

AGL Upstream Investments Pty Ltd

Gloucester Gas Project

Tiedman Irrigation Trial
Baseline Water Monitoring Program

January 2013



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Gloucester Gas Project - Tiedman Irrigation Trial Baseline Water Monitoring Program

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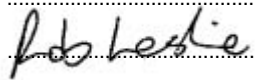
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Glossary

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.
Aquifer properties	The characteristics of an aquifer that determine its hydraulic behaviour and its response to abstraction.
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 is extracted from coal seams.
Concentration	The amount or mass of a substance present in a given volume or mass of sample, usually expressed as microgram per litre (water sample) or micrograms per kilogram (sediment sample).
Confining layer	Low permeability strata that may be saturated but will not allow water to move through it under natural hydraulic gradients.
Datalogger	A digital recording instrument that is inserted in monitoring and pumping bores to record pressure measurements and water level variations.
Discharge	The volume of water flowing in a stream or through an aquifer past a specific point in a given period of time.
Discharge area	An area in which there are upward or lateral components of flow in an aquifer.
Electrical Conductivity	A measure of a fluid's ability to conduct an electrical current and is an estimation of the total ions dissolved. It is often

(EC)	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.
Infiltration	The flow of water downward from the land surface into and through the upper soil layers.
Micro Siemens per centimetre (µS/cm)	A measure of water salinity commonly referred to as EC (see also Electrical Conductivity). Most commonly measured in the field with calibrated field meters.
Monitoring bore	A non-pumping bore, is generally of small diameter that is used to measure the elevation of the water table and/or water quality. Bores generally have a short well screen against a single aquifer through which water can enter.
Permeability	The property or capacity of a porous rock, sediment, clay or soil to transmit a fluid. It is a measure of the relative ease of fluid flow under unequal pressure. The hydraulic conductivity is the permeability of a material for water at the prevailing temperature.
Piezometer	See monitoring bore.
Recharge	The process which replenishes groundwater, usually by rainfall infiltrating from the ground surface to the water table and by river water reaching the water table or exposed aquifers. The addition of water to an aquifer.
Recharge area	A geographic area that directly receives infiltrated water from surface and in which there are downward components of hydraulic head in the aquifer. Recharge generally moves downward from the water table into the deeper parts of an aquifer then moves laterally and vertically to recharge other parts of the aquifer or deeper aquifer zones.
Salinity	The concentration of dissolved salts in water, usually expressed in EC units or milligrams of total dissolved solids per litre (mg/L TDS).
Salinity classification	<p>Fresh water quality – water with a salinity <800 µS/cm.</p> <p>Marginal water quality – water that is more saline than freshwater and generally waters between 800 and 1,600 µS/cm.</p> <p>Brackish quality – water that is more saline than freshwater and generally waters between 1,600 and 4,800 µS/cm.</p> <p>Slightly saline quality – water that is more saline than brackish water and generally waters with a salinity between 4,800 and 10,000 µS/cm.</p>

Moderately saline quality – water that is more saline than brackish 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.
Total Dissolved Solids (TDS)	A measure of the salinity of water, usually expressed in milligrams per litre (mg/L). See also EC.
Water quality	Term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.
Water quality data	Chemical, biological, and physical measurements or observations of the characteristics of surface and ground waters, atmospheric deposition, potable water, treated effluents, and waste water and of the immediate environment in which the water exists.
Water table	The top of an unconfined aquifer. It is at atmospheric pressure and indicates the level below which soil and rock are saturated with water.
Well	Pertaining to a gas exploration well or gas production well.

Executive summary

AGL Upstream Investments Pty Ltd (AGL) is proposing to develop the Gloucester Gas Project (GGP) which will comprise several stages of development; however, only one stage, the Stage 1 Gas Field Development Area (GFDA) is currently approved. 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 pending the commencement of the GGP.

As part of its current exploration program, AGL proposes to irrigate a maximum of 70 megalitres (ML) of produced water over a maximum area of 40 hectares (ha) over a three year period. The water from exploration programs, which is currently stored in the Tiedman and Stratford dams, will be blended with water from freshwater sources to optimise the quality and use as the irrigated water. A surface water and groundwater monitoring program was commenced in October 2011 and established in accordance with the Water Management Plan (AGL, 2012a); monitoring aims to ensure that the quality of the water used for irrigation is appropriate and that the application of irrigated water does not result in negative impacts on the local surface water or groundwater resources.

The groundwater and surface water monitoring network has established baseline water levels and quality for the shallow groundwater (alluvial and shallow bedrock) and the adjacent surface water receptors. Monitoring, both continuous and quarterly, assessed water level trends and water quality parameters. In addition a baseline dataset monitoring salinity changes over time in the Tiedman dams and assessing the possible leakage from the dams has been developed.

In accordance with the Australian and New Zealand guidelines for fresh and marine water quality (ANZECC, 2000), site specific guideline values were derived from local reference data. Where data were insufficient to calculate an 80th percentile, the maximum observed value has been adopted on the assumption that the baseline data reflect natural (pre-irrigation) conditions at the site. Where there is no ANZECC (2000) guideline criterion, no guideline values have been established; when the maximum analytical concentration is lower than the ANZECC (2000) guideline, the lower and more conservative guideline value is applied.

Baseline monitoring data indicate that the alluvial groundwater levels respond mainly to rainfall recharge. The rainfall response is immediate and pronounced, and suggests moderate to high permeability in the alluvial bores. A relatively small rainfall response is observed at the shallow bedrock monitoring bore suggesting groundwater levels respond to gradual rainfall recharge over a broad area.

Groundwater is typically brackish to slightly saline, while surface water is typically fresh. The shallow alluvium pH is slightly acidic to neutral, whereas the pH in the surface water and shallow bedrock is neutral. Dissolved metal concentrations in the groundwater and surface water were relatively low, with the exception of copper and zinc concentrations, and aluminium concentrations in the surface water. Ammonia concentrations were above the ANZECC (2000) guideline criteria, and total phosphorus and TOC concentrations were elevated in the alluvium and shallow bedrock.

Water in the Tiedman dams was weakly alkaline and brackish during the baseline monitoring period. Concentrations of dissolved metals and nutrients were elevated relative to groundwater and stream samples, and traces of total petroleum hydrocarbons were detected during both sampling events. Overall the water quality in the Tiedman south dam is more suitable than the north dam for blending and irrigation.

Water in the seepage bores was slightly saline and slightly acidic to neutral during the baseline monitoring period. Water quality in the seepage bores is significantly different to water in the Tiedman

dams. Dissolved metal concentrations were higher in the seepage bores compared to the Tiedman dam, while nutrient concentrations were relatively lower.

The differences in minor ion and dissolved metal chemistry, in addition to different nutrient concentrations, indicate that the seepage water is not derived from leakage from the Tiedman dams. In addition, the elevated salinity and high concentrations of certain trace metals, including iron and manganese, is consistent with water in these monitoring bores being derived from soil/pore water from the weathered siltstones and clays.

1. Introduction

AGL Upstream Investments Pty Ltd (AGL) is proposing to develop the Gloucester Gas Project (GGP) which will comprise several stages of development; however, only one stage, the Stage 1 Gas Field Development Area (GFDA) is currently approved. The current project includes the development of 110 coal seam gas (CSG) wells and associated infrastructure, the development of a central processing facility (CPF), the construction and operation of a high pressure gas transmission pipeline from Stratford to Hexham, and the Hexham Delivery System (HDS).

The GGP has been declared by the Minister for Planning as a Major Project under the *Environmental Planning and Assessment Act 1979* (EP&A Act). AGL holds a concept plan approval for the whole GGP and a planning approval for stage 1 of the GGP under Part 3A of the EP&A Act, both of which were issued in February 2011. The project was referred under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (SEWPaC). The project is deemed a 'controlled action' and SEWPaC is currently assessing the Stage 1 project under the EPBC Act.

The GGP will involve the dewatering 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 but are expected to range between 200 and 1000 metres below ground level (mbgl). The dewatering of these water bearing zones will result in produced water. Irrigation has been identified as the preferred water management and reuse method for produced water at Gloucester, and consequently an irrigation trial is proposed to demonstrate the sustainability of irrigating salt tolerant crops on improved soils on AGL's Tiedman property at Stratford.

The irrigation REF was resubmitted in June 2011 in the expectation that the Part V approval under the EP&A Act would occur within 4 to 8 weeks. The approval for the irrigation program was delayed and not issued until July 2012 (DRE, 2012).

1.1 Irrigation proposal

AGL proposes to irrigate a maximum of 70 megalitres (ML) of produced water over a maximum area of 40 hectares (ha) over a two to three year period. This will include water from exploration programs which is currently stored in the Tiedman and Stratford dams, as well as any rainfall which falls in the dams and any additional produced water from 2012, 2013, 2014 exploration activities. This water will be blended with fresh water from sources including the Avon River to optimise the quality of the irrigated water.

Within the 40 ha irrigation area (Figure 1.1), is the Stage 1A area, which is the intensive irrigation trial area to be serviced by a lateral move irrigator. The lateral move irrigator will irrigate a maximum area of 18.2 ha, comprising 16 x 0.77 ha plots (12.3 ha) incorporating four different soil improvements. A small additional (adjacent) area for enhancements to the trial program may also be serviced by the lateral move irrigator or irrigation line hydrants in the Stage 1A area.

The irrigation water will be a blended water mix with salinity (measured as Electrical Conductivity, EC) in the range of 1,500 to 2,000 $\mu\text{S}/\text{cm}$. The blended water will comprise an estimated ratio of three parts fresh water and one part produced water. Freshwater will be

sourced from local farm dams and the Avon River. The irrigation program will allow salt tolerant crops to be grown, thus providing continuous cropping over summer and winter.

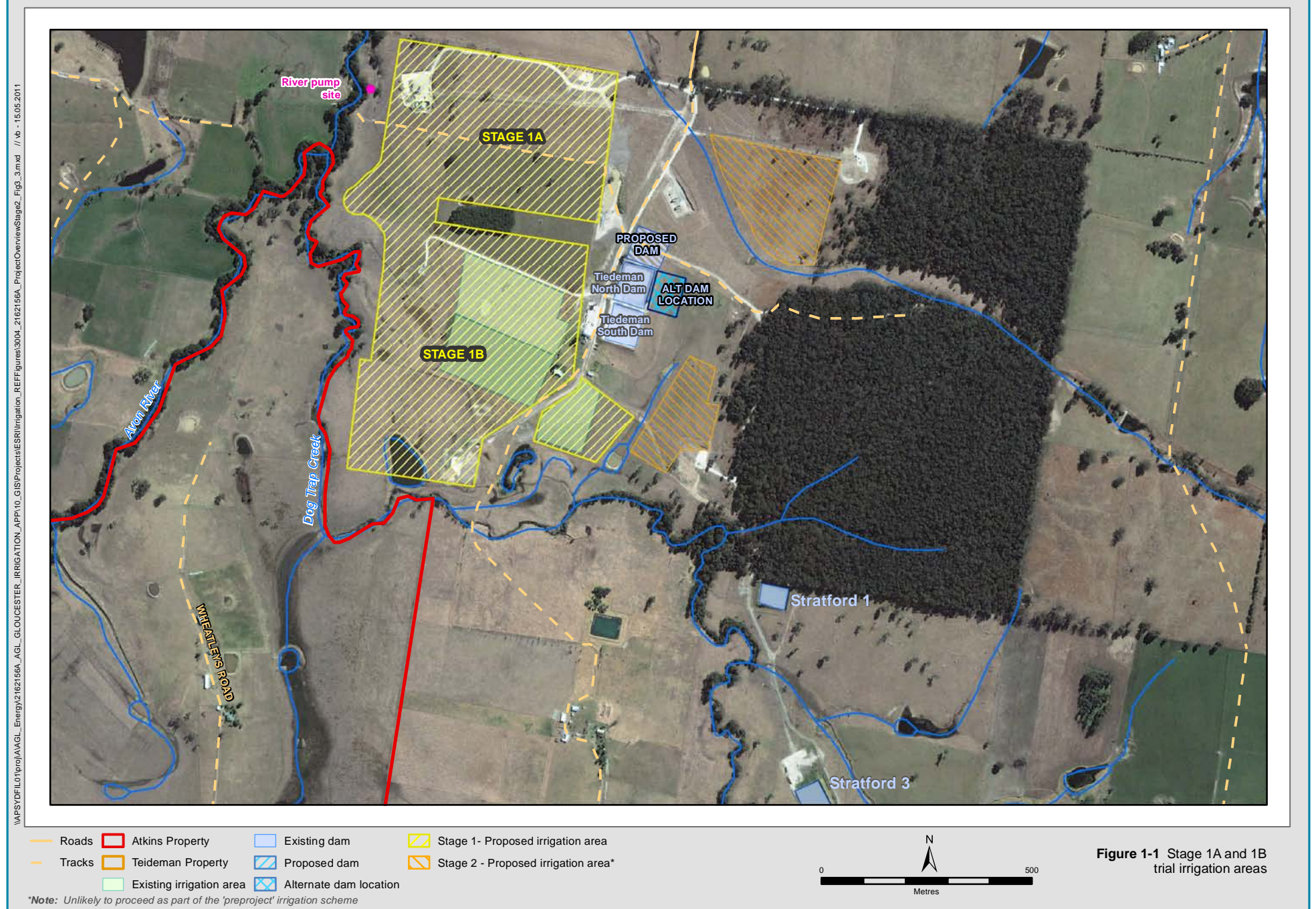


Figure 1-1 Stage 1A and 1B trial irrigation areas

1.2 Objectives

The objectives of the baseline groundwater and surface water monitoring program are to ensure that the quality of the water used for irrigation is appropriate and to provide a means to assess any negative impacts on the local surface water or groundwater resources as a result of the proposed irrigation scheme.

This report presents baseline (pre-irrigation) water level and quality data gathered between October 2011 and September 2012. In addition, the baseline monitoring data are used to derive site specific water quality guideline values determined where water quality analytes exceed the ANZECC (2000) criteria.

1.3 Report Structure

The structure of the report is as follows:

- **Section 2:** provides an overview of the monitoring network and methodology
- **Section 3:** presents the groundwater and surface water level data for the baseline monitoring period
- **Section 4:** presents the water quality results for both groundwater and surface water sites
- **Section 5:** provides a brief discussion of the baseline monitoring results
- **Section 6:** presents recommendations for future monitoring
- **Section 7:** presents conclusions from the baseline monitoring.
- **Section 8:** outlines limitations relating to analysis and reporting of data
- **Section 9:** References

2. Monitoring network & methodology

The baseline irrigation groundwater and surface water monitoring network (Figure 2.1) focuses on shallow groundwater (alluvial and shallow bedrock) and adjacent surface water receptors. The network comprises the following sites:

- Surface water stream gauges: ASW01, TSW01 and FSW01 (sampling location only) on the Avon River, stream gauge TSW02 on Dog Trap Creek
- Shallow alluvial groundwater monitoring bores: TMB01, TMB02 and TMB03 adjacent to Dog Trap Creek and the Avon River
- Shallow bedrock groundwater monitoring bore: S4MB01
- Produced water
 - ▶ Tiedman North and Tiedman South dam water quality monitoring: stored produced water (and future blended water)
 - ▶ Tiedman shallow dam seepage monitoring bores: TMB04 and TMB05.

Future irrigation monitoring will include additional monitoring of groundwater and surface water sources when constructed. These include:

- Third Tiedman produced water dam – under construction
- Western catch dam (Stage 1A) – under construction
- Eastern catch dam (Stage 1A) – under construction
- New (paired) shallow piezometers (0.3 - 1.2 m and 1.5 m deep) in the Stage 1A trial irrigation area to assess perched water (number to be confirmed).

2.1 Approved Water Management Plan

A water management plan (WMP) “*Water Management Plan for the Tiedman Irrigation Program – Gloucester*” (AGL, 2012a) was requested by the NSW Office of Water (NOW) as part of the REF approval process. The WMP was based on the outline provided in the REF (Parsons Brinckerhoff 2011), NOW’s letter of 12 August 2011, baseline monitoring initiated by AGL, discussions with NOW in December 2011, and additional information provided in February 2012.

Approval for the irrigation trial was given by DTIRIS – Division of Resources and Energy (DRE) in July 2012. Table 2.1 summarises the groundwater and surface water monitoring scope as outlined in the WMP.

Table 2.1 Approved scope for groundwater and surface water monitoring

Sample ID	Location	Water Levels	Routine Water Quality and Sampling Frequency	Extra Sampling Event
Tiedman Nth	Tiedman North Dam	Not required	Metals, nutrients, cations/anions quarterly Hydrocarbons annually	Physical parameters - monthly
Tiedman Sth	Tiedman South Dam	Not required	Salinity logger continuous Metals, nutrients, cations/anions quarterly Hydrocarbons annually	Physical parameters - monthly
Tiedman #3	Tiedman #3 Dam	Not required	Metals, nutrients, cations/anions quarterly Hydrocarbons annually	Physical parameters - monthly
Catch Dam east (small)	North East of Irrigation trial area	Not required	Salinity logger continuous	Physical parameters, metals, nutrients, cations/anions – Subject to test results from Catch Dam west overflow event *
Catch Dam west (large)	South West of Irrigation trial area	Not required	Salinity logger continuous	Physical parameters, metals, nutrients, cations/anions – Sample and test first overflow event only then assess for future events *
TMB04	Seepage MB west	Dipped quarterly	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	Seepage MB east	Dipped quarterly	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	Avon River (upgradient) Atkins Property	Yes continuous – Download	Salinity logger continuous, nominal physical parameters quarterly Metals, nutrients, cations/anions quarterly Hydrocarbons annually	Physical parameters, metals, nutrients, cations/anions – Sample and test first overflow event only then assess for future events *
TSW02	Dog Trap Creek	Yes continuous – Download	Salinity logger continuous, Physical parameters quarterly Metals, nutrients, cations/anions quarterly Hydrocarbons annually	None planned
TSW01	Avon River (downgradient Tiedman boundary)	Yes continuous – Download	Salinity logger continuous, nominal physical parameters quarterly Metals, nutrients, cations/anions quarterly Hydrocarbons annually	None planned
FSW01	Avon River (downgradient on Farley property)	Not required	Physical parameters quarterly Metals, nutrients, cations/anions quarterly Hydrocarbons annually	Physical parameters, metals, nutrients, cations/anions – Sample and test first overflow event only then assess for future events *

Sample ID	Location	Water Levels	Routine Water Quality and Sampling Frequency	Extra Sampling Event
TMB01	Avon River Alluvium (downgradient site boundary)	Yes continuous	Nominal physical parameters quarterly Metals, cations/anions quarterly Hydrocarbons and nutrients, annually	None planned
TMB02	Avon River/Dog Trap Creek Alluvium (mid site)	Yes continuous	Nominal physical parameters quarterly Metals, cations/anions quarterly Hydrocarbons and nutrients, annually	None planned
TMB03	Dog Trap Creek Alluvium (southern site)	Yes continuous	Nominal physical parameters quarterly Metals, cations/anions quarterly Hydrocarbons and nutrients, annually	None planned
S4MB01	Northern site boundary (rock aquifer)	Yes continuous	Nominal physical parameters quarterly Metals, cations/anions quarterly Hydrocarbons and nutrients annually	None planned

Key - * high rainfall event

2.2 Baseline monitoring

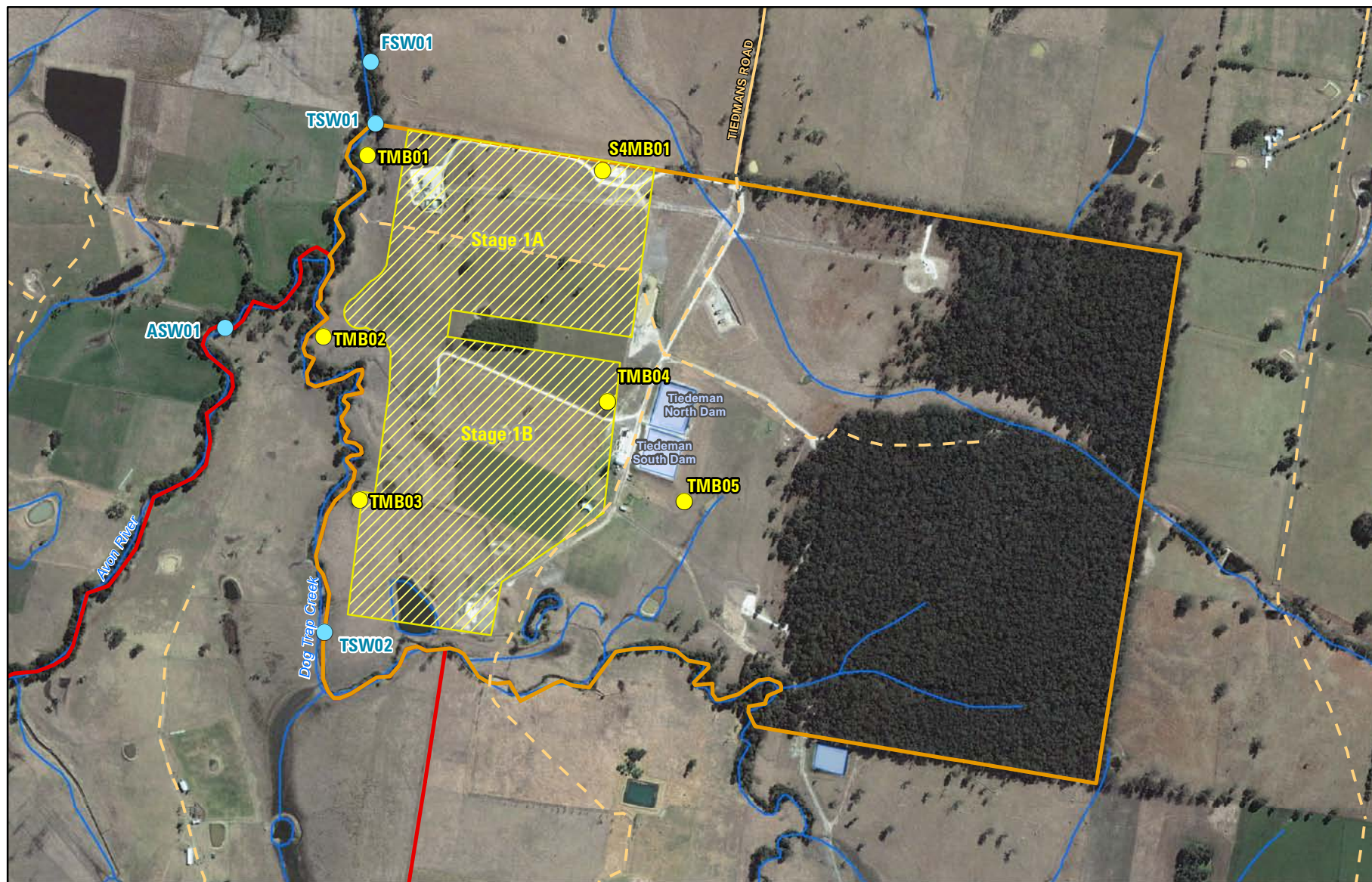
Groundwater level monitoring commenced in early 2011 (Table 2.2) and surface water level monitoring in March 2011 (Table 2.3). The baseline water quality monitoring program commenced in October 2011 in the expectation that the approval for the irrigation program would occur during the summer of 2011/12. The majority of the monitoring network was installed as part of the extensive groundwater investigation for the Stage 1 GFDA, as described in Parsons Brinckerhoff (2012).

The groundwater and surface water monitoring locations for the Stage 1A/1B irrigation trial area assess the possible receptors of irrigated water, these include:

- Surface water sources, including the Avon River and Dog Trap Creek
- The alluvial aquifer, below and down gradient of the Stage 1A/1B area
- The shallow bedrock aquifer below the Stage 1A/1B area

In addition the water quality in the Tiedman produced water storage dams is monitored to determine if the stored and blended water complies with the ANZECC (2000) irrigation water quality guidelines. Any potential losses from these dams are also monitored via two seepage monitoring bores.

The monitoring sites were sampled in October 2011, December 2011, February 2012, June 2012, and September 2012.



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- Roads
- Groundwater monitoring bore
- Atkins Property
- Existing dam
- Tracks
- Surface water monitoring location
- Tiedeman Property
- Stage 1- Proposed irrigation area

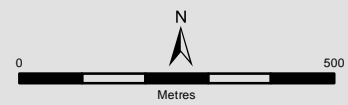


Figure 2-1 Irrigation monitoring network

2.3 Monitoring installations

The groundwater monitoring bore construction details and stream gauge installations are summarised in Table 2.2 and 2.3 respectively. Further details about the monitoring locations (including the seepage monitoring bores) are reported in *Phase 2 Groundwater Investigations – Stage 1 Gas Field development Area Gloucester Gas Project* (Parsons Brinckerhoff, 2012).

Table 2.2 Groundwater monitoring bore details

Monitoring Bore	Total depth (m)	Screened interval (mbgl)	Lithology	Formation	Monitoring commencement
S4MB01	66.0	58 - 64	Sandstone	Leloma Formation	Jan 2011
TMB01	12.0	7 – 10	Clay	Avon River Alluvium	Feb 2011
TMB02	15.5	9 – 12	Mixed gravels	Avon River Alluvium	Feb 2011
TMB03	12.5	5 – 11	Mixed gravels & sand	Avon River Alluvium	Feb 2011

mbgl = meters below ground level

Table 2.3 Stream gauges

Gauge ID	Location	Monitoring commencement
TSW01	Avon River downstream of the confluence with Dog Trap Creek and the irrigation areas, adjacent to monitoring bore TMB01	Mar 2011
TSW02	Dog Trap Creek upstream of the irrigation areas	Apr 2012
ASW01	Avon River upstream of the confluence with Dog Trap Creek	Mar 2011
FSW01	Avon River downstream of the Tiedman property and the confluence with Dog Trap Creek and the irrigation areas	Feb 2012

2.4 Water level monitoring

2.4.1 Groundwater level monitoring

Groundwater levels are electronically and manually measured in all monitoring bores (except TMB04 and TMB05 where only manual readings are taken). Pressure transducers with dataloggers suspended in the monitoring bore water column are programmed to record a groundwater level measurement every six hours. Manual measurements using an electronic dip meter are recorded every monitoring round and this is used to calibrate the logger data.

A barometric datalogger installed above the water table at S5MB01 records changes in atmospheric pressure. Data from this logger are used to correct for the effects of changing barometric pressure and barometric efficiency on groundwater levels.

2.4.2 Surface water level monitoring

Stream gauge stations include gauge boards and dataloggers to continuously monitor surface water levels and EC. A datalogger installed in the Tiedman south dam also monitors

15 minutes (at TSW01 and ASW01) or 60 minutes (TSW02). All measurements are verified and calibrated by manual gauge readings and EC monitoring.

2.5 Water quality monitoring

Three sampling methods were used to obtain baseline surface and groundwater samples. The groundwater sampling method was dictated by the permeability of the screened formation. Sampling techniques included:

- Submersible Whale 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.
- In-situ snap sampler for groundwater monitoring bore S4MB01, screened within material of relatively low permeability.
- Submersible Whale pump at the seepage monitoring bores TMB04 and TMB05 which are screened within material of very low permeability. The physical parameters of water within the bores are initially tested, then the bores are purged dry and if any inflow is observed within 12 hours then physical parameters are tested again and a sample taken for analysis.
- Grab sample using a rinsed sampling bucket for surface water samples.

Field parameters (see Table 2.4) were monitored during bore purging to ensure that they had stabilised prior to collection of a representative sample. Samples were sent to a NATA accredited laboratory for analysis. Two analytical suites were adopted:

- **A comprehensive water quality monitoring suite** was adopted for the October 2011 and September 2012 sampling rounds, and,
- **A basic water quality monitoring suite** adopted for the December 2011, February 2012, and June 2012 sampling rounds.

Table 2.4 details the basic and comprehensive analytical suite.

Table 2.4 Basic and comprehensive analytical suite

Category	Parameters	
Field parameters*	Electrical conductivity (EC; $\mu\text{S}/\text{cm}$)	Redox conditions (mV)
	Temperature ($^{\circ}\text{C}$)	pH
	Dissolved oxygen (DO% / mg/L)	
General parameters*	Electrical conductivity (EC)	Total dissolved solids (TDS)
	Total suspended solids	
Major ions*	<i>Cations</i>	<i>Anions</i>
	calcium	chloride
	magnesium	bicarbonate
	sodium	sulphate
	potassium	fluoride
		dissolved silica
Metals and minor/trace elements*	aluminium	manganese
	arsenic	molybdenum
	barium	mercury
	boron	nickel
	beryllium	lead
	bromine	selenium
	cadmium	strontium
	cobalt	uranium
	copper	vanadium
	iron	zinc
Nutrients*	Total nitrogen	nitrate
	ammonia	nitrite
	phosphorus (reactive)	
Hydrocarbons	Phenol compounds	Total petroleum hydrocarbons (TPH)
	Polycyclic aromatic hydrocarbons (PAH)	Benzene, toluene, ethyl benzene and xylenes (BTEX)

Note: * indicates the 'basic' analytical suite

Groundwater and surface water samples were sent to an NATA accredited laboratory, Australian Laboratory Service (ALS), under the appropriate chain-of-custody protocols for chemical analysis. Water quality samples were collected in the sample bottles provided by the laboratory, with the appropriate preservation when required. Table 2.5 details the sample bottles used. Samples undergoing dissolved metal analysis were filtered through 0.45 μm filters in the field prior to collection.

Table 2.5 Sample bottles

Category	Sample bottle
Major cations/anions	1 x 1 L plastic, unpreserved
Dissolved metals	1 x 60 mL plastic, preserved
Nutrients	1 x 125 mL plastic, preserved
Total organic carbon	1 x 40 mL amber glass, preserved
Phenols/PAH/TPH (C10-C36)	1 x 500 mL amber glass, unpreserved
TPH (C6-C9)/BTEX	2 x 40 mL amber glass, preserved

For quality assurance, a duplicate sample was taken during each monitoring round and industry standard sampling methodologies were used (Geoscience Australia 2009).

Table 2.6 summarises the analytical suites for each location during the baseline monitoring program.

Table 2.6 Water quality sampling summary

Sample ID	Analytical suite	Sampling methodology
Surface water samples (ASW01, TSW01, TSW02, FSW01)	Physical parameters, metals, nutrients, cations/anions quarterly, hydrocarbons annually	Grab sample
Tiedman Nth & Sth dams	Physical parameters, metals, nutrients, cations/anions quarterly, hydrocarbons annually	Grab sample
Alluvial groundwater monitoring bores (TMB01, TMB02, TMB03)	Physical parameters, metals, cations/anions quarterly, hydrocarbons and nutrients, annually	Whale
Shallow rock groundwater monitoring bore (S4MB01)	Physical parameters, metals, cations/anions quarterly, hydrocarbons and nutrients, annually	Snap sampler
Seepage monitoring bores (TMB04, TMB05)	Physical parameters then purge dry and assess inflows quarterly If inflow within 12 hours then physical parameters again, metals, nutrients, cations / anions	Whale

2.6 Sampling events and rainfall

The intended water quality sampling frequency for this baseline program was quarterly (i.e. every three months). A full 12 month period has now been assessed and no further baseline monitoring is anticipated in advance of the start of the irrigation program in early 2013. Figure 2.2 shows when sampling was undertaken in relation to daily rainfall recorded at the AGL weather station (AGL, 2012b). Note: TSW01 and S4MB01 were not sampled in October 2011, and S4MB01 was sampled in March 2012 for the February 2012 sampling event.

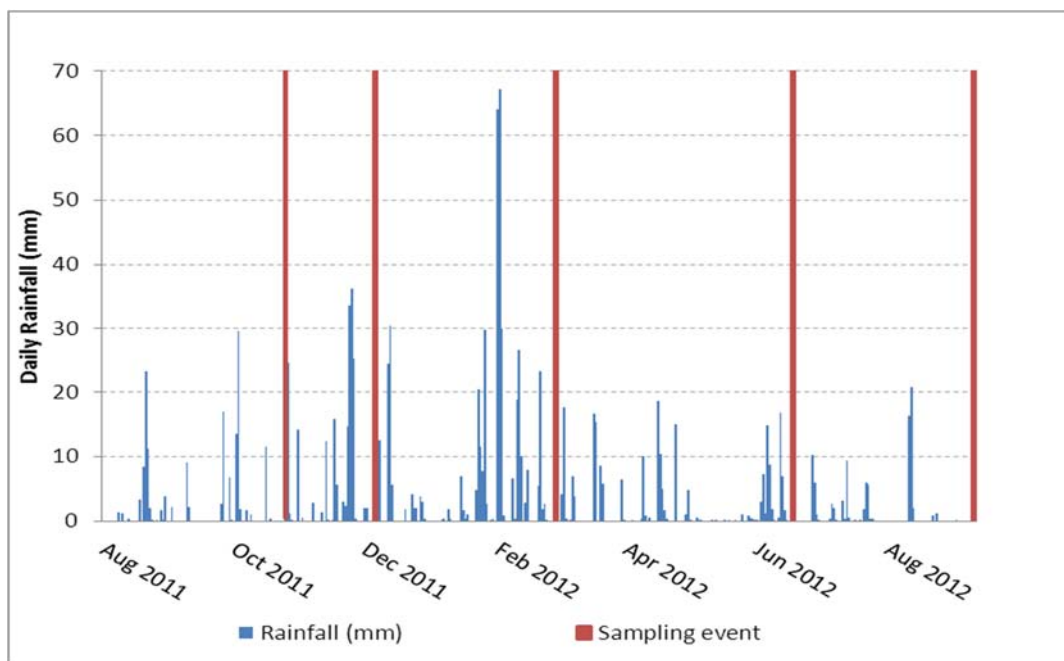


Figure 2.2 Sampling events and rainfall

All sampling events occurred on days with no rainfall, with the exception of the samples taken on 26 October 2011 from Tiedman south dam and Tiedman north dam.

Figure 2.3 compares the monthly rainfall from the AGL site weather station to the long term monthly average from the BoM weather station (Gloucester Hiawatha station, BoM 060112). With reference to Figure 2.2 it is clear the December 2011 and February 2012 monitoring rounds were undertaken following periods of greater than average rainfall.

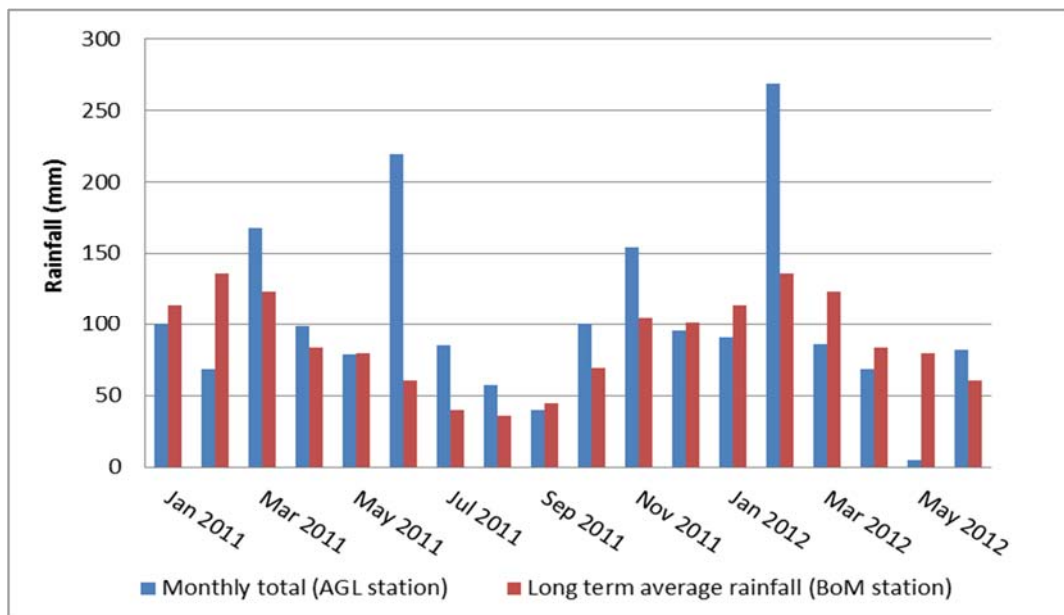


Figure 2.3 Comparison of monthly rainfall to the long term average monthly rainfall

3. Water level results

Groundwater hydrographs showing groundwater level and rainfall (from the AGL weather station, Gloucester Gas Project) are included in Figures 3.1 to 3.2, and surface water level fluctuation and rainfall in Figure 3.3. Individual hydrographs are presented in Appendix A.

3.1 Groundwater levels

3.1.1 Shallow alluvium

Three groundwater monitoring bores are screened within the shallow alluvial aquifer associated with the Avon River and Dog Trap Creek (TMB01, TMB02 and TMB03). In general, groundwater levels show a clear response to rainfall events. The magnitude and rate of the response to rainfall varies between the shallow alluvial bores (Figure 3.1). The greatest groundwater level responses were observed at TMB01 (a maximum of 2.54 m), followed by TMB02 (a maximum of 1.23 m) and TMB03 (a maximum of 1.05 m).

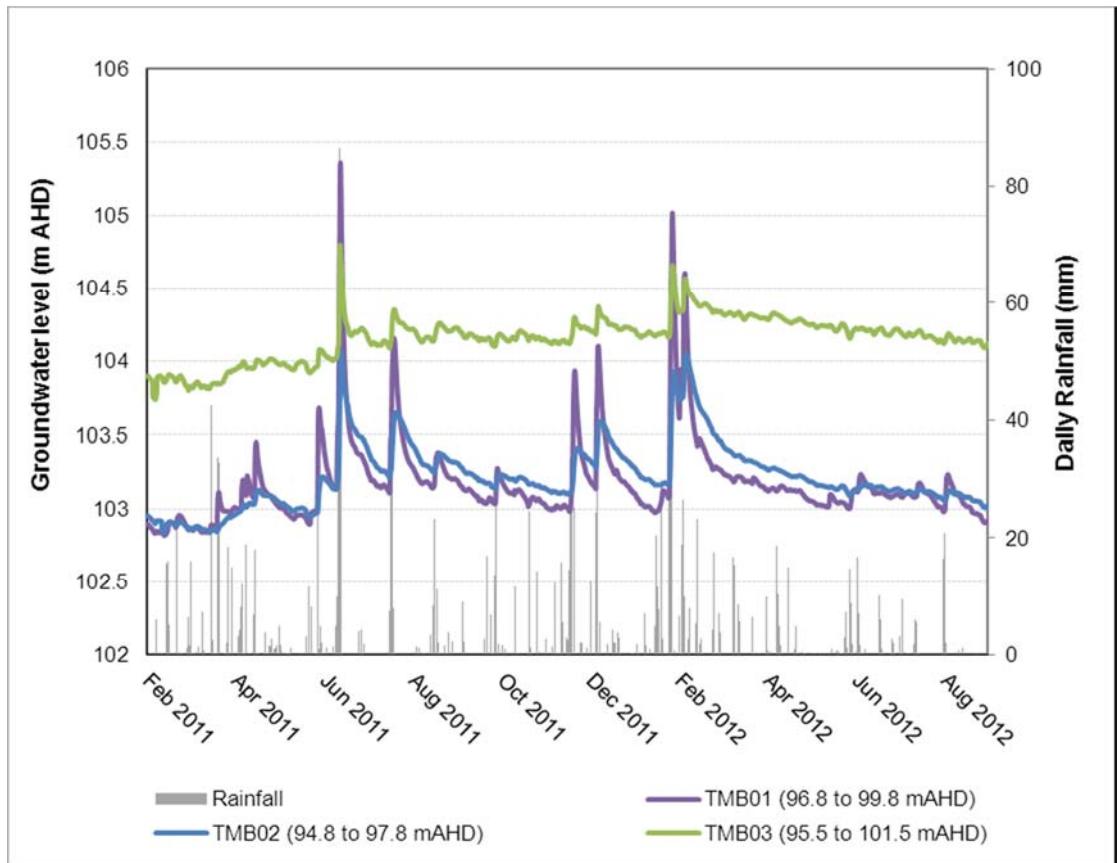


Figure 3.1 Groundwater levels and rainfall at the Tiedman alluvial bores

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 relatively direct recharge from rainfall and/or flooding and relatively high permeability of the alluvium.

- Monitoring bore TMB03 shows a more subdued response to rainfall recharge. In addition groundwater responses appear to be 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 rapid recharge during larger surface runoff and flooding events, but less significant recharge by direct rainfall infiltration alone.

These observations are consistent with field observations during bore installation that show that there is 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 due to smaller rainfall events.

3.1.2 Shallow Bedrock

The hydrograph for S4MB01 is presented in Figure 3.2. The groundwater level shows no direct response to rainfall although a gradual increase in groundwater level over the monitoring period totalling ~0.5 m is observed. Such a minimal response indicates that groundwater levels are responding to gradual recharge due to slow infiltration over a broad area. The effects of hydraulic testing ("slug" testing) and low flow sampling are visible in April 2011 and December 2011. The very slow recovery of groundwater levels after these events is consistent with low permeability in this unit (Parsons Brinckerhoff, 2012).

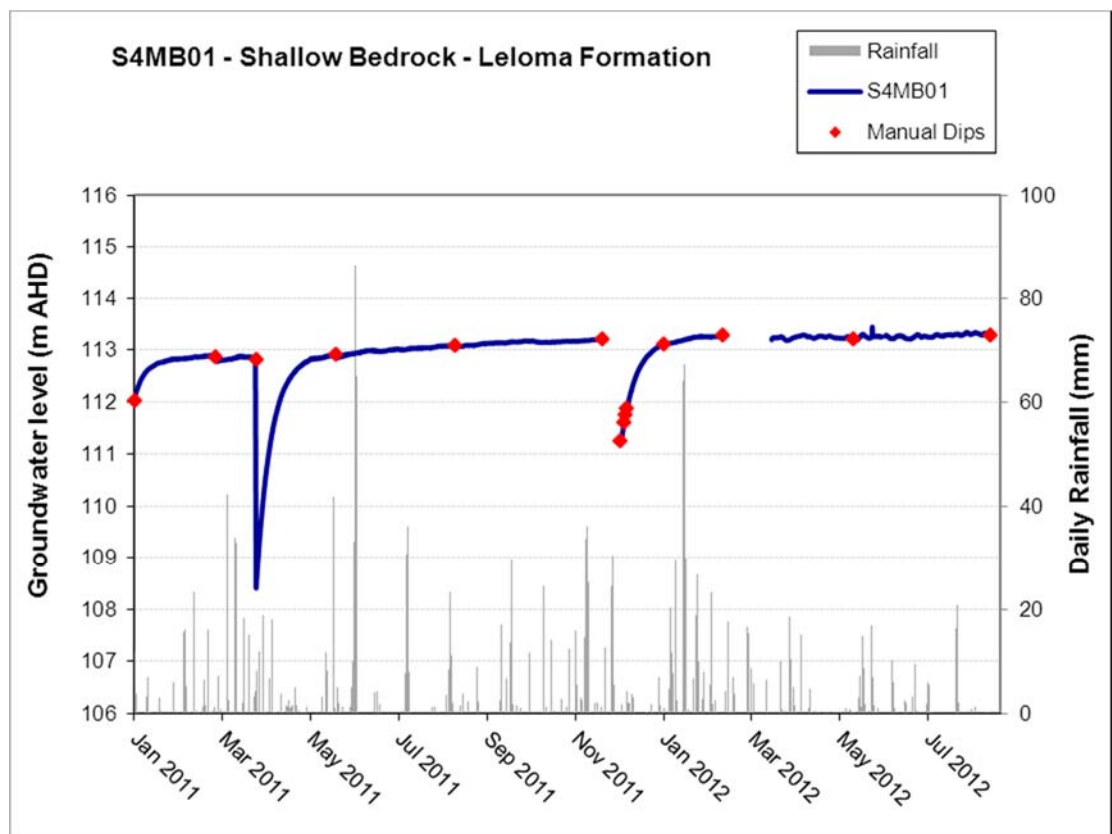


Figure 3.2 Groundwater levels and rainfall at the shallow bedrock

3.2 Surface Water

Surface water levels from stream gauges TSW01, TSW02, and ASW01 are shown in Figure 3.3. 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. This is consistent with a rapid runoff response from a relatively small upstream catchment and 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.

Anecdotal information suggests that the Avon River and its major tributaries cease to flow during prolonged drought conditions. The apparent continuous flow conditions and minor baseflow observed during the current monitoring period may therefore reflect the relatively high rainfall conditions that have prevailed over the last few years.

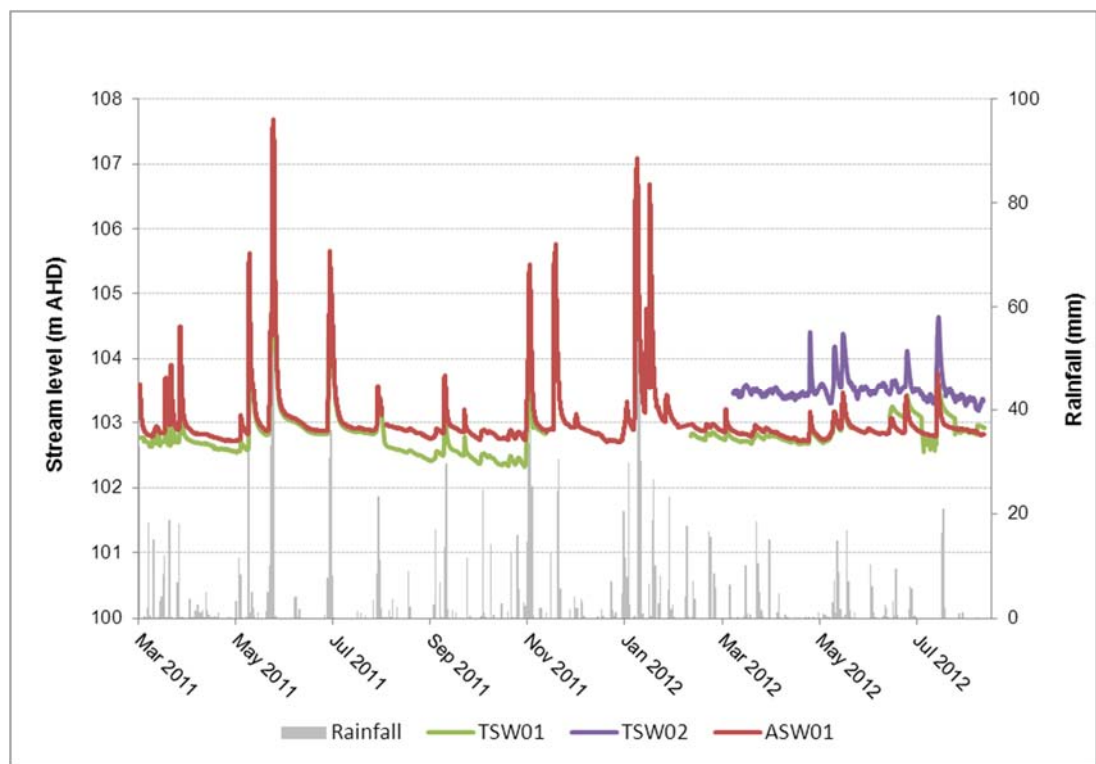


Figure 3.3 Surface water levels with rainfall

4. Water quality results

Water quality data are presented in Summary Tables 1 - 5. Groundwater and surface water quality time-series plots are provided in Figures B-1 to B-15 in Appendix B, piper diagrams in Appendix C and laboratory analysis reports in Appendix D. Appendix E outlines the QA / QC program, including the analysis of duplicate samples, and trip spikes and blanks.

It should be noted that the February 2012 EC field readings are considered inaccurate for each reading as the measured values was consistently higher compared to values calculated in Aquachem[®]. The calculated values were used instead (see Summary Tables).

4.1 Guidelines and threshold values

The surface water and groundwater water quality results have been compared against the ANZECC 2000 water quality guidelines (for freshwater aquatic ecosystems, southeast Australia and lowland rivers, 95% protection levels) as the rivers are the ultimate receiving waters for both surface water runoff and groundwater discharge. For some analytes there are no guideline criteria. The ANZECC (2000) guidelines are often naturally exceeded in catchments with rocks deposited in marine environments. This is the case for the Avon River catchment which contains shallow marine sedimentary rocks, and is a known saline catchment (Parsons Brinckerhoff, 2012). Baseline monitoring results presented in this report confirm that under natural, pre-irrigation conditions, groundwater and surface water at the site frequently exceeds the default guideline values.

The guidelines for fresh and marine water quality (ANZECC, 2000) recommend developing site specific guideline values that are derived from local reference data. Guideline values have accordingly been set at the 80th percentile of the natural concentrations observed during baseline monitoring. Where data are insufficient to calculate an 80th percentile, the maximum observed value has been adopted on the assumption that the baseline data reflect natural (pre-irrigation) conditions at the site. The ANZECC (2000) guideline allows for the trigger value to be modified as new baseline data become available by applying a rolling 80th percentile value incorporating the latest 24-month monitoring period. Where there is no ANZECC (2000) guideline criterion, no guideline values have been established; when the maximum analytical concentration is lower than the ANZECC (2000) guideline, the lower and more conservative guideline value is applied.

Water quality results for the holding dams have been compared to the ANZECC (2000) guidelines for Primary Industries (irrigation) as water from these dams will be used for irrigation.

The water quality and irrigation guidelines together with the site specific threshold values for alluvial groundwater, shallow bedrock groundwater and surface water are provided in Table 4.1. No thresholds are provided for perched groundwater at the Tiedman Dams because it is assumed to be soil/pore water and is not a water source.

Table 4.1 ANZECC (2000) water quality and irrigation guidelines, & site specific threshold values

Analyte	ANZECC – water quality guideline value	Alluvial aquifer threshold value	Shallow bedrock threshold value	Surface water threshold value	ANZECC – irrigation guideline value [@]	Dams maximum observed
pH (range)	6.5 – 8.0*	-	-	-	6 – 9	10.28
EC (µS/cm)	125 – 2,200*	8,500	6,200	-	2,000 [^]	4,575
Sodium	N/A	N/A	N/A	N/A	460 [#]	744
Aluminium (mg/L)	0.055	-	-	0.34	5	-
Boron (mg/L)	N/A	N/A	N/A	N/A	5	0.76
Cadmium (mg/L)	0.0002	-	-	0.0004	0.01	-
Copper (mg/L)	0.0014	0.006	0.002	0.007	0.2	-
Manganese (mg/L)	1.9	-	-	-	0.2	-
Molybdenum (mg/L)	N/A	N/A	N/A	N/A	0.05	0.02
Nickel (mg/L)	0.011	-	-	-	0.2	-
Zinc (mg/L)	0.008	0.15	0.021	0.19	2	-
Total P (mg/L)	0.05*	0.1	0.07	0.21	0.05	2.83
Ammonia (mg/L)	0.02*	0.37	2.45	-	N/A	N/A

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

^{*} ANZECC 2000 – Water Quality Guideline: 95% protection levels for aquatic ecosystems, South-East Australia, low lying river ecosystems.

[@] ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, short-term threshold values.

[#] medium risk of increasing crop cadmium concentrations and foliar injury in moderately tolerant crops;

[^] Average root zone salinity threshold for Lucerne, Hunter River .

– Maximum analyte concentration is lower than applicable ANZECC (2000) guideline value and thus no threshold value is required.

N/A – no guideline values, and thus no threshold value.

4.2 Shallow alluvium

4.2.1 Field parameters, and major ion chemistry

Groundwater sampled at monitoring bores screened within the shallow alluvium ranges from brackish (~3000 µS/cm in TMB01) to slightly saline (8,503 µS/cm in TMB03) and is typically of near neutral pH (6.32 to 7.77).

Electrical conductivity measurements were relatively consistent between sampling events at the alluvial bores (Figure B-2).

Groundwater in the alluvium tends to be under reducing (oxygen-poor) conditions; Dissolved oxygen concentrations were consistently low and consistent between sampling events.

Analysis of major ion components indicate that the groundwater is dominated by sodium (Na) and chloride (Cl), as shown on the Piper plots (Appendix C). Magnesium is an important ionic species at TMB01. The water types did not vary significantly between sampling events.

4.2.2 Dissolved metals

Zinc concentrations at all alluvial bores exceeded the ANZECC (2000) guideline criteria (0.008 mg/L) during every sampling event; some exceedances of the ANZECC (2000) copper criteria were also observed. Site specific threshold values have therefore been established for zinc and copper (Table 4.1, Figure B-10 and B-13).

Manganese and nickel concentrations were above the laboratory LOR but were below the applicable ANZECC (2000) guideline limit (1.9 mg/L and 0.011 mg/L, respectively) (Figure B-6 and B-9). Arsenic, barium, cobalt, strontium, uranium, iron and boron concentrations were above the laboratory LOR, however, there are no ANZECC (2000) guideline values for these analytes. The remaining dissolved metal analytes were below the relevant laboratory LOR.

No single alluvial monitoring bore consistently had the highest concentrations of total dissolved metals, although dissolved metal concentrations were typically lowest at TMB01.

4.2.3 Nutrients

Ammonia and total phosphorus concentrations were frequently above the ANZECC (2000) guideline criteria (0.02 mg/L and 0.05 mg/L, respectively) (Figure B-14 and B-15). Reactive phosphorus levels at TMB02 exceeded the ANZECC (2000) guideline limit (0.02 mg/L) on two occasions, the maximum total phosphorus concentration observed was 0.06 mg/L (June 2012). Total organic carbon concentrations were above the laboratory LOR at TMB01 only (maximum concentration 7 mg/L, December 2011), however, there is no ANZECC (2000) guideline level for this analyte. Nitrite and nitrate concentrations were either equivalent to or were below the laboratory LOR (0.01 mg/L) at all alluvial bores during all sampling events.

4.2.4 Total petroleum hydrocarbons and aromatic hydrocarbons

No TPH or BTEX were detected at the alluvial bores when sampled in October 2011 and September 2012.

4.3 Shallow Bedrock

4.3.1 Field parameters, and major cations and anions

Groundwater sampled from S4MB01 ranged from brackish (3,199 $\mu\text{S}/\text{cm}$) to slightly saline (8,193 $\mu\text{S}/\text{cm}$) with near neutral pH (6.5 to 7.16 pH units). A greater range of pH values was observed at S4MB01 compared to the alluvial monitoring bores (Figure B-1). The redox conditions were reducing and dissolved oxygen levels were consistently low.

The water type at S4MB01 was Na-Ca-Cl as shown on the Piper plots (Appendix C).

4.3.2 Dissolved metals

Zinc concentrations at S4MB01 exceeded the water quality ANZECC (2000) guideline criteria on all sampling occasions, the maximum concentration was 0.021 mg/L (June 2012) (Appendix B, Figure B-13). Copper concentrations exceeded the ANZECC (2000) guideline

value on two occasions (with a measurement of 0.002 mg/L in December 2011 and March 2012) (Figure B-10).

Manganese, nickel, strontium and boron concentrations were above the laboratory LOR, but were below the applicable ANZECC (2000) guideline criteria. Of these analytes the strontium concentration was the highest and the maximum result observed was 24.7 mg/L (March 2012). Arsenic, barium, uranium, iron and bromine were detected; however, there are no ANZECC (2000) guidelines for these analytes. The remaining dissolved metal analytes were equivalent to or were below the laboratory LOR.

4.3.3 Nutrients

Ammonia concentrations at S4MB01 were above the ANZECC (2000) guideline limit (0.02 mg/L) on all sampling occasions; the maximum ammonia concentration was 2.45 mg/L (June 2012). During the March 2012 sampling event total phosphorus concentration (0.48 mg/L) exceeded the ANZECC (2000) guideline limit (0.04 mg/L) (Figure B-15). Nitrate concentrations were elevated during the December 2011 and March 2012 sampling events, but were below the ANZECC (2000) guideline limit (0.7 mg/L). Total organic carbon levels were elevated, a maximum concentration of 135 mg/L (March 2012) was observed, however there are no ANZECC (2000) guidelines for this analyte.

4.3.4 Total petroleum hydrocarbons and aromatic hydrocarbons

No TPH or BTEX were detected at the shallow bedrock monitoring bore when sampled in October 2011 and September 2012.

4.4 Surface Water

4.4.1 Field parameters, and major cations and anions

Surface water salinity (measured as EC) is inversely correlated with rainfall and surface water flow. Typically surface water EC sharply decreases after rainfall events as relatively fresh runoff is routed into streams (Figure 4.1). However an 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. After the initial salinity spike and a reduction in EC levels, the EC gradually increases as flow decreases during periods of recession, and as groundwater discharge becomes a more dominant component of flow. Evaporative concentration of salts may also be taking place in residual and connected pools.

Overall the surface water can be classified as fresh; the maximum EC concentration observed from the grab sample results was 848 $\mu\text{S}/\text{cm}$ (TSW02, February 2012) and from continuous logging was 1,900 $\mu\text{S}/\text{cm}$ (TSW02, July 2012). Electrical conductivity values were often highest at the upstream monitoring location TSW02.

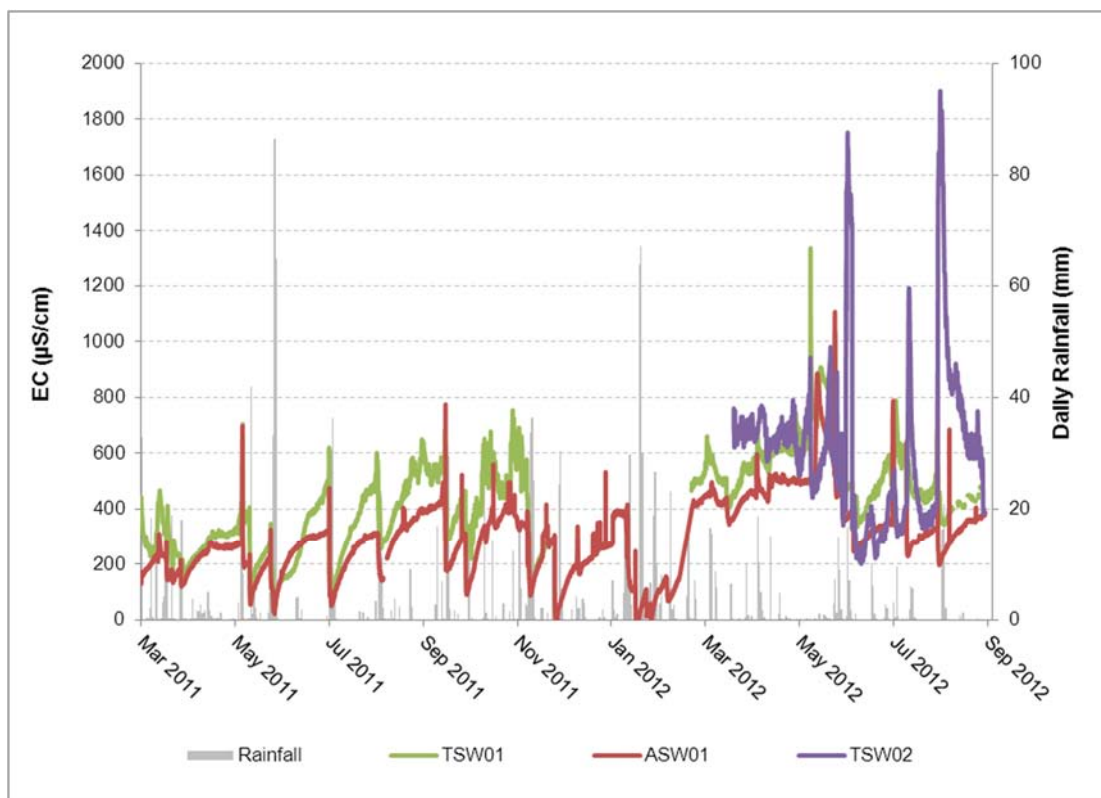


Figure 4.1 Continuous EC logging results at stream gauges

The pH ranged from 5.88 (ASW01, February 2012) to 7.9 (ASW01, December 2012). Excluding the uncharacteristically low pH value at ASW01 (5.88, February 2012) the pH conditions were neutral and mostly comparable between sampling events (Figure B-1).

The redox potential ranged from -175.6 mV to 91.1 mV, although redox environments were predominantly reducing. Surface water dissolved oxygen levels were typically higher than groundwater levels, and a greater range was observed (44% saturation, FSW01; 150% saturation, TSW01).

The water type was Na-Mg-Ca-Cl-HCO₃ as shown on the piper plots (Appendix C).

4.4.2 Dissolved metals

Aluminium, copper and zinc concentrations exceeded the applicable ANZECC (2000) guideline criteria. With the exception of aluminium concentrations, surface water dissolved metal concentrations were typically lower than measurements observed in the shallow alluvium and shallow bedrock. The maximum zinc concentration was 0.189 mg/L (TSW01, December 2012). Manganese concentrations were above the laboratory LOR, but were lower than the water quality ANZECC (2000) guideline value (1.9 mg/L). Barium, strontium, iron and boron concentrations were above the laboratory LOR, however there are no guidelines for these analytes. The remaining dissolved metal analytes were either equivalent to or were below the laboratory LOR.

4.4.3 Nutrients

Ammonia concentrations frequently exceeded the ANZECC (2000) guideline criteria (0.02 mg/L) and the maximum concentration observed was 0.22 mg/L (FSW01, August

2012). Nitrite levels were below the laboratory LOR (<0.01 mg/L) during all sampling occasions; nitrate levels were above the laboratory LOR, but were below the ANZECC (2000) guideline limit (0.7 mg/L).

Some exceedances of the ANZECC (2000) guideline limit for total and reactive phosphorus concentrations were observed in the first two sampling events and the maximum total phosphorus concentration was 0.21 mg/L (TSW01, October 2011). Total organic carbon concentrations were elevated and ranged between 5 mg/L and 17 mg/L (both at TSW01).

4.4.4 Total petroleum hydrocarbons and aromatic hydrocarbons

No TPH or BTEX were detected at the surface water monitoring locations when sampled in October 2011 and September 2012.

5. Tiedman dams

5.1 Water quality

5.1.1 Field parameters

Water in the Tiedman dams ranged from 1,810 $\mu\text{S}/\text{cm}$ (TSD, June 2012) to 6,238 $\mu\text{S}/\text{cm}$ (TND, February 2012). EC measurements are typically lower in the Tiedman south dam, although the water is brackish in both dams. The continuous EC logger data for the Tiedman south dam is plotted in Figure 5.1, and shows EC fluctuating within a 500 $\mu\text{S}/\text{cm}$ range due to water inputs and evaporation.

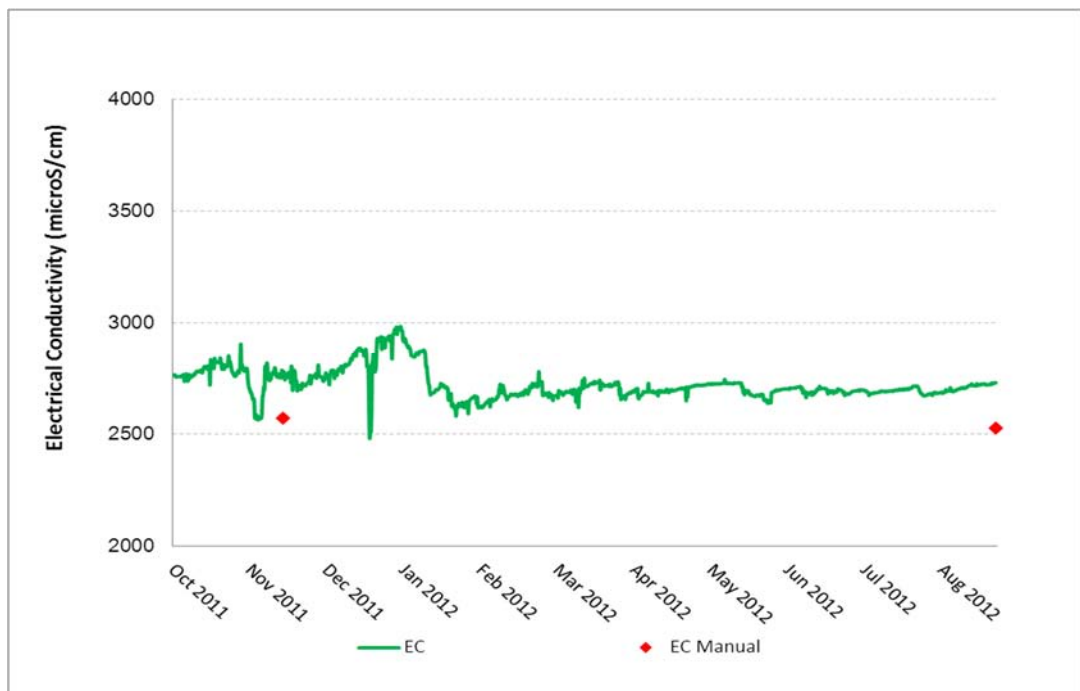


Figure 5.1 Continuous EC data at Tiedman south dam

The pH measurements were often comparable between the two dams (Appendix B, Figure B-1). The pH measurements were moderately alkaline, ranging from 9.58 (TSD, August 2012) to 10.28 (TND, February 2011)).

The redox potential ranged from - 25.7 mV (TSD, August 2012) to -172 (TND, June 2012), indicating predominantly reducing conditions. Dissolved oxygen levels were high and fluctuated; DO concentrations ranged from 72% saturation (TSD, October 2011) to 234 % saturation (TND, February 2012).

The water type for the Tiedman south dam was Na-Cl-HCO₃ and for the Tiedman north dam was Na-K-Cl-HCO₃ (Appendix C). In both Tiedman dams the chloride concentrations were below the irrigation ANZECC (2000) guideline criteria (700 mg/L) while sodium concentrations were consistently elevated above the guideline criteria (460 mg/L). The maximum sodium concentration was 744 mg/L (TND, October 2011). It is noted that, prior to irrigation, the raw dam water will be blended with fresh (surface) water to within irrigation guideline values and to minimise soil degradation.

5.1.2 Dissolved metals

Manganese, molybdenum, aluminium, arsenic, boron and copper concentrations were above the applicable laboratory LOR, but were below the irrigation ANZECC (2000) guideline criteria. The maximum molybdenum concentration was 0.02 (both the Tiedman north and south dam, October 2011) and the maximum boron concentration was 0.796 mg/L (Tiedman north dam, June 2012). Dissolved metal analytes were mostly comparable between the two dams and between sampling events.

5.1.3 Nutrients

Total phosphorus concentrations exceeded the ANZECC (2000) guideline criteria (0.05 mg/L) at both dams during all sampling occasions. The maximum total phosphorus concentration was 2.83 mg/L (TND, August 2012); concentrations were relatively higher in the Tiedman north dam. Ammonia and TOC concentrations were above the laboratory LOR, however there are no irrigation guideline criteria (ANZECC 2000) for these analytes. The maximum ammonia concentration observed was 0.14 mg/L (TSD, February 2012) and the maximum TOC concentration was 63 mg/L (TND, August 2012). The remaining nutrient analyte concentrations were below the applicable laboratory LOR.

5.1.4 Total petroleum hydrocarbons and aromatic hydrocarbons

The medium to heavy-end TPH fractions were elevated at both Tiedman dams during the October 2011 sampling event and at Tiedman north dam during the September 2012 sampling event. TPH concentrations were relatively higher in the Tiedman north dam, and the maximum concentration observed was 550 µg/L (C₁₀ – C₃₆ fraction, October 2011).

No exceedances of the aromatic hydrocarbons (BTEX) were observed during sampling.

5.2 Seepage monitoring bores

5.2.1 Water levels

Water was present in each of the seepage monitoring bores when dipped on a quarterly basis. Since the bores have occasionally been dry following periods of low rainfall, it is assumed that the bores intersect a perched water table that may not be directly connected with the regional water table. There was little variation in the measured water levels during the year with both bores having water levels around 113.5 mAHD (i.e. depth to water of around 11.7 mbTOC in TMB04, and 5.9 mbTOC in TMB05). After static water levels were taken, each bore was purged dry and on each occasion sufficient soil/pore water returned to the bore within 12 hours to take a water sample. Water levels returned to around the previously recorded static level. The available perched water is thought to represent the constant wet conditions that prevailed during 2011/12.

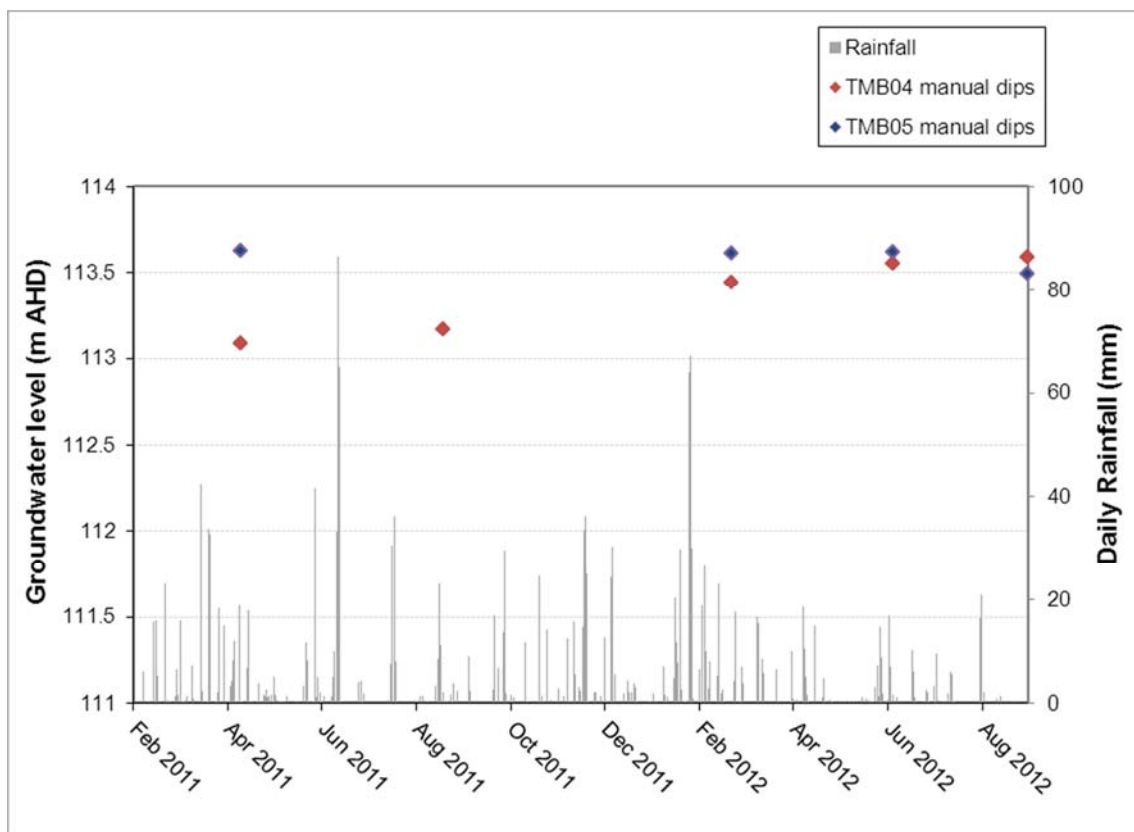


Figure 5.2 Seepage monitoring hydrographs

5.2.2 Water quality

5.2.2.1 Field parameters, and major cations and anions

Electrical conductivity measurements ranged from 5,379 $\mu\text{S}/\text{cm}$ (TMB04, June 2012) to 7,455 $\mu\text{S}/\text{cm}$ (TMB04, March 2012) and conditions were slightly saline. The seepage monitoring bore EC concentrations exceeded the water quality ANZECC (2000) guideline criteria and the EC results were relatively higher than the Tiedman dam EC measurements (Appendix B, Figure B-2).

The pH values ranged from 5.7 (TMB04, March 2012) to 6.54 (TMB05, June 2012), pH conditions were slightly acidic to neutral. The redox conditions were mildly oxidising and the maximum redox value was 116 mV (TMB04, June 2012).

The water type for both TMB04 and TMB05 was Na-Mg-Cl dominant which contrasts with both groundwater within the shallow rock elsewhere and also water from the Tiedman dams. Figure 5.3 shows that groundwater from the seepage monitoring bores can be distinguished from Tiedman dam water on the basis of K/Cl and Na/Cl ratios. It is noted that dam water samples contain distinctly higher K/Cl and Na/Cl ratios than both groundwater and surface water, with the South dam having higher K/Cl than the North dam. The major element ratios sampled from the seepage monitoring bores are similar to other groundwater samples and clearly distinct from the Tiedman dam samples. One notable exception is a sample collected from TMB04 in September 2012 which has anomalously high Na/Cl. The water quality at TMB04 will be reassessed at the next monitoring round.

On the basis of major ion chemistry it is concluded that groundwater from the seepage bores represents perched groundwater rather than seepage from the Tiedman Dams.

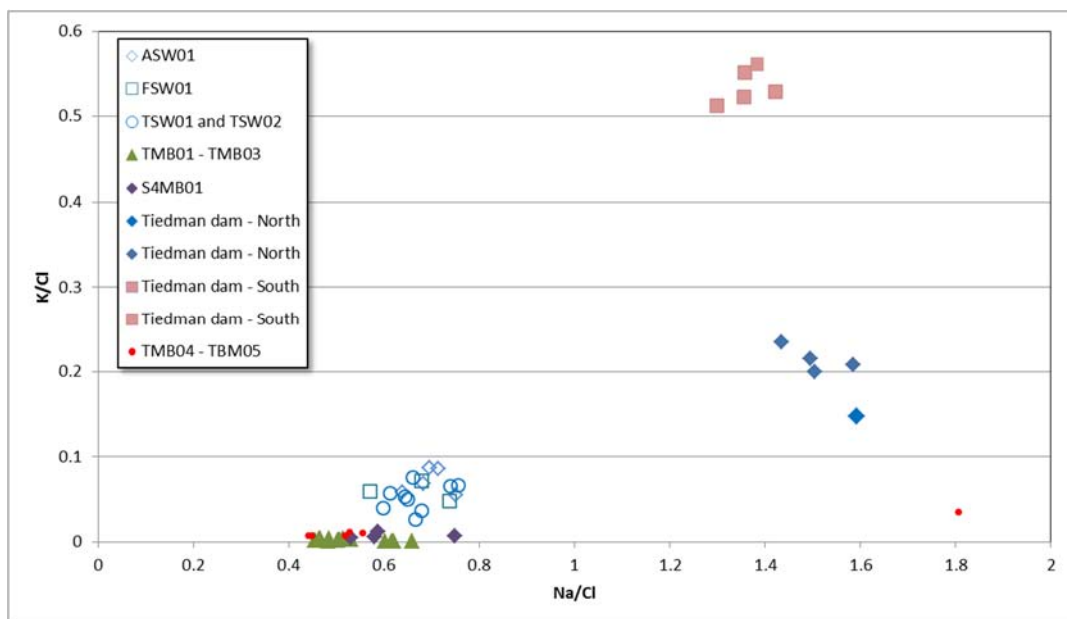


Figure 5.3 Bivariate plot of K/Cl versus Na/Cl for water analyses

5.2.2.2 Dissolved metals

Cadmium, copper, manganese, nickel and zinc concentrations were consistently above the ANZECC (2000) guideline criteria and two exceedances of aluminium above the guideline level were observed. The maximum iron concentration was 80 mg/L (TMB05, June 2012) and the maximum manganese concentration was 24.9 mg/L (TMB05, June 2012) (Appendix B, Figure B-11 and B-6).

Arsenic, barium, cobalt, strontium, iron and bromine concentration were above the laboratory LOR, however, there are no applicable ANZECC (2000) guideline criteria for these analytes. The remaining dissolved metal analytes were below the laboratory LOR. Overall dissolved metal concentrations (in particular iron and manganese concentrations) were slightly higher at the seepage monitoring bores.

5.2.2.3 Nutrients

Ammonia and total phosphorus concentrations were above the relevant ANZECC (2000) guideline limits; the maximum ammonia concentration observed was 0.21 mg/L (TMB05, March 2012) and the maximum phosphorus concentration observed was 2.13 mg/L (TMB04, August 2012). Total organic carbon concentrations were elevated and ranged from 4 mg/L (TMB04, March 2012) to 17 mg/L (June 2012). Nitrite, nitrate and reactive phosphorus concentrations were either below the laboratory LOR or were low.

6. Discussion

6.1 Water levels

Continuous monitoring indicates that the alluvial groundwater levels and surface water levels respond to rainfall recharge. 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 alluvial bores; 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 rainfall response is observed at the shallow bedrock monitoring bore (S4MB01) suggesting groundwater levels respond to gradual rainfall recharge over a broad area.

6.2 Water quality

Groundwater and surface water quality parameters were assessed and compared to the water quality ANZECC (2000) guidelines for the protection of aquatic ecosystems and irrigation. Where water quality parameters frequently exceeded the ANZECC (2000) guideline criteria, site specific threshold values based on this baseline data set were determined.

6.2.1 Groundwater

Monitoring indicated that conditions were brackish to slightly saline at the alluvium and shallow bedrock aquifers, and slightly acidic to neutral at the alluvium and neutral at the shallow bedrock aquifer. Zinc and to a lesser extent copper measurements were above the ANZECC (2000) guideline criteria at both the alluvium and shallow bedrock and therefore site specific guidelines have been adopted for these analytes. Ammonia concentrations also exceeded the ANZECC (2000) criteria and total organic carbon levels were elevated in the alluvium and shallow bedrock aquifers, while total phosphorus concentrations exceeded the ANZECC (2000) criteria in the alluvium.

These are the natural characteristics of the groundwater in these formations.

6.2.2 Surface water

The surface water was neutral and fresh; the highest EC measurements were observed upstream (at TSW02). Zinc, copper and aluminium concentrations were exceeded above the ANZECC (2000) guideline criteria, although with the exception of aluminium concentrations, the surface water dissolved metal concentrations were relatively lower than groundwater concentrations. Surface water ammonia concentrations were above the guideline limit, and on occasion total and reactive phosphorus concentrations exceeded the guideline criteria.

Apart from the nutrient concentrations these are the natural characteristics of the groundwater in these formations.

6.2.3 Tiedman dams

Water quality monitoring in the Tiedman dams indicates that the water is alkaline and brackish to slightly saline; EC measurements were higher in the Tiedman north dam during the monitoring period. Sodium levels were above the ANZECC (2000) guideline criteria. Dissolved metal concentrations were mostly above the laboratory LOR, and dissolved metals

concentrations were comparable between the two dams. It is noted however that water from the dams will be blended with fresher (surface) water prior to irrigation to meet water quality objectives and minimise the potential for impact on the soil structure.

Total phosphorus levels exceeded the ANZECC (2000) guideline criteria, and ammonia and TOC concentrations were elevated; overall nutrient concentrations were highest at the Tiedman north dam. The medium to heavy-end TPH fractions were elevated above the laboratory LOR at both dams and concentrations were higher in the Tiedman north dam. Overall the water quality in the Tiedman south dam is more suitable for blending and irrigation.

6.2.4 Seepage bores

The perched groundwater intersected by the seepage monitoring bores was slightly saline and slightly acidic to neutral. The pH and EC of this water differs to the results from the Tiedman dams: EC measurements are higher and pH concentrations lower in the soil/pore water compared to the dam water. Although the major cations and anions (sodium and chloride) were the same for the dams and seepage bores the minor ion chemistry differed.

Dissolved metals were relatively high (in particular iron and manganese concentrations), and frequent exceedances of the ANZECC (2000) guideline criteria were observed. Ammonia and total phosphorus concentrations exceeded the ANZECC (2000) guideline criteria, and TOC concentrations were elevated. Overall dissolved metal concentrations were higher in the seepage bores compared to the Tiedman dam, while nutrient concentrations were relatively lower.

The differences in minor ion and dissolved metal chemistry, in addition to different nutrient concentrations, indicates that the soil/pore water in TMB04 and TMB05 is not derived from leakage from the Tiedman dams. In addition, the elevated salinity and high concentrations of certain trace metals, including iron and manganese contrasts with both groundwater from the fractured rock elsewhere and also water from the dams. This suggests that groundwater intersected in these bores represents a local perched system that contrasts chemically with groundwater in the shallow rock elsewhere (having equilibrated with weathered siltstones and clays) and does not represent seepage from the dams.

7. Conclusions

The current groundwater and surface water monitoring network has established baseline water levels and quality for the shallow groundwater (alluvial and shallow bedrock) and the adjacent surface water receptors. Monitoring, both continuous and quarterly, provided a basis for the assessment of water level trends and water quality parameters; where applicable water quality results were compared to the ANZECC (2000) guideline criteria.

In addition a baseline dataset that monitors salinity changes over time in the Tiedman dams and assesses the possible leakage from the dams has been developed.

7.1 Recommendations

The following specific recommendations can be made:

- Surface water and groundwater monitoring should continue as outlined in the approved WMP (AGL 2012).
- The site specific interim threshold values should be updated if necessary, if there is additional baseline monitoring in advance of the irrigation program.
- The installation of electronic water level loggers at TMB04 and TMB05 would provide continuous water level monitoring. This data would allow the response to rainfall at the seepage bores to be better examined and thus the precise reason for the water level accumulations and any fluctuations could be further explored.

8. Limitations

8.1 Scope of services

This environmental site assessment 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, including the presence or otherwise of contaminants or emissions.

Also, it should be recognised that site conditions, including the extent and concentration of contaminants, can change with time.

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

8.4 Report for benefit of 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

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Summary Tables

SUMMARY TABLE 1 Irrigation Water Quality Parameters: October 2011

Water quality parameters	Units	ANZECC 2000 Guidelines Ecosystems	ANZECC 2000 Guidelines Irrigation	TMB01	TMB02	TMB03	TSW01	ASW01	TDS	TDN
Formation				Alluvium	Alluvium	Alluvium	Surface Water	Surface Water	Dam	Dam
Sample date				25/10/2011	25/10/2011	25/10/2011	25/10/2011	25/10/2011	26/10/2011	26/10/2011
Field parameters										
Temperature	oC	-	-	18.27	18.18	17.1	20.56	20.75	19.23	18.93
Conductivity	µS/cm	125 - 2200*	2000^	8503	3421	5135	588	291	2538	3608
Dissolved Oxygen	% sat	-	-	38.7	36.2	35.6	104.2	55.8	72	94.7
Dissolved Oxygen	mg/L	-	-	-	-	-	-	-	-	-
pH	pH units	6.5 - 8.0 *	6.0 - 9.0	6.55	6.33	6.78	7.21	6.95	9.96	9.9
TDS	mg/L	-	-	-	2.222	-	-	-	1.65	2.345
Redox	mV	-	-	-161.4	-109.6	-112.2	-122	-114.7	-105.7	-99.1
General Parameters										
pH	pH units	6.5 - 8.0*	6.0 - 9.0	-	-	-	-	-	-	-
Conductivity	µS/cm	125 - 2200*	2000^	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	-	-	-	-	-	-	-	-	-
Laboratory Analytes										
Hydroxide Alkalinity as CaCO3	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	-	-	<1	<1	<1	<1	<1	319	564
Bicarbonate Alkalinity as CaCO3	mg/L	-	-	557	179	439	68	58	429	514
Total Alkalinity as CaCO3	mg/L	-	-	557	179	439	68	58	748	1080
Sulfate as SO4 2-	mg/L	-	-	90	32	180	11	2	6	<1
Chloride	mg/L	-	700**	2940	1040	1330	76	46	387	538
Calcium	mg/L	-	-	242	115	135	12	12	2	1
Magnesium	mg/L	-	-	246	74	115	10	7	1	<1
Sodium	mg/L	-	460**	1340	527	875	49	32	616	744
Potassium	mg/L	-	-	4	3	1	4	4	57	302
Fluoride	mg/L	-	-	-	-	-	-	-	-	-
Sulfur	mg/L	-	-	-	-	-	-	-	-	-
Water type	-	-	-	Na-Mg-Cl	Na-Cl	Na-Cl	Na-Mg-Cl-HCO3	Na-Ca-Mg-Cl-HCO3	Na-Cl-HCO3	Na-K-Cl-HCO3
Dissolved Metals										
Aluminium	mg/L	0.055	20	<0.01	<0.01	<0.01	0.02	0.02	0.04	0.02
Arsenic	mg/L	0.013 (As V)	2	0.002	0.001	0.004	<0.001	<0.001	0.006	0.005
Beryllium	mg/L	ID	0.5	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	-	-	0.262	0.167	0.656	0.045	0.049	0.211	0.113
Cadmium	mg/L	0.0002	0.05	<0.0001	0.0002	<0.0001	<0.0001	0.0003	<0.0001	<0.0001
Cobalt	mg/L	ID	0.1	<0.001	0.004	0.003	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	0.0014	5	0.002	0.003	0.004	0.004	0.004	0.002	0.002
Lead	mg/L	0.0034	5	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	1.9	10	1.04	1.31	1.12	0.163	0.2	0.004	0.003
Molybdenum	mg/L	ID	0.05	<0.001	<0.001	<0.001	<0.001	<0.001	0.02	0.02
Nickel	mg/L	0.011	2	<0.001	0.001	0.002	0.001	0.001	0.004	0.002
Selenium	mg/L	0.011 (total)	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	mg/L	-	-	6.46	3.43	2.7	0.168	0.16	0.284	0.169
Uranium	mg/L	ID	0.1	0.004	0.017	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	mg/L	ID	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	0.008	5	0.022	0.012	0.034	0.027	0.026	0.041	0.03
Boron	mg/L	0.37	5	<0.05	<0.05	<0.05	<0.05	<0.05	0.51	0.7
Iron	mg/L	ID	10	3.4	0.54	4.84	0.26	0.4	<0.05	<0.05
Bromine	mg/L	ID	-	4	2.1	1.9	0.1	<0.1	0.8	1.4
Nutrients										
Ammonia as N	mg/L	0.02*	-	0.19	0.09	0.32	<0.01	0.05	0.02	0.1
Nitrite as N	mg/L	-	-	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/L	0.7	-	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	<0.01
Total Phosphorous	mg/L	0.05*	0.8	0.08	0.06	0.1	0.21	0.17	0.45	1.8
Reactive Phosphorous	mg/L	0.02*	-	<0.01	<0.01	<0.01	0.04	0.06	<0.01	<0.01
Total Organic Carbon	mg/L	-	-	1	<1	<1	17	12	49	48
Total petroleum hydrocarbons										
C6-C9 Fraction	µg/L	ID	-	<20	<20	<20	<20	<20	<20	<20
C10-C14 Fraction	µg/L	ID	-	<50	<50	<50	<50	<50	<50	130
C15-C28 Fraction	µg/L	ID	-	<100	<100	<100	<100	<100	140	340
C29-C36 Fraction	µg/L	ID	-	<50	<50	<50	<50	<50	<50	80
C10-C36 Fraction (sum)	µg/L	-	-	<50	<50	<50	<50	<50	140	550
Total recoverable hydrocarbons										
C6-C10 Fraction	µg/L	-	-	<20	<20	<20	<20	<20	<20	<20
C6-C10 Fraction (minus BTEX)	µg/L	-	-	<20	<20	<20	<20	<20	<20	<20
>C10-C16 Fraction	µg/L	-	-	<100	<100	<100	<100	<100	<100	200
>C16-C34 Fraction	µg/L	-	-	<100	<100	<100	<100	<100	200	310
>C34-C40 Fraction	µg/L	-	-	<100	<100	<100	<100	<100	<100	<100
>C10-C40 Fraction (sum)	µg/L	-	-	<100	<100	<100	<100	<100	200	510
Aromatic Hydrocarbons										
Benzene	µg/L	950	-	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/L	ID	-	<5	<5	<5	<5	<5	<5	<5
Ethyl Benzene	µg/L	ID	-	<2	<2	<2	<2	<2	<2	<2
m&p-Xylenes	µg/L	ID	-	<2	<2	<2	<2	<2	<2	<2
o-Xylenes	µg/L	350	-	<2	<2	<2	<2	<2	<2	<2
Total xylenes	µg/L	-	-	<2	<2	<2	<2	<2	<2	<2
Sum of BTEX	µg/L	-	-	<1	<1	<1	<1	<1	<1	<1
Naphthalene	µg/L	0.016	-	<5	<5	<5	<5	<5	<5	<5

Notes: Bold type indicates a significant

ID - Insufficient data

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

* ANZECC 2000 - Water Quality Guidelines: 95% protection levels (trigger values) for the protection of freshwater aquatic ecosystems, South-East Australia, low lying river ecosystems

ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, short-term trigger values

^ ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, Average root zone salinity threshold for Lucerne, Hunter River

**ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, medium risk of increasing cadmium concentrations and foliar injury in moderately tolerant crops

SUMMARY TABLE 2 Irrigation Water Quality Parameters: December 2011

Water quality parameters	Units	ANZECC 2000 Guidelines Ecosystems	ANZECC 2000 Guidelines Irrigation	S4MB01	TMB01	TMB02	TMB03	TSW01	TSW02	ASW01	TSD	TND
Formation				Shallow Bedrock	Alluvium	Alluvium	Alluvium	Surface Water	Surface Water	Surface Water	Dam	Dam
Sample date				6/12/2011	6/12/2011	6/12/2011	6/12/2011	6/12/2011	6/12/2011	7/12/2011	6/12/2011	6/12/2011
Type												
Field parameters												
Temperature	oC	-	-	26.48	19.68	19.61	18.75	18.28	19.52	17.22	21.2	21.37
Conductivity	µS/cm	125 - 2200*	2000^	3199	8213	3407	5356	297	567	271	3768	2568
Dissolved Oxygen	% sat	-	-	14.2	50.8	56.9	42	68.9	108.7	72.5	142.9	78.5
Dissolved Oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-
pH	pH units	6.5 - 8.0 *	6.0 - 9.0	7.16	6.7	6.5	6.87	7.33	7.51	7.9	9.83	9.62
TDS	mg/L	-	-	2.075	5.338	2.214	3.482	0.318	0.368	0.176	2.443	1.669
Redox	mV	-	-	-136.1	-122	-151.3	-157	-113.3	-175.6	-123.6	-170.4	-172
General Parameters												
pH	pH units	6.5 - 8.0*	6.0 - 9.0	-	-	-	-	-	-	-	-	-
Conductivity	µS/cm	125 - 2200*	2000^	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	-	-	-	-	-	-	-	-	-	-	-
Laboratory Analytes												
Hydroxide Alkalinity as CaCO3	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	363	665
Bicarbonate Alkalinity as CaCO3	mg/L	-	-	281	503	149	453	60	70	51	363	412
Total Alkalinity as CaCO3	mg/L	-	-	281	503	149	453	60	70	51	726	1080
Sulfate as SO4 2-	mg/L	-	-	63	97	25	213	6	4	6	5	<10
Chloride	mg/L	-	700**	841	2810	1040	1410	46	75	44	400	542
Calcium	mg/L	-	-	141	229	114	136	11	11	11	2	1
Magnesium	mg/L	-	-	35	237	74	119	7	11	7	1	<1
Sodium	mg/L	-	460**	494	1280	484	870	34	50	30	574	704
Potassium	mg/L	-	-	10	4	4	1	3	2	3	94	278
Fluoride	mg/L	-	-	0.4	0.5	0.2	0.3	0.1	0.1	0.1	0.6	0.6
Sulfur	mg/L	-	-	21	30	8	62	2	2	2	5	3
Hardness (CaCO3)	meq/L	-	-	496	1550	589	830	56	73	56	9	1550
Water type		-	-	Na-Ca-Cl	Na-Mg-Cl	Na-Cl	Na-Cl	Na-Mg-Ca-Cl-HCO3	Na-Mg-Cl-HCO3	Na-Mg-Ca-Cl-HCO3	Na-Cl-HCO3	Na-K-Cl-HCO3
Dissolved Metals												
Aluminium	mg/L	0.055	20	0.01	<0.01	0.06	0.02	0.13	0.03	0.14	0.04	0.08
Arsenic	mg/L	0.013 (As V)	2	0.003	0.001	0.004	0.002	0.001	<0.001	<0.001	0.006	0.006
Beryllium	mg/L	ID	0.5	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	-	-	1.07	0.256	0.715	0.19	0.047	0.036	0.05	0.183	0.17
Cadmium	mg/L	0.0002	0.05	<0.0001	<0.0001	<0.0001	<0.0001	0.0004	<0.0001	<0.0001	0.0002	<0.0001
Cobalt	mg/L	ID	0.1	0.001	<0.001	0.002	0.005	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	0.0014	5	0.002	<0.001	0.006	0.003	0.004	0.003	0.003	0.003	0.001
Lead	mg/L	0.0034	5	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	1.9	10	0.273	1.18	1.19	1.66	0.065	0.043	0.109	0.003	0.003
Molybdenum	mg/L	ID	0.05	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.018	0.019
Nickel	mg/L	0.011	2	0.003	0.003	0.003	0.002	0.002	0.003	0.003	0.002	0.002
Selenium	mg/L	0.011 (total)	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	mg/L	-	-	14.4	7.38	3.17	4.12	0.158	0.164	0.15	0.24	0.225
Uranium	mg/L	ID	0.1	0.001	0.003	<0.001	0.017	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	mg/L	ID	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	0.008	5	0.016	0.02	0.146	0.048	0.189	0.063	0.042	0.024	0.013
Boron	mg/L	0.37	5	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.51	0.58
Iron	mg/L	ID	10	0.69	3.19	5.63	0.7	0.44	0.09	0.77	<0.05	<0.05
Bromine	mg/L	ID	-	1.3	4.3	1.9	1.9	0.1	0.2	0.1	0.8	0.9
Nutrients												
Ammonia as N	mg/L	0.02*	-	1.16	<0.1	0.37	0.12	0.06	0.01	0.05	0.029	0.1
Nitrite as N	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/L	0.7	-	0.08	0.01	<0.01	<0.01	0.09	0.06	0.03	<0.01	<0.01
Total Phosphorous	mg/L	0.05*	0.8	0.07	0.09	0.09	0.04	0.14	0.1	0.17	0.62	1.69
Reactive Phosphorous	mg/L	0.02*	-	0.02	<0.01	<0.01	<0.01	0.02	0.04	0.06	<0.01	<0.01
Total Organic Carbon	mg/L	-	-	19	7	<1	<1	5	10	12	48	51

Notes: Bold type indicates a significant result.

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

* ANZECC 2000 - Water Quality Guidelines: 95% protection levels (trigger values) for the protection of freshwater aquatic ecosystems, South-East Australia, low lying river ecosystems

ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, short-term trigger values

^ ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, Average root zone salinity threshold for Lucerne, Hunter River

**ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, medium risk of increasing cadmium concentrations and foliar injury in moderately tolerant crops



SUMMARY TABLE 3 Irrigation Water Quality Parameters: February 2012

Water quality parameters	Units	ANZECC 2000 Guidelines Ecosystems	ANZECC 2000 Guidelines Irrigation	S4MB01	TMB01	TMB02	TMB03	TMB04	TMB05	TSW01	TSW02	ASW01	FSW01	TSD	TND
				Shallow Bedrock 23/03/2012	Alluvium 28/02/2012	Alluvium 28/02/2012	Alluvium 29/02/2012	Seepage 1/03/2012	Seepage 1/03/2012	Surface Water 29/02/2012	Surface Water 29/02/2012	Surface Water 29/02/2012	Surface Water 29/02/2012	Surface Water 29/02/2012	Surface Water 29/02/2012
Formation															
Sample date															
Field parameters															
Temperature	oC	-	-	20.08	19.4	19.37	18.81	21.58	20.14	25.59	26.23	22.95	27.86	28.04	27.34
Conductivity	µS/cm	125 - 2200*	2000^	8193	13848	5942	9280	12899	12137	509	848	421	481	4401	6238
Dissolved Oxygen	% sat	-	-	28.9	10	16.6	78.8	126.1	60.1	94.2	135	115.4	121.5	185.4	239.7
Dissolved Oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	pH units	6.5 - 8.0 *	6.0 - 9.0	6.5	6.58	6.32	7.77	5.7	5.73	6.75	7.81	5.88	6.97	10.13	10.28
TDS	mg/L	-	-	5.336	9.003	3.862	0.038	8.26	7.889	0.331	0.552	0.274	0.312	2.861	4.054
Redox	mV	-	-	-132.6	-28	-17.6	-26.4	23.7	11.8	15.3	-19.2	28.7	12.9	-60.6	-69.2
General Parameters															
pH	pH units	6.5 - 8.0*	6.0 - 9.0	7.77	-	-	-	-	-	-	-	-	-	-	-
Conductivity	µS/cm	125 - 2200*	2000^	5910	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	-	-	5700	-	-	-	-	-	-	-	-	-	-	-
Calculated EC*	µS/cm	125 - 2200*	2000^	6188	7812	3075	5379	7455	6903	404	657	388	428	339	4575
Laboratory Analytes															
Hydroxide Alkalinity as CaCO3	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	400	807
Bicarbonate Alkalinity as CaCO3	mg/L	-	-	340	540	164	481	129	22	56	97	46	53	321	273
Total Alkalinity as CaCO3	mg/L	-	-	340	540	164	481	129	22	56	97	46	53	721	1080
Sulfate as SO4 2-	mg/L	-	-	908	99	30	200	607	314	7	15	6	7	11	<1
Chloride	mg/L	-	700**	1350	2690	1090	1520	2420	2620	45	81	36	42	386	522
Calcium	mg/L	-	-	328	220	122	140	100	63	11	16	10	11	3	2
Magnesium	mg/L	-	-	65	241	81	127	257	270	8	16	6	7	2	<1
Sodium	mg/L	-	460**	1010	1300	505	942	1280	1180	34	55	27	31	577	708
Potassium	mg/L	-	-	10	3	4	2	28	19	3	3	2	2	83	273
Fluoride	mg/L	-	-	0.4	-	-	-	-	-	-	-	-	-	-	-
Sulfur	mg/L	-	-	302	-	-	-	-	-	-	-	-	-	-	-
Hardness (CaCO3)	meq/L	-	-	1090	-	-	-	-	-	-	-	-	-	-	-
Water type	-	-	-	-	Na-Mg-Cl	Na-Cl	Na-Cl	Na-Mg-Cl	Na-Mg-Cl	Na-Mg-Ca-Cl-HCO3	Na-Mg-Cl-HCO3	Na-Ca-Mg-Cl-HCO3	Na-Mg-Ca-Cl-HCO3	Na-Cl-HCO3	Na-K-Cl
Dissolved Metals															
Aluminium	mg/L	0.055	20	0.01	<0.01	0.01	<0.01	0.01	0.49	0.07	<0.01	0.19	0.13	0.16	0.07
Arsenic	mg/L	0.013 (As V)	2	0.009	0.001	0.004	0.002	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	0.005	0.004
Beryllium	mg/L	ID	0.5	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	-	-	0.256	0.229	0.585	0.193	0.071	0.082	0.041	0.048	0.033	0.036	0.104	0.066
Cadmium	mg/L	0.0002	0.05	<0.0001	<0.0001	<0.0001	<0.0001	0.0012	0.0021	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001
Cobalt	mg/L	ID	0.1	0.002	<0.001	0.002	0.004	0.144	0.377	<0.001	0.002	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	0.0014	5	0.002	<0.001	<0.001	<0.001	0.002	0.002	0.001	0.003	0.001	0.004	<0.001	<0.001
Lead	mg/L	0.0034	5	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	1.9	10	0.369	0.806	0.939	1.48	12.1	21.8	0.077	0.586	0.058	0.093	0.002	0.005
Molybdenum	mg/L	ID	0.05	0.004	<0.001	<0.001	<0.001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	0.011	0.011
Nickel	mg/L	0.011	2	0.006	0.004	0.001	0.001	0.058	0.199	0.001	0.002	0.001	<0.001	0.001	0.001
Selenium	mg/L	0.011 (total)	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	mg/L	-	-	24.7	6.08	2.45	3.92	1.09	0.953	0.142	0.208	0.139	0.092	0.154	0.111
Uranium	mg/L	ID	0.1	0.005	0.003	<0.001	0.017	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	mg/L	ID	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	0.008	5	0.013	0.02	0.019	0.014	0.288	0.993	0.01	0.028	0.031	0.042	0.012	0.007
Boron	mg/L	0.37	5	0.27	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.33	0.42
Iron	mg/L	ID	10	1.08	3.5	6.53	0.89	1.44	44.8	0.3	0.2	0.31	0.09	0.06	0.06
Bromine	mg/L	ID	-	3.2	2.7	1.1	1.9	4.6	2	<0.1	0.1	<0.1	<0.1	0.4	0.7
Nutrients															
Ammonia as N	mg/L	0.02*	-	1.28	-	-	-	0.16	0.21	0.06	0.01	0.06	0.14	0.14	0.07
Nitrite as N	mg/L	-	-	0.03	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/L	0.7	-	0.45	-	-	-	0.02	0.02	0.05	0.02	0.06	0.06	0.01	<0.01
Total Phosphorous	mg/L	0.05*	0.8	0.02	-	-	-	1.58	0.08	0.05	0.06	0.04	0.04	0.46	1.75
Reactive Phosphorous	mg/L	0.02*	-	<0.01	-	-	-	<0.01	<0.01	0.02	0.04	0.01	0.02	<0.01	<0.01
Total Organic Carbon	mg/L	-	-	135	-	-	-	4	7	8	14	6	8	39	41

Notes: Bold type indicates a significant result; *Due to equipment issues calculated EC values for the March 2012 round are used for interpretation.

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

* ANZECC 2000 - Water Quality Guidelines: 95% protection levels (trigger values) for the protection of freshwater aquatic ecosystems, South-East Australia, low lying river ecosystems

ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, short-term trigger values

^ ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, Average root zone salinity threshold for Lucerne, Hunter River

**ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, medium risk of increasing cadmium concentrations and foliar injury in moderately tolerant crops

SUMMARY TABLE 4 Irrigation Water Quality Parameters: June 2012

Water quality parameters	Units	ANZECC 2000 Guidelines Ecosystems	ANZECC 2000 Guidelines Irrigation	S4MB01	TMB01	TMB02	TMB03	TMB04	TMB05	TSW01	TSW02	ASW01	FSW01	TSd	TND
				Shallow Bedrock 20/06/2012	Alluvium 18/06/2012	Alluvium 18/06/2012	Alluvium 18/06/2012	Seepage 14/06/2012	Seepage 14/06/2012	Surface Water 18/06/2012	Surface Water 18/06/2012	Surface Water 19/06/2012	Surface Water 19/06/2012	Dam 14/06/2012	Dam 14/06/2012
Formation															
Sample date															
Field parameters															
Temperature	oC	-	-	18.92	16.76	17.11	17.34	19.7	20.2	11.53	13.17	8.69	10.96	17	15.6
Conductivity	µS/cm	125 - 2200*	2000^	4337	8014	3648	5706	5600	5379	327	530	218	284	1810	2575
Dissolved Oxygen	% sat	-	-	23.6	16.76	11.7	15.2	6.3	64.7	51.6	51.7	46.1	44.7	93	74.8
Dissolved Oxygen	mg/L	-	-	2.23	-	-	-	-	-	-	-	-	-	-	-
pH	pH units	6.5 - 8.0 *	6.0 - 9.0	6.95	6.68	6.38	6.8	6.34	6.54	7.2	7.53	7.3	7.24	10.07	10.05
TDS	mg/L	-	-	2.822	5.209	2.373	3.71	3640	3497	0.214	0.345	0.142	0.185	1176.5	1677
Redox	mV	-	-	-267	-100.2	2.9	-25.9	116.1	53.8	-7.6	-10.6	18.6	20.2	-84.8	-34.6
General Parameters															
pH	pH units	6.5 - 8.0*	6.0 - 9.0	7.58	-	-	-	6.54	6.42	-	-	-	-	-	9.6
Conductivity	µS/cm	125 - 2200*	2000^	4770	-	-	-	7920	7570	-	-	-	-	-	3610
Total Dissolved Solids	mg/L	-	-	3000	4680	2020	3180	4700	4359	226	266	130	154	1470	2120
Laboratory Analytes															
Hydroxide Alkalinity as CaCO3	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	mg/L	-	-	267	445	168	417	148	161	38	42	43	43	402	624
Total Alkalinity as CaCO3	mg/L	-	-	267	445	168	417	148	161	38	42	43	43	817	1220
Sulfate as SO4 2-	mg/L	-	-	155	81	32	199	628	321	17	27	8	17	12	<1
Chloride	mg/L	700**	700**	1330	2450	1080	1480	2450	2500	53	80	35	56	375	505
Calcium	mg/L	-	-	199	191	120	172	100	71	9	9	9	10	2	2
Magnesium	mg/L	-	-	43	214	82	133	264	249	7	10	5	8	2	1
Sodium	mg/L	460**	460**	770	1230	524	890	1360	1300	35	52	25	38	594	718
Potassium	mg/L	-	-	8	4	4	2	25	17	4	4	3	4	78	267
Fluoride	mg/L	-	-	-	0.2	0.1	0.2	0.7	0.4	<0.1	<0.1	<0.1	<0.1	0.4	0.4
Sulfur	mg/L	-	-	-	27	10	68	213	120	4	6	2	4	4	2
Hardness (CaCO3)	meq/L	-	-	-	1360	637	977	1340	1200	51	64	43	58	13	5
Water type				Na-Ca-Cl	Na-Mg-Cl	Na-Cl	Na-Cl	Na-Mg-Cl	Na-Mg-Cl	Na-Mg-Cl-HCO3	Na-Mg-Cl-HCO3	Na-Ca-Mg-Cl-HCO3	Na-Mg-Cl-HCO3	Na-K-Cl-HCO3	Na-Cl-HCO3
Dissolved Metals															
Aluminium	mg/L	20	5	<0.01	<0.01	<0.01	<0.01	0.04	0.02	0.19	0.04	0.34	0.46	0.15	0.01
Arsenic	mg/L	2	0.1	0.005	0.003	0.004	0.003	0.002	0.006	<0.001	<0.001	<0.001	<0.001	0.006	0.005
Beryllium	mg/L	0.5	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	-	-	0.541	0.231	0.685	0.221	0.078	0.082	0.039	0.037	0.036	0.068	0.119	0.129
Cadmium	mg/L	0.05	0.01	<0.0001	<0.001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.0001	<0.0001	<0.0001	<0.001
Cobalt	mg/L	0.1	0.05	<0.001	<0.001	0.002	0.003	0.13	0.178	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	5	0.2	<0.001	<0.001	0.003	<0.001	0.002	<0.001	0.005	0.005	0.007	0.003	<0.001	<0.001
Lead	mg/L	5	2	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	mg/L	10	0.2	0.223	0.969	1.4	1.73	14.1	24.9	0.035	0.034	0.037	0.096	0.011	0.007
Molybdenum	mg/L	0.05	0.01	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.018	0.015
Nickel	mg/L	2	0.2	0.002	<0.001	0.001	0.001	0.053	0.088	0.001	0.001	0.001	0.001	0.001	<0.001
Selenium	mg/L	0.05	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	mg/L	-	-	21.2	6.02	3.04	4.85	1.15	1.13	0.125	0.145	0.122	0.202	0.198	0.206
Uranium	mg/L	0.1	0.01	0.002	0.003	<0.001	0.016	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	mg/L	0.5	0.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	mg/L	5	2	0.021	0.017	0.018	0.013	0.293	0.232	0.024	0.03	0.023	0.033	0.012	<0.005
Boron	mg/L	5	0.5	0.12	<0.05	<0.05	<0.05	<0.05	0.09	<0.05	<0.05	<0.05	<0.05	0.56	0.76
Iron	mg/L	10	0.2	0.57	2.88	5.41	1.41	7.53	80	0.4	0.09	0.72	0.79	<0.05	0.05
Bromine	mg/L	-	-	2.8	4.3	2.3	3.1	4.4	1.8	0.1	0.2	0.1	0.2	0.9	1.5
Nutrients															
Ammonia as N	mg/L	-	-	2.45	0.22	0.37	0.16	0.17	0.1	0.04	0.06	0.04	0.06	<0.01	0.03
Nitrite as N	mg/L	-	-	-	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/L	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.06	0.14	0.02	0.11	<0.01	<0.01
Total Phosphorous	mg/L	0.8	0.05	0.05	0.08	0.08	0.03	0.41	0.86	0.06	0.08	0.05	0.09	0.33	1.73
Reactive Phosphorous	mg/L	-	-	-	<0.01	0.06	<0.01	<0.01	<0.01	0.02	0.05	0.01	0.02	<0.01	<0.01
Total Organic Carbon	mg/L	-	-	29	2	<1	<1	8	17	13	12	14	13	44	43

Notes: Bold type indicates a significant result.

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

* ANZECC 2000 - Water Quality Guidelines: 95% protection levels (trigger values) for the protection of freshwater aquatic ecosystems, South-East Australia, low lying river ecosystems

ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, short-term trigger values

^ ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, Average root zone salinity threshold for Lucerne, Hunter River

**ANZECC 2000 - Water Quality Guidelines: Water quality for irrigation waters and general use, medium risk of increasing cadmium concentrations and foliar injury in moderately tolerant crops



Appendix A

Hydrographs

Figure A-1: Hydrograph for TMB01

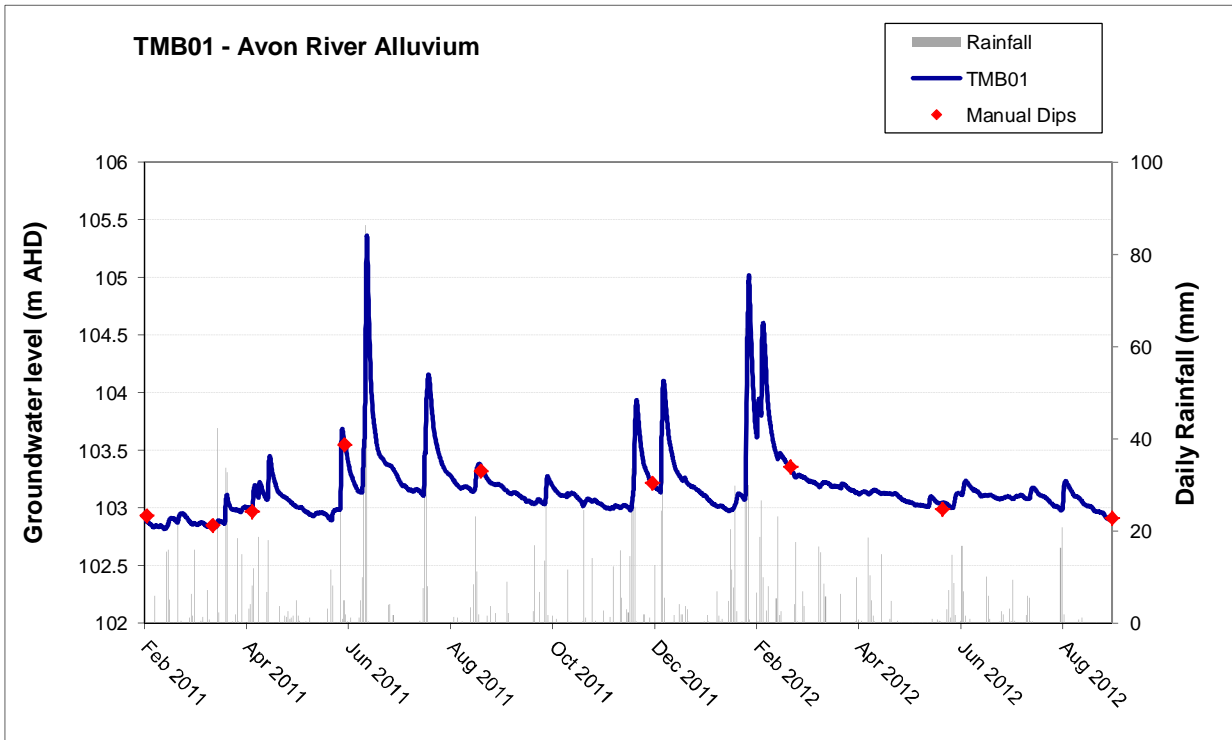


Figure A-2: Hydrograph for TMB02

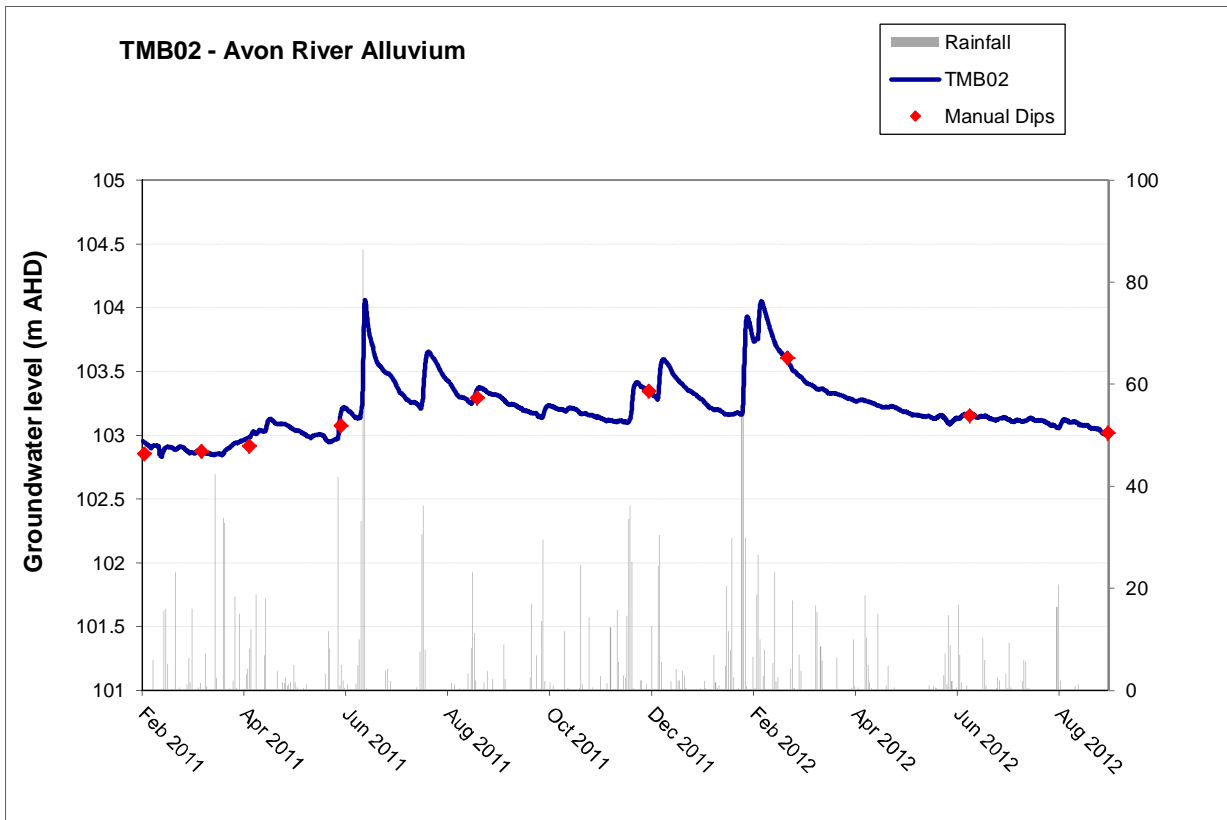


Figure A-3: Hydrograph for TMB03

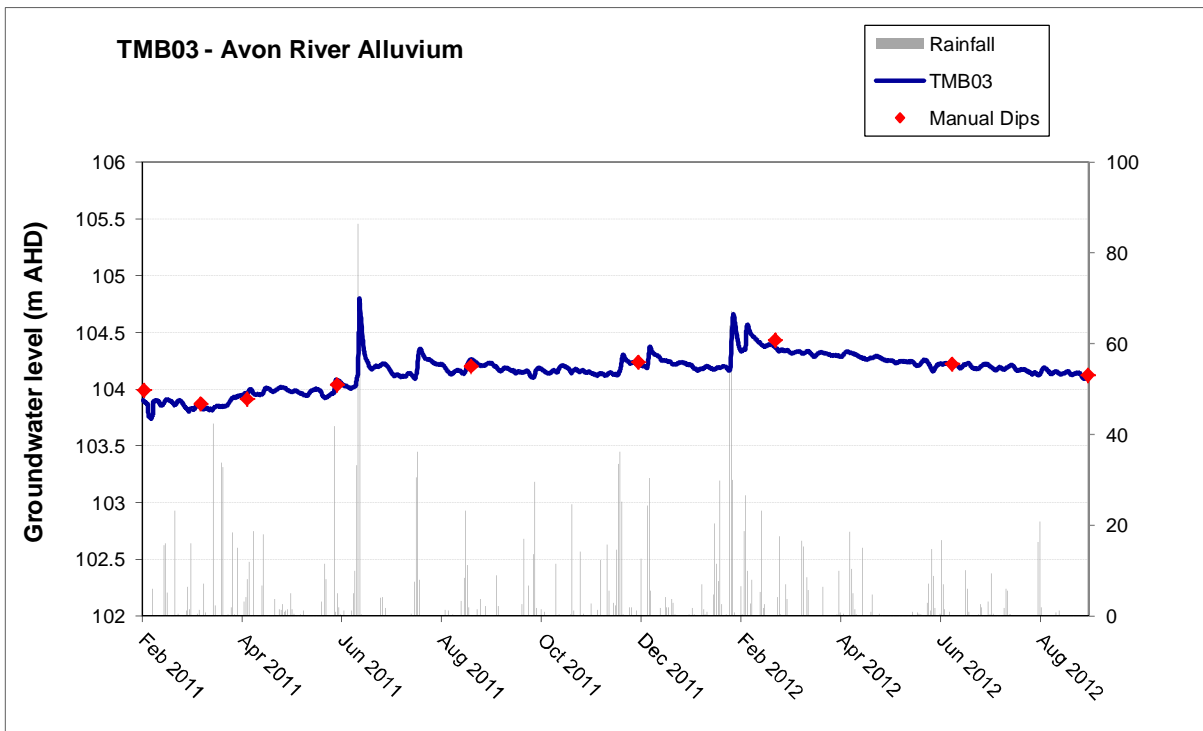


Figure A-4: Hydrograph for S4MB01

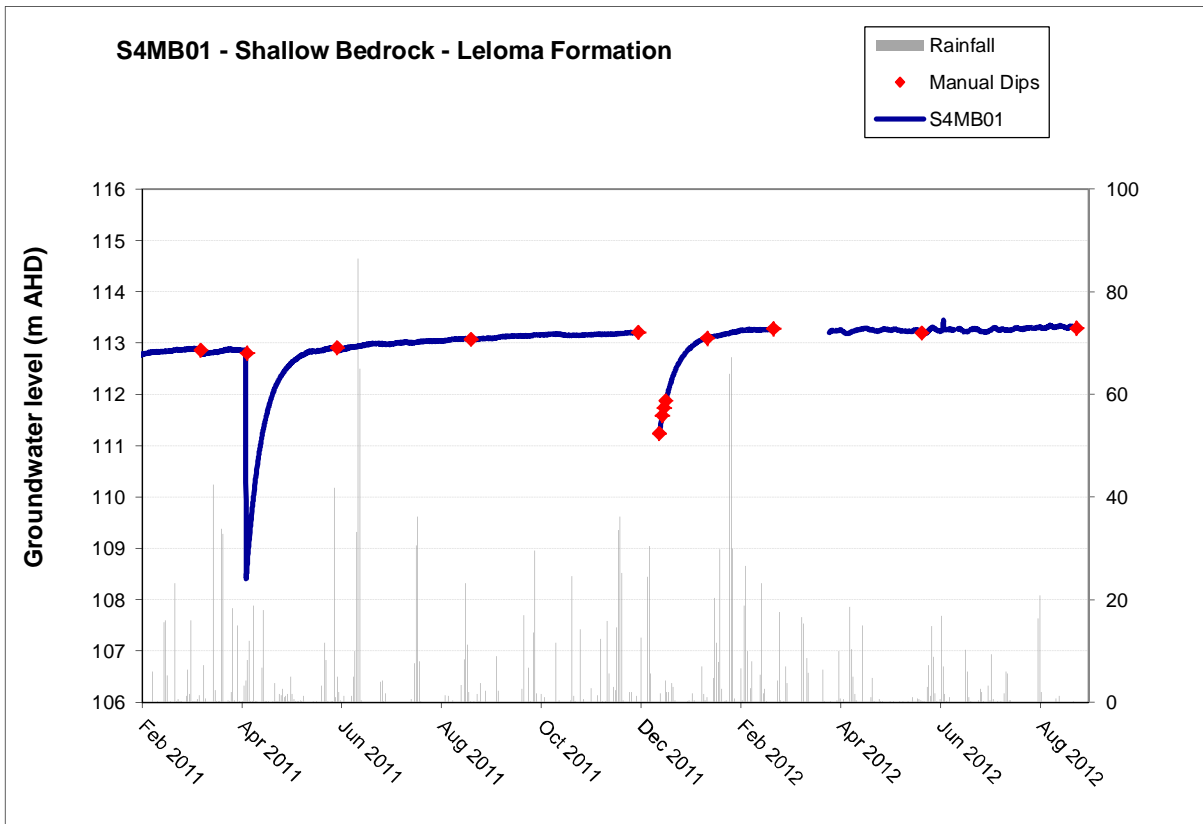


Figure A-5: Hydrograph for TSW01

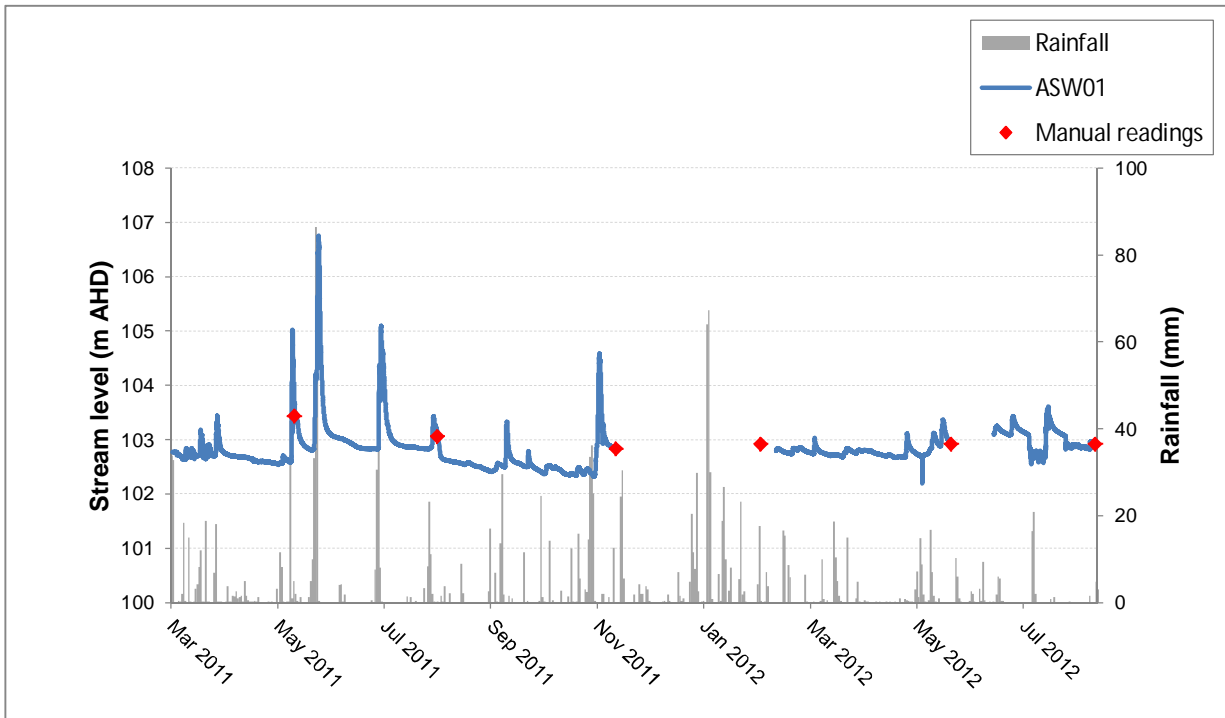


Figure A-6: Hydrograph for TSW02

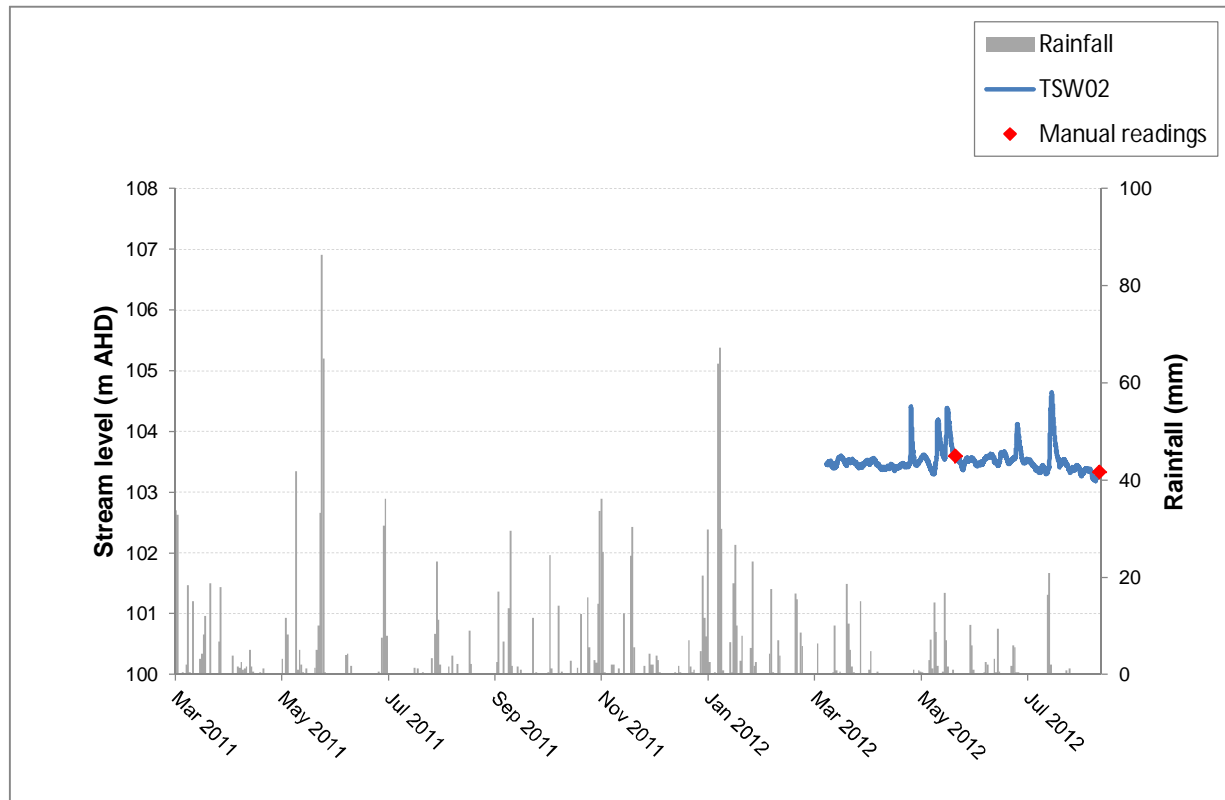


Figure A-7: Hydrograph for ASW01

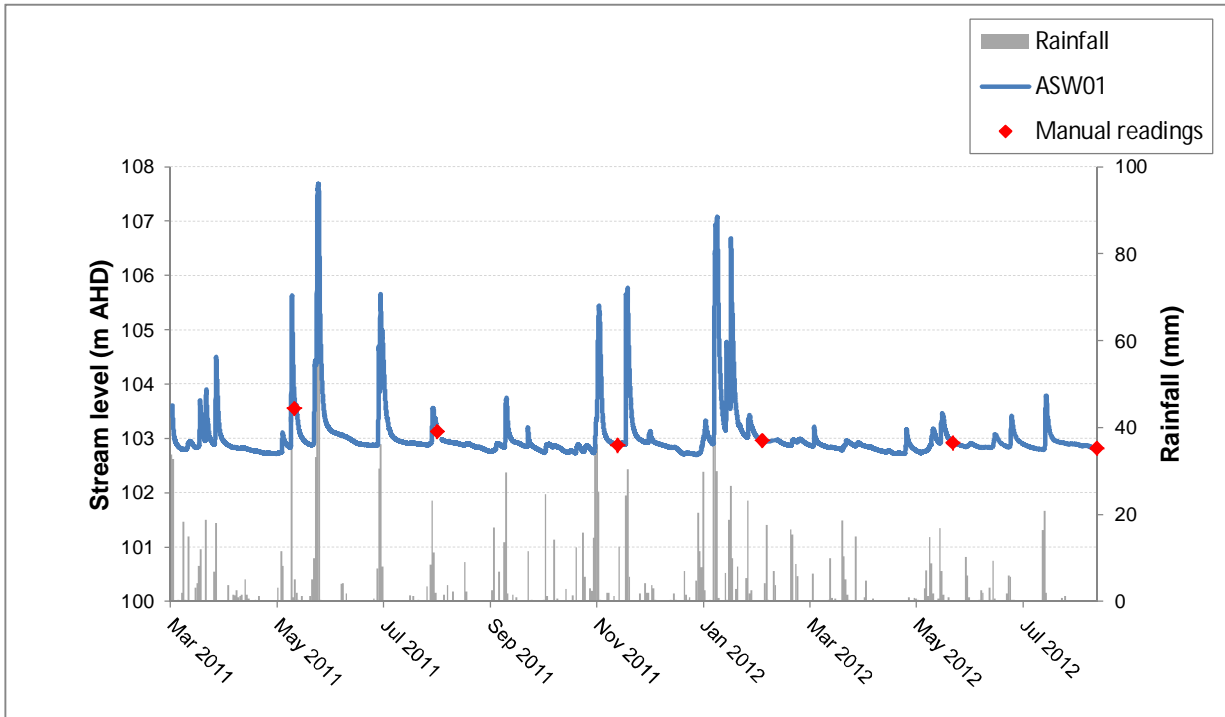
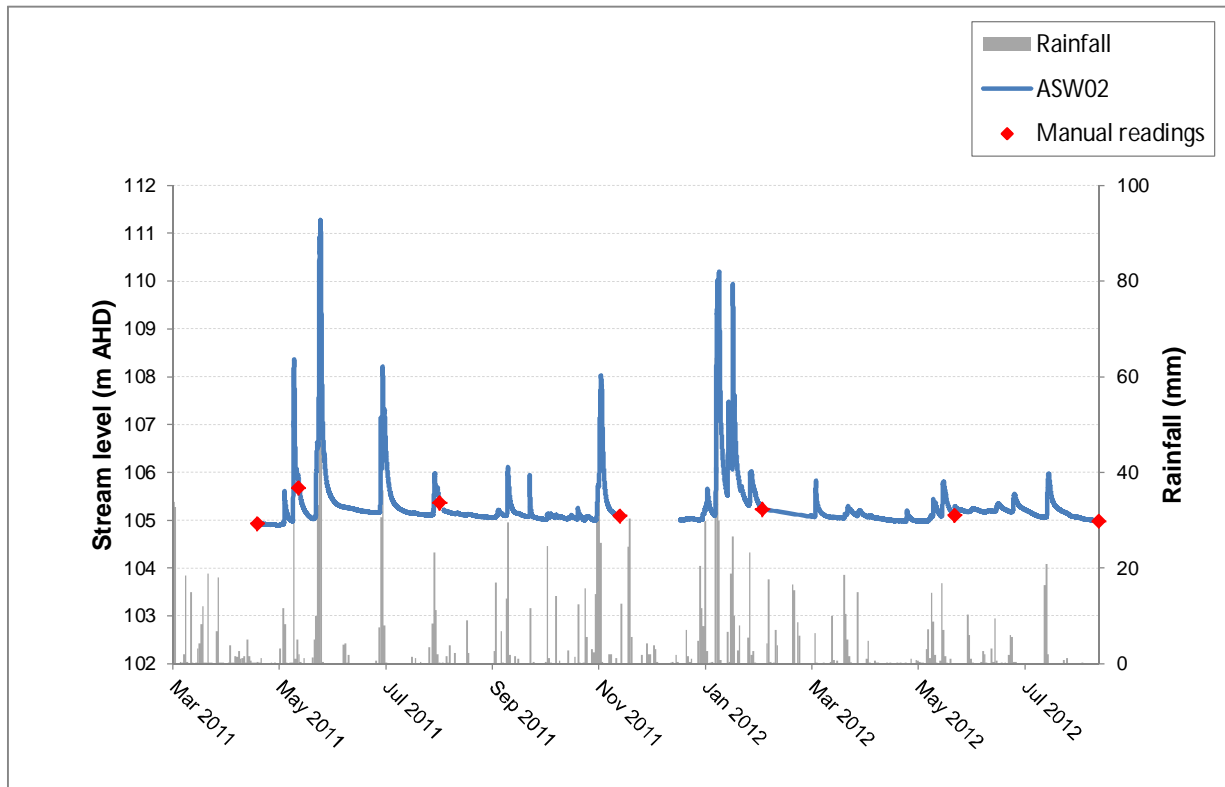


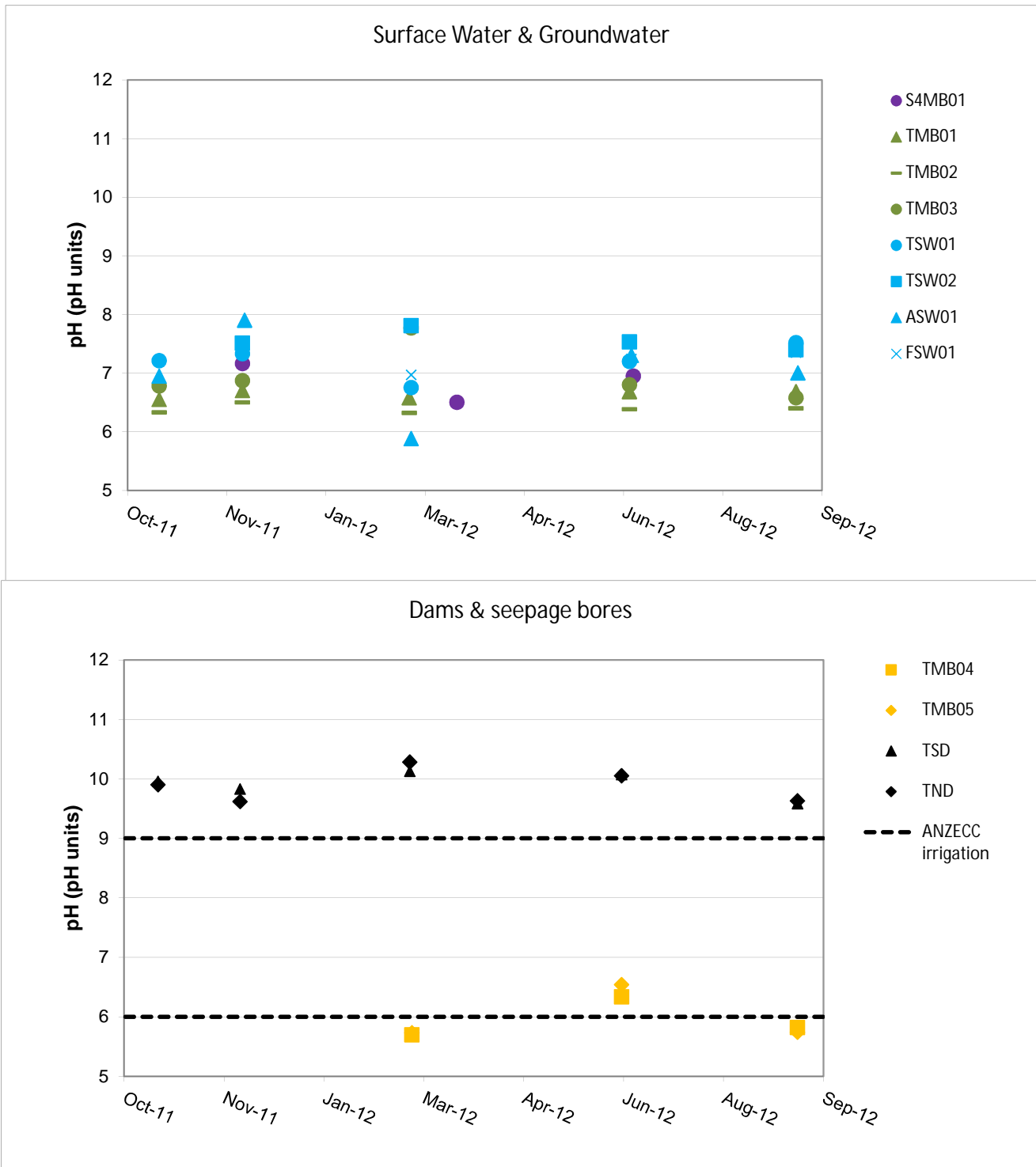
Figure A-8: Hydrograph for ASW02



Appendix B

Time series plots

Figure B-1: Field measured pH



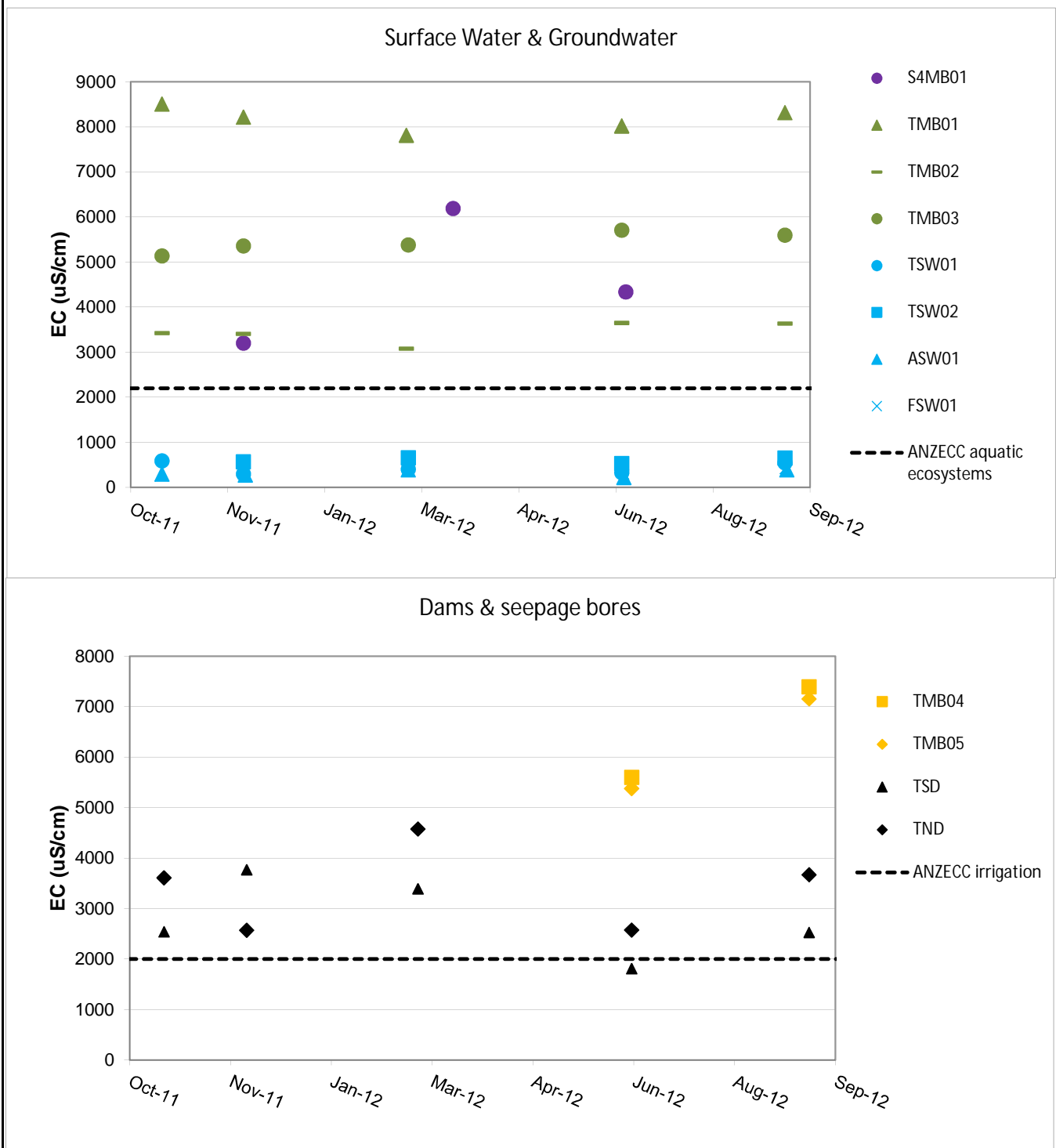
Note: ANZECC 2000. Water for irrigation and general water use

Client: AGL Upstream Investment Pty Ltd

Project: Gloucester Irrigation Monitoring

Location: Gloucester Basin, NSW

Figure B-2: Field measured EC



Note: ANZECC 2000. 95% protection levels for the protection of aquatic ecosystems

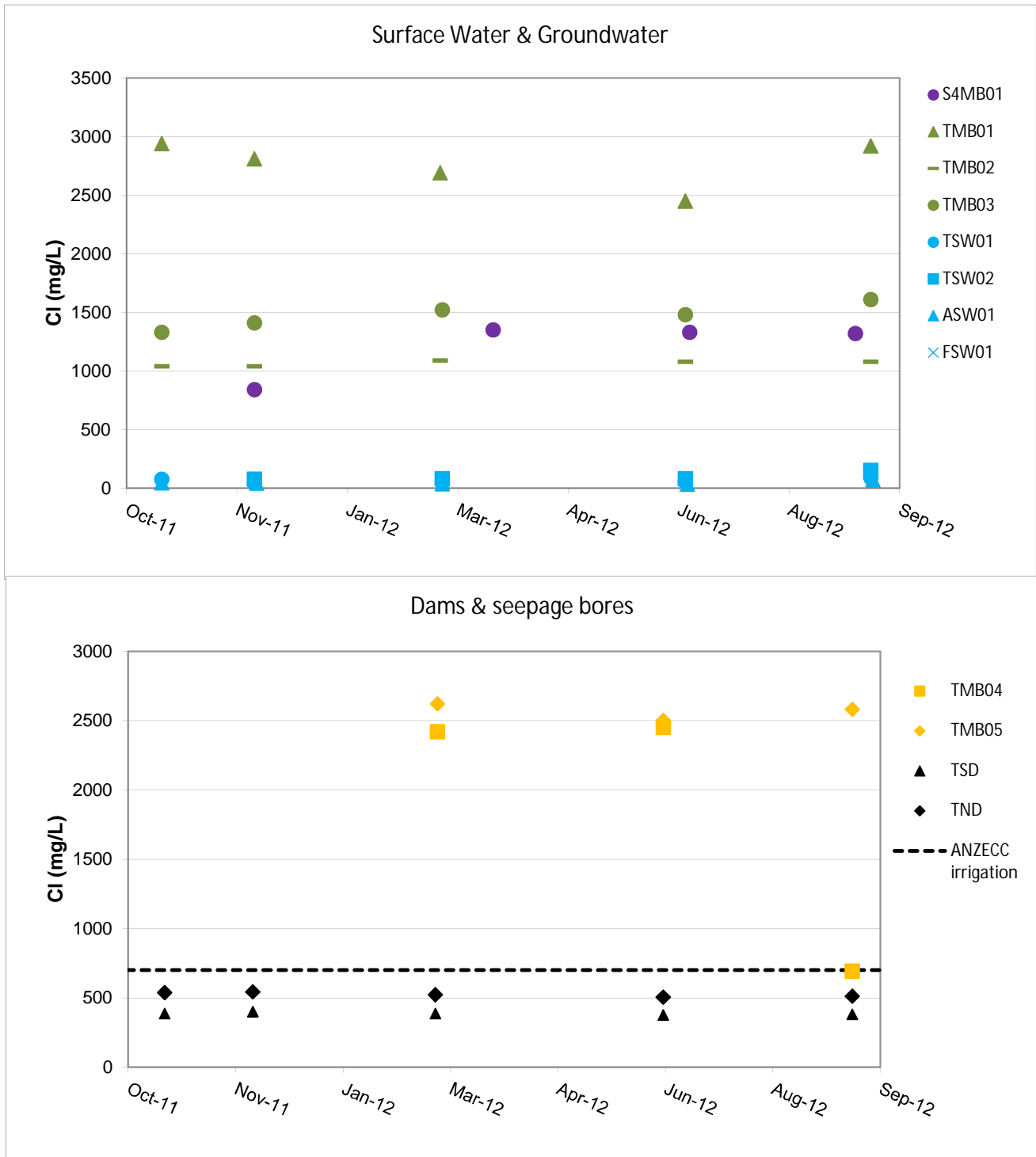
Note: ANZECC 2000. Water for irrigation and general water use

Client: AGL Upstream Investment Pty Ltd

Project: Gloucester Irrigation Monitoring

Location: Gloucester Basin, NSW

Figure B-3: Chloride concentrations



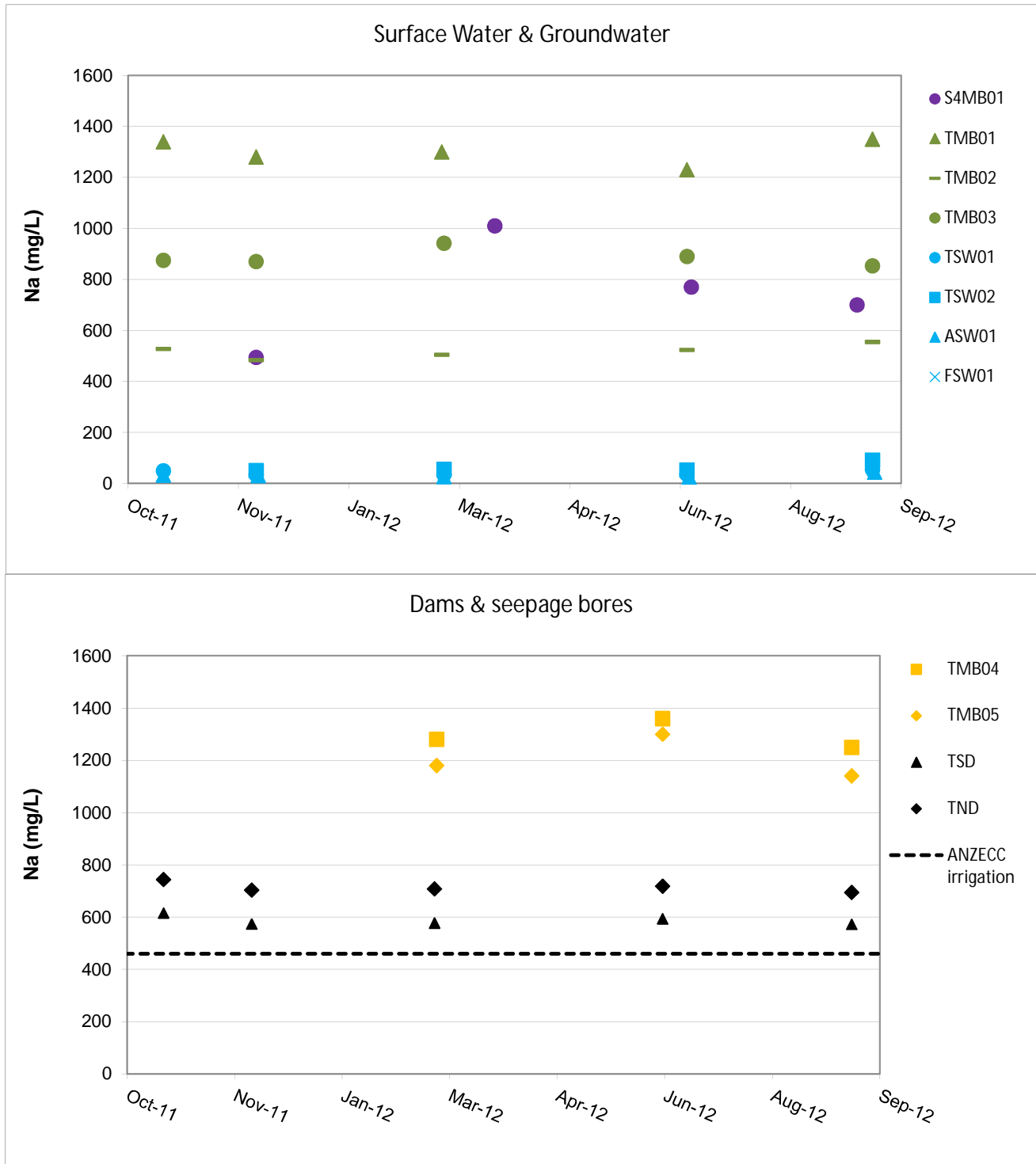
Note: ANZECC 2000. Water for irrigation and general water use

Client: AGL Upstream Investment Pty Ltd

Project: Gloucester Irrigation Monitoring

Location: Gloucester Basin, NSW

Figure B-4: Sodium concentrations



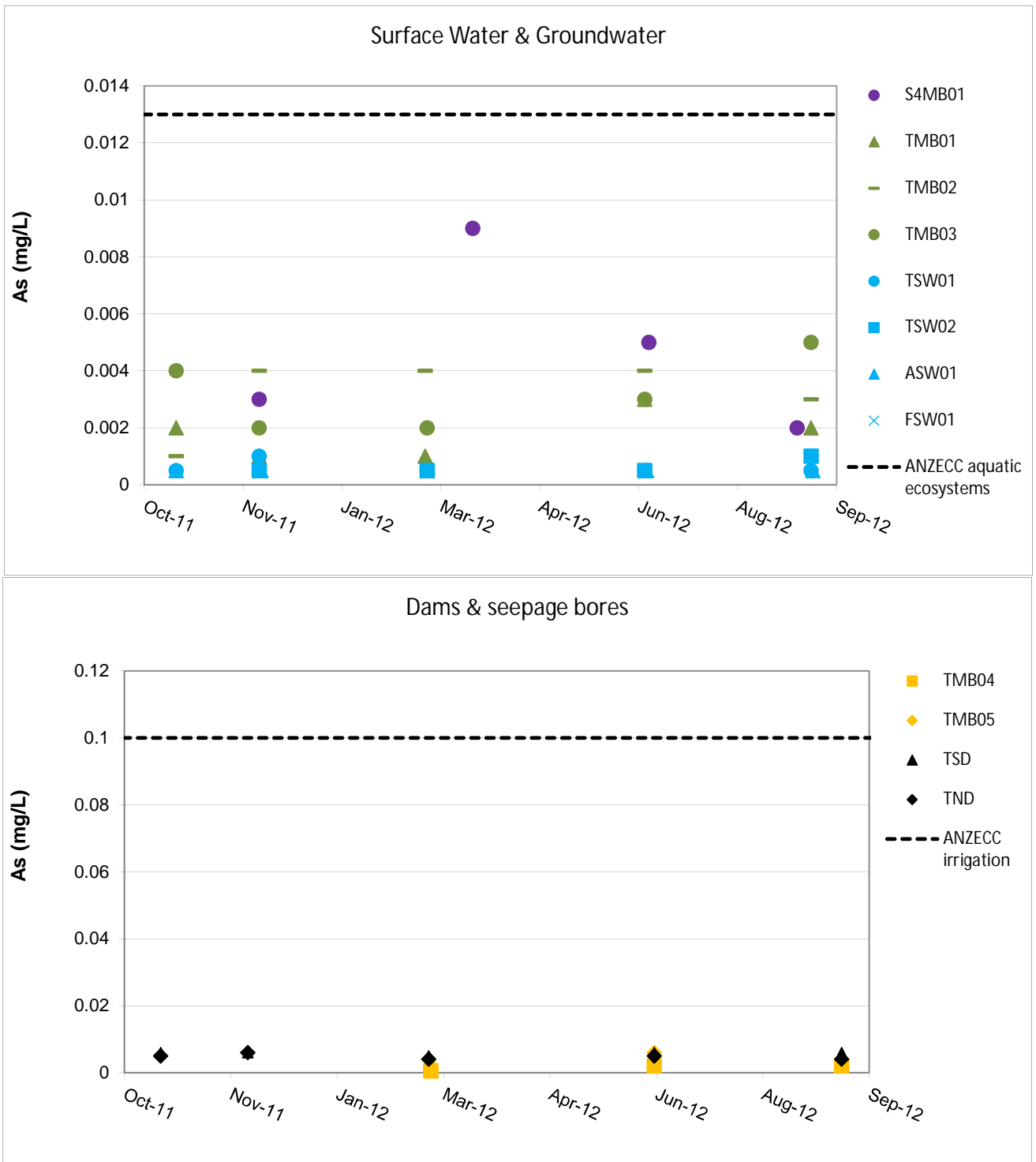
Note: ANZECC 2000. Water for irrigation and general water use

Client: AGL Upstream Investment Pty Ltd

Project: Gloucester Irrigation Monitoring

Location: Gloucester Basin, NSW

Figure B-5: Arsenic concentrations



Note: ANZECC 2000. 95% protection levels for the protection of aquatic ecosystems

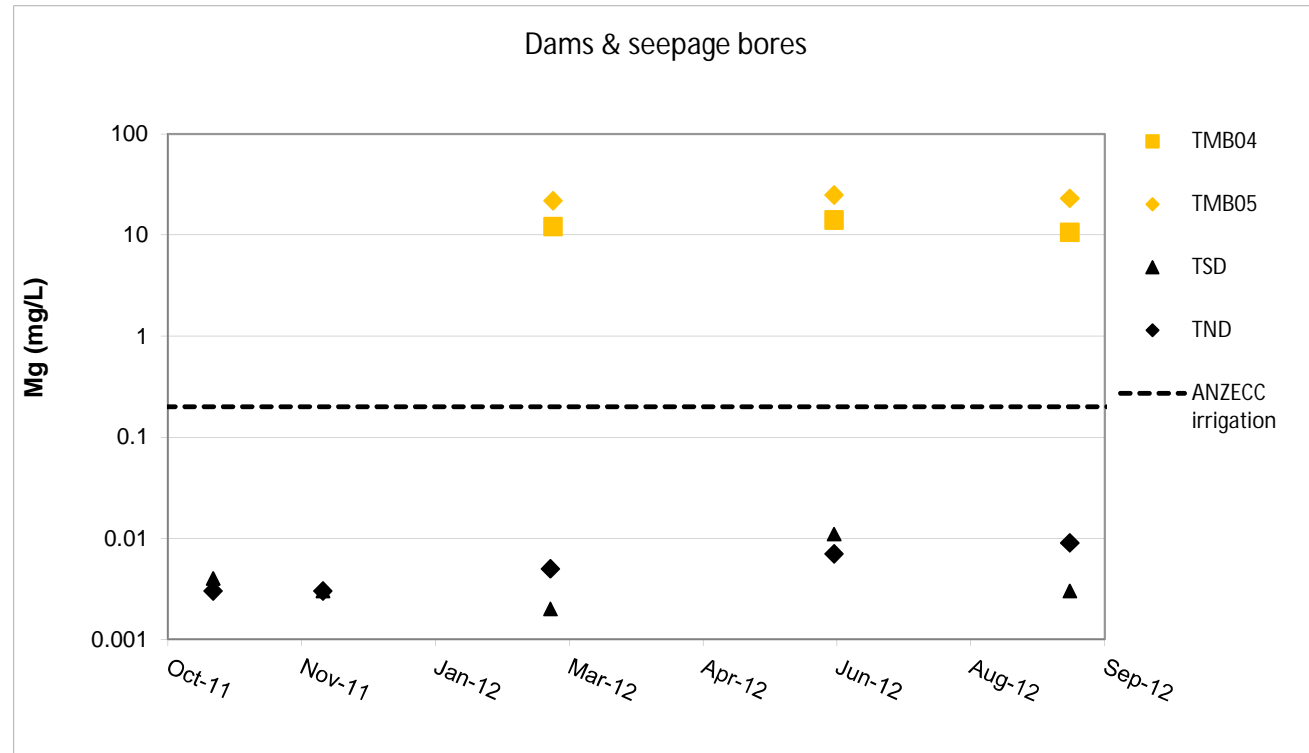
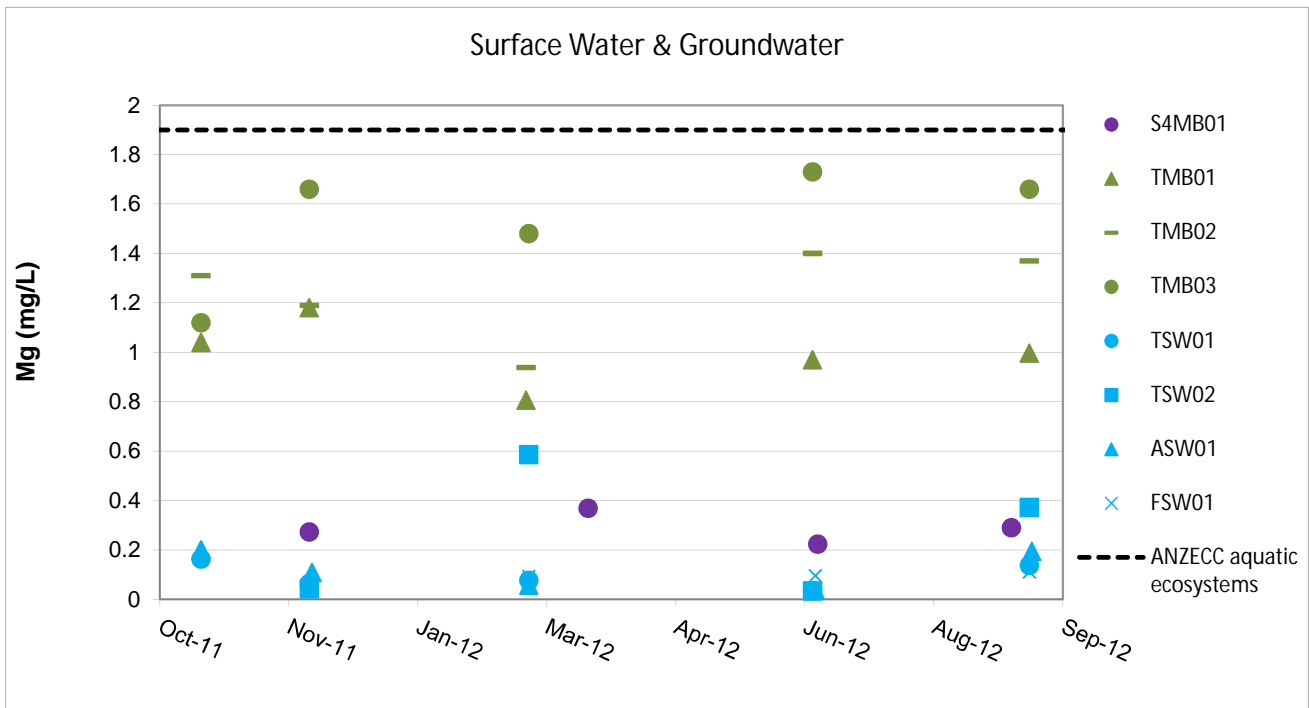
Note: ANZECC 2000. Water for irrigation and general water use

Client: AGL Upstream Investment Pty Ltd

Project: Gloucester Irrigation Monitoring

Location: Gloucester Basin, NSW

Figure B-6: Manganese concentrations



Note: ANZECC 2000. 95% protection levels for the protection of aquatic ecosystems

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

Client: AGL Upstream Investment Pty Ltd

Project: Gloucester Irrigation Monitoring

Location: Gloucester Basin, NSW

Figure B-7: Barium concentrations

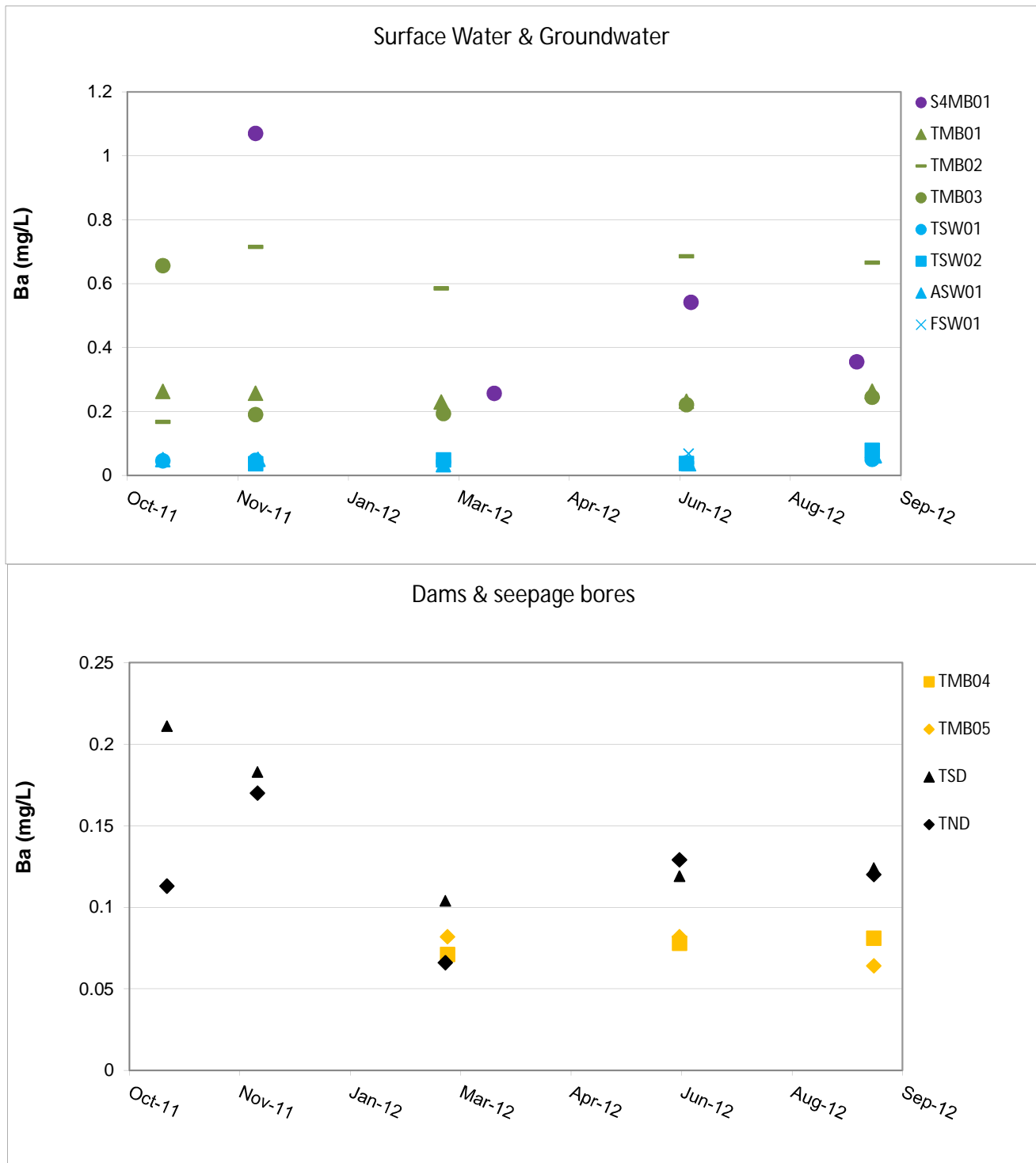


Figure B-8: Strontium concentrations

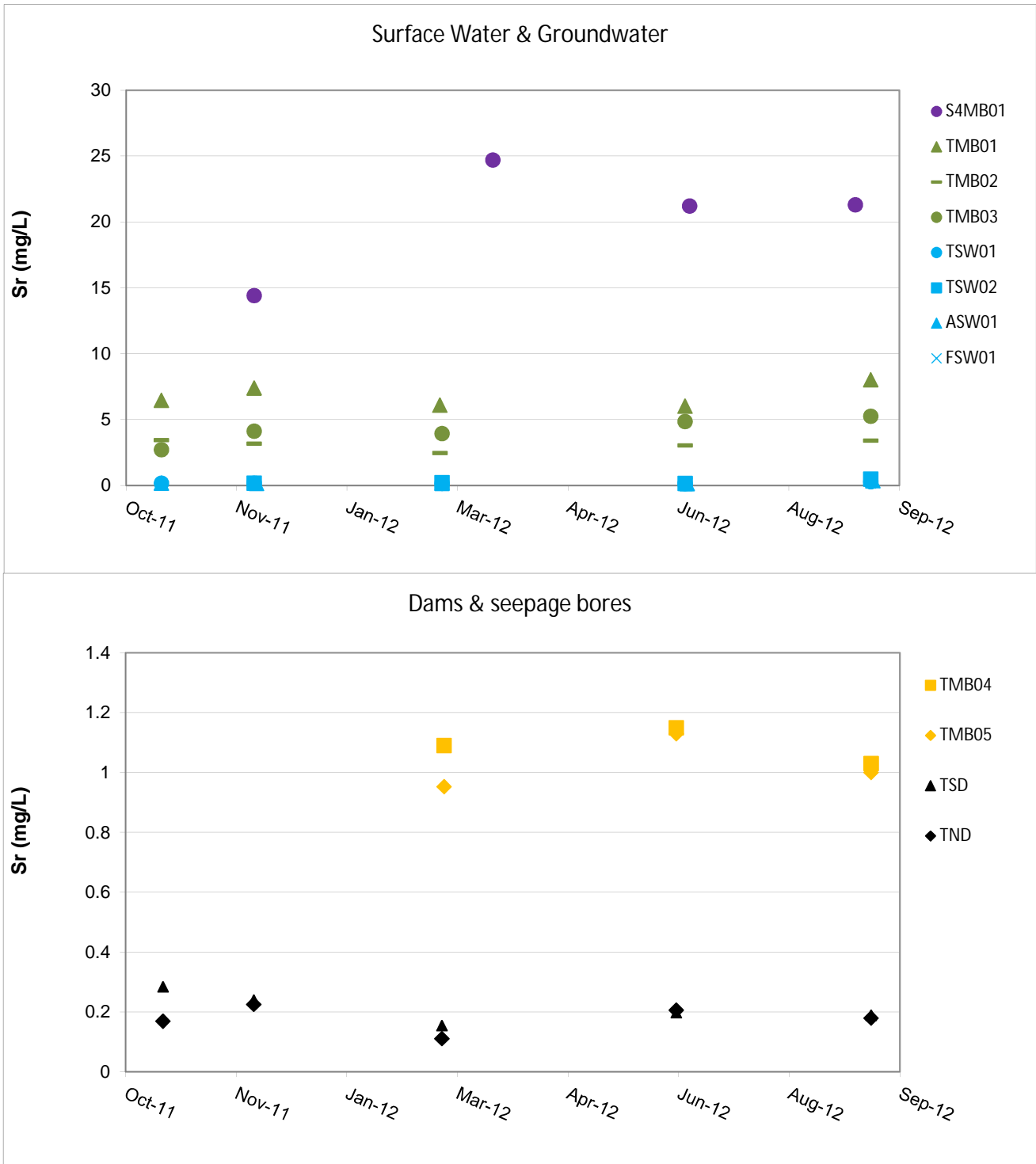
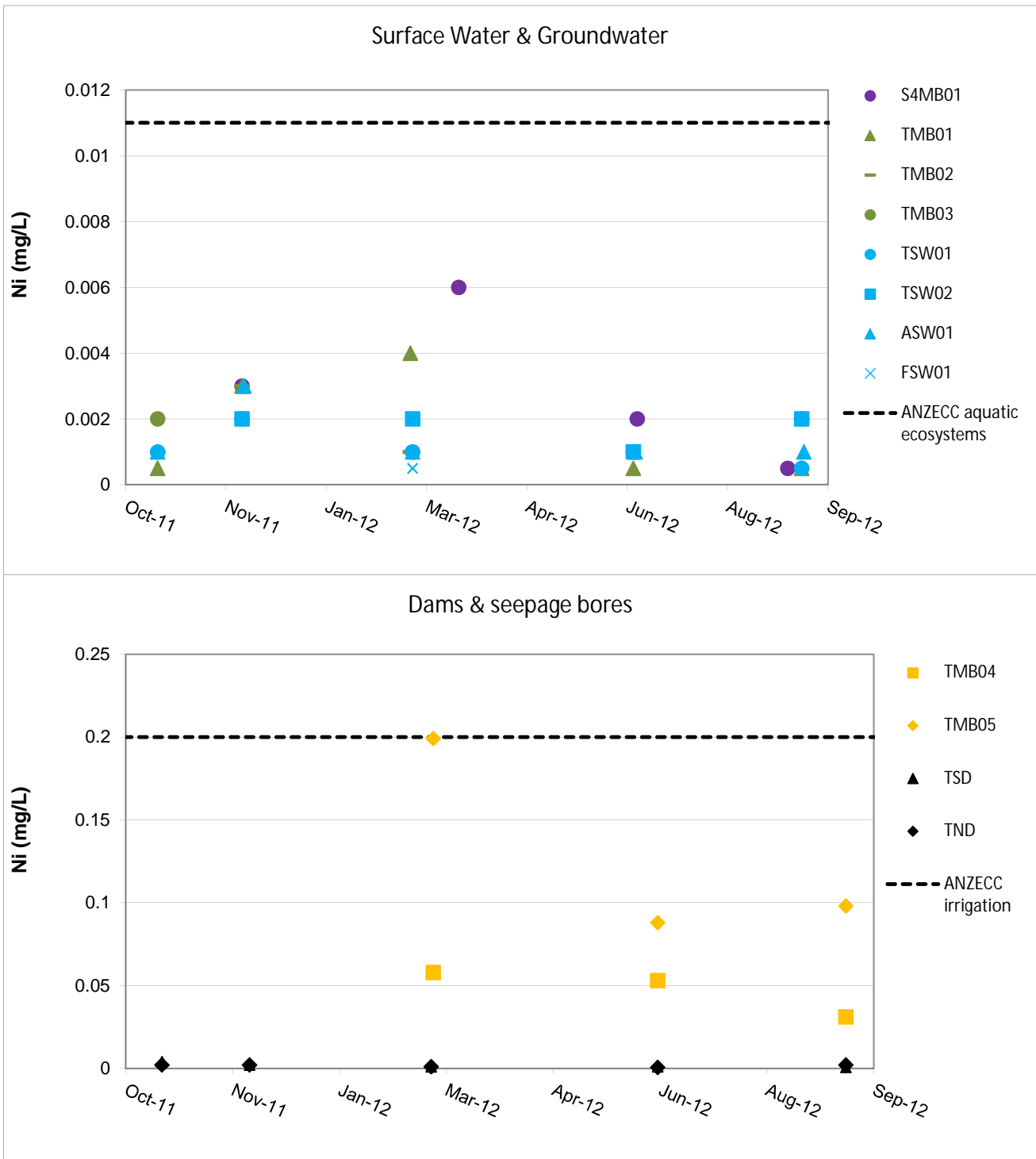


Figure B-9: Nickel concentrations



Note: ANZECC 2000. 95% protection levels for the protection of aquatic ecosystems

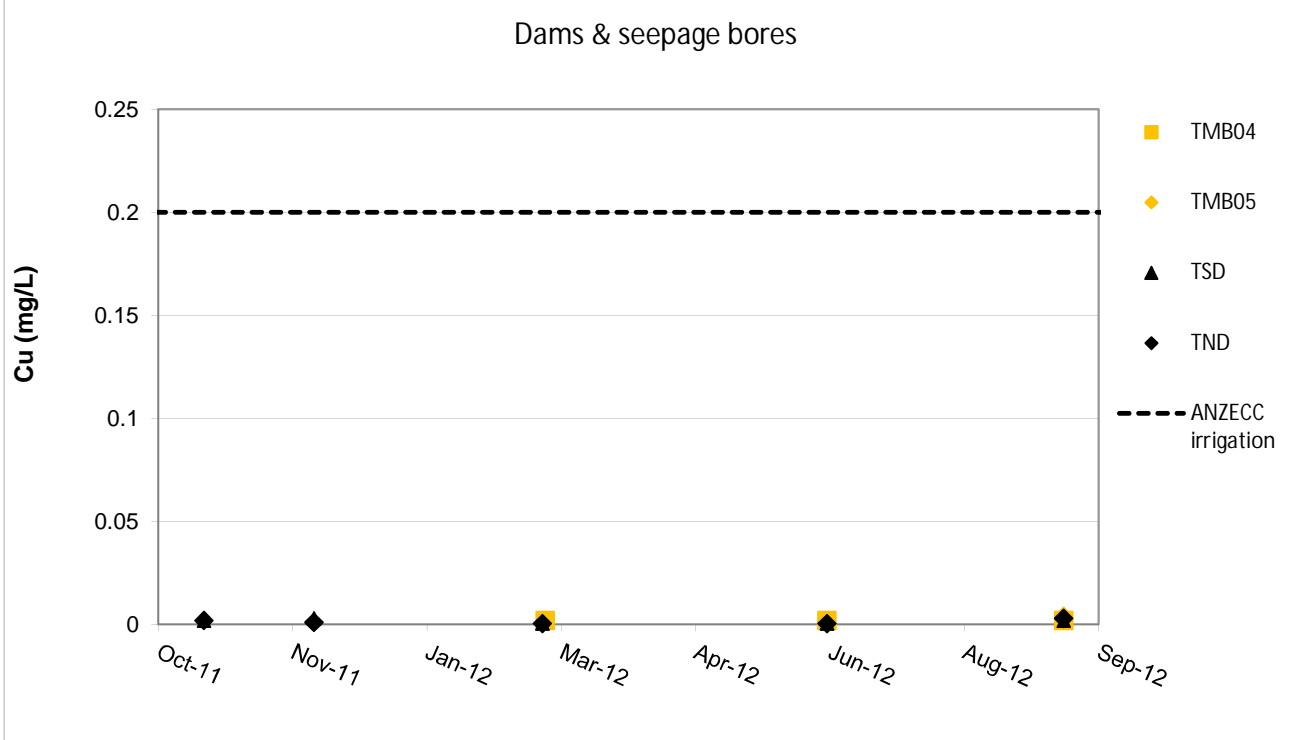
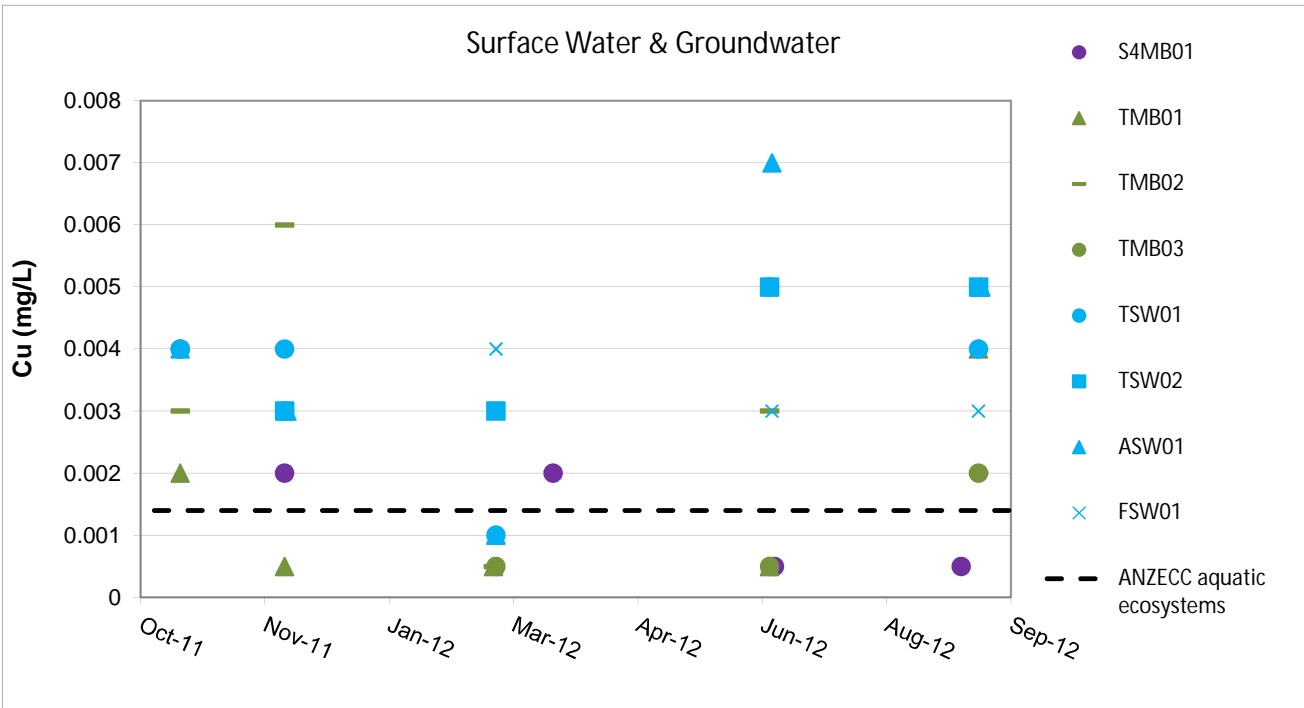
Note: ANZECC 2000. Water for irrigation and general water use

Client: AGL Upstream Investment Pty Ltd

Project: Gloucester Irrigation Monitoring

Location: Gloucester Basin, NSW

Figure B-10: Copper concentrations



Note: ANZECC 2000. 95% protection levels for the protection of aquatic ecosystems

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

Client: AGL Upstream Investment Pty Ltd

Project: Gloucester Irrigation Monitoring

Location: Gloucester Basin, NSW

Figure B-11: Iron concentrations

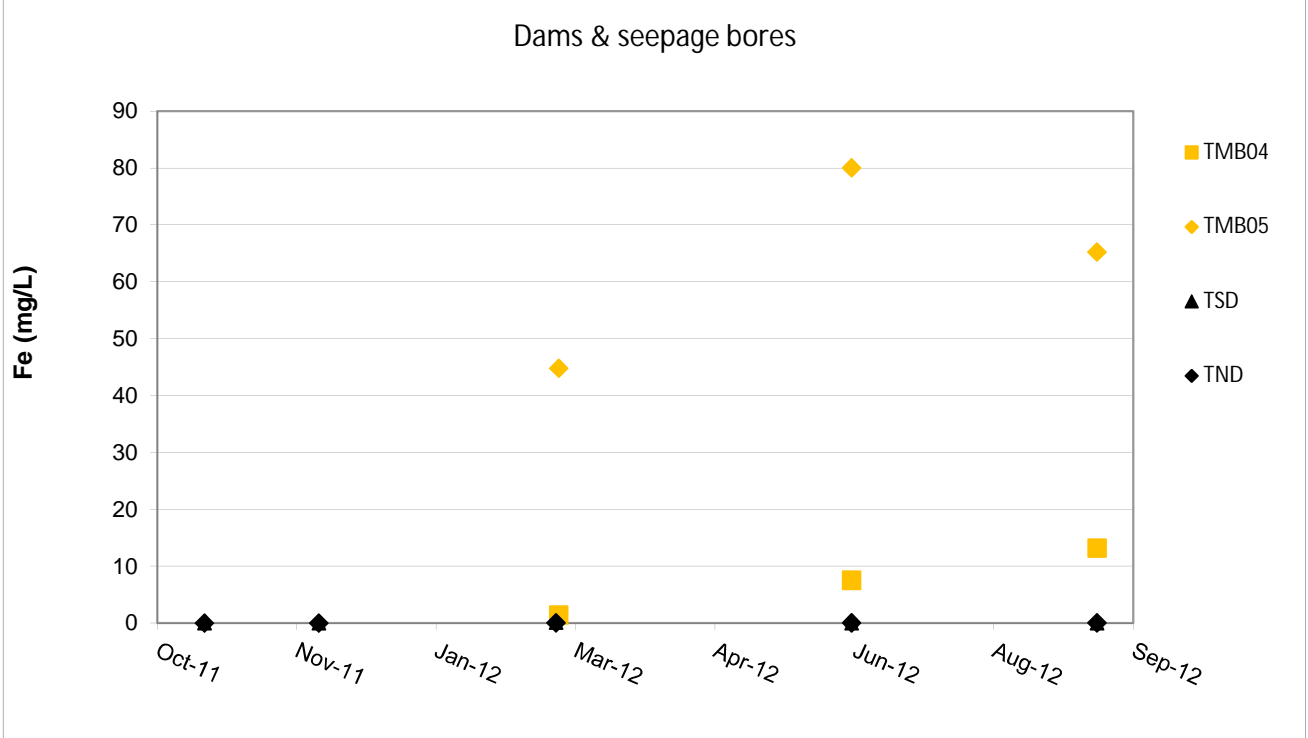
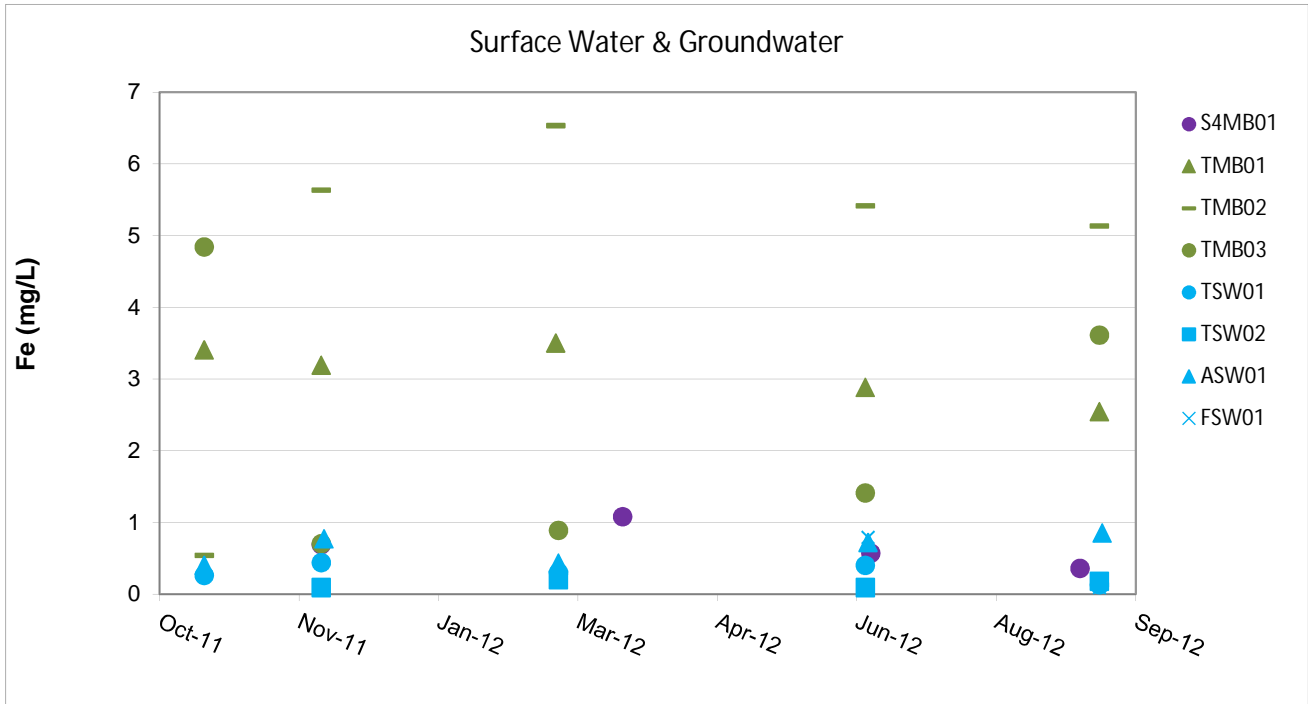


Figure B-12: Bromine concentrations

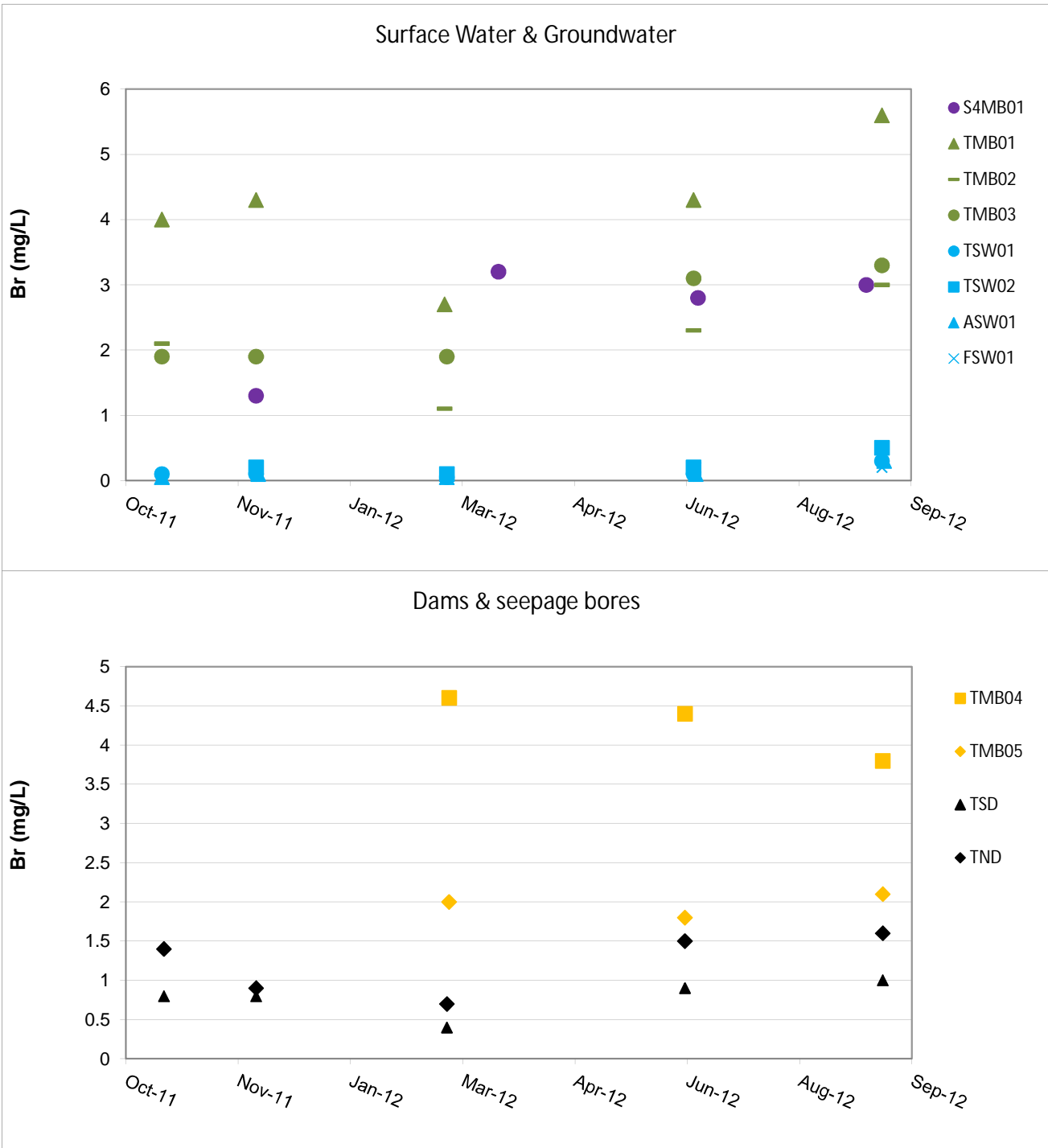
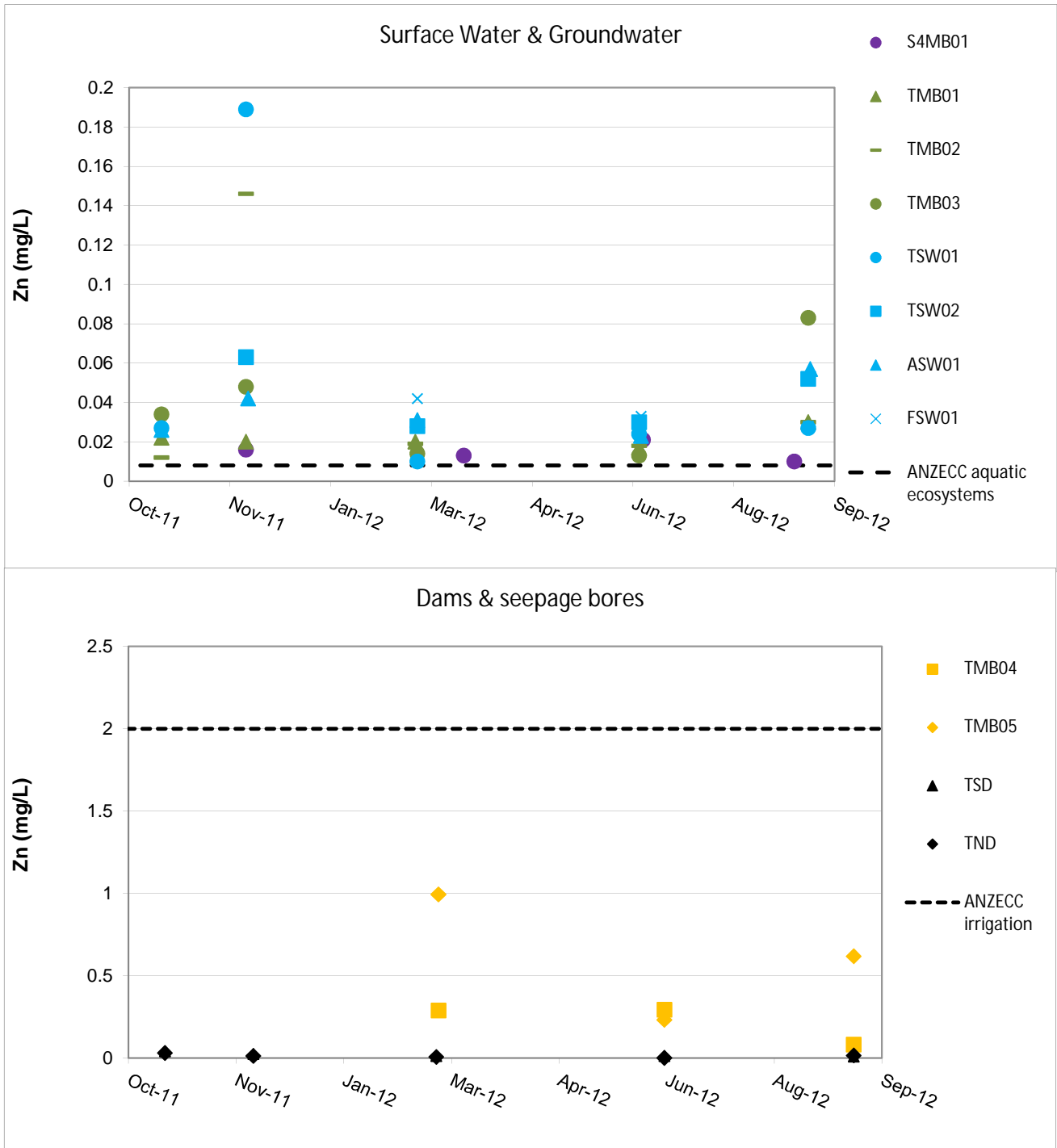


Figure B-13: Zinc concentrations



Note: ANZECC 2000. 95% protection levels for the protection of aquatic ecosystems

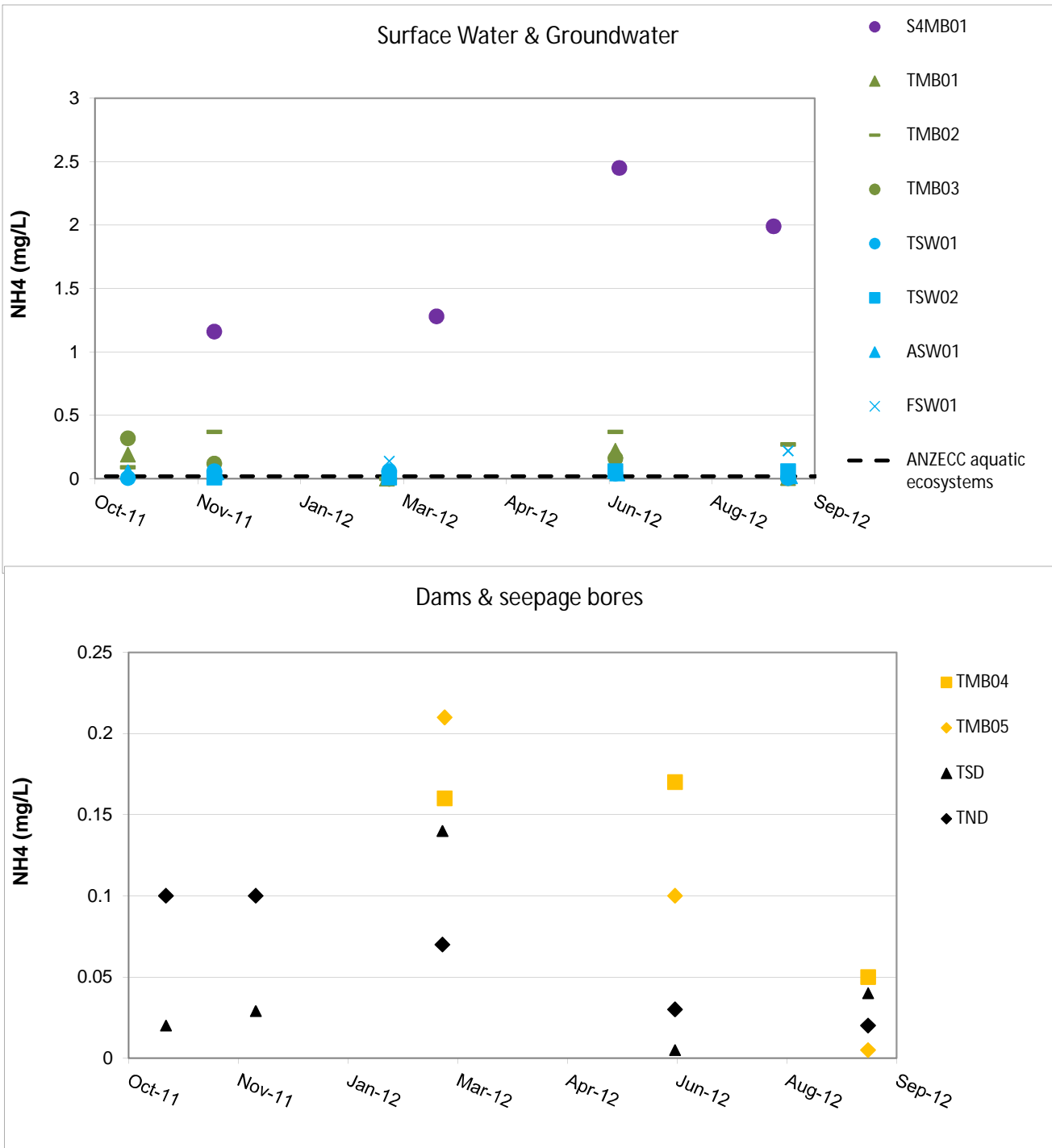
Note: ANZECC 2000. Water for irrigation and general water use

Client: AGL Upstream Investment Pty Ltd

Project: Gloucester Irrigation Monitoring

Location: Gloucester Basin, NSW

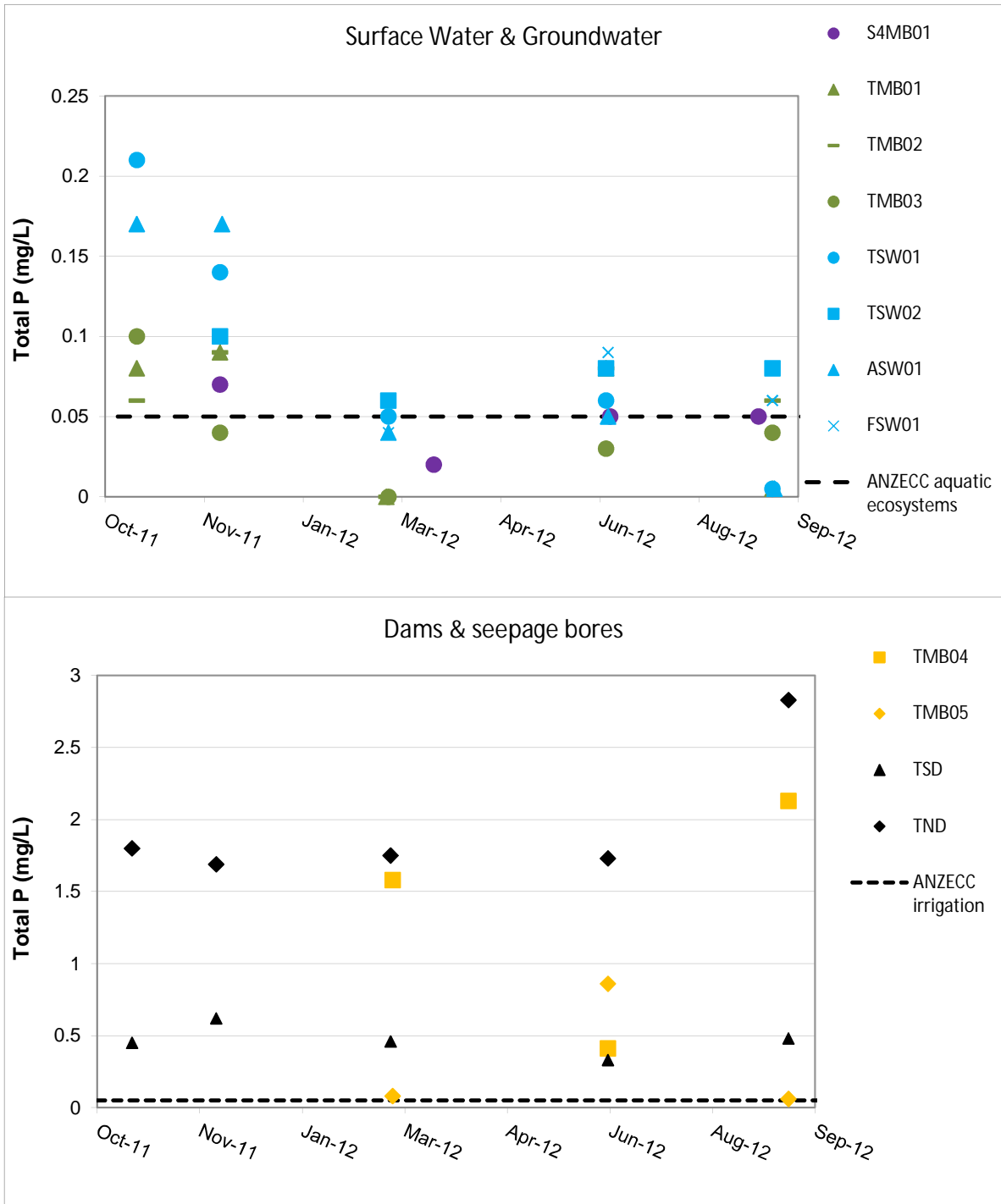
Figure B-14: Ammonia concentrations



Note: ANZECC 2000. 95% protection levels for the protection of aquatic ecosystems

Client: AGL Upstream Investment Pty Ltd
 Project: Gloucester Irrigation Monitoring
 Location: Gloucester Basin, NSW

Figure B15: Total Phosphorus



Note: ANZECC 2000. 95% protection levels for the protection of aquatic ecosystems

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

Client: AGL Upstream Investment Pty Ltd

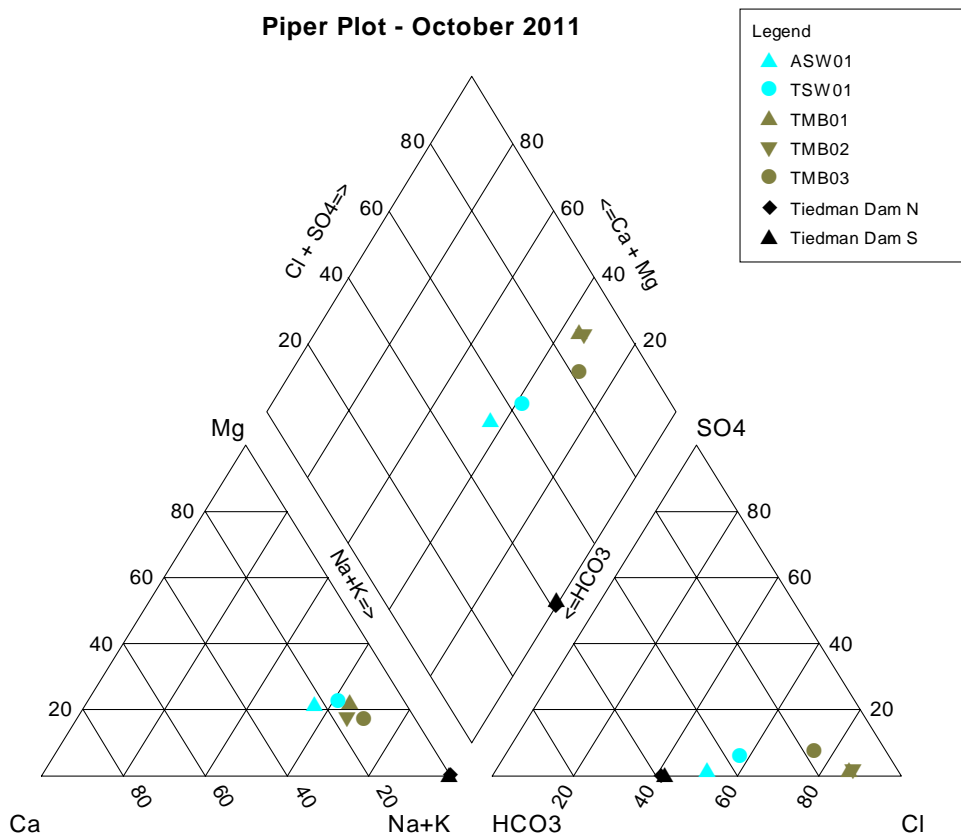
Project: Gloucester Irrigation Monitoring

Location: Gloucester Basin, NSW

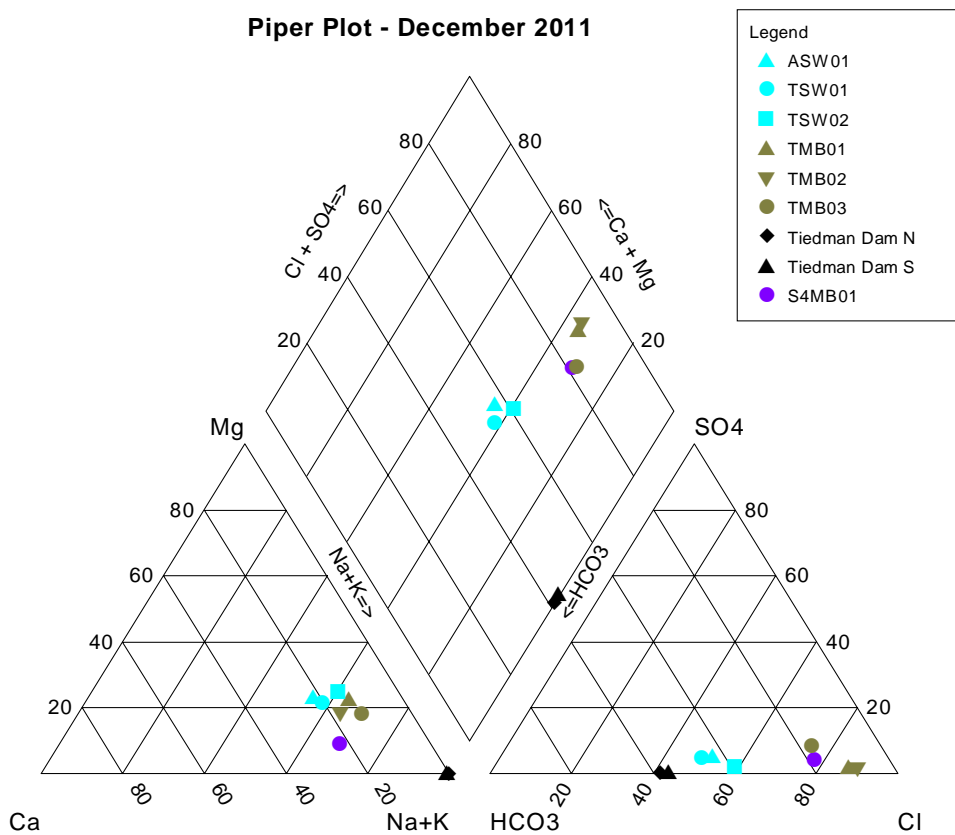
Appendix C

Piper diagrams

Piper Plot - October 2011

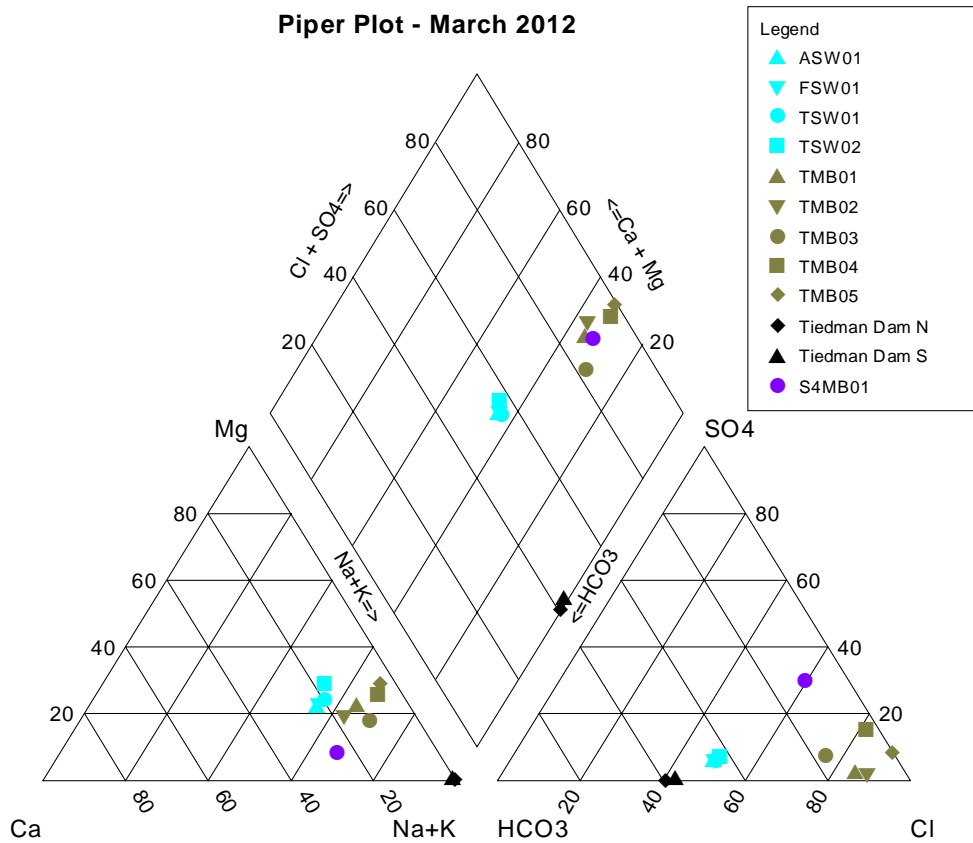


Piper Plot - December 2011

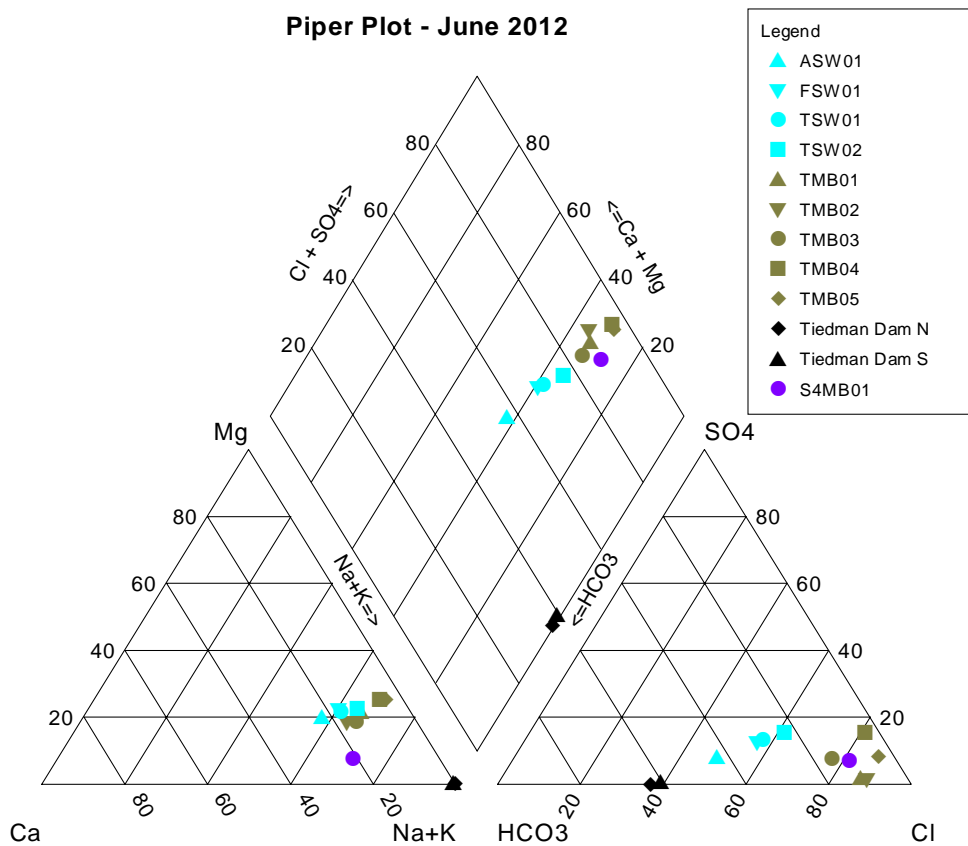


Note: Blue - surface water; Olive - shallow groundwater; Black - storage dams; purple - interburden unit

Piper Plot - March 2012

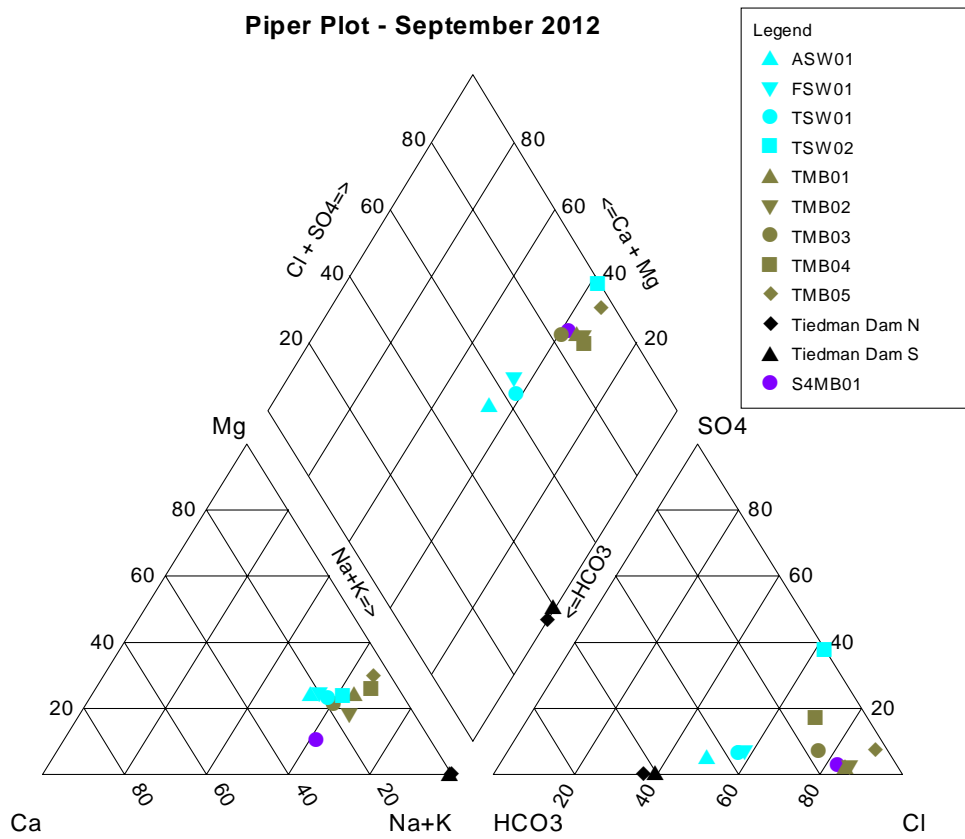


Piper Plot - June 2012



Note: Blue - surface water; Olive - shallow groundwater; Black - storage dams; purple - interburden unit

Piper Plot - September 2012



Note: Blue - surface water; Olive - shallow groundwater; Black - storage dams; purple - interburden unit

Appendix D

Laboratory reports

CERTIFICATE OF ANALYSIS

Work Order	: ES1126996	Page	: 1 of 6
Client	: PARSONS BRINCKERHOFF AUST P/L	Laboratory	: Environmental Division Sydney
Contact	: MR JAMES DUGGLEBY	Contact	: Loren Schiavon
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jduggleby@pb.com.au	E-mail	: loren.schiavon@alsglobal.com
Telephone	: +61 02 9272 5100	Telephone	: +61 2 8784 8503
Facsimile	: +61 02 9272 5101	Facsimile	: +61 2 8784 8500
Project	: 2162406D-GLOUCESTER IRRIGATION	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 08-DEC-2011
Sampler	: SM	Issue Date	: 16-DEC-2011
Site	: ----		
Quote number	: SY/394/09	No. of samples received	: 10
		No. of samples analysed	: 10

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

This document is issued in accordance with NATA accreditation requirements.

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
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Wisam Marassa	Inorganics 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.

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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

- **ED041G: LOR raised for SO4 analysi on sample ID:TND due to sample matrix**
- **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **EG020: LCS recoveries for some elements fall outside ALS Dynamic Control Limit. However, they are within the acceptance criteria based on ALS DQO. No further action is required.**
- **EK055G LOR raised for NH3 on the sample ID (QA1,TMB01) due to sample matrix.**



Analytical Results

Sub-Matrix: WATER

				Client sample ID				
				S4MB01	TMB01	TSW01	QA1	TMB02
				06-DEC-2011 10:00	06-DEC-2011 13:00	06-DEC-2011 14:00	06-DEC-2011 15:00	06-DEC-2011 14:30
				Client sampling date / time	Client sampling date / time	Client sampling date / time	Client sampling date / time	Client sampling date / time
Compound	CAS Number	LOR	Unit	ES1126996-001	ES1126996-002	ES1126996-003	ES1126996-004	ES1126996-005
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	496	1550	56	1550	589
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	281	503	60	501	149
Total Alkalinity as CaCO3	----	1	mg/L	281	503	60	501	149
ED040F: Dissolved Major Anions								
Sulfur as S	63705-05-5	1	mg/L	21	30	2	30	8
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	63	97	6	98	25
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	841	2810	46	2840	1040
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	141	229	11	230	114
Magnesium	7439-95-4	1	mg/L	35	237	7	238	74
Sodium	7440-23-5	1	mg/L	494	1280	34	1260	484
Potassium	7440-09-7	1	mg/L	10	4	3	3	4
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.01	<0.01	0.13	0.05	0.06
Arsenic	7440-38-2	0.001	mg/L	0.003	0.001	0.001	<0.001	0.004
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	1.07	0.256	0.047	0.263	0.715
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0004	<0.0001	<0.0001
Cobalt	7440-48-4	0.001	mg/L	0.001	<0.001	<0.001	0.001	0.002
Copper	7440-50-8	0.001	mg/L	0.002	<0.001	0.004	0.001	0.006
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	0.273	1.18	0.065	1.19	1.19
Molybdenum	7439-98-7	0.001	mg/L	0.001	<0.001	<0.001	0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	0.003	0.003	0.002	0.004	0.003
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	7440-24-6	0.001	mg/L	14.4	7.38	0.158	7.25	3.17
Uranium	7440-61-1	0.001	mg/L	0.001	0.003	<0.001	0.003	<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	0.016	0.020	0.189	0.057	0.146
Boron	7440-42-8	0.05	mg/L	0.07	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L	0.69	3.19	0.44	3.37	5.63



Analytical Results

Sub-Matrix: WATER

Client sample ID
 Client sampling date / time

Compound	CAS Number	LOR	Unit	S4MB01	TMB01	TSW01	QA1	TMB02
				06-DEC-2011 10:00	06-DEC-2011 13:00	06-DEC-2011 14:00	06-DEC-2011 15:00	06-DEC-2011 14:30
				ES1126996-001	ES1126996-002	ES1126996-003	ES1126996-004	ES1126996-005
EG020F: Dissolved Metals by ICP-MS - Continued								
Bromine	7726-95-6	0.1	mg/L	1.3	4.3	0.1	4.2	1.9
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.4	0.5	0.1	0.3	0.2
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	1.16	<0.10	0.02	<0.10	0.37
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	0.08	0.01	0.06	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	0.08	0.01	0.06	<0.01	<0.01
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.07	0.09	0.14	0.12	0.09
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	----	0.01	mg/L	0.02	<0.01	0.03	<0.01	<0.01
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	30.6	91.3	2.62	92.2	32.8
Total Cations	----	0.01	meq/L	31.7	86.7	2.68	86.0	32.9
Ionic Balance	----	0.01	%	1.62	2.60	----	3.50	0.15
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	19	7	7	7	<1



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				TMB03 TMB02	DTC	TSD	TND	ASW01
				06-DEC-2011 15:00	06-DEC-2011 15:30	06-DEC-2011 16:00	06-DEC-2011 16:30	07-DEC-2011 10:00
Compound	CAS Number	LOR	Unit	ES1126996-006	ES1126996-007	ES1126996-008	ES1126996-009	ES1126996-010
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	830	73	9	2	56
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	363	665	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	453	70	363	412	51
Total Alkalinity as CaCO3	----	1	mg/L	453	70	726	1080	51
ED040F: Dissolved Major Anions								
Sulfur as S	63705-05-5	1	mg/L	62	2	5	3	2
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	213	4	5	<10	6
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	1410	75	400	542	44
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	136	11	2	1	11
Magnesium	7439-95-4	1	mg/L	119	11	1	<1	7
Sodium	7440-23-5	1	mg/L	870	50	574	704	30
Potassium	7440-09-7	1	mg/L	1	2	94	278	3
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.02	0.03	0.04	0.08	0.14
Arsenic	7440-38-2	0.001	mg/L	0.002	<0.001	0.006	0.006	<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	0.190	0.036	0.183	0.170	0.050
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0002	<0.0001	<0.0001
Cobalt	7440-48-4	0.001	mg/L	0.005	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	0.003	0.003	0.003	0.001	0.003
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	1.66	0.043	0.003	0.003	0.109
Molybdenum	7439-98-7	0.001	mg/L	0.001	<0.001	0.018	0.019	<0.001
Nickel	7440-02-0	0.001	mg/L	0.002	0.002	0.002	0.002	0.003
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	7440-24-6	0.001	mg/L	4.12	0.164	0.240	0.225	0.150
Uranium	7440-61-1	0.001	mg/L	0.017	<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	0.048	0.063	0.024	0.013	0.042
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	0.51	0.58	<0.05



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				TMB03 TMB02	DTC	TSD	TND	ASW01
				06-DEC-2011 15:00	06-DEC-2011 15:30	06-DEC-2011 16:00	06-DEC-2011 16:30	07-DEC-2011 10:00
Compound	CAS Number	LOR	Unit	ES1126996-006	ES1126996-007	ES1126996-008	ES1126996-009	ES1126996-010
EG020F: Dissolved Metals by ICP-MS - Continued								
Iron	7439-89-6	0.05	mg/L	0.70	0.09	<0.05	<0.05	0.77
Bromine	7726-95-6	0.1	mg/L	2.5	0.2	0.8	0.9	0.1
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.3	0.1	0.6	0.6	0.1
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.12	0.01	0.29	0.01	0.06
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	<0.01	<0.01	0.09
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.06	<0.01	<0.01	0.09
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.04	0.10	0.62	1.69	0.14
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	----	0.01	mg/L	<0.01	0.04	<0.01	<0.01	0.02
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	53.3	3.60	25.9	36.9	2.39
Total Cations	----	0.01	meq/L	54.4	3.68	27.6	37.8	2.51
Ionic Balance	----	0.01	%	1.09	1.12	3.07	1.20	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	<1	10	48	51	5

CERTIFICATE OF ANALYSIS

Work Order	: ES1204726	Page	: 1 of 6
Client	: PARSONS BRINCKERHOFF AUST P/L	Laboratory	: Environmental Division Sydney
Contact	: MS NINA PEARSE-HAWKINS	Contact	: Loren Schiavon
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: npearsehawkins@pb.com.au	E-mail	: loren.schiavon@alsglobal.com
Telephone	: +61 02 9272 5100	Telephone	: +61 2 8784 8503
Facsimile	: +61 02 9272 5101	Facsimile	: +61 2 8784 8500
Project	: 2162406D-GLOUCESTER IRRIGATION	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 01-MAR-2012
C-O-C number	: ----	Issue Date	: 08-MAR-2012
Sampler	: NPH	No. of samples received	: 10
Site	: ----	No. of samples analysed	: 10
Quote number	: SY/394/09		

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
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics



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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: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **EG020: LCS recoveries for some elements fall outside ALS Dynamic Control Limit. However, they are within the acceptance criteria based on ALS DQO. No further action is required.**



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	T.NORTH DAM TND	T SOUTH DAMTSD	TMB01	TMB02	TMB03
				29-FEB-2012 11:00	29-FEB-2012 11:15	28-FEB-2012 12:00	28-FEB-2012 15:00	29-FEB-2012 12:00
				ES1204726-001	ES1204726-002	ES1204726-003	ES1204726-004	ES1204726-005
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	807	400	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	273	321	540	164	481
Total Alkalinity as CaCO3	----	1	mg/L	1080	721	540	164	481
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	11	99	30	200
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	522	386	2690	1090	1520
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	2	3	220	122	140
Magnesium	7439-95-4	1	mg/L	<1	2	241	81	127
Sodium	7440-23-5	1	mg/L	708	577	1300	505	942
Potassium	7440-09-7	1	mg/L	273	83	3	4	2
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.07	0.16	<0.01	0.01	<0.01
Arsenic	7440-38-2	0.001	mg/L	0.004	0.005	0.001	0.004	0.002
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	0.066	0.104	0.229	0.585	0.193
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	0.002	0.004
Copper	7440-50-8	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
Manganese	7439-96-5	0.001	mg/L	0.005	0.002	0.806	0.939	1.48
Molybdenum	7439-98-7	0.001	mg/L	0.011	0.011	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	0.001	0.001	0.004	0.001	0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	7440-24-6	0.001	mg/L	0.111	0.154	6.08	2.45	3.92
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	0.003	<0.001	0.017
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	0.007	0.012	0.020	0.019	0.014
Boron	7440-42-8	0.05	mg/L	0.42	0.33	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L	0.06	0.09	3.50	6.53	0.89
Bromine	7726-95-6	0.1	mg/L	0.7	0.4	2.7	1.1	1.9
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.07	0.14	----	----	----
EK057G: Nitrite as N by Discrete Analyser								



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				T.NORTH DAM TND	T SOUTH DAMTSD	TMB01	TMB02	TMB03
				29-FEB-2012 11:00	29-FEB-2012 11:15	28-FEB-2012 12:00	28-FEB-2012 15:00	29-FEB-2012 12:00
Compound	CAS Number	LOR	Unit	ES1204726-001	ES1204726-002	ES1204726-003	ES1204726-004	ES1204726-005
EK057G: Nitrite as N by Discrete Analyser - Continued								
Nitrite as N	----	0.01	mg/L	<0.01	<0.01	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	0.01	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.01	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	1.75	0.46	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	----	----	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	36.3	25.5	88.7	34.6	56.6
Total Cations	----	0.01	meq/L	37.9	27.5	87.4	34.8	58.5
Ionic Balance	----	0.01	%	2.10	3.75	0.74	0.25	1.56
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	41	39	----	----	----



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	ASW01	TSW01	TSW02	FSW01	QA1
				29-FEB-2012 09:00	29-FEB-2012 15:00	29-FEB-2012 12:30	29-FEB-2012 14:30	29-FEB-2012 15:00
				ES1204726-006	ES1204726-007	ES1204726-008	ES1204726-009	ES1204726-010
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	46	56	97	53	54
Total Alkalinity as CaCO3	----	1	mg/L	46	56	97	53	54
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	6	7	15	7	6
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	36	45	81	42	37
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	10	11	16	11	10
Magnesium	7439-95-4	1	mg/L	6	8	16	7	6
Sodium	7440-23-5	1	mg/L	27	34	55	31	28
Potassium	7440-09-7	1	mg/L	2	3	3	2	2
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.19	0.07	<0.01	0.13	0.07
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<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	0.033	0.041	0.048	0.036	0.035
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	0.002	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	0.001	0.001	0.003	0.004	<0.001
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	0.058	0.077	0.586	0.093	0.062
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	0.001	0.001	0.002	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	7440-24-6	0.001	mg/L	0.139	0.142	0.208	0.092	0.144
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	0.031	0.010	0.028	0.042	0.006
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L	0.43	0.30	0.20	0.31	0.25
Bromine	7726-95-6	0.1	mg/L	<0.1	<0.1	0.1	<0.1	0.1
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.06	0.06	0.01	0.14	0.02
EK057G: Nitrite as N by Discrete Analyser								



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				ASW01	TSW01	TSW02	FSW01	QA1
				29-FEB-2012 09:00	29-FEB-2012 15:00	29-FEB-2012 12:30	29-FEB-2012 14:30	29-FEB-2012 15:00
Compound	CAS Number	LOR	Unit	ES1204726-006	ES1204726-007	ES1204726-008	ES1204726-009	ES1204726-010
EK057G: Nitrite as N by Discrete Analyser - Continued								
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	0.06	0.05	0.02	0.06	0.08
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	0.06	0.05	0.02	0.06	0.08
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.04	0.05	0.06	0.04	0.03
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	----	0.01	mg/L	0.01	0.02	0.04	0.02	0.02
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	2.06	2.53	4.54	2.39	2.25
Total Cations	----	0.01	meq/L	2.22	2.76	4.58	2.52	2.26
Ionic Balance	----	0.01	%	----	----	0.52	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	6	8	14	8	6

CERTIFICATE OF ANALYSIS

<p>Work Order : ES1204934</p> <p>Client : PARSONS BRINCKERHOFF AUST P/L</p> <p>Contact : MS NINA PEARSE-HAWKINS</p> <p>Address : GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001</p> <p>E-mail : npearsehawkins@pb.com.au</p> <p>Telephone : +61 02 9272 5100</p> <p>Facsimile : +61 02 9272 5101</p> <p>Project : 2162406D-GLOUCESTER IRRIGATION</p> <p>Order number : ----</p> <p>C-O-C number : ----</p> <p>Sampler : ----</p> <p>Site : ----</p> <p>Quote number : SY/394/09</p>	<p>Page : 1 of 4</p> <p>Laboratory : Environmental Division Sydney</p> <p>Contact : Loren Schiavon</p> <p>Address : 277-289 Woodpark Road Smithfield NSW Australia 2164</p> <p>E-mail : loren.schiavon@alsglobal.com</p> <p>Telephone : +61 2 8784 8503</p> <p>Facsimile : +61 2 8784 8500</p> <p>QC Level : NEPM 1999 Schedule B(3) and ALS QCS3 requirement</p> <p>Date Samples Received : 02-MAR-2012</p> <p>Issue Date : 09-MAR-2012</p> <p>No. of samples received : 2</p> <p>No. of samples analysed : 2</p>
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This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Hoa Nguyen	Inorganic Chemist	Sydney Inorganics
Sarah Millington	Senior Inorganic Chemist	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

- **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **EG020: LCS recovery for Vanadium falls outside ALS Dynamic Control Limit. However, it is within the acceptance criteria based on ALS DQO. No further action is required.**



Analytical Results

Sub-Matrix: WATER

				Client sample ID					
				Client sampling date / time					
				TMB04	TMB05	----	----	----	
				01-MAR-2012 09:00	01-MAR-2012 09:30	----	----	----	
Compound	CAS Number	LOR	Unit	ES1204934-001	ES1204934-002	----	----	----	
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	6.68	5.55	----	----	----	
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm	7800	7520	----	----	----	
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	5380	4930	----	----	----	
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	129	22	----	----	----	
Total Alkalinity as CaCO3	----	1	mg/L	129	22	----	----	----	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	607	314	----	----	----	
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L	2420	2620	----	----	----	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	100	63	----	----	----	
Magnesium	7439-95-4	1	mg/L	257	270	----	----	----	
Sodium	7440-23-5	1	mg/L	1280	1180	----	----	----	
Potassium	7440-09-7	1	mg/L	28	19	----	----	----	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.02	0.49	----	----	----	
Arsenic	7440-38-2	0.001	mg/L	<0.001	0.002	----	----	----	
Beryllium	7440-41-7	0.001	mg/L	<0.001	0.003	----	----	----	
Barium	7440-39-3	0.001	mg/L	0.071	0.082	----	----	----	
Cadmium	7440-43-9	0.0001	mg/L	0.0012	0.0021	----	----	----	
Cobalt	7440-48-4	0.001	mg/L	0.144	0.377	----	----	----	
Copper	7440-50-8	0.001	mg/L	0.002	0.002	----	----	----	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----	
Manganese	7439-96-5	0.001	mg/L	12.1	21.8	----	----	----	
Molybdenum	7439-98-7	0.001	mg/L	0.002	0.002	----	----	----	
Nickel	7440-02-0	0.001	mg/L	0.058	0.199	----	----	----	
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	----	----	----	
Strontium	7440-24-6	0.001	mg/L	1.09	0.953	----	----	----	
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	----	----	----	
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	----	----	----	
Zinc	7440-66-6	0.005	mg/L	0.288	0.993	----	----	----	



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				TMB04	TMB05	----	----	----
				01-MAR-2012 09:00	01-MAR-2012 09:30	----	----	----
Compound	CAS Number	LOR	Unit	ES1204934-001	ES1204934-002	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued								
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	----	----	----
Iron	7439-89-6	0.05	mg/L	1.44	44.8	----	----	----
Bromine	7726-95-6	0.1	mg/L	4.6	2.0	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.16	0.21	----	----	----
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	0.02	0.02	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	0.02	0.02	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	1.58	0.08	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	----	----	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	83.5	80.9	----	----	----
Total Cations	----	0.01	meq/L	82.5	77.2	----	----	----
Ionic Balance	----	0.01	%	0.58	2.36	----	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	4	7	----	----	----

CERTIFICATE OF ANALYSIS

Work Order	: ES1207116	Page	: 1 of 4
Client	: PARSONS BRINCKERHOFF AUST P/L	Laboratory	: Environmental Division Sydney
Contact	: MR JAMES DUGGLEBY	Contact	: Loren Schiavon
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jduggleby@pb.com.au	E-mail	: loren.schiavon@alsglobal.com
Telephone	: +61 02 9272 5100	Telephone	: +61 2 8784 8503
Facsimile	: +61 02 9272 5101	Facsimile	: +61 2 8784 8500
Project	: 2162406D	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: SY/394/09	Date Samples Received	: 26-MAR-2012
C-O-C number	: ----	Issue Date	: 03-APR-2012
Sampler	: NINA PH	No. of samples received	: 1
Site	: ----	No. of samples analysed	: 1
Quote number	: SY/394/09		

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
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Hoa Nguyen	Inorganic Chemist	Sydney Inorganics
Raymond Commodor	Instrument Chemist	Sydney Inorganics
Sarah Millington	Senior Inorganic Chemist	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

- **EA015: Insufficient sample amount for confirmation analysis for sample S4MB01 for TDS**
 - **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
-



Analytical Results

Sub-Matrix: WATER

			Client sample ID	S4MB01				
			Client sampling date / time	23-MAR-2012 09:00				
Compound	CAS Number	LOR	Unit	ES1207116-001				
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.77				
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	5910				
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	5700				
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	1090				
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1				
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1				
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	340				
Total Alkalinity as CaCO3	----	1	mg/L	340				
ED040F: Dissolved Major Anions								
Sulfur as S	63705-05-5	1	mg/L	302				
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	908				
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	1350				
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	328				
Magnesium	7439-95-4	1	mg/L	65				
Sodium	7440-23-5	1	mg/L	1010				
Potassium	7440-09-7	1	mg/L	10				
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.01				
Arsenic	7440-38-2	0.001	mg/L	0.009				
Beryllium	7440-41-7	0.001	mg/L	<0.001				
Barium	7440-39-3	0.001	mg/L	0.256				
Cadmium	7440-43-9	0.0001	mg/L	<0.0001				
Cobalt	7440-48-4	0.001	mg/L	0.002				
Copper	7440-50-8	0.001	mg/L	0.002				
Lead	7439-92-1	0.001	mg/L	<0.001				
Manganese	7439-96-5	0.001	mg/L	0.369				
Molybdenum	7439-98-7	0.001	mg/L	0.004				
Nickel	7440-02-0	0.001	mg/L	0.006				
Selenium	7782-49-2	0.01	mg/L	<0.01				



Analytical Results

Sub-Matrix: **WATER**

Client sample ID

S4MB01

Client sampling date / time

23-MAR-2012 09:00

Compound	CAS Number	LOR	Unit	ES1207116-001				
EG020F: Dissolved Metals by ICP-MS - Continued								
Strontium	7440-24-6	0.001	mg/L	24.7	----	----	----	----
Uranium	7440-61-1	0.001	mg/L	0.005	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	0.013	----	----	----	----
Boron	7440-42-8	0.05	mg/L	0.27	----	----	----	----
Iron	7439-89-6	0.05	mg/L	1.08	----	----	----	----
Bromine	7726-95-6	0.1	mg/L	3.2	----	----	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.4	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	1.28	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	0.03	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	0.45	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	0.48	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.02	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	----	0.01	mg/L	<0.01	----	----	----	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	63.8	----	----	----	----
Total Cations	----	0.01	meq/L	65.9	----	----	----	----
Ionic Balance	----	0.01	%	1.63	----	----	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	135	----	----	----	----

Environmental Division

CERTIFICATE OF ANALYSIS

<p>Work Order : ES1214912</p> <p>Client : PARSONS BRINCKERHOFF AUST P/L</p> <p>Contact : MS NINA PEARSE-HAWKINS</p> <p>Address : GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001</p> <p>E-mail : npearsehawkins@pb.com.au</p> <p>Telephone : +61 02 9272 5100</p> <p>Facsimile : +61 02 9272 5101</p> <p>Project : 2162406D- GLOUCESTER IRRIGATION</p> <p>Order number : ----</p> <p>C-O-C number : ----</p> <p>Sampler : NPH</p> <p>Site : ----</p> <p>Quote number : SY/394/09</p>	<p>Page : 1 of 4</p> <p>Laboratory : Environmental Division Sydney</p> <p>Contact : Loren Schiavon</p> <p>Address : 277-289 Woodpark Road Smithfield NSW Australia 2164</p> <p>E-mail : loren.schiavon@alsglobal.com</p> <p>Telephone : +61 2 8784 8503</p> <p>Facsimile : +61 2 8784 8500</p> <p>QC Level : NEPM 1999 Schedule B(3) and ALS QCS3 requirement</p> <p>Date Samples Received : 15-JUN-2012</p> <p>Issue Date : 22-JUN-2012</p> <p>No. of samples received : 5</p> <p>No. of samples analysed : 5</p>
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This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Ashesh Patel	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Hoa Nguyen	Inorganic Chemist	Sydney Inorganics
Sarah Millington	Senior Inorganic Chemist	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

- **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
-



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				T.NORTH DAM	T.SOUTH DAM	TMB05	TMB04	QA1
				14-JUN-2012 12:00	14-JUN-2012 12:15	14-JUN-2012 14:00	14-JUN-2012 11:00	14-JUN-2012 11:00
Compound	CAS Number	LOR	Unit	ES1214912-001	ES1214912-002	ES1214912-003	ES1214912-004	ES1214912-005
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	9.60	9.63	6.42	6.54	9.60
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	3610	2530	7570	7920	3600
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	2120	1470	4350	4700	2280
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	5	13	1200	1340	5
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	595	415	<1	<1	593
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	624	402	161	148	627
Total Alkalinity as CaCO3	----	1	mg/L	1220	817	161	148	1220
ED040F: Dissolved Major Anions								
Sulfur as S	63705-05-5	1	mg/L	2	4	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	12	321	628	<1
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	505	375	2500	2450	510
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	2	2	71	100	2
Magnesium	7439-95-4	1	mg/L	<1	2	249	264	<1
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.01	0.15	0.02	0.04	0.02
Arsenic	7440-38-2	0.001	mg/L	0.005	0.006	0.006	0.002	0.005
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	0.129	0.119	0.082	0.078	0.132
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	0.178	0.130	<0.001
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	0.002	<0.001
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	0.007	0.011	24.9	14.1	0.009
Molybdenum	7439-98-7	0.001	mg/L	0.015	0.018	<0.001	<0.001	0.016
Nickel	7440-02-0	0.001	mg/L	<0.001	0.001	0.088	0.053	0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Strontium	7440-24-6	0.001	mg/L	0.206	0.198	1.13	1.15	0.211
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				T.NORTH DAM	T.SOUTH DAM	TMB05	TMB04	QA1
				14-JUN-2012 12:00	14-JUN-2012 12:15	14-JUN-2012 14:00	14-JUN-2012 11:00	14-JUN-2012 11:00
Compound	CAS Number	LOR	Unit	ES1214912-001	ES1214912-002	ES1214912-003	ES1214912-004	ES1214912-005
EG020F: Dissolved Metals by ICP-MS - Continued								
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	0.012	0.232	0.293	0.027
Boron	7440-42-8	0.05	mg/L	0.76	0.56	0.09	<0.05	0.75
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	80.0	7.53	0.06
Bromine	7726-95-6	0.1	mg/L	1.5	0.9	1.8	4.4	1.6
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.4	0.4	0.4	0.7	0.4
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.03	<0.01	0.10	0.17	0.02
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	0.02	<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	0.02	0.01	<0.01
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	1.73	0.33	0.86	0.41	1.74
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	43	44	17	8	42

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order : ES1215255 Client : PARSONS BRINCKERHOFF AUST P/L Contact : MS NINA PEARSE-HAWKINS Address : GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001 E-mail : npearsehawkins@pb.com.au Telephone : +61 02 9272 5100 Facsimile : +61 02 9272 5101 Project : 2162406D- GLOUCESTER IRRIGATION Order number : ---- C-O-C number : ---- Sampler : NPH Site : ---- Quote number : SY/394/09	Page : 1 of 6 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 1999 Schedule B(3) and ALS QCS3 requirement Date Samples Received : 20-JUN-2012 Issue Date : 27-JUN-2012 No. of samples received : 7 No. of samples analysed : 7
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This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

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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
Hoa Nguyen	Inorganic Chemist	Sydney Inorganics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics



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LOR = Limit of reporting

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

- **EG020: LCS recoveries for some elements fall outside ALS Dynamic Control Limit. However, they are within the acceptance criteria based on ALS DQO. No further action is required.**



Analytical Results

Sub-Matrix: WATER

				Client sample ID				
				TMB03	ASW01	TSW01	TSW02	TMB01
				18-JUN-2012 14:00	19-JUN-2012 08:00	18-JUN-2012 04:45	18-JUN-2012 02:30	18-JUN-2012 04:30
				Client sampling date / time				
Compound	CAS Number	LOR	Unit	ES1215255-001	ES1215255-002	ES1215255-003	ES1215255-004	ES1215255-005
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	3180	130	226	266	4680
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	977	43	51	64	1360
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	417	43	38	42	445
Total Alkalinity as CaCO3	----	1	mg/L	417	43	38	42	445
ED040F: Dissolved Major Anions								
Sulfur as S	63705-05-5	1	mg/L	68	2	4	6	27
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	199	8	17	27	81
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	1480	35	53	80	2450
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	172	9	9	9	191
Magnesium	7439-95-4	1	mg/L	133	5	7	10	214
Sodium	7440-23-5	1	mg/L	890	25	35	52	1230
Potassium	7440-09-7	1	mg/L	2	3	4	4	4
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	0.34	0.19	0.04	<0.01
Arsenic	7440-38-2	0.001	mg/L	0.003	<0.001	<0.001	<0.001	0.003
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	7440-39-3	0.001	mg/L	0.221	0.036	0.039	0.037	0.231
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	0.003	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	<0.001	0.007	0.005	0.005	<0.001
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	1.73	0.037	0.035	0.034	0.969
Molybdenum	7439-98-7	0.001	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	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
Strontium	7440-24-6	0.001	mg/L	4.85	0.122	0.125	0.145	6.02
Uranium	7440-61-1	0.001	mg/L	0.016	<0.001	<0.001	<0.001	0.003
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	0.023	0.024	0.030	0.017



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				TMB03	ASW01	TSW01	TSW02	TMB01
				18-JUN-2012 14:00	19-JUN-2012 08:00	18-JUN-2012 04:45	18-JUN-2012 02:30	18-JUN-2012 04:30
Compound	CAS Number	LOR	Unit	ES1215255-001	ES1215255-002	ES1215255-003	ES1215255-004	ES1215255-005
EG020F: Dissolved Metals by ICP-MS - Continued								
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L	1.41	0.72	0.40	0.09	2.88
Bromine	7726-95-6	0.1	mg/L	3.1	0.1	0.1	0.2	4.3
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.2	<0.1	<0.1	<0.1	0.2
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.16	0.04	0.04	0.06	0.22
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	0.02	0.06	0.14	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.02	0.06	0.14	<0.01
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.03	0.05	0.06	0.08	0.08
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	----	0.01	mg/L	<0.01	0.01	0.02	0.05	<0.01
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	54.2	2.01	2.61	3.66	79.7
Total Cations	----	0.01	meq/L	58.3	2.02	2.65	3.64	80.8
Ionic Balance	----	0.01	%	3.61	----	----	0.31	0.65
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	<1	14	13	12	2



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				TMB02	FSW01	---	---	---
				18-JUN-2012 16:00	19-JUN-2012 09:00	---	---	---
Compound	CAS Number	LOR	Unit	ES1215255-006	ES1215255-007	---	---	---
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	2020	154	---	---	---
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	---	1	mg/L	637	58	---	---	---
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	168	43	---	---	---
Total Alkalinity as CaCO3	---	1	mg/L	168	43	---	---	---
ED040F: Dissolved Major Anions								
Sulfur as S	63705-05-5	1	mg/L	10	4	---	---	---
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	32	17	---	---	---
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	1080	56	---	---	---
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	120	10	---	---	---
Magnesium	7439-95-4	1	mg/L	82	8	---	---	---
Sodium	7440-23-5	1	mg/L	524	38	---	---	---
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	0.46	---	---	---
Arsenic	7440-38-2	0.001	mg/L	0.004	<0.001	---	---	---
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	---	---	---
Barium	7440-39-3	0.001	mg/L	0.685	0.068	---	---	---
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	---	---	---
Cobalt	7440-48-4	0.001	mg/L	0.002	<0.001	---	---	---
Copper	7440-50-8	0.001	mg/L	0.003	0.003	---	---	---
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	---	---	---
Manganese	7439-96-5	0.001	mg/L	1.40	0.096	---	---	---
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	---	---	---
Nickel	7440-02-0	0.001	mg/L	0.001	0.001	---	---	---
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	---	---	---
Strontium	7440-24-6	0.001	mg/L	3.04	0.202	---	---	---
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	---	---	---
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	---	---	---
Zinc	7440-66-6	0.005	mg/L	0.018	0.033	---	---	---



Analytical Results

Sub-Matrix: WATER

				Client sample ID	TMB02	FSW01			
				Client sampling date / time	18-JUN-2012 16:00	19-JUN-2012 09:00	----	----	----
Compound	CAS Number	LOR	Unit		ES1215255-006	ES1215255-007	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	----	----	----
Iron	7439-89-6	0.05	mg/L		5.41	0.79	----	----	----
Bromine	7726-95-6	0.1	mg/L		2.3	0.2	----	----	----
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		0.37	0.06	----	----	----
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	0.11	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	0.11	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		0.08	0.09	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	----	0.01	mg/L		0.06	0.02	----	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		34.5	2.79	----	----	----
Total Cations	----	0.01	meq/L		35.6	2.91	----	----	----
Ionic Balance	----	0.01	%		1.63	----	----	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L		<1	13	----	----	----

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES1216183	Page	: 1 of 3
Client	: PARSONS BRINCKERHOFF AUST P/L	Laboratory	: Environmental Division Sydney
Contact	: MS NINA PEARSE-HAWKINS	Contact	: Loren Schiavon
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: npearsehawkins@pb.com.au	E-mail	: loren.schiavon@alsglobal.com
Telephone	: +61 02 9272 5100	Telephone	: +61 2 8784 8503
Facsimile	: +61 02 9272 5101	Facsimile	: +61 2 8784 8500
Project	: 2162406D- GLOUCESTER IRRIGATION	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: REBATCH OF ES1214912	Date Samples Received	: 29-JUN-2012
C-O-C number	: ----	Issue Date	: 05-JUL-2012
Sampler	: NPH	No. of samples received	: 5
Site	: ----	No. of samples analysed	: 5
Quote number	: SY/394/09		

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



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



Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				T.NORTH DAM	T.SOUTH DAM	TMB05	TMB04	QA1
				14-JUN-2012 12:00	14-JUN-2012 12:15	14-JUN-2012 14:00	14-JUN-2012 11:00	14-JUN-2012 11:00
<i>Compound</i>	<i>CAS Number</i>	<i>LOR</i>	<i>Unit</i>	ES1216183-001	ES1216183-002	ES1216183-003	ES1216183-004	ES1216183-005
ED040F: Dissolved Major Anions								
Sulfur as S	63705-05-5	1	mg/L	----	----	120	213	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	2	2	79	104	2
Magnesium	7439-95-4	1	mg/L	1	2	272	264	<1
Sodium	7440-23-5	1	mg/L	718	594	1300	1360	725
Potassium	7440-09-7	1	mg/L	267	78	17	25	270

CERTIFICATE OF ANALYSIS

Work Order	: ES1221947	Page	: 1 of 12
Client	: PARSONS BRINCKERHOFF AUST P/L	Laboratory	: Environmental Division Sydney
Contact	: MR JAMES DUGGLEBY	Contact	: Loren Schiavon
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jduggleby@pb.com.au	E-mail	: loren.schiavon@alsglobal.com
Telephone	: +61 02 9272 5100	Telephone	: +61 2 8784 8503
Facsimile	: +61 02 9272 5101	Facsimile	: +61 2 8784 8500
Project	: 2162406D - GLOUCESTER IRRIGATION	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 12-SEP-2012
C-O-C number	: ----	Issue Date	: 19-SEP-2012
Sampler	: ----	No. of samples received	: 11
Site	: ----	No. of samples analysed	: 11
Quote number	: SY/394/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ankit Joshi	Inorganic Chemist	Sydney Inorganics
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Edwandy Fadjar	Organic Coordinator	Sydney Organics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Wisam Marassa	Inorganics Coordinator	Sydney Inorganics



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

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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

- **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
- **EK055G LOR raised for NH3 on the various samples due to matrix interference.**
- **EK059G LOR raised for NOx on the various samples due to matrix interference.**
- **It has been noted that Reactive P is greater than Total P for sample ASW01, however this difference is within the limits of experimental variation.**



Analytical Results

Sub-Matrix: WATER

Client sample ID
 Client sampling date / time

Compound	CAS Number	LOR	Unit	ASW01	TSW02	TMB01	TSW01	TMB05
				11-SEP-2012 10:30	10-SEP-2012 14:10	10-SEP-2012 16:00	10-SEP-2012 16:30	10-SEP-2012 15:00
				ES1221947-001	ES1221947-002	ES1221947-003	ES1221947-004	ES1221947-005
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.74	3.82	7.31	7.73	6.38
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	415	732	8900	532	7620
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	202	388	4990	238	4050
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	88	128	1650	89	1290
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	88	<1	623	81	125
Total Alkalinity as CaCO3	----	1	mg/L	88	<1	623	81	125
ED040F: Dissolved Major Anions								
Sulfur as S	63705-05-5	1	mg/L	4	36	33	4	93
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	10	124	97	14	282
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	69	152	2920	88	2580
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	17	20	216	16	66
Magnesium	7439-95-4	1	mg/L	11	19	270	12	273
Sodium	7440-23-5	1	mg/L	44	91	1350	54	1140
Potassium	7440-09-7	1	mg/L	4	6	4	5	18
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.02	0.04	<0.01	<0.01	0.07
Arsenic	7440-38-2	0.001	mg/L	<0.001	0.001	0.002	<0.001	0.002
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	0.061	0.078	0.263	0.050	0.064
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	0.0006
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	0.218
Copper	7440-50-8	0.001	mg/L	0.005	0.005	0.004	0.004	0.004
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	0.194	0.373	0.997	0.137	23.0
Molybdenum	7439-98-7	0.001	mg/L	0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	0.001	0.002	<0.001	<0.001	0.098
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	ASW01	TSW02	TMB01	TSW01	TMB05
				11-SEP-2012 10:30	10-SEP-2012 14:10	10-SEP-2012 16:00	10-SEP-2012 16:30	10-SEP-2012 15:00
				ES1221947-001	ES1221947-002	ES1221947-003	ES1221947-004	ES1221947-005
EG020F: Dissolved Metals by ICP-MS - Continued								
Strontium	7440-24-6	0.001	mg/L	0.340	0.482	8.00	0.270	1.00
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	0.005	<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	0.057	0.052	0.030	0.027	0.618
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L	0.85	0.18	2.54	0.13	65.2
Bromine	7726-95-6	0.1	mg/L	0.3	0.5	5.6	0.3	2.1
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.2	<0.1	0.5
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.02	0.06	<0.10	<0.01	<0.10
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	0.02	<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	0.02	<0.01	<0.01	<0.01	0.01
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	<0.01	0.08	<0.01	<0.01	0.06
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	----	0.01	mg/L	0.01	0.03	<0.01	<0.01	<0.01
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	3.91	6.87	96.8	4.39	81.2
Total Cations	----	0.01	meq/L	3.77	6.67	----	4.26	----
Total Cations	----	0.01	meq/L	----	----	92.0	----	75.3
Ionic Balance	----	0.01	%	1.87	1.45	----	1.50	----
Ionic Balance	----	0.01	%	----	----	2.56	----	1.23
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	7	9	2	9	11
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	<20	----
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	<50	----
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	<100	----
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	<50	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	<50	----



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	ASW01	TSW02	TMB01	TSW01	TMB05
				11-SEP-2012 10:30	10-SEP-2012 14:10	10-SEP-2012 16:00	10-SEP-2012 16:30	10-SEP-2012 15:00
				ES1221947-001	ES1221947-002	ES1221947-003	ES1221947-004	ES1221947-005
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	20	µg/L	<20	<20	<20	<20	----
^ C6 - C10 Fraction minus BTEX (F1)	----	20	µg/L	<20	<20	<20	<20	----
>C10 - C16 Fraction	----	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	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	----
Toluene	108-88-3	2	µg/L	<2	<2	<2	<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	<1	<1	<1	<1	----
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	<5	----
EP080S: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.1	%	128	130	124	122	----
Toluene-D8	2037-26-5	0.1	%	126	100	97.2	101	----
4-Bromofluorobenzene	460-00-4	0.1	%	88.6	90.8	87.1	84.7	----



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				TMB02	TMB03	FSW01	TMB04	TSD
				10-SEP-2012 14:30	10-SEP-2012 14:00	10-SEP-2012 16:45	10-SEP-2012 12:00	10-SEP-2012 12:20
Compound	CAS Number	LOR	Unit	ES1221947-006	ES1221947-007	ES1221947-008	ES1221947-009	ES1221947-010
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	7.09	7.22	7.68	6.72	9.50
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	3980	6070	459	7810	2680
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	2200	3460	238	4460	1510
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	627	1230	89	1330	9
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	349
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	202	506	71	174	470
Total Alkalinity as CaCO3	----	1	mg/L	202	506	71	174	818
ED040F: Dissolved Major Anions								
Sulfur as S	63705-05-5	1	mg/L	15	64	4	226	4
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	46	200	14	692	8
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	1080	1610	84	2100	381
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	116	229	16	109	2
Magnesium	7439-95-4	1	mg/L	82	159	12	257	1
Sodium	7440-23-5	1	mg/L	555	853	48	1250	573
Potassium	7440-09-7	1	mg/L	4	4	5	24	76
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.01	0.01	0.01	<0.01	0.09
Arsenic	7440-38-2	0.001	mg/L	0.003	0.005	<0.001	0.002	0.006
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	0.666	0.244	0.050	0.081	0.124
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	0.004	0.002	<0.001	0.061	<0.001
Copper	7440-50-8	0.001	mg/L	0.002	0.002	0.003	0.002	0.002
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	1.37	1.66	0.112	10.6	0.003
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	0.016
Nickel	7440-02-0	0.001	mg/L	0.002	0.002	<0.001	0.031	<0.001
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	TMB02	TMB03	FSW01	TMB04	TSD
				10-SEP-2012 14:30	10-SEP-2012 14:00	10-SEP-2012 16:45	10-SEP-2012 12:00	10-SEP-2012 12:20
				ES1221947-006	ES1221947-007	ES1221947-008	ES1221947-009	ES1221947-010
EG020F: Dissolved Metals by ICP-MS - Continued								
Strontium	7440-24-6	0.001	mg/L	3.39	5.24	0.172	1.03	0.189
Uranium	7440-61-1	0.001	mg/L	<0.001	0.005	<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	0.030	0.083	0.028	0.081	0.010
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	0.49
Iron	7439-89-6	0.05	mg/L	5.13	3.61	0.09	13.2	<0.05
Bromine	7726-95-6	0.1	mg/L	3.0	3.3	0.2	3.8	1.0
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.1	0.2	<0.1	0.6	0.5
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.27	<0.10	0.22	<0.10	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
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.06	0.04	0.06	2.13	0.48
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	----	0.01	mg/L	0.04	<0.01	<0.01	<0.01	<0.01
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	35.5	59.7	4.08	77.1	27.3
Total Cations	----	0.01	meq/L	----	61.7	4.00	----	27.0
Total Cations	----	0.01	meq/L	37.1	----	----	82.3	----
Ionic Balance	----	0.01	%	----	1.67	0.97	----	0.42
Ionic Balance	----	0.01	%	2.20	----	----	3.24	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	<1	<1	9	12	42
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	<20	<20	----	<20
C10 - C14 Fraction	----	50	µg/L	<50	<50	<50	----	<50
C15 - C28 Fraction	----	100	µg/L	<100	<100	<100	----	<100
C29 - C36 Fraction	----	50	µg/L	<50	<50	<50	----	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	<50	<50	----	<50



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

Compound	CAS Number	LOR	Unit	TMB02	TMB03	FSW01	TMB04	TSD
				10-SEP-2012 14:30	10-SEP-2012 14:00	10-SEP-2012 16:45	10-SEP-2012 12:00	10-SEP-2012 12:20
				ES1221947-006	ES1221947-007	ES1221947-008	ES1221947-009	ES1221947-010
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	20	µg/L	<20	<20	<20	----	<20
^ C6 - C10 Fraction minus BTEX (F1)	----	20	µg/L	<20	<20	<20	----	<20
>C10 - C16 Fraction	----	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
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	<1	----	<1
Toluene	108-88-3	2	µg/L	<2	<2	<2	----	<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	<1	<1	<1	----	<1
Naphthalene	91-20-3	5	µg/L	<5	<5	<5	----	<5
EP080S: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.1	%	118	123	117	----	119
Toluene-D8	2037-26-5	0.1	%	112	126	94.1	----	93.5
4-Bromofluorobenzene	460-00-4	0.1	%	98.0	83.4	82.1	----	79.6



Analytical Results

Sub-Matrix: **WATER**

			Client sample ID	TND				
			Client sampling date / time	10-SEP-2012 12:15	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1221947-011	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	9.48	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	3900	----	----	----	----
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	2180	----	----	----	----
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	----	1	mg/L	5	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	466	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	788	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	1250	----	----	----	----
ED040F: Dissolved Major Anions								
Sulfur as S	63705-05-5	1	mg/L	2	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	----	----	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	511	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	2	----	----	----	----
Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
Sodium	7440-23-5	1	mg/L	694	----	----	----	----
Potassium	7440-09-7	1	mg/L	282	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.02	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	0.004	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L	<0.001	----	----	----	----
Barium	7440-39-3	0.001	mg/L	0.120	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L	0.003	----	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	0.009	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	0.015	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	0.002	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----



Analytical Results

Sub-Matrix: **WATER**

				Client sample ID	TND				
				Client sampling date / time	10-SEP-2012 12:15	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1221947-011	----	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Strontium	7440-24-6	0.001	mg/L	0.179	----	----	----	----	----
Uranium	7440-61-1	0.001	mg/L	<0.001	----	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	----	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	0.015	----	----	----	----	----
Boron	7440-42-8	0.05	mg/L	0.67	----	----	----	----	----
Iron	7439-89-6	0.05	mg/L	0.05	----	----	----	----	----
Bromine	7726-95-6	0.1	mg/L	1.6	----	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L	0.5	----	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	0.02	----	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L	<0.01	----	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	<0.10	----	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	<0.10	----	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	2.83	----	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	----	0.01	mg/L	0.02	----	----	----	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L	39.4	----	----	----	----	----
Total Cations	----	0.01	meq/L	37.5	----	----	----	----	----
Ionic Balance	----	0.01	%	2.48	----	----	----	----	----
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L	63	----	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L	<20	----	----	----	----	----
C10 - C14 Fraction	----	50	µg/L	Not Authorised	----	----	----	----	----
C15 - C28 Fraction	----	100	µg/L	Not Authorised	----	----	----	----	----
C29 - C36 Fraction	----	50	µg/L	Not Authorised	----	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	Not Authorised	----	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft									
C6 - C10 Fraction	----	20	µg/L	<20	----	----	----	----	----



Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				TND	----	----	----	----
				10-SEP-2012 12:15	----	----	----	----
<i>Compound</i>	<i>CAS Number</i>	<i>LOR</i>	<i>Unit</i>	ES1221947-011	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft - Continued								
^ C6 - C10 Fraction minus BTEX (F1)	----	20	µg/L	<20	----	----	----	----
>C10 - C16 Fraction	----	100	µg/L	Not Authorised	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L	Not Authorised	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L	Not Authorised	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	Not Authorised	----	----	----	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	----	----	----	----
Toluene	108-88-3	2	µg/L	<2	----	----	----	----
Ethylbenzene	100-41-4	2	µg/L	<2	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	----	----	----	----
ortho-Xylene	95-47-6	2	µg/L	<2	----	----	----	----
^ Total Xylenes	1330-20-7	2	µg/L	<2	----	----	----	----
^ Sum of BTEX	----	1	µg/L	<1	----	----	----	----
Naphthalene	91-20-3	5	µg/L	<5	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.1	%	130	----	----	----	----
Toluene-D8	2037-26-5	0.1	%	129	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	87.4	----	----	----	----



Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128

CERTIFICATE OF ANALYSIS

Work Order	: ES1221389	Page	: 1 of 6
Client	: PARSONS BRINCKERHOFF AUST P/L	Laboratory	: Environmental Division Sydney
Contact	: MR JAMES DUGGLEBY	Contact	: Loren Schiavon
Address	: GPO BOX 5394 SYDNEY NSW, AUSTRALIA 2001	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jduggleby@pb.com.au	E-mail	: loren.schiavon@alsglobal.com
Telephone	: +61 02 9272 5100	Telephone	: +61 2 8784 8503
Facsimile	: +61 02 9272 5101	Facsimile	: +61 2 8784 8500
Project	: 2162406D- GLOUCESTER IRRIGATION	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 05-SEP-2012
C-O-C number	: ----	Issue Date	: 12-SEP-2012
Sampler	: SM + JD	No. of samples received	: 1
Site	: ----	No. of samples analysed	: 1
Quote number	: SY/394/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



NATA Accredited Laboratory 825

Accredited for compliance with
ISO/IEC 17025.

Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Celine Conceicao	Senior Spectroscopist	Sydney Inorganics
Pabi Subba	Senior Organic Chemist	Sydney Organics
Sarah Millington	Senior Inorganic Chemist	Sydney Inorganics
Wisam Marassa	Inorganics 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

- **EG020: Bromine quantification may be unreliable due to its low solubility in acid, leading to variable volatility during measurement by ICPMS.**
 - **EG020: Some samples were diluted and rerun due to matrix interference and LOR's have been raised accordingly. (High sample salinity)**
 - **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

				Client sample ID				
				S4MB01	---	---	---	---
				Client sampling date / time	03-SEP-2012 14:00	---	---	---
Compound	CAS Number	LOR	Unit	ES1221389-001	---	---	---	---
EA015: Total Dissolved Solids								
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	3130	---	---	---	---
EA065: Total Hardness as CaCO3								
Total Hardness as CaCO3	---	1	mg/L	958	---	---	---	---
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	---	---	---	---
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	---	---	---	---
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	324	---	---	---	---
Total Alkalinity as CaCO3	---	1	mg/L	324	---	---	---	---
ED040F: Dissolved Major Anions								
Sulfur as S	63705-05-5	1	mg/L	63	---	---	---	---
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	179	---	---	---	---
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	1320	---	---	---	---
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	280	---	---	---	---
Magnesium	7439-95-4	1	mg/L	63	---	---	---	---
Sodium	7440-23-5	1	mg/L	700	---	---	---	---
Potassium	7440-09-7	1	mg/L	7	---	---	---	---
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	0.02	---	---	---	---
Arsenic	7440-38-2	0.001	mg/L	0.002	---	---	---	---
Beryllium	7440-41-7	0.001	mg/L	<0.001	---	---	---	---
Barium	7440-39-3	0.001	mg/L	0.355	---	---	---	---
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	---	---	---	---
Cobalt	7440-48-4	0.001	mg/L	<0.001	---	---	---	---
Copper	7440-50-8	0.001	mg/L	<0.001	---	---	---	---
Lead	7439-92-1	0.001	mg/L	<0.001	---	---	---	---
Manganese	7439-96-5	0.001	mg/L	0.290	---	---	---	---
Molybdenum	7439-98-7	0.001	mg/L	<0.001	---	---	---	---
Nickel	7440-02-0	0.001	mg/L	<0.001	---	---	---	---
Selenium	7782-49-2	0.01	mg/L	<0.01	---	---	---	---
Strontium	7440-24-6	0.001	mg/L	21.3	---	---	---	---
Uranium	7440-61-1	0.001	mg/L	0.001	---	---	---	---
Vanadium	7440-62-2	0.01	mg/L	<0.01	---	---	---	---
Zinc	7440-66-6	0.005	mg/L	0.010	---	---	---	---



Analytical Results

Sub-Matrix: **WATER**

				Client sample ID				
				S4MB01	----	----	----	----
				Client sampling date / time	03-SEP-2012 14:00	----	----	----
Compound	CAS Number	LOR	Unit	ES1221389-001				
EG020F: Dissolved Metals by ICP-MS - Continued								
Boron	7440-42-8	0.05	mg/L	0.16	----	----	----	----
Iron	7439-89-6	0.05	mg/L	0.36	----	----	----	----
Bromine	7726-95-6	0.1	mg/L	3.0	----	----	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	0.4	----	----	----	----
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	1.99	----	----	----	----
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	<0.01	----	----	----	----
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	----	----	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser								
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	----	----	----	----
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.05	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	----	0.01	mg/L	<0.01	----	----	----	----
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	47.4	----	----	----	----
Total Cations	----	0.01	meq/L	49.8	----	----	----	----
Ionic Balance	----	0.01	%	2.42	----	----	----	----
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	20	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	----	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	----	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	----	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft								
C6 - C10 Fraction	----	20	µg/L	<20	----	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	----	20	µg/L	<20	----	----	----	----
>C10 - C16 Fraction	----	100	µg/L	<100	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----



Analytical Results

Sub-Matrix: **WATER**

Client sample ID

S4MB01

Client sampling date / time

03-SEP-2012 14:00

Compound	CAS Number	LOR	Unit	ES1221389-001				
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft - Continued								
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	----	----	----	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	----	----	----	----
Toluene	108-88-3	2	µg/L	<2	----	----	----	----
Ethylbenzene	100-41-4	2	µg/L	<2	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	----	----	----	----
ortho-Xylene	95-47-6	2	µg/L	<2	----	----	----	----
^ Total Xylenes	1330-20-7	2	µg/L	<2	----	----	----	----
^ Sum of BTEX	----	1	µg/L	<1	----	----	----	----
Naphthalene	91-20-3	5	µg/L	<5	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.1	%	121	----	----	----	----
Toluene-D8	2037-26-5	0.1	%	128	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	125	----	----	----	----



Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	71	137
Toluene-D8	2037-26-5	79	131
4-Bromofluorobenzene	460-00-4	70	128



Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: ES1123309	Page	: 1 of 9
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Project	: 2162406D-GLOUCESTER IRRIGATION	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----	Date Samples Received	: 26-OCT-2011
C-O-C number	: ----	Issue Date	: 02-NOV-2011
Sampler	: SM	No. of samples received	: 7
Site	: ----	No. of samples analysed	: 7
Quote number	: SY/394/09		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits



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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
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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

- **EG020: LCS recovery for Vanadium falls outside ALS Dynamic Control Limit. However, it is within the acceptance criteria based on ALS DQO. No further action is required.**
- **EP080: Level of reporting raised for toluene due to ambient background levels in the laboratory.**



Analytical Results

Sub-Matrix: WATER

Client sample ID
 Client sampling date / time

				TMBO1	TSW01	ASW01	TMBO3	TMB02
				25-OCT-2011 10:45	25-OCT-2011 11:00	25-OCT-2011 11:00	25-OCT-2011 15:00	25-OCT-2011 16:00
Compound	CAS Number	LOR	Unit	ES1123309-001	ES1123309-002	ES1123309-003	ES1123309-004	ES1123309-005
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	557	68	58	439	179
Total Alkalinity as CaCO3	----	1	mg/L	557	68	58	439	179
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	90	11	2	180	32
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	2940	76	46	1330	1040
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	242	12	12	135	115
Magnesium	7439-95-4	1	mg/L	246	10	7	115	74
Sodium	7440-23-5	1	mg/L	1340	49	32	875	527
Potassium	7440-09-7	1	mg/L	4	4	4	1	3
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	0.02	0.02	<0.01	<0.01
Arsenic	7440-38-2	0.001	mg/L	0.002	<0.001	<0.001	0.001	0.004
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	0.262	0.045	0.049	0.167	0.656
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0003	0.0002	<0.0001
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	0.004	0.003
Copper	7440-50-8	0.001	mg/L	0.002	0.004	0.004	0.003	0.004
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Manganese	7439-96-5	0.001	mg/L	1.04	0.163	0.200	1.31	1.12
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	<0.001	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
Strontium	7440-24-6	0.001	mg/L	6.46	0.168	0.160	3.43	2.70
Uranium	7440-61-1	0.001	mg/L	0.004	<0.001	<0.001	0.017	<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	0.022	0.027	0.026	0.012	0.034
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L	3.40	0.26	0.40	0.54	4.84
Bromine	7726-95-6	0.1	mg/L	4.0	0.1	<0.1	2.1	1.9
EK055G: Ammonia as N by Discrete Analyser								
Ammonia as N	7664-41-7	0.01	mg/L	0.19	<0.01	0.05	0.09	0.32
EK057G: Nitrite as N by Discrete Analyser								
Nitrite as N	----	0.01	mg/L	0.01	<0.01	<0.01	<0.01	<0.01



Analytical Results

Sub-Matrix: WATER

Client sample ID

Client sampling date / time

				TMBO1	TSW01	ASW01	TMBO3	TMB02
				25-OCT-2011 10:45	25-OCT-2011 11:00	25-OCT-2011 11:00	25-OCT-2011 15:00	25-OCT-2011 16:00
Compound	CAS Number	LOR	Unit	ES1123309-001	ES1123309-002	ES1123309-003	ES1123309-004	ES1123309-005
EK058G: Nitrate as N by Discrete Analyser								
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	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	<0.01	0.03	<0.01	<0.01
EK067G: Total Phosphorus as P by Discrete Analyser								
Total Phosphorus as P	----	0.01	mg/L	0.08	0.21	0.17	0.06	0.10
EK071G: Reactive Phosphorus as P by discrete analyser								
Reactive Phosphorus as P	----	0.01	mg/L	<0.01	0.04	0.06	<0.01	<0.01
EN055: Ionic Balance								
Total Anions	----	0.01	meq/L	95.9	3.73	2.50	50.0	33.6
Total Cations	----	0.01	meq/L	90.7	3.66	2.67	54.3	34.8
Ionic Balance	----	0.01	%	2.81	1.04	----	4.06	1.82
EP005: Total Organic Carbon (TOC)								
Total Organic Carbon	----	1	mg/L	1	17	12	<1	<1
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 2010 Draft								
C6 - C10 Fraction	----	20	µg/L	<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	----	20	µg/L	<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	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
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L	<5	<5	<5	<5	<5
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
EP080S: TPH(V)/BTEX Surrogates								
1,2-Dichloroethane-D4	17060-07-0	0.1	%	106	107	113	108	111



Analytical Results

Sub-Matrix: **WATER**

Client sample ID

Client sampling date / time

				TMBO1	TSW01	ASW01	TMBO3	TMB02
				25-OCT-2011 10:45	25-OCT-2011 11:00	25-OCT-2011 11:00	25-OCT-2011 15:00	25-OCT-2011 16:00
<i>Compound</i>	<i>CAS Number</i>	<i>LOR</i>	<i>Unit</i>	ES1123309-001	ES1123309-002	ES1123309-003	ES1123309-004	ES1123309-005
EP080S: TPH(V)/BTEX Surrogates - Continued								
Toluene-D8	2037-26-5	0.1	%	101	100	102	102	101
4-Bromofluorobenzene	460-00-4	0.1	%	103	99.1	99.3	97.1	99.6



Analytical Results

Sub-Matrix: WATER

				Client sample ID					
				Client sampling date / time					
				TDS	TDN	---	---	---	
				26-OCT-2011 09:00	26-OCT-2011 09:30	---	---	---	
Compound	CAS Number	LOR	Unit	ES1123309-006	ES1123309-007	---	---	---	
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	319	564	---	---	---	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	429	514	---	---	---	
Total Alkalinity as CaCO3	---	1	mg/L	748	1080	---	---	---	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	6	<1	---	---	---	
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L	387	538	---	---	---	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	2	1	---	---	---	
Magnesium	7439-95-4	1	mg/L	1	<1	---	---	---	
Sodium	7440-23-5	1	mg/L	616	744	---	---	---	
Potassium	7440-09-7	1	mg/L	57	302	---	---	---	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	0.04	0.02	---	---	---	
Arsenic	7440-38-2	0.001	mg/L	0.006	0.005	---	---	---	
Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	---	---	---	
Barium	7440-39-3	0.001	mg/L	0.211	0.113	---	---	---	
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	---	---	---	
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	---	---	---	
Copper	7440-50-8	0.001	mg/L	0.002	0.002	---	---	---	
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	---	---	---	
Manganese	7439-96-5	0.001	mg/L	0.004	0.003	---	---	---	
Molybdenum	7439-98-7	0.001	mg/L	0.020	0.020	---	---	---	
Nickel	7440-02-0	0.001	mg/L	0.004	0.002	---	---	---	
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	---	---	---	
Strontium	7440-24-6	0.001	mg/L	0.284	0.169	---	---	---	
Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	---	---	---	
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	---	---	---	
Zinc	7440-66-6	0.005	mg/L	0.041	0.030	---	---	---	
Boron	7440-42-8	0.05	mg/L	0.51	0.70	---	---	---	
Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	---	---	---	
Bromine	7726-95-6	0.1	mg/L	0.8	1.4	---	---	---	
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L	0.02	0.10	---	---	---	
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	---	0.01	mg/L	<0.01	<0.01	---	---	---	



Analytical Results

Sub-Matrix: WATER

				Client sample ID					
				Client sampling date / time					
				TDS	TDN	---	---	---	
				26-OCT-2011 09:00	26-OCT-2011 09:30	---	---	---	
Compound	CAS Number	LOR	Unit	ES1123309-006	ES1123309-007	---	---	---	
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	---	---	---	
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	---	---	---	
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L	0.45	1.80	---	---	---	
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	---	---	---	
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L	26.0	36.8	---	---	---	
Total Cations	----	0.01	meq/L	28.4	40.1	---	---	---	
Ionic Balance	----	0.01	%	4.45	4.37	---	---	---	
EP005: Total Organic Carbon (TOC)									
Total Organic Carbon	----	1	mg/L	49	48	---	---	---	
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L	<20	<20	---	---	---	
C10 - C14 Fraction	----	50	µg/L	<50	130	---	---	---	
C15 - C28 Fraction	----	100	µg/L	140	340	---	---	---	
C29 - C36 Fraction	----	50	µg/L	<50	80	---	---	---	
^ C10 - C36 Fraction (sum)	----	50	µg/L	140	550	---	---	---	
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft									
C6 - C10 Fraction	----	20	µg/L	<20	<20	---	---	---	
^ C6 - C10 Fraction minus BTEX (F1)	----	20	µg/L	<20	<20	---	---	---	
>C10 - C16 Fraction	----	100	µg/L	<100	200	---	---	---	
>C16 - C34 Fraction	----	100	µg/L	200	310	---	---	---	
>C34 - C40 Fraction	----	100	µg/L	<100	<100	---	---	---	
^ >C10 - C40 Fraction (sum)	----	100	µg/L	200	510	---	---	---	
EP080: BTEXN									
Benzene	71-43-2	1	µg/L	<1	<1	---	---	---	
Toluene	108-88-3	2	µg/L	<5	<5	---	---	---	
Ethylbenzene	100-41-4	2	µg/L	<2	<2	---	---	---	
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	---	---	---	
ortho-Xylene	95-47-6	2	µg/L	<2	<2	---	---	---	
^ Total Xylenes	1330-20-7	2	µg/L	<2	<2	---	---	---	
^ Sum of BTEX	----	1	µg/L	<1	<1	---	---	---	
Naphthalene	91-20-3	5	µg/L	<5	<5	---	---	---	
EP080S: TPH(V)/BTEX Surrogates									
1,2-Dichloroethane-D4	17060-07-0	0.1	%	111	108	---	---	---	



Analytical Results

Sub-Matrix: **WATER**

				Client sample ID						
				Client sampling date / time		TDS	TDN	---	---	---
				26-OCT-2011 09:00	26-OCT-2011 09:30	---	---	---	---	---
Compound	CAS Number	LOR	Unit	ES1123309-006	ES1123309-007	---	---	---	---	---
EP080S: TPH(V)/BTEX Surrogates - Continued										
Toluene-D8	2037-26-5	0.1	%	103	104	---	---	---	---	---
4-Bromofluorobenzene	460-00-4	0.1	%	99.8	99.4	---	---	---	---	---



Surrogate Control Limits

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP080S: TPH(V)/BTEX Surrogates			
1,2-Dichloroethane-D4	17060-07-0	76.4	133.1
Toluene-D8	2037-26-5	79.6	126.8
4-Bromofluorobenzene	460-00-4	79.1	125.0

Appendix E

QA/QC

Table E-1

Quality Control Analytical Results December 2011

Gloucester Irrigation Trial Baseline Monitoring

Major Ions

QC sample	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Total Alkalinity as CaCO3 (mg/L)
LOR	1	1	1	1	1	1	1
TMB01	229	237	1280	4	97	2810	503
QA1(duplicate of TMB01)	230	238	1260	3	98	2840	501
RPD (%)	0	0	2	29	1	1	0

Dissolved Metals

QC sample	Aluminium (mg/L)	Arsenic (mg/L)	Barium (mg/L)	Cobalt (mg/L)	Copper (mg/L)	Manganese (mg/L)	Molybdenum (mg/L)	Nickel (mg/L)	Strontium (mg/L)	Uranium (mg/L)	Iron (mg/L)	Bromine (mg/L)	Zinc (mg/L)
LOR	0.01	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.05	0.1	0.005
TMB01	0.005	0.001	0.256	0.0005	0.0005	1.18	0.0005	0.003	7.38	0.003	3.19	4.3	0.02
QA1(duplicate of TMB01)	0.05	0.0005	0.263	0.001	0.001	1.19	0.001	0.004	7.25	0.003	3.37	4.2	0.057
RPD (%)	163.6	66.7	2.7	66.7	66.7	0.8	66.7	28.6	1.8	0.0	5.5	2.4	96.1

Nutrients

QC sample	Nitrate as N (mg/L)	Phosphorus (mg/L)	Total organic carbon (mg/L)
LOR	0.01	0.01	1
TMB01	0.01	0.09	7
QA1(duplicate of TMB01)	0.005	0.12	7
RPD (%)	66.7	28.6	0.0

Notes:

RPD = Relative Percentage Difference (between the original and duplicate sample analytical results)

nc = RPD was not calculated as one result was below the LOR

LOR = laboratory limit of reporting

BOLD & shaded RPD exceeds acceptable limits



Table E-2

Quality Control Analytical Results February 2012

Gloucester Irrigation Trial Baseline Monitoring

Major Ions

QC sample	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Total Alkalinity as CaCO3 (mg/L)
LOR	1	1	1	1	1	1	1
ASW01	10	6	27	2	6	36	46
QA1(duplicate of ASW01)	10	6	28	2	6	37	54
RPD (%)	0	0	4	0	0	3	16

Dissolved Metals

QC sample	Aluminium (mg/L)	Barium (mg/L)	Copper (mg/L)	Manganese (mg/L)	Nickel (mg/L)	Strontium (mg/L)	Iron (mg/L)	Bromine (mg/L)	Zinc (mg/L)
LOR	0.01	0.001	0.001	0.001	0.001	0.001	0.05	0.1	0.005
ASW01	0.19	0.033	0.001	0.058	0.001	0.139	0.43	0.05	0.031
QA1(duplicate of ASW01)	0.07	0.035	0.0005	0.062	0.0005	0.144	0.25	0.1	0.006
RPD (%)	92.3	5.9	66.7	6.7	66.7	3.5	52.9	66.7	135.1

Nutrients

QC sample	Ammonia (mg/L)	Nitrate as N (mg/L)	Phosphorus (mg/L)	Reactive Phosphorus (mg/L)	Total organic carbon (mg/L)
LOR	0.01	0.01	0.01	0.01	1
ASW01	0.06	0.06	0.04	0.01	6
QA1(duplicate of ASW01)	0.02	0.08	0.03	0.02	6
RPD (%)	100.0	28.6	28.6	66.7	0.0

Notes:

RPD = Relative Percentage Difference (between the original and duplicate sample analytical results)

nc = RPD was not calculated as one result was below the LOR

LOR = laboratory limit of reporting

BOLD & shaded RPD exceeds acceptable limits



Table E-3

Quality Control Analytical Results

Gloucester Irrigation Trial Baseline Monitoring
2162406D

Jun-12

Major Ions

QC sample	Calcium (mg/L)	Magnesium (mg/L)	Sodium (mg/L)	Potassium (mg/L)	Chloride (mg/L)	Total Alkalinity as CaCO3 (mg/L)
LOR	1	1	1	1	1	1
T. North Dam	2	1	718	267	505	1220
QA1(duplicate of T.North Dam)	2	0.5	725	270	510	1220
RPD (%)	0	67	1	1	1	0

Dissolved Metals

QC sample	Aluminium (mg/L)	Arsenic (mg/L)	Barium (mg/L)	Manganese (mg/L)	Molybdenum (mg/L)	Nickel (mg/L)	Strontium (mg/L)	Iron (mg/L)	Boron (mg/L)	Bromine (mg/L)	Zinc (mg/L)
LOR	0.01	0.001	0.001	0.001	0.001	0.001	0.001	0.05	0.05	0.1	0.005
T. North Dam	0.01	0.005	0.129	0.007	0.015	0.0005	0.206	0.43	0.76	1.5	0.0025
QA1(duplicate of T.North Dam)	0.02	0.005	0.132	0.009	0.016	0.001	0.211	0.25	0.75	1.6	0.027
RPD (%)	66.7	0.0	2.3	25.0	6.5	66.7	2.4	52.9	1.3	6.5	166.1

Nutrients

QC sample	Ammonia (mg/L)	Phosphorus (mg/L)	Total organic carbon (mg/L)
LOR	0.01	0.01	1
T. North Dam	0.03	1.73	43
QA1(duplicate of T.North Dam)	0.02	1.74	42
RPD (%)	40.0	0.6	2.4

Notes:

RPD = Relative Percentage Difference (between the original and duplicate sample analytical results)

nc = RPD was not calculated as one result was below the LOR

LOR = laboratory limit of reporting

BOLD & shaded RPD exceeds acceptable limits



