



Transport  
Roads & Maritime  
Services

# Oxley Highway to Kempsey Upgrade Project **Construction water quality monitoring report - 22 January 2015 to 21 July 2015**



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# Contents

1	Introduction .....	1
1.1	The project.....	1
1.2	Project approval.....	1
1.3	Purpose of this report .....	3
2	Methodology.....	4
2.1	Monitoring sites .....	4
2.2	Monitoring parameters.....	7
2.3	Water quality analysis.....	8
2.4	Monitoring frequency and duration .....	9
2.5	Rainfall records.....	9
3	Results .....	11
3.1	Prevailing climatic conditions.....	11
3.2	Summary of construction activities .....	11
3.3	Limitations of surface water results .....	11
3.4	Summary of surface water results .....	12
3.5	Discussion of surface water results .....	41
3.6	Project response to surface water quality results .....	44
3.7	Limitations of groundwater results.....	46
3.8	Summary of groundwater results.....	46
3.9	Discussion of groundwater results.....	63
3.10	Project response to groundwater quality results .....	64

## List of table

Table 2-1	Surface water quality monitoring locations .....	4
Table 2-2	Groundwater quality monitoring locations.....	6
Table 2-3	Water quality monitoring parameters.....	7
Table 3-1	Construction surface water quality results by waterway .....	14
Table 3-2	Construction surface water quality results by waterway (cont.).....	15
Table 3-3	Construction surface water quality results by waterway (cont.).....	16
Table 3-4	Construction surface water quality results by waterway (cont.).....	17
Table 3-5	Construction surface water quality results by waterway (cont.).....	18
Table 3-6	Construction surface water quality results by waterway (cont.).....	19
Table 3-7	Construction surface water quality results by waterway (cont.).....	20
Table 3-8	Construction surface water quality results by waterway (cont.).....	21
Table 3-9	Construction surface water quality results by waterway (cont.).....	22

Table 3-10 Construction surface water quality results by waterway (cont.).....	23
Table 3-11 Construction surface water quality results by waterway (cont.).....	24
Table 3-12 Construction surface water quality results by waterway (cont.).....	25
Table 3-13 Construction surface water quality results by waterway (cont.).....	26
Table 3-14 Construction surface water quality results by waterway (cont.).....	27
Table 3-15 Construction surface water quality results by waterway (cont.).....	28
Table 3-16 Construction surface water quality results by waterway (cont.).....	29
Table 3-17 Construction surface water quality results by waterway (cont.).....	30
Table 3-18 Construction surface water quality results by waterway (cont.).....	31
Table 3-19 Construction surface water quality results by waterway (cont.).....	32
Table 3-20 Construction surface water quality results by waterway (cont.).....	33
Table 3-21 Construction surface water quality results by waterway (cont.).....	34
Table 3-22 Construction surface water quality results by waterway (cont.).....	35
Table 3-23 Construction surface water quality results by waterway (cont.).....	36
Table 3-24 Construction surface water quality results by waterway (cont.).....	37
Table 3-25 Construction surface water quality results by waterway (cont.).....	38
Table 3-26 Construction surface water quality results by waterway (cont.).....	39
Table 3-27 Construction surface water quality results by waterway (cont.).....	40
Table 3-28 Construction groundwater monitoring results by borehole .....	49
Table 3-29 Construction groundwater monitoring results by borehole (cont.) .....	50
Table 3-30 Construction groundwater monitoring results by borehole (cont.) .....	51
Table 3-31 Construction groundwater monitoring results by borehole (cont.) .....	52
Table 3-32 Construction groundwater monitoring results by borehole (cont.) .....	53
Table 3-33 Construction groundwater monitoring results by borehole (cont.) .....	54
Table 3-34 Construction groundwater monitoring results by borehole (cont.) .....	55
Table 3-35 Construction groundwater monitoring results by borehole (cont.) .....	56
Table 3-36 Construction groundwater monitoring results by borehole (cont.) .....	57
Table 3-37 Construction groundwater monitoring results by borehole (cont.) .....	58
Table 3-38 Construction groundwater level – manual record .....	60
Table 3-39 Construction groundwater monitoring (EC) – manual record .....	61
Table 3-40 Construction groundwater monitoring (pH) – manual record.....	62
Table 3-41 Construction groundwater monitoring (temperature) – manual record ....	63
List of figures	
Figure 1-1 Location of Oxley Highway to Kempsey project .....	2
Figure 3-1 Location of Stage 1 works and surrounding land uses.....	45

Appendix A – Site locality maps

Appendix B – Rainfall records

Appendix C – Surface water quality sampling results

Appendix D – Borehole water level data plots

Appendix E – Cumulative construction groundwater results

# 1 Introduction

## 1.1 The Project

On behalf of the Australian and NSW governments, Roads and Maritime Services (Roads and Maritime) is currently constructing the Oxley Highway to Kempsey Pacific Highway Upgrade (the Project). The Project is 37 kilometres in length, commencing approximately 700 metres north of the Oxley Highway interchange and continuing northwards to tie in with the dual carriageways of the Kempsey to Eungai Pacific Highway Upgrade. The Project involves the duplication of the existing highway, except for sections in the vicinity of the Hastings River and Wilsons River that deviate from the existing highway, and a bypass of Telegraph Point. The existing highway will be retained wherever possible for use as a service road or local road connection. Figure 1-1 shows the location of the Project.

Roads and Maritime will construct and open the Project in stages. The stages of the project are:

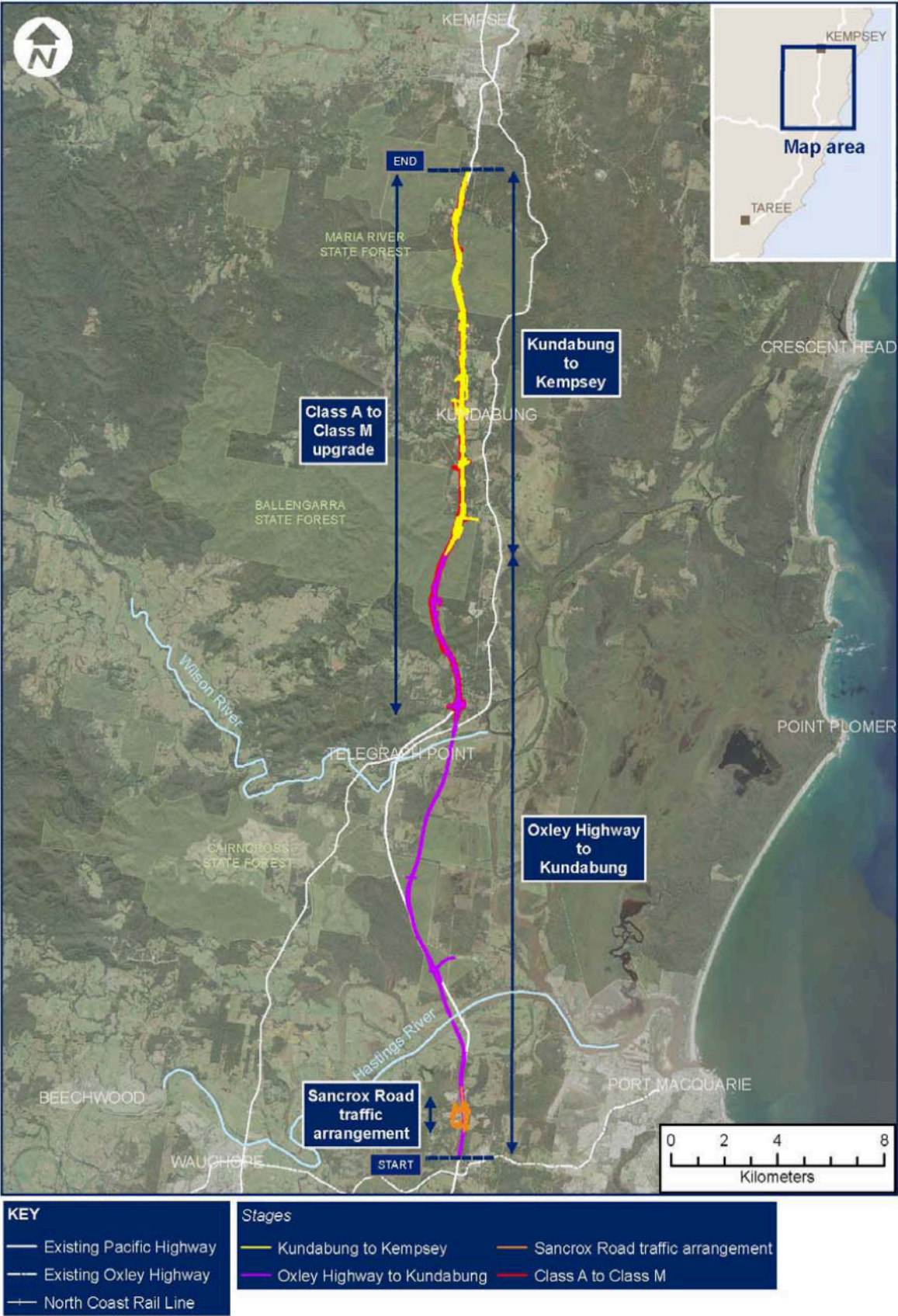
- Stage 1 - The Sancrox Traffic Arrangement works located about two kilometres north of the Oxley Highway / Pacific Highway intersection.
- Stage 2 - Kundabung to Kempsey Stage consisting of about 14 kilometres of dual carriageway, commencing north of Barrys Creek near Kundabung (chainage 24,000) and connecting to the Kempsey Bypass at Stumpy Creek (Chainage 37,800).
- Stage 3 - Oxley Highway to Kundabung Stage consisting of about 24 kilometres of dual carriageway, commencing just north of the Oxley Highway / Pacific Highway intersection (chainage 700) and connecting with the Kundabung to Kempsey stage just north of Barrys Creek (chainage 24,000).

## 1.2 Project approval

On 8 December 2006, the Project was declared by the then Minister for Planning to be a project to which Part 3A of the *Environmental Planning and Assessment Act 1979* applies. An environmental assessment was prepared and placed on public exhibition for 30 days between September and October 2010. Following consideration of submissions made during the exhibition period, the submissions report, including changes to the proposal following consideration of submissions, was submitted to the Minister for Planning and Infrastructure seeking approval. Approval of the Project was granted on 8 February 2012, subject to a number of Conditions of Approval (MCoA). At the request of Roads and Maritime, the Minister has since modified the approval on two occasions.

Under MCoA B17, Roads and Maritime must prepare and implement a Water Quality Monitoring Program (WQMP) to monitor the impacts of the Project on surface and groundwater quality and resources and wetlands, during construction and operation. The WQMP was prepared in consultation with the EPA, DPI (Fishing and Aquaculture) and NoW, and was submitted to the Department of Planning and Infrastructure for approval on 11 February 2014. The plan was subsequently approved on 5 March 2014.

Figure 1-1 Location of Oxley Highway to Kempsey Project





## 1.3 Purpose of this report

The WQMP developed in response to MCoA B17 outlines various pre-construction, construction and post-construction surface and groundwater quality monitoring and assessment requirements. This report addresses the second construction period between 22 January 2015 and 21 July 2015 of surface and groundwater quality monitoring requirements outlined in Chapter 4 and Chapter 5 of the WQMP, which include, but are not limited to:

- Undertaking surface and groundwater quality sampling monthly and at other intervals throughout construction.
- Collecting and analysing representative surface water samples for chemical, physical and nutrient properties during dry and wet-weather conditions.
- Collecting and analysing representative groundwater samples for chemical, physical and nutrient properties, and major cations and anions at nominated intervals.
- Comparing upstream and downstream surface water sampling results to evaluate and determine whether any changes and/or impacts on water quality might be attributable to construction.
- Evaluate trends in groundwater conditions through an analysis of measured results gathered during pre-construction and construction, and determine any changes and/or impacts that might be attributable to construction.
- Reviewing surface and ground water quality monitoring results to evaluate the potential for surface and groundwater interactions where a change in an established historical trend suggests an influence.
- Providing results of sampling to relevant stakeholders including the DP&E, DPI (Fisheries and Aquaculture) and NOW.
- Accumulating further data to provide a basis for construction and post-construction monitoring result comparison.

## 2 Methodology

The approved method for surface and groundwater quality monitoring is outlined in detail in the WQMP. The following sections are a summary of key elements of that program.

### 2.1 Monitoring sites

The Project traverses either through or near a number of water dependent ecosystems including major rivers, creeks, tributaries, SEPP 14 wetlands and endangered ecological communities. Surface and groundwater quality monitoring sites were selected to ensure potential impacts on these systems from the Project could be identified early and where necessary measures to remedy any impacts implemented.

#### 2.1.1 Surface water monitoring sites

Table 2-1 lists the 27 surface water quality monitoring locations and the reason for site selection. Appendix A includes a series of maps that show the location of each monitoring site relative to the Project alignment. The WQMP identified 30 locations for sampling of which SW4a, SW4b and SW5a are no longer subject to the program. These sites were removed from the regular sample regime as they rarely hold or carry water, generally only limited to the immediate affect of surface flows during a rain event. The remaining 27 site are considered sufficiently diverse in terms of location, condition, type and suitability for the protection of nearby sensitive water depended ecosystems / land uses.

**Table 2-1 Surface water quality monitoring locations**

Site no.	Chainage	Waterway name	Position relative to project	Reason for site selection
SW1a	2500	Unnamed tributary of Fernbank Creek	Upstream / West	Industrial land use upstream
SW1b	2600	Unnamed tributary of Fernbank Creek	Upstream / West	Industrial land use upstream
SW1c	2650	Unnamed tributary of Fernbank Creek	Downstream / East	Industrial land use upstream
SW2a	4620	Fernbank Creek	Downstream / East	EEC / ASS
SW2b	4800	Fernbank Creek	Upstream / West	EEC / ASS
SW3a	6040	Northern bank of Hastings River	Upstream / West	Major river with oyster leases downstream
SW3b	6080	Northern bank of Hastings River	Downstream / East	Major river with oyster leases downstream
SW5b	15820	Unnamed tributary of Wilson River	Downstream / West	EEC / ASS
SW6a	16460	South bank of Wilson River	Upstream / West	Major river / SEPP 14 / Floodplain / ASS

Site no.	Chainage	Waterway name	Position relative to project	Reason for site selection
SW6b	16600	South bank of Wilson River	Downstream / East	Major river / SEPP 14 / Floodplain / ASS
SW6c	16830	North bank of Wilson River	Upstream / West	Major river / SEPP 14 / Floodplain / ASS
SW6d	16840	North bank of Wilson River	Downstream / East	Major river / SEPP 14 / Floodplain / ASS
SW7a	19660	Cooperabung Creek	Upstream / West	EEC / Giant Barred Frog habitat
SW7b	19660	Cooperabung Creek	Downstream / East	EEC / Giant Barred Frog habitat
SW8a	23775	Barrys Creek	Upstream / West	EEC / Giant Barred Frog habitat
SW8b	24000	Barrys Creek	Downstream / East	EEC / Giant Barred Frog habitat
SW8c	25325	Barrys Creek	Downstream / East	EEC / Giant Barred Frog habitat
SW9a	28300	Smiths Creek	Downstream / East	EEC / Giant Barred Frog habitat
SW9b	28300	Smiths Creek	Upstream / West	EEC / Giant Barred Frog habitat
SW10a	30700	Pipers Creek	Downstream / East	EEC / Giant Barred Frog habitat
SW10b	30700	Pipers Creek	Upstream / West	EEC / Giant Barred Frog habitat
SW11a	34650	Unnamed drainage line	Downstream / East	Downhill of significant cut site / potential ASR
SW11b	34700	Unnamed drainage line	Upstream / West	Downhill of significant cut site / potential ASR
SW12a	36850	Maria River	Upstream / West	Major river / EEC / Giant Barred Frog habitat
SW12b	36850	Maria River	Downstream / East	Major river / EEC / Giant Barred Frog habitat
SW13a	37700	Stumpy Creek	Downstream / East	Major creek / EEC
SW13b	37750	Stumpy Creek	Upstream / West	Major creek / EEC

Surface water quality monitoring of a spring fed dam on private property (known as tipping dam) that had the potential to be affected during construction was also proposed in the WQMP. As noted in the pre-construction surface water quality monitoring report (June 2015) Roads and Maritime's construction partner for Stage 2 (K2K) and the property owner

reached an agreement to use the resource during construction. The dam was enlarged and water is being used for construction purposes. The dam and surrounding land will be restored inline with the agreement established between the two parties. Ongoing monitoring of water levels during construction as outlined in section 4.2 to the WQMP is therefore no longer proposed.

## 2.1.2 Groundwater monitoring sites

Further detail is provided in Section 3.7.

Table 2-2 lists the 30 groundwater quality monitoring locations and the reason for site selection. Appendix A includes a series of maps that show the location of each monitoring site relative to the Project alignment. A number of these monitoring sites have been directly affected by construction (ie top of casing damaged by earthworks) during this or the previous reporting period. Further detail is provided in Section 3.7.

Table 2-2 Groundwater quality monitoring locations

Site no.	Chainage	Reason for site selection
GW01	3020	Category A Cut
GW02	5000	Floodplain / ASS / significant embankment
GW03	5500	Floodplain / ASS / significant embankment
GW04	6140	Floodplain / ASS / significant embankment
GW05	6350	Floodplain / ASS / significant embankment
GW06	7620	Category A Cut
GW07	8640	Category A Cut / significant earthworks for intersection / no existing groundwater information in this location
GW08	10360	Category A Cut / no existing groundwater information in this location
GW09	10440	Category A Cut
GW10	11460	Confirm Cut Category B / near EEC & GDE
GW11	13100	Floodplain / near existing groundwater users / near EEC & GDE
GW12	15830	Floodplain / ASS / near EEC & GDE
GW13	16400	Floodplain / ASS / near EEC & GDE / significant embankment
GW14	17080	SEPP 14 / floodplain / significant embankment / ASS / EEC / GDE
GW15	17920	Category A Cut / nearby existing groundwater users
GW16	18390	Category A Cut / near existing groundwater users / near ASS
GW17	20680	Category A Cut
GW18	21050	Category A Cut
GW19	22000	Confirm Cut Category B / near EEC
GW20	22620	Category A Cut
GW21	22620	Category A Cut (and will assist with modelling)
GW22	24800	Significant cut / acid sulfate rock expected in this location / capture impacts from the rest areas
GW23	24800	Significant cut / acid sulfate rock expected in this location / capture impacts from the rest areas

Site no.	Chainage	Reason for site selection
GW24	25900	Cluster of private bores to the east of the highway / next to a cut
GW25	33800	Category A Cut
GW26	34300	Category B Cut
GW27	35150	Category A Cut
GW28	35280	Category A Cut
GW29	35900	Category A Cut
GW30	37160	Category A Cut/ near existing groundwater user

## 2.2 Monitoring parameters

Surface water quality monitoring parameters have been selected with reference to:

- Roads and Maritime Guideline for Construction Water Quality Monitoring (RTA undated).
- The Australian guidelines for water quality monitoring and reporting (ANZECC Monitoring Guidelines) (ANZECC/ARMCANZ 2000b).
- The parameters included in earlier monitoring programs within the region (eg by the Port Macquarie Hastings Council and by the Kempsey Bypass Alliance).

For groundwater, the standard water quality parameters were selected from Appelo & Postma (1993), Driscoll (1989) and Sterrett (2007).

Table 2-3 lists the monitoring parameters that form the basis of the surface and groundwater water monitoring program and identifies whether measurement is taken in the field or by a NATA accredited laboratory off site.

**Table 2-3 Water quality monitoring parameters**

Parameter type	Surface (SW) or groundwater (GW)	Parameter	Unit of measurement	Analysis method
Chemical properties	SW and GW	pH	Scale 0 to 14	Field measurement
	SW	Dissolved oxygen (DO)	%	Field measurement
	SW and GW	Total petroleum hydrocarbons	ug/L	Field visual assessment / laboratory measurement
	SW and GW	Trace metals: Aluminum (Al) Arsenic (As) Cadmium (Cd) Chromium (Cr) Copper (Cu) Iron (Fe) Lead (Pb) Manganese (Mn) Mercury (Hg) Nickel (Ni)	mg/L	Laboratory measurement

		Silver (Ag) Zinc (Zn)		
Physical properties	SW	Electrical conductivity (EC)	uS/cm	Field measurement
	GW	Electrical conductivity (EC)	uS/cm	Field measurement / laboratory analysis
	SW and GW	Temperature	°C	Field measurement
	SW	Turbidity	NTU	Field measurement
	SW	Total suspended solids	mg/L	Laboratory measurement
Nutrients	SW and GW	Total nitrogen (TN)	mg/L	Laboratory measurement
	SW and GW	Total phosphorous (TP)	mg/L	Laboratory measurement
Nutrients	GW	Ammonia (NH <sub>4</sub> ) Phosphate (PO <sub>4</sub> )	mg/L	Laboratory measurement
Major anions	GW	Bicarbonate (HCO <sup>-</sup> ) Chloride (Cl <sup>-</sup> ) Nitrate (NO <sub>3</sub> <sup>-</sup> ) Sulfate (SO <sub>4</sub> <sup>2-</sup> )	mg/L	Laboratory measurement
Major cations	GW	Calcium (Ca <sup>2+</sup> ) Magnesium (Mg <sup>2+</sup> ) Potassium (K <sup>+</sup> ) Sodium (Na <sup>+</sup> )	mg/L	Laboratory measurement
Groundwater levels	GW	Groundwater levels	Metres below top of casing (mTOC)	Field measurement

## 2.3 Water quality analysis

Section 2.2 noted that the analysis of water quality depending on the parameter subject to investigation is undertaken in one of two ways. Some physical and chemical properties due to their rapid degradation with time are analysed in the field. This analysis has been performed with the use of a Yeo-Kal Model 615 Water Quality Analyser on surface waters. The instrument is factory calibrated annually, with in-field calibration checked / undertaken at regular intervals, typically monthly and/or prior to each sampling event.

ALS NATA accredited Sydney laboratory operations undertake all off-site surface water quality analysis. Samples are collected on-site in ALS supplied sample bottles, refrigerated and transported to the ALS Warabrook depot for dispatch to Sydney. Chain of custody documentation is produced and updated during the collection, transport and analysis stages of the process.

Similarly, analysis of groundwater is undertaken both in the field and off-site by an accredited NATA laboratory as the parameter dictates (refer to Section 2.2). Automated data loggers (Hobo) have been installed at 26 groundwater monitoring sites to record groundwater levels below ground at 30 minute intervals. One barometric air pressure data logger has also been installed, enabling the correction of water levels across the monitoring site to local atmospheric conditions. In-field dip level monitoring is also undertaken on a two monthly basis.

In-field parameters are analysed using a DKK-TOA Model WQC-24 multi parameter water quality meter. The presence of hydrocarbons for both surface and groundwater are undertaken on a visual basis in the first instance. Where found to be present a sample is collected and sent for laboratory analysis.

Port Macquarie-Hastings Council with support by Sydney Water, and ALS have performed off-site groundwater sample analysis during this reporting period. Chain of custody documentation is produced and updated during the collection, transport and analysis stages of the process.

## 2.4 Monitoring frequency and duration

### 2.4.1 Surface water

During the construction surface water quality monitoring phase, sampling of all parameters except trace metals, are required for one dry event and as required two wet-weather events per month. Further monitoring of trace metals are required for one dry weather event and as required one wet weather event per month. A wet-weather event has been defined as 10 millimetres of rainfall within a 24-hour period. Sampling for a wet-weather event commences within 24 hours of the cessation of that event.

### 2.4.2 Groundwater

During the construction groundwater quality monitoring phase, sampling of in-field parameters are required on a monthly basis, or every two months where a groundwater level logger is in place. Monitoring of anions, cations, ammonia and phosphate are to be monitored on one occasion in the first quarter and then on an annual basis thereafter. All other laboratory analysed parameters shall be monitored on a monthly basis for the first three months and then on a three monthly basis if no impact is detected. If an impact is detected (ie levels outside of trigger values that are inconsistent with historical trends), this monitoring would be reinstated to a monthly basis.

The requirements for ongoing construction and post-construction monitoring are detailed in the WQMP and will be outlined in subsequent construction and post-construction surface water quality monitoring reports.

## 2.5 Rainfall records

During this construction monitoring period rainfall records were obtained through three Bureau of Meteorology weather stations including:

- Kempsey Airport (Station number – 59007).
- Telegraph Point – Farrawells Road (Station number – 60031).
- Port Macquarie Airport (Station number – 60139).

Rainfall records for these stations are attached at Appendix B and include the period between January 2015 and July 2015.

Site based weather stations have also been established for the Project at three locations including:

- Kundabung – Port Macquarie.
- Telegraph Point – Port Macquarie.
- Sancrox – Port Macquarie.

These stations have been established at various times during pre-construction and construction. These stations have been used during the construction phase of the Project to determine the need for wet-weather monitoring and ongoing water quality reporting. Records from these sites for the monitoring period are also attached and Appendix B.



# 3 Results

## 3.1 Prevailing climatic conditions

Rainfall during the reporting period 22 January 2015 to 21 July 2015 was mixed with four of the six monthly records at the Port Macquarie Airport Bureau of Meteorology monitoring station characterised as below average to average. January and May were well above average with rainfall four and two times the respective historical monthly averages. A summary of daily / monthly rainfall for the three Bureau of Meteorology weather stations within the Port Macquarie / Kempsey area and three Project weather stations referred to in Section 2.5 are provided at Appendix B.

## 3.2 Summary of construction activities

Construction activity with the potential to impact on surface water quality was in progress extensively across the Project during the monitoring period. To a lesser extent, only select locations, those where deep cuts or substantial fills had progressed, would have the potential to impact on groundwater (see further detail in Section 3.9). Works on each of the stages included:

- Stage 1 – Extensive earthworks across the entire site including culvert work at the new quarry entrance. Some paving was undertaken at select locations. However, the site was generally exposed to rainfall impact and surface flows. Works on Stage 1 with the potential to influence surface water quality were in progress near waterway with reference number SW1.
- Stage 2 – Nearly all outstanding vegetation to be cleared was removed during the monitoring period. Other activities included topsoil removal, installation of additional temporary and permanent water quality basins, earthworks (about 30 per cent), and culvert and bridge related works. Works on Stage 2 with the potential to influence surface water quality were in progress near all waterways at different times during the monitoring period. Works near SW8C and SW11 commenced in January, in February at SW10, in March at SW9, in May at SW13 and finally in June at SW12.
- Stage 3 – More than 80 per cent of all requisite vegetation clearing has been completed up to and including the current monitoring period. Other activities included topsoil removal, installation of additional temporary and permanent water quality basins, earthworks, and culvert and bridge related works. Works on Stage 3 with the potential to influence surface water quality were in progress near all waterways at different times during the monitoring period with the exception of SW3. Works near SW8b commenced in January, in February at SW5, in March at SW2 and SW7, in April at SW6a and b, and finally in May at SW6c and d.

Further detail on all construction activities undertaken during the reporting period is provided in the Oxley Highway to Kempsey – Construction Compliance Tracking Report 2 (September 2015).

## 3.3 Limitations of surface water results

A number of factors have influenced either the continuity or completeness of water quality results obtained during the monitoring period and the extent in some circumstances to which they are suitable for upstream and downstream comparison. Relevant considerations include:

- Waterway conditions at times were such that where sampling was undertaken following wet weather events (ie an event greater than 10 millimetres in 24 hours), particularly where only a marginal event occurred, no visible response within some waterways was observed ie no subsequent flow and/or connection between upstream and downstream sampling locations.
- Some freshwater streams were observed to be isolated ponds at different times during sampling. Waterways affected included SW1, SW8, SW11 and SW12.
- SW8a was dry on three occasions during the monitoring period and at other times all sample point along SW8 persisted as isolated ponds. On this basis, comparison between 80<sup>th</sup> and 20<sup>th</sup> percentiles at SW8a and downstream locations (ie SW8b, SW8c) do not always adequately represent any potential impacts associated with construction.
- In May 2015 construction progressed to an extent that the SW8c monitoring location no longer represented a downstream sampling site. A new sample location was selected adjacent to the Project boundary downstream of the Project alignment (see Map 12 in Appendix A).
- 80<sup>th</sup> and 20<sup>th</sup> percentile trigger values have generally been established from 24 sampling events up to and including the month subject to analysis (consistent with ANZECC requirements). However, due to the frequency of metal analysis during pre-construction and prevailing dry conditions during the first construction period, the trigger values have been derived from fewer samples for some waterway ie those other than SW3 and SW6. This anomaly will be resolved progressively during subsequent reporting periods as the number of samples analysed for metals reaches and exceeds 24 events.
- A wet weather event recorded on 26 June 2015 was not subject to sampling due to a weather station system failure (Sancrox station). While the station continued to log rainfall during the event the data was not uploaded to the online service that allows real-time monitoring. Other Project weather stations that remained on-line during this time were monitored and showed rainfall records for the same 24 hour period of five millimetres or less. When the system restored some 24 hours later it was noted that the Sancrox weather station had actually received 13 millimetres. While only a marginal event, this would under normal circumstances trigger a wet weather sampling event.
- While construction on Stage 3 technically commenced during November 2014, samples collected up until January 2015 at SW5b have been used to supplement pre-construction data. Rainfall during the pre-construction period was sporadic and below average leading to a prolonged period where samples were unable to be collected for SW5b (ie water absent from sample location). As works with the ability to affected water quality at SW5b were not in progress until late January 2015, data collected up until this time has been used for pre-construction / construction comparison purposes.
- Sheet piling in the Wilsons River to create a coffer dam was completed in May 2015. The completion of this work has effectively closed the south branch of the river and restricted all tidal and flood water movements to the northern branch (via sample points SW6c and SW6d). Sampling points SW6a and SW6b no longer provide an effective correlation between upstream and downstream conditions.

### 3.4 Summary of surface water results

Table 3-1 to Table 3-27 represent an aggregate summary of water quality results by waterway for upstream and downstream sampling locations. In accordance with the WQMP, 80<sup>th</sup> and 20<sup>th</sup> percentiles for upstream sample locations form the trigger values for median downstream results. Appendix C includes all monitoring results for this construction period. Full laboratory reports for all sampling events are available on request.



**Table 3-1 Construction surface water quality results by waterway**

Parameter	Results												
	Unit	LOR / probe limit	ANZECC default trigger value	February 2015					March 2015				
				SW1a derived trigger values*			SW1b	SW1c	SW1a derived trigger values*			SW1b	SW1c
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Median
Temperature	°C	-2-50	NA	4.4	21.8	13.2	24.5	24.1	4.6	22.5	13.2	22.9	22.7
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	757	1259	304	868	1072	664	1259	304	634	582
Dissolved oxygen (DO)	%	0-200	85-110	20	48	6	16	26	21	48	6	38	43
pH		0-14	6.5-8	0.4	7.1	6.5	7.0	6.8	0.5	7.1	6.4	6.8	6.7
Turbidity	NTU	0-600	6-50	36	54	17	35	21	36	54	17	52	62
Total suspended solids (TSS)	mg/L	5	-	20	36	5	12	6	20	36	5	25	23
Aluminium (Al)	mg/L	0.01	0.055"	0.22	0.38	0.03	0.02	0.01	0.41	0.42	0.03	0.59	0.44
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.003	0.001	0.000	0.001	0.001	0.005	0.002
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0003	0.0004	0.0001	0.0001	0.0001	0.0003	0.0003	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.003	0.003	0.001	0.001	0.001	0.003	0.003	0.001	0.002	0.002
Iron (Fe)	mg/L	0.05	ID	4.97	4.36	0.24	2.10	0.27	7.05	4.85	0.31	4.09	1.21
Lead (Pb)	mg/L	0.001	0.0034	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.222	0.377	0.031	0.833	0.982	0.282	0.380	0.029	0.517	0.443
Mercury (Hg)	mg/L	0.0001	0.0006	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.002	0.002	0.001	0.001	0.001	0.002	0.002	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.051	0.033	0.008	0.012	0.015	0.049	0.032	0.008	0.029	0.021
Total Nitrogen (TN)	mg/L	0.1	0.5	0.9	0.8	0.4	0.7	0.5	0.9	0.8	0.4	1.3	0.7
Total Phosphorous (TP)	mg/L	0.01	0.05	0.15	0.06	0.02	0.21	0.08	0.15	0.05	0.02	0.37	0.08

\* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

**Table 3-2 Construction surface water quality results by waterway (cont.)**

Parameter	Results												
	Unit	LOR / probe limit	ANZECC default trigger value	April 2015					May 2015				
				SW1a derived trigger values*			SW1b	SW1c	SW1a derived trigger values*			SW1b	SW1c
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Median
Temperature	°C	-2-50	NA	3.7	22.5	16.0	21.5	21.4	3.4	22.5	16.9	16.9	16.8
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	490.4	1174.2	199.6	267	267	495.8	1170.4	176.8	511	584
Dissolved oxygen (DO)	%	0-200	85-110	24.2	54.8	6.1	70	66	26.2	64.5	6.1	79	73
pH		0-14	6.5-8	0.5	7.1	6.4	6.6	6.6	0.5	6.9	6.3	6.9	6.9
Turbidity	NTU	0-600	6-50	34.2	48.3	18.8	55	56	33.4	48.8	19.5	45	51
Total suspended solids (TSS)	mg/L	5	-	13.6	26.0	5.0	13	10	13.6	25.0	5.0	7	10
Aluminium (Al)	mg/L	0.01	0.055"	0.50	0.44	0.03	0.48	0.43	0.64	0.44	0.03	0.64	0.56
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0003	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.002	0.002	0.001	0.003	0.002	0.001	0.002	0.001	0.001	0.002
Iron (Fe)	mg/L	0.05	ID	7.06	4.85	0.31	0.74	0.69	7.06	4.10	0.31	0.98	0.71
Lead (Pb)	mg/L	0.001	0.0034	0.001	0.001	0.001	0.002	0.001	0.000	0.001	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.281	0.379	0.025	0.061	0.089	0.283	0.356	0.020	0.088	0.108
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.002	0.002	0.001	0.002	0.001	0.002	0.001	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.049	0.026	0.008	0.023	0.022	0.045	0.022	0.008	0.010	0.012
Total Nitrogen (TN)	mg/L	0.1	0.5	0.9	1.0	0.4	0.9	0.9	0.9	0.9	0.5	0.8	0.7
Total Phosphorous (TP)	mg/L	0.01	0.05	0.15	0.04	0.02	0.05	0.04	0.15	0.04	0.02	0.04	0.04

\* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

**Table 3-3 Construction surface water quality results by waterway (cont.)**

Parameter	Results												
	Unit	LOR / probe limit	ANZECC default trigger value	June 2015					July 2015				
				SW1a derived trigger values*			SW1b	SW1c	SW1a derived trigger values*			SW1b	SW1c
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Median
Temperature	°C	-2-50	NA	3.7	22.5	16.9	13.2	13.0	3.9	22.5	16.9	11.8	11.4
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	491	1170	177	1039	1040	484	1170	177	1207	1027
Dissolved oxygen (DO)	%	0-200	85-110	27	65	6	14	23	27	65	6	11	16
pH		0-14	6.5-8	0.5	6.9	6.3	6.8	6.7	0.4	6.9	6.3	6.9	6.9
Turbidity	NTU	0-600	6-50	34	49	17	22	34	34	49	17	64	20
Total suspended solids (TSS)	mg/L	5	-	14	25	5	7	5	13	25	5	21	5
Aluminium (Al)	mg/L	0.01	0.055"	0.65	0.44	0.03	0.02	0.01	0.64	0.44	0.03	0.01	0.01
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.003	0.001	0.000	0.001	0.001	0.002	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.001	0.002	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	7.37	6.29	0.49	4.27	0.32	7.60	9.30	0.66	3.90	0.13
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.349	0.407	0.020	0.444	0.442	0.406	0.469	0.025	0.537	0.471
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.002	0.001	0.001	0.002	0.001	0.002	0.001	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.045	0.022	0.007	0.011	0.010	0.045	0.018	0.007	0.018	0.007
Total Nitrogen (TN)	mg/L	0.1	0.5	0.8	0.9	0.5	1.7	0.9	0.8	0.9	0.5	4.4	1.0
Total Phosphorous (TP)	mg/L	0.01	0.05	0.15	0.04	0.02	0.33	0.1	0.15	0.04	0.02	0.99	0.10

\* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

**Table 3-4 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	February 2015				March 2015				April 2015			
				SW2b*			SW2a	SW2b*			SW2a	SW2b*			SW2a
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	4.5	25.4	18.5	25.7	4.9	28.0	18.5	27.5	4.1	27.8	19.8	25.7
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	290	828	339	339	265	828	382	430	255	893	507	492
Dissolved oxygen (DO)	%	0-200	85-110	33	87	32	11	33	91	43	76	34	106	57	103
pH		0-14	6.5-8	1.0	6.3	4.1	6.7	1.0	6.3	4.1	6.4	1.1	6.5	4.1	6.4
Turbidity (NTU)	NTU	0-600	6-50	171	96	16	26	171	90	16	34	180	47	16	32
Total suspended solids (TSS)	mg/L	5	-	742	141	15	37	743	141	15	24	796	35	11	11
Aluminium (Al)	mg/L	0.01	0.055 <sup>u</sup>	11.11	0.96	0.10	0.17	10.25	0.87	0.04	0.05	9.57	0.84	0.03	0.03
Arsenic (As)	mg/L	0.001	0.024	0.011	0.003	0.001	0.003	0.010	0.003	0.001	0.002	0.009	0.002	0.001	0.002
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0004	0.0010	0.0001	0.0001	0.0004	0.0008	0.0001	0.0001	0.0004	0.0005	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.019	0.001	0.001	0.001	0.017	0.002	0.001	0.001	0.016	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.022	0.004	0.001	0.002	0.021	0.004	0.001	0.001	0.019	0.003	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	68.00	15.64	0.56	6.13	62.71	10.32	0.64	3.79	58.59	8.97	0.75	1.33
Lead (Pb)	mg/L	0.001	0.0034	0.010	0.001	0.001	0.001	0.009	0.001	0.001	0.001	0.008	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	1.580	2.112	0.243	0.918	1.510	1.922	0.218	0.396	1.434	1.846	0.240	0.214
Mercury (Hg)	mg/L	0.0001	0.0006	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.241	0.012	0.003	0.003	0.223	0.011	0.002	0.002	0.207	0.009	0.002	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.097	0.047	0.009	0.029	0.090	0.042	0.007	0.016	0.084	0.031	0.007	0.007
Total Nitrogen (TN)	mg/L	0.1	0.5	9.6	5.4	0.7	2.9	9.3	5.4	0.7	3.1	9.7	3.2	0.7	1.3
Total Phosphorous (TP)	mg/L	0.01	0.05	1.86	0.79	0.03	0.58	1.80	0.71	0.04	0.29	1.88	0.41	0.03	0.08

\* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

<sup>u</sup> for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

**Table 3-5 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	May 2015				June 2015				July 2015			
				SW2b*			SW2a	SW2b*			SW2a	SW2b*			SW2a
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	4.6	27.6	18.8	17.0	5.2	27.6	18.3	11.9	5.4	27.3	18.0	10.8
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	270	875	446	338	274	875	446	387	277	946	450	434
Dissolved oxygen (DO)	%	0-200	85-110	34	101	57	59	33	96	57	50	33	99	57	40
pH		0-14	6.5-8	1.0	6.6	4.7	6.4	1.0	6.6	4.7	6	1.0	6.6	4.8	6.3
Turbidity (NTU)	NTU	0-600	6-50	177	46	16	20	177	46	15	12	174	44	12	28
Total suspended solids (TSS)	mg/L	5	-	781	33	8	7	781	33	6	5	765	32	5	5
Aluminium (Al)	mg/L	0.01	0.055"	9.00	0.80	0.02	0.08	8.75	0.68	0.02	0.02	8.52	0.56	0.02	0.03
Arsenic (As)	mg/L	0.001	0.024	0.009	0.002	0.001	0.001	0.009	0.002	0.001	0.001	0.008	0.002	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0004	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.015	0.001	0.001	0.001	0.015	0.001	0.001	0.001	0.014	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.018	0.003	0.001	0.001	0.018	0.003	0.001	0.001	0.017	0.003	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	55.17	7.62	0.86	0.88	53.72	7.50	0.64	0.68	52.37	7.39	0.50	1.23
Lead (Pb)	mg/L	0.001	0.0034	0.008	0.001	0.001	0.001	0.008	0.001	0.001	0.001	0.007	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	1.364	1.770	0.224	0.177	1.343	1.740	0.210	0.056	1.307	1.710	0.214	0.131
Mercury (Hg)	mg/L	0.0001	0.0006	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.195	0.007	0.002	0.002	0.190	0.007	0.002	0.001	0.185	0.007	0.002	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.079	0.021	0.006	0.006	0.077	0.020	0.006	0.006	0.075	0.020	0.006	0.008
Total Nitrogen (TN)	mg/L	0.1	0.5	9.5	3.1	0.7	0.6	9.5	3.1	0.7	0.6	9.3	3.1	0.7	0.6
Total Phosphorous (TP)	mg/L	0.01	0.05	1.8	0.37	0.04	0.06	1.84	0.37	0.03	0.04	1.81	0.33	0.03	0.04

\* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note – Since April 2014 the upper limit of Electrical Conductivity (EC) is 8000 uS/cm due to in-field equipment range limitations.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

ID – Insufficient representative data (ANZECC).



**Table 3-6 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	February 2015				March 2015				April 2015			
				SW3a*			SW3b	SW3a*			SW3b	SW3a*			SW3b
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	4.5	26.7	16.8	27.0	4.6	26.9	16.8	25.6	4.2	26.9	20.4	23.8
Electrical conductivity (EC)	uS/cm	0-8000	-	0	8000	8000	8000	1329	8000	8000	4729	1329	8000	8000	8000
Dissolved oxygen (DO)	%	0-200	80-110	15	94	70	89	16	100	70	101	16	100	72	88
pH		0-14	7.0-8.5	0.4	7.6	7.0	7.4	0.4	7.5	6.9	7.2	0.4	7.4	6.8	6.9
Turbidity (NTU)	NTU	0-600	0.5-10	26	38	8	19	58	44	9	68	57	47	13	41
Total suspended solids (TSS)	mg/L	5		15	21	5	5	29	35	5	33	28	36	5	24
Aluminium (Al)	mg/L	0.01	ID	0.39	0.10	0.03	0.08	0.37	0.12	0.02	0.09	0.36	0.10	0.02	0.08
Arsenic (As)	mg/L	0.001	ID	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0055	0.0004	0.0010	0.0001	0.0001	0.0004	0.0010	0.0001	0.0001	0.0004	0.0010	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.0274	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0013	0.004	0.010	0.001	0.002	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	0.44	0.50	0.07	0.23	0.42	0.50	0.06	0.17	0.41	0.50	0.06	0.22
Lead (Pb)	mg/L	0.001	0.0044	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001
Manganese (Mn)	mg/L	0.001	ID	0.025	0.044	0.017	0.083	0.024	0.046	0.018	0.035	0.027	0.048	0.018	0.075
Mercury (Hg)	mg/L	0.0001	0.0004	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.07	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001
Silver (Ag)	mg/L	0.001	0.0014	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.015	0.022	0.050	0.005	0.021	0.022	0.050	0.005	0.008	0.022	0.050	0.005	0.006
Total Nitrogen (TN)	mg/L	0.1	0.3	1.6	0.5	0.2	0.4	1.6	0.5	0.2	0.5	0.2	0.6	0.2	0.6
Total Phosphorous (TP)	mg/L	0.01	0.03	0.03	0.08	0.03	0.03	0.05	0.08	0.04	0.13	0.04	0.08	0.04	0.05

\* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note – Since April 2014 the upper limit of Electrical Conductivity (EC) is 8000 uS/cm due to in-field equipment range limitations.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

ID – Insufficient representative data (ANZECC).

**Table 3-7 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	May 2015				June 2015				July 2015			
				SW3a*			SW3b	SW3a*			SW3b	SW3a*			SW3b
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	3.5	26.9	20.8	18.6	3.7	26.9	20.8	15.9	3.9	26.9	20.8	14.6
Electrical conductivity (EC)	uS/cm	0-8000	-	1968	8000	8000	8000	1968	8000	8000	8000	1968	8000	8000	8000
Dissolved oxygen (DO)	%	0-200	80-110	13	102	84	87	12	102	85	90	11	102	87	95
pH		0-14	7.0-8.5	0.3	7.2	6.7	7.1	0.3	7.2	6.8	7.3	0.3	7.3	6.8	7.6
Turbidity (NTU)	NTU	0-600	0.5-10	58	47	16	15	58	47	14	5	58	47	13	6
Total suspended solids (TSS)	mg/L	5		29	40	5	12	29	40	5	5	29	40	5	5
Aluminium (Al)	mg/L	0.01	ID	0.35	0.13	0.03	0.29	0.34	0.12	0.02	0.01	0.33	0.11	0.02	0.01
Arsenic (As)	mg/L	0.001	ID	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0055	0.0004	0.0010	0.0001	0.0001	0.0005	0.0010	0.0001	0.0001	0.0004	0.0010	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.0274	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0013	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	0.39	0.50	0.08	0.29	0.39	0.50	0.06	0.05	0.39	0.50	0.05	0.05
Lead (Pb)	mg/L	0.001	0.0044	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001
Manganese (Mn)	mg/L	0.001	ID	0.026	0.048	0.018	0.035	0.026	0.047	0.018	0.045	0.025	0.047	0.018	0.030
Mercury (Hg)	mg/L	0.0001	0.0004	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.07	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001
Silver (Ag)	mg/L	0.001	0.0014	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001	0.004	0.010	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.015	0.021	0.050	0.005	0.006	0.021	0.050	0.005	0.005	0.021	0.050	0.005	0.005
Total Nitrogen (TN)	mg/L	0.1	0.3	0.3	0.6	0.2	0.6	0.3	0.6	0.2	0.2	0.3	0.6	0.2	0.2
Total Phosphorous (TP)	mg/L	0.01	0.03	0.04	0.08	0.04	0.04	0.04	0.08	0.03	0.03	0.04	0.08	0.04	0.08

\* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note – Since April 2014 the upper limit of Electrical Conductivity (EC) is 8000 uS/cm due to in-field equipment range limitations.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

ID – Insufficient representative data (ANZECC).

**Table 3-8 Construction surface water quality results by waterway (cont.)**

Parameter				Results								
	Unit	LOR / probe limit	ANZECC default trigger value	SW5b pre construction trigger values*			SW5b median values					
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	February 2015	March 2015	April 2015	May 2015	June 2015	July 2015
Temperature	°C	-2-50	No data	5.4	27.3	19.3	26.4	30.9	26.8	20.4	17.2	13.9
Electrical conductivity (EC)	uS/cm	0-8000	No data	446	1042	490	194	279	252	229	260	364
Dissolved oxygen (DO)	%	0-200	No data	28	115	67	11	78	55	64	70	76
pH		0-14	No data	0.8	5.6	4.2	6.2	6.7	6.4	6.7	6.0	6.4
Turbidity (NTU)	NTU	0-600	No data	172	50	6	17	61	20	22	9	15
Total suspended solids	mg/L	5	-	313	279	8	8	30	6	8	5	5
Aluminium (Al)	mg/L	0.01	0.055"	1.13	1.97	0.42	0.14	0.15	0.12	0.11	0.02	0.01
Arsenic (As)	mg/L	0.001	0.024	0.003	0.004	0.001	0.004	0.003	0.003	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0004	0.0007	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.002	0.004	0.002	0.002	0.003	0.001	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	5.55	4.49	0.31	5.28	1.20	2.58	0.80	0.28	0.08
Lead (Pb)	mg/L	0.001	0.0034	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	1.097	3.086	1.652	1.255	0.916	1.270	0.238	0.019	0.028
Mercury (Hg)	mg/L	0.0001	0.0006	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.008	0.015	0.005	0.002	0.002	0.002	0.002	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.126	0.269	0.043	0.054	0.064	0.006	0.008	0.023	0.106
Total Nitrogen (TN)	mg/L	0.1	No data	4.4	5.3	0.4	2.8	1.3	0.9	0.6	0.5	0.8
Total Phosphorous (TP)	mg/L	0.01	No data	0.59	0.16	0.02	0.19	0.10	0.04	0.04	0.02	0.02

\* Trigger values are typically derived from 24 sampling events up to and including the month indicated. However, this is not the case for SW5b due to the general absence of water during the pre-construction monitoring period. The pre-construction period was extended to 20 January 2015 to facilitate the inclusion of additional pre-construction results. While work was in progress more broadly across the Project, there was no work in the vicinity of the sampling point with the potential to influence results.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

**Table 3-9 Construction surface water quality results by waterway (cont)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	February 2015				March 2015				April 2015			
				SW6a*			SW6b	SW6a*			SW6b	SW6a*			SW6b
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	5.0	26.5	15.9	25.6	5.1	27.3	15.9	26.2	4.5	27.3	19.7	21.5
Electrical conductivity (EC)	uS/cm	0-8000	-	3056	8000	2301	282	3252	8000	1393	189	3420	8000	260	216
Dissolved oxygen (DO)	%	0-200	80-110	14	88	63	101	14	89	63	88	13	89	67	70
pH		0-14	7.0-8.5	0.5	7.4	6.6	6.8	0.5	7.4	6.4	6.5	0.5	7.4	6.3	6.4
Turbidity (NTU)	NTU	0-600	0.5-10	18	22	3	18	20	24	3	44	19	27	6	26
Total suspended solids (TSS)	mg/L	5		19	10	5	5	18	15	5	15	18	16	5	8
Aluminium (Al)	mg/L	0.01	ID	0.07	0.08	0.01	0.21	0.20	0.20	0.01	0.55	0.17	0.14	0.01	0.36
Arsenic (As)	mg/L	0.001	ID	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.002	0.000	0.002	0.001	0.002
Cadmium (Cd)	mg/L	0.0001	0.0055	0.0000	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.0274	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0013	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.003	0.000	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	0.13	0.28	0.05	0.29	0.37	0.41	0.05	0.57	0.18	0.44	0.05	0.77
Lead (Pb)	mg/L	0.001	0.0044	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	ID	0.023	0.083	0.034	0.054	0.052	0.091	0.032	0.026	0.024	0.082	0.035	0.066
Mercury (Hg)	mg/L	0.0001	0.0004	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.07	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001	0.0014	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.015	0.001	0.006	0.005	0.007	0.005	0.008	0.005	0.007	0.001	0.006	0.005	0.005
Total Nitrogen (TN)	mg/L	0.1	0.3	0.2	0.5	0.3	0.4	0.2	0.5	0.2	0.5	0.2	0.5	0.3	0.6
Total Phosphorous (TP)	mg/L	0.01	0.03	0.03	0.05	0.01	0.02	0.03	0.05	0.02	0.05	0.03	0.04	0.02	0.03

\* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note – Since April 2014 the upper limit of Electrical Conductivity (EC) is 8000 uS/cm due to in-field equipment range limitations.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

ID – Insufficient representative data (ANZECC).

**Table 3-10 Construction surface water quality results by waterway (cont)**

Parameter				Results											
	Unit	LOR / probe limit	ANZECC default trigger value	May 2015				June 2015				July 2015			
				SW6a*			SW6b	SW6a*			SW6b	SW6a*			SW6b
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	3.7	27.3	20.8	18.0	3.7	27.3	20.8	15.4	3.9	27.3	20.8	15.4
Electrical conductivity (EC)	uS/cm	0-8000	-	3303	8000	214	197	3351	8000	214	437	3381	8000	214	1829
Dissolved oxygen (DO)	%	0-200	80-110	14	89	69	72	14	92	74	80	13	95	76	95
pH		0-14	7.0-8.5	0.5	7.3	6.2	6.3	0.5	7.3	6.3	6.6	0.5	7.3	6.5	6.9
Turbidity (NTU)	NTU	0-600	0.5-10	20	32	8	38	20	32	8	15	20	32	10	15
Total suspended solids (TSS)	mg/L	5		18	16	5	18	18	16	5	5	18	16	5	9
Aluminium (Al)	mg/L	0.01	ID	0.20	0.31	0.01	0.47	0.20	0.30	0.01	0.16	0.20	0.28	0.01	0.06
Arsenic (As)	mg/L	0.001	ID	0.000	0.002	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0055	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.0274	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0013	0.000	0.001	0.001	0.002	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	0.34	0.46	0.05	0.55	0.33	0.45	0.05	0.91	0.33	0.45	0.05	0.62
Lead (Pb)	mg/L	0.001	0.0044	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	ID	0.049	0.091	0.030	0.037	0.048	0.091	0.029	0.035	0.048	0.090	0.030	0.045
Mercury (Hg)	mg/L	0.0001	0.0004	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.07	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001	0.0014	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.015	0.004	0.008	0.005	0.008	0.004	0.008	0.005	0.005	0.004	0.008	0.005	0.005
Total Nitrogen (TN)	mg/L	0.1	0.3	0.2	0.6	0.4	0.6	0.2	0.5	0.4	0.6	0.2	0.5	0.4	0.5
Total Phosphorous (TP)	mg/L	0.01	0.03	0.03	0.05	0.02	0.03	0.03	0.05	0.02	0.02	0.03	0.05	0.02	0.02

\* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note – Since April 2014 the upper limit of Electrical Conductivity (EC) is 8000 uS/cm due to in-field equipment range limitations.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

ID – Insufficient representative data (ANZECC).

**Table 3-11 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	February 2015				March 2015				April 2015			
				SW6c*			SW6d	SW6c*			SW6d	SW6c*			SW6d
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	5.3	27.6	15.8	25.4	5.1	27.6	15.8	25.1	4.7	27.6	19.4	21.7
Electrical conductivity (EC)	uS/cm	0-8000	-	3031	8000	2533	356	3214	8000	1167	190	3397	8000	259	176
Dissolved oxygen (DO)	%	0-200	80-110	13	86	59	95	13	88	62	85	13	92	66	89
pH		0-14	7.0-8.5	0.3	7.1	6.5	6.7	0.3	7.1	6.5	6.5	0.3	7.0	6.5	6.6
Turbidity (NTU)	NTU	0-600	0.5-10	95	17	3	20	92	18	3	43	95	19	7	18
Total suspended solids (TSS)	mg/L	5		52	11	5	6	50	12	5	22	52	12	5	5
Aluminium (Al)	mg/L	0.01	ID	0.09	0.14	0.01	0.13	0.16	0.09	0.01	0.37	0.15	0.23	0.01	0.79
Arsenic (As)	mg/L	0.001	ID	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.002
Cadmium (Cd)	mg/L	0.0001	0.0055	0.0003	0.0003	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.0274	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0013	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	0.22	0.31	0.05	0.37	0.15	0.34	0.05	0.44	0.22	0.42	0.05	0.80
Lead (Pb)	mg/L	0.001	0.0044	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	ID	0.049	0.095	0.034	0.073	0.028	0.085	0.032	0.017	0.048	0.086	0.030	0.049
Mercury (Hg)	mg/L	0.0001	0.0004	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.07	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001	0.0014	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.015	0.004	0.007	0.005	0.008	0.003	0.006	0.005	0.005	0.003	0.007	0.005	0.007
Total Nitrogen (TN)	mg/L	0.1	0.3	0.2	0.5	0.2	0.7	0.2	0.5	0.2	0.5	0.2	0.5	0.2	0.5
Total Phosphorous (TP)	mg/L	0.01	0.03	0.08	0.05	0.01	0.03	0.08	0.05	0.01	0.04	0.04	0.05	0.01	0.02

\* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note – Since April 2014 the upper limit of Electrical Conductivity (EC) is 8000 uS/cm due to in-field equipment range limitations.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

ID – Insufficient representative data (ANZECC).

**Table 3-12 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	May 2015				June 2015				July 2015			
				SW6c*			SW6d	SW6c*			SW6d	SW6c*			SW6d
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	4.0	27.6	20.4	16.5	4.2	27.6	20.4	14.7	4.4	27.6	20.4	13.4
Electrical conductivity (EC)	uS/cm	0-8000	-	3293	8000	164	146.0	3346	8000	164	280	3368	8000	164	1158
Dissolved oxygen (DO)	%	0-200	80-110	12	93	74	89.8	11	94	77	90	10	94	79	95
pH		0-14	7.0-8.5	0.3	6.9	6.5	6.8	0.3	6.9	6.5	6.9	0.3	6.9	6.5	7.0
Turbidity (NTU)	NTU	0-600	0.5-10	95	24	8	19.4	95	24	8	11	95	24	9	15
Total suspended solids (TSS)	mg/L	5		52	16	5	5.0	52	16	5	5	52	16	5	5
Aluminium (Al)	mg/L	0.01	ID	0.19	0.23	0.01	0.46	0.19	0.23	0.02	0.09	0.19	0.23	0.02	0.06
Arsenic (As)	mg/L	0.001	ID	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0055	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.0274	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0013	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	0.21	0.43	0.05	0.31	0.21	0.43	0.05	0.44	0.21	0.43	0.05	0.38
Lead (Pb)	mg/L	0.001	0.0044	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	ID	0.047	0.086	0.028	0.022	0.047	0.085	0.026	0.025	0.046	0.085	0.027	0.031
Mercury (Hg)	mg/L	0.0001	0.0004	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.07	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001	0.0014	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.015	0.003	0.007	0.005	0.005	0.003	0.007	0.005	0.005	0.003	0.007	0.005	0.012
Total Nitrogen (TN)	mg/L	0.1	0.3	0.2	0.5	0.3	0.4	0.2	0.5	0.3	0.3	0.2	0.5	0.3	0.3
Total Phosphorous (TP)	mg/L	0.01	0.03	0.04	0.05	0.01	0.02	0.04	0.05	0.02	0.02	0.04	0.05	0.02	0.01

\* Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Note – Since April 2014 the upper limit of Electrical Conductivity (EC) is 8000 uS/cm due to in-field equipment range limitations.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

ID – Insufficient representative data (ANZECC).

**Table 3-13 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	February 2015				March 2015				April 2015			
				SW7a*			SW7b	SW7a*			SW7b	SW7a*			SW7b
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	4.1	22.3	13.9	21.9	4.2	22.4	13.9	22.7	3.5	22.4	16.1	20.3
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	35	217	170	170	40	217	170	142	44	217	135	134
Dissolved oxygen (DO)	%	0-200	85-110	24	73	29	70	25	76	30	72	28	90	34	93
pH		0-14	6.5-8	0.7	7.5	6.4	6.6	0.7	7.5	6.3	6.3	0.7	7.5	6.4	6.5
Turbidity (NTU)	NTU	0-600	6-50	10	14	4	15	12	16	5	40	14	26	8	47
Total suspended solids (TSS)	mg/L	5	-	7	13	5	5	7	15	5	14	7	15	5	5
Aluminium (Al)	mg/L	0.01	0.055"	0.07	0.18	0.04	0.15	0.21	0.19	0.04	0.57	0.32	0.22	0.04	0.79
Arsenic (As)	mg/L	0.001	0.024	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.002
Copper (Cu)	mg/L	0.001	0.0014	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	2.87	0.97	0.33	0.37	2.73	0.89	0.37	0.60	2.61	0.86	0.41	0.62
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	1.590	0.331	0.041	0.034	1.523	0.318	0.031	0.051	1.464	0.305	0.017	0.023
Mercury (Hg)	mg/L	0.0001	0.0006	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.002	0.008	0.005	0.018	0.002	0.008	0.005	0.007	0.002	0.008	0.005	0.005
Total Nitrogen (TN)	mg/L	0.1	0.5	0.2	0.4	0.1	0.3	0.2	0.4	0.1	0.4	0.2	0.5	0.2	0.5
Total Phosphorous (TP)	mg/L	0.01	0.05	0.01	0.03	0.01	0.01	0.01	0.03	0.01	0.04	0.01	0.03	0.01	0.02

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).



**Table 3-14 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	May 2015				June 2015				July 2015			
				SW7a*			SW7b	SW7a*			SW7b	SW7a*			SW7b
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	2.8	22.4	17.2	16.8	3.0	22.4	17.2	13.0	3.4	22.4	17.2	11.0
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	46	217	135	159	46	217	135	183	46	217	135	191
Dissolved oxygen (DO)	%	0-200	85-110	30	95	34	93	30	95	34	82	30	95	34	80
pH		0-14	6.5-8	0.5	7.3	6.3	6.9	0.5	7.4	6.3	7.3	0.5	7.3	6.3	7.3
Turbidity (NTU)	NTU	0-600	6-50	15	33	10	32	15	33	10	12	15	33	10	13
Total suspended solids (TSS)	mg/L	5	-	7	15	5	5	7	15	5	5	7	15	5	5
Aluminium (Al)	mg/L	0.01	0.055"	0.45	0.23	0.04	0.71	0.44	0.23	0.05	0.10	0.43	0.22	0.05	0.02
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.002	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	2.50	0.88	0.36	0.46	2.46	0.87	0.34	0.39	2.42	0.87	0.35	0.25
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	1.411	0.278	0.016	0.045	1.386	0.264	0.017	0.053	1.363	0.251	0.017	0.054
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.002	0.008	0.005	0.006	0.002	0.008	0.005	0.006	0.002	0.008	0.005	0.005
Total Nitrogen (TN)	mg/L	0.1	0.5	0.2	0.5	0.2	0.4	0.2	0.5	0.2	0.3	0.2	0.5	0.2	0.1
Total Phosphorous (TP)	mg/L	0.01	0.05	0.01	0.03	0.01	0.02	0.01	0.03	0.01	0.01	0.01	0.03	0.01	0.02

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

**Table 3-15 Construction surface water quality results by waterway (cont.)**

Parameter	Results												
	Unit	LOR / probe limit	ANZECC default trigger value	February 2015					March 2015				
				SW8a derived trigger values*			SW8b	SW8c	SW8a derived trigger values*			SW8b	SW8c
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Median
Temperature	°C	-2-50	NA	2.0	21.0	19.9	20.5	21.2	1.9	20.9	20.0	21.2	21.3
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	33	183	111	135	133	37	179	104	119	116
Dissolved oxygen (DO)	%	0-200	85-110	38	90	12	24	54	41	96	13	53	69
pH		0-14	6.5-8	0.3	6.3	5.7	5.9	6.1	0.3	6.2	5.8	6.0	6.0
Turbidity	NTU	0-600	6-50	8	28	13	17	20	9	31	14	25	30
Total suspended solids (TSS)	mg/L	5	-	2	5	4	5	5	4	7	4	10	11
Aluminium (Al)	mg/L	0.01	0.055"	0.32	0.77	0.30	0.31	0.33	0.35	0.95	0.39	0.43	0.47
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	0.12	0.32	0.14	0.13	0.15	0.12	0.38	0.17	0.20	0.25
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.035	0.080	0.035	0.017	0.017	0.037	0.079	0.006	0.019	0.046
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.000	0.006	0.005	0.013	0.005	0.002	0.008	0.006	0.008	0.028
Total Nitrogen (TN)	mg/L	0.1	0.5	0.1	0.5	0.2	0.2	0.2	0.1	0.5	0.2	0.3	0.4
Total Phosphorous (TP)	mg/L	0.01	0.05	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.05

\* Trigger values typically derived from 24 sampling events up to and including the month indicated. However, due to the absence of water at SW8a during pre-construction and the previous reporting period, a few number of events have been used to derive 80<sup>th</sup> and 20<sup>th</sup> percentile trigger values.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

**Table 3-16 Construction surface water quality results by waterway (cont.)**

Parameter	Results												
	Unit	LOR / probe limit	ANZECC default trigger value	April 2015					May 2015				
				SW8a derived trigger values*			SW8b	SW8c	SW8a derived trigger values*			SW8b	SW8c
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Median
Temperature	°C	-2-50	NA	1.6	20.8	19.9	20.9	20.0	1.8	20.6	17.8	19.7	17.2
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	34	169	104	127	119	47	176	104	120	136
Dissolved oxygen (DO)	%	0-200	85-110	37	98	15	55	80	37	98	17	63	73
pH		0-14	6.5-8	0.3	6.2	5.7	5.7	6.0	0.3	6.2	5.8	6.0	6.2
Turbidity	NTU	0-600	6-50	8	30	16	24	35	8	32	17	36	36
Total suspended solids (TSS)	mg/L	5	-	3	6	5	5	5	3	6	5	5	5
Aluminium (Al)	mg/L	0.01	0.055"	0.44	1.02	0.55	1.08	0.44	0.46	1.19	0.41	0.99	0.97
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	0.14	0.38	0.21	0.63	0.23	0.16	0.45	0.15	0.37	0.42
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.004	0.001	0.000	0.001	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.033	0.078	0.006	0.090	0.028	0.031	0.053	0.005	0.011	0.023
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.002	0.008	0.005	0.007	0.006	0.004	0.009	0.005	0.016	0.006
Total Nitrogen (TN)	mg/L	0.1	0.5	0.1	0.5	0.2	0.3	0.3	0.1	0.4	0.2	0.4	0.3
Total Phosphorous (TP)	mg/L	0.01	0.05	0.01	0.02	0.01	0.02	0.01	0.01	0.02	0.01	0.02	0.03

\* Trigger values typically derived from 24 sampling events up to and including the month indicated. However, due to the absence of water at SW8a during pre-construction and the previous reporting period, a few number of events have been used to derive 80<sup>th</sup> and 20<sup>th</sup> percentile trigger values.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

**Table 3-17 Construction surface water quality results by waterway (cont.)**

Parameter	Results												
	Unit	LOR / probe limit	ANZECC default trigger value	June 2015					July 2015				
				SW8a derived trigger values*			SW8b	SW8c	SW8a derived trigger values*			SW8b	SW8c
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Median
Temperature	°C	-2-50	NA	1.8	20.6	17.8	16.0	15.8	1.8	20.6	17.8	13.5	13.6
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	47	176	104	165	148	47	176	104	206	182
Dissolved oxygen (DO)	%	0-200	85-110	37	98	17	39	105	37	98	17	48	51
pH		0-14	6.5-8	0.3	6.2	5.8	5.9	6.9	0.3	6.2	5.8	6.5	6.5
Turbidity	NTU	0-600	6-50	8	32	17	36	24	8	32	17	12	16
Total suspended solids (TSS)	mg/L	5	-	3	6	5	5	5	3	6	5	5	5
Aluminium (Al)	mg/L	0.01	0.055"	0.46	1.19	0.41	0.26	0.14	0.46	1.19	0.41	0.04	0.09
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	0.16	0.45	0.15	0.20	0.14	0.16	0.45	0.15	0.14	0.10
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.031	0.053	0.005	0.082	0.064	0.031	0.053	0.005	0.160	0.010
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.004	0.009	0.005	0.006	0.034	0.004	0.009	0.005	0.007	0.007
Total Nitrogen (TN)	mg/L	0.1	0.5	0.1	0.4	0.2	0.2	0.2	0.1	0.4	0.2	0.1	0.1
Total Phosphorous (TP)	mg/L	0.01	0.05	0.01	0.02	0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.01

\* Trigger values typically derived from 24 sampling events up to and including the month indicated. However, due to the absence of water at SW8a during pre-construction and the previous reporting period, a few number of events have been used to derive 80<sup>th</sup> and 20<sup>th</sup> percentile trigger values.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

**Table 3-18 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	February 2015				March 2015				April 2015			
				SW9b*			SW9a	SW9b*			SW9a	SW9b*			SW9a
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	4.8	22.3	12.8	21.9	4.9	22.3	12.8	21.3	4.1	22.3	15.1	19.7
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	369	336	194	169	374	336	182	145	361	322	151	143
Dissolved oxygen (DO)	%	0-200	85-110	25	50	13	77	28	65	13	77	32	83	16	93
pH		0-14	6.5-8	0.3	6.9	6.5	6.5	0.3	6.9	6.6	6.4	0.3	6.9	6.5	6.5
Turbidity (NTU)	NTU	0-600	6-50	10	27	8	17	11	28	10	27	11	28	10	24
Total suspended solids (TSS)	mg/L	5	-	3	9	5	5	4	10	5	12	4	10	5	5
Aluminium (Al)	mg/L	0.01	0.055"	0.17	0.07	0.02	0.33	0.32	0.18	0.02	0.86	0.32	0.38	0.02	0.33
Arsenic (As)	mg/L	0.001	0.024	0.000	0.002	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0003	0.0002	0.0001	0.0001	0.0003	0.0002	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	1.35	2.63	0.41	0.38	1.29	2.03	0.46	0.75	1.25	1.43	0.41	0.39
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.590	0.969	0.066	0.016	0.580	0.913	0.032	0.024	0.569	0.857	0.018	0.012
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.004	0.009	0.005	0.005	0.004	0.008	0.005	0.008	0.004	0.006	0.005	0.008
Total Nitrogen (TN)	mg/L	0.1	0.5	0.3	0.8	0.2	0.5	0.3	0.8	0.2	0.4	0.3	0.8	0.2	0.3
Total Phosphorous (TP)	mg/L	0.01	0.05	0.03	0.06	0.01	0.02	0.03	0.06	0.01	0.08	0.03	0.06	0.01	0.02

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

**Table 3-19 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	May 2015				June 2015				July 2015			
				SW9b*			SW9a	SW9b*			SW9a	SW9b*			SW9a
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	2.9	22.3	17.7	15.6	3.2	22.3	17.7	12.8	3.4	22.3	17.7	11.0
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	82	308	120	161	81	308	120	215	83	308	120	274
Dissolved oxygen (DO)	%	0-200	85-110	35	92	15	91	35	92	15	82	36	92	15	74
pH		0-14	6.5-8	0.3	6.9	6.4	6.8	0.3	6.9	6.4	6.8	0.3	6.9	6.4	6.8
Turbidity (NTU)	NTU	0-600	6-50	10	32	12	21	10	32	14	15	10	32	14	11
Total suspended solids (TSS)	mg/L	5	-	4	10	5	5	4	10	5	5	4	10	5	5
Aluminium (Al)	mg/L	0.01	0.055"	0.33	0.43	0.02	0.67	0.32	0.41	0.02	0.08	0.32	0.40	0.02	0.10
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	1.22	1.10	0.40	0.49	1.20	1.08	0.40	0.46	1.18	1.05	0.41	0.53
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.557	0.811	0.012	0.010	0.551	0.793	0.012	0.015	0.544	0.776	0.012	0.020
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.004	0.006	0.005	0.006	0.005	0.008	0.005	0.006	0.005	0.007	0.005	0.019
Total Nitrogen (TN)	mg/L	0.1	0.5	0.3	0.8	0.2	0.2	0.3	0.8	0.2	0.2	0.3	0.8	0.2	0.2
Total Phosphorous (TP)	mg/L	0.01	0.05	0.03	0.06	0.01	0.02	0.03	0.06	0.01	0.02	0.03	0.06	0.01	0.09

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

**Table 3-20 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	February 2015				March 2015				April 2015			
				SW10b*			SW10a	SW10b*			SW10a	SW10b*			SW10a
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	5.2	23.0	12.9	21.9	5.3	23.0	12.9	21.5	4.9	23.0	14.0	19.8
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	44	273	189	195	49	273	189	165	51	266	173	167
Dissolved oxygen (DO)	%	0-200	85-110	19	47	11	52	21	47	11	57	24	65	14	81
pH		0-14	6.5-8	0.3	6.9	6.4	6.5	0.3	6.9	6.4	6.4	0.3	6.8	6.2	6.4
Turbidity (NTU)	NTU	0-600	6-50	11	24	10	16	13	26	10	37	15	32	11	43
Total suspended solids (TSS)	mg/L	5	-	4	9	5	5	5	11	5	15	5	11	5	5
Aluminium (Al)	mg/L	0.01	0.055 <sup>“</sup>	0.19	0.14	0.03	0.10	0.34	0.18	0.03	0.89	0.33	0.32	0.04	0.41
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	0.88	1.26	0.67	0.55	0.83	1.22	0.70	0.93	0.81	1.20	0.67	0.66
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.164	0.308	0.057	0.031	0.165	0.304	0.056	0.041	0.166	0.297	0.030	0.019
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.002	0.006	0.005	0.005	0.003	0.008	0.005	0.005	0.002	0.008	0.005	0.009
Total Nitrogen (TN)	mg/L	0.1	0.5	0.2	0.8	0.4	0.4	0.2	0.8	0.4	0.6	0.2	0.8	0.4	0.7
Total Phosphorous (TP)	mg/L	0.01	0.05	0.02	0.04	0.02	0.02	0.02	0.04	0.02	0.04	0.02	0.04	0.02	0.03

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

“ for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

**Table 3-21 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	May 2015				June 2015				July 2015			
				SW10b*			SW10a	SW10b*			SW10a	SW10b*			SW10a
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	3.5	23.1	17.5	14.9	3.7	23.1	17.5	12.4	4.0	23.1	17.5	10.9
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	51	241	164	191	53	244	171	277	58	254	174	333
Dissolved oxygen (DO)	%	0-200	85-110	28	78	23	89	28	79	23	74	28	79	23	62
pH		0-14	6.5-8	0.3	6.7	6.2	6.7	0.3	6.8	6.2	6.7	0.3	6.8	6.2	6.6
Turbidity (NTU)	NTU	0-600	6-50	15	40	13	25	15	40	13	15	15	40	13	17
Total suspended solids (TSS)	mg/L	5	-	5	12	5	5	5	12	5	5	5	12	5	5
Aluminium (Al)	mg/L	0.01	0.055"	0.41	0.45	0.05	0.70	0.40	0.41	0.05	0.18	0.40	0.37	0.05	0.06
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.002	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	0.78	1.18	0.66	0.61	0.77	1.17	0.66	0.96	0.76	1.17	0.65	0.71
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.165	0.291	0.021	0.013	0.164	0.287	0.021	0.030	0.162	0.283	0.022	0.037
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.002	0.008	0.005	0.005	0.002	0.008	0.005	0.006	0.002	0.008	0.005	0.005
Total Nitrogen (TN)	mg/L	0.1	0.5	0.2	0.8	0.4	0.3	0.2	0.8	0.3	0.4	0.2	0.8	0.3	0.2
Total Phosphorous (TP)	mg/L	0.01	0.05	0.02	0.05	0.02	0.02	0.02	0.05	0.02	0.04	0.02	0.05	0.02	0.01

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).



**Table 3-22 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	February 2015				March 2015				April 2015			
				SW11b*			SW11a	SW11b*			SW11a	SW11b*			SW11a
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	5.6	23.1	13.2	23.4	5.8	24.2	13.2	22.2	5.0	24.2	15.2	20.2
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	65	235	104	208	62	231	104	262	62	232	105	194
Dissolved oxygen (DO)	%	0-200	85-110	24	49	17	60	28	65	19	63	30	89	24	93
pH		0-14	6.5-8	0.5	6.8	5.8	5.7	0.5	6.8	5.8	5.9	0.5	6.7	5.7	6.6
Turbidity (NTU)	NTU	0-600	6-50	26	48	8	124	27	49	8	57	27	64	13	57
Total suspended solids (TSS)	mg/L	5	-	5	13	5	26	5	14	5	14	5	15	5	12
Aluminium (Al)	mg/L	0.01	0.055"	0.42	0.38	0.04	0.77	0.72	0.76	0.05	0.84	0.68	0.77	0.06	0.37
Arsenic (As)	mg/L	0.001	0.024	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0002	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	1.58	2.11	0.59	1.15	1.51	1.95	0.54	0.51	1.47	1.80	0.51	0.31
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.121	0.274	0.072	0.102	0.120	0.247	0.060	0.122	0.118	0.208	0.041	0.117
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.006	0.014	0.005	0.008	0.006	0.014	0.005	0.023	0.005	0.013	0.005	0.018
Total Nitrogen (TN)	mg/L	0.1	0.5	0.6	1.3	0.4	0.7	0.6	1.2	0.4	0.5	0.6	1.2	0.5	0.5
Total Phosphorous (TP)	mg/L	0.01	0.05	0.04	0.08	0.02	0.02	0.05	0.08	0.01	0.02	0.05	0.08	0.01	0.01

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

**Colour red** - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

**Table 3-23 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	May 2015				June 2015				July 2015			
				SW11b*			SW11a	SW11b*			SW11a	SW11b*			SW11a
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	4.1	24.2	17.3	19.0	4.2	24.2	17.3	14.1	4.4	24.2	17.3	DNS
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	61	231	105	296	74	236	105	870	88	241	105	
Dissolved oxygen (DO)	%	0-200	85-110	31	93	26	78	32	95	26	57	32	96	28	
pH		0-14	6.5-8	0.5	6.7	5.6	6.2	0.5	6.7	5.6	6.3	0.5	6.7	5.6	
Turbidity (NTU)	NTU	0-600	6-50	26	66	17	59	26	66	17	18	26	66	15	
Total suspended solids (TSS)	mg/L	5	-	5	15	5	11	5	15	5	5	5	15	5	
Aluminium (Al)	mg/L	0.01	0.055"	0.71	0.88	0.07	1.04	0.69	0.84	0.07	0.17	0.68	0.81	0.05	
Arsenic (As)	mg/L	0.001	0.024	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0002	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0002	0.0001	0.0001	
Chromium (Cr)	mg/L	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	
Copper (Cu)	mg/L	0.001	0.0014	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.001	
Iron (Fe)	mg/L	0.05	ID	1.40	1.66	0.53	0.51	1.38	1.64	0.54	0.47	1.37	1.61	0.50	
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	
Manganese (Mn)	mg/L	0.001	1.9	0.117	0.202	0.039	0.037	0.114	0.195	0.040	0.189	0.112	0.189	0.040	
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	
Zinc (Zn)	mg/L	0.005	0.008	0.005	0.012	0.005	0.008	0.005	0.012	0.005	0.028	0.005	0.013	0.005	
Total Nitrogen (TN)	mg/L	0.1	0.5	0.6	1.1	0.5	0.6	0.6	1.1	0.5	0.6	0.6	1.1	0.4	
Total Phosphorous (TP)	mg/L	0.01	0.05	0.05	0.08	0.02	0.04	0.05	0.08	0.01	0.01	0.05	0.08	0.01	

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

**Table 3-24 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	February 2015				March 2015				April 2015			
				SW12a*			SW12b	SW12a*			SW12b	SW12a*			SW12b
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	5.0	21.9	12.0	22.1	5.0	22.1	12.0	21.7	4.0	22.1	16.9	19.9
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	40	208	158	172	44	213	153	152	47	212	127	136
Dissolved oxygen (DO)	%	0-200	85-110	20	48	18	26	20	51	20	48	21	61	20	62
pH		0-14	6.5-8	0.5	6.8	6.2	5.9	0.5	6.8	6.1	5.9	0.5	6.7	5.7	5.8
Turbidity (NTU)	NTU	0-600	6-50	14	42	18	19	14	45	18	32	15	46	18	44
Total suspended solids (TSS)	mg/L	5	-	5	13	5	5	6	13	5	14	6	13	6	7
Aluminium (Al)	mg/L	0.01	0.055"	0.29	0.39	0.07	0.67	0.54	0.46	0.08	1.39	0.53	0.78	0.08	0.64
Arsenic (As)	mg/L	0.001	0.024	0.000	0.002	0.001	0.001	0.000	0.002	0.001	0.001	0.000	0.002	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.002	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	1.64	1.59	0.69	0.81	1.57	1.58	0.68	1.10	1.50	1.57	0.69	0.84
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.255	0.278	0.089	0.079	0.247	0.269	0.079	0.097	0.239	0.258	0.071	0.074
Mercury (Hg)	mg/L	0.0001	0.0006	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.004	0.016	0.007	0.006	0.005	0.015	0.006	0.006	0.004	0.015	0.006	0.006
Total Nitrogen (TN)	mg/L	0.1	0.5	0.3	1.0	0.5	0.8	0.3	1.0	0.5	0.8	0.3	1.0	0.5	0.6
Total Phosphorous (TP)	mg/L	0.01	0.05	0.02	0.07	0.03	0.03	0.02	0.07	0.03	0.11	0.02	0.06	0.02	0.03

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

**Table 3-25 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	May 2015				June 2015				July 2015			
				SW12a*			SW12b	SW12a*			SW12b	SW12a*			SW12b
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	3.0	22.1	17.9	14.9	3.2	22.1	17.9	12.8	3.6	22.1	17.9	11.3
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	50	212	107	181	54	216	107	275	62	218	107	329
Dissolved oxygen (DO)	%	0-200	85-110	22	69	22	56	22	69	20	38	22	69	21	25
pH		0-14	6.5-8	0.5	6.7	5.7	5.8	0.5	6.7	5.7	6.0	0.5	6.6	5.7	6.2
Turbidity (NTU)	NTU	0-600	6-50	14	43	18	29	14	43	18	17	14	43	18	19
Total suspended solids (TSS)	mg/L	5	-	6	13	5	6	6	13	5	5	6	13	5	5
Aluminium (Al)	mg/L	0.01	0.055"	0.55	0.83	0.09	1.08	0.54	0.82	0.09	0.22	0.53	0.81	0.09	0.15
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	1.44	1.55	0.70	1.00	1.41	1.54	0.70	1.69	1.39	1.53	0.70	3.06
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.234	0.247	0.058	0.039	0.229	0.242	0.061	0.132	0.225	0.236	0.064	0.214
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.002	0.001	0.002	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.006	0.015	0.006	0.009	0.005	0.015	0.006	0.005	0.005	0.015	0.006	0.007
Total Nitrogen (TN)	mg/L	0.1	0.5	0.3	1.0	0.5	0.7	0.3	1.0	0.5	0.5	0.3	1.0	0.5	0.2
Total Phosphorous (TP)	mg/L	0.01	0.05	0.02	0.05	0.02	0.02	0.03	0.05	0.02	0.02	0.03	0.05	0.02	0.01

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

**Table 3-26 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	February 2015				March 2015				April 2015			
				SW13b*			SW13a	SW13b*			SW13a	SW13b*			SW13a
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	4.4	21.7	13.9	21.5	4.5	21.9	13.9	21.1	3.4	21.9	15.7	19.8
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	118	373	133	131	126	373	122	112	123	354	120	97
Dissolved oxygen (DO)	%	0-200	85-110	16	57	30	54	17	59	32	52	17	73	34	70
pH		0-14	6.5-8	0.6	7.1	6.1	5.9	0.7	7.1	6.1	5.8	0.7	6.9	6.1	5.5
Turbidity (NTU)	NTU	0-600	6-50	72	59	23	28	72	60	23	41	82	59	23	59
Total suspended solids (TSS)	mg/L	5	-	32	16	5	5	32	18	5	15	32	19	6	8
Aluminium (Al)	mg/L	0.01	0.055"	0.67	0.64	0.08	0.94	0.43	0.47	0.06	1.74	0.66	1.16	0.09	0.85
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0003	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.002	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.001	0.003	0.001	0.002	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	1.19	1.38	0.51	0.96	0.25	0.88	0.47	1.50	1.09	1.31	0.47	0.78
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.075	0.174	0.075	0.069	0.049	0.154	0.053	0.094	0.076	0.161	0.046	0.032
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.002	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.002	0.001	0.002
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.012	0.014	0.008	0.017	0.013	0.014	0.008	0.005	0.011	0.014	0.007	0.006
Total Nitrogen (TN)	mg/L	0.1	0.5	1.8	0.9	0.6	0.9	0.3	0.9	0.6	1.0	0.3	1.0	0.6	0.8
Total Phosphorous (TP)	mg/L	0.01	0.05	0.04	0.04	0.02	0.02	0.04	0.05	0.02	0.21	0.04	0.05	0.02	0.05

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

**Table 3-27 Construction surface water quality results by waterway (cont.)**

Parameter	Results														
	Unit	LOR / probe limit	ANZECC default trigger value	May 2015				June 2015				July 2015			
				SW13b*			SW13a	SW13b*			SW13a	SW13b*			SW13a
				Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median	Std dev	80 <sup>th</sup> %	20 <sup>th</sup> %	Median
Temperature	°C	-2-50	NA	2.7	21.9	17.2	15.7	2.9	21.9	17.2	13.6	3.3	21.9	17.2	11.8
Electrical conductivity (EC)	uS/cm	0-8000	125-2200	104	323	110	113	103	323	110	215	103	323	110	325
Dissolved oxygen (DO)	%	0-200	85-110	18	73	36	73	17	73	37	66	17	73	37	69
pH		0-14	6.5-8	0.6	6.7	5.9	5.9	0.6	6.7	5.8	5.9	0.6	6.7	5.8	6.6
Turbidity (NTU)	NTU	0-600	6-50	82	65	27	55	81	65	27	22	81	65	31	40
Total suspended solids (TSS)	mg/L	5	-	32	20	5	6	32	20	5	5	32	20	5	5
Aluminium (Al)	mg/L	0.01	0.055"	0.68	1.23	0.09	1.86	0.67	1.20	0.10	0.4	0.66	1.18	0.10	0.10
Arsenic (As)	mg/L	0.001	0.024	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Cadmium (Cd)	mg/L	0.0001	0.0002	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001	0.0003	0.0001	0.0001	0.0001
Chromium (Cr)	mg/L	0.001	0.001	0.000	0.001	0.001	0.002	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Copper (Cu)	mg/L	0.001	0.0014	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.002	0.001	0.001
Iron (Fe)	mg/L	0.05	ID	1.04	1.30	0.54	1.16	1.02	1.35	0.58	1.80	1.00	1.33	0.61	0.81
Lead (Pb)	mg/L	0.001	0.0034	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Manganese (Mn)	mg/L	0.001	1.9	0.076	0.159	0.033	0.027	0.075	0.157	0.037	0.115	0.073	0.156	0.040	0.139
Mercury (Hg)	mg/L	0.0001	0.0006	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001
Nickel (Ni)	mg/L	0.001	0.011	0.000	0.002	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Silver (Ag)	mg/L	0.001		0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001
Zinc (Zn)	mg/L	0.005	0.008	0.011	0.014	0.007	0.011	0.011	0.013	0.007	0.005	0.011	0.013	0.007	0.007
Total Nitrogen (TN)	mg/L	0.1	0.5	0.3	1.0	0.6	0.9	0.2	1.0	0.7	0.6	0.2	1.0	0.7	0.5
Total Phosphorous (TP)	mg/L	0.01	0.05	0.04	0.05	0.02	0.03	0.04	0.05	0.02	0.02	0.04	0.05	0.02	0.03

Trigger values derived from 24 sampling events up to and including the month indicated. However, metals have not been sampled on 24 occasions. This limitation will be resolved during subsequent six monthly monitoring reports.

Colour red - Represents the calculated median result being either above the 80<sup>th</sup> percentile or below the 20<sup>th</sup> percentile at the downstream sampling location.

" for pH >6.5. Insufficient data for pH <6.5.

ID – Insufficient representative data (ANZECC).

## 3.5 Discussion of surface water results

Nearly all waterways had at least one parameter for one or more monthly results that fell either above or below calculated upstream 80<sup>th</sup> and 20<sup>th</sup> percentile values. While construction works at different times during the reporting period were in close proximity to all waterways, this level of variability remained typical of results experienced during pre-construction monitoring. Observations made during site monitoring suggest some elevated parameter levels (eg turbidity) in some waterways was attributable to construction. At other times, impacts were considered to be unrelated to the Project. Therefore, the following general and specific observations can be made:

- The monitoring period can be characterised by a mixture of below average to average, and well above average rainfall across the entire Project and broader region. Most waterways were continuous (ie a connection between upstream and downstream sampling points was maintained) throughout the monitoring period. Exceptions to this were experienced at SW1, SW8, SW11 and SW12 that were observed to be isolated ponds at different times during the monitoring period.
- Electrical conductivity – Calculated median values were below or above the calculated upstream 80<sup>th</sup> and 20<sup>th</sup> percentile trigger value on one or more occasions for all waterways during the monitoring period. On review of individual sampling events where calculated monthly medians fall outside of 80<sup>th</sup> or 20<sup>th</sup> percentile trigger values, the individual results are typically consistent between upstream and downstream samples. Exceptions to this include individual results at SW1, SW2, SW6 (a and b) and SW11. At SW1, SW2 and SW11 the greater differences typically coincide with no visible flow or sample points persisting as isolated ponds. At SW6b (9 July 2015 event) the difference is likely attributable to the coffer dam reducing tidal flushing at SW6a verses 6b. For all freshwater waterways the calculated median values were well within the default trigger values for low land rivers presented in the ANZECC guidelines. Impacts attributable to construction for all waterways, with the exception of the one off July event at SW6a/6b, are considered unlikely.
- Dissolved oxygen – Calculated median values were primarily above the calculated upstream 80<sup>th</sup> percentile trigger value on one or more occasions for all waterways, with the exception of SW8, SW12 and SW13, during the monitoring period. SW2a and SW5b were each below the 20<sup>th</sup> percentile trigger values for three months during the monitoring period. While 80<sup>th</sup> percentile trigger values were exceeded on a number of occasions, particularly SW9 and SW10, in all instance levels were below the upper limit default trigger value for low land rivers presented in the ANZECC guidelines. On review of individual sampling events where calculated monthly medians fall outside of 80<sup>th</sup> or 20<sup>th</sup> percentile trigger values, the individual results are typically consistent between upstream and downstream samples. At SW2 and SW5b, these locations routinely persist as standing water where water level, rather than flow, is very depended on rainfall. These locations have been observed to have algae outbreaks that trigger substantial fluctuations in dissolved oxygen levels from month to month. This variability remains consistent with pre-construction conditions. Impacts attributable to construction are considered unlikely.
- pH – Calculated median values were generally within the calculated upstream 80<sup>th</sup> and 20<sup>th</sup> percentile trigger values for all waterways throughout the six month monitoring period. However, there were minor exceptions (in most instances between pH 0.1 and 0.3) at nearly all waterways for at least an individual month. There were more substantial exceptions at SW5b when comparing pre-construction results. During pre-construction SW5b exhibited quite acidic conditions. Due largely to an increase in rainfall and elevated water levels during sampling for this construction period, pH levels were above the

calculated 80<sup>th</sup> percentile levels for all months. In all but two instances, pH levels at SW5b were below the default trigger values for low land rivers presented in the ANZECC guidelines. When comparing all other exceptions, all but one individual sampling event (SW8b on 10 June 2015) show consistent pH levels between upstream and downstream sampling locations. At SW8b while there was a difference of pH 1.0 between SW8c, both sample locations persisted as isolated ponds and were located more than 500 metres apart. It is considered that pH variability within all waterways across the Project was unrelated to construction during the monitoring period.

- Turbidity – Calculated median values for SW1b, SW1c, SW3b, SW5b, SW6b, SW6d, SW7b, SW8b, SW8c, SW10a and SW11a exceeded calculated 80<sup>th</sup> percentile values on one or more occasions during the monitoring period. With the exception of some exceedances at SW1, SW3, SW5b, SW6 and SW11, all elevated levels were below the upper limit ANZECC default trigger value for the respective waterway type. Where calculated median levels exceeded the upper limit ANZECC default trigger value, in all but those recorded at SW1, SW3 and SW11, upstream values for individual events were comparable to those recorded downstream. For the March SW3b exceedance, the elevated level recorded on 23 March 2015, that was primarily responsible for the exceedance, was considerably lower than the upstream level recorded at the same time. The high turbidity levels in the waterway during this sampling event can be attributed to more than 90 millimetres of rain that fell in the preceding two days, the associated flood water, wind and wave action close to shore, and heterogeneous nature of water in the waterway, particularly close to shore, due to these factors. It is considered that all exceedances, with the exception of those experienced at SW1 and SW11, were due to factors within the broader waterway catchments unrelated to the Project.

At SW1b and SW1c turbidity levels during individual sampling events were typically elevated when compared to the upstream reference point. As discussed in the previous monitoring report, the catchment for SW1 includes a number of industrial activities (ie quarry operations and a heavy machinery sales and servicing business) in addition to the Project and it is considered likely that all are contributing to the elevated downstream turbidity levels. Roads and Maritime has been proactive in its response to minimising any impacts attributable to the Project. This is discussed further in section 3.6.

Elevated turbidity levels for calculated downstream median values were also experienced at SW11 during February and March 2015. During the monitoring period, substantial earthworks and culvert works were in progress within the catchment of SW11. It is considered that a number of site based factors contributed to the elevated levels. Firstly, and as noted in the previous report, large wet weather events where site controls have been overwhelmed have been observed to deposit sediment from site within the waterway. Subsequent events appear to have remobilised these sediments. Secondly, site inspections by Roads and Maritime personnel have at times identified deficiencies in erosion and sediment controls, particularly in the vicinity of the waterway. Roads and Maritimes response to these deficiencies is discussed further in section 3.6.

- Nitrogen and phosphorus – Calculated median values for nitrogen and phosphorus exceeded the calculated 80<sup>th</sup> percentile values on one off occasions at a number of waterways during the monitoring period. However, exceedances of 80<sup>th</sup> percentile values for either nitrogen or phosphorus, or both, occurred at SW1 on a number of occasions. Exceedances occurred during February, March, April, June and July 2015 and were on occasion well above the default upper limited trigger values presented in the ANZECC guidelines. While it appears clear that catchment activities are influencing levels within the waterway, this level of exceedance is not inconsistent with results obtained during the pre-construction period. Roads and Maritime has recently become aware that a septic system failure unrelated to the Project has at times resulted in the release of untreated effluent above SW1b and SW1c. This may account for elevated levels, particularly during



wet weather when septic systems experience higher loads. Irrespective, Roads and Maritime has been proactive in its response to minimising any potential impacts attributable to the Project. This is discussed further in section 3.6.

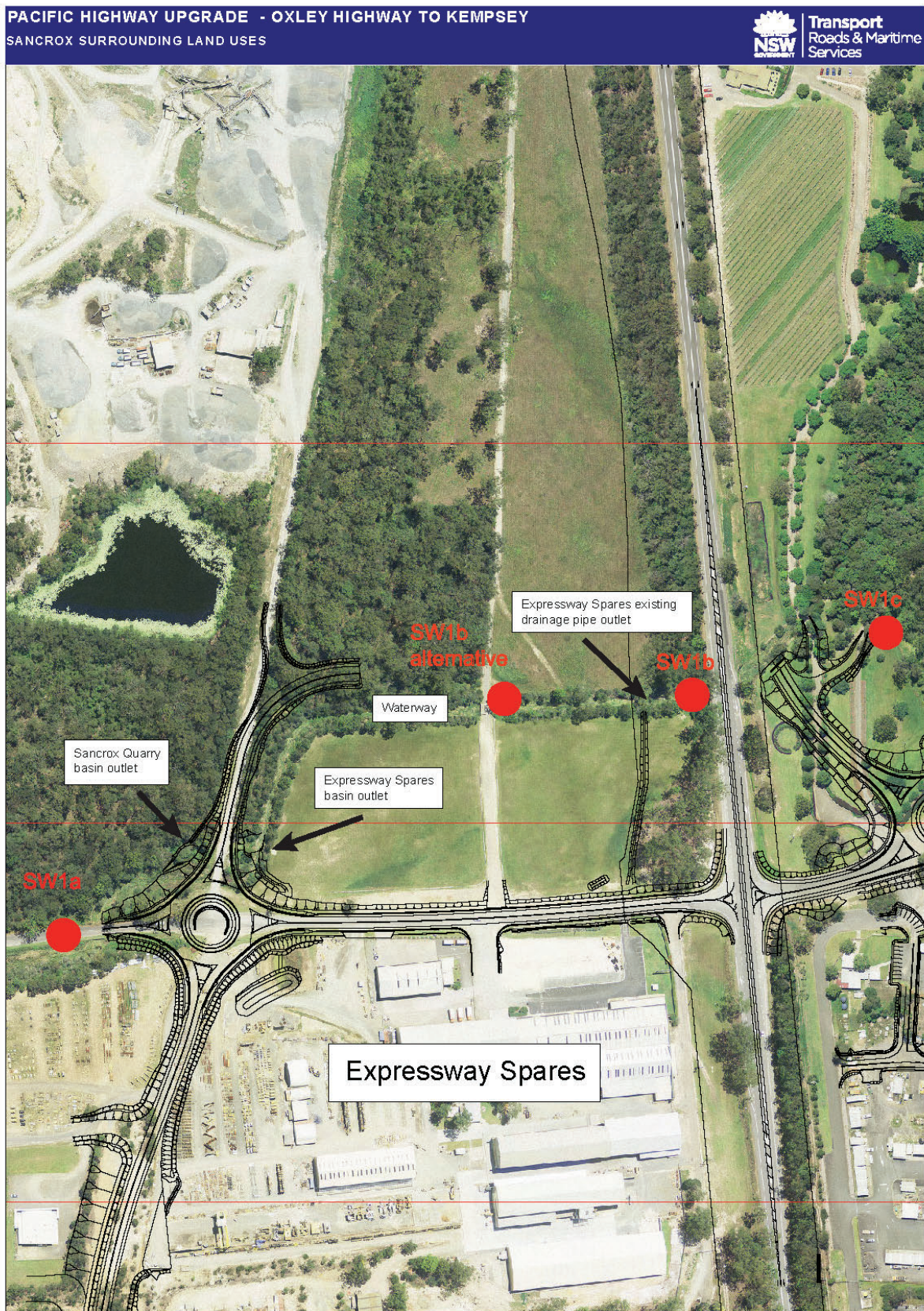
- Total petroleum hydrocarbons (TPH) – Sampling for TPH following the observed presence of oil and grease was undertaken at SW1c on one occasion. The catchment for SW1 includes a heavy machinery sales and servicing business, quarry operations and the Project. Despite the visual observation, laboratory reporting returned a negative result for the presence of hydrocarbons. It should be noted that positive TPH results (namely for heavy oil) have been recorded during pre-construction and the previous construction reporting period. In all instances, Roads and Maritime has been of the view that the presence of TPH is unrelated to the Project.
- Metals – Analysis of metals showed limited variation in levels for nearly all sampling locations and analytes. Exceptions included aluminium, iron and magnesium at some waterways, that showed substantial variability. Elevated levels were generally experienced concurrently both upstream and downstream for individual monitoring events. This was consistent with the variability and levels experienced during the pre-construction and previous construction monitoring periods. None of the elevated or low metal parameters are considered likely to be attributable to construction related activities (eg exposure of acid sulfate material).

## 3.6 Project response to surface water quality results

Impacts on water quality attributable to the Project were generally considered to be negligible during the monitoring period. However, elevated turbidity levels at SW1 and SW11 downstream monitoring sites might be considered in part or largely attributable to Project activities. In response, Roads and Maritime and its construction partners have adopted a number of responses to minimise the likelihood of future reoccurrences. These include, but are not limited to:

- SW1 – as discussed above, the monitoring points at SW1 are considered to be influenced by a number of surrounding industrial activities, unsealed access tracks and the construction of the Sancrox Interchange (Figure 3-1). Two of the industrial land uses in the area have sediment basins and all have exposed surfaces, hardstand areas, unsealed carparks and unsealed access roads that discharge to the drainage line (between the up and downstream monitoring points) where the monitoring is conducted. Despite this, Ferrovial Agroman continues to identify areas where their sediment controls could be improved to minimise sediment laden water runoff, particularly during culvert works in this drainage line. This included maintaining the lining of the clean water diversion, installing more robust controls at each side of the culvert after it was completed and filled in, clearer clean and dirty water separation, and general maintenance of controls following rain events. Progressive Erosion and Sediment Control Plans continue to be prepared by the soil conservation specialist prior to implementation and updated as required, based on the staging of works. In addition, an incident that occurred on 31 March 2015, may have contributed to the water quality monitoring result on 1 April 2015. The incident related to a subsurface drain that had been finalised to run directly into the creek, without confirmation that the water from the subsurface drain was clean. This drain was re-directed back into site controls as soon as the issue was identified, and only directed back to the final outlet location once the drainage system had been flushed and the water quality confirmed. Further detail on this incident can be found in the Oxley Highway to Kempsey – Construction Compliance Tracking Report 2 (September 2015).
- SW11 – In February, McConnell Dowell OHL Joint Venture was using a pump around system, which was found to be agitating the water at the inlet. This area was subsequently grubbed and lined with geofabric, to ensure this water remained clean even if it was stirred up during pumping. These measures appear to have improved water quality results in subsequent monitoring events. Whilst the March results did exceed the trigger values, these were relatively minor. For example the monitoring event on the 11 March 2015, identified an increase from 17 to 35 NTU, which, following laboratory monitoring, was found to be an increase of only 5 to 7 mg/L TSS. Despite this, a number of minor ERSSED rectifications were identified during routine inspections in March, including maintenance of the temporary rock crossing, reinstatement of the geofabric splash curtain over the rock crossing, minor revision of the basin spillway, and maintenance of the geofabric in the clean water diversion, to ensure it was pinned with the direction of flow. These issues were rectified as part of the inspection close out process, and no further exceedances of the trigger values were recorded for the remainder of the reporting period

**Figure 3-1 Location of Stage 1 works and surrounding land uses**



Note: Roads and Maritime relocated SW1b sampling point in August 2015 due to proximity to construction works. Alternative location is shown on above figure for information.

## 3.7 Limitations of groundwater results

A number of factors have influenced the continuity and completeness of groundwater quality results obtained during this and previous monitoring periods and the extent to which they can be analysed for trends. Relevant considerations include:

- There is insufficient historical (pre-construction) data to allow for the development of 80<sup>th</sup> and 20<sup>th</sup> percentile trigger values in accordance with ANZECC guidelines. The minimum number of samples to develop site specific trigger values is 24 (eg generally a period of two years). With the exception of groundwater level and temperature, most analytes were sampled on three or less occasions.
- Data files for automated groundwater depth loggers at GW03 and GW21 were corrupted at the time of download.
- GW06 was dry when monitored in December 2014 and believed destroyed prior to the subsequent sampling event in February 2015.
- GW07 and GW08 had insufficient water to sample during the July 2015 monitoring event.
- GW08 has no pre-construction water quality data to facilitate the development of trends between pre, during and post construction. Depth was measured on one occasion during pre-construction.
- GW09 has either been dry or contained insufficient water to sample during all construction monitoring events.
- GW16, GW17 and GW20 were not sampled during the pre-construction period and, with the exception of GW17, remained dry during this construction monitoring period.
- GW01, GW04, GW06, GW10, GW13, GW14 and GW19 have been destroyed by construction either during this or the previous construction monitoring period.
- All metals analysed for the July 2015 monitoring event were for total metals. Previous monitoring events analysed dissolved metals with the exception of iron and manganese. It is not possible to determine a relationship between concentrations over time when comparing total and dissolved metals. However, Roads and Maritime having identified this issue have instructed the laboratory to analyse both total and dissolved metals for all future monitoring events. This instruction will take effect for events from December 2015 onward.
- From November 2014, monitoring was conducted once every two months for the first six-months, rather than once a month for the first three months, due to a misinterpretation of the Water Quality Monitoring Program. However, this error resulted in an extended initial monitoring period within which to determine whether there were any construction impacts, before reducing this monitoring to quarterly as allowed for in the WQMP. No construction related impacts were detected during this six-month period.

## 3.8 Summary of groundwater results

Table 3-28 to Table 3-41 present data collected manually during the construction period 22 January 2015 to 21 July 2015 with reference to the pre-construction data reported in the Oxley Highway to Kempsey Groundwater Pre-construction Report, April 2014 (note, the previous report contained monitoring data up until February 2015. This report presents data from monitoring undertaken in April and July 2015). Groundwater levels captured automatically (as noted in section 2.3) have been graphed with corresponding rainfall data from the Bureau of Meteorology and presented in Appendix D.

Appendix E presents cumulative construction groundwater quality monitoring results since December 2014. These tables will be developed further over time with the inclusion of subsequent construction and post-construction monitoring data and allow for the identification of any long term trends.



**Table 3-28 Construction groundwater monitoring results by borehole**

Parameter	Unit	LOR	GW01		Results		GW02		Results		GW03		Results	
			20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>
Dissolved Aluminium	mg/L	0.01	4.24	4.6			<0.01*	<0.01*	0.01	17.2	0.03	0.03	<0.01	0.24
Dissolved Arsenic	mg/L	0.001	0.007	0.008			0.0034	0.0046	<0.001	0.007	0.003	0.003	<0.001	0.006
Dissolved Cadmium	mg/L	0.0001	0.001	0.001			<0.01*	<0.01*	<0.001	0.0032	<0.001*	<0.001*	<0.001	0.0002
Dissolved Chromium	mg/L	0.001	0.001	0.001			<0.01*	<0.01*	<0.001	0.011	0.012	0.012	<0.001	<0.001
Dissolved Copper	mg/L	0.001	0.043	0.063			<0.01*	<0.01*	0.003	0.069	0.007	0.007	0.005	0.010
Total Iron	mg/L	0.05	7.01	10.84			42.54	59.28	31.9	15.7	53.7	149.8	3.73	17.4
Dissolved Lead	mg/L	0.001	0.021	0.03			<0.01*	<0.01*	<0.001	0.009	<0.001*	<0.001*	<0.001	<0.001
Total Manganese	mg/L	0.001	0.472	0.487			0.458	0.482	0.073	0.216	0.252	0.483	0.141	1.34
Mercury	mg/L	0.0001							<0.00001				<0.00001	
Dissolved Nickel	mg/L	0.001	0.033	0.035			0.0032	0.0038	0.003	0.009	0.0048	0.0132	0.007	0.017
Dissolved Silver	mg/L	0.001	<0.001*	<0.001*			<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001
Dissolved Zinc	mg/L	0.005	0.522	0.553			0.0074	0.0086	0.012	0.050	0.013	0.013	0.015	0.028
EC laboratory	uS/cm		5166	5982			383.6	468.8	231	852	967	1292	519	1040
Total Nitrogen	mg/L		0.35	1.00			1.08	2.04	0.48		1.2	1.9	0.59	
Total Phosphorus	mg/L		0.04	0.12			0.196	0.424	0.35		0.30	0.62	0.14	
Ammonia	mg/L		0.03	0.03			0.272	0.506	0.02		0.07	0.17	0.02	
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>								23				120	
Chloride	mg/L		1427	1919			27	37.2	52		194	325	74	
Nitrate									0.07	0.26			<0.01	0.22
Sulphate	mg/L		105	258			14.4	29.4			99	149		
Calcium	mg/L		7.86	10.23			14.28	18.66	8.57		33.1	58.0	42.1	
Magnesium	mg/L		109.3	136.2			12.18	16.92	5.82		37	76	15.4	
Potassium	mg/L		6.17	7.23			4.85	6.044	7.53		6.17	13.84	2.47	
Sodium	mg/L		741	874			38.48	54.38	32.9		97	337	38.6	

\* No variation established between sampling events.

+ Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.

**Table 3-29 Construction groundwater monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW04		Results	GW05		Results		GW07 <sup>^</sup>		Results		
			20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15
Dissolved Aluminium	mg/L	0.01	<0.01*	<0.01*	<0.01		<0.01*	<0.01*	<0.01	6.72			0.08	
Dissolved Arsenic	mg/L	0.001	0.0034	0.0046	0.001		0.006	0.010	<0.001	0.005			<0.001	
Dissolved Cadmium	mg/L	0.0001	<0.001*	<0.001*	<0.001		<0.001*	<0.001*	<0.001	0.0008			<0.001	
Dissolved Chromium	mg/L	0.001	0.002	0.002	0.002		<0.001*	<0.001*	<0.001	0.010			<0.001	
Dissolved Copper	mg/L	0.001	<0.001*	<0.001*	0.003		<0.001*	<0.001*	0.001	0.047			0.004	
Total Iron	mg/L	0.05	66.3	93.3	24.4		158	510	59.4	69.3	38.3	38.3	13.2	
Dissolved Lead	mg/L	0.001	<0.001*	<0.001*	<0.001		<0.001*	<0.001*	<0.001	0.005			<0.001	
Total Manganese	mg/L	0.001	0.410	0.540	0.486		0.799	0.980	1.02	0.726			0.125	
Mercury	mg/L	0.0001			<0.00001				<0.00001				<0.00001	
Dissolved Nickel	mg/L	0.001	0.0018	0.0042	0.007		0.004	0.01	0.008	0.008			<0.001	
Dissolved Silver	mg/L	0.001	<0.001*	<0.001*	<0.001		<0.001*	<0.001*	<0.001	<0.001			<0.001	
Dissolved Zinc	mg/L	0.005	0.010	0.014	0.016		0.019	0.019	0.022	0.055			0.011	
EC laboratory	uS/cm		3212	4922	3170		6598	7294	6890	7320	168	168	238	
Total Nitrogen	mg/L		1.4	2.7	0.88		2.6	5.5	1.42		1.4	1.4	0.45	
Total Phosphorus	mg/L		0.38	1.40	0.12		1.60	3.18	1.35		0.2	0.2	0.22	
Ammonia	mg/L		0.18	0.98	0.13		0.80	0.89	0.71		0.07	0.07	0.01	
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>				206				460				45	
Chloride	mg/L		1089	1309	900		1468	1564	1500		38	38	38	
Nitrate					0.04				0.1	0.26			<0.01	
Sulphate	mg/L		40	65			1055	1171			4.7	4.7		
Calcium	mg/L		34.7	54.9	29.6		170	232	161		37.6	37.6	10.2	
Magnesium	mg/L		68	107	62.1		273	367	268		16.9	16.9	4.0	
Potassium	mg/L		14.2	24.7	10.4		35.4	56.34	34.4		5.25	5.25	1.75	
Sodium	mg/L		511	701	506		973	1045	1010		26.2	26.2	46.3	

\* No variation established between sampling events.

+ Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.



**Table 3-30 Construction groundwater monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW08		Results		GW09			Results		GW010		Results	
			20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15	
Dissolved Aluminium	mg/L	0.01			1.21	72.9	0.23 <sup>^</sup>	0.23 <sup>^</sup>			1 <sup>^</sup>	1 <sup>^</sup>	0.80		
Dissolved Arsenic	mg/L	0.001			<0.001	0.028	<0.001 <sup>^</sup>	<0.001 <sup>^</sup>			0.001 <sup>^</sup>	0.001 <sup>^</sup>	0.007		
Dissolved Cadmium	mg/L	0.0001			<0.001	0.0024	0.002 <sup>^</sup>	0.002 <sup>^</sup>			<0.001 <sup>^</sup>	<0.001 <sup>^</sup>	<0.001		
Dissolved Chromium	mg/L	0.001			0.003	0.082	0.001 <sup>^</sup>	0.001 <sup>^</sup>			0.003 <sup>^</sup>	0.003 <sup>^</sup>	0.005		
Dissolved Copper	mg/L	0.001			0.002	0.114	0.218 <sup>^</sup>	0.218 <sup>^</sup>			0.02 <sup>^</sup>	0.02 <sup>^</sup>	0.112		
Total Iron	mg/L	0.05			78.6	75.4	8.47	9.49			115.1	194.5	75.4		
Dissolved Lead	mg/L	0.001			<0.001	0.063	<0.001 <sup>^</sup>	<0.001 <sup>^</sup>			0.001 <sup>^</sup>	0.001 <sup>^</sup>	0.002		
Total Manganese	mg/L	0.001			0.089	0.158	0.85 <sup>^</sup>	0.85 <sup>^</sup>			0.013 <sup>^</sup>	0.013 <sup>^</sup>	0.271		
Mercury	mg/L	0.0001			<0.00001								<0.00001		
Dissolved Nickel	mg/L	0.001			<0.001	0.015	0.061 <sup>^</sup>	0.061 <sup>^</sup>			0.002 <sup>^</sup>	0.002 <sup>^</sup>	0.003		
Dissolved Silver	mg/L	0.001			<0.001	<0.001	<0.001 <sup>^</sup>	<0.001 <sup>^</sup>			<0.001 <sup>^</sup>	<0.001 <sup>^</sup>	<0.001		
Dissolved Zinc	mg/L	0.005			0.017	0.291	0.063 <sup>^</sup>	0.063 <sup>^</sup>			0.007 <sup>^</sup>	0.007 <sup>^</sup>	0.028		
EC laboratory	uS/cm				435	528					270 <sup>^</sup>	270 <sup>^</sup>	590		
Total Nitrogen	mg/L				2.90	0.06					1.1 <sup>^</sup>	1.1 <sup>^</sup>	2.11		
Total Phosphorus	mg/L				0.55						0.11 <sup>^</sup>	0.11 <sup>^</sup>	0.55		
Ammonia	mg/L				0.04						<0.02 <sup>^</sup>	<0.02 <sup>^</sup>	0.01		
Phosphate	mg/L														
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>				26								52		
Chloride	mg/L				120						52 <sup>^</sup>	52 <sup>^</sup>	150		
Nitrate					0.02	0.06							<0.01		
Sulphate	mg/L										9.4 <sup>^</sup>	9.4 <sup>^</sup>			
Calcium	mg/L				18.3		20.45	59.86			46.1	127.0	17.5		
Magnesium	mg/L				12.0		54.8	108.9			22.1	48.6	16.4		
Potassium	mg/L				8.88		5.57	11.59			9.42	16.01	9.59		
Sodium	mg/L				72.3		478	698			69.0	120.8	107		

\* No variation established between sampling events.

+ Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.

<sup>^</sup> Based on one record only.

**Table 3-31 Construction groundwater monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW11		Results		GW12		Results		GW013		Results	
			20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15
Dissolved Aluminium	mg/L	0.01	0.26	0.56	0.01	0.62	0.02	0.02	<0.01	2.33	0.02	0.03		
Dissolved Arsenic	mg/L	0.001	<0.001*	<0.001*	0.001	0.004	0.029	0.030	0.002	0.077	0.002	0.004		
Dissolved Cadmium	mg/L	0.0001	0.0022	0.0028	<0.001	0.0007	<0.001*	<0.001*	<0.001	0.0005	<0.001*	<0.001*		
Dissolved Chromium	mg/L	0.001	0.001	0.001	<0.001	0.002	<0.001*	<0.001*	<0.001	0.006	0.001	0.001		
Dissolved Copper	mg/L	0.001	0.1818	0.2292	0.018	0.039	<0.001*	<0.001*	<0.001	0.016	<0.001*	<0.001*		
Total Iron	mg/L	0.05	46.8	219.3	16.0	1.79	185	283	169	135	41.5	60.4		
Dissolved Lead	mg/L	0.001	<0.001*	<0.001*	<0.001	0.003	<0.001*	<0.001*	<0.001	0.003	<0.001*	<0.001*		
Total Manganese	mg/L	0.001	0.791	1.623	0.069	0.117	5.07	7.14		4.97	0.217	0.249		
Mercury	mg/L	0.0001			<0.00001				<0.00001					
Dissolved Nickel	mg/L	0.001	0.0626	0.0884	0.003	0.012	0.003	0.003	0.007	0.005	0.003	0.003		
Dissolved Silver	mg/L	0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001*	<0.001*		
Dissolved Zinc	mg/L	0.005	0.0788	0.0992	0.021	0.064	0.028	0.034	0.029	0.040	0.014	0.023		
EC laboratory	uS/cm		2904	7650	1040	2390	3314	6962	2470	2600	207	305		
Total Nitrogen	mg/L		0.56	1	0.56		1.3	1.7	1.08		1.6	1.7		
Total Phosphorus	mg/L		0.08	0.70	0.075		0.08	0.19	0.15		0.41	0.59		
Ammonia	mg/L		0.03	0.13	0.02		0.82	0.93	1.05		0.32	0.50		
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>				273				56					
Chloride	mg/L		581	1422	140		394	781	230		25	36		
Nitrate					<0.01	0.02			<0.01	1.53				
Sulphate	mg/L		448	1263			1284	3267			14	26		
Calcium	mg/L		30.8	120.4	8.50		85.9	148.8	62.3		3.70	4.36		
Magnesium	mg/L		58.1	189.4	9.14		137	233	104		8.23	9.23		
Potassium	mg/L		14.4	20.8	6.05		14.2	21.0	11.0		6.19	8.58		
Sodium	mg/L		427	1013	200		313	481	264		28.8	41.2		

\* No variation established between sampling events.

+ Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.

**Table 3-32 Construction groundwater monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW14		Results	GW15		Results		GW017		Results		
			20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>
Dissolved Aluminium	mg/L	0.01	4.07	4.29			0.01	0.01	0.01	0.47			0.01	1.16
Dissolved Arsenic	mg/L	0.001	0.001	0.001			0.020	0.021	0.005	0.026			<0.001	0.002
Dissolved Cadmium	mg/L	0.0001	<0.001*	<0.001*			<0.001*	<0.001*	<0.001	<0.0001			<0.001	0.0002
Dissolved Chromium	mg/L	0.001	<0.001*	<0.001*			<0.001*	<0.001*	<0.001	<0.001			<0.001	0.002
Dissolved Copper	mg/L	0.001	0.114	0.200			<0.001*	<0.001*	0.002	0.012			0.001	0.006
Total Iron	mg/L	0.05	2.05	3.40			8.13	10.30	5.02	3.98			19.9	1.73
Dissolved Lead	mg/L	0.001	0.001	0.001			<0.001*	<0.001*	<0.001	0.002			<0.001	0.003
Total Manganese	mg/L	0.001	0.757	0.759			2.85	2.99	2.00	1.94			0.561	0.238
Mercury	mg/L	0.0001							<0.00001				<0.00001	
Dissolved Nickel	mg/L	0.001	0.028	0.029			0.003	0.003	0.003	0.003			0.005	0.003
Dissolved Silver	mg/L	0.001	<0.001*	<0.001*			<0.001*	<0.001*	<0.001	<0.001			<0.001	<0.001
Dissolved Zinc	mg/L	0.005	0.130	0.146			0.007	0.007	0.020	0.022			0.026	0.046
EC laboratory	uS/cm		7480	8074			3768	3798	3660	3760			3680	4150
Total Nitrogen	mg/L		0.7	0.9			0.43	0.96	0.28				0.55	
Total Phosphorus	mg/L		0.02	0.03			0.07	0.09	0.08				0.30	
Ammonia	mg/L		0.08	0.10			0.07	0.10	0.07				0.02	
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>								244				560	
Chloride	mg/L		2386	3480			990	1559	1000				770	
Nitrate									<0.01	<0.01			<0.01	0.10
Sulphate	mg/L		166	215			136	206						
Calcium	mg/L		106	127			62.3	71.5	51.7				165	
Magnesium	mg/L		165	195			115	123	110				171	
Potassium	mg/L		2.67	3.12			8.80	9.14	8.54				9.85	
Sodium	mg/L		1048	1216			532	557	549				355	

\* No variation established between sampling events.

+ Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.

**Table 3-33 Construction groundwater monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW018		Results	GW19			Results	GW20		Results		
			20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15
Dissolved Aluminium	mg/L	0.01	<0.01*	<0.01*	<0.01	0.63	<0.01^	<0.01^	0.04				0.01	
Dissolved Arsenic	mg/L	0.001	0.007	0.008	0.005	0.011	0.001^	0.001^	0.001				<0.001	
Dissolved Cadmium	mg/L	0.0001	<0.001*	<0.001*	<0.001	0.0020	<0.001^	<0.001^	<0.001				<0.001	
Dissolved Chromium	mg/L	0.001	0.001	0.001	<0.001	<0.001	<0.001^	<0.001^	0.001				<0.001	
Dissolved Copper	mg/L	0.001	<0.001*	<0.001*	0.003	0.034	0.013^	0.013^	0.013				0.003	
Total Iron	mg/L	0.05	5.76	9.92	5.76	2.40	18.1	48.4	22.0				17.5	
Dissolved Lead	mg/L	0.001	<0.001*	<0.001*	<0.001	0.012	<0.001^	<0.001^	<0.001				<0.001	
Total Manganese	mg/L	0.001	1.64	1.83	1.80	1.58	0.636^	0.636^	0.162				1.10	
Mercury	mg/L	0.0001			<0.00001				<0.00001				<0.00001	
Dissolved Nickel	mg/L	0.001	0.003	0.005	0.002	0.002	0.015^	0.015^	0.007				0.065	
Dissolved Silver	mg/L	0.001	<0.001*	<0.001*	<0.001	<0.001	<0.001^	<0.001^	<0.001				<0.001	
Dissolved Zinc	mg/L	0.005	0.011	0.015	0.022	0.040	0.057^	0.057^	0.024				0.696	
EC laboratory	uS/cm		1652	1658	1660	1700	746	1371	734					
Total Nitrogen	mg/L		0.6	0.7	0.37		1.6	1.7	0.64					
Total Phosphorus	mg/L		0.15	0.15	0.08		0.24	0.38	0.40					
Ammonia	mg/L		0.20	0.22	0.12		0.1	0.28	0.01					
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>				684				201				167	
Chloride	mg/L		101	109	98		90	98	73				150	
Nitrate					<0.01	2.02			<0.01					
Sulphate	mg/L		150	154			46	143						
Calcium	mg/L		166	185	199		34.8	124.9	4.08				82.0	
Magnesium	mg/L		61.9	62.1	55		22.7	55.8	5.9				94.4	
Potassium	mg/L		7.65	8.02	6.56		7.74	8.23	6.69				17.0	
Sodium	mg/L		100.0	108.3	101		91.1	100.8	157				137	

\* No variation established between sampling events.

+ Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.

^ Based on one record only.

**Table 3-34 Construction groundwater monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW21 <sup>^</sup>		Results	GW022			Results	GW23		Results		
			20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>
Dissolved Aluminium	mg/L	0.01	0.05	0.05	0.02	12.2	0.05 <sup>^</sup>	0.05 <sup>^</sup>	2.34	87.2	0.05	0.19	0.49	0.04
Dissolved Arsenic	mg/L	0.001	0.002	0.002	0.002	0.011	<0.01 <sup>^</sup>	<0.01 <sup>^</sup>	0.001	0.074	0.001	0.001	<0.001	<0.001
Dissolved Cadmium	mg/L	0.0001	<0.001	<0.001	<0.001	0.0010	<0.001 <sup>^</sup>	<0.001 <sup>^</sup>	<0.001	0.0005	<0.001 <sup>*</sup>	<0.001 <sup>*</sup>	<0.001	<0.0001
Dissolved Chromium	mg/L	0.001	<0.001	<0.001	<0.001	0.011	<0.001 <sup>^</sup>	<0.001 <sup>^</sup>	0.002	0.023	<0.001 <sup>*</sup>	<0.001 <sup>*</sup>	0.002	<0.001
Dissolved Copper	mg/L	0.001	0.048	0.048	0.026	0.126	0.01 <sup>^</sup>	0.01 <sup>^</sup>	0.019	0.236	0.009	0.009	0.019	0.001
Total Iron	mg/L	0.05	43.2	43.2	19.3	35.8	199	217	110	66.2	21.9	35.8	53.2	0.21
Dissolved Lead	mg/L	0.001	<0.001	<0.001	<0.001	0.049	<0.001 <sup>^</sup>	<0.001 <sup>^</sup>	<0.001	0.086	<0.001 <sup>*</sup>	<0.001 <sup>*</sup>	<0.001	<0.001
Total Manganese	mg/L	0.001	0.358	0.358	0.557	0.577	0.011 <sup>^</sup>	0.011 <sup>^</sup>	0.261	0.632	0.458	0.642	0.713	0.076
Mercury	mg/L	0.0001			<0.00001				<0.00001				<0.00001	
Dissolved Nickel	mg/L	0.001	0.144	0.144	0.003	0.018	<0.001 <sup>^</sup>	<0.001 <sup>^</sup>	0.001	0.018	0.003	0.006	<0.001	<0.001
Dissolved Silver	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001 <sup>^</sup>	<0.001 <sup>^</sup>	<0.001	<0.001	<0.001 <sup>*</sup>	<0.001 <sup>*</sup>	<0.001	<0.001
Dissolved Zinc	mg/L	0.005	0.122	0.122	0.056	1.16	0.084 <sup>^</sup>	0.084 <sup>^</sup>	0.050	2.33	0.069	0.239	0.035	0.050
EC laboratory	uS/cm		1750	1750	748	730	872	2056	296	470	417	624	177	230
Total Nitrogen	mg/L		2.6	2.6	1.22		2.4	2.6	1.85		0.5	0.8	1.41	
Total Phosphorus	mg/L		0.39	0.39	0.19		0.56	0.89	0.35		0.43	1.096	0.90	
Ammonia	mg/L				0.13		0.08	0.08	0.02		0.03	0.04	0.02	
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>				346				15				9	
Chloride	mg/L		178	178	58		201	475	71		55.4	86	44	
Nitrate	mg/L				<0.01	0.14			<0.01	0.05			<0.01	0.06
Sulphate	mg/L		326	326			52	154			51	87		
Calcium	mg/L		29.3	29.3	43.8		22.5	27.5	11.8		28.8	45.6	35.6	
Magnesium	mg/L		28.2	28.2	14.2		42.3	56.5	23.7		17	23	17.7	
Potassium	mg/L		10.3	10.3	9.83		17.5	18.3	9.13		5.56	5.93	6.70	
Sodium	mg/L		310	310	127		154.8	331.9	72.9		54.0	87.6	34.5	

\* No variation established between sampling events.

+ Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.

<sup>^</sup> Based on one record only.

**Table 3-35 Construction groundwater monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW24		Results	GW025			Results	GW26		Results		
			20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>
Dissolved Aluminium	mg/L	0.01	0.19 <sup>^</sup>	0.19	0.26	24.6	0.05 <sup>^</sup>	0.05 <sup>^</sup>	0.05	10.7			0.21	55.2
Dissolved Arsenic	mg/L	0.001	0.002 <sup>^</sup>	0.002	<0.001	0.010	0.001 <sup>^</sup>	0.001 <sup>^</sup>	<0.001	0.004			<0.001	0.013
Dissolved Cadmium	mg/L	0.0001	<0.001 <sup>^</sup>	<0.001	<0.001	0.0010	0.001 <sup>^</sup>	0.001 <sup>^</sup>	<0.001	0.0014			<0.001	0.0034
Dissolved Chromium	mg/L	0.001	<0.001 <sup>^</sup>	<0.001	0.001	0.043	<0.001 <sup>^</sup>	<0.001 <sup>^</sup>	<0.001	0.007			0.001	0.023
Dissolved Copper	mg/L	0.001	0.428 <sup>^</sup>	0.428	0.353	5.09	0.066 <sup>^</sup>	0.066 <sup>^</sup>	0.095	0.129			1.01	38.6
Total Iron	mg/L	0.05	34.2	98.5	34.2	35.6	89.0	103.3	17.7	8.38	41.3	41.3	11.5	16.5
Dissolved Lead	mg/L	0.001	<0.001 <sup>^</sup>	<0.001	<0.001	0.021	0.001 <sup>^</sup>	0.001 <sup>^</sup>	<0.001	0.012			<0.001	0.045
Total Manganese	mg/L	0.001	0.172 <sup>^</sup>	0.172	0.145	0.180	0.902 <sup>^</sup>	0.902 <sup>^</sup>	0.308	0.298			0.300	0.488
Mercury	mg/L	0.0001			<0.00001				<0.00001				<0.00001	
Dissolved Nickel	mg/L	0.001	0.028 <sup>^</sup>	0.028	0.008	0.025	0.016 <sup>^</sup>	0.016 <sup>^</sup>	0.005	0.027			0.013	0.056
Dissolved Silver	mg/L	0.001	<0.001 <sup>^</sup>	<0.001	<0.001	<0.001	<0.001 <sup>^</sup>	<0.001 <sup>^</sup>	<0.001	<0.001			<0.001	<0.001
Dissolved Zinc	mg/L	0.005	0.13 <sup>^</sup>	0.13	0.063	0.235	0.15 <sup>^</sup>	0.15 <sup>^</sup>	0.074	0.144			0.179	0.779
EC laboratory	uS/cm		5530 <sup>^</sup>	5530 <sup>^</sup>	558	840	805 <sup>^</sup>	805 <sup>^</sup>	449	467	494	494	750	1190
Total Nitrogen	mg/L		1.2 <sup>^</sup>	1.2 <sup>^</sup>	1.10		0.9 <sup>^</sup>	0.9 <sup>^</sup>	1.09		1.4	1.4	0.57	
Total Phosphorus	mg/L		4.6 <sup>^</sup>	4.6 <sup>^</sup>	0.365		0.12 <sup>^</sup>	0.12 <sup>^</sup>	0.11		0.18	0.18	0.135	
Ammonia	mg/L		0.04 <sup>^</sup>	0.04 <sup>^</sup>	0.02		0.14 <sup>^</sup>	0.14 <sup>^</sup>	0.19		0.1	0.1	0.01	
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>				<5				7				34	
Chloride	mg/L		1686 <sup>^</sup>	1686 <sup>^</sup>	150		235 <sup>^</sup>	235 <sup>^</sup>	120		136	136	220	
Nitrate					<0.01	<0.50			0.03	0.04			<0.01	<0.01
Sulphate	mg/L		151 <sup>^</sup>	151 <sup>^</sup>			18 <sup>^</sup>	18 <sup>^</sup>			18	18		
Calcium	mg/L		42.5	160.6	1.75		2.55 <sup>^</sup>	2.55 <sup>^</sup>	1.02		2.09	2.09	4.70	
Magnesium	mg/L		29.35	96.59	7.63		14.8 <sup>^</sup>	14.8 <sup>^</sup>	4.86		7.07	7.07	20.5	
Potassium	mg/L		7.2	12.5	5.97		17 <sup>^</sup>	17 <sup>^</sup>	8.67		12.8	12.8	6.87	
Sodium	mg/L		206.7	593.9	99.5		130 <sup>^</sup>	130 <sup>^</sup>	79.3		78.9	78.9	131	

\* No variation established between sampling events.

+ Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.

<sup>^</sup> Based on one record only.

**Table 3-36 Construction groundwater monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW27		Results	GW028			Results	GW29		Results		
			20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>
Dissolved Aluminium	mg/L	0.01	<0.01 <sup>^</sup>	<0.01 <sup>^</sup>	0.02	20.3			0.09	47.7	3.21 <sup>^</sup>	3.21 <sup>^</sup>	0.78	29.4
Dissolved Arsenic	mg/L	0.001	0.001 <sup>^</sup>	0.001 <sup>^</sup>	<0.001	0.021			<0.001	0.023	0.014 <sup>^</sup>	0.014 <sup>^</sup>	0.002	0.017
Dissolved Cadmium	mg/L	0.0001	<0.001 <sup>^</sup>	<0.001 <sup>^</sup>	<0.001	0.0016			<0.001	0.0035	0.001 <sup>^</sup>	0.001 <sup>^</sup>	<0.001	0.0010
Dissolved Chromium	mg/L	0.001	<0.001 <sup>^</sup>	<0.001 <sup>^</sup>	<0.001	0.063			<0.001	0.085	0.006 <sup>^</sup>	0.006 <sup>^</sup>	0.003	0.021
Dissolved Copper	mg/L	0.001	0.002 <sup>^</sup>	0.002 <sup>^</sup>	0.084	2.70			0.545	23.0	0.017 <sup>^</sup>	0.017 <sup>^</sup>	0.017	0.154
Total Iron	mg/L	0.05	6.61	10.20	6.08	37.3	65.3	65.3	51.9	53.0	109	110	3.98	18.8
Dissolved Lead	mg/L	0.001	<0.001 <sup>^</sup>	<0.001 <sup>^</sup>	<0.001	0.045			<0.001	0.056	0.009 <sup>^</sup>	0.009 <sup>^</sup>	<0.001	0.047
Total Manganese	mg/L	0.001	0.492 <sup>^</sup>	0.492 <sup>^</sup>	0.403	0.950			0.202	0.312	0.571 <sup>^</sup>	0.571 <sup>^</sup>	0.099	0.289
Mercury	mg/L	0.0001			<0.00001				<0.00001				<0.00001	
Dissolved Nickel	mg/L	0.001	0.006 <sup>^</sup>	0.006 <sup>^</sup>	0.005	0.039			0.003	0.047	0.031 <sup>^</sup>	0.031 <sup>^</sup>	0.010	0.037
Dissolved Silver	mg/L	0.001	<0.001 <sup>^</sup>	<0.001 <sup>^</sup>	<0.001	<0.001			<0.001	<0.001	<0.001 <sup>^</sup>	<0.001 <sup>^</sup>	<0.001	<0.001
Dissolved Zinc	mg/L	0.005	0.026 <sup>^</sup>	0.026 <sup>^</sup>	0.021	0.420			0.019	0.280	5.25 <sup>^</sup>	5.25 <sup>^</sup>	0.087	1.47
EC laboratory	uS/cm		567	746	353	438	2140	2140	199	235	291	539	158	195
Total Nitrogen	mg/L		0.3	0.7	0.64		2.6	2.6	0.80		2.6	4.8	0.68	
Total Phosphorus	mg/L		0.14	0.22	0.17		0.92	0.92	0.40		0.63	1.07	0.085	
Ammonia	mg/L		0.04	0.06	0.04		0.06	0.06	0.02		0.05	0.06	0.09	
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>				50				14				23	
Chloride	mg/L		80	81	65		34	34	45		45	63	29	
Nitrate					0.08	0.26			<0.01	<0.01			0.1	0.64
Sulphate	mg/L		41	64			5.9	5.9			35.9	123.7		
Calcium	mg/L		18.3	25.6	10.3		5.75	5.75	3.55		7.2	13.9	0.77	
Magnesium	mg/L		8.3	9.6	4.55		6.83	6.83	7.27		23.1	34.0	2.05	
Potassium	mg/L		4.34	6.24	4.37		10.5	10.5	9.23		13.9	20.3	1.95	
Sodium	mg/L		60.2	60.3	55.1		33.1	33.1	36.2		133	231	29.2	

\* No variation established between sampling events.

+ Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.

<sup>^</sup> Based on one record only.

**Table 3-37 Construction groundwater monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW30			Results		GW			Results		GW		Results	
			20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15 <sup>+</sup>	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15		
Dissolved Aluminium	mg/L	0.01	2.34	2.60	0.05	6.79										
Dissolved Arsenic	mg/L	0.001	0.002	0.003	0.002	0.022										
Dissolved Cadmium	mg/L	0.0001	0.001	0.001	<0.001	0.0010										
Dissolved Chromium	mg/L	0.001	<0.001*	<0.001*	0.001	0.007										
Dissolved Copper	mg/L	0.001	2.09	2.23	0.01	0.127										
Total Iron	mg/L	0.05	36.9	115.6	17.3	9.16										
Dissolved Lead	mg/L	0.001	<0.001*	<0.001*	<0.001	0.005										
Total Manganese	mg/L	0.001	3.21	3.58	0.187	0.168										
Mercury	mg/L	0.0001			<0.00001											
Dissolved Nickel	mg/L	0.001	0.161	0.172	0.004	0.006										
Dissolved Silver	mg/L	0.001	<0.001*	<0.001*	<0.001	<0.001										
Dissolved Zinc	mg/L	0.005	0.813	0.859	0.029	0.068										
EC laboratory	uS/cm		4436	4934	511	677										
Total Nitrogen	mg/L		1.8	2.0	0.88											
Total Phosphorus	mg/L		0.52	0.55	0.10											
Ammonia	mg/L		0.04	0.05	0.11											
Phosphate	mg/L															
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>				95											
Chloride	mg/L		1219	1390	76											
Nitrate					0.12	0.03										
Sulphate	mg/L		158	167												
Calcium	mg/L		11.5	12.3	5.74											
Magnesium	mg/L		79.9	90.3	3.73											
Potassium	mg/L		13.2	14.2	6.33											
Sodium	mg/L		687	760	105											

\* No variation established between sampling events.

+ Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.





**Table 3-38 Construction groundwater level – manual record**

Borehole reference	Top of casting RL (mAHD)	Depth of water level			
		Pre-construction		Construction	
		20 <sup>th</sup> per	80 <sup>th</sup> per	Apr 2015	July 2015
GW01 (mTOC)	20.11	4.41	4.93	Destroyed	Destroyed
GW01 (mAHD)		15.18	15.70		
GW02 (mTOC)	3.57	1.95	2.96	1.34	1.88
GW02 (mAHD)		0.61	1.62		
GW03 (mTOC)	2.64	0.81	2.08	0.2	0.08
GW03 (mAHD)		0.58	1.81		
GW04 (mTOC)	1.69	1.11	2.21	0.43	Destroyed
GW04 (mAHD)		-0.52	0.58		
GW05 (mTOC)	1.24	0.81	1.55	0.17	0.47
GW05 (mAHD)		-0.31	0.43		
GW06 (mTOC)	20.1	5.36	5.85	Destroyed	Destroyed
GW06 (mAHD)		14.25	14.74		
GW07 (mTOC)	15.98	2.86	5.19	1.0	Dry
GW07 (mAHD)		10.79	13.12		
GW08 (mTOC)	19.09	6.94	6.94	4.6	13.28
GW08 (mAHD)		12.15	12.15		
GW09 (mTOC)	17.57	8.05	8.66	Dry	8.54
GW09 (mAHD)		8.91	9.52		
GW10 (mTOC)	15.38	3.34	7.27	5.69	Destroyed
GW10 (mAHD)		8.11	12.04		
GW11 (mTOC)	1.591	1.49	2.45	1.55	1.13
GW11 (mAHD)		-0.86	0.10		
GW12 (mTOC)	1.573	0.74	1.68	0.2	0.34
GW12 (mAHD)		-0.20	0.83		
GW13 (mTOC)	2.04	1.44	2.05	Destroyed	Destroyed
GW13 (mAHD)		-0.01	0.60		
GW14 (mTOC)	5.656	2.60	3.43	Destroyed	Destroyed
GW14 (mAHD)		2.23	3.06		
GW15 (mTOC)	13.79	10.01	10.32	10.5	10.04
GW15 (mAHD)		3.47	3.78		
GW16 (mTOC)	14.14	8.13	8.13	Dry	Dry
GW16 (mAHD)		6.01	6.01		
GW17 (mTOC)	59.47	Dry	Dry	12.72	11.66
GW17 (mAHD)		Dry	Dry		
GW18 (mTOC)	96.71	33.98	34.04	33.76	33.71
GW18 (mAHD)		62.67	62.73		
GW19 (mTOC)	51.81	7.53	9.46	5.59	Destroyed
GW19 (mAHD)		42.35	44.28		
GW20 (mTOC)	87.18	Dry	Dry	32.83	33.08
GW20 (mAHD)		Dry	Dry		
GW21 (mTOC)	51.29	4.65	5.79	1.65	4.27
GW21 (mAHD)		45.50	46.64		
GW22 (mTOC)	17.27	4.64	5.28	0.76	3.21
GW22 (mAHD)		11.99	12.63		
GW23 (mTOC)	39.22	15.93	15.99	15.91	15.99

Borehole reference	Top of casting RL (mAHD)	Depth of water level			
		Pre-construction		Construction	
		20 <sup>th</sup> per	80 <sup>th</sup> per	Apr 2015	July 2015
GW23 (mAHD)		23.23	23.29		
GW24 (mTOC)	26.09	6.25	7.78	6.15	7.45
GW24 (mAHD)		18.31	19.84		
GW25 (mTOC)	61.72	11.53	12.35	12.32	12.55
GW25 (mAHD)		49.37	50.19		
GW26 (mTOC)	54.56	14.17	14.98	13.45	14.5
GW26 (mAHD)		39.58	40.39		
GW27 (mTOC)	74.33	27.45	27.66	27.21	28.58
GW27 (mAHD)		46.67	46.88		
GW28 (mTOC)	54.65	8.45	9.40	8.05	9.05
GW28 (mAHD)		45.25	46.20		
GW29 (mTOC)	45.11	2.97	8.82	1.33	5.73
GW29 (mAHD)		36.29	42.14		
GW30 (mTOC)	41.49	3.16	4.59	2.76	2.86
GW30 (mAHD)		36.90	38.33		

**Table 3-39 Construction groundwater monitoring (EC) – manual record**

Borehole reference	Electrical conductivity (uS/cm)			
	Pre-construction		Construction	
	20 <sup>th</sup> per	80 <sup>th</sup> per	Apr 2015	Jul 2015
GW01	5062	5502	Destroyed	Destroyed
GW02	293	656	25700	Not taken
GW03	1009	1283	57400	Not taken
GW04	3027	5520	0356	Not taken
GW05	5970	6728	0768	Not taken
GW06	1359	8204	Destroyed	Destroyed
GW07	172	230	27.2	Not taken
GW08	No record	No record	47.900	Not taken
GW09	1981	2536	Insufficient water	Not taken
GW10	443	780	65.900	Not taken
GW11	1296	5880	112	Not taken
GW12	2467	4460	273	Not taken
GW13	186	295	Destroyed	Destroyed
GW14	6312	7068	Destroyed	Destroyed
GW15	3600	3740	410	Not taken
GW16	No record	No record	Insufficient water	Not taken
GW17	No record	No record	415	Not taken
GW18	1588	1648	182	Not taken
GW19	554	602	83700	Not taken
GW20	No record	No record	Insufficient water	Not taken
GW21	1861	2426	82200	Not taken
GW22	842	5484	33700	Not taken
GW23	415	726	21700	Not taken
GW24	509	974	62900	Not taken
GW25	476	965	49600	Not taken

Electrical conductivity (uS/cm)				
Borehole reference	Pre-construction		Construction	
	20 <sup>th</sup> per	80 <sup>th</sup> per	Apr 2015	Jul 2015
GW26	1083	1337	83100	Not taken
GW27	535	737	39100	Not taken
GW28	181	225	22000	Not taken
GW29	222	299	17500	Not taken
GW30	1750	3800	56900	Not taken

**Table 3-40 Construction groundwater monitoring (pH) – manual record**

pH				
Borehole reference	Pre-construction		Construction	
	20 <sup>th</sup> per	80 <sup>th</sup> per	Apr 2015	Jul 2015
GW01	4.1	4.5	Destroyed	Destroyed
GW02	6.2	6.5	6.3	6.9
GW03	6.0	6.5	6.8	6.6
GW04	6.0	6.3	6.5	Destroyed
GW05	6.2	6.6	6.6	7.0
GW06	3.6	5.0	Destroyed	Destroyed
GW07	5.6	5.9	6.0	Dry
GW08	No record	No record	6.0	Insufficient water
GW09	4.1	5.6	Dry	Insufficient water
GW10	5.7	6.3	5.6	Destroyed
GW11	4.9	5.2	6.6	7.0
GW12	5.8	6.0	6.2	6.0
GW13	5.3	5.8	Destroyed	Destroyed
GW14	4.4	6.1	Destroyed	Destroyed
GW15	6.2	6.4	6.4	6.2
GW16	No record	No record	Dry	Dry
GW17	No record	No record	6.8	6.5
GW18	6.5	6.7	6.9	6.8
GW19	6.1	6.4	6.4	
GW20	No record	No record	Insufficient water	Insufficient water
GW21	6.2	6.3	6.9	6.6
GW22	6.0	6.3	5.6	6.9
GW23	5.8	6.2	5.4	5.6
GW24	4.5	5.3	4.9	5.2
GW25	4.7	5.0	5.1	5.1
GW26	5.5	5.9	5.3	5.3
GW27	6.0	6.2	6.2	Insufficient water
GW28	5.3	5.7	5.3	Insufficient water
GW29	5.4	5.9	5.7	5.8
GW30	4.3	5.0	Instrument error	5.8

**Table 3-41 Construction groundwater monitoring (temperature) – manual record**

Borehole reference	Temperature			
	Pre-construction		Construction	
	20 <sup>th</sup> per	80 <sup>th</sup> per	Apr 2015	Jul 2015
GW01	20.1	20.9	Destroyed	Destroyed
GW02	19.0	21.2	21.4	18.5
GW03	18.5	21.3	20.8	16.8
GW04	18.6	20.3	21.2	Destroyed
GW05	17.4	18.9	19.5	16.3
GW06	18.5	19.8		Destroyed
GW07	18.5	19.5	22.1	Insufficient water
GW08	No record	No record	20.0	Insufficient water
GW09	18.3	18.5	Insufficient water	Insufficient water
GW10	18.2	19.5	20.3	Destroyed
GW11	18.2	19.6	22.0	17.5
GW12	18.0	20.5	21.1	15.6
GW13	19.1	20.0	Destroyed	Destroyed
GW14	19.2	20.0	Destroyed	Destroyed
GW15	19.4	20.2	20.3	19.8
GW16	No record	No record	Insufficient water	Insufficient water
GW17	No record	No record	19.7	19.2
GW18	19.9	20.5	19.7	18.8
GW19	19.5	20.2	20.1	Destroyed
GW20	No record	No record	Insufficient water	Insufficient water
GW21	18.8	20.3	20.8	18.8
GW22	17.6	20.2	21.0	18.3
GW23	19.0	19.6	18.9	18.3
GW24	18.3	19.0	19.7	18.5
GW25	19.9	20.5	19.6	19.4
GW26	19.1	20.6	19.9	18.8
GW27	19.3	20.5	19.2	Insufficient water
GW28	19.5	22.6	19.5	18.6
GW29	18.4	19.9	20.3	Insufficient water
GW30	19.4	20.0	20.5	19.0

### 3.9 Discussion of groundwater results

Construction activity at the time of the first monitoring event (ie April 2015) was limited. Activity across the majority of the Project at that time was largely limited to vegetation clearing, topsoil removal and minor earthworks (eg water quality basins), and is considered unlikely to have directly or indirectly affect groundwater resources. Construction activity at the time of the second monitoring event (ie July 2015) had progressed with a number of large cut and fill operations progressing. Activities during this period with potential to affect groundwater included:

- Progress on fill embankments at GW02, GW03 and GW04.
- Cut progressing toward final levels at GW06.
- Progress on fill embankment at GW08 and GW09.

- Progress on fill embankment at GW11.
- Bridging layer installation at GW12 and GW13.
- Progress on fill embankment beyond four metres at GW14.
- Substantial progress on cuttings in the vicinity of GW17 to GW22.
- Considerable progress on fill embankment at GW23.
- Substantial progress on large cutting near GW27 and GW28.

Considering these factors, the following observations can be made:

- Logged data shows that groundwater level for the majority of boreholes responds to rainfall across the site. Of the 23 functioning logger sites, 13 record a steep rise in level following significant rain events. The remaining sites tend to show smaller fluctuations (see Appendix D).
- No major changes to groundwater levels appear to have coincided with construction works in the vicinity of sampling locations. A noticeable change was observed at GW08. However, only one pre-construction sample was possible due to the frequent absence of water and during construction sampling has so far shown considerable variability. This location is not fitted with an automated depth logger. Further monitoring is necessary to determine the potential for Project interference.
- Laboratory analysed parameters show considerable variability for a number of analytes between sampling events. Note, comparison between a July 2015 and earlier results for a number of metal parameters are not possible due to the nature of analyte recorded ie total metals verses dissolve metals.
- Manually recorded pH and temperature records are generally consistent with levels recorded during the pre-construction and the previous reporting period.
- Table 3-39 shows considerable variability in electrical conductivity between pre-construction and construction levels. This anomaly was highlighted in Roads and Maritime's pre-construction groundwater report (April 2014) that noted the differences between laboratory results and those collected in the field. It remains unclear why the differences have occurred, but is most likely attributable to infield monitor calibration. It should be noted that infield monitoring results during this and the previous reporting period were generally consistent (refer to Table 12 in Appendix E). Variability, as indicated earlier, is not considered attributable to construction.

### 3.10 Project response to groundwater quality results

Considering the generally consistent results (in particular for pH, temperature, groundwater depth, and some of the laboratory analysed parameters) onsite management actions / interventions are not proposed at this time. Recommendations for subsequent monitoring would include:

- Ensuring laboratory analysis is consistent with pre-construction and earlier construction monitoring eg total and dissolved metals to be analysed and reported where necessary. Note, Roads and Maritime having identified this issue have instructed the laboratory to analyse both total and dissolved metals for all future monitoring events. This instruction will take effect for events from December 2015 onward.
- Close monitoring of groundwater depth at GW08 during subsequent monitoring events.

# Terms and acronyms

Term	Meaning
CEMP	Construction environmental management plan
Director General	Director General of the NSW Department of Planning and Environment (or delegate)
DPI (Fishing and Aquaculture)	The Department of Primary Industry (Fishing and Aquaculture)
EA	Environmental Assessment
EMS	Environmental management system
EPA	Environmental Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
ER	Environmental Representative
K2K	Kundabung to Kempsey stage of the Oxley Highway to Kempsey Project
MCoA	The Department of Planning and Infrastructure Ministers Condition of Approval
Minister, the	Minister for Planning and Environment (formerly “Minister for Planning and Infrastructure”)
NOW	The NSW Office of Water
OH2K	Oxley Highway to Kempsey, also referred to as the project
OH2Ku	Oxley Highway to Kundabung stage of the Oxley Highway to Kempsey project
OEH	Office of Environment and Heritage
P&E	The Department of Planning and the Environment (formerly P&I)
P&I	The Department of Planning and Infrastructure
Project, the	Oxley Highway to Kempsey Pacific Highway Upgrade
Roads and Maritime	Roads and Maritime Services
SoC	Revised statement of commitments (March 2011)
Stage 1	Sancrox Traffic Arrangement works
Stage 2	Kundabung to Kempsey stage of the Oxley Highway to Kempsey Project
Stage 3	Oxley Highway to Kundabung stage of the Oxley Highway to Kempsey Project

# Appendix A – Site locality maps



# Appendix B – Rainfall records

Port Macquarie Airport rainfall records from January 2015 to July 2015

Day of month	January 2015	February 2015	March 2015	April 2015	May 2015	June 2015	July 2015
1	3.2	0	0	15.4	104	2	0.2
2	0	0.4	6	1.6	36.4	0	0
3	0	0	0	0	34	0	0
4	0	0	0	25.8	2.6	0	0
5	0	0	0	15	0	0.2	0
6	0	0	0	0	0.2	0.2	0
7	0	0	0	7.2	0	5.2	0
8	0	0	0	0	0	0.2	0.2
9	0.2	0	0	0	0.2	0	0.2
10	0	0	0	0	0	0.2	0.6
11	0	1.6	0	1.2	0	10	0
12	11.6	2.6	0	0.2	0	0.2	0
13	0	0	2.8	0	0	0.2	0
14	1.4	0.2	0.6	0	0.2	0.2	0
15	0.8	0	0	0	0	0.4	0
16	0	0	0.4	0	12.4	2	0
17	0	0	0	0	2.4	1.8	0
18	0	3.6	1	0.2	12.8	3	0
19	0.8	6.4	0	2.8	4.2	0	0
20	26.8	6.4	0	2.8	0.2	0	5.2
21	125	56.8	3	0.2	7.2	0	0.6
22	15.2	42	67.4	0	7	0	0.6
23	52.6	7.2	25.2	1	26	0	0
24	1.2	1.8	0.2	0	1.2	0	0.4
25	0	0	0	0	0	0.2	4.2
26	6.2	0	0	0	0	16	0
27	165.8	5	0	0	0	0	0
28	7.8	0	0	0	0	0	0
29	0.2		0	0	0.2	0	0
30	0		0	21.8	0.2	0	0
31	0		45		2.8		0
Highest Daily	165.8	56.8	67.4	25.8	104	16	5.2
Monthly Total	418.8	134	151.6	95.2	254.2	42	12.2

Statistics for all years												
Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	157.9	166.9	165	144	121.6	135.9	66.2	64.1	59.8	73.5	158.7	103.7
Median	135.3	152.8	156.2	112	78.1	138	67.4	35.8	47.2	58.9	137.5	97.5

Telegraph Point rainfall records from January 2015 to July 2015

Day of month	January 2015	February 2015	March 2015	April 2015	May 2015	June 2015	July 2015
1	1.9	0	0	12.8	106	3.4	0
2	0	16	9.5	0.4	68	0	0
3	0	0.6	0	0.1	27	0	0
4	0	0	0	24	11.2	0	0
5	0	0	0	0	0	0.5	0
6	0	0	0	0.3	0	0.4	0
7	0	0	0	9	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	1.2	0	0	0	5.8	0
12	17.4	2.6	0	2.2	0	0.2	0
13	4.7	5.8	15.8	0	0	0	0
14	0.5	10.2	5.3	0	0	0	0
15	0.6	0	3	0	0	0	0
16	0	1	3.5	0	6.7	1.6	0
17	0	0	0	0	3.5	0.5	0
18	0	5	0	0	10.3	2.4	0
19	0	10.4	0	2.2	6.7	0	0
20	32.5	2.5	0	2.9	0.3	0	2
21	94.5	39.6	0	0	7.6	0	0.8
22	3.2	53	114	0	5.6	0	0
23	18.5	13.2	35.8	1.2	15.4	0	0
24	0.6	7.1	0.2	0	0.3	0	0.4
25	0	6.8	0.1	0	0	0	3.8
26	1.2	0.3	0	0	0	6.8	0
27	126	5.7	0	0	0	0	0
28	12	0	0	0	0.4	0	0
29	2.8	0	0	0	0.2	0	0
30	0	0	0	8	0.3	0	0
31	0	0	52.5	0	2.7	0	0
Highest Daily	126	53	114	24	106	6.8	3.8
Monthly Total	316.4	181	239.7	63.1	272.2	21.6	7

Statistics for all years												
Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	138.6	176	165.4	127.3	105.7	107.1	67.7	57.7	60.3	83.4	108.4	114.1
Median	110.7	148.6	148.8	85.4	60.2	72.7	37	25.9	42.9	54.6	89.3	95.2

Kempsey airport rainfall records from January 2015 to July 2015

Day of month	January 2015	February 2015	March 2015	April 2015	May 2015	June 2015	July 2015
1	4	0.2	0.2	35.4	55.2	3.8	0.2
2	0	30	2.2	1	86.8	0	0.2
3	0	2.8	0.2	0	24.4	0	0
4	0	0	0	22.8	18.8	0	0
5	0	0	0	19	0	0.2	0
6	0	0.2	0	0.4	0.2	1	0
7	0.4	0.2	0	10.2	0.2	0.4	0.2
8	0	0	0.2	0	0	0.2	0.2
9	0	0	4	0		0	0
10	0	0.2	0	0		0.2	0
11		3.8	0	0		0.8	0.4
12	14	2.8	0	0.2		0.2	1.6
13	1.8	2.2	2.4	0		0.6	0.2
14	0	1.8	0.2	0		0	0
15	7.6	0.2	0	0		0	0
16	0.4	3.8	0.2	0	0.2	0.2	0
17	0	0.2	0	0.2	1.4	1.8	0
18	0	1.4	0.2	0.2	11	1.2	0
19	0	4.2	0	1.8	5.4	0.2	0
20	121.2	0.8	0	2.6	0	0	0
21	37	29.2	0	0.6	4.6	0	2.6
22	12.4	39.4	70.2	0	9.4	0.2	0.8
23	10.4	13.4	5.2	0	8.2	0	0
24	0.4	9	0	0	0	0.2	0.2
25	0.4	4.6	0	0	0	0	2.2
26	9.2	0.4	0	0	0.2	0.4	0
27	55.4	2.6	0		0	0	0
28	21.2	6	0	0	0.2	0.2	0.2
29	0		0	0	0.4	0	0
30	0.2		0	1	0	0.2	0
31	0		8.2		5.4		
Highest Daily	121.2	39.4	70.2	35.4	86.8	3.8	2.6
Monthly Total	296	159.4	93.4	95.4	232	12	9

Statistics for all years												
Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean												
Median												

Sancrox site weather station rainfall records from January 2015 to July 2015

Day of month	January 2015	February 2015	March 2015	April 2015	May 2015	June 2015	July 2015
1		0.4	6.2	1.8	55.8	0	0.2
2		0.2	0	0	34	0	0
3		0	0	29.6	9	0	0
4		0	0	12.6	0.2	0.2	0
5		1.2	0	0	0	0.6	0
6		0	0	7.6	0.2	0.2	0.2
7		0	0	0	0	0	0
8		0	0	0	0	0	0
9		1.2	0	0	0	0.2	0
10		2.8	0	0	0	8.4	0.4
11		0.2	0	0.4	0	0.4	0
12		0	2.8	0	0	0	0
13		9.4	1.4	0	0.2	0	0
14		0	0	0	0	0.4	0
15		0	1.4	0	8.6	1.2	0
16		0.2	0	0	5.8	1.6	0
17		3	1	0	7.8	2.8	0
18		11.2	0	2.2	3.8	0	0
19		1.4	0	2.8	0	0	2.6
20		51	1	0	6.6	0.2	0.4
21		36.6	76.2	0	7.2	0	
22	32.2	6.2	20.4	3.8	20.8	0	
23	0.8	0.8	0	0.2	1	0	
24	0	0	0.2	0	0	0.2	
25	1.2	0	0	0	0	13.8	
26	87.8	4.6	0	0	0	0	
27	9	0	0	0	0	0.2	
28	0	0	0	0	0.4	0	
29	0		0	13.4	0.4	0	
30	0		34.4	103	3	0.4	
31	0		13.2		2.4		

Telegraph Point site weather station rainfall records from January 2015 to July 2015

Day of month	January 2015	February 2015	March 2015	April 2015	May 2015	June 2015	July 2015
1		16.4	2.6	0.2	65.8	0	0.2
2		0.2	0	0	21.4	0	0.2
3		0	0	26	6.4	0.2	0
4		0	0	12.4	0	0.2	0
5		1	0	0.2	0.4	0.4	0.2
6		0	0	8.4	0	2.6	0.2
7		0	0	0.2	0	0	0
8		0	0	0	0.2	0.2	0
9		0.4	0.2	0	0.4	0.2	0.2
10		2.2	0	0	0	5.2	0.2
11		0.8	0	0	0	0	0
12		1.8	8.4	0	0	0	0
13		0.8	0.8	0	0.2	0	0
14		0.2	0.2	0	0	1.2	0
15		0.4	0.2	0.2	4.6	1.2	0
16		0	0	0	4.4	0.6	0
17		2.2	3.6	0.2	8.6	2.6	0
18		14.8	0.2	1.2	7.4	0.2	0
19		2.4	0	3.2	0.2	0	1.8
20		44.4	1.2	0	5.8	0	0.6
21		46.2	86.8	0.4	3.8	0	
22	1	15.4	25.6	0.4	14.8	0.2	
23	0	2.6	0	0	1	0	
24	0	5.8	0	0	0	0.2	
25	0	0.2	0	0.2	0	5.2	
26	121	6	0	0	0.2	0	
27	15.4	0	0	0	0.2	0.2	
28	0.8	0	0	0	0	0	
29	0		0	3.4	0.4	0.2	
30	0		12.6	98.4	2.8	0	
31	0		20		3.2		

Kundabung site weather station rainfall records from January 2015 to July 2015

Day of month	January 2015	February 2015	March 2015	April 2015	May 2015	June 2015	July 2015
1		16.4	2.6	0.2	65.8	0	0.2
2		0.2	0	0	21.4	0	0.2
3		0	0	26	6.4	0.2	0
4		0	0	12.4	0	0.2	0
5		1	0	0.2	0.4	0.4	0.2
6		0	0	8.4	0	2.6	0.2
7		0	0	0.2	0	0	0
8		0	0	0	0.2	0.2	0
9		0.4	0.2	0	0.4	0.2	0.2
10		2.2	0	0	0	5.2	0.2
11		0.8	0	0	0	0	0
12		1.8	8.4	0	0	0	0
13		0.8	0.8	0	0.2	0	0
14		0.2	0.2	0	0	1.2	0
15		0.4	0.2	0.2	4.6	1.2	0
16		0	0	0	4.4	0.6	0
17		2.2	3.6	0.2	8.6	2.6	0
18		14.8	0.2	1.2	7.4	0.2	0
19		2.4	0	3.2	0.2	0	1.8
20		44.4	1.2	0	5.8	0	0.6
21		46.2	86.8	0.4	3.8	0	
22	1	15.4	25.6	0.4	14.8	0.2	
23	0	2.6	0	0	1	0	
24	0	5.8	0	0	0	0.2	
25	0	0.2	0	0.2	0	5.2	
26	121	6	0	0	0.2	0	
27	15.4	0	0	0	0.2	0.2	
28	0.8	0	0	0	0	0	
29	0		0	3.4	0.4	0.2	
30	0		12.6	98.4	2.8	0	
31	0		20		3.2		





# Appendix C – Surface water quality sampling results

**Table 1 SW1 – Unnamed tributary or Fernbank Creek (Chainage 2500 to 2650)**

No.	Parameter	Unit	2/02/15 (D)			9/02/15 (D)			14/02/15 (W)			11/03/15 (D)			23/03/15 (W)			01/04/15 (W)			05/04/15 (W)		
			SW1a (US)	SW1b (US)	SW1c (DS)	SW1a <sup>#</sup> (US)	SW1b (US)	SW1c <sup>#</sup> (DS)	SW1a <sup>#</sup> (US)	SW1b (US)	SW1c <sup>#</sup> (DS)	SW1a <sup>#</sup> (US)	SW1b <sup>#</sup> (US)	SW1c <sup>#</sup> (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)
1	Temperature	°C	27	25	24	22	24	22	23	25	24	23	23	23	22	23	23	21	22	22	21	21	21
2	Electrical conductivity (EC)	uS/cm	689	868	1072	1178	1200	1160	1159	851	572	1396	1079	953	119	189	211	146	244	267	117	267	267
3	Dissolved oxygen (DO)	%	58	64	45	5	16	17	6	8	26	6	5	12	70	72	74	77	80	78	69	70	66
4	pH		6.9	7.1	6.8	6.8	7.0	6.8	6.6	7.0	7.0	6.9	7.4	7.0	5.9	6.2	6.3	6.0	6.3	6.4	6.3	6.6	6.6
5	Turbidity (NTU)	NTU	27	190	19	10	19	21	19	35	87	14	25	33	42	80	92	42	93	89	48	55	56
6	Total suspended solids (TSS)	mg/L	19	33	6	5	12	6	5	<5	12	15	18	9	14	32	37	8	16	13	13	9	10
7	Total Petroleum Hydrocarbons	mg/L																					
8	Aluminium (Al)	mg/L	0.03	0.02	0.01	0.1	<0.01	<0.01				0.06	0.03	<0.01	1.9	1.14	0.87	1.76	0.76	0.73			
9	Arsenic (As)	mg/L	<0.001	0.002	0.001	0.002	0.004	0.001				0.002	0.009	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
10	Cadmium (Cd)	mg/L	0.0005	<0.0001	<0.0001	0.0001	<0.0001	<0.0001				<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				<0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.001	<0.001	<0.001			
12	Copper (Cu)	mg/L	0.001	0.001	<0.001	0.001	0.001	0.001				0.003	<0.001	<0.001	0.001	0.002	0.003	0.002	0.002	0.002			
13	Iron (Fe)	mg/L	0.21	0.35	0.4	21.8	3.85	0.13				28.9	7.15	1.56	1.39	1.02	0.85	1.4	0.78	0.82			
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
15	Manganese (Mn)	mg/L	0.339	0.365	0.614	0.934	1.3	1.35				1.1	1.02	0.873	0.01	0.013	0.013	0.013	0.016	0.026			
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
17	Nickel (Ni)	mg/L	0.009	0.001	0.001	0.002	<0.001	<0.001				<0.001	0.001	<0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001			
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
19	Zinc (Zn)	mg/L	0.234	0.016	0.021	0.03	0.007	0.008				0.011	0.021	0.013	0.014	0.036	0.028	0.011	0.016	0.029			
20	Total Nitrogen (TN)	mg/L	0.8	0.7	0.5	1.1	0.7	0.6	0.8	1	0.5	0.7	1.5	0.5	1	1	0.9	1	1	0.9	1	0.8	0.9
21	Total Phosphorous (TP)	mg/L	0.04	0.21	0.08	0.03	0.18	0.03	0.03	0.5	0.17	0.02	0.7	0.11	0.03	0.04	0.05	0.03	0.05	0.04	0.02	0.02	0.02
22	C6 - C10 Fraction	ug/L																					
23	>C10 - C16 Fraction	ug/L																					
24	>C16 - C34 Fraction	ug/L																					
25	>C34 - C40 Fraction	ug/L																					

# - Sample location persisting as an isolated pond.

**Table 2 SW1 – Unnamed tributary or Fernbank Creek (Chainage 2500 to 2650) Cont.**

No.	Parameter	Unit	09/04/15 (D)			04/05/15 (W)			11/05/15 (D)			18/05/15 (W)			10/06/15 (D)			09/07/15 (D)			SW1a (US)	SW1b <sup>#</sup> (US)	SW1c <sup>#</sup> (DS)
			SW1a <sup>#</sup> (US)	SW1b (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a <sup>#</sup> (US)	SW1b <sup>#</sup> (US)	SW1c (DS)	SW1a (US)	SW1b (US)	SW1c (DS)	SW1a <sup>#</sup> (US)	SW1b (US)	SW1c (DS)	SW1a <sup>#</sup> (US)	SW1b (US)	SW1c (DS)			
1	Temperature	°C	19	19	18	20	20	20	12	13	14	17	17	17	12	13	13	11	12	11			
2	Electrical conductivity (EC)	uS/cm	187	919	856	95	335	335	247	879	911	304	511	584	552	1039	1040	738	1207	1027			
3	Dissolved oxygen (DO)	%	53	64	48	81	81	79	37	58	49	69	79	73	11	14	23	14	11	16			
4	pH		6.6	7.3	7.2	6.2	6.6	6.7	6.9	7.1	7.1	6.7	6.9	6.9	6.5	6.8	6.7	6.5	6.9	6.9			
5	Turbidity (NTU)	NTU	25	41	18	49	51	52	33	17	20	42	45	51	12	22	34	17	64	20			
6	Total suspended solids (TSS)	mg/L	<5	13	<5	<5	7	<5	<5	<5	10	<5	16	22	<5	7	<5	8	21	<5			
7	Total Petroleum Hydrocarbons	mg/L																					
8	Aluminium (Al)	mg/L	0.44	0.2	0.13	2.3	1.19	1.04	0.23	0.09	0.08				0.07	0.02	0.01	0.03	0.01	<0.01			
9	Arsenic (As)	mg/L	<0.001	<0.001	0.001	<0.001	<0.001	0.001	<0.001	0.001	<0.001				0.001	0.003	<0.001	<0.001	0.002	0.001			
10	Cadmium (Cd)	mg/L	<0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
12	Copper (Cu)	mg/L	0.001	0.004	0.001	0.002	0.001	0.002	0.001	<0.001	<0.001				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
13	Iron (Fe)	mg/L	1.98	0.7	0.56	1.64	0.99	0.9	1.89	0.97	0.52				15.3	4.27	0.32	15.1	3.9	0.13			
14	Lead (Pb)	mg/L	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
15	Manganese (Mn)	mg/L	0.098	0.106	0.152	0.011	0.016	0.014	0.171	0.159	0.201				1.28	0.444	0.442	1.36	0.537	0.471			
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
17	Nickel (Ni)	mg/L	<0.001	0.002	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001				0.001	0.002	0.001	<0.001	0.001	<0.001			
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
19	Zinc (Zn)	mg/L	0.009	0.03	0.014	0.009	0.009	0.011	0.024	0.01	0.013				0.006	0.011	0.01	0.017	0.018	0.007			
20	Total Nitrogen (TN)	mg/L	0.9	0.9	0.6	0.9	0.8	0.9	0.9	0.8	0.6	0.5	0.7	0.7	0.7	1.7	0.9	0.3	4.4	1			
21	Total Phosphorous (TP)	mg/L	0.02	0.22	0.06	0.03	0.03	0.04	0.01	0.04	0.03	0.02	0.08	0.1	0.01	0.33	0.07	0.01	0.99	0.1			
22	C6 - C10 Fraction	ug/L									<20												
23	>C10 - C16 Fraction	ug/L									<100												
24	>C16 - C34 Fraction	ug/L									<100												
25	>C34 - C40 Fraction	ug/L									<100												

# - Sample location persisting as an isolated pond.

**Table 3 SW2 – Fernbank Creek (Chainage 4620 to 4800)**

No.	Parameter	Unit	2/02/15 (W)		9/02/15 (D)		14/02/15 (W)		11/03/15 (D)		23/03/15 (W)		01/04/15 (W)		05/04/15 (W)		09/04/15 (D)		04/05/15 (W)	
			SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a* (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)
1	Temperature	°C	30.6	30.3	25.7	25.5	25.4	28.7	28.7	30.6	26.3	28.2	26.3	25.6	25.7	25.8	23.2	24.4	22.1	23.1
2	Electrical conductivity (EC)	uS/cm	184	230	339	341	382	338	474	606	385	520	492	563	468	577	515	571	230	190
3	Dissolved oxygen (DO)	%	20	8.7	6	8	11	11	59	58	93	93	111	114	85	125	103	95	82	107
4	pH		6.1	6.4	6.7	7.0	6.8	6.6	6.6	6.7	6.2	6.6	6.4	6.3	6.3	6.6	6.6	6.4	6.4	6.3
5	Turbidity (NTU)	NTU	26	30	20	27	45	41	40	44	27	51	39	33	32	32	28	29	19	16
6	Total suspended solids (TSS)	mg/L	18	30	37	36	41	34	24	21	23	20	7	18	18	29	11	6	<5	5
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	0.2	0.2	0.13	0.1			0.03	0.02	0.06	0.03	0.03	0.04			0.02	0.02	0.13	0.15
9	Arsenic (As)	mg/L	0.002	0.002	0.003	0.003			0.002	0.002	<0.001	<0.001	0.002	<0.001			<0.001	<0.001	<0.001	<0.001
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
11	Chromium (Cr)	mg/L	<0.001	0.001	<0.001	<0.001			<0.001	0.006	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
12	Copper (Cu)	mg/L	0.002	0.001	<0.001	0.001			<0.001	0.003	0.001	<0.001	<0.001	<0.001			<0.001	0.002	<0.001	0.001
13	Iron (Fe)	mg/L	3.1	11	9.16	4.72			5.34	7.62	2.23	3.16	1.4	1.53			1.26	3.93	0.79	1.33
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
15	Manganese (Mn)	mg/L	0.726	1.62	1.11	1.19			0.576	0.559	0.215	0.207	0.313	0.354			0.115	0.578	0.091	0.224
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
17	Nickel (Ni)	mg/L	0.003	0.003	0.002	0.002			0.002	0.002	0.001	0.002	0.001	0.002			0.001	0.003	0.002	0.002
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
19	Zinc (Zn)	mg/L	0.053	0.009	<0.005	0.007			0.005	<0.005	0.027	0.016	0.008	0.012			0.006	<0.005	0.006	0.009
20	Total Nitrogen (TN)	mg/L	2.5	3.3	3.1	3.1	2.9	3.2	1.5	1.5	4.6	1.9	1.3	1.4	1.3	2	1.2	1.2	0.6	0.7
21	Total Phosphorous (TP)	mg/L	0.45	0.94	0.61	0.64	0.58	0.49	0.2	0.15	0.37	0.14	0.08	0.09	0.08	0.29	0.11	0.09	0.08	0.11

**Table 4 SW2 – Fernbank Creek (Chainage 4620 to 4800) Cont.**

No.	Parameter	Unit	11/05/15 (D)		18/05/15 (W)		10/06/15 (D)		9/07/15 (D)		SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	
			SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)	SW2a (DS)	SW2b (US)											
1	Temperature	°C	14.8	13.3	17.0	19.7	11.9	11.5	10.8	12.5											
2	Electrical conductivity (EC)	uS/cm	376	450	338	502	387	855	434	987											
3	Dissolved oxygen (DO)	%	29	25	59	98	50	85	40	105											
4	pH		6.5	6.5	6.2	6.7	6.0	5.9	6.3	6.4											
5	Turbidity (NTU)	NTU	20	36	20	32	12	12	28	7											
6	Total suspended solids (TSS)	mg/L	8	8	7	5	<5	<5	<5	<5											
7	Total Petroleum Hydrocarbons	mg/L																			
8	Aluminium (Al)	mg/L	0.02	0.01			0.02	<0.01	0.03	<0.01											
9	Arsenic (As)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001											
11	Chromium (Cr)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
12	Copper (Cu)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
13	Iron (Fe)	mg/L	0.97	4.31			0.68	0.3	1.23	0.25											
14	Lead (Pb)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
15	Manganese (Mn)	mg/L	0.263	1.31			0.056	0.187	0.131	0.832											
16	Mercury (Hg)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001											
17	Nickel (Ni)	mg/L	0.002	0.003			0.001	0.001	0.001	0.002											
18	Silver (Ag)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
19	Zinc (Zn)	mg/L	<0.005	0.006			0.006	0.006	0.008	0.009											
20	Total Nitrogen (TN)	mg/L	0.8	1.2	0.6	0.9	0.6	0.6	0.6	0.3											
21	Total Phosphorous (TP)	mg/L	0.06	0.13	0.04	0.06	0.04	0.03	0.04	0.01											

**Table 5 SW3 – Hastings River north bank (Chainage 6040 to 6080)**

No.	Parameter	Unit	2/02/15 (W)		9/02/15 (D)		14/02/15 (W)		11/03/15 (D)		23/03/15 (W)		01/04/15 (W)		05/04/15 (W)		09/04/15 (D)		4/05/15 (W)	
			SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)
1	Temperature	°C	26.6	26.7	27.1	27.0	28.4	28.4	27.7	27.4	24.9	23.7	25.4	25.3	23.9	23.8	22.5	22.4	19.6	19.3
2	Electrical conductivity (EC)	uS/cm	8000	8000	8000	8000	8000	8000	8000	8000	1350	1457	8000	8000	8000	8000	8000	8000	443	415
3	Dissolved oxygen (DO)	%	85	85	112	110	91	89	115	115	87	87	88	88	72	71	90	93	90	87
4	pH		6.4	6.6	7.1	7.4	7.1	7.4	7.3	7.7	6.6	6.7	6.9	6.8	6.9	6.9	7.1	7.3	6.6	6.8
5	Turbidity (NTU)	NTU	22	23	19	19	18	12	48	39	289	97	28	19	47	41	47	70	98	78
6	Total suspended solids (TSS)	mg/L	7	12	<5	<5	<5	<5	54	29	136	36	18	13	40	24	34	54	68	29
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	0.15	0.14	0.02	0.02			0.01	0.01	0.17	0.17	0.06	0.07			0.08	0.08	0.43	0.53
9	Arsenic (As)	mg/L	0.001	0.001	<0.001	<0.001			0.001	<0.001	<0.001	<0.001	0.001	<0.001			<0.001	<0.001	<0.001	<0.001
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	0.001	0.001
12	Copper (Cu)	mg/L	0.002	0.001	0.003	0.002			<0.001	<0.001	0.001	0.001	0.001	0.001			<0.001	<0.001	0.001	0.001
13	Iron (Fe)	mg/L	0.4	0.38	0.06	0.07			<0.05	<0.05	0.3	0.28	0.2	0.24			0.22	0.2	0.43	0.48
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
15	Manganese (Mn)	mg/L	0.096	0.09	0.079	0.075			0.048	0.046	0.028	0.024	0.108	0.103			0.047	0.047	0.039	0.025
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
17	Nickel (Ni)	mg/L	0.001	0.001	<0.001	<0.001			<0.001	<0.001	0.001	<0.001	<0.001	<0.001			<0.001	<0.001	0.001	<0.001
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
19	Zinc (Zn)	mg/L	0.013	0.036	<0.005	<0.005			<0.005	<0.005	0.011	0.011	0.007	0.006			<0.005	<0.005	<0.005	<0.005
20	Total Nitrogen (TN)	mg/L	0.9	0.9	0.5	0.4	<0.2	<0.2	<0.1	<0.1	1.1	0.9	0.7	0.7	0.6	0.6	0.6	0.5	1	0.9
21	Total Phosphorous (TP)	mg/L	0.05	0.06	0.05	0.03	0.04	0.03	0.19	0.15	0.17	0.1	0.06	0.07	0.06	0.05	0.05	0.05	0.11	0.08

Note - Elevated turbidity for 11 March, 23 March, 5 April, 9 April and 5 May 2015 sampling events attributable to wind and wave action close to sure at time of sampling.

Note - Elevated turbidity for 23 March and 5 May 2015 sampling events attributable to flood waters at time of sampling.

Note - Elevated turbidity for 1 April 2015 sampling event attributable to fish activity close to sure at time of sampling.

**Table 6 SW3 – Hastings River north bank (Chainage 6040 to 6080) cont.**

No.	Parameter	Unit	11/05/15 (D)		18/05/15 (W)		10/06/15 (D)		9/07/15 (D)		SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	
			SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)	SW3a (US)	SW3b (DS)											
1	Temperature	°C	16.9	16.9	18.7	18.6	15.9	15.9	14.6	14.6											
2	Electrical conductivity (EC)	uS/cm	8000	8000	8000	8000	8000	8000	8000	8000											
3	Dissolved oxygen (DO)	%	84	83	103	101	92	90	98	95											
4	pH		6.9	7.1	7.1	7.4	7.1	7.3	7.5	7.6											
5	Turbidity (NTU)	NTU	13	15	13	11	6	5	6	6											
6	Total suspended solids (TSS)	mg/L	<5	8	15	12	<5	<5	<5	<5											
7	Total Petroleum Hydrocarbons	mg/L																			
8	Aluminium (Al)	mg/L	0.05	0.04			0.01	0.01	<0.01	<0.01											
9	Arsenic (As)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	0.001											
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001											
11	Chromium (Cr)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
12	Copper (Cu)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
13	Iron (Fe)	mg/L	0.11	0.09			<0.05	<0.05	<0.05	<0.05											
14	Lead (Pb)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
15	Manganese (Mn)	mg/L	0.045	0.045			0.045	0.045	0.031	0.03											
16	Mercury (Hg)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001											
17	Nickel (Ni)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
18	Silver (Ag)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
19	Zinc (Zn)	mg/L	<0.005	0.006			0.006	<0.005	<0.005	<0.005											
20	Total Nitrogen (TN)	mg/L	0.6	0.6	0.2	0.2	<0.2	<0.2	<0.2	<0.2											
21	Total Phosphorous (TP)	mg/L	0.02	0.04	0.02	0.04	0.02	0.03	0.04	0.08											

**Table 7 SW5 – Unnamed tributary of the Wilson River (Chainage 15820)**

No.	Parameter	Unit	2/02/15 (W)	9/02/15 (D)	14/02/15 (W)	11/03/15 (D)	23/03/15 (W)	01/04/15 (W)	05/04/15 (W)	09/04/15 (D)	04/05/15 (W)
			SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)
1	Temperature	°C	29.7	25.9	26.4	30.6	31.2	28.6	26.8	25.9	25.0
2	Electrical conductivity (EC)	uS/cm	160	212	194	378	180	209	274	252	84
3	Dissolved oxygen (DO)	%	9	11	18	88	67	62	55	55	64
4	pH		6.0	6.2	6.2	6.8	6.6	6.4	6.4	6.4	5.9
5	Turbidity (NTU)	NTU	23	17	16	26	97	20	48	12	22
6	Total suspended solids (TSS)	mg/L	8	18	6	22	38	6	14	<5	<5
7	Total Petroleum Hydrocarbons	mg/L									
8	Aluminium (Al)	mg/L	0.15	0.13		0.06	0.23	0.13		0.11	0.12
9	Arsenic (As)	mg/L	0.003	0.005		0.005	<0.001	0.004		0.002	<0.001
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001		<0.0001	<0.0001
11	Chromium (Cr)	mg/L	<0.001	<0.001		<0.001	<0.001	<0.001		<0.001	<0.001
12	Copper (Cu)	mg/L	0.002	0.002		<0.001	0.005	0.001		<0.001	0.001
13	Iron (Fe)	mg/L	3.82	6.73		2.02	0.38	3.05		2.1	0.31
14	Lead (Pb)	mg/L	<0.001	<0.001		<0.001	<0.001	<0.001		<0.001	<0.001
15	Manganese (Mn)	mg/L	1.51	1		1.7	0.132	1.51		1.03	0.074
16	Mercury (Hg)	mg/L	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001		<0.0001	<0.0001
17	Nickel (Ni)	mg/L	0.002	0.001		0.002	0.001	0.002		0.002	<0.001
18	Silver (Ag)	mg/L	<0.001	<0.001		<0.001	<0.001	<0.001		<0.001	<0.001
19	Zinc (Zn)	mg/L	0.035	0.072		0.122	0.006	0.006		<0.005	0.011
20	Total Nitrogen (TN)	mg/L	2.4	3	2.8	1.6	1	1.5	0.6	0.9	0.5
21	Total Phosphorous (TP)	mg/L	0.2	0.19	0.14	0.11	0.09	0.08	0.02	0.04	0.04



**Table 8 SW5 – Unnamed tributary of the Wilson River (Chainage 15820) cont.**

No.	Parameter	Unit	11/05/15 (D)	18/05/15 (W)	10/06/15 (D)	9/07/15 (D)					
			SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)	SW5b (DS)
1	Temperature	°C	14.3	20.4	17.2	13.9					
2	Electrical conductivity (EC)	uS/cm	262	229	260	364					
3	Dissolved oxygen (DO)	%	24	70	70	76					
4	pH		6.8	6.7	6.0	6.4					
5	Turbidity (NTU)	NTU	36	15	9	15					
6	Total suspended solids (TSS)	mg/L	8	8	<5	<5					
7	Total Petroleum Hydrocarbons	mg/L									
8	Aluminium (Al)	mg/L	0.09		0.02	0.01					
9	Arsenic (As)	mg/L	0.001		<0.001	<0.001					
10	Cadmium (Cd)	mg/L	<0.0001		<0.0001	<0.0001					
11	Chromium (Cr)	mg/L	<0.001		<0.001	<0.001					
12	Copper (Cu)	mg/L	0.001		<0.001	<0.001					
13	Iron (Fe)	mg/L	1.29		0.28	0.08					
14	Lead (Pb)	mg/L	<0.001		<0.001	<0.001					
15	Manganese (Mn)	mg/L	0.401		0.019	0.028					
16	Mercury (Hg)	mg/L	<0.0001		<0.0001	<0.0001					
17	Nickel (Ni)	mg/L	0.003		0.001	<0.001					
18	Silver (Ag)	mg/L	<0.001		<0.001	<0.001					
19	Zinc (Zn)	mg/L	<0.005		0.023	0.106					
20	Total Nitrogen (TN)	mg/L	0.8	0.6	0.5	0.8					
21	Total Phosphorous (TP)	mg/L	0.04	0.02	0.02	0.02					

**Table 9 SW6 – Wilson River south bank (Chainage 16460 to 16600)**

No.	Parameter	Unit	2/02/15 (W)		9/02/15 (D)		14/02/15 (W)		11/03/15 (D)		23/03/15 (W)		01/04/15 (W)		05/04/15 (W)		09/04/15 (D)		04/05/15 (W)	
			SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)
1	Temperature	°C	24.5	24.5	25.1	25.6	28.7	29.0	27.6	27.9	23.3	24.4	24.1	23.4	22.1	21.5	21.2	21.3	20.2	19.6
2	Electrical conductivity (EC)	uS/cm	227	231	279	282	372	359	272	279	97	98	243	275	152	154	172	216	110	105
3	Dissolved oxygen (DO)	%	89	87	106	106	99	101	88	94	82	82	81	65	95	88	81	70	67	72
4	pH		6.7	6.7	6.8	6.8	6.9	7.0	6.9	6.9	6.2	6.2	6.4	6.2	6.6	6.5	6.6	6.4	5.9	6.0
5	Turbidity (NTU)	NTU	17	18	17	17	78	47	22	23	64	65	22	33	19	21	26	26	68	102
6	Total suspended solids (TSS)	mg/L	<5	<5	<5	<5	82	19	17	14	20	16	16	14	<5	6	8	8	16	45
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	0.12	0.17	0.06	0.25			0.08	0.07	0.66	1.02	0.24	0.29			0.34	0.42	0.54	0.68
9	Arsenic (As)	mg/L	0.001	0.001	0.002	0.001			0.002	0.002	0.001	<0.001	0.002	0.002			<0.001	<0.001	<0.001	<0.001
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
12	Copper (Cu)	mg/L	0.001	<0.001	0.001	<0.001			<0.001	<0.001	0.001	0.004	<0.001	0.001			0.001	<0.001	0.001	0.001
13	Iron (Fe)	mg/L	0.21	0.22	0.39	0.35			0.46	0.54	0.44	0.6	0.45	0.7			0.53	0.84	0.41	0.48
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
15	Manganese (Mn)	mg/L	0.056	0.057	0.069	0.051			0.019	0.024	0.023	0.028	0.067	0.089			0.037	0.042	0.027	0.028
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
17	Nickel (Ni)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
19	Zinc (Zn)	mg/L	0.007	0.008	0.005	<0.005			<0.005	<0.005	0.006	0.009	<0.005	<0.005			0.006	<0.005	0.008	<0.005
20	Total Nitrogen (TN)	mg/L	0.5	0.6	0.4	0.4	0.6	0.4	0.2	0.2	0.9	0.8	0.5	0.6	0.5	0.6	0.5	1	0.8	0.9
21	Total Phosphorous (TP)	mg/L	0.02	0.02	0.02	0.02	0.09	0.04	0.02	0.02	0.07	0.07	0.03	0.03	0.02	0.01	0.02	0.03	0.07	0.08

Note - Elevated turbidity for 5 April 2015 sampling event attributable to flood waters at time of sampling.

**Table 10 SW6 – Wilson River south bank (Chainage 16460 to 16600) cont.**

No.	Parameter	Unit	11/05/15 (D)		18/05/15 (W)		10/06/15 (D)		9/07/15 (D)		SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	
			SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)	SW6a (US)	SW6b (DS)											
1	Temperature	°C	18.5	18.0	18.0	16.2	16.6	15.4	14.5	15.4											
2	Electrical conductivity (EC)	uS/cm	194	197	242	260	310	437	828	1829											
3	Dissolved oxygen (DO)	%	52	65	86	78	103	80	98	95											
4	pH		6.6	6.3	6.8	6.7	6.8	6.6	7.2	6.9											
5	Turbidity (NTU)	NTU	23	38	16	18	18	15	11	15											
6	Total suspended solids (TSS)	mg/L	<5	18	<5	<5	7	<5	<5	9											
7	Total Petroleum Hydrocarbons	mg/L																			
8	Aluminium (Al)	mg/L	0.23	0.26			0.06	0.16	0.07	0.06											
9	Arsenic (As)	mg/L	0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001											
11	Chromium (Cr)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
12	Copper (Cu)	mg/L	0.002	0.002			<0.001	<0.001	<0.001	<0.001											
13	Iron (Fe)	mg/L	0.61	0.61			0.34	0.91	0.45	0.62											
14	Lead (Pb)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
15	Manganese (Mn)	mg/L	0.098	0.046			0.03	0.035	0.034	0.045											
16	Mercury (Hg)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001											
17	Nickel (Ni)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
18	Silver (Ag)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
19	Zinc (Zn)	mg/L	0.008	0.011			0.012	<0.005	0.006	<0.005											
20	Total Nitrogen (TN)	mg/L	0.8	0.6	0.5	0.5	0.4	0.6	0.3	0.5											
21	Total Phosphorous (TP)	mg/L	0.04	0.03	0.03	0.02	0.03	0.02	0.01	0.02											

**Table 11 SW6 – Wilson River north bank (Chainage 16830 to 16840)**

No.	Parameter	Unit	2/02/15 (W)		9/02/15 (D)		14/02/15 (W)		11/03/15 (D)		23/03/15 (W)		01/04/15 (W)		05/04/15 (W)		09/04/15 (D)		04/05/15 (W)	
			SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)
1	Temperature	°C	24.2	23.6	25.2	25.4	28.0	28.0	27.0	26.9	24.2	23.4	24.2	24.2	21.5	21.5	21.4	21.7	19.1	19.1
2	Electrical conductivity (EC)	uS/cm	220	241	337	356	409	385	260	267	99	113	258	258	145	148	148	176	82	99
3	Dissolved oxygen (DO)	%	92	87	92	95	82	98	89	88	86	82	78	78	96	96	94	89	90	89
4	pH		6.8	6.7	6.6	6.6	6.6	6.8	6.7	6.8	6.2	6.2	6.3	6.3	6.6	6.6	6.8	6.7	6.3	6.2
5	Turbidity (NTU)	NTU	17	20	18	20	478	160	18	24	59	63	13	15	19	18	20	21	82	97
6	Total suspended solids (TSS)	mg/L	<5	<5	<5	6	261	125	12	15	24	28	12	7	<5	<5	6	<5	26	44
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	0.16	0.18	0.08	0.07			0.07	0.07	0.66	0.67	0.23	0.32			0.26	1.26	0.75	0.73
9	Arsenic (As)	mg/L	<0.001	0.001	0.002	0.002			0.001	0.001	<0.001	<0.001	0.002	0.001			0.001	0.002	0.001	0.001
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
12	Copper (Cu)	mg/L	<0.001	<0.001	0.001	<0.001			<0.001	<0.001	0.001	0.001	<0.001	<0.001			0.001	<0.001	0.001	<0.001
13	Iron (Fe)	mg/L	0.19	0.27	0.42	0.46			0.44	0.43	0.43	0.45	0.57	0.62			0.35	0.98	0.43	0.41
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
15	Manganese (Mn)	mg/L	0.045	0.055	0.085	0.091			0.017	0.015	0.018	0.019	0.071	0.07			0.025	0.027	0.02	0.019
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
17	Nickel (Ni)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
19	Zinc (Zn)	mg/L	0.011	0.01	0.017	<0.005			<0.005	<0.005	<0.005	<0.005	<0.005	<0.005			0.008	0.008	<0.005	<0.005
20	Total Nitrogen (TN)	mg/L	0.5	0.6	0.5	0.7	1.1	0.7	0.2	0.2	0.8	0.8	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6
21	Total Phosphorous (TP)	mg/L	0.02	0.03	0.02	0.02	0.18	0.1	0.03	0.02	0.06	0.06	0.02	0.02	0.02	0.02	0.05	0.03	0.05	0.06

Note - Elevated turbidity for 14 February 2015 sampling event attributable to a jetski and associated wave action close to shore at time of sampling.

**Table 12 SW6 – Wilson River north bank (Chainage 16830 to 16840) cont.**

No.	Parameter	Unit	11/05/15 (D)		18/05/15 (W)		10/06/15 (D)		9/07/15 (D)		SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	
			SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)	SW6c (US)	SW6d (DS)											
1	Temperature	°C	16.9	16.5	16.5	16.4	14.6	14.7	13.4	13.4											
2	Electrical conductivity (EC)	uS/cm	148	146	175	179	273	280	1158	1158											
3	Dissolved oxygen (DO)	%	90	90	95	94	93	90	93	95											
4	pH		6.7	6.8	6.9	6.9	6.7	6.9	7.0	7.0											
5	Turbidity (NTU)	NTU	24	19	14	16	12	11	10	15											
6	Total suspended solids (TSS)	mg/L	<5	<5	<5	<5	<5	<5	<5	<5											
7	Total Petroleum Hydrocarbons	mg/L																			
8	Aluminium (Al)	mg/L	0.12	0.19			0.07	0.09	0.07	0.06											
9	Arsenic (As)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001											
11	Chromium (Cr)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
12	Copper (Cu)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
13	Iron (Fe)	mg/L	0.2	0.21			0.44	0.44	0.51	0.38											
14	Lead (Pb)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
15	Manganese (Mn)	mg/L	0.029	0.024			0.023	0.025	0.028	0.031											
16	Mercury (Hg)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001											
17	Nickel (Ni)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
18	Silver (Ag)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
19	Zinc (Zn)	mg/L	<0.005	<0.005			0.005	<0.005	0.01	0.012											
20	Total Nitrogen (TN)	mg/L	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3											
21	Total Phosphorous (TP)	mg/L	0.02	0.01	0.02	0.02	0.02	0.02	0.03	0.01											

**Table 13 SW7 – Cooperabung Creek (Chainage 19660)**

No.	Parameter	Unit	2/02/15 (W)		9/02/15 (D)		14/02/15 (W)		11/03/15 (D)		23/03/15 (W)		01/04/15 (W)		05/04/15 (W)		09/04/15 (D)		04/05/15 (W)	
			SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b*	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)
1	Temperature	°C	21.7	21.9	21.4	21.8	22.4	23.2	22.7	23.6	21.1	21.7	20.6	20.9	20.3	20.3	18.8	19.0	19.1	19.2
2	Electrical conductivity (EC)	uS/cm	141	143	168	170	180	180	183	182	96	101	128	134	116	112	140	143	96	99
3	Dissolved oxygen (DO)	%	87	90	74	70	63	60	60	54	95	91	93	89	97	95	97	93	95	93
4	pH		6.3	6.7	6.2	6.3	6.5	6.6	6.5	6.4	6.3	6.2	6.5	6.5	6.4	6.4	6.8	6.5	6.3	6.3
5	Turbidity (NTU)	NTU	22	21	14	15	15	15	13	16	51	63	42	47	49	48	25	27	45	54
6	Total suspended solids (TSS)	mg/L	<5	<5	<5	<5	<5	<5	8	10	16	17	7	9	<5	<5	<5	<5	<5	5
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	0.22	0.25	0.07	0.05			0.05	0.05	1	1.09	1.29	1.27			0.48	0.3	1.8	1.29
9	Arsenic (As)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	0.002			<0.001	<0.001	<0.001	<0.001
12	Copper (Cu)	mg/L	<0.001	<0.001	<0.001	0.001			<0.001	<0.001	0.001	<0.001	0.001	<0.001			<0.001	0.001	0.001	0.001
13	Iron (Fe)	mg/L	0.31	0.33	0.42	0.4			0.62	0.6	0.51	0.59	0.86	0.84			0.48	0.4	0.89	0.68
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
15	Manganese (Mn)	mg/L	0.017	0.019	0.04	0.049			0.063	0.08	0.011	0.022	0.016	0.021			0.02	0.025	0.011	0.015
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
17	Nickel (Ni)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
19	Zinc (Zn)	mg/L	0.008	0.031	<0.005	<0.005			<0.005	<0.005	<0.005	0.009	<0.005	<0.005			<0.005	0.005	<0.005	0.005
20	Total Nitrogen (TN)	mg/L	0.4	0.4	0.3	0.3	0.1	0.1	0.1	0.1	0.5	0.7	0.5	0.7	0.5	0.5	0.4	0.4	0.4	0.6
21	Total Phosphorous (TP)	mg/L	0.02	0.02	0.02	0.01	0.01	<0.01	<0.01	0.01	0.05	0.06	0.04	0.04	0.02	0.02	0.02	0.02	0.03	0.04

**Table 14 SW7 – Cooperabung Creek (Chainage 19660) cont.**

No.	Parameter	Unit	11/05/15 (D)		18/05/15 (W)		10/06/15 (D)		9/07/15 (D)		SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	
			SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)	SW7a (US)	SW7b (DS)											
1	Temperature	°C	15.0	15.9	16.6	16.8	12.6	13.0	10.8	11.0											
2	Electrical conductivity (EC)	uS/cm	140	244	149	159	180	183	189	191											
3	Dissolved oxygen (DO)	%	95	93	95	92	85	82	86	80											
4	pH		7.1	6.9	7.0	7.0	7.6	7.3	7.3	7.3											
5	Turbidity (NTU)	NTU	26	25	18	32	13	12	9	13											
6	Total suspended solids (TSS)	mg/L	<5	<5	<5	<5	<5	<5	<5	<5											
7	Total Petroleum Hydrocarbons	mg/L																			
8	Aluminium (Al)	mg/L	0.21	0.13			0.08	0.1	0.07	0.02											
9	Arsenic (As)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001											
11	Chromium (Cr)	mg/L	<0.001	<0.001			<0.001	0.002	<0.001	<0.001											
12	Copper (Cu)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
13	Iron (Fe)	mg/L	0.32	0.24			0.36	0.39	0.39	0.25											
14	Lead (Pb)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
15	Manganese (Mn)	mg/L	0.021	0.075			0.034	0.053	0.032	0.054											
16	Mercury (Hg)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001											
17	Nickel (Ni)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
18	Silver (Ag)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
19	Zinc (Zn)	mg/L	<0.005	0.006			<0.005	0.006	<0.005	<0.005											
20	Total Nitrogen (TN)	mg/L	0.2	0.4	0.2	0.2	0.1	0.3	0.1	<0.1											
21	Total Phosphorous (TP)	mg/L	0.02	0.02	0.02	0.02	0.01	0.01	<0.01	0.02											

**Table 15 SW8 – Barrys Creek (Chainage 23775 to 25325)**

No.	Parameter	Unit	2/02/15 (W)			9/02/15 (D)			14/02/15 (W)			11/03/15 (D)			23/03/15 (W)			01/04/15 (W)			5/04/15 (W)		
			SW8a (US)	SW8b (DS)	SW8c (DS)	SW8a (US)	SW8b (DS)	SW8c# (DS)	SW8a# (US)	SW8b# (DS)	SW8c# (DS)	SW8a# (US)	SW8b# (DS)	SW8c# (DS)	SW8a (US)	SW8b (DS)	SW8c (DS)	SW8a (US)	SW8b (DS)	SW8c (DS)	SW8a (US)	SW8b (DS)	SW8c (DS)
1	Temperature	°C	20.6	20.5	21.2	20.2	20.3	22.0	21.0	20.9	21.2	DNS	21.6	22.0	20.7	20.8	20.6	20.3	21.1	20.1	19.8	20.0	20.0
2	Electrical conductivity (EC)	uS/cm	104	101	103	146	135	133	189	143	135		148	147	87	90	84	149	140	126	104	110	103
3	Dissolved oxygen (DO)	%	97	95	94	16	24	54	12	12	48		13	46	103	94	91	48	32	62	98	87	90
4	pH		5.7	5.9	5.9	5.6	5.5	6.1	6.2	6.0	6.5		6.1	6.1	6.1	5.9	5.9	5.5	5.6	5.8	6.2	5.9	6.0
5	Turbidity (NTU)	NTU	25	24	24	15	14	18	18	17	20		17	20	31	32	40	25	24	77	31	29	35
6	Total suspended solids (TSS)	mg/L	<5	<5	<5	<5	<5	<5	<5	<5	<5		<5	<5	15	14	16	6	6	11	<5	<5	<5
7	Total Petroleum Hydrocarbons	mg/L																					
8	Aluminium (Al)	mg/L	0.57	0.43	0.54	0.12	0.18	0.12					0.06	0.08	1.02	0.8	0.85	1.53	1.84	0.4			
9	Arsenic (As)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001					<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
12	Copper (Cu)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001			
13	Iron (Fe)	mg/L	0.23	0.17	0.2	0.08	0.08	0.09					0.09	0.15	0.38	0.3	0.34	0.52	1.09	0.23			
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.006	<0.001			
15	Manganese (Mn)	mg/L	0.006	0.005	0.008	0.081	0.029	0.026					0.031	0.077	0.005	0.006	0.014	0.009	0.135	0.04			
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001					<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			
17	Nickel (Ni)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
19	Zinc (Zn)	mg/L	<0.005	0.016	<0.005	0.006	0.01	<0.005					0.006	<0.005	0.01	0.01	0.051	<0.005	0.008	<0.005			
20	Total Nitrogen (TN)	mg/L	0.4	0.4	0.4	0.2	0.2	0.2	0.2	<0.1	<0.1		<0.1	0.1	0.5	0.5	0.6	0.2	0.2	0.3	0.4	0.5	0.4
21	Total Phosphorous (TP)	mg/L	0.01	<0.01	0.01	0.01	0.02	0.03	0.02	0.01	<0.01		<0.01	<0.01	0.02	0.02	0.09	0.01	0.02	0.01	<0.01	0.02	<0.01

# - Sample location persisting as an isolated pond.

DNS (Did not sample) – Sample not taken due to absence of sufficient water to collect sample.



**Table 16 SW8 – Barrys Creek (Chainage 23775 to 25325) cont.**

No.	Parameter	Unit	9/04/15 (D)			4/05/15 (W)			11/05/15 (D)			18/05/15 (W)			11/06/15 (D)			9/07/15 (D)			SW8a (US)	SW8b (DS)	SW8c (DS)
			SW8a (US)	SW8b (DS)	SW8c (DS)	SW8a (US)	SW8b (DS)	SW8c (DS)	SW8a (US)	SW8b (DS)	SW8c <sup>#</sup> (DS)	SW8a <sup>#</sup> (US)	SW8b <sup>#</sup> (DS)	SW8c <sup>#</sup> (DS)	SW8a (US)	SW8b <sup>#</sup> (DS)	SW8c (DS)	SW8a (US)	SW8b <sup>#</sup> (DS)	SW8c (DS)			
1	Temperature	°C	20.3	20.9	19.0	18.7	19.0	18.9	17.2	20.2	16.0	17.0	19.7	17.2	DNS	16.0	15.8	DNS	13.5	13.6			
2	Electrical conductivity (EC)	uS/cm	126	127	119	90	89	90	126	120	140	269	135	136		165	148		206	182			
3	Dissolved oxygen (DO)	%	43	55	80	100	92	97	47	63	73	17	30	59		39	105		48	51			
4	pH		5.9	5.7	6.2	6.2	6.1	6.1	6.0	5.9	6.4	6.1	6.0	6.2		5.9	6.9		6.5	6.5			
5	Turbidity (NTU)	NTU	21	20	25	37	36	42	36	44	25	19	36	36		36	24		12	16			
6	Total suspended solids (TSS)	mg/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	8	<5	6		<5	<5		<5	<5			
7	Total Petroleum Hydrocarbons	mg/L																					
8	Aluminium (Al)	mg/L	0.55	0.32	0.48	1.31	1.72	1.68	0.31	0.25	0.25					0.26	0.14		0.04	0.09			
9	Arsenic (As)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					<0.001	<0.001		<0.001	<0.001			
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001					<0.0001	<0.0001		<0.0001	<0.0001			
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					<0.001	<0.001		<0.001	<0.001			
12	Copper (Cu)	mg/L	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					<0.001	<0.001		<0.001	<0.001			
13	Iron (Fe)	mg/L	0.21	0.17	0.22	0.5	0.64	0.69	0.11	0.1	0.15					0.2	0.14		0.14	0.1			
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					<0.001	<0.001		<0.001	<0.001			
15	Manganese (Mn)	mg/L	0.016	0.044	0.016	0.006	0.008	0.01	0.004	0.013	0.035					0.082	0.064		0.16	0.01			
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001					<0.0001	<0.0001		<0.0001	<0.0001			
17	Nickel (Ni)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					<0.001	<0.001		<0.001	<0.001			
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001					<0.001	<0.001		<0.001	<0.001			
19	Zinc (Zn)	mg/L	0.008	<0.005	0.007	<0.005	0.006	0.006	0.018	0.026	<0.005					0.006	0.034		0.007	0.007			
20	Total Nitrogen (TN)	mg/L	0.2	0.3	0.3	0.4	0.6	0.6	0.2	0.4	0.2	0.2	0.3	0.3		0.2	0.2		0.1	0.1			
21	Total Phosphorous (TP)	mg/L	<0.01	0.01	0.01	0.01	0.02	0.04	<0.01	0.02	<0.01	0.01	<0.01	0.03		0.02	0.02		<0.01	<0.01			

# - Sample location persisting as an isolated pond.

DNS (Did not sample) – Sample not taken due to absence of sufficient water to collect sample.

**Table 17 SW9 – Smiths Creek (Chainage 28300)**

No.	Parameter	Unit	2/02/15 (W)		9/02/15 (D)		14/02/15 (W)		11/03/15 (D)		23/03/15 (W)		01/04/15 (W)		05/04/15 (W)		09/04/15 (D)		04/05/15 (W)	
			SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)
1	Temperature	°C	21.3	21.3	22.1	22.3	21.9	22.1	22.3	22.4	20.3	20.4	19.9	20.0	19.7	19.7	18.0	18.1	18.7	18.8
2	Electrical conductivity (EC)	uS/cm	102	102	169	168	182	181	201	200	88	88	157	156	104	104	143	143	93	93
3	Dissolved oxygen (DO)	%	94	96	77	79	68	70	59	61	95	91	86	90	96	97	93	93	94	96
4	pH		6.1	6.0	6.5	6.6	6.9	7.2	6.6	6.6	6.2	6.3	6.5	6.6	6.3	6.4	6.6	6.7	6.2	6.3
5	Turbidity (NTU)	NTU	28	28	15	15	17	17	14	14	40	40	20	21	41	40	24	24	35	35
6	Total suspended solids (TSS)	mg/L	<5	<5	<5	<5	<5	<5	<5	<5	18	20	<5	6	<5	5	<5	<5	<5	<5
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	0.57	0.63	0.08	0.07			0.06	0.05	1.66	1.29	0.34	0.61			0.32	0.37	1.13	0.83
9	Arsenic (As)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	0.002	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
12	Copper (Cu)	mg/L	<0.001	<0.001	0.001	0.002			<0.001	<0.001	<0.001	<0.001	<0.001	0.001			<0.001	<0.001	<0.001	<0.001
13	Iron (Fe)	mg/L	0.39	0.41	0.37	0.38			0.64	0.64	0.86	0.74	0.4	0.5			0.38	0.4	0.69	0.52
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
15	Manganese (Mn)	mg/L	0.008	0.009	0.024	0.026			0.041	0.042	0.006	0.005	0.012	0.012			0.012	0.012	0.008	0.008
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
17	Nickel (Ni)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
19	Zinc (Zn)	mg/L	<0.005	<0.005	<0.005	<0.005			<0.005	<0.005	0.01	<0.005	0.01	0.006			<0.005	<0.005	<0.005	<0.005
20	Total Nitrogen (TN)	mg/L	0.5	0.6	0.5	0.2	<0.1	0.1	0.1	0.2	0.6	0.6	0.3	0.3	0.6	0.6	0.3	0.3	0.6	0.5
21	Total Phosphorous (TP)	mg/L	0.02	0.02	0.03	0.01	0.01	0.01	0.02	0.02	0.13	0.04	0.01	0.01	0.06	0.01	0.02	0.02	0.02	0.03

**Table 18 SW9 – Smiths Creek (Chainage 28300) cont.**

No.	Parameter	Unit	11/05/15 (D)		18/05/15 (W)		10/06/15 (D)		9/07/15 (D)		SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	
			SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)	SW9a (DS)	SW9b (US)											
1	Temperature	°C	14.6	14.7	15.6	15.7	12.8	12.9	11.0	11.1											
2	Electrical conductivity (EC)	uS/cm	161	160	186	186	215	215	274	273											
3	Dissolved oxygen (DO)	%	91	93	87	87	82	83	74	80											
4	pH		6.8	7.0	6.8	6.9	6.8	6.8	6.8	6.8											
5	Turbidity (NTU)	NTU	21	21	17	17	15	15	11	11											
6	Total suspended solids (TSS)	mg/L	<5	<5	<5	<5	<5	<5	<5	<5											
7	Total Petroleum Hydrocarbons	mg/L																			
8	Aluminium (Al)	mg/L	0.21	0.17			0.08	0.07	0.1	0.04											
9	Arsenic (As)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001											
11	Chromium (Cr)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
12	Copper (Cu)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
13	Iron (Fe)	mg/L	0.29	0.26			0.46	0.44	0.53	0.49											
14	Lead (Pb)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
15	Manganese (Mn)	mg/L	0.011	0.011			0.015	0.014	0.02	0.019											
16	Mercury (Hg)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001											
17	Nickel (Ni)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
18	Silver (Ag)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
19	Zinc (Zn)	mg/L	0.006	<0.005			0.006	0.023	0.019	<0.005											
20	Total Nitrogen (TN)	mg/L	0.2	0.4	0.2	0.2	0.2	0.3	0.2	<0.1											
21	Total Phosphorous (TP)	mg/L	0.02	0.01	0.03	0.03	0.02	0.01	0.09	0.02											

**Table 19 SW10 – Pipers Creek (Chainage 30700)**

No.	Parameter	Unit	2/02/15 (W)		9/02/15 (D)		14/02/15 (W)		11/03/15 (D)		23/03/15 (W)		01/04/15 (W)		05/04/15 (W)		09/04/15 (D)		04/05/15 (W)	
			SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)
1	Temperature	°C	DNS	DNS	22.0	23.3	21.7	21.5	22.5	22.6	20.6	20.6	20.0	19.9	19.8	19.8	18.0	18.2	18.7	18.7
2	Electrical conductivity (EC)	uS/cm			185	186	205	206	232	231	97	97	183	187	147	147	167	166	93	93
3	Dissolved oxygen (DO)	%			60	65	44	45	31	37	83	78	70	67	81	79	84	85	89	90
4	pH				6.4	6.2	6.7	6.7	6.6	6.4	6.2	6.2	6.4	6.4	6.3	6.2	6.6	6.4	6.1	6.0
5	Turbidity (NTU)	NTU			16	16	16	16	23	18	52	53	64	57	43	45	29	29	44	44
6	Total suspended solids (TSS)	mg/L			<5	<5	<5	<5	8	<5	22	22	10	9	<5	6	<5	8	<5	<5
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L			0.1	0.1			0.07	0.05	1.7	1.38	0.46	0.49			0.36	0.24	1.23	1.48
9	Arsenic (As)	mg/L			<0.001	<0.001			<0.001	<0.001	0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
10	Cadmium (Cd)	mg/L			<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
11	Chromium (Cr)	mg/L			<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	0.003	0.001
12	Copper (Cu)	mg/L			0.001	0.001			<0.001	<0.001	0.001	<0.001	<0.001	<0.001			<0.001	0.001	<0.001	0.001
13	Iron (Fe)	mg/L			0.55	0.59			0.86	0.83	1	0.9	0.7	0.72			0.61	0.47	0.78	0.9
14	Lead (Pb)	mg/L			<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
15	Manganese (Mn)	mg/L			0.031	0.035			0.074	0.068	0.008	0.006	0.023	0.023			0.015	0.014	0.009	0.01
16	Mercury (Hg)	mg/L			<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
17	Nickel (Ni)	mg/L			<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	0.001	<0.001			<0.001	<0.001	<0.001	<0.001
18	Silver (Ag)	mg/L			<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
19	Zinc (Zn)	mg/L			0.005	<0.005			<0.005	0.011	<0.005	0.008	0.013	<0.005			<0.005	0.007	<0.005	0.005
20	Total Nitrogen (TN)	mg/L			0.4	0.4	0.3	0.3	0.4	0.3	0.7	0.7	0.5	0.5	0.7	0.7	0.7	0.7	0.7	0.9
21	Total Phosphorous (TP)	mg/L			0.02	0.02	0.02	0.02	0.03	0.02	0.04	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.03	0.03

DNS (Did not sample) – Sample not taken due to site access restrictions in place at the time of sampling.

**Table 20 SW10 – Pipers Creek (Chainage 30700) cont.**

No.	Parameter	Unit	11/05/15 (D)		18/05/15 (W)		10/06/15 (D)		9/07/15 (D)		20/01/15 (W)									
			SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)	SW10a (DS)	SW10b (US)		
1	Temperature	°C	13.9	13.9	14.9	14.9	12.4	12.2	10.9	10.7										
2	Electrical conductivity (EC)	uS/cm	191	191	224	224	277	279	333	330										
3	Dissolved oxygen (DO)	%	89	93	81	83	74	79	62	66										
4	pH		7.1	7.3	6.7	6.9	6.7	6.9	6.6	6.7										
5	Turbidity (NTU)	NTU	25	25	22	21	15	16	17	17										
6	Total suspended solids (TSS)	mg/L	<5	<5	8	5	<5	<5	<5	<5										
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	0.17	0.22			0.18	0.15	0.06	0.07										
9	Arsenic (As)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001										
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001										
11	Chromium (Cr)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001										
12	Copper (Cu)	mg/L	<0.001	<0.001			<0.001	0.001	<0.001	<0.001										
13	Iron (Fe)	mg/L	0.44	0.43			0.96	0.76	0.71	0.64										
14	Lead (Pb)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001										
15	Manganese (Mn)	mg/L	0.017	0.016			0.03	0.028	0.037	0.039										
16	Mercury (Hg)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001										
17	Nickel (Ni)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001										
18	Silver (Ag)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001										
19	Zinc (Zn)	mg/L	<0.005	0.006			0.006	<0.005	<0.005	<0.005										
20	Total Nitrogen (TN)	mg/L	0.3	0.3	0.3	0.3	0.4	0.3	0.2	0.2										
21	Total Phosphorous (TP)	mg/L	0.01	0.01	0.02	0.02	0.04	0.02	0.01	0.02										

**Table 21 SW11 – Unnamed drainage line (Chainage 34650 to 34700)**

No.	Parameter	Unit	2/02/15 (W)		9/02/15 (D)		14/02/15 (W)		11/03/15 (D)		23/03/15 (W)		01/04/15 (W)		05/04/15 (W)		09/04/15 (D)		04/05/15 (W)	
			SW11a (DS)	SW11b (US)	SW11a <sup>#</sup> (DS)	SW11b <sup>#</sup> (US)	SW11a <sup>#</sup> (DS)	SW11b <sup>#</sup> (US)	SW11a <sup>#</sup> (DS)	SW11b <sup>#</sup> (US)	SW11a <sup>#</sup> (DS)	SW11b <sup>#</sup> (US)	SW11a (DS)	SW11b (US)	SW11a (DS)	SW11b (US)	SW11a (DS)	SW11b (US)	SW11a (DS)	SW11b (US)
1	Temperature	°C	23.2	22.4	25.5	30.3	23.4	22.7	23.3	25.0	21.1	21.0	21.0	21.0	20.2	20.1	18.9	19.9	19.0	19.0
2	Electrical conductivity (EC)	uS/cm	88	84	208	194	791	210	427	217	96	96	591	137	109	110	194	237	82	86
3	Dissolved oxygen (DO)	%	99	104	60	49	37	50	27	86	99	95	42	87	93	95	108	98	98	101
4	pH		5.4	5.5	5.7	5.8	6.3	6.3	6.1	6.2	5.7	5.6	6.6	5.9	5.6	5.5	6.7	6.7	5.6	5.6
5	Turbidity (NTU)	NTU	46	40	243	47	124	66	36	17	77	72	53	78	76	75	57	46	63	59
6	Total suspended solids (TSS)	mg/L	<5	<5	96	17	26	<5	7	5	20	20	14	18	<5	<5	12	8	<5	<5
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	1.21	1.37	0.33	0.24			0.03	0.16	1.65	2.84	0.17	0.7			0.56	0.36	1.9	1.79
9	Arsenic (As)	mg/L	<0.001	<0.001	0.002	<0.001			<0.001	0.001	<0.001	<0.001	0.001	<0.001			<0.001	<0.001	<0.001	<0.001
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	0.001	0.002	<0.001	<0.001			<0.001	<0.001	0.001	<0.001
12	Copper (Cu)	mg/L	<0.001	<0.001	0.002	0.002			<0.001	0.003	<0.001	<0.001	<0.001	0.004			<0.001	<0.001	<0.001	<0.001
13	Iron (Fe)	mg/L	0.49	0.53	1.8	1.34			0.14	0.48	0.88	1.24	0.25	0.63			0.37	0.3	0.86	0.77
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	0.001			<0.001	<0.001	<0.001	<0.001
15	Manganese (Mn)	mg/L	0.02	0.011	0.183	0.306			0.231	0.076	0.013	0.01	0.195	0.039			0.039	0.038	0.009	0.009
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
17	Nickel (Ni)	mg/L	<0.001	<0.001	<0.001	0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
19	Zinc (Zn)	mg/L	<0.005	<0.005	0.01	0.005			0.041	0.012	<0.005	<0.005	0.024	0.012			0.011	<0.005	<0.005	<0.005
20	Total Nitrogen (TN)	mg/L	0.7	0.7	1	1.2	0.5	0.4	0.1	0.5	0.8	0.8	0.4	0.7	0.8	0.8	0.5	0.3	0.8	0.7
21	Total Phosphorous (TP)	mg/L	0.02	0.02	0.04	0.07	0.02	0.03	0.02	0.01	0.02	0.02	0.01	0.03	0.01	<0.01	0.01	<0.01	0.06	0.02

# - Sample location persisting as an isolated pond.

**Table 22 SW11 – Unnamed drainage line (Chainage 34650 to 34700) cont.**

No.	Parameter	Unit	11/05/15 (D)		18/05/15 (W)		10/06/15 (D)		9/07/15 (D)		SW11a (DS)	SW11b (US)	SW11a (DS)	SW11b (US)	SW11a (DS)	SW11b (US)	SW11a (DS)	SW11b (US)	SW11a (DS)	SW11b (US)	
			SW11a <sup>#</sup> (DS)	SW11b <sup>#</sup> (US)	SW11a <sup>#</sup> (DS)	SW11b <sup>#</sup> (US)	SW11a <sup>#</sup> (DS)	SW11b <sup>#</sup> (US)	SW11a <sup>#</sup> (DS)	SW11b <sup>#</sup> (US)											
1	Temperature	°C	19.0	15.3	15.9	17.1	14.1	13.5	DNS	10.2											
2	Electrical conductivity (EC)	uS/cm	510	203	472	129	870	386		424											
3	Dissolved oxygen (DO)	%	57	83	64	89	57	101		105											
4	pH		6.9	6.0	6.5	6.1	6.3	6.1		6.6											
5	Turbidity (NTU)	NTU	55	33	35	65	18	21		7											
6	Total suspended solids (TSS)	mg/L	17	7	9	10	<5	<5		<5											
7	Total Petroleum Hydrocarbons	mg/L																			
8	Aluminium (Al)	mg/L	0.18	0.37			0.17	0.22		0.03											
9	Arsenic (As)	mg/L	<0.001	<0.001			<0.001	<0.001		<0.001											
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001		<0.0001											
11	Chromium (Cr)	mg/L	<0.001	<0.001			<0.001	<0.001		<0.001											
12	Copper (Cu)	mg/L	<0.001	<0.001			<0.001	<0.001		<0.001											
13	Iron (Fe)	mg/L	0.15	1.22			0.47	0.68		0.1											
14	Lead (Pb)	mg/L	<0.001	<0.001			<0.001	<0.001		<0.001											
15	Manganese (Mn)	mg/L	0.065	0.202			0.189	0.168		0.097											
16	Mercury (Hg)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001		<0.0001											
17	Nickel (Ni)	mg/L	<0.001	<0.001			0.001	<0.001		<0.001											
18	Silver (Ag)	mg/L	<0.001	<0.001			<0.001	<0.001		<0.001											
19	Zinc (Zn)	mg/L	0.011	0.01			0.028	0.006		0.013											
20	Total Nitrogen (TN)	mg/L	0.3	0.4	0.2	0.4	0.6	0.3		<0.1											
21	Total Phosphorous (TP)	mg/L	<0.01	<0.01	<0.01	0.03	<0.01	<0.01		<0.01											

# - Sample location persisting as an isolated pond.

DNS (Did not sample) – Sample not taken due to absence of sufficient water to collect sample.

**Table 23 SW12 – Maria River (Chainage 36850)**

No.	Parameter	Unit	2/02/15 (W)		9/02/15 (D)		14/02/15 (W)		11/03/15 (D)		23/03/15 (W)		01/04/15 (W)		05/04/15 (W)		09/04/15 (D)		04/05/15 (W)	
			SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)	SW12a <sup>#</sup> (US)	SW12b <sup>#</sup> (DS)	SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)
1	Temperature	°C	22.1	22.2	21.6	22.1	21.4	21.7	22.4	22.7	20.7	20.7	19.8	19.9	19.9	19.9	18.0	17.9	18.7	18.7
2	Electrical conductivity (EC)	uS/cm	113	113	174	172	187	186	216	212	90	91	197	177	97	97	136	136	83	83
3	Dissolved oxygen (DO)	%	63	65	21	26	24	17	16	27	71	70	18	45	75	77	59	62	82	81
4	pH		6.1	5.9	6.4	6.1	6.1	5.9	6.3	6.2	5.6	5.5	5.7	6.0	5.6	5.6	5.9	5.8	5.5	5.4
5	Turbidity (NTU)	NTU	50	52	19	19	17	18	19	14	48	50	21	27	52	53	44	44	42	43
6	Total suspended solids (TSS)	mg/L	<5	<5	6	7	<5	<5	11	10	21	18	12	10	6	<5	5	7	<5	<5
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	1	0.97	0.41	0.37			0.3	0.22	2.39	2.56	0.86	0.52			0.81	0.75	1.44	1.57
9	Arsenic (As)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	0.001	<0.001	<0.001	0.001	0.001			<0.001	<0.001	<0.001	<0.001
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
11	Chromium (Cr)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	0.002	0.002	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
12	Copper (Cu)	mg/L	<0.001	0.002	0.001	0.001			<0.001	<0.001	<0.001	<0.001	<0.001	0.001			<0.001	<0.001	<0.001	<0.001
13	Iron (Fe)	mg/L	0.83	0.81	0.83	0.8			0.62	0.89	1.21	1.31	1.3	0.88			0.8	0.8	0.79	0.88
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
15	Manganese (Mn)	mg/L	0.048	0.046	0.123	0.111			0.176	0.177	0.021	0.017	0.17	0.117			0.032	0.03	0.017	0.015
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
17	Nickel (Ni)	mg/L	0.001	0.001	0.002	0.002			0.002	0.002	<0.001	0.001	0.002	0.001			<0.001	0.001	<0.001	0.001
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
19	Zinc (Zn)	mg/L	0.006	0.006	0.006	0.005			<0.005	0.006	0.005	<0.005	0.008	0.006			0.006	0.005	<0.005	<0.005
20	Total Nitrogen (TN)	mg/L	0.8	0.8	0.9	0.9	0.6	0.5	0.5	0.5	1	1	0.8	0.6	1	1	0.4	0.6	0.7	0.7
21	Total Phosphorous (TP)	mg/L	0.02	0.03	0.05	0.08	0.03	0.03	0.02	0.02	0.06	0.19	0.02	0.03	0.03	0.05	<0.01	0.02	0.02	0.02

# - Sample location persisting as an isolated pond.



**Table 24 SW12 – Maria River (Chainage 36850) cont.**

No.	Parameter	Unit	11/05/15 (D)		18/05/15 (W)		10/06/15 (D)		9/07/15 (D)		20/01/15 (W)								
			SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)	SW12a <sup>#</sup> (US)	SW12b <sup>#</sup> (DS)	SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)	SW12a (US)	SW12b (DS)	
1	Temperature	°C	14.8	14.4	15.2	14.9	12.2	12.8	10.2	11.3									
2	Electrical conductivity (EC)	uS/cm	183	181	222	224	275	275	327	329									
3	Dissolved oxygen (DO)	%	34	34	69	56	16	38	21	25									
4	pH		5.8	5.8	6.2	6.1	6.2	6.0	6.3	6.2									
5	Turbidity (NTU)	NTU	31	29	20	26	18	17	18	19									
6	Total suspended solids (TSS)	mg/L	7	6	8	12	<5	<5	5	<5									
7	Total Petroleum Hydrocarbons	mg/L																	
8	Aluminium (Al)	mg/L	0.6	0.58			0.18	0.22	0.12	0.15									
9	Arsenic (As)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001									
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001									
11	Chromium (Cr)	mg/L	<0.001	<0.001			<0.001	0.001	<0.001	<0.001									
12	Copper (Cu)	mg/L	<0.001	0.001			<0.001	<0.001	<0.001	<0.001									
13	Iron (Fe)	mg/L	1.11	1.12			1.38	1.69	0.82	3.06									
14	Lead (Pb)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001									
15	Manganese (Mn)	mg/L	0.064	0.063			0.133	0.132	0.204	0.214									
16	Mercury (Hg)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001									
17	Nickel (Ni)	mg/L	0.001	0.001			<0.001	0.002	0.001	0.001									
18	Silver (Ag)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001									
19	Zinc (Zn)	mg/L	0.027	0.013			0.008	0.005	0.006	0.007									
20	Total Nitrogen (TN)	mg/L	0.6	0.8	0.5	0.5	0.5	0.5	0.3	0.2									
21	Total Phosphorous (TP)	mg/L	0.02	0.02	0.03	0.03	0.02	0.02	0.01	0.01									

# - Sample location persisting as an isolated pond.

**Table 25 SW13 – Stumpy Creek (Chainage 37700 to 37750)**

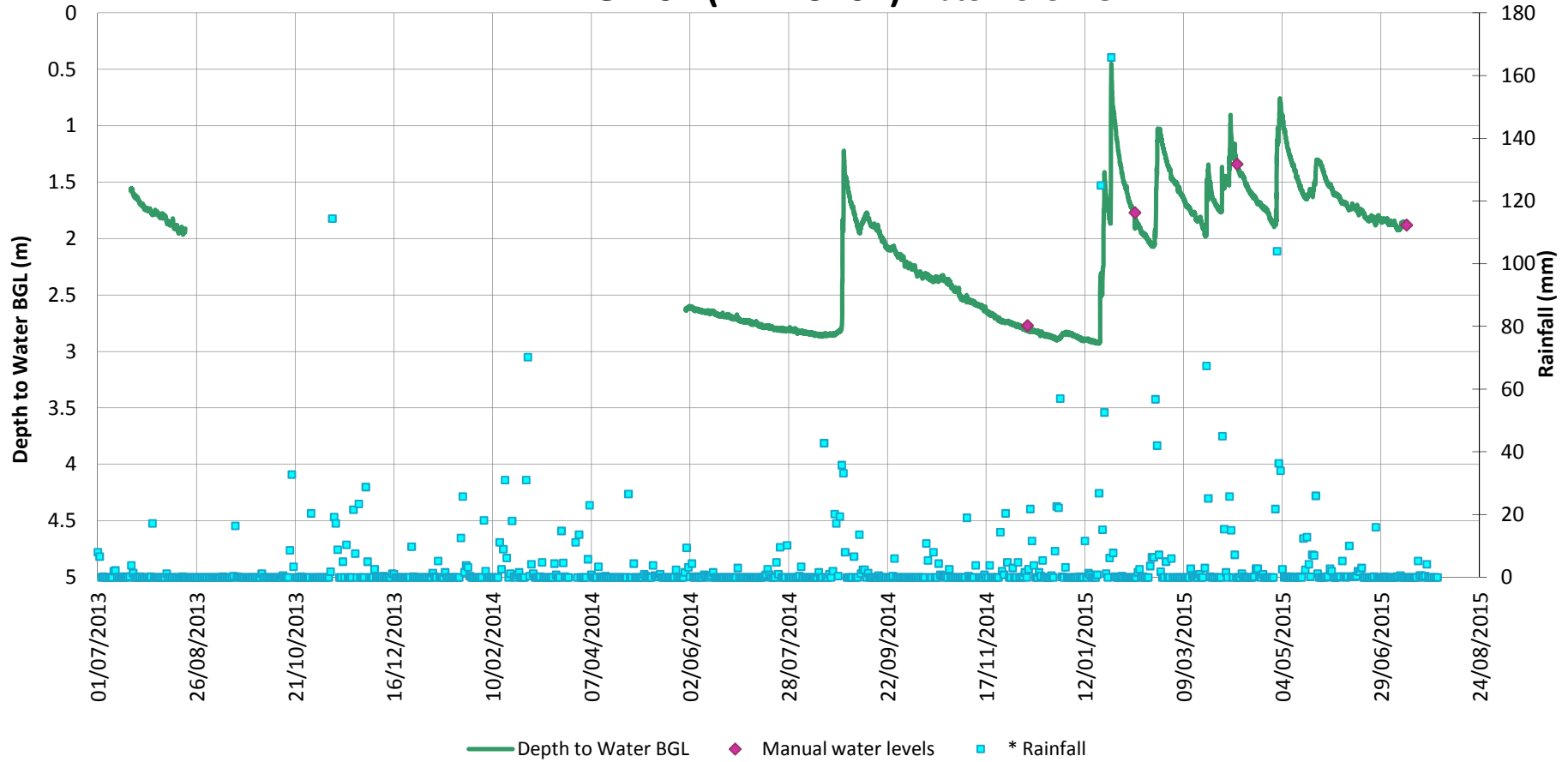
No.	Parameter	Unit	2/02/15 (W)		9/02/15 (D)		14/02/15 (W)		11/03/15 (D)		23/03/15 (W)		01/04/15 (W)		05/04/15 (W)		09/04/15 (D)		04/05/15 (W)	
			SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)
1	Temperature	°C	22.2	22.1	21.5	22.1	20.5	20.9	21.5	21.8	20.8	20.9	20.2	20.4	19.8	20.4	18.0	18.0	18.7	18.7
2	Electrical conductivity (EC)	uS/cm	104	120	131	126	217	242	152	144	71	100	212	254	97	300	94	94	62	76
3	Dissolved oxygen (DO)	%	66	62	54	51	43	33	38	21	66	72	70	73	65	62	75	73	80	77
4	pH		5.4	5.8	5.9	6.1	6.2	6.1	6.1	6.1	5.4	6.0	6.4	6.6	5.4	6.3	5.5	5.7	5.2	5.5
5	Turbidity (NTU)	NTU	28	27	20	19	34	40	22	20	60	86	177	254	59	54	52	52	55	54
6	Total suspended solids (TSS)	mg/L	<5	<5	5	<5	<5	<5	9	13	20	27	24	37	6	13	8	9	<5	<5
7	Total Petroleum Hydrocarbons	mg/L																		
8	Aluminium (Al)	mg/L	1.32	1.32	0.55	0.6			0.4	0.39	3.07	1.27	0.51	0.31			1.19	1.31	2.71	1.79
9	Arsenic (As)	mg/L	<0.001	<0.001	<0.001	<0.001			0.001	0.002	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
11	Chromium (Cr)	mg/L	0.001	0.001	<0.001	<0.001			<0.001	<0.001	0.002	0.001	0.001	<0.001			0.001	0.001	0.002	0.001
12	Copper (Cu)	mg/L	<0.001	<0.001	0.002	0.004			0.001	0.002	<0.001	<0.001	0.001	0.002			0.001	<0.001	<0.001	<0.001
13	Iron (Fe)	mg/L	0.89	0.88	1.02	0.84			1.63	1.31	1.37	0.81	0.66	0.47			0.9	0.91	1.2	0.88
14	Lead (Pb)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	0.001	<0.001
15	Manganese (Mn)	mg/L	0.043	0.046	0.094	0.09			0.169	0.153	0.018	0.019	0.042	0.027			0.022	0.024	0.015	0.023
16	Mercury (Hg)	mg/L	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001
17	Nickel (Ni)	mg/L	<0.001	0.001	0.001	0.001			<0.001	0.001	0.001	<0.001	0.002	<0.001			0.001	<0.001	0.001	<0.001
18	Silver (Ag)	mg/L	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001
19	Zinc (Zn)	mg/L	0.01	0.009	0.024	0.008			<0.005	0.007	<0.005	0.005	0.007	0.007			0.005	<0.005	<0.005	<0.005
20	Total Nitrogen (TN)	mg/L	0.9	0.9	0.9	0.9	0.6	0.7	0.7	0.6	1.2	1.1	0.8	0.9	1.1	1	0.8	0.9	0.9	0.8
21	Total Phosphorous (TP)	mg/L	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.02	0.39	0.08	0.05	0.06	0.08	0.06	0.02	0.02	0.04	0.03

**Table 26 SW13 – Stumpy Creek (Chainage 37700 to 37750) cont.**

No.	Parameter	Unit	11/05/15 (D)		18/05/15 (W)		10/06/15 (D)		9/07/15 (D)		SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	
			SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)	SW13a (DS)	SW13b (US)											
1	Temperature	°C	14.1	14.4	15.7	16.1	13.6	12.3	11.8	11.1											
2	Electrical conductivity (EC)	uS/cm	113	116	241	224	215	214	325	253											
3	Dissolved oxygen (DO)	%	73	66	69	69	66	52	69	47											
4	pH		5.9	5.8	6.4	6.3	5.9	5.9	6.6	6.3											
5	Turbidity (NTU)	NTU	38	38	73	110	22	22	40	37											
6	Total suspended solids (TSS)	mg/L	6	<5	16	21	<5	<5	<5	<5											
7	Total Petroleum Hydrocarbons	mg/L																			
8	Aluminium (Al)	mg/L	1	0.91			0.41	0.34	0.1	0.15											
9	Arsenic (As)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
10	Cadmium (Cd)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001											
11	Chromium (Cr)	mg/L	0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
12	Copper (Cu)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
13	Iron (Fe)	mg/L	1.11	1.03			1.8	1.56	0.81	1.15											
14	Lead (Pb)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
15	Manganese (Mn)	mg/L	0.038	0.043			0.115	0.123	0.139	0.093											
16	Mercury (Hg)	mg/L	<0.0001	<0.0001			<0.0001	<0.0001	<0.0001	<0.0001											
17	Nickel (Ni)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	0.001											
18	Silver (Ag)	mg/L	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001											
19	Zinc (Zn)	mg/L	0.016	0.006			0.005	<0.005	0.007	0.009											
20	Total Nitrogen (TN)	mg/L	0.9	0.9	0.7	0.7	0.6	0.7	0.5	0.5											
21	Total Phosphorous (TP)	mg/L	0.02	0.02	0.03	0.03	0.02	0.05	0.03	0.02											

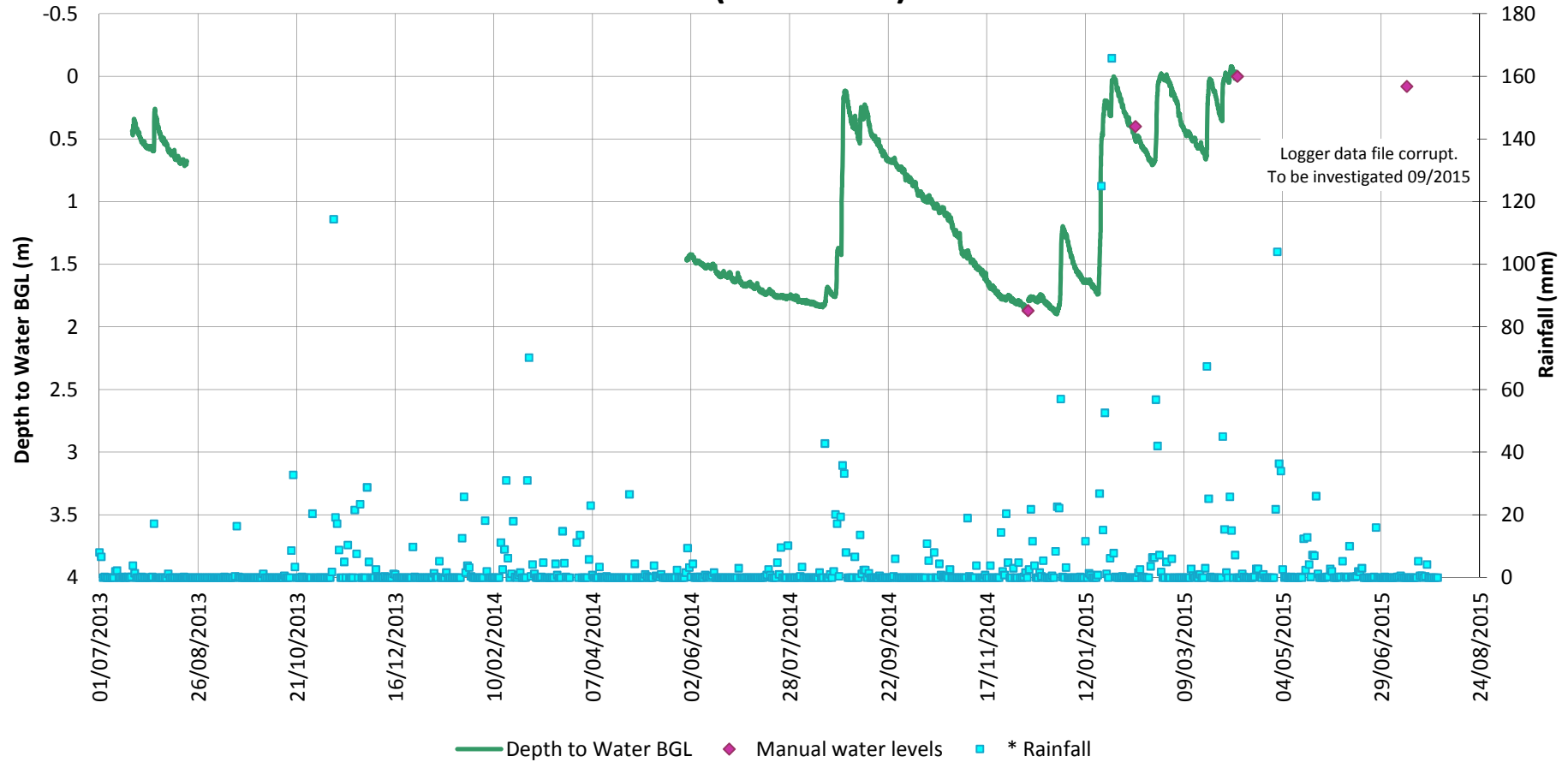
# Appendix D – Borehole water level data plots

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW02 (A-BH3102) Water Level BGL



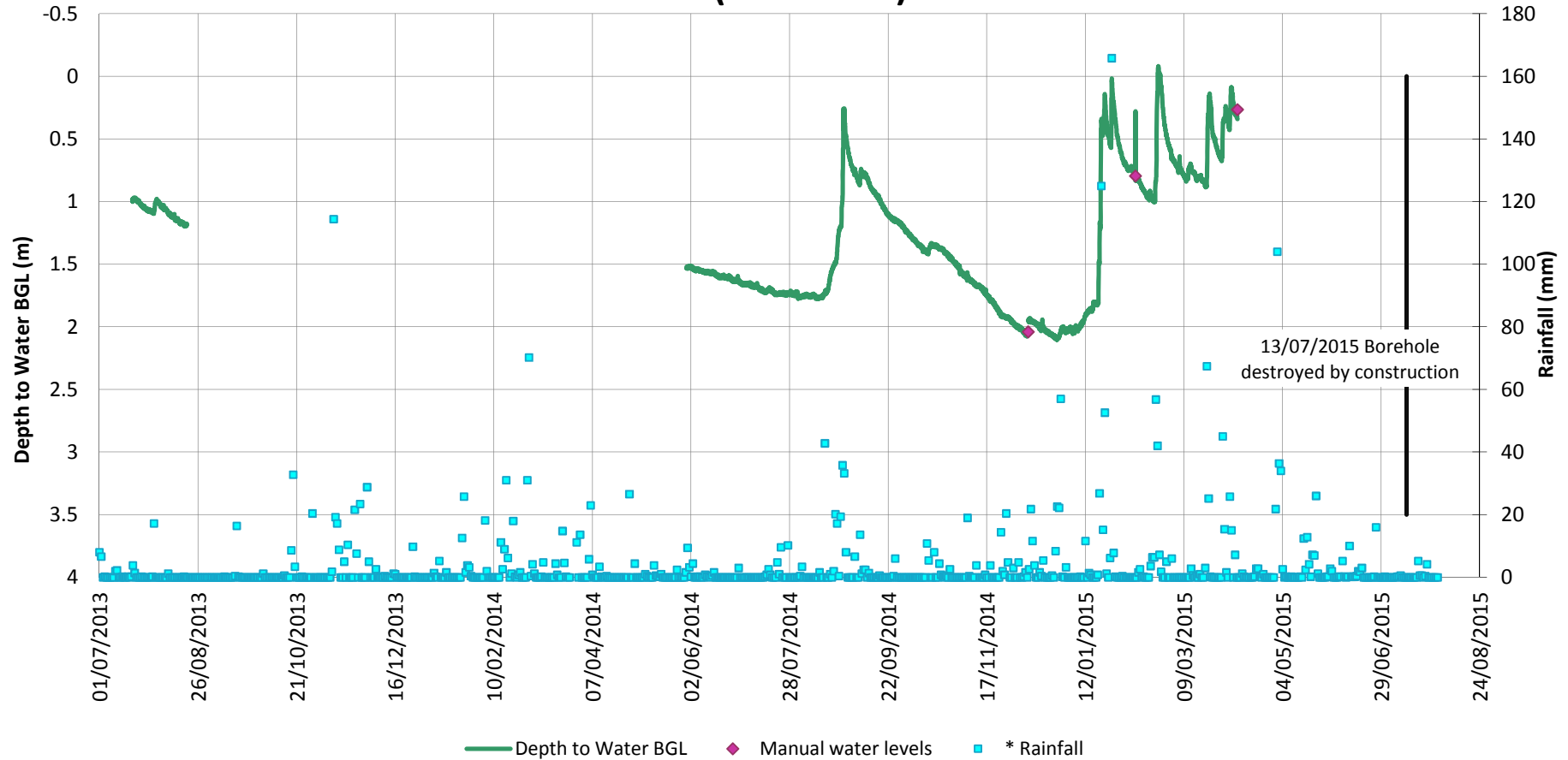
Drawn	KF	 Transport <b>Roads &amp; Maritime                  Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10283850	
Date	14/07/2015		BH ID	A-BH3102	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-1
Groundwater sample taken at time of manual water levels			BGL = below ground level (existing)		
* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)					

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW03 (A-BH3103) Water Level BGL



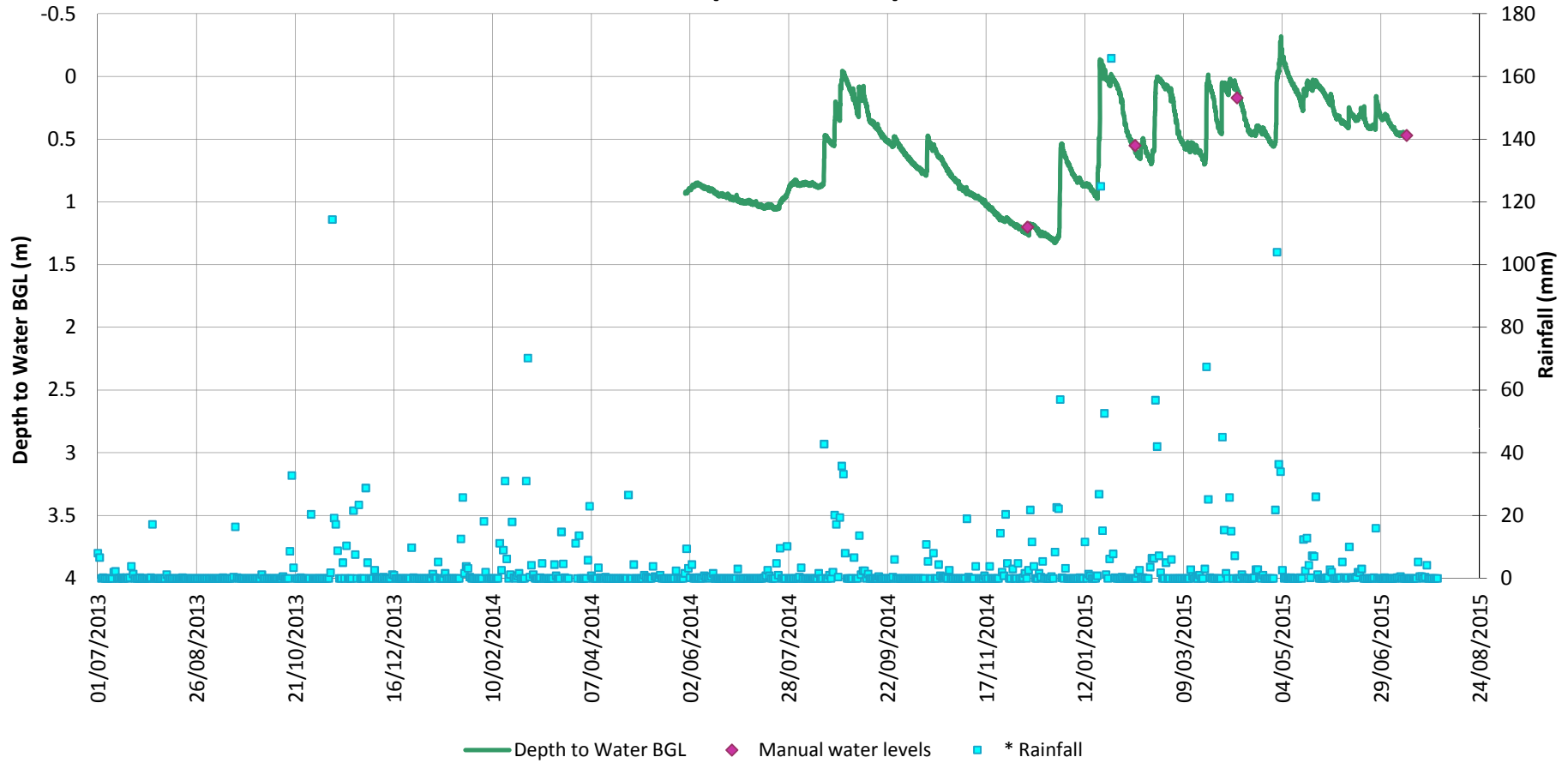
Drawn	KF	 <b>Transport Roads &amp; Maritime Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10229626	
Date	14/07/2015		BH ID	A-BH3103	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-2
Groundwater sample taken at time of manual water levels			BGL = below ground level (existing)		
* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)					

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW04 (A-BH3104) Water Level BGL



Drawn	KF	 <b>Transport Roads &amp; Maritime Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10229629	
Date	14/07/2015		BH ID	A-BH3104	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-3
Groundwater sample taken at time of manual water levels			BGL = below ground level (existing)		
* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)					

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW05 (A-BH3105) Water Level BGL



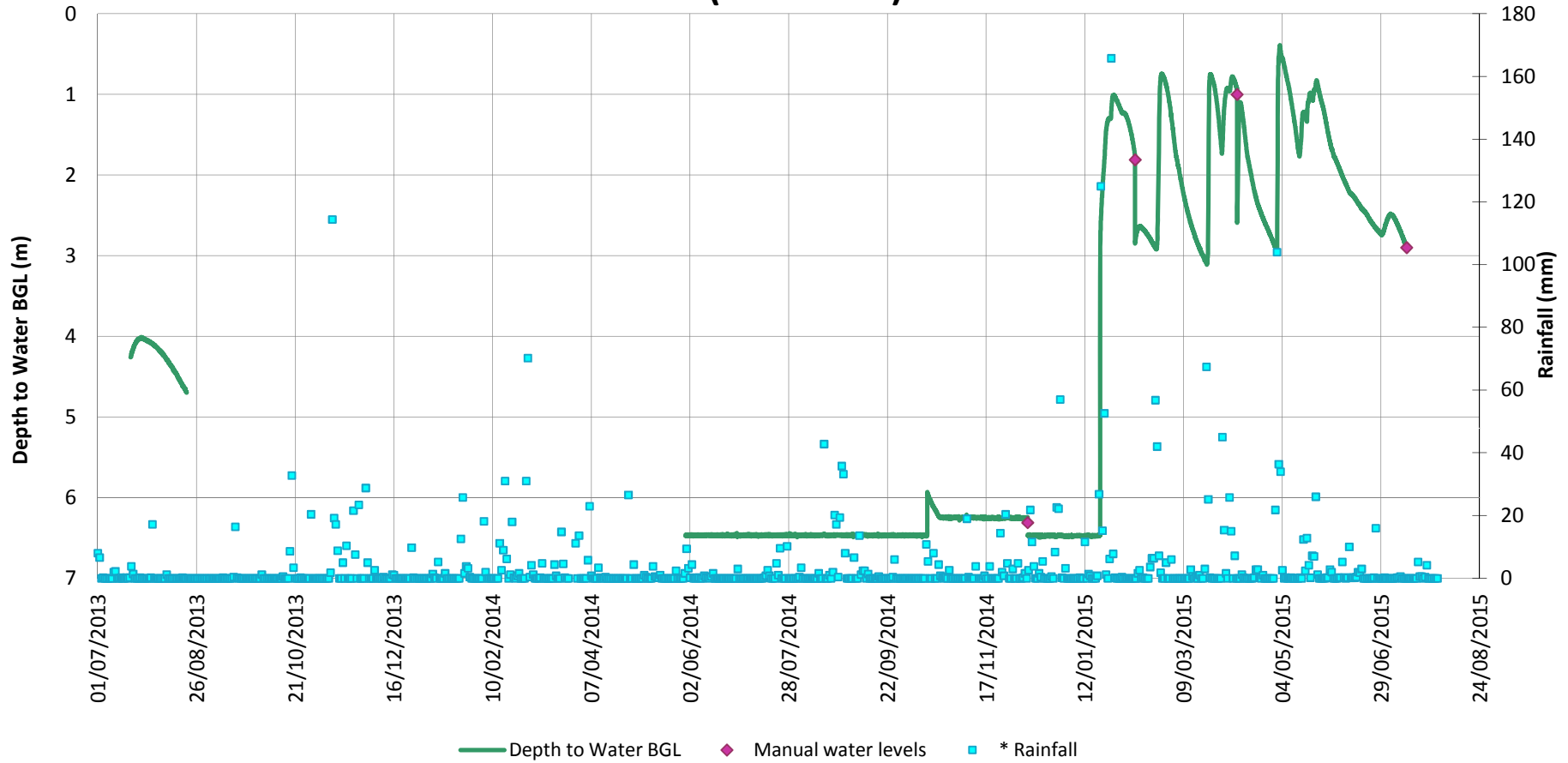
Drawn	KF	 Transport <b>Roads &amp; Maritime                  Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262196	
Date	14/07/2015		BH ID	A-BH3105	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-4

Groundwater sample taken at time of manual water levels     BGL = below ground level (existing)

\* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)



## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW07 (A-BH3107) Water Level BGL

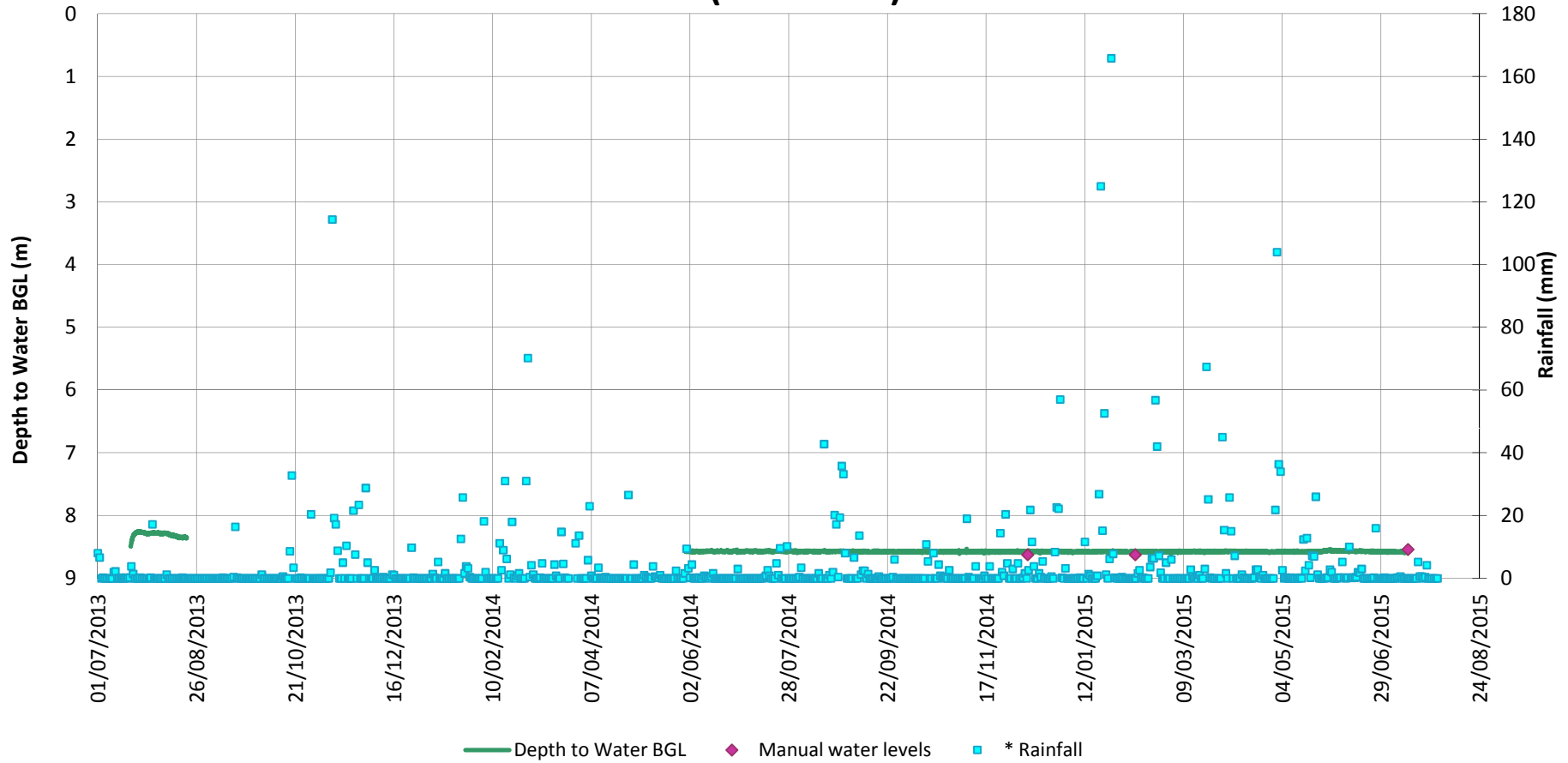



Drawn	KF	 Transport <b>Roads &amp; Maritime                  Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10229627	
Date	14/07/2015		BH ID	A-BH3107	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-5

Groundwater sample taken at time of manual water levels      BGL = below ground level (existing)

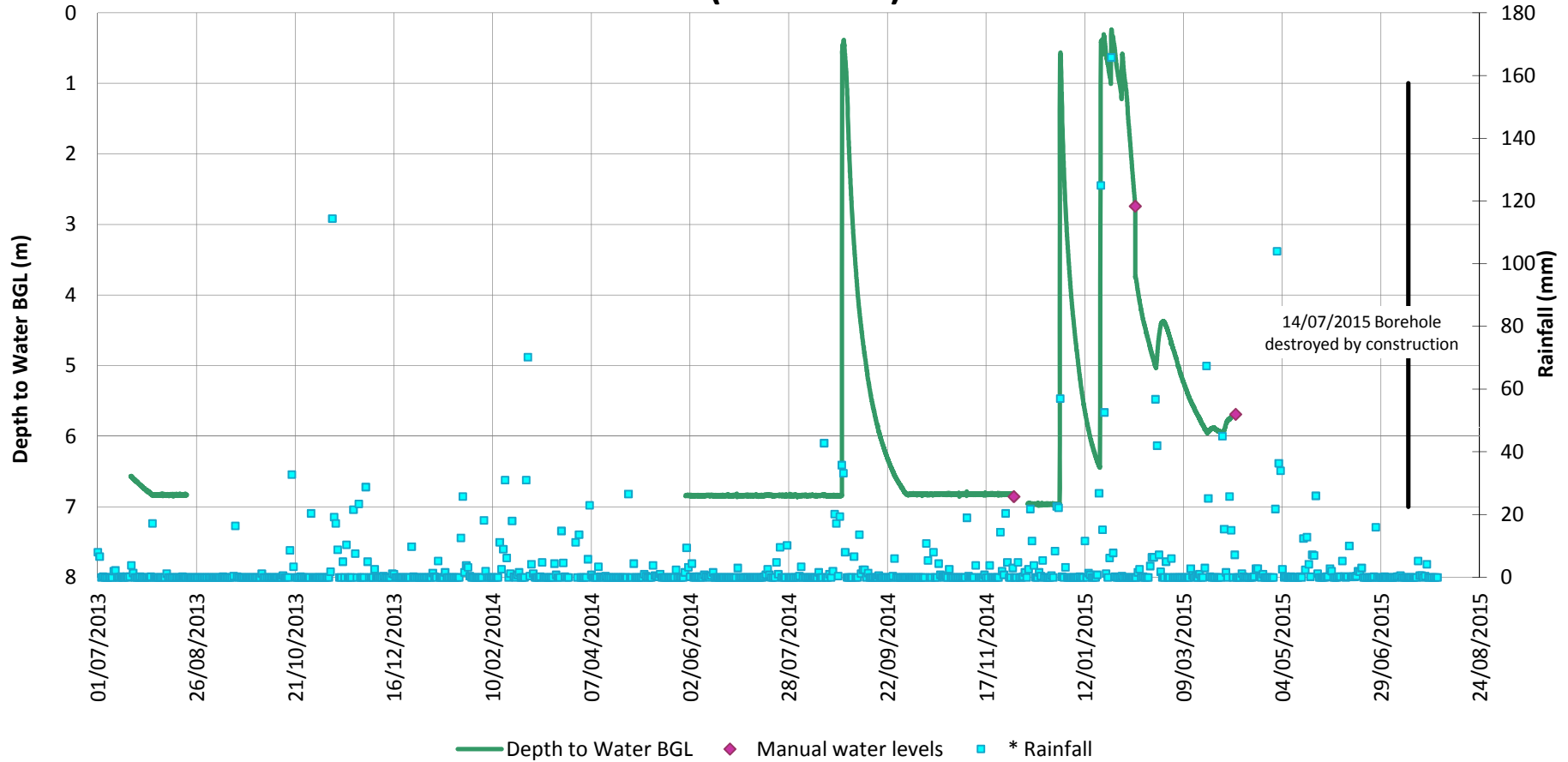
\* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW09 (B-BH3102) Water Level BGL



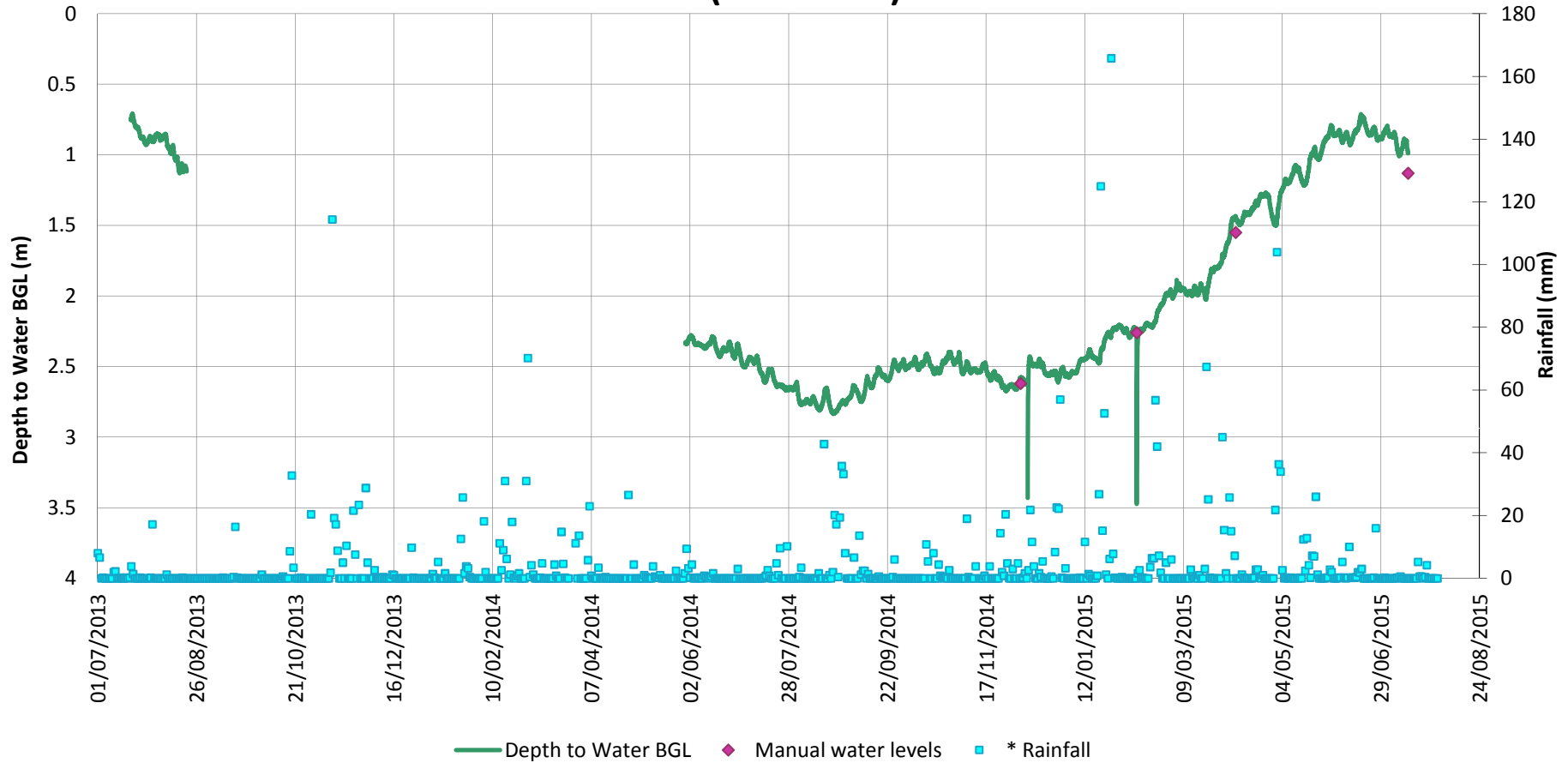
Drawn	KF	 <b>Transport Roads &amp; Maritime Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262198	
Date	14/07/2015		BH ID	B-BH3102	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-6
Groundwater sample taken at time of manual water levels			BGL = below ground level (existing)		
* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)					

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW10 (B-BH3103) Water Level BGL



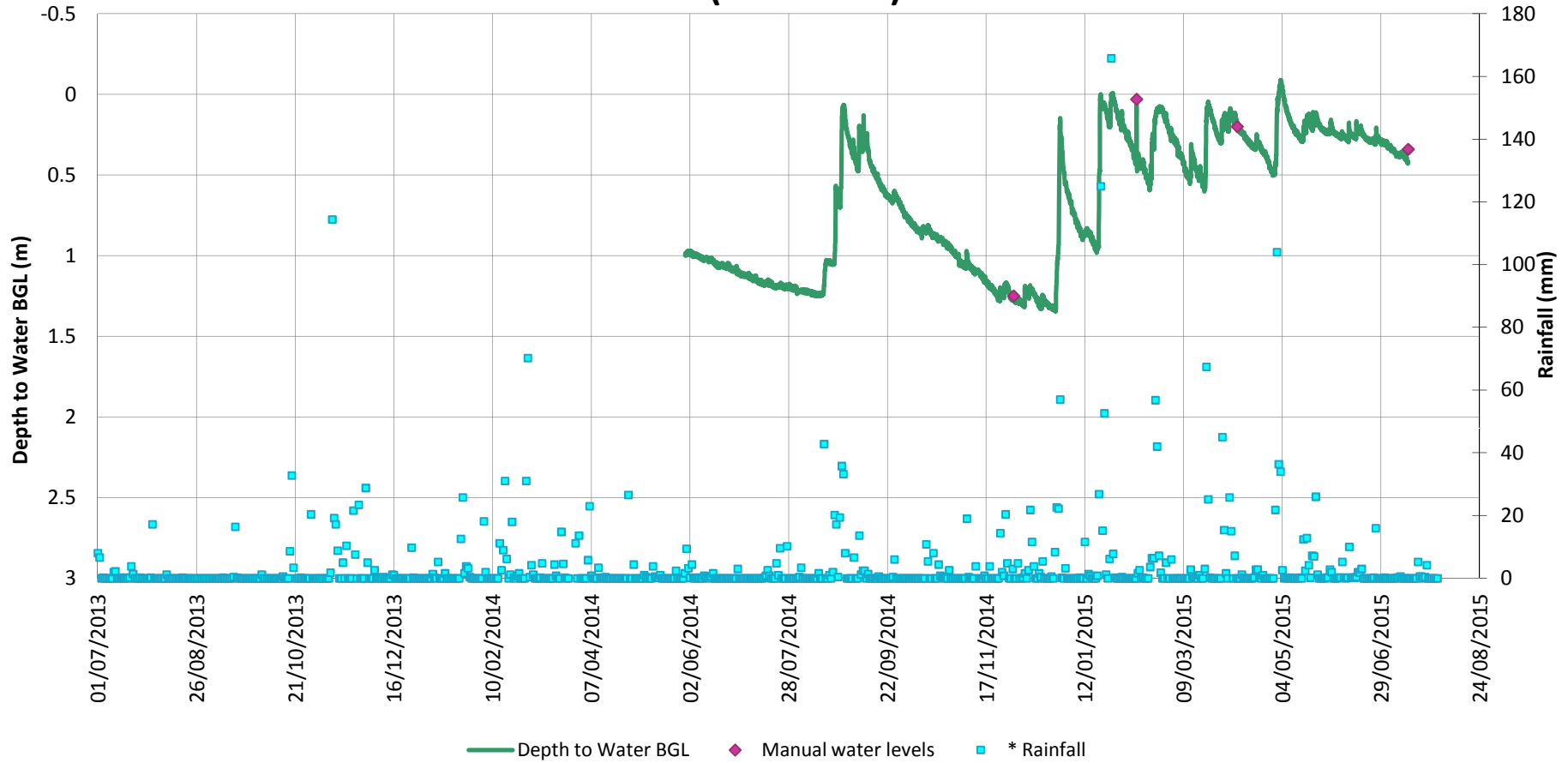
Drawn	KF	 <b>Transport Roads &amp; Maritime Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10238337	
Date	14/07/2015		BH ID	B-BH3103	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-7
Groundwater sample taken at time of manual water levels			BGL = below ground level (existing)		
* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)					

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW11 (B-BH3104) Water Level BGL



Drawn	KF	 Transport <b>Roads &amp; Maritime                  Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10224040	
Date	14/07/2015		BH ID	B-BH3104	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-8
Groundwater sample taken at time of manual water levels			BGL = below ground level (existing)		
* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)					

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW12 (B-BH3105) Water Level BGL

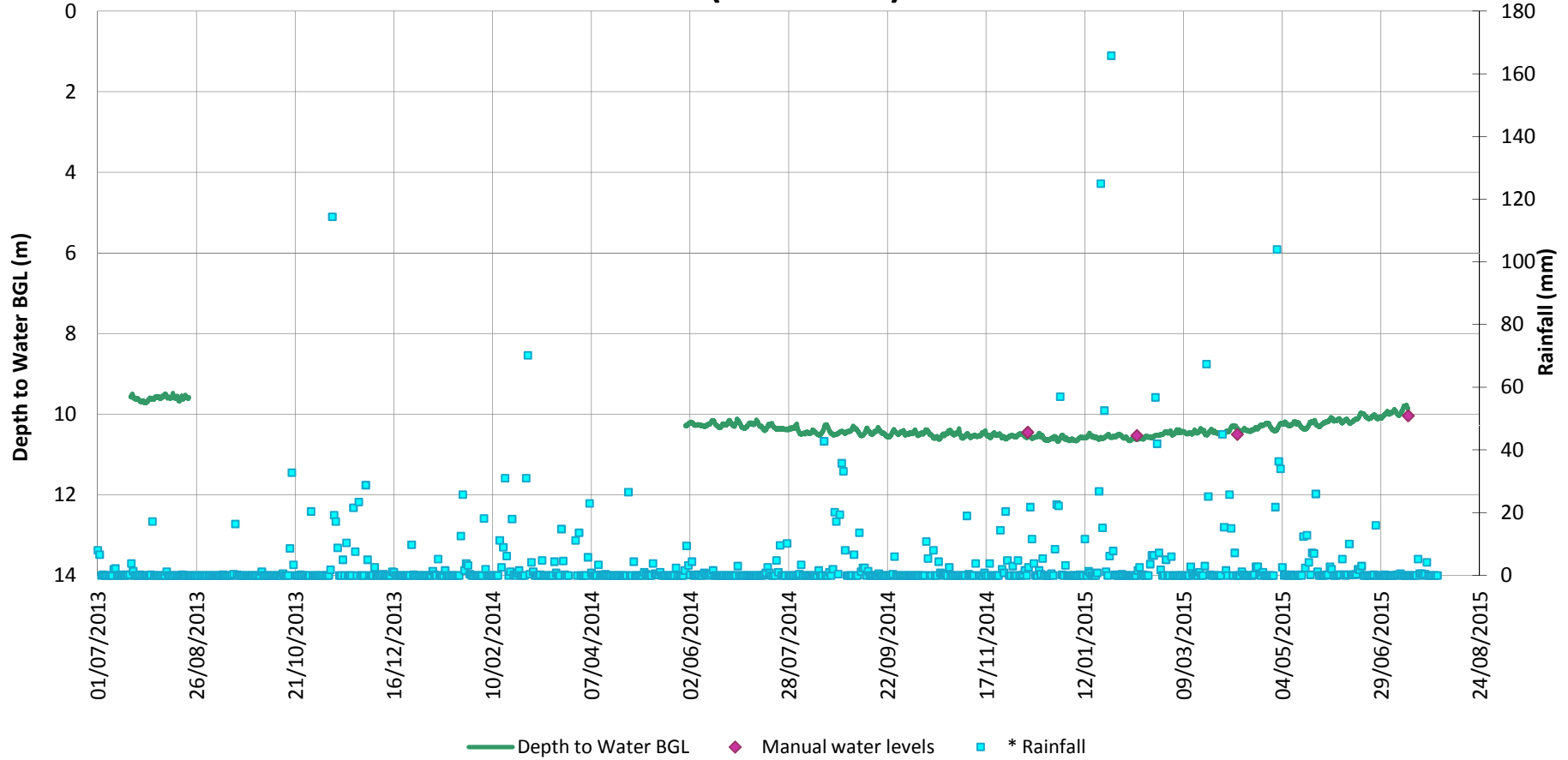


Drawn	KF	 Transport <b>Roads &amp; Maritime                  Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262196	
Date	14/07/2015		BH ID	B-BH3105	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-9

Groundwater sample taken at time of manual water levels                      BGL = below ground level (existing)

\* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW15 (B-BH3108) Water Level BGL

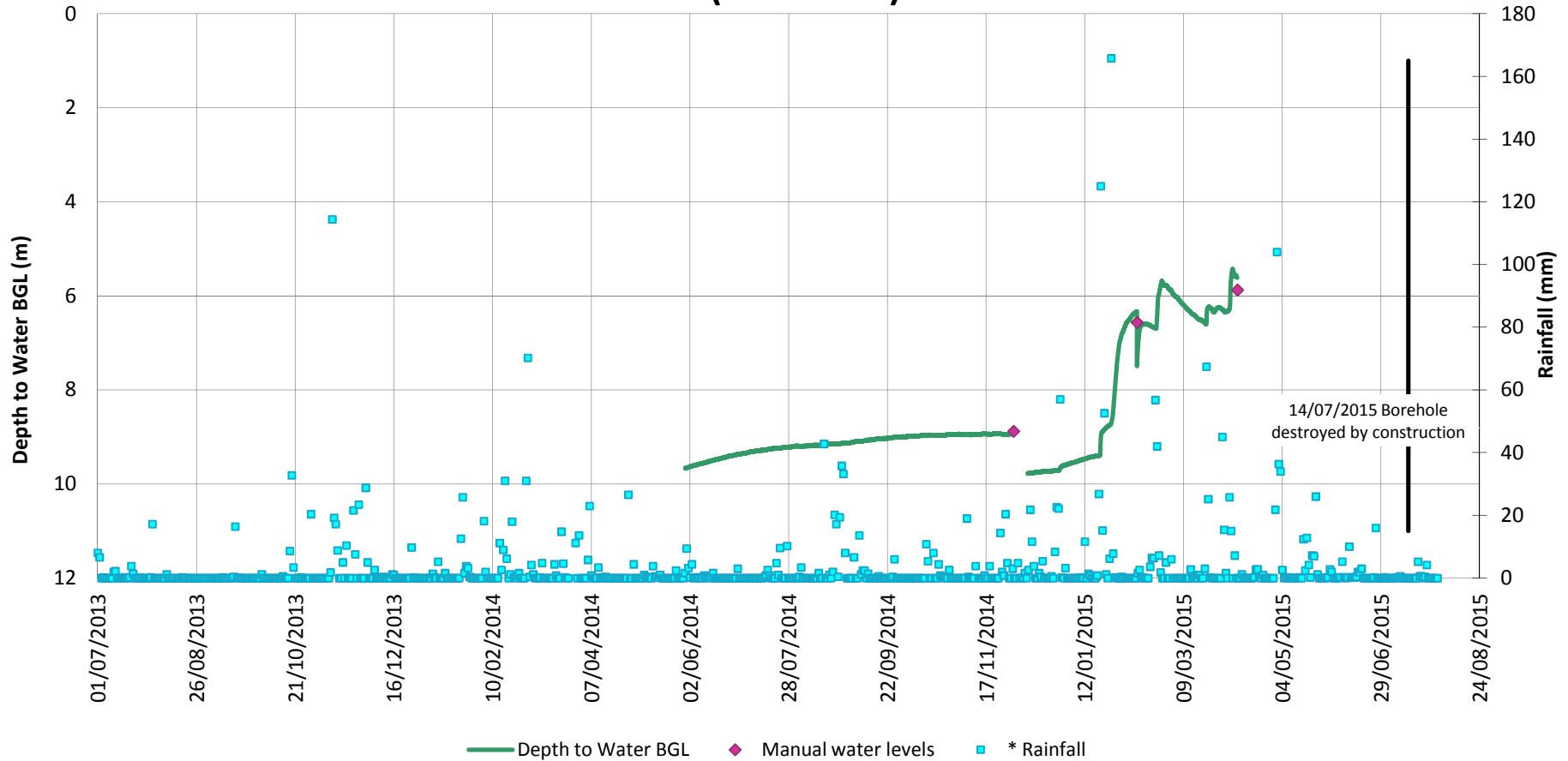


Drawn	KF	 Transport <b>Roads &amp; Maritime                  Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10238352	
Date	14/07/2015		BH ID	B-BH3108	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: <b>B-10</b>

Groundwater sample taken at time of manual water levels     BGL = below ground level (existing)

\* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW19 (C-BH3103) Water Level BGL

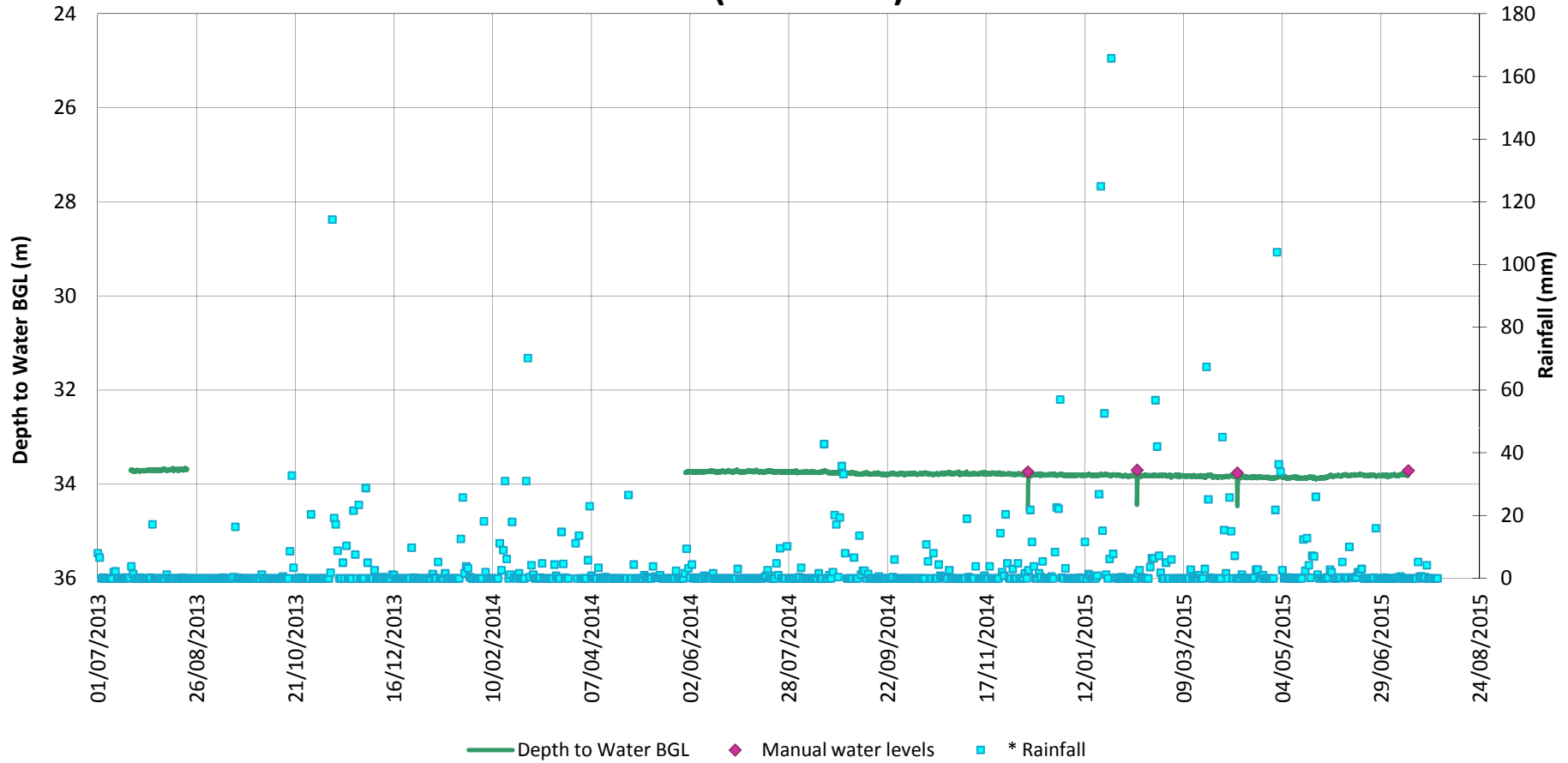


Drawn	KF	 <b>Transport Roads &amp; Maritime Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N10262199	
Date	14/07/2015		BH ID	C-BH3103	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-11

Groundwater sample taken at time of manual water levels      BGL = below ground level (existing)

\* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW18 (C-BH3102) Water Level BGL



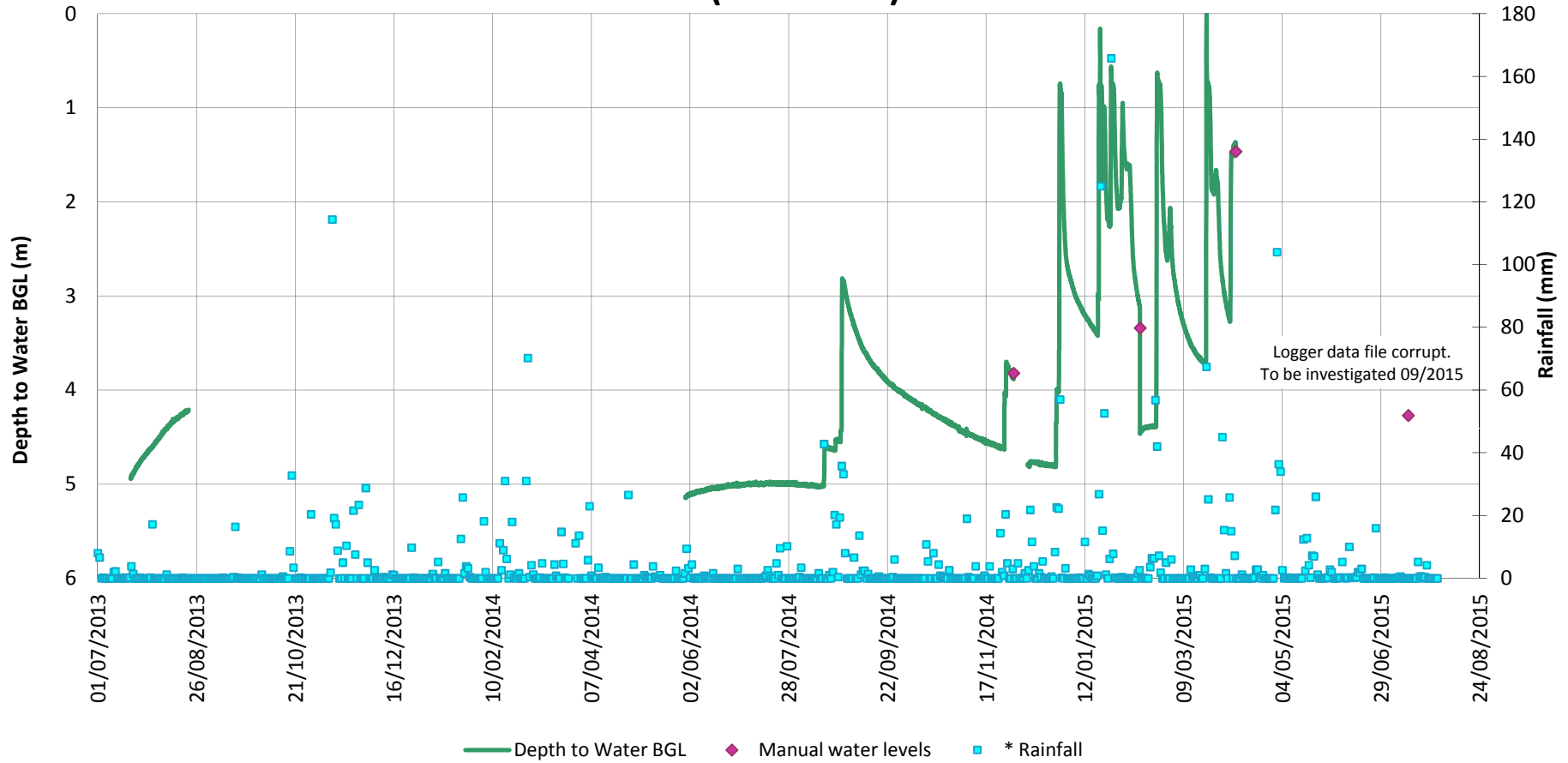
Drawn	KF	 <b>Transport Roads &amp; Maritime Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N10262195	
Date	14/07/2015		BH ID	C-BH3102	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: <b>B-12</b>

Groundwater sample taken at time of manual water levels      BGL = below ground level (existing)

\* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

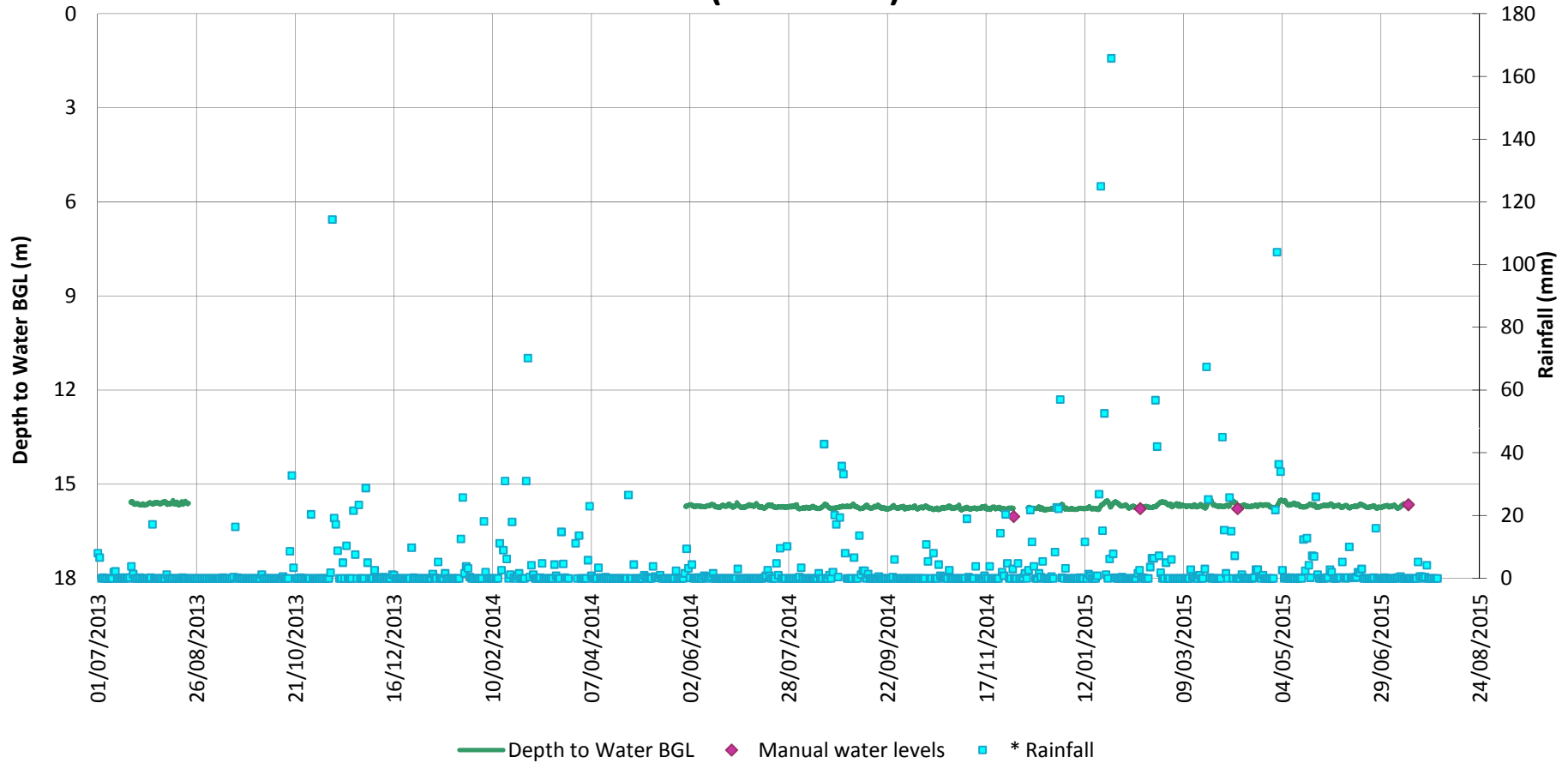


## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW21 (C-BH3105) Water Level BGL



Drawn	KF	 <b>Transport Roads &amp; Maritime Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10280416	
Date	14/07/2015		BH ID	C-BH3105	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-13
Groundwater sample taken at time of manual water levels			BGL = below ground level (existing)		
* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)					

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW22 (C-BH3107) Water Level BGL

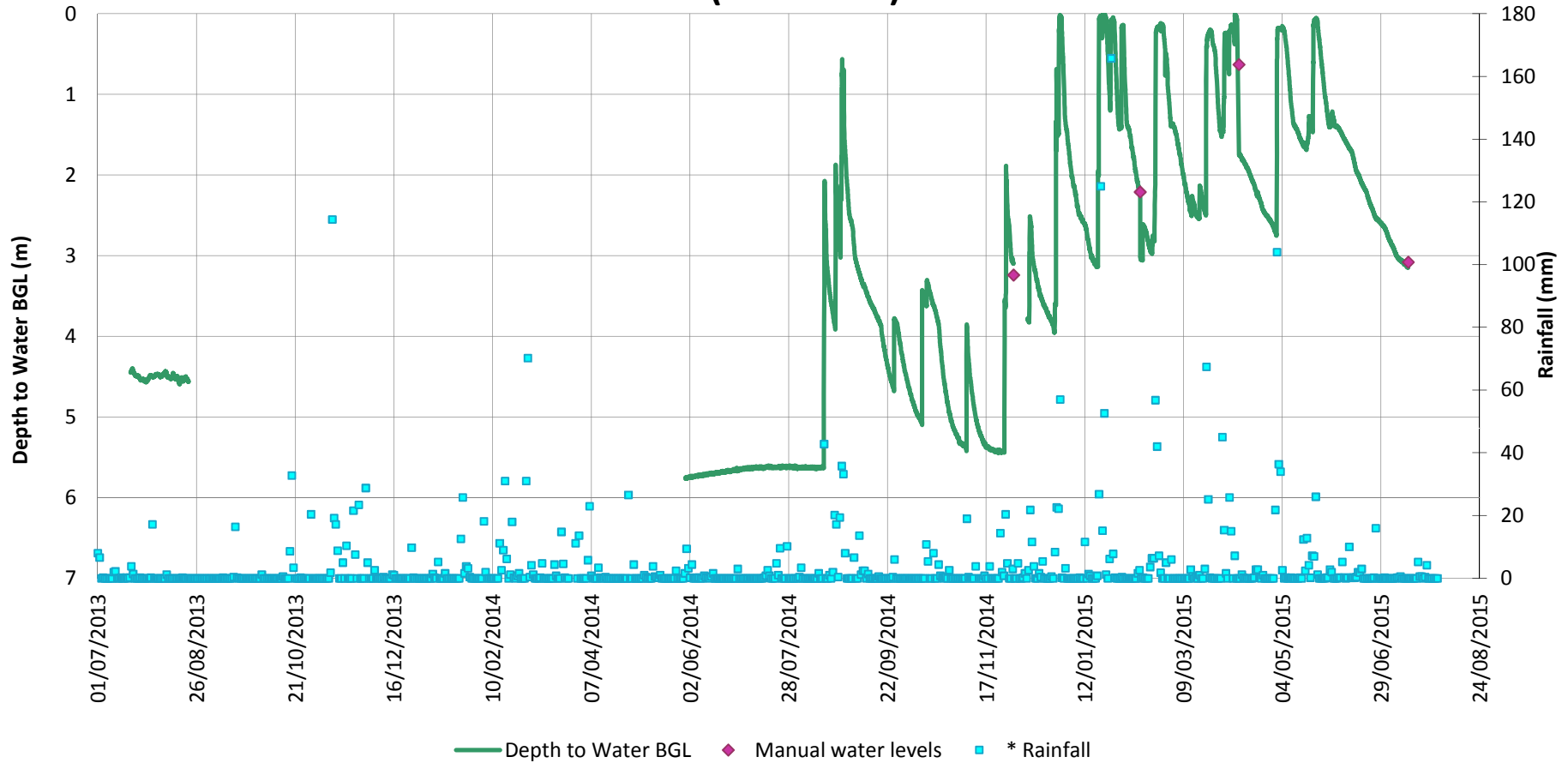


Drawn	KF	 Transport <b>Roads &amp; Maritime                  Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10280407	
Date	14/07/2015		BH ID	C-BH3107	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: <b>B-14</b>

Groundwater sample taken at time of manual water levels      BGL = below ground level (existing)

\* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW23 (C-BH3106) Water Level BGL

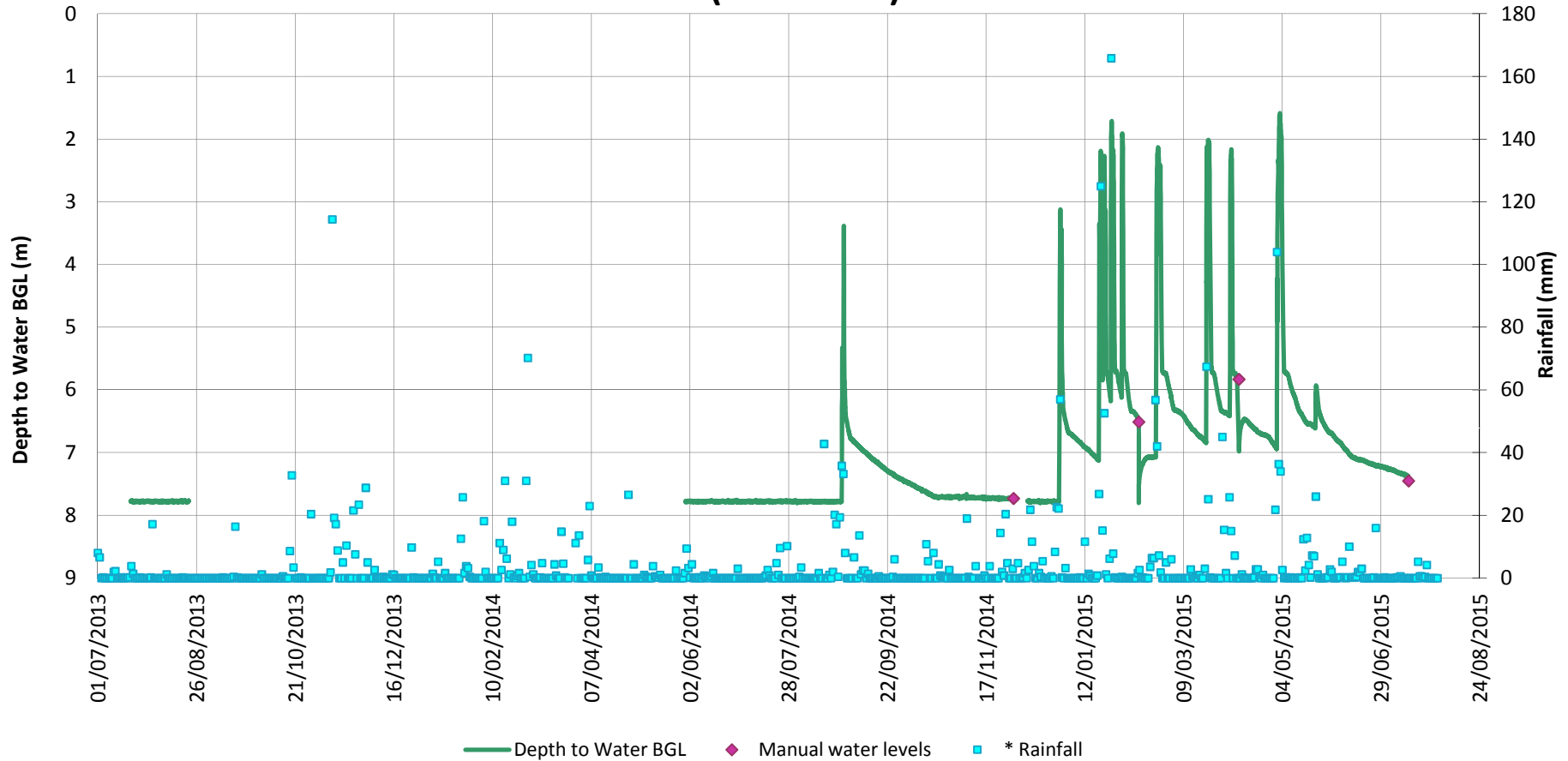


Drawn	KF	 Transport <b>Roads &amp; Maritime                  Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262202	
Date	14/07/2015		BH ID	C-BH3106	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-15

Groundwater sample taken at time of manual water levels      BGL = below ground level (existing)

\* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW24 (C-BH3108) Water Level BGL

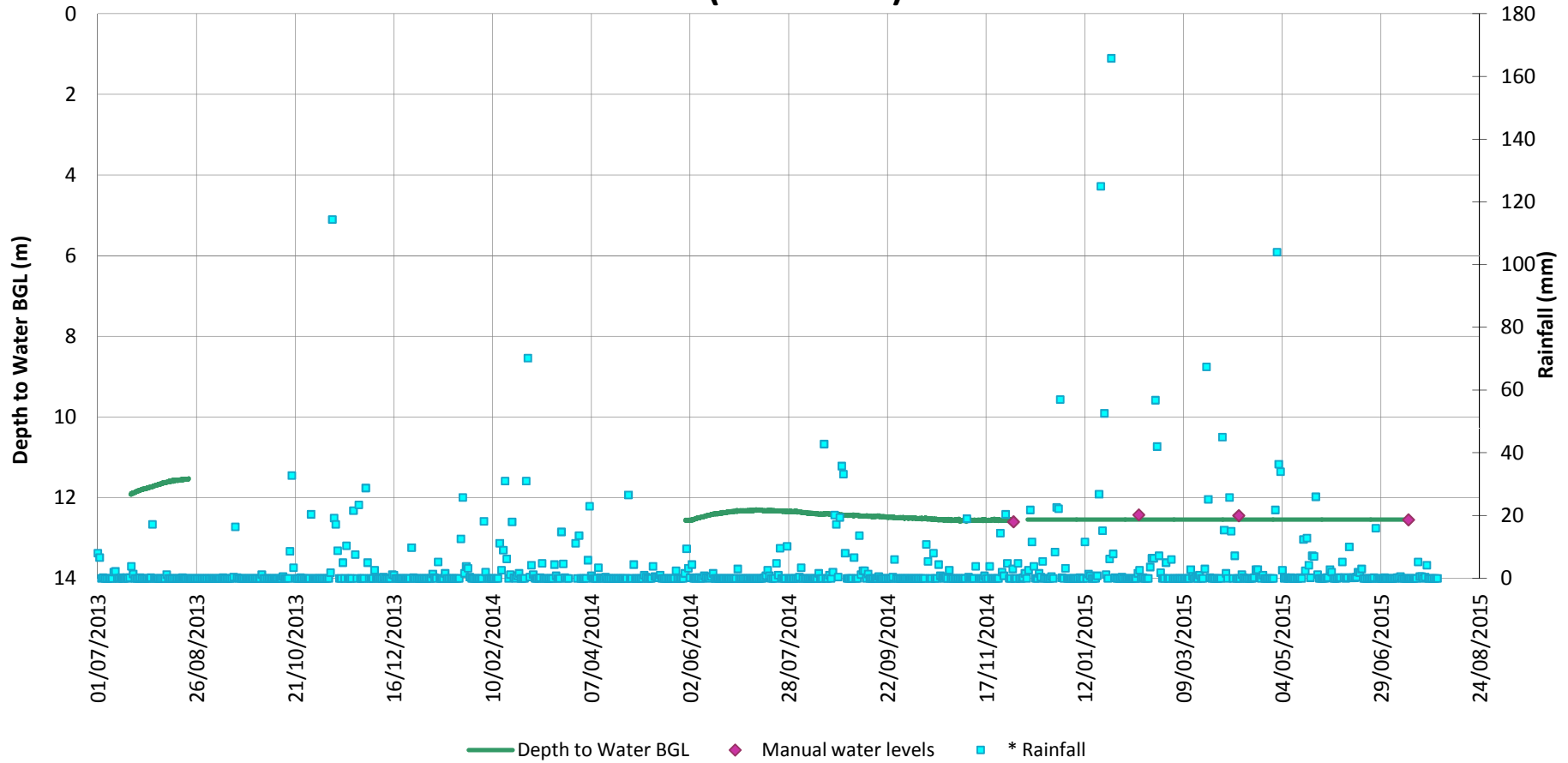


Drawn	KF	 Transport <b>Roads &amp; Maritime                  Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262197	
Date	14/07/2015		BH ID	C-BH3108	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: <b>B-16</b>

Groundwater sample taken at time of manual water levels     BGL = below ground level (existing)

\* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW25 (D-BH3101) Water Level BGL

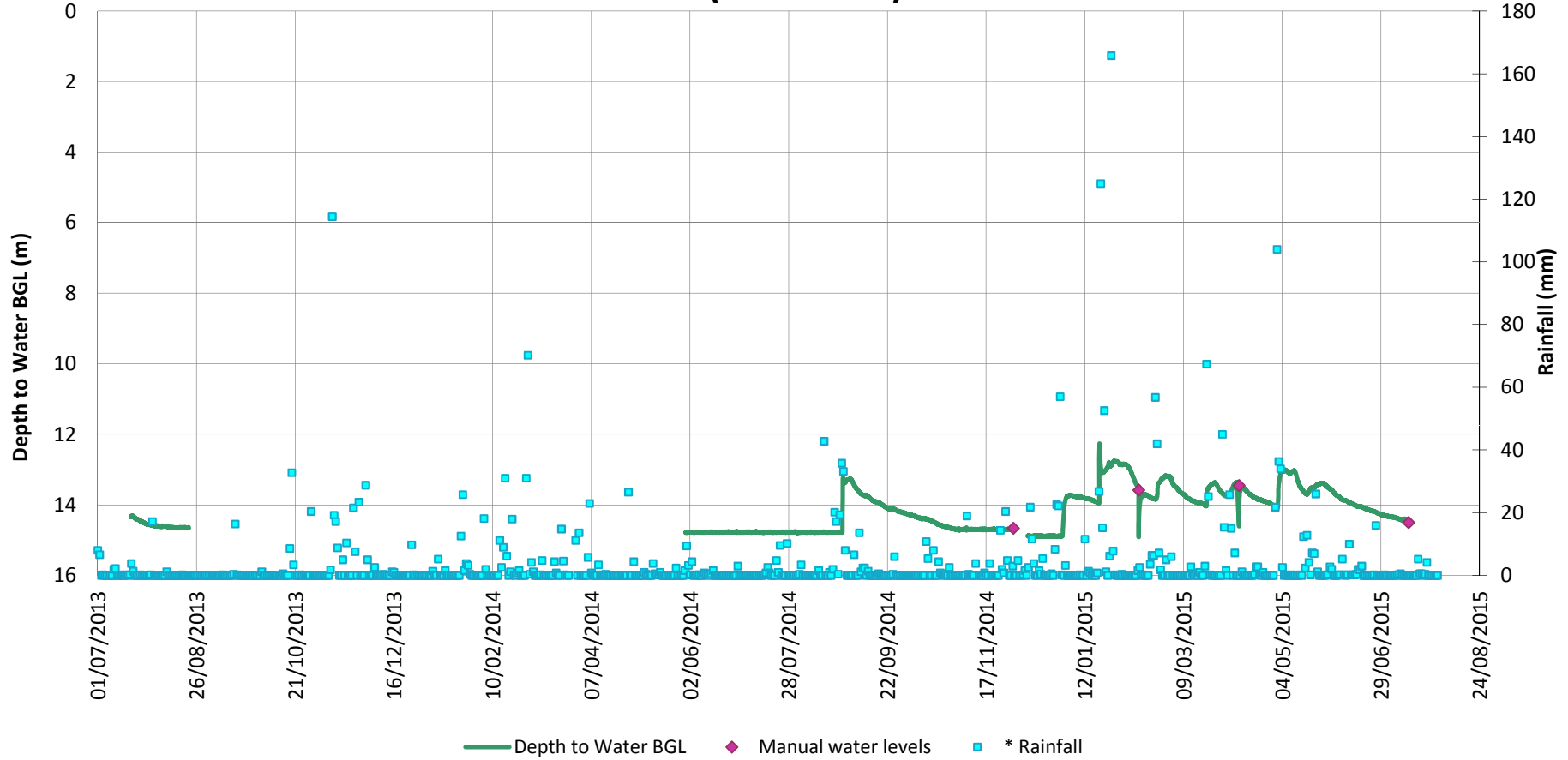


Drawn	KF	 Transport <b>Roads &amp; Maritime                  Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262203	
Date	14/07/2015		BH ID	D-BH3101	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-17

Groundwater sample taken at time of manual water levels     BGL = below ground level (existing)

\* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW26 (D-BH3106) Water Level BGL

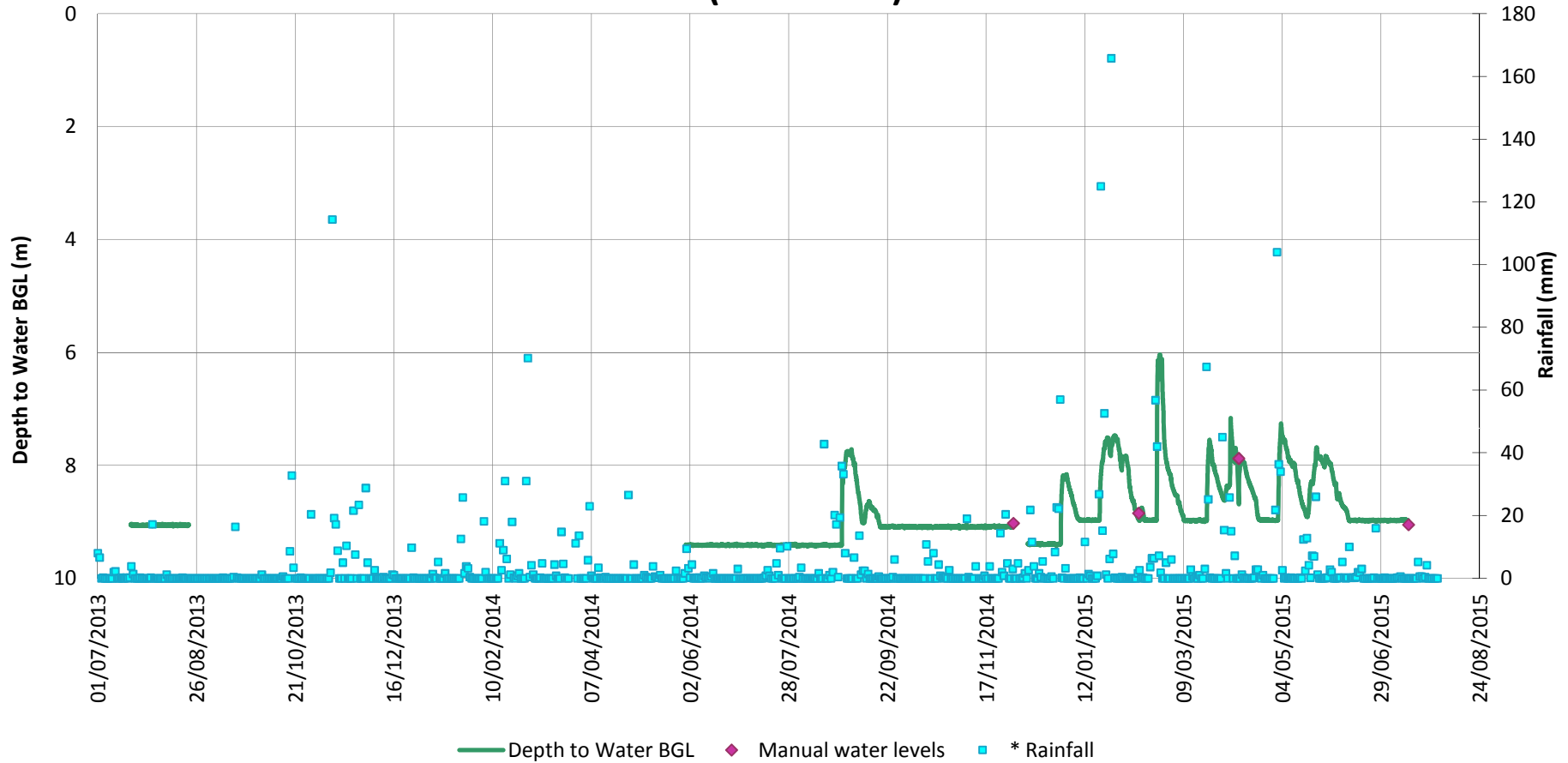


Drawn	KF	 Transport <b>Roads &amp; Maritime                  Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262194	
Date	14/07/2015		BH ID	D-BH3106	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: <b>B-18</b>

Groundwater sample taken at time of manual water levels      BGL = below ground level (existing)

\* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW28 (D-BH3103) Water Level BGL

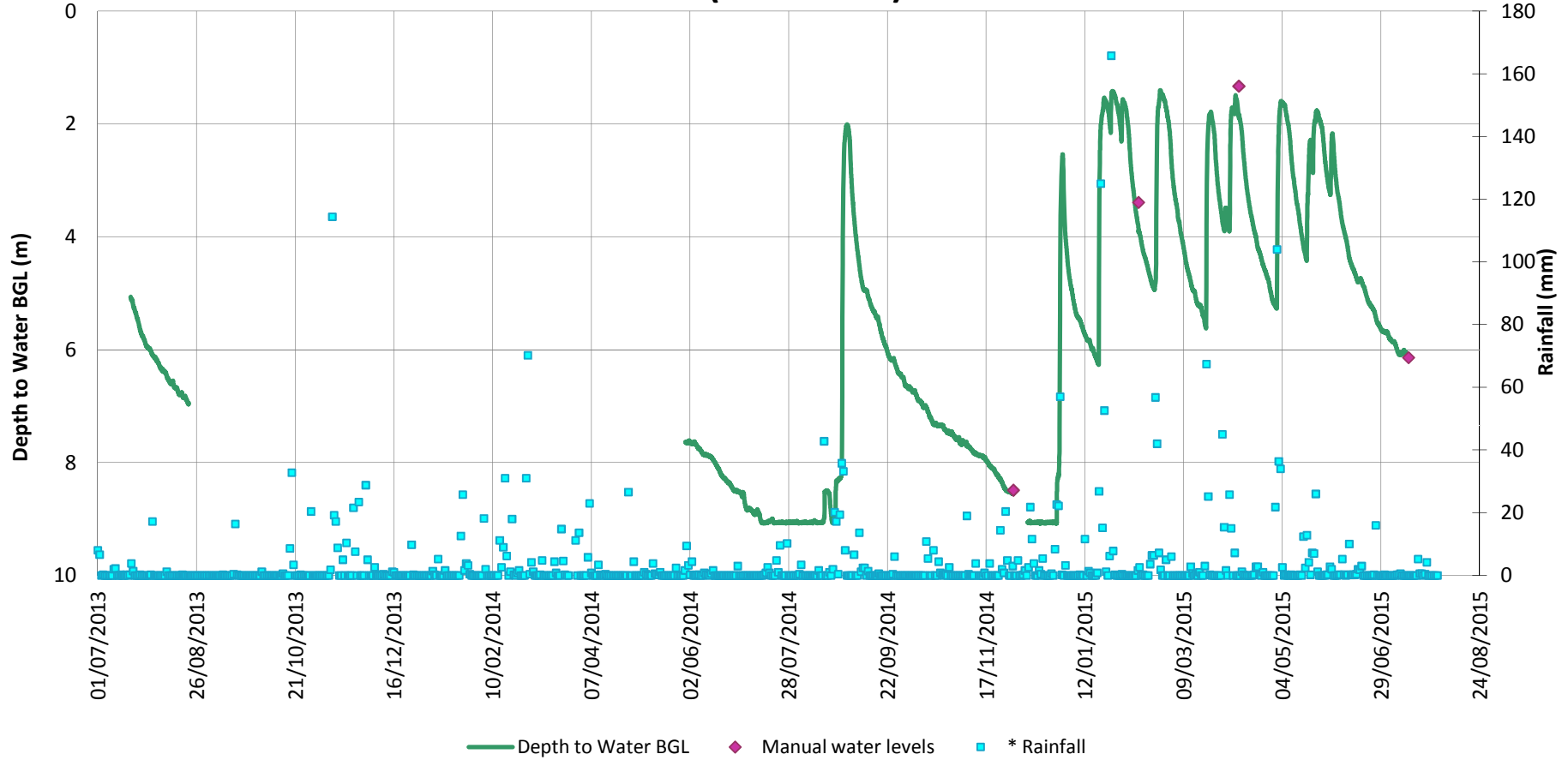


Drawn	KF	 Transport <b>Roads &amp; Maritime                  Services</b>	Client	RMS	Figure no: <b>B-19</b>
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262205	
Date	14/07/2015		BH ID	D-BH3103	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	

Groundwater sample taken at time of manual water levels      BGL = below ground level (existing)

\* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW29 (D-BH3104) Water Level BGL



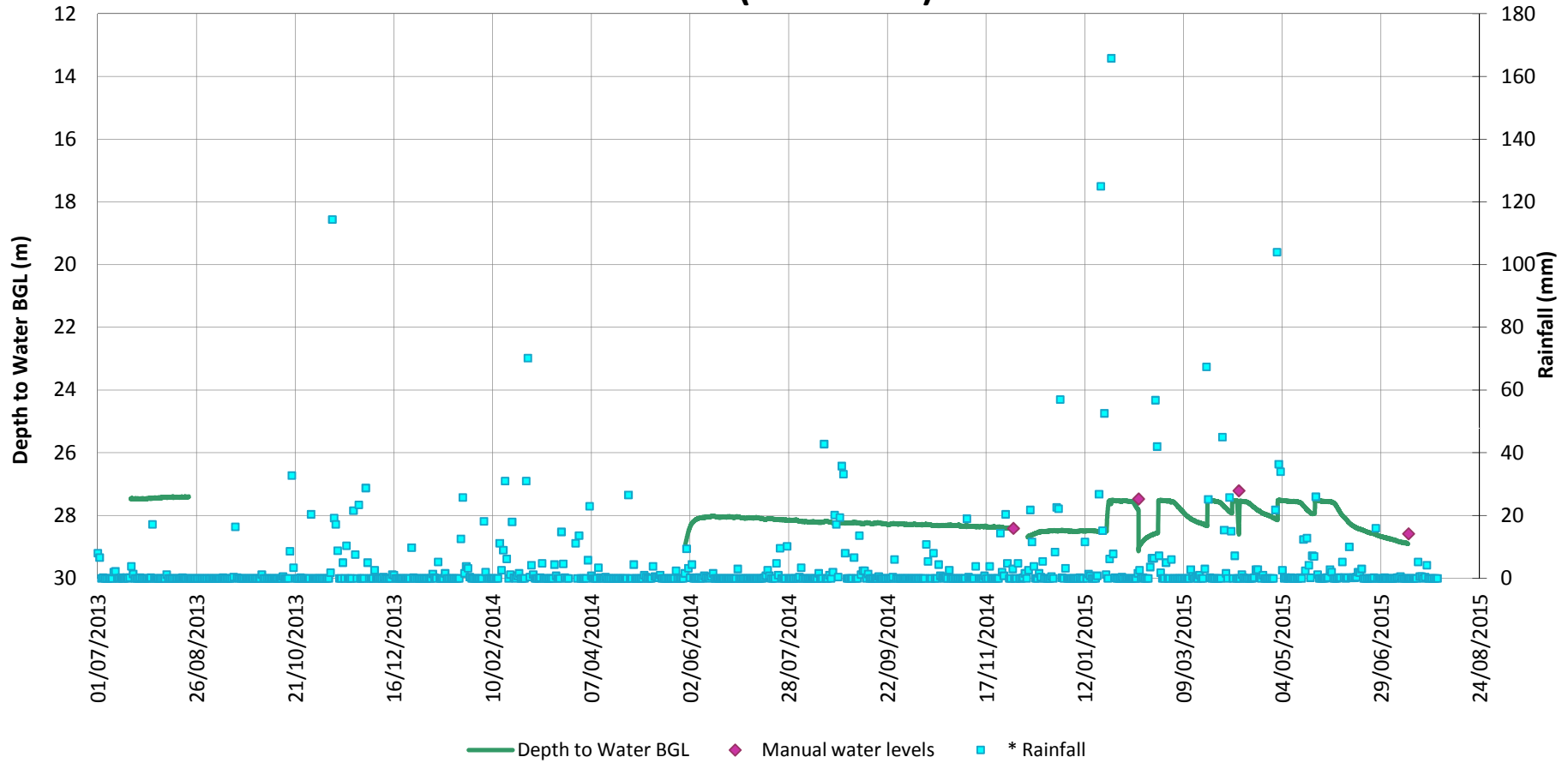
Drawn	KF	 Transport <b>Roads &amp; Maritime                  Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262201	
Date	14/07/2015		BH ID	D-BH3104	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: <b>B-20</b>

Groundwater sample taken at time of manual water levels     BGL = below ground level (existing)

\* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)



## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW27 (D-BH3102) Water Level BGL

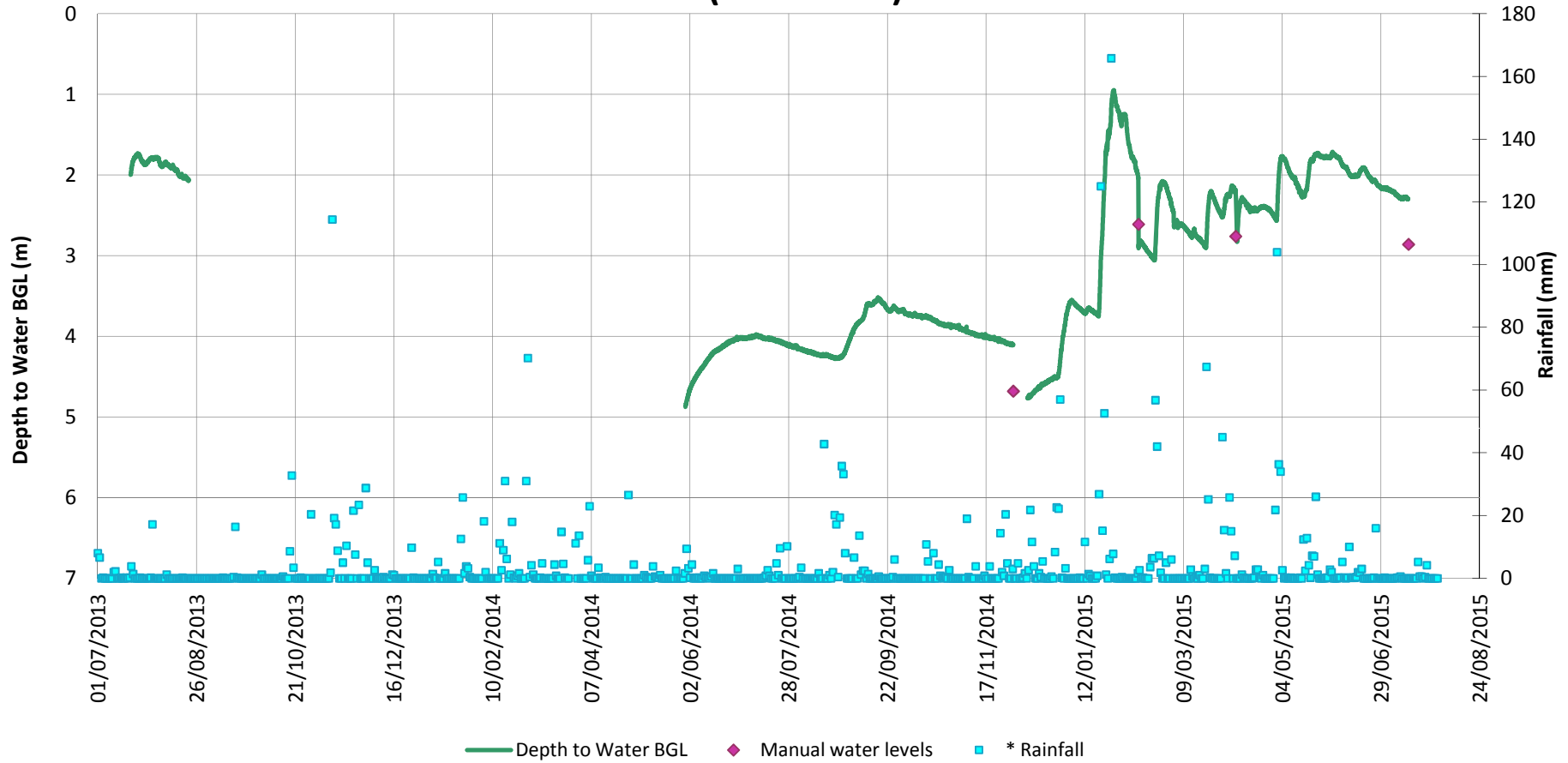


Drawn	KF	 <b>Transport Roads &amp; Maritime Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262200	
Date	14/07/2015		BH ID	D-BH3102	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-21

Groundwater sample taken at time of manual water levels      BGL = below ground level (existing)

\* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)

## HW10 Pacific Hwy; Oxley Hwy to Kempsey GW30 (D-BH3105) Water Level BGL



Drawn	KF	 <b>Transport Roads &amp; Maritime Services</b>	Client	RMS	
Approved	MD		Instrument	HOBO Water Level Data Logger S/N 10262193	
Date	14/07/2015		BH ID	D-BH3105	
			Project	Pacific Hwy (HW10) Oxley Hwy to Kempsey	Figure no: B-22
Groundwater sample taken at time of manual water levels			BGL = below ground level (existing)		
* Rainfall data sourced from Bureau of Meteorology (BoM) Port Macquarie Airport AWS (Stn 060139, BoM, 2015)					

# Appendix E – Cumulative construction groundwater results

**Table 1 Cumulative construction groundwater quality monitoring results by borehole**

Parameter	Unit	LOR	GW01		Results	GW02		Results	GW03		Results	Results		
			Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15	Jul 15*
Dissolved Aluminium	mg/L	0.01	2.51	0.1			<0.01	0.03	0.01	17.2	<0.01	0.02	<0.01	0.24
Dissolved Arsenic	mg/L	0.001	0.008	0.002			0.003	<0.001	<0.001	0.007	<0.001	<0.001	<0.001	0.006
Dissolved Cadmium	mg/L	0.0001	<0.001	<0.001			<0.001	<0.001	<0.001	0.0032	<0.001	<0.001	<0.001	0.0002
Dissolved Chromium	mg/L	0.001	<0.001	<0.001			<0.001	<0.001	<0.001	0.011	<0.001	<0.001	<0.001	<0.001
Dissolved Copper	mg/L	0.001	0.037	0.009			0.001	0.004	0.003	0.069	0.005	0.005	0.005	0.010
Total Iron	mg/L	0.05	2.27	1.8			15.9	8.65	31.9	15.7	35.7	11.3	3.73	17.4
Dissolved Lead	mg/L	0.001	0.026	0.002			<0.001	<0.001	<0.001	0.009	<0.001	<0.001	<0.001	<0.001
Total Manganese	mg/L	0.001	0.247	0.052			0.477	0.088	0.073	0.216	1.13	0.947	0.141	1.34
Mercury	mg/L	0.0001	<0.00001	0.00001			<0.00001	<0.00001	<0.00001		<0.00001	<0.00001	<0.00001	
Dissolved Nickel	mg/L	0.001	0.025	0.005			0.003	0.004	0.003	0.009	0.012	0.013	0.007	0.017
Dissolved Silver	mg/L	0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dissolved Zinc	mg/L	0.005	0.347	0.118			0.007	0.026	0.012	0.050	0.01	0.019	0.015	0.028
EC laboratory	uS/cm		4400	2170			345	178	231	852	1290	939	519	1040
Total Nitrogen	mg/L		0.38	0.5			2.7	1.0	0.48		0.7	0.6	0.59	
Total Phosphorus	mg/L		0.05	0.07			0.37	0.23	0.35		0.37	0.11	0.14	
Ammonia	mg/L		0.02	<0.02			1.54	0.12	0.02		0.17	0.10	0.02	
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>		7	13			123	34	23		147	118	120	
Chloride	mg/L		1307	489			27	24	52		254	163	74	
Nitrate			0.08	0.25			0.11	0.04	0.07	0.26	0.02	0.02	<0.01	0.22
Sulphate	mg/L		159	274			7.7	8.4			102	80		
Calcium	mg/L		4.41	1.28			14.8	6.07	8.57		30.8	27.4	42.1	
Magnesium	mg/L		87.4	21.7			9.62	4.01	5.82		39.9	24.5	15.4	
Potassium	mg/L		5.78	3.2			4.09	1.89	7.53		3.49	2.93	2.47	
Sodium	mg/L		692	370			36.5	21.5	32.9		164	105	38.6	

\* Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.

**Table 2 Cumulative construction groundwater quality monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW04		Results		GW05		Results		GW07		Results	
			Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15	Jul 15*
Dissolved Aluminium	mg/L	0.01	<0.01	0.01	<0.01		0.01	0.02	<0.01	6.72		0.2	0.08	
Dissolved Arsenic	mg/L	0.001	<0.001	<0.001	0.001		<0.001	<0.001	<0.001	0.005		<0.001	<0.001	
Dissolved Cadmium	mg/L	0.0001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	0.0008		<0.001	<0.001	
Dissolved Chromium	mg/L	0.001	0.001	0.002	0.002		<0.001	0.001	<0.001	0.010		0.002	<0.001	
Dissolved Copper	mg/L	0.001	0.005	0.002	0.003		0.01	0.003	0.001	0.047		0.001	0.004	
Total Iron	mg/L	0.05	106	28.6	24.4		111	66.2	59.4	69.3		26.7	13.2	
Dissolved Lead	mg/L	0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	0.005		<0.001	<0.001	
Total Manganese	mg/L	0.001	0.632	0.409	0.486		0.944	1.15	1.02	0.726		0.124	0.125	
Mercury	mg/L	0.0001	<0.00001	<0.00001	<0.00001		<0.00001	<0.00001	<0.00001			<0.00001	<0.00001	
Dissolved Nickel	mg/L	0.001	0.002	0.004	0.007		0.004	0.012	0.008	0.008		0.002	<0.001	
Dissolved Silver	mg/L	0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	
Dissolved Zinc	mg/L	0.005	<0.005	0.017	0.016		0.015	0.020	0.022	0.055		0.005	0.011	
EC laboratory	uS/cm		4190	3050	3170		7260	6910	6890	7320		212	238	
Total Nitrogen	mg/L		1.5	0.9	0.88		3.1	1.8	1.42			0.7	0.45	
Total Phosphorus	mg/L		0.52	0.11	0.12		9.43	1.03	1.35			0.16	0.22	
Ammonia	mg/L		0.34	0.16	0.13		0.82		0.71			<0.02	0.01	
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>		319	176	206		558	397	460			36	45	
Chloride	mg/L		1148	858	900		2494	1654	1500			35	38	
Nitrate			0.01	0.01	0.04		0.10	0.07	0.1	0.26		<0.01	<0.01	
Sulphate	mg/L		44	29			2032	1305				9.5		
Calcium	mg/L		44.2	25.2	29.6		96.6	148	161			22.6	10.2	
Magnesium	mg/L		83.7	48.7	62.1		281	228	268			9.09	4.0	
Potassium	mg/L		21.8	11.2	10.4		21.9	31	34.4			2.92	1.75	
Sodium	mg/L		627	456	506		999	914	1010			30.8	46.3	

\* Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.

**Table 3 Cumulative construction groundwater quality monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW08			Results		GW09			Results		GW010			Results	
			Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15	Jul 15*			
Dissolved Aluminium	mg/L	0.01	0.02	0.12	1.21	72.9					0.17	0.54	0.80				
Dissolved Arsenic	mg/L	0.001	0.001	<0.001	<0.001	0.028					0.002	0.004	0.007				
Dissolved Cadmium	mg/L	0.0001	<0.001	<0.001	<0.001	0.0024					<0.001	<0.001	<0.001				
Dissolved Chromium	mg/L	0.001	<0.001	0.001	0.003	0.082					0.002	0.004	0.005				
Dissolved Copper	mg/L	0.001	<0.001	0.004	0.002	0.114					0.087	0.014	0.112				
Total Iron	mg/L	0.05	139	52.1	78.6	75.4					74.1	23.8	75.4				
Dissolved Lead	mg/L	0.001	<0.001	<0.001	<0.001	0.063					<0.001	0.001	0.002				
Total Manganese	mg/L	0.001	0.452	0.125	0.089	0.158					0.22	0.15	0.271				
Mercury	mg/L	0.0001	<0.00001	<0.00001	<0.00001						<0.00001	<0.00001	<0.00001				
Dissolved Nickel	mg/L	0.001	0.002	0.005	<0.001	0.015					0.003	0.003	0.003				
Dissolved Silver	mg/L	0.001	<0.001	<0.001	<0.001	<0.001					<0.001	<0.001	<0.001				
Dissolved Zinc	mg/L	0.005	<0.005	0.063	0.017	0.291					0.007	0.018	0.028				
EC laboratory	uS/cm			1530	435	528						419	590				
Total Nitrogen	mg/L			1.6	2.90	0.06						0.8	2.11				
Total Phosphorus	mg/L			0.27	0.55							0.09	0.55				
Ammonia	mg/L			0.05	0.04							<0.02	0.01				
Phosphate	mg/L																
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>			37	26						71	15	52				
Chloride	mg/L		264	400	120						70	106	150				
Nitrate				0.02	0.02	0.06						<0.01	<0.01				
Sulphate	mg/L		11	24							5.5	7					
Calcium	mg/L		108	23.2	18.3						28.6	9.38	17.5				
Magnesium	mg/L		50	22.8	12.0						10.9	7.11	16.4				
Potassium	mg/L		17.2	9.61	8.88						5.64	3.9	9.59				
Sodium	mg/L		229	264	72.3						66.1	63.4	107				

\* Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.

**Table 4 Cumulative construction groundwater quality monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW11				GW12				GW013			
			Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15	Jul 15*
Dissolved Aluminium	mg/L	0.01	0.96	0.01	0.01	0.62	0.01	0.01	<0.01	2.33	0.02	0.01		
Dissolved Arsenic	mg/L	0.001	0.003	<0.001	0.001	0.004	0.004	0.003	0.002	0.077	<0.001	<0.001		
Dissolved Cadmium	mg/L	0.0001	0.002	<0.001	<0.001	0.0007	<0.001	<0.001	<0.001	0.0005	<0.001	<0.001		
Dissolved Chromium	mg/L	0.001	<0.001	0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.006	<0.001	0.001		
Dissolved Copper	mg/L	0.001	0.126	0.039	0.018	0.039	<0.001	<0.001	<0.001	0.016	0.004	0.003		
Total Iron	mg/L	0.05	14	14.5	16.0	1.79	344	191	169	135	76.9	13.7		
Dissolved Lead	mg/L	0.001	0.003	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	0.003	<0.001	<0.001		
Total Manganese	mg/L	0.001	1.80	0.735	0.069	0.117	8.61	4.85		4.97	0.358	0.114		
Mercury	mg/L	0.0001	<0.00001	<0.00001	<0.00001		<0.00001	<0.00001	<0.00001		<0.00001	<0.00001		
Dissolved Nickel	mg/L	0.001	0.157	0.043	0.003	0.012	0.004	0.009	0.007	0.005	<0.001	0.001		
Dissolved Silver	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		
Dissolved Zinc	mg/L	0.005	0.136	0.045	0.021	0.064	0.02	0.018	0.029	0.040	0.007	0.014		
EC laboratory	uS/cm		8510	4370	1040	2390	4020	2860	2470	2600	300	247		
Total Nitrogen	mg/L		0.7	--	0.56		3.8	2.0	1.08		1.4	0.7		
Total Phosphorus	mg/L		0.10	0.03	0.075		0.70	0.20	0.15		4.21	0.33		
Ammonia	mg/L		0.19	0.07	0.02		1.58	1.48	1.05		0.38	0.23		
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>		7	118	273		74	83	56		62	40		
Chloride	mg/L		2076	966	140		354	281	230		39	24		
Nitrate			0.02	0.01	<0.01	0.02	<0.01	<0.10*	<0.01	1.53	0.01	<0.01		
Sulphate	mg/L		1889	928			1865	1342			22	34		
Calcium	mg/L		94.7	62.6	8.50		64.2	68.3	62.3		4.48	10.1		
Magnesium	mg/L		272	103	9.14		217	103	104		7	2.54		
Potassium	mg/L		14.1	12.6	6.05		10.6	11.6	11.0		3.89	2.8		
Sodium	mg/L		1240	669	200		488	281	264		40.6	32.3		

\* Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.

**Table 5 Cumulative construction groundwater quality monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW14		Results	GW15		Results	GW017		Results	Results		
			Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15*	Jul 15*
Dissolved Aluminium	mg/L	0.01	0.05	0.03			0.02	0.02	0.01	0.47			0.01	1.16
Dissolved Arsenic	mg/L	0.001	<0.001	<0.001			0.01	0.008	0.005	0.026			<0.001	0.002
Dissolved Cadmium	mg/L	0.0001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.0001			<0.001	0.0002
Dissolved Chromium	mg/L	0.001	<0.001	0.001			<0.001	0.001	<0.001	<0.001			<0.001	0.002
Dissolved Copper	mg/L	0.001	0.024	0.008			0.008	0.002	0.002	0.012			0.001	0.006
Total Iron	mg/L	0.05	0.79	0.37			7.28	6.61	5.02	3.98			19.9	1.73
Dissolved Lead	mg/L	0.001	<0.001	<0.001			<0.001	<0.001	<0.001	0.002			<0.001	0.003
Total Manganese	mg/L	0.001	0.279	0.171			2.55	2.21	2.00	1.94			0.561	0.238
Mercury	mg/L	0.0001	<0.00001	0.00001			<0.00001	<0.00001	<0.00001				<0.00001	
Dissolved Nickel	mg/L	0.001	0.003	0.002			0.003	0.003	0.003	0.003			0.005	0.003
Dissolved Silver	mg/L	0.001	<0.001	<0.001			<0.001	<0.001	<0.001	<0.001			<0.001	<0.001
Dissolved Zinc	mg/L	0.005	0.018	0.019			0.021	0.016	0.020	0.022			0.026	0.046
EC laboratory	uS/cm		3690	3230			3760	3740	3660	3760			3680	4150
Total Nitrogen	mg/L		0.7	1.1			0.26	--	0.28				0.55	
Total Phosphorus	mg/L		0.03	0.06			0.09	0.05	0.08				0.30	
Ammonia	mg/L		0.03	0.04			0.05	--	0.07				0.02	
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>		506	461			260	239	244				560	
Chloride	mg/L		833	700			981	1086	1000				770	
Nitrate			0.22	0.38			<0.01	<0.01	<0.01	<0.01			<0.01	0.10
Sulphate	mg/L		284	286			149	164						
Calcium	mg/L		141	138			30.2	47.7	51.7				165	
Magnesium	mg/L		32.9	23.9			105	99.3	110				171	
Potassium	mg/L		2.76	3.32			5.30	8.87	8.54				9.85	
Sodium	mg/L		610	509			507	527	549				355	

\* Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.



**Table 6 Cumulative construction groundwater quality monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW018			Results		GW19			Results		GW20			Results	
			Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15	Jul 15*			
Dissolved Aluminium	mg/L	0.01	0.02	0.03	<0.01	0.63	0.02	0.14	0.04				0.01				
Dissolved Arsenic	mg/L	0.001	0.006	0.005	0.005	0.011	0.002	<0.001	0.001				<0.001				
Dissolved Cadmium	mg/L	0.0001	<0.001	<0.001	<0.001	0.0020	<0.001	<0.001	<0.001				<0.001				
Dissolved Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001				<0.001				
Dissolved Copper	mg/L	0.001	0.008	0.004	0.003	0.034	0.043	0.01	0.013				0.003				
Total Iron	mg/L	0.05	5.26	5.57	5.76	2.40	24.7	83.6	22.0				17.5				
Dissolved Lead	mg/L	0.001	<0.001	<0.001	<0.001	0.012	<0.001	<0.001	<0.001				<0.001				
Total Manganese	mg/L	0.001	2.00	1.80	1.80	1.58	0.865	0.319	0.162				1.10				
Mercury	mg/L	0.0001	<0.00001	<0.00001	<0.00001		<0.00001	0.00002	<0.00001				<0.00001				
Dissolved Nickel	mg/L	0.001	0.002	0.002	0.002	0.002	0.016	0.006	0.007				0.065				
Dissolved Silver	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				<0.001				
Dissolved Zinc	mg/L	0.005	0.022	0.014	0.022	0.040	0.056	0.016	0.024				0.696				
EC laboratory	uS/cm		1690	1690	1660	1700	634	435	734								
Total Nitrogen	mg/L		0.46	--	0.37		0.5	1.1	0.64								
Total Phosphorus	mg/L		0.09	0.06	0.08		0.14	0.64	0.40								
Ammonia	mg/L		0.14	0.18	0.12		0.03	<0.02	0.01								
Phosphate	mg/L																
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>		676	645	684		96	40	201				167				
Chloride	mg/L		96	95	98		126	64	73				150				
Nitrate			0.02	<0.01	<0.01	2.02	<0.01	<0.01	<0.01								
Sulphate	mg/L		168	157			22	57									
Calcium	mg/L		115	186	199		3.36	3.37	4.08				82.0				
Magnesium	mg/L		56.6	49.2	55		10.2	9.21	5.9				94.4				
Potassium	mg/L		4.48	6.15	6.56		6.15	10.6	6.69				17.0				
Sodium	mg/L		97.7	98.9	101		114	79.3	157				137				

\* Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.

**Table 7 Cumulative construction groundwater quality monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW21			GW022			GW23			Results		
			Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15	Jul 15*
Dissolved Aluminium	mg/L	0.01	0.36	0.03	0.02	12.2	0.16	0.62	2.34	87.2	0.07	0.18	0.49	0.04
Dissolved Arsenic	mg/L	0.001	0.008	0.002	0.002	0.011	0.001	0.001	0.001	0.074	<0.001	<0.001	<0.001	<0.001
Dissolved Cadmium	mg/L	0.0001	<0.001	<0.001	<0.001	0.0010	<0.001	<0.001	<0.001	0.0005	<0.001	<0.001	<0.001	<0.0001
Dissolved Chromium	mg/L	0.001	0.004	<0.001	<0.001	0.011	<0.001	<0.001	0.002	0.023	0.001	<0.001	0.002	<0.001
Dissolved Copper	mg/L	0.001	0.021	<0.001	0.026	0.126	0.018	0.014	0.019	0.236	0.021	0.003	0.019	0.001
Total Iron	mg/L	0.05	159	86.6	19.3	35.8	96.9	101	110	66.2	77.2	55.5	53.2	0.21
Dissolved Lead	mg/L	0.001	0.01	<0.001	<0.001	0.049	<0.001	<0.001	<0.001	0.086	<0.001	<0.001	<0.001	<0.001
Total Manganese	mg/L	0.001	1.00	0.979	0.557	0.577	0.232	0.252	0.261	0.632	1.75	0.863	0.713	0.076
Mercury	mg/L	0.0001	<0.00001	<0.00001	<0.00001		<0.00001	<0.00001	<0.00001		<0.00001	<0.00001	<0.00001	
Dissolved Nickel	mg/L	0.001	0.009	0.003	0.003	0.018	<0.001	<0.001	0.001	0.018	0.007	0.001	<0.001	<0.001
Dissolved Silver	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dissolved Zinc	mg/L	0.005	0.022	0.009	0.056	1.16	0.048	0.022	0.050	2.33	0.123	0.037	0.035	0.050
EC laboratory	uS/cm		1050	714	748	730	501	325	296	470	542	205	177	230
Total Nitrogen	mg/L		3.1	2.2	1.22		2.3	2.5	1.85		0.6	1.1	1.41	
Total Phosphorus	mg/L		0.55	0.42	0.19		0.37	0.39	0.35		0.45	0.49	0.90	
Ammonia	mg/L		<0.02	<0.02	0.13		<0.02	<0.02	0.02		<0.02	<0.02	0.02	
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>		376	292	346		18	19	15		32	11	9	
Chloride	mg/L		101	54	58		128	72	71		62	45	44	
Nitrate	mg/L		0.01	<0.01	<0.01	0.14	0.01	<0.01	<0.01	0.05	<0.01	0.01	<0.01	0.06
Sulphate	mg/L		54	1.8			24	21			137	12		
Calcium	mg/L		39.9	38.8	43.8		12.7	9.04	11.8		88.1	41.5	35.6	
Magnesium	mg/L		50.3	26.9	14.2		16.1	15.4	23.7		35	18.9	17.7	
Potassium	mg/L		39.1	18.6	9.83		11.6	12.5	9.13		9.65	8.94	6.70	
Sodium	mg/L		220	147	127		104	65.2	72.9		77.6	35.9	34.5	

\* Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.

**Table 8 Cumulative construction groundwater quality monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW24			GW025			GW26			Results		
			Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15	Jul 15*
Dissolved Aluminium	mg/L	0.01	0.07	0.27	0.26	24.6	0.20	0.14	0.05	10.7	<0.01	0.04	0.21	55.2
Dissolved Arsenic	mg/L	0.001	0.003	<0.001	<0.001	0.010	<0.001	<0.001	<0.001	0.004	0.002	<0.001	<0.001	0.013
Dissolved Cadmium	mg/L	0.0001	<0.001	<0.001	<0.001	0.0010	0.001	0.001	<0.001	0.0014	<0.001	<0.001	<0.001	0.0034
Dissolved Chromium	mg/L	0.001	<0.001	<0.001	0.001	0.043	<0.001	<0.001	<0.001	0.007	<0.001	<0.001	0.001	0.023
Dissolved Copper	mg/L	0.001	0.087	1.52	0.353	5.09	0.156	0.351	0.095	0.129		0.23	1.01	38.6
Total Iron	mg/L	0.05	92.5	23.8	34.2	35.6	30.5	17.6	17.7	8.38	26.2	43.6	11.5	16.5
Dissolved Lead	mg/L	0.001	<0.001	<0.001	<0.001	0.021	0.006	0.005	<0.001	0.012	<0.001	<0.001	<0.001	0.045
Total Manganese	mg/L	0.001	0.366	0.132	0.145	0.180	2.23	0.929	0.308	0.298	0.928	0.972	0.300	0.488
Mercury	mg/L	0.0001	<0.00001	<0.00001	<0.00001		<0.00001	<0.00001	<0.00001		<0.00001	<0.00001	<0.00001	
Dissolved Nickel	mg/L	0.001	0.007	0.011	0.008	0.025	0.035	0.018	0.005	0.027	0.021	0.016	0.013	0.056
Dissolved Silver	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Dissolved Zinc	mg/L	0.005	0.06	0.074	0.063	0.235	0.388	0.306	0.074	0.144	0.165	0.178	0.179	0.779
EC laboratory	uS/cm			595	558	840		967	449	467		896	750	1190
Total Nitrogen	mg/L			1.3	1.10			0.8	1.09			1	0.57	
Total Phosphorus	mg/L			0.3	0.365			0.05	0.11			0.23	0.135	
Ammonia	mg/L			0.09	0.02			0.18	0.19			0.03	0.01	
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>		32	<5	<5		<5	<5	7			26	34	
Chloride	mg/L		136	154	150		523	269	120		281	250	220	
Nitrate				<0.01	<0.01	<0.50		0.12	0.03	0.04		0.01	<0.01	<0.01
Sulphate	mg/L		37	26			20	25			32	11		
Calcium	mg/L		7.57	1.69	1.75		2.98	1.67	1.02		38.2	18.4	4.70	
Magnesium	mg/L		12.6	6.71	7.63		25.7	12.2	4.86		46.5	57.4	20.5	
Potassium	mg/L		10.1	5.48	5.97		10.0	9.9	8.67		12.6	14.6	6.87	
Sodium	mg/L		100	94.4	99.5		250	150	79.3		229	153	131	

\* Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.

**Table 9 Cumulative construction groundwater quality monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW27			Results		GW028			Results		GW29			Results	
			Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15	Jul 15*	Dec 14	Feb 15	Apr 15	Jul 15*			
Dissolved Aluminium	mg/L	0.01	<0.01	0.02	0.02	20.3	0.11		0.09	47.7	0.16	0.72	0.78	29.4			
Dissolved Arsenic	mg/L	0.001	0.003	<0.001	<0.001	0.021	0.002		<0.001	0.023	0.004	0.002	0.002	0.017			
Dissolved Cadmium	mg/L	0.0001	<0.001	<0.001	<0.001	0.0016	<0.001		<0.001	0.0035	<0.001	<0.001	<0.001	0.0010			
Dissolved Chromium	mg/L	0.001	<0.001	<0.001	<0.001	0.063	0.001		<0.001	0.085	<0.001	0.002	0.003	0.021			
Dissolved Copper	mg/L	0.001	0.012	0.053	0.084	2.70			0.545	23.0	0.014	0.022	0.017	0.154			
Total Iron	mg/L	0.05	21.2	20.5	6.08	37.3	22.6		51.9	53.0	187	5.29	3.98	18.8			
Dissolved Lead	mg/L	0.001	<0.001	<0.001	<0.001	0.045	<0.001		<0.001	0.056	<0.001	0.001	<0.001	0.047			
Total Manganese	mg/L	0.001	2.66	1.33	0.403	0.950	0.226		0.202	0.312	3.29	0.089	0.099	0.289			
Mercury	mg/L	0.0001	<0.00001	<0.00001	<0.00001		0.00001		<0.00001		<0.00001	<0.00001	<0.00001				
Dissolved Nickel	mg/L	0.001	0.008	0.011	0.005	0.039	0.015		0.003	0.047	0.007	0.007	0.010	0.037			
Dissolved Silver	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001			
Dissolved Zinc	mg/L	0.005	0.020	0.066	0.021	0.420	0.052		0.019	0.280	0.069	0.103	0.087	1.47			
EC laboratory	uS/cm			514	353	438			199	235	274	145	158	195			
Total Nitrogen	mg/L			0.8	0.64				0.80		5.5%	0.7	0.68				
Total Phosphorus	mg/L			0.31	0.17				0.40		1.23%	0.1	0.085				
Ammonia	mg/L			0.05	0.04				0.02		0.03	<0.02	0.09				
Phosphate	mg/L																
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>		231	51	50		31		14		46	17	23				
Chloride	mg/L		139	76	65		40		45		46	27	29				
Nitrate				0.09	0.08	0.26			<0.01	<0.01	0.01	0.01	0.1	0.64			
Sulphate	mg/L		55	73			51				28	6.4					
Calcium	mg/L		71.1	25.4	10.3		4.56		3.55		36.3	0.74	0.77				
Magnesium	mg/L		18.5	8.8	4.55		11.1		7.27		85.1	1.77	2.05				
Potassium	mg/L		7.35	7.48	4.37		6.63		9.23		39.9	2.08	1.95				
Sodium	mg/L		90.5	52.6	55.1		50.2		36.2		67.4	24.3	29.2				

\* Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.

**Table 10 Cumulative construction groundwater quality monitoring results by borehole (cont.)**

Parameter	Unit	LOR	GW30		Results	GW			Results	GW			Results	
			Dec 14	Feb 15	Apr 15	Jul 15*	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15	20 <sup>th</sup> per <sup>#</sup>	80 <sup>th</sup> per <sup>#</sup>	Apr 15	Jul 15
Dissolved Aluminium	mg/L	0.01	1.36	0.06	0.05	6.79								
Dissolved Arsenic	mg/L	0.001	0.001	0.002	0.002	0.022								
Dissolved Cadmium	mg/L	0.0001	<0.001	<0.001	<0.001	0.0010								
Dissolved Chromium	mg/L	0.001	<0.001	<0.001	0.001	0.007								
Dissolved Copper	mg/L	0.001	0.175	0.009	0.01	0.127								
Total Iron	mg/L	0.05	16.8	6.37	17.3	9.16								
Dissolved Lead	mg/L	0.001	<0.001	<0.001	<0.001	0.005								
Total Manganese	mg/L	0.001	1.10	0.162	0.187	0.168								
Mercury	mg/L	0.0001	<0.00001	<0.00001	<0.00001									
Dissolved Nickel	mg/L	0.001	0.067	0.004	0.004	0.006								
Dissolved Silver	mg/L	0.001	<0.001	<0.001	<0.001	<0.001								
Dissolved Zinc	mg/L	0.005	0.310	0.018	0.029	0.068								
EC laboratory	uS/cm		2820	435	511	677								
Total Nitrogen	mg/L		0.6	0.6	0.88									
Total Phosphorus	mg/L		0.11	0.06	0.10									
Ammonia	mg/L		0.03	<0.02	0.11									
Phosphate	mg/L													
Bicarbonate / Alkalinity	mg CaCO <sub>3</sub> /L <sup>-1</sup>		<5	120	95									
Chloride	mg/L		798	39	76									
Nitrate			0.24	<0.01	0.12	0.03								
Sulphate	mg/L		232	32										
Calcium	mg/L		3.37	15.6	5.74									
Magnesium	mg/L		31.9	3.58	3.73									
Potassium	mg/L		6.59	1.96	6.33									
Sodium	mg/L			78.2	105									

\* Analysis of all metals for July 2015 event is for "total" metals despite otherwise indicated in table.

**Table 11 Cumulative construction groundwater level – manual record**

Borehole reference	Top of casting RL (mAHD)	Depth of water level			
		Construction		Construction	
		Dec 14	Feb 15	Apr 2015	July 2015
GW01 (mTOC)	20.11	5.65	5.02	Destroyed	Destroyed
GW01 (mAHD)					
GW02 (mTOC)	3.57	3.17	1.77	1.34	1.88
GW02 (mAHD)					
GW03 (mTOC)	2.64	2.29	0.64	0.2	0.08
GW03 (mAHD)					
GW04 (mTOC)	1.69	2.37	0.96	0.43	Destroyed
GW04 (mAHD)					
GW05 (mTOC)	1.24	1.79	0.55	0.17	0.47
GW05 (mAHD)					
GW06 (mTOC)	20.1	Dry	Destroyed	Destroyed	Destroyed
GW06 (mAHD)					
GW07 (mTOC)	15.98	6.79 (dry)	1.81	1.0	Dry
GW07 (mAHD)					
GW08 (mTOC)	19.09	8.58	7.97	4.6	13.28
GW08 (mAHD)					
GW09 (mTOC)	17.57	Dry	Dry	Dry	8.54
GW09 (mAHD)					
GW10 (mTOC)	15.38	7.31	2.74	5.69	Destroyed
GW10 (mAHD)					
GW11 (mTOC)	1.591	2.99	Not taken	1.55	1.13
GW11 (mAHD)					
GW12 (mTOC)	1.573	1.60	0.38	0.2	0.34
GW12 (mAHD)					
GW13 (mTOC)	2.04	2.08	0.98	Destroyed	Destroyed
GW13 (mAHD)					
GW14 (mTOC)	5.656	3.92	2.60	Destroyed	Destroyed
GW14 (mAHD)					
GW15 (mTOC)	13.79	10.45	10.63	10.5	10.04
GW15 (mAHD)					
GW16 (mTOC)	14.14	Dry	Dry	Dry	Dry
GW16 (mAHD)					
GW17 (mTOC)	59.47	Dry	Dry	12.72	11.66
GW17 (mAHD)					
GW18 (mTOC)	96.71	34.09	33.70	33.76	33.71
GW18 (mAHD)					
GW19 (mTOC)	51.81	9.45	6.28	5.59	Destroyed
GW19 (mAHD)					
GW20 (mTOC)	87.18	Dry	32.80 (dry)	32.83	33.08
GW20 (mAHD)					
GW21 (mTOC)	51.29	4.19	3.34	1.65	4.27
GW21 (mAHD)					
GW22 (mTOC)	17.27	3.37	2.34	0.76	3.21
GW22 (mAHD)					
GW23 (mTOC)	39.22	16.29	15.98	15.91	15.99

Borehole reference	Top of casting RL (mAHD)	Depth of water level			
		Construction		Construction	
		Dec 14	Feb 15	Apr 2015	July 2015
GW23 (mAHD)					
GW24 (mTOC)	26.09	8.05	3.51	6.15	7.45
GW24 (mAHD)					
GW25 (mTOC)	61.72	13.04	12.30	12.32	12.55
GW25 (mAHD)					
GW26 (mTOC)	54.56	15.00	13.58	13.45	14.5
GW26 (mAHD)					
GW27 (mTOC)	74.33	28.41	27.47	27.21	28.58
GW27 (mAHD)					
GW28 (mTOC)	54.65	9.37	9.02	8.05	9.05
GW28 (mAHD)					
GW29 (mTOC)	45.11	8.49	3.39	1.33	5.73
GW29 (mAHD)					
GW30 (mTOC)	41.49	5.14	2.61	2.76	2.86
GW30 (mAHD)					

**Table 12 Cumulative construction groundwater monitoring (EC) – manual record**

Borehole reference	Electrical conductivity (uS/cm)			
	Construction		Construction	
	Dec 14	Feb 15	Apr 2015	Jul 2015
GW01	446	202	Destroyed	Destroyed
GW02	31600	16400	25700	Not taken
GW03	118	85000	57400	Not taken
GW04	450	294	356	Not taken
GW05	737	666	768	Not taken
GW06	Dry	Destroyed	Destroyed	Destroyed
GW07	Dry	20300	272	Not taken
GW08	47700	140	47900	Not taken
GW09	Dry	Dry	Insufficient water	Not taken
GW10	46300	39000	65900	Not taken
GW11	845	416	112	Not taken
GW12	399	271	273	Not taken
GW13	39100	22400	Destroyed	Destroyed
GW14	340	308	Destroyed	Destroyed
GW15	371	359	410	Not taken
GW16	Dry	Dry	Insufficient water	Not taken
GW17	Dry	Dry	415	Not taken
GW18	162	155	182	Not taken
GW19	60000	40900	83700	Not taken
GW20	Dry	Dry	Insufficient water	Not taken
GW21	100400	67100	82200	Not taken
GW22	50200	31300	33700	Not taken
GW23	54100	14300	21700	Not taken
GW24	54000	55500	62900	Not taken
GW25	158	90100	49600	Not taken

Electrical conductivity (uS/cm)				
Borehole reference	Construction		Construction	
	Dec 14	Feb 15	Apr 2015	Jul 2015
GW26	87800	84500	83100	Not taken
GW27	87200	47200	39100	Not taken
GW28	28400	Dry	22000	Not taken
GW29	26800	14100	17500	Not taken
GW30	257	39400	56900	Not taken

**Table 13 Cumulative construction groundwater monitoring (pH) – manual record**

pH				
Borehole reference	Construction		Construction	
	Dec 14	Feb 15	Apr 2015	Jul 2015
GW01	4.4	5.4	Destroyed	Destroyed
GW02	Not recorded	5.7	6.3	6.9
GW03	6.5	6.2	6.8	6.6
GW04	6.5	6.2	6.5	Destroyed
GW05	6.8	6.5	6.6	7.0
GW06	Dry	Destroyed	Destroyed	Destroyed
GW07	Dry	5.9	6.0	Dry
GW08	6.3	5.7	6.0	Insufficient water
GW09	Dry	Dry	Dry	Insufficient water
GW10	6.7	5.5	5.6	Destroyed
GW11	5.3	6.1	6.6	7.0
GW12	6.4	6.0	6.2	6.0
GW13	6.3	6.0	Destroyed	Destroyed
GW14	7.6	6.9	Destroyed	Destroyed
GW15	6.5	6.3	6.4	6.2
GW16	Dry	Dry	Dry	Dry
GW17	Dry	Dry	6.8	6.5
GW18	6.7	6.9	6.9	6.8
GW19	6.1	5.6	6.4	Destroyed
GW20	Dry	Dry	Insufficient water	Insufficient water
GW21	6.8	6.9	6.9	6.6
GW22	5.7	5.7	5.6	6.9
GW23	5.7	5.0	5.4	5.6
GW24	5.9	4.8	4.9	5.2
GW25	6.0	4.6	5.1	5.1
GW26	6.3	5.5	5.3	5.3
GW27	7.1	6.2	6.2	Insufficient water
GW28	6.2	Dry	5.3	Insufficient water
GW29	6.0	5.5	5.7	5.8
GW30	4.6	6.1	Instrument error	5.8



**Table 14 Construction groundwater monitoring (temperature) – manual record**

Borehole reference	Temperature			
	Construction		Construction	
	Dec 14	Feb 15	Apr 2015	Jul 2015
GW01	18.9	21.1	Destroyed	Destroyed
GW02	18.5	21.9	21.4	18.5
GW03	19.0	22.7	20.8	16.8
GW04	18.7	22.3	21.2	Destroyed
GW05	17.3	20.1	19.5	16.3
GW06	Dry	Destroyed	Destroyed	Destroyed
GW07	Dry	21.7	22.1	Insufficient water
GW08	20.2	21.6	20.0	Insufficient water
GW09	Dry	Dry	Insufficient water	Insufficient water
GW10	19.0	20.6	20.3	Destroyed
GW11	18.3	20.4	22.0	17.5
GW12	18.1	21.5	21.1	15.6
GW13	18.2	21.4	Destroyed	Destroyed
GW14	18.2	20.6	Destroyed	Destroyed
GW15	18.8	20.5	20.3	19.8
GW16	Dry	Dry	Insufficient water	Insufficient water
GW17	Dry	Dry	19.7	19.2
GW18	18.5	20.2	19.7	18.8
GW19	18.8	19.6	20.1	Destroyed
GW20	Dry	Dry	Insufficient water	Insufficient water
GW21	18.9	19.8	20.8	18.8
GW22	18.3	20.3	21.0	18.3
GW23	19.1	19.2	18.9	18.3
GW24	21.8	19.7	19.7	18.5
GW25	21.0	21.1	19.6	19.4
GW26	22.7	20.3	19.9	18.8
GW27	19.6	20.4	19.2	Insufficient water
GW28	21.6	Dry	19.5	18.6
GW29	18.3	19.6	20.3	Insufficient water
GW30	18.4	20.2	20.5	19.0
