----	
Phenanthrene	85-01-8	1	µg/L	<1.0	<1.0	<1.0	----	----	
Anthracene	120-12-7	1	µg/L	<1.0	<1.0	<1.0	----	----	
Fluoranthene	206-44-0	1	µg/L	<1.0	<1.0	<1.0	----	----	
Pyrene	129-00-0	1	µg/L	<1.0	<1.0	<1.0	----	----	
Benz(a)anthracene	56-55-3	1	µg/L	<1.0	<1.0	<1.0	----	----	
Chrysene	218-01-9	1	µg/L	<1.0	<1.0	<1.0	----	----	
Benzo(b+j)fluoranthene	205-99-2	205-82-3	1	µg/L	<1.0	<1.0	----	----	
Benzo(k)fluoranthene	207-08-9	1	µg/L	<1.0	<1.0	<1.0	----	----	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TSD	TND	TED	----	----
Client sampling date / time				12-May-2015 15:00	12-May-2015 15:40	12-May-2015 16:30	----	----	
Compound	CAS Number	LOR	Unit	ES1521821-001	ES1521821-002	ES1521821-003	-----	-----	
				Result	Result	Result	Result	Result	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
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	µg/L	<1.0	<1.0	<1.0	----	----	
Dibenz(a.h)anthracene	53-70-3	1	µg/L	<1.0	<1.0	<1.0	----	----	
Benzo(g.h.i)perylene	191-24-2	1	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	<20	<20	<20	----	----	
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	<20	<20	<20	----	----	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	----	----	
>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	<2	<2	<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	----	----	
^ Total Xylenes	1330-20-7	2	µg/L	<2	<2	<2	----	----	
^ Sum of BTEX	----	1	µg/L	<1	<1	<1	----	----	
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	----	----	
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	1	%	20.4	23.2	22.2	----	----	
2-Chlorophenol-D4	93951-73-6	1	%	30.0	31.8	45.1	----	----	
2,4,6-Tribromophenol	118-79-6	1	%	31.8	23.3	39.9	----	----	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TSD	TND	TED	----	----
Client sampling date / time					12-May-2015 15:00	12-May-2015 15:40	12-May-2015 16:30	----	----
Compound	CAS Number	LOR	Unit	ES1521821-001	ES1521821-002	ES1521821-003	-----	-----	
				Result	Result	Result	Result	Result	
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1	%	75.6	73.2	65.4	----	----	
Anthracene-d10	1719-06-8	1	%	70.3	87.6	64.6	----	----	
4-Terphenyl-d14	1718-51-0	1	%	72.2	65.4	65.3	----	----	
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	2	%	88.8	97.1	91.2	----	----	
Toluene-D8	2037-26-5	2	%	99.2	94.2	97.8	----	----	
4-Bromofluorobenzene	460-00-4	2	%	89.6	90.2	89.0	----	----	

CERTIFICATE OF ANALYSIS

Work Order : ES1521929 Client : PARSONS BRINCKERHOFF AUST P/L Contact : MS CAROLINA SARDELLA Address : GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001 E-mail : csardella@pb.com.au Telephone : +61 02 92725100 Facsimile : +61 02 92725101 Project : 2268517B Order number : ---- C-O-C number : ---- Sampler : CAROLINA SARDELLA Site : ---- Quote number : ----	Page : 1 of 17 Laboratory : Environmental Division Sydney Contact : Loren Schiavon Address : 277-289 Woodpark Road Smithfield NSW Australia 2164 E-mail : loren.schiavon@alsglobal.com Telephone : +61 2 8784 8503 Facsimile : +61-2-8784 8500 QC Level : NEPM 2013 Schedule B(3) and ALS QCS3 requirement Date Samples Received : 14-May-2015 13:00 Date Analysis Commenced : 15-May-2015 Issue Date : 21-May-2015 15:59 No. of samples received : 14 No. of samples analysed : 14
--	--

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics
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.

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
∅ = ALS is not NATA accredited for these tests.

- **EP071: The result for ES1521929_007 & 014 had been confirmed by re-extraction and re-analysis.**
- EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.
- TDS by method EA-015 may bias high for sample ID SP8B due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	CDE	SP8B	SP5B	TMB01	TMBO2
Client sampling date / time				13-May-2015 09:00	13-May-2015 08:30	13-May-2015 09:30	13-May-2015 13:10	13-May-2015 13:50	
Compound	CAS Number	LOR	Unit	ES1521929-001	ES1521929-002	ES1521929-003	ES1521929-004	ES1521929-005	
				Result	Result	Result	Result	Result	
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	7.79	5.41	7.51	7.16	7.06	
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm	461	405	5650	7500	3720	
EA015: Total Dissolved Solids									
^ Total Dissolved Solids @180°C	----	10	mg/L	388	3110	3200	4780	2450	
EA025: Suspended Solids									
^ Suspended Solids (SS)	----	5	mg/L	58	6740	283	92	26	
ED009: Anions									
Chloride	16887-00-6	0.1	mg/L	27.6	91.5	1590	2300	1140	
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	80	10	376	562	174	
Total Alkalinity as CaCO3	----	1	mg/L	80	10	376	562	174	
ED040F: Dissolved Major Anions									
^ Silicon as SiO2	14464-46-1	0.1	mg/L	9.0	67.1	32.2	38.6	35.2	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	106	55	290	81	20	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	23	72	1300	2160	959	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	35	2	29	223	164	
Magnesium	7439-95-4	1	mg/L	10	3	146	199	91	
Sodium	7440-23-5	1	mg/L	36	80	1060	1060	443	
Potassium	7440-09-7	1	mg/L	16	<1	3	2	3	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.02	1.60	0.01	<0.01	<0.01	
Arsenic	7440-38-2	0.001	mg/L	0.002	0.004	0.004	<0.001	0.003	
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	0.061	0.191	0.076	0.185	0.796	
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	0.002	0.004	<0.001	0.001	
Chromium	7440-47-3	0.001	mg/L	<0.001	0.001	0.002	<0.001	<0.001	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	CDE	SP8B	SP5B	TMB01	TMBO2
Client sampling date / time					13-May-2015 09:00	13-May-2015 08:30	13-May-2015 09:30	13-May-2015 13:10	13-May-2015 13:50
Compound	CAS Number	LOR	Unit	ES1521929-001	ES1521929-002	ES1521929-003	ES1521929-004	ES1521929-005	
				Result	Result	Result	Result	Result	
EG020F: Dissolved Metals by ICP-MS - Continued									
Copper	7440-50-8	0.001	mg/L	0.001	0.005	0.005	<0.001	<0.001	
Manganese	7439-96-5	0.001	mg/L	0.007	0.042	0.126	0.891	1.08	
Nickel	7440-02-0	0.001	mg/L	<0.001	0.004	0.120	<0.001	<0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	0.004	<0.001	<0.001	<0.001	
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	
Zinc	7440-66-6	0.005	mg/L	0.014	0.027	0.018	0.021	0.007	
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.021	<0.001	<0.001	
Strontium	7440-24-6	0.001	mg/L	0.182	0.013	1.18	5.42	3.43	
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	0.16	2.98	0.33	2.31	6.70	
Bromine	7726-95-6	0.1	mg/L	<0.1	0.3	3.3	3.7	1.9	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.2	0.1	0.4	0.3	0.2	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	0.05	0.04	0.02	0.13	0.30	
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	0.53	0.03	<0.01	<0.01	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.53	0.03	<0.01	<0.01	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.8	5.6	2.7	0.2	0.3	
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L	1.8	6.1	2.7	0.2	0.3	
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	0.91	0.68	0.30	0.04	0.06	
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	0.46	0.06	0.05	<0.01	<0.01	
EN055: Ionic Balance									
^ Total Anions	----	0.01	meq/L	4.45	3.38	50.2	73.8	30.9	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	CDE	SP8B	SP5B	TMB01	TMBO2
Client sampling date / time				13-May-2015 09:00	13-May-2015 08:30	13-May-2015 09:30	13-May-2015 13:10	13-May-2015 13:50	
Compound	CAS Number	LOR	Unit	ES1521929-001	ES1521929-002	ES1521929-003	ES1521929-004	ES1521929-005	
				Result	Result	Result	Result	Result	
EN055: Ionic Balance - Continued									
^ Total Cations	----	0.01	meq/L	4.54	3.83	59.6	73.7	35.0	
^ Ionic Balance	----	0.01	%	1.01	6.22	8.55	0.13	6.18	
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L	13	41	37	4	2	
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L	<10	<10	<10	18	<10	
Ethene	74-85-1	10	µg/L	<10	<10	<10	<10	<10	
Ethane	74-84-0	10	µg/L	<10	<10	<10	<10	<10	
Propene	115-07-1	10	µg/L	<10	<10	<10	<10	<10	
Propane	74-98-6	10	µg/L	<10	<10	<10	<10	<10	
Butene	25167-67-3	10	µg/L	<10	<10	<10	<10	<10	
Butane	106-97-8	10	µg/L	<10	<10	<10	<10	<10	
EP075(SIM)A: Phenolic Compounds									
Phenol	108-95-2	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
2-Chlorophenol	95-57-8	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
2-Methylphenol	95-48-7	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
3- & 4-Methylphenol	1319-77-3	2	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	
2-Nitrophenol	88-75-5	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
2,4-Dimethylphenol	105-67-9	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
2,4-Dichlorophenol	120-83-2	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
2,6-Dichlorophenol	87-65-0	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
4-Chloro-3-methylphenol	59-50-7	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
2,4,6-Trichlorophenol	88-06-2	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
2,4,5-Trichlorophenol	95-95-4	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Pentachlorophenol	87-86-5	2	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Acenaphthylene	208-96-8	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Acenaphthene	83-32-9	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Fluorene	86-73-7	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Phenanthrene	85-01-8	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Anthracene	120-12-7	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Fluoranthene	206-44-0	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Pyrene	129-00-0	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Benz(a)anthracene	56-55-3	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	CDE	SP8B	SP5B	TMB01	TMBO2
Client sampling date / time					13-May-2015 09:00	13-May-2015 08:30	13-May-2015 09:30	13-May-2015 13:10	13-May-2015 13:50
Compound	CAS Number	LOR	Unit	ES1521929-001	ES1521929-002	ES1521929-003	ES1521929-004	ES1521929-005	
				Result	Result	Result	Result	Result	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Chrysene	218-01-9	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Benzo(k)fluoranthene	207-08-9	1	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	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Dibenz(a.h)anthracene	53-70-3	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Benzo(g,h,i)perylene	191-24-2	1	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	<20	<20	<20	<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 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<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	<2	<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	
^ Total Xylenes	1330-20-7	2	µg/L	<2	<2	<2	<2	<2	
^ Sum of BTEX	----	1	µg/L	<1	<1	<1	<1	<1	
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	<5	
EP075(SIM)S: Phenolic Compound Surrogates									



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	CDE	SP8B	SP5B	TMB01	TMBO2
Client sampling date / time				13-May-2015 09:00	13-May-2015 08:30	13-May-2015 09:30	13-May-2015 13:10	13-May-2015 13:50	
Compound	CAS Number	LOR	Unit	ES1521929-001	ES1521929-002	ES1521929-003	ES1521929-004	ES1521929-005	
				Result	Result	Result	Result	Result	
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
Phenol-d6	13127-88-3	1	%	17.2	28.5	15.3	18.9	14.8	
2-Chlorophenol-D4	93951-73-6	1	%	41.6	47.1	40.7	47.1	38.0	
2,4,6-Tribromophenol	118-79-6	1	%	46.0	47.6	45.6	56.1	38.8	
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1	%	59.2	65.3	60.0	72.8	56.3	
Anthracene-d10	1719-06-8	1	%	69.9	63.8	86.2	72.6	81.7	
4-Terphenyl-d14	1718-51-0	1	%	62.0	59.2	55.1	61.5	55.3	
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	2	%	115	102	110	107	110	
Toluene-D8	2037-26-5	2	%	129	107	123	119	118	
4-Bromofluorobenzene	460-00-4	2	%	115	97.4	108	104	103	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TMBO3	TMBO4	TSW01	TSW02	FSW01
Client sampling date / time				13-May-2015 09:40	13-May-2015 12:40	13-May-2015 13:30	13-May-2015 10:55	13-May-2015 14:15	
Compound	CAS Number	LOR	Unit	ES1521929-006	ES1521929-007	ES1521929-008	ES1521929-009	ES1521929-010	
				Result	Result	Result	Result	Result	
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	7.35	6.66	7.44	7.41	7.47	
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm	5780	7140	275	437	269	
EA015: Total Dissolved Solids									
^ Total Dissolved Solids @180°C	----	10	mg/L	3190	4660	184	193	181	
EA025: Suspended Solids									
^ Suspended Solids (SS)	----	5	mg/L	49	2910	<5	<5	<5	
ED009: Anions									
Chloride	16887-00-6	0.1	mg/L	1570	2060	50.8	55.0	49.8	
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	<1	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	575	159	48	48	43	
Total Alkalinity as CaCO3	----	1	mg/L	575	159	48	48	43	
ED040F: Dissolved Major Anions									
^ Silicon as SiO2	14464-46-1	0.1	mg/L	32.6	51.4	22.0	14.6	22.1	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	214	605	10	15	10	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	1300	1740	42	45	41	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	211	73	10	8	11	
Magnesium	7439-95-4	1	mg/L	134	200	7	9	8	
Sodium	7440-23-5	1	mg/L	796	1020	30	34	32	
Potassium	7440-09-7	1	mg/L	2	19	2	3	2	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	<0.01	0.05	0.02	0.14	0.03	
Arsenic	7440-38-2	0.001	mg/L	0.003	<0.001	<0.001	<0.001	<0.001	
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	0.186	0.054	0.032	0.031	0.034	
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	0.0008	<0.0001	<0.0001	<0.0001	
Cobalt	7440-48-4	0.001	mg/L	0.005	0.089	<0.001	<0.001	<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)				Client sample ID	TMBO3	TMBO4	TSW01	TSW02	FSW01
Client sampling date / time				13-May-2015 09:40	13-May-2015 12:40	13-May-2015 13:30	13-May-2015 10:55	13-May-2015 14:15	
Compound	CAS Number	LOR	Unit	ES1521929-006	ES1521929-007	ES1521929-008	ES1521929-009	ES1521929-010	
				Result	Result	Result	Result	Result	
EG020F: Dissolved Metals by ICP-MS - Continued									
Copper	7440-50-8	0.001	mg/L	<0.001	0.005	<0.001	<0.001	<0.001	
Manganese	7439-96-5	0.001	mg/L	1.74	9.64	0.048	0.036	0.054	
Nickel	7440-02-0	0.001	mg/L	<0.001	0.038	<0.001	0.001	<0.001	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	
Zinc	7440-66-6	0.005	mg/L	0.014	0.269	<0.005	0.007	0.047	
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	
Strontium	7440-24-6	0.001	mg/L	4.89	0.724	0.119	0.101	0.124	
Uranium	7440-61-1	0.001	mg/L	0.008	<0.001	<0.001	<0.001	<0.001	
Iron	7439-89-6	0.05	mg/L	1.28	1.53	0.26	0.45	0.26	
Bromine	7726-95-6	0.1	mg/L	2.7	3.0	0.1	0.1	0.1	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.4	0.8	0.1	<0.1	<0.1	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	0.09	0.04	0.03	<0.01	0.03	
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	0.06	0.03	0.01	0.03	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.06	0.03	0.01	0.03	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.1	0.4	0.5	0.9	0.5	
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
[^] Total Nitrogen as N	----	0.1	mg/L	0.1	0.5	0.5	0.9	0.5	
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	0.02	0.08	0.04	0.07	0.05	
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	0.02	0.03	0.02	
EN055: Ionic Balance									
[^] Total Anions	----	0.01	meq/L	52.6	64.8	2.35	2.54	2.22	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TMBO3	TMBO4	TSW01	TSW02	FSW01
Client sampling date / time				13-May-2015 09:40	13-May-2015 12:40	13-May-2015 13:30	13-May-2015 10:55	13-May-2015 14:15	
Compound	CAS Number	LOR	Unit	ES1521929-006	ES1521929-007	ES1521929-008	ES1521929-009	ES1521929-010	
				Result	Result	Result	Result	Result	
EN055: Ionic Balance - Continued									
^ Total Cations	----	0.01	meq/L	56.2	65.0	2.43	2.70	2.65	
^ Ionic Balance	----	0.01	%	3.32	0.06	----	----	----	
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L	4	8	9	16	9	
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L	<10	<10	26	<10	32	
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	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
2-Chlorophenol	95-57-8	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
2-Methylphenol	95-48-7	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
3- & 4-Methylphenol	1319-77-3	2	µg/L	<2.0	3.2	<2.0	<2.0	<2.0	
2-Nitrophenol	88-75-5	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
2,4-Dimethylphenol	105-67-9	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
2,4-Dichlorophenol	120-83-2	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
2,6-Dichlorophenol	87-65-0	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
4-Chloro-3-methylphenol	59-50-7	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
2,4,6-Trichlorophenol	88-06-2	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
2,4,5-Trichlorophenol	95-95-4	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Pentachlorophenol	87-86-5	2	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Acenaphthylene	208-96-8	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Acenaphthene	83-32-9	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Fluorene	86-73-7	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Phenanthrene	85-01-8	1	µg/L	1.8	1.3	<1.0	<1.0	<1.0	
Anthracene	120-12-7	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Fluoranthene	206-44-0	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Pyrene	129-00-0	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	
Benz(a)anthracene	56-55-3	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TMBO3	TMBO4	TSW01	TSW02	FSW01
Client sampling date / time					13-May-2015 09:40	13-May-2015 12:40	13-May-2015 13:30	13-May-2015 10:55	13-May-2015 14:15
Compound	CAS Number	LOR	Unit	ES1521929-006	ES1521929-007	ES1521929-008	ES1521929-009	ES1521929-010	ES1521929-010
				Result	Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Chrysene	218-01-9	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	207-08-9	1	µg/L	<1.0	<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	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a.h)anthracene	53-70-3	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(g,h,i)perylene	191-24-2	1	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L	1.8	1.3	<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	<0.5
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L	<50	170	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	170	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	<20	<20	<20	<20	<20
>C10 - C16 Fraction	>C10_C16	100	µg/L	<100	160	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L	<100	<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	160	<100	<100	<100	<100
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	160	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	<2	<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L	<2	<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L	<2	<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	µg/L	<2	<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L	<1	<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	<5	<5
EP075(SIM)S: Phenolic Compound Surrogates									



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TMBO3	TMBO4	TSW01	TSW02	FSW01
Client sampling date / time				13-May-2015 09:40	13-May-2015 12:40	13-May-2015 13:30	13-May-2015 10:55	13-May-2015 14:15	
Compound	CAS Number	LOR	Unit	ES1521929-006	ES1521929-007	ES1521929-008	ES1521929-009	ES1521929-010	
				Result	Result	Result	Result	Result	
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
Phenol-d6	13127-88-3	1	%	16.4	16.3	15.6	15.7	20.0	
2-Chlorophenol-D4	93951-73-6	1	%	42.8	41.5	35.0	38.4	51.5	
2,4,6-Tribromophenol	118-79-6	1	%	42.8	60.9	53.1	49.2	63.2	
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1	%	59.9	59.7	54.2	55.0	74.4	
Anthracene-d10	1719-06-8	1	%	78.1	67.9	84.9	81.0	98.1	
4-Terphenyl-d14	1718-51-0	1	%	57.2	59.4	57.8	56.3	66.0	
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	2	%	110	104	111	120	106	
Toluene-D8	2037-26-5	2	%	117	114	114	128	111	
4-Bromofluorobenzene	460-00-4	2	%	101	95.2	100	110	95.0	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID		TCMB01	TTMB02	S4MB01	TED(SUMP)	----
Client sampling date / time		13-May-2015 15:10		13-May-2015 15:45	13-May-2015 16:20	13-May-2015 11:45	----	----
Compound	CAS Number	LOR	Unit	ES1521929-011	ES1521929-012	ES1521929-013	ES1521929-014	-----
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.71	7.37	7.71	6.50	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	3000	2490	4790	191	----
EA015: Total Dissolved Solids								
^ Total Dissolved Solids @180°C	----	10	mg/L	2110	1480	3050	132	----
EA025: Suspended Solids								
^ Suspended Solids (SS)	----	5	mg/L	<5	10	41	24	----
ED009: Anions								
Chloride	16887-00-6	0.1	mg/L	824	532	1330	33.0	----
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	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	324	378	575	25	----
Total Alkalinity as CaCO3	----	1	mg/L	324	378	575	25	----
ED040F: Dissolved Major Anions								
^ Silicon as SiO2	14464-46-1	0.1	mg/L	20.5	34.8	29.7	10.7	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	2	52	14	11	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	734	497	1110	30	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	309	190	455	1	----
Magnesium	7439-95-4	1	mg/L	73	52	62	2	----
Sodium	7440-23-5	1	mg/L	276	233	631	30	----
Potassium	7440-09-7	1	mg/L	4	3	6	2	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	<0.01	0.03	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	0.003	----
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	0.15	<0.05	----
Barium	7440-39-3	0.001	mg/L	8.23	0.716	8.27	0.009	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TCMB01	TTMB02	S4MB01	TED(SUMP)	----
Client sampling date / time				13-May-2015 15:10	13-May-2015 15:45	13-May-2015 16:20	13-May-2015 11:45	----	----
Compound	CAS Number	LOR	Unit	ES1521929-011	ES1521929-012	ES1521929-013	ES1521929-014	-----	-----
				Result	Result	Result	Result	Result	Result
EG020F: Dissolved Metals by ICP-MS - Continued									
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----	----
Manganese	7439-96-5	0.001	mg/L	0.030	0.092	0.164	0.056	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.003	<0.001	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----	----
Zinc	7440-66-6	0.005	mg/L	0.014	0.011	0.011	0.017	----	----
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----	----
Strontium	7440-24-6	0.001	mg/L	14.2	3.01	23.9	0.007	----	----
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----	----
Iron	7439-89-6	0.05	mg/L	1.55	2.52	1.73	3.97	----	----
Bromine	7726-95-6	0.1	mg/L	0.7	0.6	2.4	0.1	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.4	0.1	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	1.20	0.53	1.74	0.95	----	----
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	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	1.3	0.6	2.2	1.8	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
[^] Total Nitrogen as N	----	0.1	mg/L	1.3	0.6	2.2	1.8	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	<0.01	0.27	0.08	0.02	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	0.04	<0.01	0.06	<0.01	----	----
EN055: Ionic Balance									
[^] Total Anions	----	0.01	meq/L	27.2	22.6	43.1	1.57	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TCMB01	TTMB02	S4MB01	TED(SUMP)	----
Client sampling date / time				13-May-2015 15:10	13-May-2015 15:45	13-May-2015 16:20	13-May-2015 11:45	----	----
Compound	CAS Number	LOR	Unit	ES1521929-011	ES1521929-012	ES1521929-013	ES1521929-014	-----	-----
				Result	Result	Result	Result	Result	Result
EN055: Ionic Balance - Continued									
^ Total Cations	----	0.01	meq/L	33.5	24.0	55.4	1.57	----	----
^ Ionic Balance	----	0.01	%	10.4	2.84	12.5	----	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L	3	6	51	10	----	----
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L	247	14	9610	310	----	----
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	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
2-Chlorophenol	95-57-8	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
2-Methylphenol	95-48-7	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
3- & 4-Methylphenol	1319-77-3	2	µg/L	<2.0	<2.0	<2.0	<2.0	----	----
2-Nitrophenol	88-75-5	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
2,4-Dimethylphenol	105-67-9	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
2,4-Dichlorophenol	120-83-2	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
2,6-Dichlorophenol	87-65-0	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
4-Chloro-3-methylphenol	59-50-7	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
2,4,6-Trichlorophenol	88-06-2	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
2,4,5-Trichlorophenol	95-95-4	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
Pentachlorophenol	87-86-5	2	µg/L	<2.0	<2.0	<2.0	<2.0	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
Acenaphthylene	208-96-8	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
Acenaphthene	83-32-9	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
Fluorene	86-73-7	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
Phenanthrene	85-01-8	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
Anthracene	120-12-7	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
Fluoranthene	206-44-0	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
Pyrene	129-00-0	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
Benz(a)anthracene	56-55-3	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TCMB01	TTMB02	S4MB01	TED(SUMP)	----
Client sampling date / time					13-May-2015 15:10	13-May-2015 15:45	13-May-2015 16:20	13-May-2015 11:45	----
Compound	CAS Number	LOR	Unit	ES1521929-011	ES1521929-012	ES1521929-013	ES1521929-014	-----	-----
				Result	Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Chrysene	218-01-9	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
Benzo(k)fluoranthene	207-08-9	1	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	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
Dibenz(a,h)anthracene	53-70-3	1	µg/L	<1.0	<1.0	<1.0	<1.0	----	----
Benzo(g,h,i)perylene	191-24-2	1	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	140	<20	100	<20	----	----
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	----	----
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	120	----	----
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	120	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L	150	<20	100	<20	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	50	<20	30	<20	----	----
>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	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	----	----
Toluene	108-88-3	2	µg/L	102	<2	72	<2	----	----
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	102	<1	72	<1	----	----
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	----	----
EP075(SIM)S: Phenolic Compound Surrogates									



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TCMB01	TTMB02	S4MB01	TED(SUMP)	----
Client sampling date / time				13-May-2015 15:10	13-May-2015 15:45	13-May-2015 16:20	13-May-2015 11:45	----	----
Compound	CAS Number	LOR	Unit	ES1521929-011	ES1521929-012	ES1521929-013	ES1521929-014	-----	-----
				Result	Result	Result	Result	Result	Result
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
Phenol-d6	13127-88-3	1	%	20.0	19.5	24.7	20.7	----	----
2-Chlorophenol-D4	93951-73-6	1	%	52.2	52.6	62.3	54.3	----	----
2.4.6-Tribromophenol	118-79-6	1	%	53.2	55.0	68.0	65.1	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1	%	71.2	71.4	80.8	67.0	----	----
Anthracene-d10	1719-06-8	1	%	68.6	73.1	75.2	65.3	----	----
4-Terphenyl-d14	1718-51-0	1	%	66.3	73.5	75.1	65.7	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%	118	89.1	115	116	----	----
Toluene-D8	2037-26-5	2	%	124	104	130	120	----	----
4-Bromofluorobenzene	460-00-4	2	%	102	88.9	105	100.0	----	----

CERTIFICATE OF ANALYSIS

Work Order	: ES1522044	Page	: 1 of 7
Client	: PARSONS BRINCKERHOFF AUST P/L	Laboratory	: Environmental Division Sydney
Contact	: MS CAROLINA SARDELLA	Contact	: Loren Schiavon
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	: loren.schiavon@alsglobal.com
Telephone	: +61 02 92725100	Telephone	: +61 2 8784 8503
Facsimile	: +61 02 92725101	Facsimile	: +61-2-8784 8500
Project	: 2268517B	QC Level	: NEPM 2013 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 15-May-2015 14:40
C-O-C number	: ----	Date Analysis Commenced	: 15-May-2015
Sampler	: CAROLINA SARDELLA, DAVID WHITING	Issue Date	: 22-May-2015 17:48
Site	: ----		
Quote number	: ----	No. of samples received	: 2
		No. of samples analysed	: 2

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
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.

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
∅ = ALS is not NATA accredited for these tests.

- EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a,h)anthracene (1.0), Benzo(g,h,i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)		Client sample ID		TMB05	ASW01	----	----	----
Client sampling date / time		14-May-2015 12:00		14-May-2015 12:40		----	----	----
Compound	CAS Number	LOR	Unit	ES1522044-001	ES1522044-002	-----	-----	-----
				Result	Result	Result	Result	Result
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	6.20	7.32	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	7570	295	----	----	----
EA015: Total Dissolved Solids								
^ Total Dissolved Solids @180°C	----	10	mg/L	4580	181	----	----	----
EA025: Suspended Solids								
^ Suspended Solids (SS)	----	5	mg/L	550	26	----	----	----
ED009: Anions								
Chloride	16887-00-6	0.1	mg/L	2320	51.8	----	----	----
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	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	91	54	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	91	54	----	----	----
ED040F: Dissolved Major Anions								
^ Silicon as SiO2	14464-46-1	0.1	mg/L	60.0	22.2	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	207	9	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	2220	41	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	75	13	----	----	----
Magnesium	7439-95-4	1	mg/L	231	7	----	----	----
Sodium	7440-23-5	1	mg/L	938	30	----	----	----
Potassium	7440-09-7	1	mg/L	16	2	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.15	0.01	----	----	----
Arsenic	7440-38-2	0.001	mg/L	0.001	<0.001	----	----	----
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	----	----	----
Barium	7440-39-3	0.001	mg/L	0.282	0.037	----	----	----
Beryllium	7440-41-7	0.001	mg/L	0.002	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	0.0001	<0.0001	----	----	----
Cobalt	7440-48-4	0.001	mg/L	0.162	<0.001	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TMB05	ASW01	----	----	----
Client sampling date / time				14-May-2015 12:00	14-May-2015 12:40	----	----	----	
Compound	CAS Number	LOR	Unit	ES1522044-001	ES1522044-002	-----	-----	-----	
				Result	Result	Result	Result	Result	
EG020F: Dissolved Metals by ICP-MS - Continued									
Copper	7440-50-8	0.001	mg/L	0.001	<0.001	----	----	----	
Manganese	7439-96-5	0.001	mg/L	17.2	0.051	----	----	----	
Nickel	7440-02-0	0.001	mg/L	0.075	<0.001	----	----	----	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----	
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	----	----	----	
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	----	----	----	
Zinc	7440-66-6	0.005	mg/L	0.272	0.005	----	----	----	
Molybdenum	7439-98-7	0.001	mg/L	0.002	<0.001	----	----	----	
Strontium	7440-24-6	0.001	mg/L	1.36	0.146	----	----	----	
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	----	----	----	
Iron	7439-89-6	0.05	mg/L	32.8	0.20	----	----	----	
Bromine	7726-95-6	0.1	mg/L	1.7	0.1	----	----	----	
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	----	----	----	
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.7	<0.1	----	----	----	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	3.06	0.02	----	----	----	
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	0.04	----	----	----	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	0.01	0.04	----	----	----	
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L	16.4	0.4	----	----	----	
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
[^] Total Nitrogen as N	----	0.1	mg/L	16.4	0.4	----	----	----	
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	2.04	0.03	----	----	----	
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.01	mg/L	<0.01	<0.01	----	----	----	
EN055: Ionic Balance									
[^] Total Anions	----	0.01	meq/L	68.8	2.42	----	----	----	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TMB05	ASW01	----	----	----
Client sampling date / time				14-May-2015 12:00	14-May-2015 12:40	----	----	----	
Compound	CAS Number	LOR	Unit	ES1522044-001	ES1522044-002	-----	-----	-----	
				Result	Result	Result	Result	Result	
EN055: Ionic Balance - Continued									
^ Total Cations	----	0.01	meq/L	64.0	2.58	----	----	----	
^ Ionic Balance	----	0.01	%	3.62	----	----	----	----	
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L	59	6	----	----	----	
EP033: C1 - C4 Hydrocarbon Gases									
Methane	74-82-8	10	µg/L	234	26	----	----	----	
Ethene	74-85-1	10	µg/L	<10	<10	----	----	----	
Ethane	74-84-0	10	µg/L	<10	<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	µg/L	3.3	<1.0	----	----	----	
2-Chlorophenol	95-57-8	1	µg/L	<1.0	<1.0	----	----	----	
2-Methylphenol	95-48-7	1	µg/L	<1.0	<1.0	----	----	----	
3- & 4-Methylphenol	1319-77-3	2	µg/L	<2.0	<2.0	----	----	----	
2-Nitrophenol	88-75-5	1	µg/L	<1.0	<1.0	----	----	----	
2,4-Dimethylphenol	105-67-9	1	µg/L	<1.0	<1.0	----	----	----	
2,4-Dichlorophenol	120-83-2	1	µg/L	<1.0	<1.0	----	----	----	
2,6-Dichlorophenol	87-65-0	1	µg/L	<1.0	<1.0	----	----	----	
4-Chloro-3-methylphenol	59-50-7	1	µg/L	<1.0	<1.0	----	----	----	
2,4,6-Trichlorophenol	88-06-2	1	µg/L	<1.0	<1.0	----	----	----	
2,4,5-Trichlorophenol	95-95-4	1	µg/L	<1.0	<1.0	----	----	----	
Pentachlorophenol	87-86-5	2	µg/L	<2.0	<2.0	----	----	----	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1	µg/L	<1.0	<1.0	----	----	----	
Acenaphthylene	208-96-8	1	µg/L	<1.0	<1.0	----	----	----	
Acenaphthene	83-32-9	1	µg/L	<1.0	<1.0	----	----	----	
Fluorene	86-73-7	1	µg/L	<1.0	<1.0	----	----	----	
Phenanthrene	85-01-8	1	µg/L	<1.0	<1.0	----	----	----	
Anthracene	120-12-7	1	µg/L	<1.0	<1.0	----	----	----	
Fluoranthene	206-44-0	1	µg/L	<1.0	<1.0	----	----	----	
Pyrene	129-00-0	1	µg/L	<1.0	<1.0	----	----	----	
Benz(a)anthracene	56-55-3	1	µg/L	<1.0	<1.0	----	----	----	



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TMB05	ASW01	----	----	----
Client sampling date / time				14-May-2015 12:00	14-May-2015 12:40	----	----	----	
Compound	CAS Number	LOR	Unit	ES1522044-001	ES1522044-002	-----	-----	-----	
				Result	Result	Result	Result	Result	
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Chrysene	218-01-9	1	µg/L	<1.0	<1.0	----	----	----	
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<1.0	<1.0	----	----	----	
Benzo(k)fluoranthene	207-08-9	1	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	µg/L	<1.0	<1.0	----	----	----	
Dibenz(a.h)anthracene	53-70-3	1	µg/L	<1.0	<1.0	----	----	----	
Benzo(g.h.i)perylene	191-24-2	1	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	50	<20	----	----	----	
C10 - C14 Fraction	----	50	µg/L	1430	<50	----	----	----	
C15 - C28 Fraction	----	100	µg/L	420	<100	----	----	----	
C29 - C36 Fraction	----	50	µg/L	300	<50	----	----	----	
^ C10 - C36 Fraction (sum)	----	50	µg/L	2150	<50	----	----	----	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	20	µg/L	50	<20	----	----	----	
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	20	<20	----	----	----	
>C10 - C16 Fraction	>C10_C16	100	µg/L	1480	<100	----	----	----	
>C16 - C34 Fraction	----	100	µg/L	500	<100	----	----	----	
>C34 - C40 Fraction	----	100	µg/L	210	<100	----	----	----	
^ >C10 - C40 Fraction (sum)	----	100	µg/L	2190	<100	----	----	----	
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	1480	<100	----	----	----	
EP080: BTEXN									
Benzene	71-43-2	1	µg/L	<1	<1	----	----	----	
Toluene	108-88-3	2	µg/L	26	<2	----	----	----	
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	26	<1	----	----	----	
Naphthalene	91-20-3	5	µg/L	<5	<5	----	----	----	
EP075(SIM)S: Phenolic Compound Surrogates									



Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	TMB05	ASW01	----	----	----
Client sampling date / time				14-May-2015 12:00	14-May-2015 12:40	----	----	----	
Compound	CAS Number	LOR	Unit	ES1522044-001	ES1522044-002	-----	-----	-----	
				Result	Result	Result	Result	Result	
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
Phenol-d6	13127-88-3	1	%	26.4	41.3	----	----	----	
2-Chlorophenol-D4	93951-73-6	1	%	53.9	85.0	----	----	----	
2.4.6-Tribromophenol	118-79-6	1	%	75.8	75.2	----	----	----	
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	1	%	68.2	99.2	----	----	----	
Anthracene-d10	1719-06-8	1	%	62.4	93.5	----	----	----	
4-Terphenyl-d14	1718-51-0	1	%	65.3	92.1	----	----	----	
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%	102	91.3	----	----	----	
Toluene-D8	2037-26-5	2	%	123	90.2	----	----	----	
4-Bromofluorobenzene	460-00-4	2	%	126	93.6	----	----	----	