Coffs Harbour City Council

Coramba Groundwater Monitoring - April 2017

Groundwater Monitoring Report

August 2017

Executive summary

GHD Pty Ltd (GHD) was engaged by Coffs Harbour City Council (CHCC) to complete a Groundwater Monitoring Event (GME) in April 2017 as part of the implementation of the Groundwater Management Plan (GMP) (GHD, 2017a) for the future management and monitoring of hydrocarbon impacted groundwater in Coramba, NSW (the site).

Groundwater sampling of 11 existing groundwater monitoring wells was undertaken and river water samples were collected from two locations in the Orara River.

With reference to the objectives in Section 1.2 and in accordance with the limitations set out in Section 9 the following summary and conclusions are made.

A comparison of the current data to the previous monitoring rounds shows an overall decrease in benzene, toluene, xylene and naphthalene (BTEXN) and total recoverable hydrocarbon (TRH) concentrations in all wells except MW14, which is near the top (source) end of the groundwater contamination plume. A comparison of the current results to the 2015 results was undertaken, with the following points of interest noted:

- In MW2 and MW20, TRH and BTEXN concentrations decreased to below the laboratory limit of reporting (LOR) compared to 2015 results, which has resulted in benzene concentrations dropping below the adopted assessment criteria.
- In MW18, benzene concentrations have reduced by an order of magnitude, but remain above the Australian Drinking Water Guidelines (ADWG) and adopted recreational criteria. Concentrations of all other contaminants of potential concern (COPC) have also decreased and remain below the adopted assessment criteria.
- In MW4B and MW11, benzene concentrations have reduced significantly (over an order of magnitude in MW4B, and by a factor of 6 in MW11), but remain above the ADWG and recreational criteria. TRH concentrations have decreased to below the adopted Netherlands (2000) criteria.
- MW9, MW10 and MW15 TRH and BTEX concentrations have remained below the LOR.
- MW6 and MW12 benzene concentrations have reduced by about a factor of 4, but remain above the ADWG and recreational criteria. Most other COPC concentrations also reduced.
- Benzene concentrations only reduced slightly in MW14, and remain above the ADWG and recreational criteria, the adopted freshwater groundwater investigation levels (GIL) and above the adopted health screening levels (HSL) for vapour intrusion.
- There have been some minor increases in toluene, ethylbenzene and/or xylene concentrations in MW6, MW11, MW12 and MW14, with xylene (m&p) in MW6 now above NEPM 2013 GILs for freshwater. In MW12, xylene (m&p) concentrations have increased to above NEPM 2013 GILs for freshwater, however xylene (o) and total xylene concentrations have decreased to below the adopted assessment criteria. All other increases are considered insignificant and have not resulted in additional exceedances of the adopted assessment criteria.
- Overall contaminant concentrations appear to have decreased in all wells, except MW14, where, due to the increase in xylene concentrations, the overall contamination status is considered stable (i.e. no significant changes from the 2015 monitoring round).

- There is strong evidence to indicate that natural attenuation of hydrocarbons is occurring at the site. Given that the contaminant concentrations at the site have decreased since 2015, it appears that natural attenuation has been occurring at the site since the air sparge unit was turned off in 2015, particularly in the lower areas of the plume. Although geochemical parameters indicate natural attenuation processes are occurring at MW14, there has not been a significant decrease in hydrocarbon concentrations at this location since 2015, suggesting there is a significant residual source of contamination in the upper area of the plume.
- Based on the results, it appears that MW9 is a suitable background location and can replace MW2 for natural attenuation monitoring in the future.
- None of the groundwater trigger levels for further assessment have been exceeded and groundwater monitoring in the future should occur in accordance with the GMP.
- No odours were noted or reported that trigger implementation of contingency measures outlined in the Odour Management Plan (GHD 2017b).
- Contaminant concentrations in river water samples were below the LOR at both locations, which is consistent with previous monitoring rounds. This indicates that the impacted groundwater is not causing significant impacts in the Orara River. Risks to ecological and recreational receptors in the river, from the hydrocarbon plume are considered to be low.
- Potentially complete Source – pathway – receptor linkages remain present at the site for volatilisation to indoor air, direct contact with groundwater and lateral migration to ecological and recreational receptors in the riparian zone of the Orara River.

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1. Introduction

GHD Pty Ltd (GHD) was engaged by Coffs Harbour City Council (CHCC) to complete a Groundwater Monitoring Event (GME) in April 2017 as part of the implementation of the Groundwater Management Plan (GMP) (GHD, 2017a) for the future management and monitoring of hydrocarbon impacted groundwater in Coramba, NSW (the site). The location of the site is shown on Figure 1, Appendix A.

1.1 Background

In 2002, hydrocarbon contaminated groundwater was discovered seeping into a backwater adjacent to the Orara River, Coramba, NSW. The source of the hydrocarbon contaminated groundwater was identified as an unleaded petrol leak from an underground storage tank (UST) at a nearby service station, located approximately 150 m up gradient of the Orara River. The leaking tank and contaminated soil were removed and managed in accordance with guidelines and legislative requirements that were relevant at the time.

A total of 24 groundwater wells (including two (MW1 and MW19) which could not be located in preparation of the GMP and do not form part of the monitoring program) comprise the existing monitoring network installed down gradient of the Service Station to the Orara River to assess the extent of the hydrocarbon plume. Figure 2, Appendix A shows the location of all groundwater monitoring wells at the site.

Further management of the contamination at the site was undertaken in 2011 with the installation of a soil vapour extraction system and air sparging treatment system. This infrastructure operated sporadically from 2011 and then continuously for over 18 months from July 2013 to reduce the hydrocarbon impact.

The air sparging remediation system was turned off in March 2015, with groundwater monitoring events undertaken just before it was turned off and 3 months after it had been turned off. Results of the 2015 (WSP, 2015) monitoring indicated that the overall groundwater contamination appears to be decreasing or stabilising, however select wells still contained benzene, toluene, ethylbenzene, xylene (BTEX) and total recoverable hydrocarbon (TRH) concentrations above the adopted groundwater assessment criteria. Recent monitoring indicates that fluctuating contaminant levels may be due to climatic events such as high rainfall.

No groundwater monitoring events have been undertaken since June 2015, up to the time of this GME.

The Service Station is reportedly being monitored in accordance with the requirements of the Protection of the Environment (Underground Petroleum Storage Systems) Regulation 2014 and associated guidelines.

A GMP (GHD 2017a) was developed to outline future management and monitoring of the hydrocarbon impacted groundwater at the site, including:

- Groundwater sampling of existing groundwater monitoring wells and river water sampling from the Orara River.
- Odour management – Identification of odour management measures in the event that odour complaints or issues are identified at the site.
- Rebound assessment – Determining the trigger points to recommence the use of the existing air sparge system.

- Exit strategy – Developing an exit strategy for the monitoring program based on a stabilised or decreasing trend in hydrocarbon impact at the site.

1.2 Objectives

The objective of the GME was to monitor groundwater and river water quality at the site in accordance with the GMP (GHD 2017a) to assess whether:

- Groundwater in the area has been remediated to sufficient extent that it does not pose any unacceptable risks for ongoing commercial, residential and recreational land use or to recreational users or ecosystems in the Orara River.
- Contaminant concentrations in groundwater and surface water are stable or declining.
- Natural attenuation processes are further reducing the contamination to ultimately restore groundwater quality to its natural background condition.
- Contaminant concentrations or trends trigger recommencement of the operation of the air sparge system.

1.3 Scope of work

In order to meet this objective, the following scope of work was completed in April 2017:

- Groundwater sampling of 11 existing groundwater monitoring wells.
- River water sampling from two locations in the Orara River.
- Laboratory analysis of samples for contaminants of potential concern (COPC) including:
  - TRH and BTEXN
  - Monitored natural attenuation parameters
- Preparation of this GME report.

2. Site information

2.1 Location details

The site is located in Coramba, approximately 12 km north-west of Coffs Harbour on the Mid North Coast of NSW as shown on Figure 1 Appendix A. The service station where the leak occurred is located at 33 Gale Street on Lot 2, DP 264343 and the river bank where the hydrocarbon leak was first observed is located on Lot 122 DP 876790 (Council owned reserve at the end of Martin Street) as shown on Figure 2, Appendix A. The contaminated groundwater extends beneath multiple properties between these two points, including Martin St Road Reserve. The locations of the 24 monitoring wells are presented in Figure 2, Appendix A. The air sparge treatment system is located on Martin Street on Lot 121 DP 876790. The 'site' refers to the area impacted or formerly impacted by the hydrocarbon contamination from the service station to the Orara River, including all 24 previously installed monitoring wells and the air sparge unit.

The site location and further site details are provided in Table 2-1.

Table 2-1 Site identification

Local Government Area	Coffs Harbour City Council (Council)
Current Land Use	Residential and Recreational along the Orara River
Proposed future land use	Residential and Recreational
Local Land Use Zoning based on Coffs Harbour Local Environmental Plan (LEP) 2013	Zone R2 – Low Density Residential
Objectives of Zone	• *To provide for the housing needs of the community within a low density residential environment.* • *To enable other land uses that provide facilities or services to meet the day to day needs of residents.*

2.2 Environmental setting

Table 2-2 provides an overview of the environmental setting of the site obtained from a desktop review of publically available information, including previous site reports and the following information sources:

- 1:250,000 scale Regional Geology Sheet for the Coffs Harbour area
- NSW Land & Property Information, *SIX Maps* (http://maps.six.nsw.gov.au/), accessed 14 October 2016
- Department of Primary Industries Office of Water database (http://allwaterdata.water.nsw.gov.au/water.stm), accessed 14 October 2016

Table 2-2 Summary of site conditions

Section	Summary
Geology and soils	The site is underlain primarily by the Carboniferous aged Coramba beds, comprising siliceous argillite. Granodiorite forms the bedrock in a small portion of the northern part of the site. Soils at the site consist of alluvial sediments comprising gravelly river sediments close to the Orara River and sandy silty sediments further up the bank.
Topography	The site slopes down to the Orara River with an elevation ranging from approximately 80 metres Australia Height Datum (AHD) at the Orara River to 120 m AHD at Gale Street, where the service station is located.
Hydrology	The nearest surface water receptor (ecological) is the Orara River, which forms the north eastern boundary of the investigations to date. The Orara River is a tributary of the Clarence River. Runoff from the site would flow in a north westerly direction towards the Orara River.
Hydrogeology	There are 24 groundwater monitoring wells located at the site, for the purposes of assessing the impact of the contaminated groundwater, which is the focus of this report. An off-site well is located approximately 300 m north west of the site and is used for domestic purposes.

2.3 Surrounding land use

Current land uses immediately surrounding the site are detailed in Table 2-3, listed in order of proximity to the site and shown in Figure 2, Appendix A.

Table 2-3 Surrounding land use

Direction	Land use
North	The Orara River is located immediately north of the site, beyond which a railway and rural residential properties are located.
East	Martin Street is located on the eastern portion of the site, followed by residential properties and the Orara River.
South	Residential properties off Gale Street are located to the south of the site, beyond which rural land is located.
West	Residential properties and commercial businesses are located to the west of the site.

2.4 Surrounding sensitive receptors

A CSM is provided in Section 7. The following potentially sensitive receptors were identified in the vicinity of the site:

- Ecological receptors and recreational users of the Orara River
- Groundwater beneath the Site and users of groundwater in the surrounding area
- Residences (on-site and off-site)
- Workers (on-site and off-site), including those working on nearby underground services and utilities and intrusive maintenance workers
- Visitors to the site

3. Groundwater monitoring event

3.1 Data quality objectives

The Data Quality Objective (DQO) process was applied to the investigation as described below, to ensure that data collection activities were appropriate and achieved the stated objectives.

A process for establishing data quality objectives for an investigation site has been defined by the *National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended by the *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)*, herein referred to as the NEPM and the Guidelines for the NSW Site Auditor System (NSW DEC 2006).

The DQO process involves seven steps as described and addressed in Table 3-1.

Table 3-1 Data quality objectives

Step 1: State the problem
The 'problem' as it stands is that residual groundwater contamination associated with a fuel leak from a UST exceeds appropriate guidelines in a number of wells across the site, and has the potential to adversely impact upon human and environmental receptors.
Step 2: Identify the decision
The primary decisions are as follows: • Has groundwater in the area been remediated to sufficient extent that it does not pose any unacceptable risks for ongoing commercial, residential and recreational land use or to recreational users or ecosystems in the Orara River? • Are contaminant concentrations in groundwater and surface water stable or declining? • Are natural attenuation processes further reducing the contamination to ultimately restore groundwater quality to its natural background condition? • Do contaminant concentrations or trends trigger recommencement of the operation of the air sparge system?
Step 3: Identify inputs to the decision
Data input to the decision making process included: • Information gained via the review of previous investigations. • Quantitative data gained via groundwater sampling and analytical works (Section 5). • Adopted assessment criteria (Section 3.4). The sampling program was designed to provide sufficient information to allow a sound scientific and statistical evaluation of the questions set out in Step 2. This was to be achieved by: • Collection of groundwater and surface water samples to provide sufficient site coverage and statistically valid data sets upon which to base subsequent decisions. • Comparing the analytical data to applicable guidelines and comparing the results against previous monitoring rounds.

Step 4: Define the study boundaries

With respect to physical boundaries, the lateral boundaries of the investigation area are defined as the 'site' as discussed in Section 2.1 and shown on Figures 1 and 2, Appendix A.

The vertical boundary will be the depth of existing groundwater monitoring wells.

Step 5: Develop a decision rule

Field and laboratory quality assurance/quality control (QA/QC) procedures were utilised throughout the sampling programme and all sampling work was carried out in accordance with appropriate Standard Field Operating Procedures, which are based on relevant guidelines and current industry practices. QA/QC results were compared to nominal acceptance limits (as outlined in Section 3.4) and project analytical data was compared to relevant guidelines made or endorsed by the NSW EPA (as outlined in Section 3.4).

Step 6: Specify limits on decision errors

Two types of decision errors were possible:

- The groundwater is considered 'uncontaminated' when in fact it is contaminated.
- The groundwater is considered 'contaminated' when in fact it is not contaminated.

The implications of the first decision error are considered less acceptable than the second, as the first error could involve unacceptable risk to health and/or the environment, and potentially future costs including possible litigation if the site is found to be unsuitable in the future. The risks associated with the second error are primarily limited to unwarranted remediation costs.

The limits on the first decision error are therefore addressed by use of conservative investigation criteria (which incorporate a factor of safety) and by further assessing any data exceeding these criteria.

The risk of the second decision error occurring was minimised by reducing the potential for unrepresentative data which could arise from the following causes:

- Sampling errors which occur when the sampling program does not adequately detect the variability of a contaminant from point to point across the site, (i.e. the samples collected are not representative of the site conditions).
- Measurement errors which occur during sample collection, handling preparation, analysis and data reduction.

To minimise the potential for unrepresentative data, Data Quality Indicators (DQIs) were evaluated including completeness, comparability, representativeness, precision and accuracy. These are discussed in Section 3.4.

Step 7: Optimise the design for obtaining data

The sampling program (Section 3.3) was designed to provide sufficient information to allow a sound scientific and statistical evaluation of the questions set out in Step 2, taking into account data from previous investigations undertaken at the site. Works were completed in accordance with NSW EPA guidelines and accepted industry standards. To optimise the design of the investigations a sampling and analytical program was prepared to specifically target information required to meet the project objectives.

3.2 Methodology

3.2.1 Groundwater elevation gauging

Immediately upon opening each monitoring well, a photo-ionisation detector (PID) was used to assess for the presence of volatile organic compounds (VOC) in the air contained within the well.

The depth of the standing water level was measured at each of the monitoring wells using an interface probe, along with the total well depth and presence (including thickness) or absence of phase separated hydrocarbons (PSH). All measurements were recorded from the top of casing (TOC).

3.2.2 Groundwater sampling

Groundwater samples were collected using a low flow peristaltic pump with the exception of one monitoring well (MW14) which was sampled with a disposal bailer due to limitations of the suction capacity of the peristaltic pump, when drawing water from a greater depth (than the other wells) in that location. Using a bailer for the sampling of MW14 represents a deviation from the proposed methodology presented in the GMP (GHD 2017a) which states that '*groundwater samples are to be collected using a low flow micropurge sampler*'. Previous sampling rounds at MW14 were also completed with a micro-purge pump under low flow conditions. In general, the use of low-flow submersible pumps or positive-displacement pumps capable of controlling flow rates and minimising purging requirements are the preferred methods of groundwater sampling for site characterisation purposes. Peristaltic and micropurge pumps are considered to be comparable in this regard. Purging and sampling methods using bailers or high speed pumps are not recommended due to the difficulty of obtaining a representative groundwater sample. These methods may result in degassing of samples and can also introduce high levels of turbidity (NEPC 2013). Given the relatively high concentrations of COPC in MW14 (as discussed in Section 5.2), it is considered the data gained from the two methods (low flow and bailer) would be comparable enough to meet the objectives of this assessment; however, any future sampling rounds under the GMP are to be completed using the same (micropurge) methods prescribed in the GMP in order to obtain repeatable and comparable results.

Groundwater field parameters (pH, electrical conductivity, temperature, dissolved oxygen and redox) were measured continuously during purging using a flow cell attached to the pump to ensure representative samples were collected. The intake of the pump was set at the approximate mid-level of the screen. Samples were collected once field parameters had stabilised (within 10% of each other). Visual or olfactory observations were recorded, in particular the absence or presence of a hydrocarbon sheen or odour. River samples were collected with a clean unpreserved container and extension pole.

Collected groundwater and river water samples were immediately transferred to sample containers of appropriate composition, which are pre-treated in a manner appropriate for the laboratory analysis. Sample bottles were filled directly from the pump or dedicated bailer (for MW14 only) with a minimal amount of air contact and vials for volatile organic analysis were filled to be free from headspace. All sample containers were clearly labelled with a sample number, sample location and sample date with waterproof indelible ink. The sample containers were transferred to a cooler chilled with ice for sample preservation prior to and during shipment to the testing laboratory. A chain-of-custody form was completed, and forwarded with the samples to the testing laboratory within holding times appropriate to the analysis required. Dedicated sampling equipment (i.e. tubing, bailers, filters etc.) was disposed of after each well was sampled, with other sampling equipment (i.e. the peristaltic pump head) decontaminated using a mixture of Decon Neutracon solution and potable water and then rinsed with potable tap water between each well location.

All samples were analysed at a National Association of Testing Authorities (NATA) registered laboratory (Eurofins MGT).

3.3 Sampling and analysis program

Based on the groundwater information available to date, the remediation goals and the objective of assessing whether groundwater treatment should continue, monitoring locations were selected as outlined and justified in the Coramba GMP (GHD, 2017). The sampling and analysis program (SAQP) used during this investigation was consistent with the GMP with the exception of the collection of inter-laboratory duplicates which were omitted by the field staff. The overall frequency of duplicate samples did; however meet the requirements of the GMP. The SAQP is summarised in Table 3-2

Table 3-2 Sampling and analysis program

Location	Analytes	Basis of Monitoring
MW14	F/T/M	Source zone monitoring well.
MW18	F/T	Mid zone, edge of plume. Consider sampling MW22 and MW24 as a contingency if MW18 shows a consistent increase.
MW6	F/T/M	Mid zone, plume centre.
MW4B	F/T	Mid zone, plume centre.
MW12	F/T	Lower zone bedrock well, fluctuating and still fairly high concentrations.
MW15	F/T	Close proximity to treatment system and still fluctuating.
MW2	F/T/M	Dry June 2015. One round to confirm decrease and compare MNA with MW9, reinstate if MW15 increases.
MW9	F/T/M	New MNA well – best 'background' location available.
MW11	F/T/M	Discharge zone alluvial well with highest impact, continued MNA monitoring point.
MW20	F/T	Proximity to treatment system. Do one last round in wet weather, cease if concentrations still low (discharge zone covered by MW10 and MW11). Reinstate if there is an increase in upgradient wells (MW15, MW4B).
MW10	F/T	Discharge zone alluvial well.
River 1	F/T	Site A – upstream of footbridge – up gradient so if there is impact, it can be determined whether it was due to plume.
River 2	F/T	Site B – outside bund (sample site in backwater of river adjacent to problem area) – point of most likely impact to receptor(s). (Due diligence point).
Intra lab duplicates	T	The SAQP in the GMP calls for analysis of 5% intra lab duplicates and 5% inter lab duplicates to be analysed for the same analytes as their primary sample. During this round GHD did not collect any inter lab duplicates but collected intra lab duplicates at a rate of 15%.
Inter lab duplicates	T	
Rinsates	T	One per day of sampling.
Trip blanks	T	One per monitoring program.
Trip spikes	T	One per monitoring program.

F is field parameters (SWL, well depth, PSH thickness, temp, DO, Redox, pH, EC)
T is TRH/BTEXN
M is the MNA suite (Natural attenuation indicators - nitrate, sulfate, ferrous iron, methane; major anions and cations, with hardness and alkalinity, ion balance; and manganese)

3.4 Quality assurance/quality control

3.4.1 Overview

QA/QC practices were applied to all stages of data gathering and subsequent sample handling procedures and were designed to provide control over both field and laboratory operations. Additionally, the analytical laboratory completed their own internal QA procedures, as required by NATA registration, during the analysis of samples.

Results of the QA/QC program were used to determine if the data met the objectives of the study and are acceptable for the intended use.

3.4.2 QA/QC procedures

All fieldwork was conducted in general accordance with GHD's Standard Field Operating Procedure to ensure that all environmental samples were collected by a set of uniform and systematic methods as required by the QA system.

The Data Quality Objectives (DQI) for sampling techniques and laboratory analysis of collected samples were based on those listed in Appendix V of the NSW EPA Auditor Guidelines (DEC 2006). Step 5 and Step 6 of the DQOs were assessed by reference to data quality indicators as follows:

- **Data representativeness** - expresses the degree which sample data accurately and precisely represents a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples in an appropriate pattern across the site, and by using an adequate number of sample locations to characterise the site. Consistent and repeatable sampling techniques and methods are utilised throughout the sampling.
- **Completeness** - defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study. If there is insufficient valid data, then additional data are required to be collected.
- **Comparability** - is a qualitative parameter expressing the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to collect samples and ensuring analysing laboratories use consistent analysis techniques and reporting methods.
- **Precision** - measures the reproducibility of measurements under a given set of conditions. The precision of the data is assessed by calculating the Relative Percent Difference (RPD) between duplicate sample pairs.

$$RPD(\%) = \frac{|C_o - C_d|}{C_o + C_d} \times 200$$

Where Co = Analyte concentration of the original sample

Cd = Analyte concentration of the duplicate sample

GHD adopted the nominal acceptance criteria of 50% RPD; however, it is noted that this will not always be achieved, particularly in heterogeneous soil or fill materials, or at low analyte concentrations (concentrations less than 10 times the LOR will not be assessed against the acceptance criteria).

- **Accuracy** - measures the bias in a measurement system. Accuracy can be undermined by such factors as field contamination of samples, poor preservation of samples, poor sample preparation techniques and poor selection of analysis techniques by the analysing laboratory. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes, laboratory blanks and analyses against reference standards. The nominal “acceptance limits” on laboratory control samples are defined as follows:
  - Laboratory spikes – recovery 70-130 % for metals/inorganics, 60-140 % for organics.
  - Laboratory duplicates – RPD <30 % for metals/inorganics, <50 % for organics.
  - Laboratory blanks - <practical quantitation limit.

  The testing laboratory conduct an assessment of the laboratory QC program, internally; however, the results were also independently reviewed and assessed by GHD.

The laboratory quality control procedures included analysis of method blanks, laboratory duplicate samples, laboratory control samples, matrix spike samples and surrogates.

4. Assessment criteria

The overarching reference to be used in this assessment is the NEPM (NEPC, 2013), and the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC 2000). The NEPM and the ANZECC guidelines contain investigation and screening levels suitable for the assessment of CoPC in groundwater and surface water at the site.

For the purpose of the ongoing monitoring and assessment, groundwater and surface water analytical results will be compared against investigation levels appropriate for a residential and a recreational land use setting as the impacted groundwater is located beneath residential properties and in a public reserve.

NEPM Health Screening Limits (HSL) are based on specific assumptions, and similarly aquatic toxicity for TRH would be based on the constituents. Therefore while TRH criteria have been nominated for initial comparative purposes in this assessment, if they are exceeded, analysis of constituent parameters may be required, and specific assessment against criteria for those parameters. Although restrictions have been placed on the use of groundwater for domestic purposes at the site, potential contact may result from groundwater used in sprinklers, wading pools etc. The criteria may be used to assess whether restrictions may be lifted at the completion of the monitoring program.

Groundwater investigation levels (GILs) and the corresponding ANZECC (2000) trigger values for freshwater were deemed applicable due to the Orara River adjoining the site.

Criteria from the *Ministry of Housing (Netherlands), Spatial Planning and the Environment* (2000) was used for the assessment of TRH C10-C36 given the lack of other criteria.

The Orara River is used for recreation including swimming. The Australian Drinking Water Guidelines (NHMRC 2011, version 3.1, as updated March 2015) refers to NHMRC (2008) *Guidelines for Managing Risks in Recreational Water*. These guidelines were developed to protect human health during recreational activities such as swimming and boating, and to preserve the aesthetic appeal of water bodies. The criteria in NHMRC (2008) are based on a simple screening approach in which a substance occurring in recreational water at a concentration of 10 times that stipulated in the drinking water guidelines may merit further consideration.

The groundwater assessment criteria adopted for this project are summarised in Section 4.1, 4.2 and presented in the results tables in Appendix C.

4.1 Human health

The NEPM (and related CRC CARE documents referenced in the NEPM) includes groundwater HSLs for residential and recreational landuse and GILs for drinking water as presented in Table 4-1.

Table 4-1 Groundwater health screening and investigation levels referenced

Title	Level	Abbr.	Reference	Use
Groundwater HSLs for vapour intrusion	Residential Recreational/ open space	HSL A/B HSL C	NEPM Schedule B1 Table 1A(4)	Assessment of petroleum hydrocarbon concentrations in on-site groundwater. Sand criteria used due to on-site soil conditions. Conservative depth of 2 m to <4 m used.
Groundwater GILs (Groundwater investigation levels)	Drinking water	Drinking water GIL	NEPM Schedule B1 Table 1C	For comparison purpose only, in the case of groundwater extraction for potential potable use. Assessment of petroleum hydrocarbons in groundwater.
NHMRC Australian Drinking Water Guidelines	Drinking Water	NHMRC Drinking Water	ADWG 2011 Table 10.5	For comparison purpose only, in the case of groundwater extraction for potential potable use. Assessment of petroleum hydrocarbons in groundwater
NHMRC Australian Drinking Water Guidelines	Recreational Water	NHMRC Recreational Water		Assessment of BTEX in regard to recreational use of the Orara River.
*Ministry of Housing (**Netherlands**), Spatial Planning and the Environment* (2000)				Initial screening/comparative assessment of TRH C10-C36 given the lack of other criteria

4.2 Ecological

GILs are provided in the NEPM for assessing ecological risk from direct contact with groundwater. The nearest receiving water ecosystem is the Orara River which forms the northern boundary of the site. The Orara River is considered to be a slightly-moderately disturbed system (to which the GILs apply) and is expected to be fresh water. The ANZECC guidelines provide 95% protection levels for freshwater species.

The NEPM and ANZECC (2000) include GILs and 95% freshwater guidelines for ecological protection as referenced in Table 4-2.

Table 4-2 Ecological groundwater investigation levels referenced

Title	Level	Abbr.	Reference	Use
Groundwater GILs (Groundwater investigation levels)	Fresh Waters	Fresh Waters GIL	NEPM Schedule B1 Table 1C	Assessment of petroleum hydrocarbons in groundwater, for potential receiving environment of the Orara River.
ANZECC 95% protection levels for freshwater	Fresh Waters	95% FW	ANZECC Table 3.4.1, Table 8.3.14 (Low reliability guidelines for BTEX)	Assessment of petroleum hydrocarbons in groundwater, for potential receiving environment of the Orara River.

4.3 Groundwater trigger levels for further assessment

This GME forms part of a larger two-year monitoring program as outlined in the GMP (which may be revised as ongoing monitoring proceeds).

In the GMP, trigger values were set for notification, further monitoring and assessment and revision of the GMP, which may include recommencement of groundwater treatment. The trigger values and rationale are presented in Table 4-3.

Review of the GMP may include consideration and review of the nature and frequency of site monitoring and locations, and shall be undertaken on completion of each monitoring round to ensure that the monitoring program remains representative. The review is to be undertaken by CHCC (or its technical representative) in conjunction with the NSW Environment Protection Authority (EPA). At this time, a period shall be set for further monitoring, review or additional investigations if required, or agreement that no further monitoring is necessary. The review should involve consultation with relevant interested parties, such as adjoining landowners, CHCC and other government agencies as required.

Table 4-3 Groundwater trigger levels for further assessment

Groundwater /surface water parameter	Trigger for further monitoring	Management Actions	Trigger for revision of the GMP
TRH (C6-C9), BTEX, PAH, phenol	>50% increase from previous event, if above assessment criteria. 20% increase over two annual sampling rounds, if above assessment criteria.	Notification to CHCC and EPA. Re-sampling (with CHCC approval) and assessment. Assess if plume is expanding overall or in localised areas.	If re-sampling confirms rising concentrations.
PSH	Appearance of PSH in well (greater than 2 mm thick). PSH noted at discharge point near Orara River.	Notification to CHCC and EPA. Re-sampling (with CHCC approval) and assessment. Removal of PSH (bailer and other extraction as practical given recoverability). Council and EPA Notification required.	If PSH is identified in 2 consecutive monitoring events within the same well.

Groundwater /surface water parameter	Trigger for further monitoring	Management Actions	Trigger for revision of the GMP
MNA	Evidence that biodegradation has ceased or is occurring at a notably reduced rate.	Notification to CHCC and EPA. Re-sampling (with CHCC approval) and assessment.	If biodegradation has ceased or is occurring at a notably reduced rate in two consecutive monitoring events.
Surface water (river) sample parameters	Exceedance of assessment criteria.	Notification to CHCC and EPA and additional monitoring, reassessment/ resampling and investigation.	If re-sampling confirms rising concentrations.
Non-sampling parameters	NA	NA	Changes to consent or licence conditions. Any significant incident at the site.

5. Results

5.1 Field observations

Photographs taken during the sampling are presented in Appendix B. Field observations are presented in gauging sheets in Appendix E and in Table 2, Appendix C.

Standing water levels (SWL) during sampling were recorded from 12.54 m below top of casing (m bTOC) at MW14 (close to the BP service station) to 0.76 m bTOC at MW10 (close to the Orara River). Standing water levels recorded during this sampling round were 0.4 to 1.7 m higher than the average SWL recorded for each well. SWLs were also higher in this sampling round than recorded during the 2015 sampling for all monitoring wells with the exception of MW14, where an anomalously high SWL was recorded in 2015. The elevated SWLs reflects high rainfall received in during period preceding the sampling (920 mm recorded during January to March as opposed to an average of 640 mm and 650 mm received during March as opposed to an average of 230 mm).

A moderate odour and light sheen was noted in MW14 and a low odour was noted in MW12. These results corresponded with elevated PID readings from the monitoring well headspace of 314 ppm in MW14 and 376 ppm in MW12.

No PSH was observed in any of the wells sampled by GHD during this GME.

No odours were noted onsite during sampling (excluding those in the water sampled from MW12 and MW14) and no odour complaints were reported to GHD. Accordingly, no contingency measures outlined in the Odour Management Plan (GHD 2017b) require implementation.

5.2 Analytical results

5.2.1 Groundwater field parameters

Groundwater field parameters are presented in gauging sheets in Appendix E and in Table 2, Appendix C. Key observations of groundwater field parameters following purging are summarised as follows:

- pH ranged from 4.7 (MW2) to 6.5 (MW11)
- Electrical Conductivity (EC) ranged from 88 μS/cm (MW10) to 335 μS/cm (MW11)
- Dissolved oxygen ranged from 0.5 ppm (MW11) to 3.7 ppm (MW15)
- Redox ranged from -209 mV (MW11) to 341 mV (MW2)

5.2.2 Groundwater COPC

Groundwater analytical results for the COPC are provided in Appendix D and summarised in Table 1, Appendix C. A summary of the results include:

- The groundwater samples analysed from MW2, MW9, MW10, MW15 and MW20 reported concentrations of COPC below the adopted assessment criteria for all analytes, and below the laboratory reporting limit (LOR) for all COPC.

- Samples from MW4B, MW6 (and DUP2), MW11, MW12 (and DUP1) and MW18 reported benzene concentrations above drinking water guidelines (NEPM 2013, NHMRC 2011) and recreational guidelines (NHMRC 2008). In MW6 (and/or DUP2) and MW12 (and/or DUP1), ethylbenzene, xylene (m&p) and naphthalene concentrations also exceeded ANZECC 2000 guidelines for 95% protection of freshwater species, TRH F1 (C_6-C_9 minus BTEX) concentrations exceeded NEPM 2013 HSL A/B and TRH C_{10}-C_{36} concentrations exceeded the Netherlands (2000) criteria.
- Samples analysed from MW14 reported elevated TRH and BTEXN concentrations with exceedances above the adopted assessment criteria as follows:
  - Benzene, toluene, ethylbenzene and xylene total concentrations exceeded drinking water guidelines (NEPM 2013, NHMRC 2011) and freshwater species protection guidelines (ANZECC 2000 and NEPM 2013 GILs).
  - Benzene concentrations also exceeded recreational guidelines (NHMRC 2008) and human health guidelines (NEPM 2013 HSL A/B).
  - Total xylene concentrations also exceeded recreational guidelines (NHMRC 2008).
  - Naphthalene concentrations exceeded ANZECC 2000 guidelines for 95% protection of freshwater species.
  - TRH F1 (C_6-C_9 minus BTEX) and TRH F2 (C_{10}-C_{16} minus naphthalene) concentrations exceeded NEPM 2013 HSL A/B.
  - TRH C_{10}-C_{36} concentrations exceeded the Netherlands (2000) guidelines.

5.2.3 River water COPC

River water analytical results for the COPC are provided in Appendix D and summarised in Table 1, Appendix C. In summary, the groundwater samples analysed from River1 and River2 reported concentrations of COPC below the LOR and below the adopted assessment criteria for all analytes.

5.2.4 Natural attenuation parameters

The MNA suite was analysed in five groundwater wells based on locations within the plume (MW6, MW11 and MW14) from a high contaminant concentration well at the source (MW14) through to a low contaminant concentration well near the Orara River (MW11) as well as background wells (MW2 and MW9).

Methane, ferrous iron and manganese concentrations were elevated in MW14, MW11 and MW6, where elevated concentrations of TRH and BTEXN were also reported. Methane and ferrous iron concentrations were below the LOR and manganese concentrations were very low in MW2 and MW9, where TRH and BTEXN were also reported below the LOR.

Nitrate-N concentrations were below the laboratory LOR in all locations except MW2, and sulphate-S concentrations were below the LOR at MW2, MW11 and MW14.

Further discussion on the results of the natural attenuation analysis is presented in Section 6.2.

5.2.5 QA/QC results

Field program

All fieldwork was carried out in accordance with the QA/QC requirements provided in Section 3.4.2 with the exception of the sampling method used at MW14 and the collection of inter-laboratory duplicate samples.

As discussed in Section 3.2.2, MW14 was sampled with a disposal bailer due to limitations of the suction capacity of the peristaltic pump available onsite, when drawing water from a greater depth (than the other wells) in that location. Using a bailer for the sampling of MW14 represents a deviation from the proposed methodology presented in the GMP (GHD 2017a) which states that '*groundwater samples are to be collected using a low flow micropurge sampler*'. Given COPC concentrations in MW14 gained during this assessment were relatively consistent with concentration trends noted in previous monitoring rounds, it is considered the data gained from the two methods (low flow and bailer) would be comparable enough to meet the objectives of this assessment. Any future sampling rounds under the GMP are to be completed using the same (micropurge) methods prescribed in the GMP, in order to obtain repeatable and comparable results.

The field QC duplicate results are presented in Table 4, Appendix C.

Two groundwater intra-laboratory duplicates were analysed as part of the sampling program:

- MW12 and DUP1
- MW6 and DUP2

Assessment of field QC duplicate samples was undertaken by calculating the RPD of the duplicate sample pair and comparing against the nominated acceptance criteria. The duplicate samples were analysed for the same parameters as the primary samples. The analyte concentration RPD results were within the acceptable range, with the exception of the outliers presented in Table 5-1.

Table 5-1 RPD exceedances

Sample ID	Sample type	Analyte	RPD	Higher sample
MW12 and DUP1	Intra lab	Toluene	60%	DUP1
MW12 and DUP1	Intra lab	Xylene (o)	96%	DUP1
MW12 and DUP1	Intra lab	Naphthalene	143%	DUP1
MW6 and DUP2	Intra lab	TPH C_{10}-C_{14}	55%	DUP2
MW6 and DUP2	Intra lab	Toluene	56%	MW6
MW6 and DUP2	Intra lab	Xylene (o)	91%	MW6
MW6 and DUP2	Intra lab	Naphthalene	143%	DUP2

Elevated RPDs are attributable to low concentrations of these analytes in these particular samples (primary and duplicates), where a relatively small absolute difference results in a large RPD. As the particular analytes for which the RPD threshold was exceeded do not govern the risk to receptors, the discrepancy is not expected to materially affect the outcome of the assessment.

While the overall frequency of duplicate samples was in accordance with the GMP, the lack of interlaboratory duplicates precludes assessment of potential interlaboratory bias; although the accuracy of the project laboratory can still be assessed on the basis of the laboratory's internal quality control measures (e.g. surrogates and laboratory control spikes). The inclusion of inter-laboratory duplicate samples in the SAQP (as discussed in Section 3.3) would have provided additional data to assess the significance of elevated RPDs noted for some analytes in the intra-laboratory duplicates. Additional groundwater monitoring events are to include inter-laboratory duplicates as per the requirements of the GMP (GHD 2017).

Two trip blanks (TB01 and TB02) were analysed as part of the groundwater investigations with TRH and BTEXN concentrations reported below the LOR indicating that no contamination was introduced during the transport and storage of samples from the time of sampling to the time of analysis. Two trip spikes (TS01 and TS02) were analysed as part of the groundwater investigations with results compared to a control sample. All recoveries were within the acceptable range of 70%-130% indicating that no significant loss of volatile contaminants occurred during the transport and storage of samples from the time of sampling to the time of analysis. Results are presented in Table 5, Appendix C.

Two rinsate blanks (Rinsate1 and Rinsate2) were collected and analysed as part of the groundwater investigations. The rinsate blanks did not report any detection of TRH and BTEXN. Therefore the risk of cross contamination during the groundwater sampling was considered to be low. Results are presented in Table 5, Appendix C.

Laboratory program

Laboratory QA/QC documentation is presented in Appendix D.

The NATA certified laboratory QA/QC sheets refer to a quality control program comprising the analysis of spikes, method blanks, surrogates, holding times and duplicate samples.

No QA/QC non-compliances were noted in the laboratory report, however it was noted that the LORs for MW11 were raised due to the high concentration of one or more analytes.

QA/QC summary

Noting the deviations from the SAQP and QA/QC program provided in the GMP (GHD 2017a), including the sampling method used at MW14 and omission of inter-laboratory duplicates and variance noted in intra-laboratory duplicate analyte concentrations, the data is considered to be valid and of sufficient quality to meet the data quality objectives for this assessment.

6. Discussion

6.1 Contamination status

6.1.1 Groundwater

In the following discussion, comparison of petroleum hydrocarbon results refers to the NEPM 1999 TRH fractions (as opposed to the NEPM 2013 fractions), to enable comparison with the data reported in historic reports. Table 2, Appendix C shows a comparison of current results to historic results, Table 6-1 shows contaminant trends from 2015 to 2017 and Figure 6-1 presents historical benzene trends for the wells GHD sampled in this GME.

A comparison of the current data to the previous monitoring rounds shows an overall decrease in BTEXN and TRH concentrations in all wells. A comparison of the current results to the 2015 results was undertaken, with the following points observed:

- In MW2 and MW20, TRH and BTEXN concentrations decreased to below the laboratory LOR compared to 2015 results, which has resulted in benzene concentrations dropping below the adopted assessment criteria.
- In MW18, benzene concentrations have reduced by an order of magnitude, but remain above the ADWG and recreational criteria. Concentrations of all other COPC have also decreased and remain below the adopted assessment criteria.
- In MW4B and MW11, benzene concentrations have reduced significantly (over an order of magnitude in MW4B, and by a factor of 6 in MW11), but remain above the ADWG and recreational criteria. TRH concentrations have decreased to below the adopted Netherlands (2000) criteria.
- MW9, MW10 and MW15 TRH and BTEX concentrations have remained below the LOR.
- MW6 and MW12 benzene concentrations have reduced by about a factor of 4, but remain above the ADWG and recreational criteria. Most other COPC concentrations also reduced.
- Benzene concentrations only reduced slightly in MW14, and remain above the ADWG and recreational criteria, the freshwater GILs and above the HSL A/B.
- There have been some minor increases in toluene, ethylbenzene and/or xylene concentrations in MW6, MW11, MW12 and MW14, with xylene (m&p) in MW6 reported above the NEPM 2013 GILs for freshwater during the current monitoring round. In MW12, xylene (m&p) concentrations have increased to above NEPM 2013 GILs for freshwater, however xylene (o) and total xylene concentrations have decreased to below the adopted assessment criteria. All other increases are considered insignificant and have not resulted in additional exceedances of the adopted assessment criteria.
- Overall contaminant concentrations appear to have decreased in all wells, except MW14, where, due to the increase in xylene concentrations, the overall contamination status is considered stable (i.e. no significant changes from the 2015 monitoring round).
- The influence of SWLs in each monitoring well being higher than average (as discussed in Section 5.1) is uncertain; however, it possible that concentrations would tend to be increased by higher groundwater levels saturating the ‘smear zone’ around the historical groundwater table, and as contaminants are ‘flushed’ downgradient from the source area.

Table 6-1 Contaminant trends from 2015 to 2017

	TRH	Benzene	Toluene	Ethylbenzene	Xylene	Overall
MW2	↓	↓	↓	↓	↓	↓
MW4B	↓	↓	↓	↓	↓	↓
MW6	↓	↓	↔	↓	↑	↓
MW9	↔	↔	↔	↔	↔	↔
MW10	↔	↔	↔	↔	↔	↔
MW11	↓	↓	↑	↓	↑	↓
MW12	↓	↓	↑	↓	↓	↓
MW14	↓	↓	↓	↑	↑	↔
MW15	↔	↔	↔	↔	↔	↔
MW18	↓	↓	↓	↓	↓	↓
MW20	↓	↓	↓	↓	↓	↓

↑	represents an increasing concentration trend from 2015 to 2017
↔	represents a stable concentration trend <LOR from 2015 to 2017
↓	represents a decreasing concentration trend from 2015 to 2017
↔	represents a stable concentration trend >LOR from 2015 to 2017

6.1.2 River water

A comparison of current results to historic results is presented in Table 3, Appendix C. Contaminant concentrations in river water samples were below the LOR at both locations, which is consistent with previous monitoring rounds. This indicates that the impacted groundwater is not causing significant impacts in the Orara River. Risks to ecological and recreational receptors in the river, from the hydrocarbon plume are considered to be low.

6.2 Natural attenuation

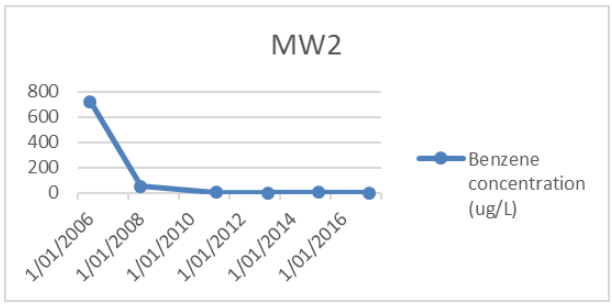
Natural attenuation is the process of breaking down contamination through one or a combination of naturally occurring physical, chemical or biological processes. Natural attenuation processes are evaluated through three key lines of evidence:

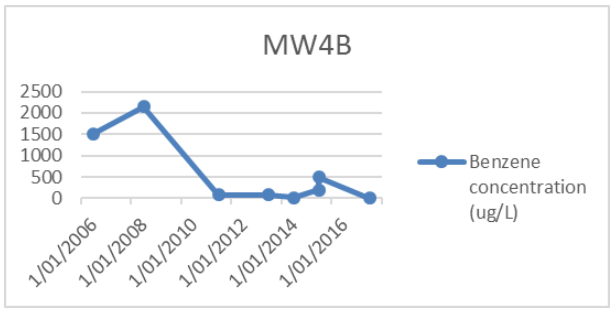
- Primary evidence – shrinkage of plume extent and attenuation of contaminant concentrations.
- Secondary evidence – trends in chemical indicator parameters which support the presence of active biological degradation processes.
- Tertiary evidence – demonstrated presence of bacterial fauna which are known to degrade the identified COPC.

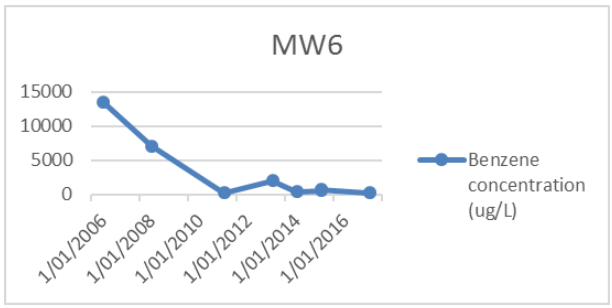
6.2.1 Primary lines of evidence

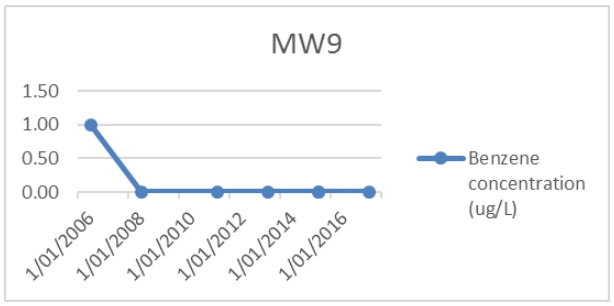
Illustrative representations of benzene trends in select groundwater wells at the site since groundwater monitoring commenced are presented in Figure 6-1. Benzene concentrations (excluding MW14 which did not significantly reduce, and MW9, MW10 and MW15 which remained below LOR) since 2015 are presented in Figure 6-2. Benzene concentrations either decreased or remained below the LOR compared to the 2015 results in all wells sampled during this GME.

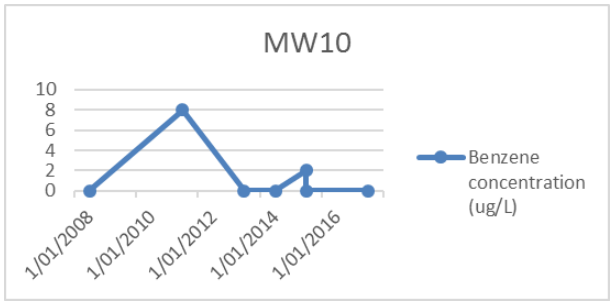
Based on these results, it appears that natural attenuation processes have been occurring at the site. Figure 6-2 shows a brief peak in concentrations in 2015 after the treatment system was shut down, after which concentrations in 2017 have reduced to below those present in 2015 before the system was shut down.

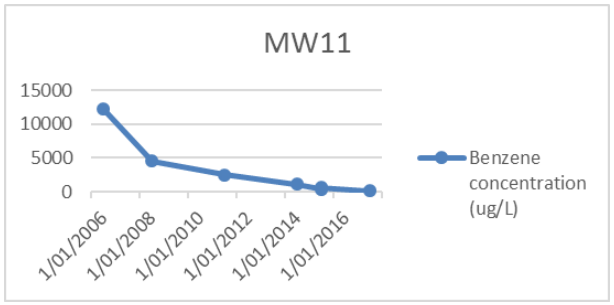

MW2
800
600
400
200
0
1/01/2006
1/01/2008
1/01/2010
1/01/2012
1/01/2014
1/01/2016
Benzene concentration (ug/L)

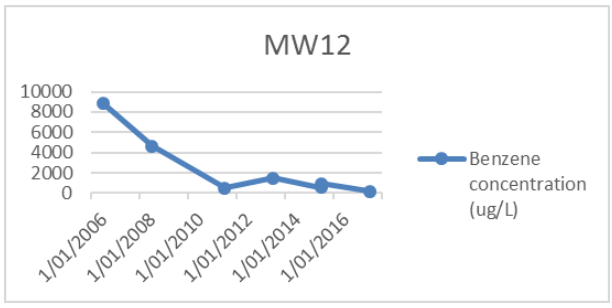

MW4B
2500
2000
1500
1000
500
0
1/01/2006
1/01/2008
1/01/2010
1/01/2012
1/01/2014
1/01/2016
Benzene concentration (ug/L)

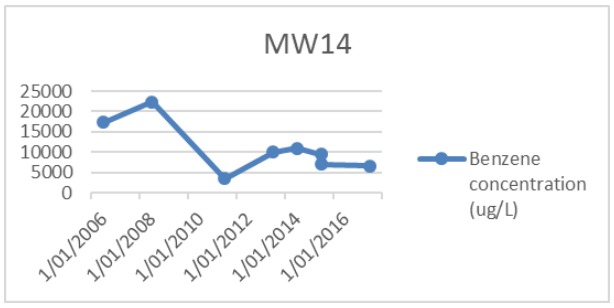

MW6
15000
10000
5000
0
1/01/2006
1/01/2008
1/01/2010
1/01/2012
1/01/2014
1/01/2016
Benzene concentration (ug/L)

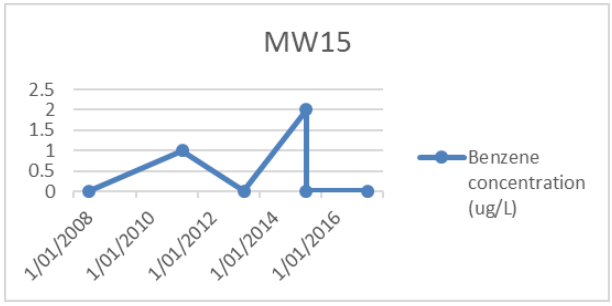

MW9
1.50
1.00
0.50
0.00
1/01/2006
1/01/2008
1/01/2010
1/01/2012
1/01/2014
1/01/2016
Benzene concentration (ug/L)

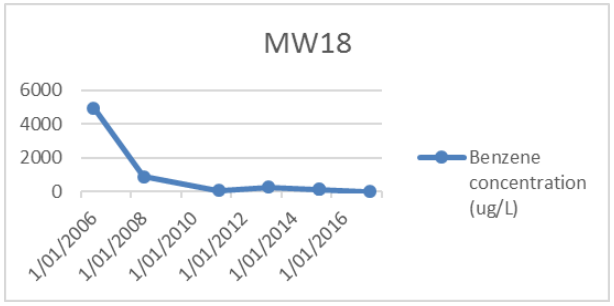

MW10
10
8
6
4
2
0
1/01/2008
1/01/2010
1/01/2012
1/01/2014
1/01/2016
Benzene concentration (ug/L)


MW11
15000
10000
5000
0
1/01/2006
1/01/2008
1/01/2010
1/01/2012
1/01/2014
1/01/2016
Benzene concentration (ug/L)


MW12
10000
8000
6000
4000
2000
0
1/01/2006
1/01/2008
1/01/2010
1/01/2012
1/01/2014
1/01/2016
Benzene concentration (ug/L)


MW14
25000
20000
15000
10000
5000
0
1/01/2006
1/01/2008
1/01/2010
1/01/2012
1/01/2014
1/01/2016
Benzene concentration (ug/L)


MW15
2.5
2
1.5
1
0.5
0
1/01/2008
1/01/2010
1/01/2012
1/01/2014
1/01/2016
Benzene concentration (ug/L)


MW18
6000
4000
2000
0
1/01/2006
1/01/2008
1/01/2010
1/01/2012
1/01/2014
1/01/2016
Benzene concentration (ug/L)

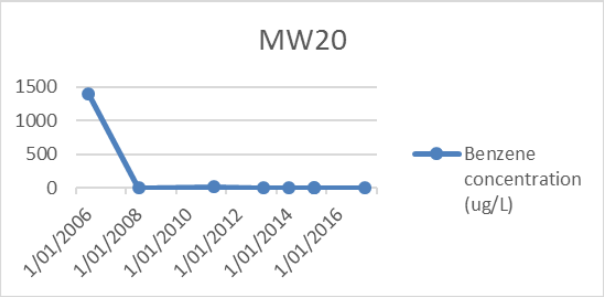


Figure 6-1 Benzene trends since groundwater monitoring commenced

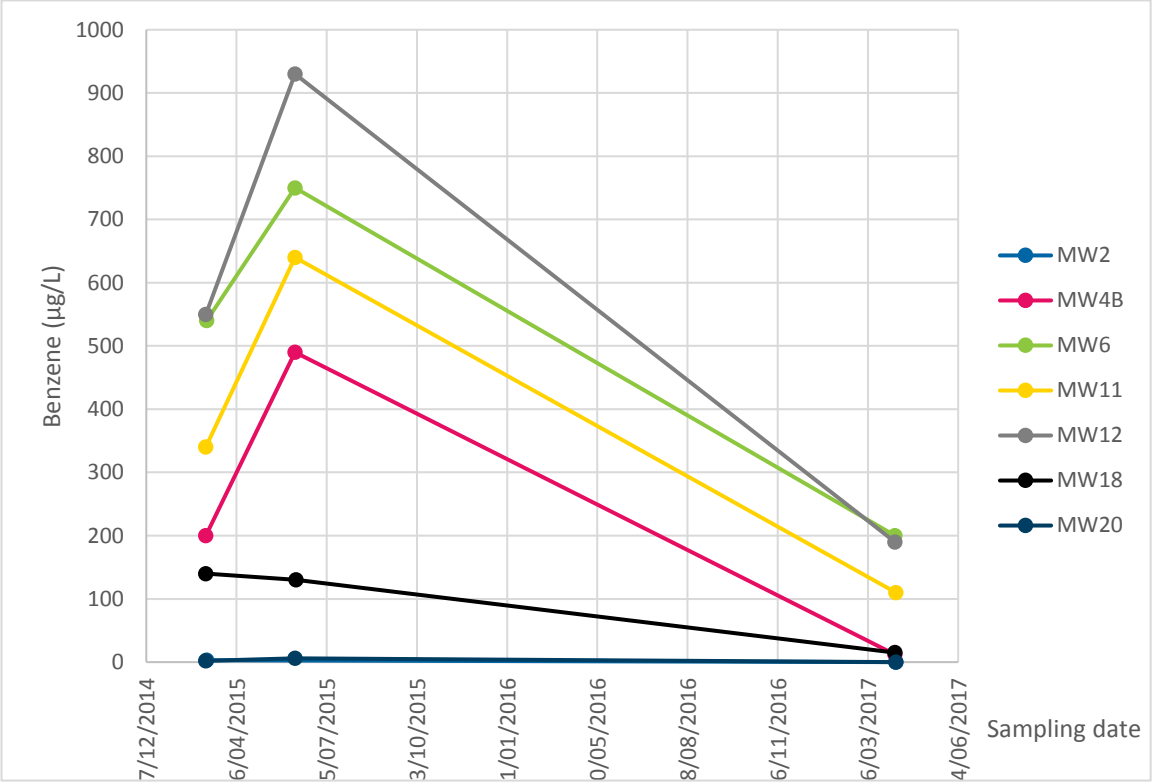


Figure 6-2 Benzene concentrations since 2015

6.2.2 Secondary lines of evidence

For the purpose of evaluating whether natural attenuation of hydrocarbon contaminants was likely to be occurring at the site, key geochemical parameters were analysed, as summarised in Table 6 in Appendix C. Illustrative representations of the natural attenuation indicators and concentrations of COPC across the site are presented in Figure 6-3. For the purposes of the below figure, where concentrations were below the laboratory LOR, half the LOR was used.

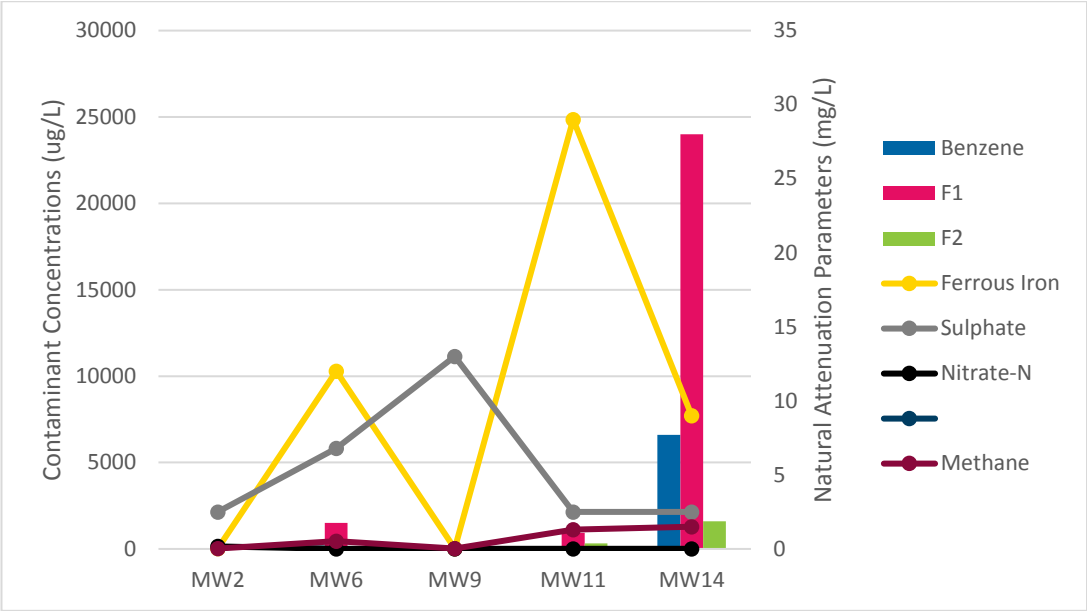


Figure 6-3 Natural Attenuation Indicators vs COPC Concentrations – April 2017

Dissolved oxygen

DO concentrations (not shown in above figures) should be lowest in wells with hydrocarbon impact, within the inferred source zone and down hydraulic gradient of the plume. The concentrations of DO were highest in the background wells with no hydrocarbon impact (MW2 and MW9). Low DO concentrations were reported in impacted wells MW6 and MW11. While DO readings were not recorded for MW14, historical DO concentrations for this location were low.

Nitrate

For de-nitrification to occur, the following conditions must be met: (1) nitrate-reducing bacteria must be present in the affected aquifer, (2) nitrate must be present, (3) biodegradable organic carbon must be present, and (4) lightly reducing conditions must prevail[1].

Nitrate concentrations were below the laboratory LOR in all wells, except background well MW2, suggesting that de-nitrification is not currently a significant pathway.

Manganese

Manganese (Mn^{4+}) is the next preferred electron receptor, being reduced to its more soluble Mn^{2+} form. Manganese concentrations in groundwater were highest in MW14, then MW11 and MW6, indicating manganese is an important component of natural attenuation processes occurring in the plume. Manganese concentrations were low (at naturally occurring levels) in the background wells MW2 and MW9.

Ferrous iron

After the available oxygen, nitrate and manganese have been depleted, naturally occurring $Fe(OH)_3$ will be the preferred electron acceptor, producing ferrous iron (Fe^{2+}).

Ferrous iron concentrations were below the LOR in background wells (MW2 and MW9) but were detected in the impacted wells (MW6, MW11 and MW14). This suggests that natural attenuation processes are occurring via this pathway through the source zone.

[1] Wiedemeier, TH, Rifai, HS, Newell, CJ, and Wilson, JT, (1999). Natural Attenuation of Fuels and Chlorinated Solvents in the Subsurface. John Wiley & Sons, Inc.

Sulphate

After the available oxygen and nitrate have been depleted, sulphate-reducing bacteria can begin degrading petroleum hydrocarbons.

Sulphate concentrations were detected in one background well (MW9) and one impacted well (MW6), while the other background well (MW2) and other impacted wells (MW11 and MW14) did not contain sulphate.

The presence of sulphate in MW6 indicates that there may be availability of sulphate to act as an electron acceptor for biodegradation within site, although this does not seem to be consistently available at the site.

Due to the absence of sulphate at the impacted source zone wells, manganese and ferrous iron are currently the preferred electron acceptors in these wells.

Methane

Methanogenesis is a process commonly observed in the degradation of petroleum hydrocarbons, generally within the source zone where other preferred electron receptors have been depleted. It is a two-step process involving fermentation and respiration. In the first step, BTEX compounds are fermented to compounds such as acetate (CH_3COOH) and hydrogen (H^+) and in the second step, the bacteria use the acetate as an electron acceptor, generating methane[(1)]. Carbon dioxide from the groundwater will also serve as an electron acceptor during methanogenesis.

The highest methane concentrations were measured within the impacted wells (MW14, MW11 and MW6 in order of decreasing concentration), while methane concentrations were below the LOR in the background wells (MW2 and MW9). This indicates that methanogenesis is occurring in the vicinity of the hydrocarbon impact.

6.2.3 Summary

Overall, there is strong evidence to indicate that natural attenuation of hydrocarbons is occurring at the site. Given that the contaminant concentrations at the site have decreased since 2015, it appears that natural attenuation has been occurring at the site since the air sparge unit was turned off in 2015, particularly in the lower areas of the plume. Although geochemical parameters indicate natural attenuation processes are occurring at MW14, there has not been a significant decrease in hydrocarbon concentrations at this location since 2015, suggesting there is a significant residual source of contamination in the upper area of the plume.

Based on the results, it appears that MW9 is a suitable background location and could replace MW2 for natural attenuation monitoring in the future.

6.3 Groundwater trigger levels for further assessment

None of the groundwater trigger levels for further assessment discussed in Section 4.3 have been exceeded and groundwater monitoring in the future should occur in accordance with the GMP.

7. Conceptual site model

A conceptual site model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. A CSM provides the framework for identifying contamination sources and how potential receptors may be exposed to contamination.

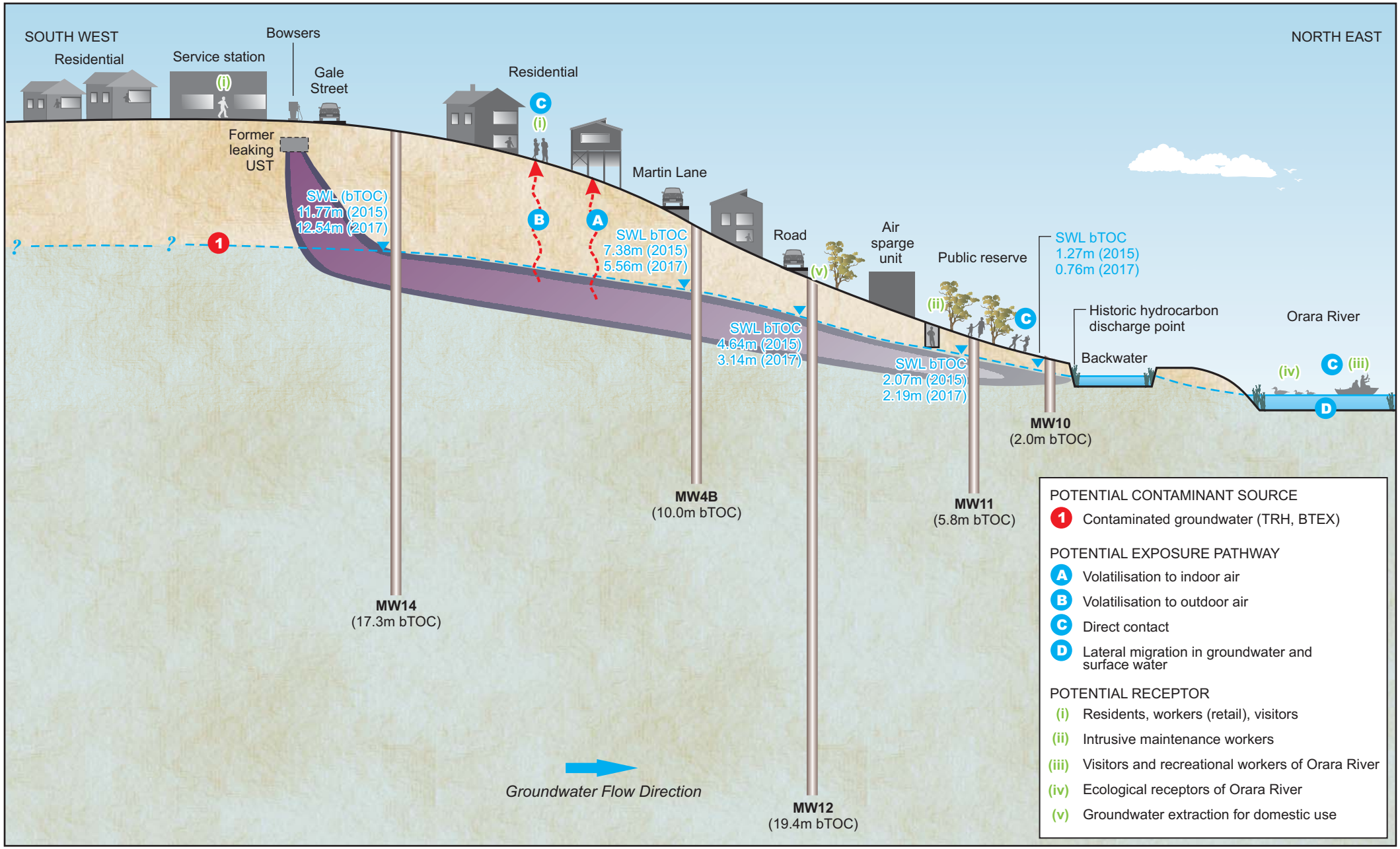
Based on the information collected as part of this investigation, the CoPC in groundwater beneath the site are considered to comprise:

- TRH
- BTEXN

The presence of TRH and BTEXN concentrations exceeding guideline levels in a number of wells throughout the site is due to a historical leak in a UST from the up gradient service station. Since the removal of this UST contaminant concentrations have generally been decreasing, however source-pathway-receptor linkages are still present. The CSM refers to impacted groundwater only. A summary of the potential contaminant source – pathway – receptor linkages is provided in Table 7-1 and Figure 7-1.

Table 7-1 Conceptual site model

Potential Source	Potential Pathway	Potential Receptor	Potential for completeness
TRH and BTEXN in groundwater beneath the site and lateral migration off site	Volatilisation to indoor air (shops along Gale street and residences) and subsequent inhalation	Residents Visitors Retail workers	Potentially complete due to benzene (in MW14) and TRH (in MW14, MW12 and MW6) concentrations exceeding health screening levels (HSL) for vapour intrusion in monitoring wells adjacent to residential properties.
	Volatilisation to outdoor air and subsequent inhalation	Retail workers Intrusive maintenance workers Residents Visitors	Incomplete except for intrusive maintenance workers as any volatilisation (of benzene or TRH exceeding HSLs) would disperse in outdoor air. (HSLs for HSL C – outdoor areas – are not limiting).
	Direct contact (accidental ingestion)	Intrusive maintenance workers exposed to groundwater. Recreational users of Orara River	Potentially complete for intrusive maintenance workers given exceedances of direct contact (recreational) assessment criteria in several monitoring wells. Incomplete for recreational users of the Orara River given lack of surface water concentrations exceeding assessment criteria.
	Lateral migration in groundwater and surface water (Orara River)	Ecological and recreational receptors to Orara River and adjacent riparian zone	Potentially complete to recreational receptors in the riparian zone to the south of the river given benzene concentrations exceeding recreational assessment criteria in MW11 (adjacent to the Orara River). Incomplete in the Orara River given lack of surface water concentrations exceeding assessment criteria.
		Groundwater extraction for domestic use	Incomplete given restrictions on groundwater extraction for domestic use and the nearest registered domestic well-being located 300 m north west of the site (outside of the plume).



Conceptual diagram only - not to scale

N

LEGEND

Inferred dissolved hydrocarbon plume ~2006

Inferred dissolved hydrocarbon plume ~2015

Groundwater level

Coffs Harbour City Council
Coramba Groundwater Monitoring

Conceptual Site Model

Job Number	22-18605
Revision	A
Date	18 Nov 2016

Figure 7.1

N:\AU\Launceston\Projects\22\18605\2218605_LTN_01.cdr
Level 3, GHD Tower, 24 Honeysuckle Drive Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com **W** www.ghd.com

8. Conclusions

GHD was engaged by CHCC to complete a groundwater monitoring event in April 2017 as part of the implementation of the Groundwater Management Plan (GHD, 2017a) for the future management and monitoring of hydrocarbon impacted groundwater in Coramba, NSW. Groundwater sampling of 11 existing groundwater monitoring wells was undertaken and river water samples were collected from two locations in the Orara River.

With reference to the objectives in Section 1.2 and in accordance with the limitations set out in Section 9 the following summary and conclusions are made.

A comparison of the current data to the previous monitoring rounds shows an overall decrease in BTEXN and TRH concentrations in all wells except MW14, which is near the top (source) end of the groundwater contamination plume. A comparison of the current results to the 2015 results was undertaken, with the following points of interest noted:

- In MW2 and MW20, TRH and BTEXN concentrations decreased to below the laboratory LOR compared to 2015 results, which has resulted in benzene concentrations dropping below the adopted assessment criteria.
- In MW18, benzene concentrations have reduced by an order of magnitude, but remain above the ADWG and recreational criteria. Concentrations of all other COPC have also decreased and remain below the adopted assessment criteria.
- In MW4B and MW11, benzene concentrations have reduced significantly (over an order of magnitude in MW4B, and by a factor of 6 in MW11), but remain above the ADWG and recreational criteria. TRH concentrations have decreased to below the adopted Netherlands (2000) criteria.
- MW9, MW10 and MW15 TRH and BTEX concentrations have remained below the LOR.
- MW6 and MW12 benzene concentrations have reduced by about a factor of 4, but remain above the ADWG and recreational criteria. Most other COPC concentrations also reduced.
- Benzene concentrations only reduced slightly in MW14, and remain above the ADWG and recreational criteria, the freshwater GILs and above the HSL A/B for vapour intrusion.
- There have been some minor increases in toluene, ethylbenzene and/or xylene concentrations in MW6, MW11, MW12 and MW14, with xylene (m&p) in MW6 now above NEPM 2013 GILs for freshwater. In MW12, xylene (m&p) concentrations have increased to above NEPM 2013 GILs for freshwater, however xylene (o) and total xylene concentrations have decreased to below the adopted assessment criteria. All other increases are considered insignificant and have not resulted in additional exceedances of the adopted assessment criteria.
- Overall contaminant concentrations appear to have decreased in all wells, except MW14, where, due to the increase in xylene concentrations, the overall contamination status is considered stable (i.e. no significant changes from the 2015 monitoring round).

- There is strong evidence to indicate that natural attenuation of hydrocarbons is occurring at the site. Given that the contaminant concentrations at the site have decreased since 2015, it appears that natural attenuation has been occurring at the site since the air sparge unit was turned off in 2015, particularly in the lower areas of the plume. Although geochemical parameters indicate natural attenuation processes are occurring at MW14, there has not been a significant decrease in hydrocarbon concentrations at this location since 2015, suggesting there is a significant residual source of contamination in the upper area of the plume.
- Based on the results, it appears that MW9 is a suitable background location and can replace MW2 for natural attenuation monitoring in the future.
- None of the groundwater trigger levels for further assessment have been exceeded and groundwater monitoring in the future should occur in accordance with the GMP.
- No odours were noted or reported that trigger implementation of contingency measures outlined in the Odour Management Plan (GHD 2017b).
- Contaminant concentrations in river water samples were below the LOR at both locations, which is consistent with previous monitoring rounds. This indicates that the impacted groundwater is not causing significant impacts in the Orara River. Risks to ecological and recreational receptors in the river, from the hydrocarbon plume are considered to be low.
- Potentially complete Source – pathway – receptor linkages remain present at the site for volatilisation to indoor air, direct contact with groundwater and lateral migration to ecological and recreational receptors in the riparian zone of the Orara River.

9. Limitations

This groundwater monitoring report ("Report") has been prepared by GHD Pty Ltd ("GHD") for use by Coffs Harbour City Council for the purpose as stated in Section 1.2 of the report.

GHD and its servants, employees and officers otherwise expressly disclaim responsibility to any person other than Coffs Harbour City Council arising from or in connection with this Report.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the Report are excluded unless they are expressly stated to apply in this Report.

The services undertaken by GHD in connection with preparing this Report:

- Were limited to those specifically detailed in Section 1.3 of this Report.
- Were undertaken in accordance with current profession practice and by reference to relevant environmental regulatory authority and industry standards, guidelines and assessment criteria in existence as at the date of this Report.

The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD when undertaking the services mentioned above and preparing the Report ("Assumptions"), as specified throughout this Report.

GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the Assumptions being incorrect except where GHD has been negligent in the adoption of those Assumptions.

Subject to the paragraphs in this section of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the time of preparation of this Report and are relevant until such times as the site conditions or relevant legislations changes, at which time, GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with those opinions, conclusions and any recommendations.

GHD has prepared this Report on the basis of information provided by Coffs Harbour City Council, which GHD has not independently verified or checked ("Unverified Information") beyond the agreed scope of work.

GHD expressly disclaims responsibility in connection with the Unverified Information, including (but not limited to) errors in, or omissions from, the Report, which were caused or contributed to by errors in, or omissions from, the Unverified Information.

No investigations have been undertaken into any off-site conditions, or whether any adjoining sites may have been impacted by contamination or other conditions originating from this site, beyond that explained in this report.

The opinions, conclusions and any recommendations in this Report are based on information obtained from, and testing undertaken at or in connection with, specific sampling points and may not fully represent the conditions that may be encountered across the site at other than these locations. Site conditions at other parts of the site may be different from the site conditions found at the specific sampling points.

GHD has considered and/or tested for only those chemicals specifically referred to in this Report, and makes no statement or representation as to the existence (or otherwise) of any other chemicals.

Site conditions (including any the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD expressly disclaims responsibility:

- Arising from, or in connection with, any change to the site conditions
- To update this Report if the site conditions change

Subsurface conditions can vary across a particular site and cannot be exhaustively defined by the investigations carried out prior to this Report. As a result, it is unlikely that the results and estimations expressed or used to compile this Report will represent conditions at any location other than the specific points of sampling. A site that appears to be unaffected by contamination at the time of the Report may later, due to natural causes or human intervention, become contaminated.

Except as otherwise expressly stated in this Report, GHD makes no warranty, statement or representation of any kind concerning the suitability of the site for any purpose or the permissibility of any use, development or re-development of the site.

These Disclaimers should be read in conjunction with the entire Report and no excerpts are taken to be representative of the findings of this Report.

To the extent of any inconsistency between this Disclaimer and the terms of any service agreement between Coffs Harbour City Council and GHD pursuant to which this Report was prepared, the terms of the service agreement will prevail.

10. References

ANZECC/ARMCANZ (2000). *National Water Quality Management Strategy, Paper No. 4, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, October 2000.* Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ).

Department of Environment and Conservation (DEC) 2006. *Guidelines for the NSW Site Auditor Scheme (2nd edition)*.

Department of Primary Industries Office of Water (DPI OoW). *Groundwater database*. http://allwaterdata.water.nsw.gov.au/water.stm

Friebel, E and Nadebaum, P (2011). *Health screening levels for petroleum hydrocarbons in soil and Groundwater. Summary*, CRC CARE Technical Report no. 10, CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia.

GHD (2017a). *Hydrocarbon Impacted Groundwater, Coramba, NSW – Groundwater Management Plan.* February 2017.

GHD (2017b) *Hydrocarbon Impacted Groundwater, Coramba. Odour Management Plan.* February 2017.

Ministry of Housing (Netherlands), *Spatial Planning and the Environment (2000). Environment Quality Objectives in the Netherlands for petroleum hydrocarbons in groundwater (screening levels only)*.

NEPC (2013). *National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended by the National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)*, National Environment Protection Council, May 2013.

NHMRC (2008). *Guidelines for Managing Risks in Recreational Water.* National Health and Medical Research Council, 2008.

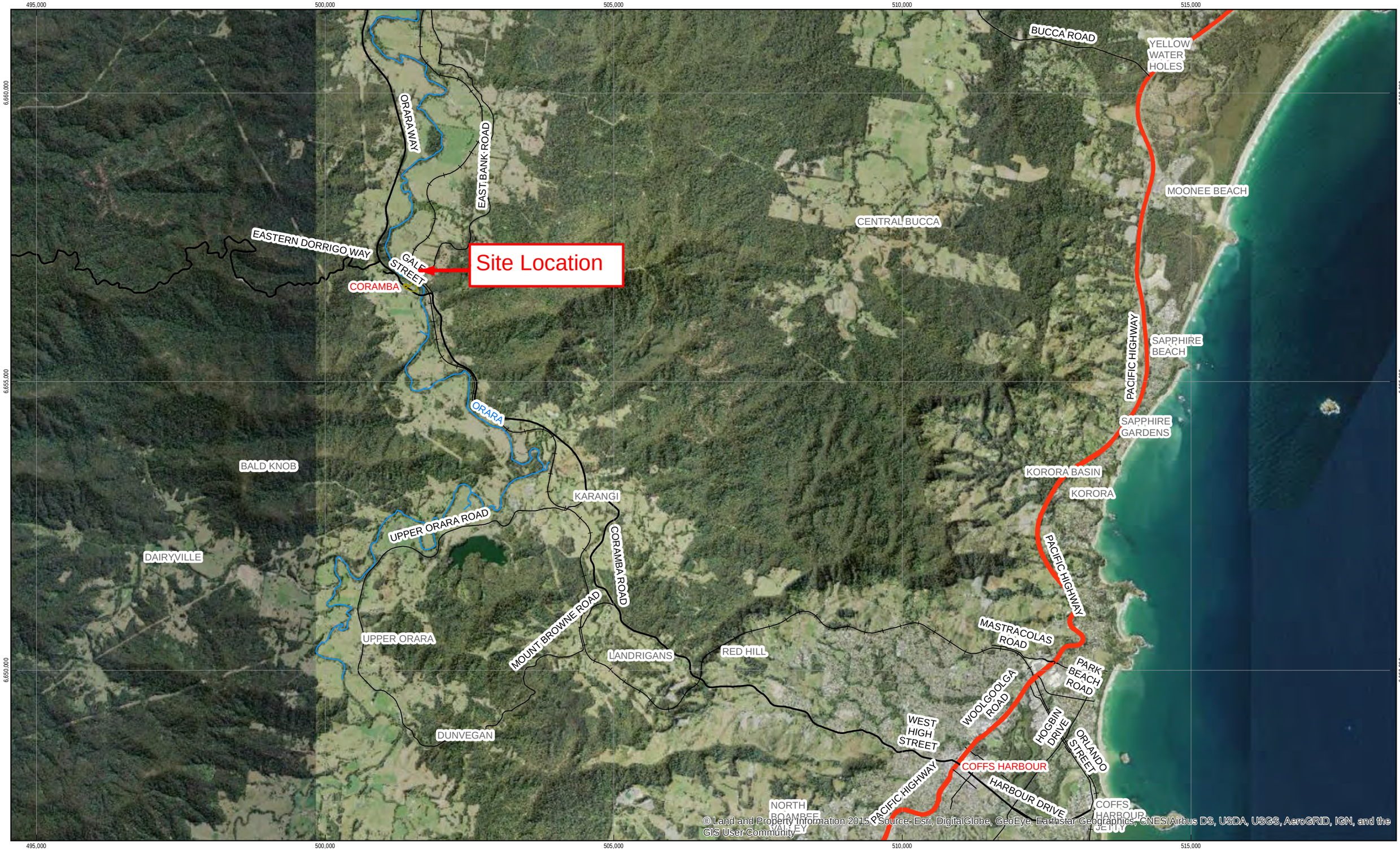
NHMRC, NRMMC (2011). *Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy.* National Health and Medical Research Council, National Resource Management Ministerial Council, Commonwealth of Australia, Canberra, 2011.

NSW Land & Property Information. *SIX Maps.* http://maps.six.nsw.gov.au/

WSP (2015). *Groundwater Monitoring Report – Coramba.* March 2015.

Appendices

Appendix A – Figures



Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Highway
- Major Road
- Arterial Road
- Railway
- Rivers

Coffs Harbour City Council
Coramba Groundwater Monitoring

Job Number	22-18605
Revision	0
Date	08 Jun 2017

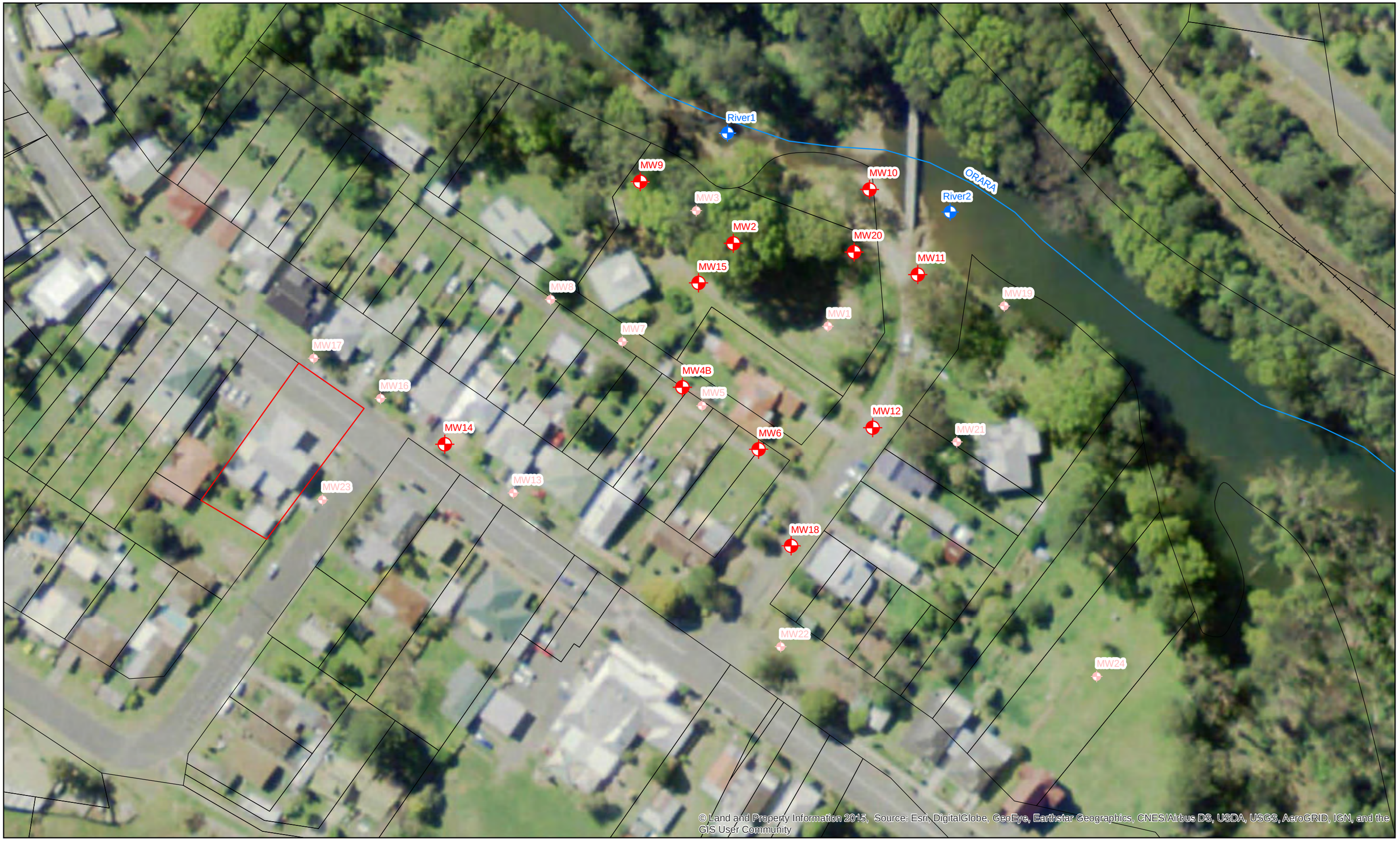
Site Location

Figure 1

N:\AU\Coffs Harbour\Projects\22\18605\GIS\Maps\Deliverables\22_18605_GME_Fig_01_SiteLocation_Rev_A.mxd

Data source: NSW LPI, DCDB (2012) / Aerial Imagery (2015). Created by:slmartin

230 Harbour Drive Coffs Harbour NSW 2450 Australia **T** 61 2 6650 5600 **F** 61 2 6650 5601 **E** cfsmail@ghd.com **W** www.ghd.com



Paper Size A3

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Cadastre
- Service Station
- Railway
- Rivers
- River Sampling Locations
- **GHD Groundwater Sampling Locations**
- No
- Yes

Coffs Harbour City Council
Coramba Groundwater Monitoring

Job Number	22-18605
Revision	0
Date	08 Jun 2017

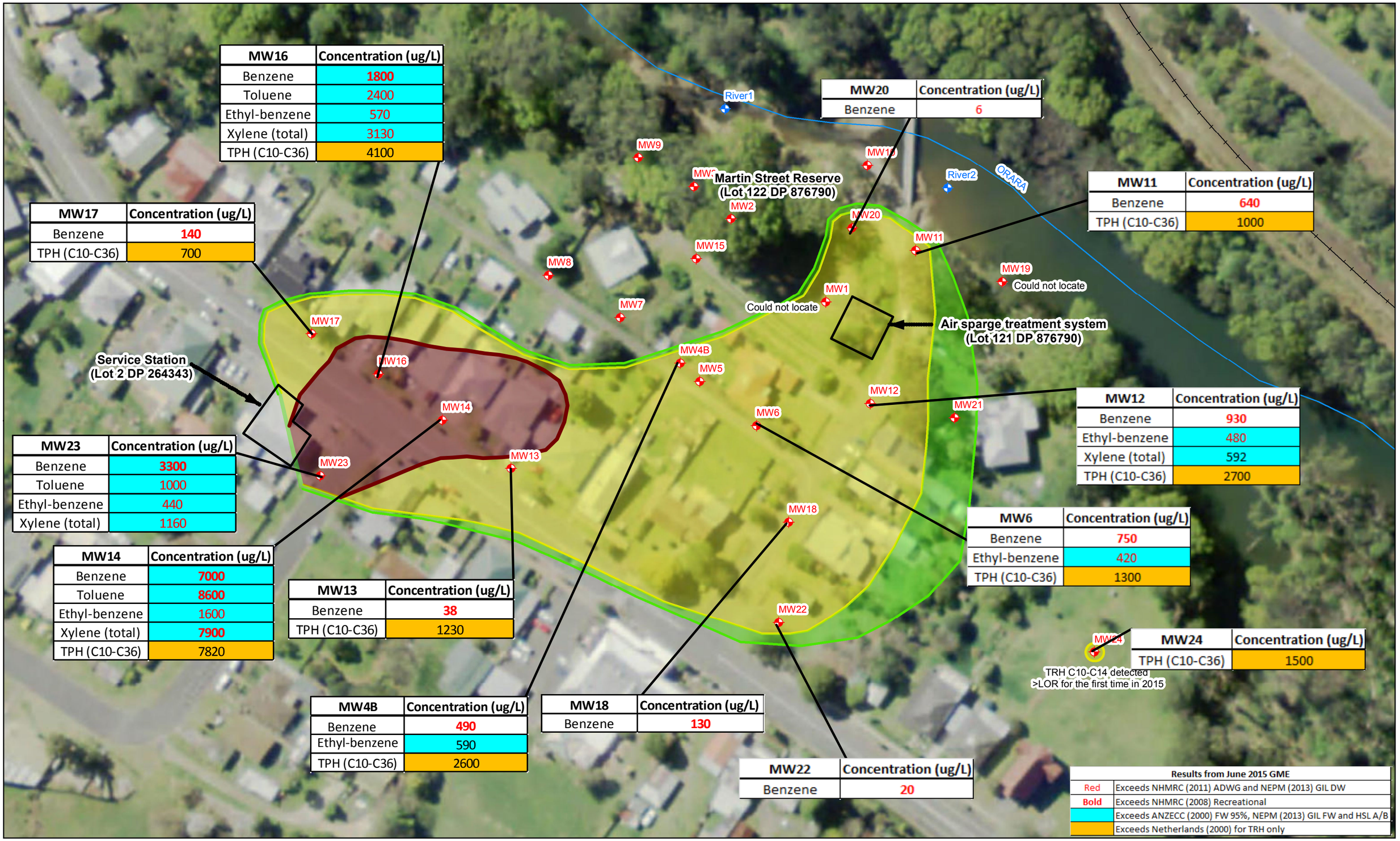
GHD Sampling Locations

Figure 02

N:\AU\Coffs Harbour\Projects\22\18605\GIS\Maps\Deliverables\22_18605_GME_Fig_02_GHDSamplingLocations_Rev_A.mxd

Data source: NSW LPI, DCDB (2012) / Aerial Imagery (2015). Created by:slmartin

230 Harbour Drive Coffs Harbour NSW 2450 Australia **T** 61 2 6650 5600 **F** 61 2 6650 5601 **E** cfsmail@ghd.com **W** www.ghd.com



MW16	Concentration (ug/L)
Benzene	1800
Toluene	2400
Ethyl-benzene	570
Xylene (total)	3130
TPH (C10-C36)	4100

MW20	Concentration (ug/L)
Benzene	6

MW11	Concentration (ug/L)
Benzene	640
TPH (C10-C36)	1000

MW17	Concentration (ug/L)
Benzene	140
TPH (C10-C36)	700

MW12	Concentration (ug/L)
Benzene	930
Ethyl-benzene	480
Xylene (total)	592
TPH (C10-C36)	2700

MW23	Concentration (ug/L)
Benzene	3300
Toluene	1000
Ethyl-benzene	440
Xylene (total)	1160

MW6	Concentration (ug/L)
Benzene	750
Ethyl-benzene	420
TPH (C10-C36)	1300

MW14	Concentration (ug/L)
Benzene	7000
Toluene	8600
Ethyl-benzene	1600
Xylene (total)	7900
TPH (C10-C36)	7820

MW13	Concentration (ug/L)
Benzene	38
TPH (C10-C36)	1230

MW24	Concentration (ug/L)
TPH (C10-C36)	1500

MW4B	Concentration (ug/L)
Benzene	490
Ethyl-benzene	590
TPH (C10-C36)	2600

MW18	Concentration (ug/L)
Benzene	130

MW22	Concentration (ug/L)
Benzene	20

Results from June 2015 GME	
Red	Exceeds NHMRC (2011) ADWG and NEPM (2013) GIL DW
Bold	Exceeds NHMRC (2008) Recreational
	Exceeds ANZECC (2000) FW 95%, NEPM (2013) GIL FW and HSL A/B
	Exceeds Netherlands (2000) for TRH only

Paper Size A3

0 5 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- SiteFeatures
- River Sampling Locations
- Groundwater MW Locations
- Benzene Plume June 2015 (> FW 95% and HSL A/B)
- TRH and/or BTEX >LOR 2015
- TRH and/or BTEX exceeded assessment criteria 2015
- Railway
- Rivers

Coffs Harbour City Council
Coramba Groundwater Monitoring

Job Number 22-18605
Revision 0
Date 08 Jun 2017

Interpreted extent of impact 2015

Figure 3

N:\AU\Coffs Harbour\Projects\22\18605\GIS\Maps\Deliverables\22_18605_GME_Fig_03_InterpretedExtent2015_Rev_A.mxd

Data source: LPI: DCDB 2012 ; LPI: Sixmaps Aerial Imagery 2015. Created by:slmartin

230 Harbour Drive Coffs Harbour NSW 2450 Australia T 61 2 6650 5600 F 61 2 6650 5601 E cfsmail@ghd.com W www.ghd.com

MW14	Concentration (ug/L)
Benzene	6600
Toluene	7200
Ethyl-benzene	2300
Xylene (m&p)	8600
Xylene (o)	3000
Xylene (Total)	12000
TRH F1	24000
TRH (C10-C36)	5600

MW11	Concentration (ug/L)
Benzene	110

MW12/DUP 1	Concentration (ug/L)
Benzene	190
Ethyl-benzene	290
Xylene (m&p)	280
Napthalene	60
TRH (C10-C36)	750
TRH F1	1700

MW6/DUP2	Concentration (ug/L)
Benzene	200
Ethyl-benzene	270
Xylene (m&p)	290
TRH F1	1700

MW4B	Concentration (ug/L)
Benzene	12

MW18	Concentration (ug/L)
Benzene	15

Results from April 2017 GME	
Red	Exceeds NHMRC (2011) ADWG and NEPM (2013) GIL DW
Bold	Exceeds NHMRC (2008) Recreational
Underline	Exceeds NEPM (2013) HSL A/B
	Exceeds ANZECC (2000) FW 95%, NEPM (2013) GIL FW
	Exceeds Netherlands (2000) for TRH only

Paper Size A3

0 5 10 20 30 40

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Cadastre
- Service Station
- Railway
- Rivers
- River Sampling Locations
- **GHD Groundwater Sampling Locations**
- Not Sampled
- Sampled

Coffs Harbour City Council
Coramba Groundwater Monitoring

Job Number	22-18605
Revision	0
Date	14 Jun 2017

Groundwater Exceedances 2017 Figure 04

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Data source: NSW LPI, DCDB (2012) / Aerial Imagery (2015). Created by:sldouglas

230 Harbour Drive Coffs Harbour NSW 2450 Australia **T** 61 2 6650 5600 **F** 61 2 6650 5601 **E** cfsmail@ghd.com **W** www.ghd.com

Appendix B – Photographs

Appendix B – Site Photographs

Photograph 1. Orara River in March 2017.

Photograph 2. Orara River in March 2017.

Photograph 3. Orara River in March 2017.

Photograph 4. Orara River in March 2017.

Photograph 5. River bed near previous groundwater discharge point adjacent to the Orara River.

Photograph 6. Groundwater sampling undertaken in April 2017.

Appendix C – Summary Results Tables

Appendix C
Table 1
Analytical Results 2017

	TRH - NEPM 2013						TRH - NEPM 1999					BTEX						PAH
	C6-C10 minus BTEX (F1)	C6 - C10 Fraction	>C10-C16 minus Naphthalene (F2	>C10 - C16 Fraction	>C16 - C34 Fraction (F3)	>C34 - C40 Fraction (F4)	C6 - C 9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 (Sum of Total)	Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	Naphthalene
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
LOR	20	20	50	50	100	100	20	50	100	100	100	1	1	1	1	2	3	10
ADWG 2015 Health												1	800	300			600	
NEPM 2013 Table 1C GILs, Drinking Water												1	800	300			600	
NHMRC Recreational Guidelines 2008												**10**	**8000**	**3000**			**6000**	
NEPM 2013 Table 1A(4) HSL A/B Res GW for Vapour Intrusion, Sand																		
2-4m	1000		1000									800	NL	NL			NL	NL
4-8m	1000		1000									800	NL	NL			NL	NL
>8m	1000		1000									900	NL	NL			NL	NL
NEPM 2013 Table 1A(4) HSL C Rec GW for Vapour Intrusion, Sand																		
2-4m	NL		NL									NL	NL	NL			NL	NL
4-8m	NL		NL									NL	NL	NL			NL	NL
>8m	NL		NL									NL	NL	NL			NL	NL
ANZECC 2000 FW 95%												950	180	80	350	200	550	16
NEPM 2013 Table 1C GILs, Fresh Waters												950			350			16
Netherlands (2000)											600							

Site_ID	Field_ID	Loc_Code	Sampled_Date_Time																	
Groundwater																				
Coramba	MW2	MW2	6/04/2017	<20	<20	<50	<50	<100	<100	<20	<50	<100	<100	<100	<1	<1	<1	<1	<2	<3	<10
Coramba	MW4B	MW4B	5/04/2017	440	650	<50	<50	<100	<100	560	70	<100	<100	<100	**12**	58	43	30	68	98	<10
Coramba	MW6	MW6	5/04/2017	1500	2200	140	140	<100	<100	1800	510	<100	<100	510	**140**	50	270	56	220	270	<10
Coramba	DUP2	MW6	5/04/2017	1700	2500	330	390	<100	<100	2000	900	<100	<100	900	**200**	28	260	21	290	310	60
Coramba	MW9	MW9	6/04/2017	<20	<20	<50	<50	<100	<100	<20	<50	<100	<100	<100	<1	<1	<1	<1	<2	<3	<10
Coramba	MW10	MW10	5/04/2017	<20	<20	<50	<50	<100	<100	<20	<50	<100	<100	<100	<1	<1	<1	<1	<2	<3	<10
Coramba	MW11	MW11	6/04/2017	940	1200	320	320	<100	<100	970	490	<100	<100	490	**110**	24	<10	<10	130	130	<10
Coramba	MW12	MW12	5/04/2017	1400	2200	210	210	<100	<100	1800	750	<100	<100	750	**190**	27	250	20	280	300	<10
Coramba	DUP1	MW12	5/04/2017	1700	2500	150	210	<100	<100	2100	480	<100	<100	480	**160**	50	290	57	230	290	60
Coramba	MW14	MW14	6/04/2017	24,000	52,000	1600	1900	<100	<100	44,000	5500	100	<100	5600	**6600**	7200	2300	3000	8600	**12,000**	350
Coramba	MW15	MW15	6/04/2017	<20	<20	<50	<50	<100	<100	<20	<50	<100	<100	<100	<1	<1	<1	<1	<2	<3	<10
Coramba	MW18	MW18	5/04/2017	340	360	50	50	<100	<100	320	70	<100	<100	<100	**15**	<1	3	<1	3	3	<10
Coramba	MW20	MW20	6/04/2017	<20	<20	<50	<50	<100	<100	<20	<50	<100	<100	<100	<1	<1	<1	<1	<2	<3	<10
River Water																				
Coramba	RIVER 1	RIVER 1	29/03/2017	<20	<20	<50	<50	<100	<100	<20	<50	<100	<100	<100	<1	<1	<1	<1	<2	<3	<10
Coramba	RIVER 2	RIVER 2	29/03/2017	<20	<20	<50	<50	<100	<100	<20	<50	<100	<100	<100	<1	<1	<1	<1	<2	<3	<10

Appendix C
Table 2
Current and Historic Groundwater Data

		Field Parameters									BTEX						TRH - NEPM 1999					Comments
		SWL	Total well depth	PID	Purge volume	pH	EC	Temp	DO	RP	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	C6 - C 9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 (Sum of Total)	Observations
		mbTOC	mbTOC	ppm	L	pH units	uS/cm	°C	mg/L	mV	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	-
LOR		-	-	-	-	-	-	-	-	-	1	1	1	1-2	1-2	3	10-20	50	100	100	100	-
NHMRC ADW 2011		-	-	-	-	-	-	-	-	-	1	800	300	-	-	600	-	-	-	-	-	
NEPM 2013 GIL Drinking Water		-	-	-	-	-	-	-	-	-	1	800	300	-	-	600	-	-	-	-	-	
NHMRC Recreational 2008		-	-	-	-	-	-	-	-	-	**10**	**8000**	**3000**	-	-	**6000**	-	-	-	-	-	
NEPM 2013 Groundwater HSL A/B		-	-	-	-	-	-	-	-	-	800	-	-	-	-	-	-	-	-	-	-	
NEPM 2013 Groundwater HSL C		-	-	-	-	-	-	-	-	-	NL	-	-	-	-	-	-	-	-	-	-	
ANZECC 2000 FW 95%		-	-	-	-	-	-	-	-	-	950	180	80	200	350	550	-	-	-	-	-	
NEPM 2013 GIL Freshwater		-	-	-	-	-	-	-	-	-	950	-	-	-	350	-	-	-	-	-	-	
Netherlands (2000)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	600	
Field_ID	**Sampled_Date**																					
MW1	1/05/2006	-	-	-	-	-	-	-	-	-	**2950**	960	840	900	450	1350	5800	2840	ND	90	2930	
	29/01/2008	4.25	-	-	20	6.35	263	23.5	0.69	144	**1020**	156	375	288	224	512	3150	1440	ND	ND	1440	Brown, turbid, no odour
	17/03/2011	4.35	-	0	10	5.92	0.315	22.55	0	1456*	**310**	<100	240	<100	<100	ND	1100	620	<100	<100	720	Slightly turbid, slight HC odour
	22/08/2013	-	-	Could not locate																		
	4/12/2014	-	-	Not sampled																		
	4/03/2015	-	-	Could not locate																		
	11/06/2015	-	-	Could not locate																		
	5/04/2017	-	-	Not sampled																		
MW2	1/05/2006	-	-	-	-	-	-	-	-	-	**720**	**15500**	1820	8800	3290	**12090**	28200	10300	300	60	10660	
	29/01/2008	4.77	-	-	40	6.5	177	19.6	0.54	236	**50**	1690	853	4750	2050	**6800**	13000	7030	ND	ND	7030	Strong HC odour and sheen
	17/03/2011	4.87	-	0	16	5.58	0.288	22.31	0.26	180.9*	4	<1	24	8	3	11	260	690	<100	<100	790	Very slight HC odour. No well cap, well sealed with tape
	21/08/2013	5.498	7.63	-	10	6.07	232.3	18.6	0.48	-135.2	<1	<1	1	<2	<1	ND	370	210	<100	<100	310	Clear, slight HC odour
	4/12/2014	-	-	Not sampled																		
	4/03/2015	4.08	4.73	-	2.5	4.25	138.2	19.5	3.32	177.5	3	2	3	2	5	7	19	<50	<100	<100	ND	Clear, no odour
	11/06/2015	dry	4.73	-	Dry																	
	6/04/2017	3.81	4.78	0	3	4.73	138.3	20.1	3.31	34.1	<1	<1	<1	<2	<1	<3	<20	<50	<100	<100	<100	Clear, no odour, no sheen
MW3	1/05/2006	-	-	-	-	-	-	-	-	-	<5	<5	<5	<10	<5	ND	ND	ND	ND	ND	ND	
	29/01/2008	4.575	-	-	2	5.95	187.2	20.6	1.64	279	<1	<1	<1	<2	<1	ND	ND	ND	ND	ND	ND	Purged dry
	17/03/2011	4.64	-	0	6	4.3	0.17	20.79	0.79	414.6*	5	<1	7	3	<1	3	260	690	<100	<100	790	Clear with HC odour
	21/08/2013	5.2	5.54	-	1.5	5.16	155.1	18.2	0.7	35.3	<1	<1	<1	<2	<1	ND	<10	<50	<100	<100	ND	Clear, slight HC odour
	4/12/2014	-	-	Not sampled																		
	4/03/2015	3.81	5.6	-	8	4.9	144.7	19.4	1.62	-6.8	<1	<1	<1	<1	<2	ND	<10	<50	<100	<100	ND	Clear, no odour
	10/06/2015	4.97	-	-	3	5.3	160.3	18.9	1.61	103	<1	2	<1	<1	<2	ND	<10	<50	<100	<100	ND	Dark brown, turbid
	5/04/2017	-	-	Not sampled																		
MW4B	15/06/2006	-	-	-	-	-	-	-	-	-	**1510**	1240	700	4030	1950	5980	9700	1340	ND	ND	1340	
	30/01/2008	6.97	-	-	30	6.51	328	21.4	0.9	169	**2150**	3700	918	2300	1580	3880	13000	2130	ND	ND	2130	HC odour
	17/03/2011	7.03	-	0	7	4.82	233	23	0.02	203*	**89**	110	46	60	65	125	310	570	<100	<100	670	
	19/08/2013	7.8	10	-	8.5	6.45	334.5	20.3	0.31	-159.9	**82**	39	160	64	55	119	1100	1200	<100	<100	1300	Clear HC odour
	4/12/2014	8.36	9.9	-	10	6.45	340.1	20.6	0.8	-76.4	**15**	13	60	70	17	87	900	920	320	<100	1240	Slightly cloudy, HC odour
	3/03/2015	5.93	10	-	7	6.19	268.8	20.9	0.31	-96.5	**200**	37	210	21	75	96	1200	580	<100	<100	580	Clear, HC odour
	10/06/2015	7.38	10	-	6	6.55	345.1	20.5	0.66	-109	**490**	88	590	68	470	538	4800	2600	<100	<100	2600	Clear, HC odour
	5/04/2017	5.56	10.01	113	9	6.23	233.3	21	0.81	-92	**12**	58	43	68	30	98	560	70	<100	<100	<100	Clear, no odour, no sheen
MW5	1/05/2006	dry	6.6	-	Dry																	
	29/01/2008	dry	6.6	-	Dry																	Dry, HC odour
	17/03/2011	dry	6.6	337	Dry																	
	22/08/2013	dry	6.6	-	Dry																	
	4/12/2014	dry	6.6	-	Dry																	
	4/03/2015	5.36	6.6	-	4	4.6	86.7	21.2	1.41	140.7	1	2	1	1	3	4	96	<50	<100	<100	ND	Clear, no odour
	11/06/2015	dry	6.6	-	Dry																	
	5/04/2017	-	-	Not sampled																		
MW6	15/06/2006	-	-	-	-	-	-	-	-	-	**13500**	**13800**	2290	7170	3130	**10300**	47500	7610	ND	70	7680	
	30/01/2008	6.135	-	-	12	6.48	303	21.5	1.03	146	**7080**	**8690**	2050	5130	3180	**8310**	28400	11600	36600	1620	49820	Strong HC odour
	17/03/2011	6.26	-	330	8	4.83	188.5	24.1	0.02	45*	270	170	77	180	130	310	920	1000	<100	<100	1100	Clear with strong HC odour
	21/08/2013	6.98	8.89	-	6	6.31	289.3	19.6	0.46	-203.1	**2000**	190	1100	700	180	880	8000	2700	200	<100	2950	Clear, HC odour
	3/12/2014	7.472	8.87	-	8	6.3	259.6	20.9	1.1	-133.7	**410**	22	520	270	120	390	2900	2000	1200	110	3310	Turbid, HC odour
	4/03/2015	5.37	8.85	-	9	5.82	245.9	20.8	0.46	-158.8	**540**	380	670	350	870	1220	4400	1900	<100	<100	1900	Clear, slight HC odour
	10/06/2015	6.52	8.85	-	6	5.76	234	20.9	0.16	-124	**750**	37	420	35	200	235	3000	1300	<100	<100	1300	Clear, HC odour
	5/04/2017	4.81	8.79	0	9	6.14	291.9	21.7	1.57	-122.2	**140**	50	270	220	56	270	1800	510	<100	<100	510	Clear, no odour, no sheen
	DUP2	4.81	8.79	0	9	6.14	291.9	21.7	1.57	-122.2	**200**	28	260	290	21	310	2000	900	<100	<100	900	Clear, no odour, no sheen
MW7	15/06/2006	-	-	-	-	-	-	-	-	-	2	ND	ND	ND	4	4	ND	ND	ND	ND	ND	
	30/01/2008	8.185	-	-	8	7.14	584	21.2	0.04	145	<1	<1	<1	<2	<1	ND	ND	ND	ND	130	130	Slightly cloudy
	17/03/2011	9	-	352	4	4.96	468	21.5	0.19	359*	1	4	3	8	5	13	17	79	<100	<100	179	Clear
	19/08/2013	8.33	18	-	31	5.82	480.3	20.6	0.14	-68	<1	<1	<1	<2	<1	ND	<10	<50	<100	<100	ND	Clear, no odour
	3/12/2014	9.41	17.8	-	18	6.88	468	20.3	0.77	-116.1	<1	<1	<1	<2	<1	ND	<10	<50	190	<100	190	Slightly cloudy, no odour
	3/03/2015	7.625	18.1	-	24	4.69	184.4	20.4	1.02	168.1	<1	<1	<1	<1	<2	ND	<10	<50	<100	<100	ND	Clear, no odour
	10/06/2015	8.73	18.1	-	8	5.82	189.1	19.6	0.82	104	<1	<1	<1	<1	<2	ND	<10	<50	<100	<100	ND	Clear, no odour
	5/04/2017	-	-	Not sampled																		

Appendix C
Table 2
Current and Historic Groundwater Data

		Field Parameters									BTEX						TRH - NEPM 1999					Comments
		SWL	Total well depth	PID	Purge volume	pH	EC	Temp	DO	RP	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	C6 - C 9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 (Sum of Total)	Observations
		mbTOC	mbTOC	ppm	L	pH units	uS/cm	°C	mg/L	mV	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	-
LOR		-	-	-	-	-	-	-	-	-	1	1	1	1-2	1-2	3	10-20	50	100	100	100	-
NHMRC ADW 2011		-	-	-	-	-	-	-	-	-	1	800	300	-	-	600	-	-	-	-	-	
NEPM 2013 GIL Drinking Water		-	-	-	-	-	-	-	-	-	1	800	300	-	-	600	-	-	-	-	-	
NHMRC Recreational 2008		-	-	-	-	-	-	-	-	-	**10**	**8000**	**3000**	-	-	**6000**	-	-	-	-	-	
NEPM 2013 Groundwater HSL A/B		-	-	-	-	-	-	-	-	-	800	-	-	-	-	-	-	-	-	-	-	
NEPM 2013 Groundwater HSL C		-	-	-	-	-	-	-	-	-	NL	-	-	-	-	-	-	-	-	-	-	
ANZECC 2000 FW 95%		-	-	-	-	-	-	-	-	-	950	180	80	200	350	550	-	-	-	-	-	
NEPM 2013 GIL Freshwater		-	-	-	-	-	-	-	-	-	950	-	-	-	350	-	-	-	-	-	-	
Netherlands (2000)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	600	
Field_ID	**Sampled_Date**																					
MW8	15/06/2006	-	-	-	-	-	-	-	-	-	4	ND	ND	ND	4	4	ND	ND	ND	ND	ND	
	30/01/2008	9.55	-	-	32	6.44	258	21.5	0.95	244	<1	<1	<1	<2	<1	ND	ND	ND	ND	140	140	Grey, clear, no odour
	17/03/2011	9.69	-	1924	7	4.56	307	20.5	0.08	422*	<1	3	2	6	3	9	14	62	<100	<100	162	Light brown, highly turbid with HC odour
	19/08/2013	9.99	14.37	-	16	5.82	264.8	20.3	0.3	35.7	<1	<1	<1	<2	<1	ND	<10	<50	<100	<100	ND	Slightly cloudy, no odour
	4/12/2014	-	-	Not sampled																		
	3/03/2015	9	14.37	-	20	4.87	177.3	21.4	2.22	104.3	<1	<1	<1	<1	<2	ND	<10	<50	<100	<100	ND	Cleear, no odour
	11/06/2015	9.57	14.37	-	8	5.46	191.8	20.5	0.28	153.3	<1	<1	<1	<1	<2	ND	<10	<50	<100	<100	ND	Clear, no odour
	5/04/2017	-	-	Not sampled																		
MW9	15/06/2006	-	-	-	-	-	-	-	-	-	1	5	2	150	170	320	370	1550	ND	ND	1550	
	29/01/2008	4.98	-	-	10	5.66	175.5	19.3	0.59	301	<1	<1	<1	<2	<1	ND	ND	ND	ND	<50	ND	No sheen, no odour
	17/03/2011	5.1	-	0	6	4.04	0.135	20.07	1.31	433.6*	<1	<1	<1	<2	<1	ND	<10	<50	<100	<100	ND	Clear, becoming slightly turbid after 4L pruge. No odour.
	21/08/2013	6.11	7.88	-	8.5	5.07	84.3	19.2	1.16	-6.1	<1	<1	<1	<2	<1	ND	<10	<50	<100	<100	ND	Clear, no odour
	4/12/2014	-	-	Not sampled																		
	4/03/2015	4.33	7.87	-	9	4.69	139.6	19.3	3.85	170.2	<1	<1	<1	<1	<2	ND	<10	<50	<100	<100	ND	Clear, no odour
	10/06/2015	5.79	-	-	4	5.02	136.8	19.3	2.1	201	<1	<1	<1	<1	<2	ND	<10	<50	<100	<100	ND	Pale brown, cloudy
	6/04/2017	4.17	6.32	0	5	4.95	140.5	19.8	3.45	22.1	<1	<1	<1	<2	<1	<3	<20	<50	<100	<100	<100	Clear, no odour, no sheen
MW10	13/06/2006	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	29/01/2008	1.03	-	-	22	5.24	80.3	22.8	0.73	273	<1	<1	<1	<2	<1	ND	ND	190	1780	80	2050	Turbid, yellow, HC odour
	16/03/2011	0.95	-	0	12	4.35	0	23.72	0	390.3*	8	2	10	19	3	22	44	<50	<100	<100	ND	Light orange with slight turbidity. Became clear in colour after 4L purged. No odour.
	20/08/2013	1.145	2	-	5	5.46	69	15	0.4	-0.3	<1	<1	<1	<2	<1	ND	<10	<50	<100	<100	ND	Clear, no odour
	3/12/2014	1.882	2.1	-	7	6.36	84.3	25.1	0.51	-26.6	<1	<1	<1	<2	<1	ND	<10	<50	<100	<100	ND	Turbid, no odour
	3/03/2015	0.81	2	-	5	4.97	79.9	23	0.46	175.1	2	<1	<1	<2	<1	ND	12	<50	<100	<100	ND	Clear, no odour
	10/06/2015	1.27	-	-	6	6.78	81.3	15.4	0.39	-75	<1	1	<1	<2	<1	ND	<10	<50	<100	<100	ND	Brown, clear, no odour
	5/04/2017	0.76	2.11	0	10	5.05	88.3	22.2	1.52	-57	<1	<1	<1	<1	<1	<3	<20	<50	<100	<100	<100	Clear, no odour, no sheen
MW11	14/06/2006	-	-	-	-	-	-	-	-	-	**12200**	**12200**	2190	5950	2950	**8900**	46200	6800	ND	ND	6800	
	29/01/2008	2.425	-	-	40	6.85	330	22	1.06	189	**4520**	5740	1810	4330	2790	**7120**	20600	2810	ND	ND	2810	Strong HC odour
	16/03/2011	2.36	-	0	10	5.93	0.381	20.87	0	200.8*	**2500**	340	1100	1500	310	1810	7900	3400	<100	<100	3500	Slightly turbid with HC odour
	22/08/2013	-	-	-	Could not locate																	
	4/12/2014	2.805	5.8	-	13	6.35	368.4	19.9	0.92	-64.9	**1100**	8	5	45	<1	45	2600	1200	<100	<100	1200	Turbid, HC odour
	3/03/2015	2.19	5.88	-	12	6.29	316	21.2	0.33	-130.2	**340**	27	17	2	160	162	1500	890	<100	<100	890	Clear, HC odour
	10/06/2015	2.7	-	-	6	6.49	339	20.5	0.33	-122	**640**	5	4	<1	31	31	2000	1000	<100	<100	1000	Clear, HC odour
	6/04/2017	2.19	5.58	0	7.5	6.46	335.3	21.2	0.54	-209	**110**	24	<10	130	<10	130	970	490	<100	<100	490	Clear, no odour, no sheen
MW12	14/06/2006	-	-	-	-	-	-	-	-	-	**8850**	7380	1510	3990	2080	**6070**	28700	6490	ND	ND	6490	
	30/01/2008	5.16	-	-	18	6.74	341	22.1	2.14	134	**4620**	4710	1500	3350	2200	5550	18300	2400	ND	ND	2400	Clear, colourless, HC odour
	17/03/2011	4.21	-	0	5	5	244	21.2	0.07	153*	**520**	130	110	250	120	370	940	810	100	<100	960	Light brown and turbid with strong HC odour. Became clear after 3L purged.
	20/08/2013	4.815	6.5	-	6.5	6.36	324.5	20.6	0.23	-142.7	**1500**	32	560	880	3	883	5000	2100	150	<100	2300	Clear, HC odour
	4/12/2014	-	-	Not sampled																		
	3/03/2015	3.325	6.6	-	9	6.12	308.5	22.8	0.44	-127.6	**550**	97	470	22	720	742	3400	2200	<100	<100	2200	Clear, HC odour
	10/06/2015	4.64	6.6	-	6	6.49	352.9	21.5	0.69	-138	**930**	13	480	2	590	592	4300	2700	<100	<100	2700	Clear, HC odour
	5/04/2017	3.14	6.51	376	10	6.37	291.4	23.6	0.72	-93.5	**190**	27	250	280	20	300	1800	750	<100	<100	750	Clear, low HC odour, no sheen
	DUP1	3.14	6.51	376	10	6.37	291.4	23.6	0.72	-93.5	**160**	50	290	230	57	290	2100	480	<100	<100	480	Clear, low HC odour, no sheen
MW13	14/06/2006	-	-	-	-	-	-	-	-	-	**3650**	**8410**	910	3770	1410	5180	18500	6790	ND	ND	6790	
	30/01/2008	12.76	-	-	50	6.49	317	20.7	0.1	181	**1160**	5020	1210	4280	1880	**6160**	15900	2940	ND	ND	2940	Clear, HC odour, sheen
	16/03/2011	13.8	-	0	5	4.7	216	21.3	0.07	213*	**18**	58	13	49	26	75	220	120	<100	<100	220	HC odour
	20/08/2013	13.78	19.2	-	16	5.49	299.1	20.6	0.41	-147.6	**220**	800	430	1100	480	1580	4300	1200	<100	<100	1300	Slightly cloudy, HC odour
	4/12/2014	-	-	Not sampled																		
	3/03/2015	11.435	19.4	-	22	5.22	346.4	21.4	5.24	-68.3	**13**	25	30	21	64	85	610	330	<100	<100	330	Clear, no odour
	11/06/2015	13.22	19.4	-	6	5.61	335	20.6	0.78	-79	**38**	72	61	50	120	170	1200	1100	130	<100	1230	Clear, HC odour
	5/04/2017	-	-	Not sampled																		
MW14	14/06/2006	-	-	-	-	-	-	-	-	-	**17300**	**19000**	2350	8490	3560	**12050**	69200	11500	250	ND	11750	
	30/01/2008	13.18	-	-	40	6.79	338	21.5	1.01	136	**22400**	**41200**	**3380**	12600	6050	**18650**	89300	7000	240	100	7340	Clear, HC odour, sheen
	16/03/2011	13.15	-	0	5	4.89	74	21.3	0.08	119*	**3500**	6900	980	3500	2000	5500	15000	5900	540	<100	6490	Clear with HC odour
	21/08/2013	14.28	17.206	-	13	6.44	331.9	20.6	0.5	-165.4	**10000**	**16000**	2300	8300	3700	**12000**	53000	5100	440	<100	5590	Clear, strong HC odour
	4/12/2014	15.325	17.3	-	10	6.46	371.6	21.3	1.81	-78.7	**11000**	**12000**	2400	9400	3800	**13200**	52000	76000	5100	460	81100	Slightly cloudy, strong HC odour
	2/03/2015	11.77	17.3	-	18	6.24	396.5	21.5	1.65	-142.9	**9400**	**15000**	2700	4300	9900	**14200**	56000	7400	290	<100	7690	Clear, strong HC odour
	11/06/2015	-	17.3	-	6	6.45	348	20.7	0.25	-141	**7000**	**8600**	1600	2400	5500	**7900**	38000	7400	420	<100	7820	Cloudy, HC odour
	6/04/2017	12.54	17.26	314	30	-	-	-	-	-	**6600**	**7200**	2300	8600	3000	**12000**	44000	5500	100	<100	5600	Clear, moderate HC odour, light sheen

Appendix C
Table 2
Current and Historic Groundwater Data

		Field Parameters									BTEX						TRH - NEPM 1999					Comments
		SWL	Total well depth	PID	Purge volume	pH	EC	Temp	DO	RP	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	C6 - C 9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 (Sum of Total)	Observations
		mbTOC	mbTOC	ppm	L	pH units	uS/cm	°C	mg/L	mV	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	-
LOR		-	-	-	-	-	-	-	-	-	1	1	1	1-2	1-2	3	10-20	50	100	100	100	-
NHMRC ADW 2011		-	-	-	-	-	-	-	-	-	1	800	300	-	-	600	-	-	-	-	-	
NEPM 2013 GIL Drinking Water		-	-	-	-	-	-	-	-	-	1	800	300	-	-	600	-	-	-	-	-	
NHMRC Recreational 2008		-	-	-	-	-	-	-	-	-	**10**	**8000**	**3000**	-	-	**6000**	-	-	-	-	-	
NEPM 2013 Groundwater HSL A/B		-	-	-	-	-	-	-	-	-	800	-	-	-	-	-	-	-	-	-	-	
NEPM 2013 Groundwater HSL C		-	-	-	-	-	-	-	-	-	NL	-	-	-	-	-	-	-	-	-	-	
ANZECC 2000 FW 95%		-	-	-	-	-	-	-	-	-	950	180	80	200	350	550	-	-	-	-	-	
NEPM 2013 GIL Freshwater		-	-	-	-	-	-	-	-	-	950	-	-	-	350	-	-	-	-	-	-	
Netherlands (2000)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	600	
Field_ID	**Sampled_Date**																					
MW15	15/06/2006	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	29/01/2008	5.025	-	-	22	6.01	210	19.6	0.72	179	<1	<1	<1	<2	<1	ND	ND	ND	ND	ND	ND	No sheen, no odour
	17/03/2011	6.06	-	0	8	4.03	0.188	20.13	1.01	439*	1	<1	2	<2	<1	ND	<10	<50	<100	<100	ND	Clear becoming slightly turbid. No odour.
	21/08/2013	5.69	7.6	-	11	6.5	383.9	18.7	0.96	-52.9	<1	<1	<1	<2	<1	ND	<10	<50	<100	<100	ND	Clear, no odour
	4/12/2014	-	-	Not sampled																		
	3/03/2015	4.06	7.6	-	12	5.2	129.6	19.5	4.56	104.5	**2**	<1	2	<1	2	2	<10	<50	<100	<100	ND	Clear, no odour
	10/06/2015	-	7.6	-	6	5.53	193	17.9	1.21	132	<1	<1	<1	<1	<2	ND	<10	<50	<100	<100	ND	Brown, turbid, no odour
	6/04/2017	3.99	7.8	0	8	4.95	163.4	19.5	3.7	-6.9	<1	<1	<1	<2	<1	<3	<20	<50	<100	<100	<100	Grey, turbid, no odour, no sheen
MW16	14/06/2006	-	-	-	-	-	-	-	-	-	**10600**	**14000**	1690	6770	2760	**9530**	41700	6810	ND	ND	6810	
	30/01/2008	14.01	-	-	40	6.94	385	21.1	0.8	146	**7240**	**12900**	1460	5050	2430	**7480**	31000	2250	ND	ND	2300	HC odour, turbid
	16/03/2011	13.99	-	0	7	4.82	257	20.6	0.01	173*	**9400**	**11000**	2300	6800	4000	**10800**	46000	1200	<100	<100	1300	Light brown with low turbidity and a HC odour. Becomes clear after 4L purged.
	21/08/2013	15.1	18	-	8	6.52	330.1	20.2	1.29	-178.6	**3200**	5600	1100	4300	1800	**6100**	21000	2900	110	<100	3060	Clear, HC odour
	4/12/2014	-	-	Not sampled																		
	2/03/2015	12.58	18	-	18	6.26	350.7	21.6	0.3	-120	**1900**	2100	420	660	1500	2160	9000	2400	<100	<100	2400	Clear, very slight odour
	11/06/2015	14.4	18	-	6	6.42	303.2	20.4	0.21	-154	**1800**	2400	570	930	2200	3130	12000	4000	100	<100	4100	Pale brown, cloudy, HC odour
	5/04/2017	-	-	Not sampled																		
MW17	15/06/2006	-	-	-	-	-	-	-	-	-	**5940**	**8560**	2090	7130	2800	**9930**	27400	4960	ND	ND	4960	
	30/01/2008	14.575	-	-	15	6.26	1820	21.6	2.28	181	**2930**	1250	1280	2130	1510	3640	10600	2020	ND	ND	2020	Slight HC odour
	16/03/2011	14.73	-	0	8	4.74	37	23.9	0.14	173*	**96**	8	27	37	13	37	190	520	<100	<100	620	Light brown and turbid with strong HC odour
	20/08/2013	15.7	17.1	-	7.5	5.01	225.4	19.6	0.86	-122.6	**130**	2	22	10	2	12	470	400	<100	<100	500	Slightly cloudy, HC odour
	4/12/2014	-	-	Not sampled																		
	2/03/2015	13.29	17.1	-	12	5.15	213.3	21.2	0.83	-29	**150**	41	90	63	280	343	1600	890	<100	<100	890	Clear, slight odour
	11/06/2015	15.1	17.1	-	4	6.34	258.3	20	0.25	-151	**140**	5	41	3	22	25	720	700	<100	<100	700	Pale brown, turbid, HC odour
	5/04/2017	-	-	Not sampled																		
MW18	14/06/2006	-	-	-	-	-	-	-	-	-	**4940**	2830	850	3220	1160	4380	13000	7540	ND	ND	7540	
	30/01/2008	6.075	-	-	30	6.99	417	22.9	0.9	129	**905**	204	434	931	290	1221	4980	3810	ND	ND	3810	HC odour, sheen, clear
	17/03/2011	6.13	-	0	6	5.12	261	20.8	0.1	29*	**76**	5	26	32	2	34	210	520	<100	<100	620	Clear with strong HC odour
	20/08/2013	7.055	8.15	-	8	5.88	353.8	21	0.27	-122.2	**290**	6	150	110	<1	110.5	1800	970	130	<100	1150	Slightly cloudy, HC odour
	4/12/2014	-	-	Not sampled																		
	3/03/2015	5.61	8.9	-	10	6.3	346.6	21.4	0.34	-160.6	**140**	28	62	3	59	62	1000	630	<100	<100	630	Clear, slight HC odour
	11/06/2015	6.6	8.9	-	6	6.28	268.1	21.3	0.28	-74	**130**	4	59	<1	41	41	750	480	<100	<100	480	Clear, HC odour
	5/04/2017	4.58	8.93	0	4	6.42	301.7	21.8	1.51	-109.1	**15**	<1	3	3	<1	3	320	70	<100	<100	<100	Clear, no odour, no sheen
MW19	15/06/2006	-	-	-	-	-	-	-	-	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	30/01/2008	3.58	-	-	10.5	5.56	203.7	21.3	0.94	298	<1	<1	2	3	2	5	ND	ND	ND	ND	ND	Brown, turbid, no odour or sheen
	17/03/2011	-	-	Could not locate																		
	22/08/2013	-	-	Could not locate																		
	4/12/2014	4.09	5.4	-	3.5	5.91	79.4	19.3	3.79	13.3	<1	<1	<1	<2	<1	ND	<10	<50	<100	<100	ND	Turbid, very slight odour
	4/03/2015	-	-	Could not locate																		
	11/06/2015	-	-	Could not locate																		
	5/04/2017	-	-	Not sampled																		
MW20	14/06/2006	-	-	-	-	-	-	-	-	-	**1390**	62	160	360	55	415	2080	410	ND	ND	410	
	30/01/2008	2.925	-	-	10	5.31	155.6	21.7	0.47	260	<1	<1	<1	16	8	24	50	ND	ND	ND	ND	Brown, turbid, sheen
	17/03/2011	2.81	-	0	8	4.85	187	20.71	1.34	239.4*	**21**	3	31	110	4	114	180	110	<100	<100	210	Clear with slight HC odour
	20/08/2013	3.1	5.8	-	11	5.76	208.3	18.8	0.33	-119.9	6	<1	5	31	<1	31.5	100	<50	<100	<100	ND	Clear-slightly cloudy, slight HC odour
	3/12/2014	3.425	5.8	-	8	5.99	233.1	19.2	0.72	-4.6	<1	<1	1	8	<1	8	36	71	520	<100	591	Turbid, no odour
	3/03/2015	2.62	5.8	-	9	5.07	110.9	21.2	0.43	62.5	2	<1	1	<1	5	5	17	<50	<100	<100	ND	Clear, no odour
	10/06/2015	3.15	-	-	6	5.61	122.7	19.8	0.37	-36	6	<1	10	<1	54	54	130	82	<100	<100	82	Clear, no odour
	6/04/2017	2.59	5.8	0	8	5.23	118.4	21.8	1.16	-16.7	<1	<1	<1	<2	<1	<3	<20	<50	<100	<100	<100	Clear, no odour, no sheen
MW21	14/06/2006	-	-	-	-	-	-	-	-	-	**190**	94	490	2590	890	3480	6070	9200	ND	ND	9200	
	30/01/2008	5.325	-	-	30	5.9	125	21	0.95	309	**1370**	196	731	2020	830	2850	7040	6430	ND	ND	6430	Brown, turbid, sheen, HC odour
	17/03/2011	5.4	-	0	10	4.77	0.176	20.77	0	272.8*	**250**	<1	27	<2	<1	ND	420	690	<100	<100	790	Clear becoming turbid after 2L purged. Slight HC odour.
	20/08/2013	5.795	6.9	-	4	5.66	174	19.7	0.23	-83.9	<1	<1	3	<2	<1	ND	140	400	<100	<100	500	Clear, slight HC odour
	4/12/2014	-	-	Not sampled																		
	4/03/2015	5.08	6.9	-	7	5.35	110	21.2	0.36	59.4	**45**	<1	<1	2	<2	2	130	73	<100	<100	73	Clear, no odour
	11/06/2015	5.72	6.9	-	6	5.46	134.6	19.9	0.57	101	<1	<1	<1	<1	<2	ND	62	<50	<100	<100	ND	Clear, no odour
	5/04/2017	-	-	Not sampled																		

Appendix C
Table 2
Current and Historic Groundwater Data

		Field Parameters									BTEX						TRH - NEPM 1999					Comments
		SWL	Total well depth	PID	Purge volume	pH	EC	Temp	DO	RP	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	Xylene Total	C6 - C 9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 (Sum of Total)	Observations
		mbTOC	mbTOC	ppm	L	pH units	uS/cm	°C	mg/L	mV	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	-
LOR		-	-	-	-	-	-	-	-	-	1	1	1	1-2	1-2	3	10-20	50	100	100	100	-
NHMRC ADW 2011		-	-	-	-	-	-	-	-	-	1	800	300	-	-	600	-	-	-	-	-	
NEPM 2013 GIL Drinking Water		-	-	-	-	-	-	-	-	-	1	800	300	-	-	600	-	-	-	-	-	
NHMRC Recreational 2008		-	-	-	-	-	-	-	-	-	**10**	**8000**	**3000**	-	-	**6000**	-	-	-	-	-	
NEPM 2013 Groundwater HSL A/B		-	-	-	-	-	-	-	-	-	800	-	-	-	-	-	-	-	-	-	-	
NEPM 2013 Groundwater HSL C		-	-	-	-	-	-	-	-	-	NL	-	-	-	-	-	-	-	-	-	-	
ANZECC 2000 FW 95%		-	-	-	-	-	-	-	-	-	950	180	80	200	350	550	-	-	-	-	-	
NEPM 2013 GIL Freshwater		-	-	-	-	-	-	-	-	-	950	-	-	-	350	-	-	-	-	-	-	
Netherlands (2000)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	600	
Field_ID	**Sampled_Date**																					
MW22	14/06/2006	-	-	-	-	-	-	-	-	-	2960	260	140	280	130	410	3910	1050	ND	ND	1050	
	30/01/2008	9.15	-	-	40	6.44	334	18.9	0.9	154	1720	456	395	686	378	1064	4130	780	ND	ND	780	Clear, HC odour, no sheen
	17/03/2011	9.23	-	461	6	4.99	227	21	0.05	112*	120	9	42	52	5	57	260	250	<100	<100	350	Light brown turbid with slight HC odour
	20/08/2013	10.27	13	-	11	5.55	208.9	20.6	0.39	-119.4	16	<1	14	6	<1	6.5	140	140	<100	<100	240	Clear, very slight HC odour
	4/12/2014	-	-	Not sampled																		
	3/03/2015	7.66	13	-	13	5.61	176.7	20.9	1.43	-51.9	<1	<1	<1	<1	<2	ND	35	<50	<100	<100	ND	Clear, slight HC odour
	11/06/2015	9.72	13	-	8	6.27	214.1	19.9	0.67	-93	20	<1	16	<1	3	3	170	160	<100	<100	160	Clear, HC odour
	5/04/2017	-	-	Not sampled																		
MW23	14/06/2006	-	-	-	-	-	-	-	-	-	9870	1750	190	660	350	1010	13900	2030	ND	ND	2030	
	30/01/2008	12.17	-	-	40	7	360	19	0.23	137	7340	570	223	202	130	332	9870	600	ND	ND	600	HC odour
	17/03/2011	12.18	-	72.4	7	5.1	284	18.5	0.09	114*	2500	750	180	300	180	480	3300	720	130	<100	900	Clear with black suspended solids. Strong HC odour.
	20/08/2013	13.22	17.82	-	18.5	5.34	364.5	20.1	0.75	-88.7	4600	1100	600	1000	210	1210	11000	1500	180	<100	1730	Slightly cloudy, strong HC odour
	4/12/2014	-	-	Not sampled																		
	2/03/2015	10.77	17.9	-	20	6.42	410.1	22	0.82	-131.3	2000	110	210	14	280	294	4000	690	<100	<100	690	Slightly cloudy, slight odour
	11/06/2015	12.67	17.91	-	6	6.68	353.1	20.5	0.23	-92	3300	1000	440	190	970	1160	8700	<50	<100	<100	ND	Brown, turbid, HC odour
	5/04/2017	-	-	Not sampled																		
MW24	15/06/2006	-	-	-	-	-	-	-	-	-	3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	30/01/2008	5.89	-	-	25	5.41	151.1	20.4	1.06	355	<1	<1	<1	<2	<1	ND	ND	ND	ND	ND	ND	Clear, colourless, no odour or sheen
	17/03/2011	6.04	-	0	6	3.72	157	14.5	0.07	488*	5	4	4	12	6	18	25	<50	<100	<100	<250	Light brown with low turbidity. Slight HC odour.
	20/08/2013	6.5	8.9	-	10	5.21	133.2	20.2	0.5	28.2	<1	<1	<1	<2	<1	ND	<10	<50	<100	<100	ND	Clear, no odour
	4/12/2014	-	-	Not sampled																		
	4/03/2015	5.47	8.9	-	10	5.16	138.1	20.9	1.16	50.1	<1	<1	<1	<1	<2	ND	<10	<50	<100	<100	ND	Clear, no odour
	11/06/2015	6.44	8.92	-	8	6.41	220.5	20.8	0.32	37	<1	<1	<1	<1	<2	ND	<10	1500	<100	<100	1500	Cloudy, no odour
	5/04/2017	-	-	Not sampled																		

* ORP field results converted to Standard Hydrogen Electrode (SHE) readings by adding 199 mV to each field value - TPS 90FLMV Water Quality Meter
ND = Non Detect
EC = Electrical Conductivity
RP = Redox Potential
DO = Dissolved Oxygen
mbTOC = metres below top of casing
SWL = Standing water level

Appendix C
Table 3
Current and Historic River Water Data

Coramba Orara River Water Monitoring		all results in micrograms per litre (ug/L)					
		< symbol indicates "less than", i.e. <25 is less than 25 micrograms per litre					
Location No.	**Sample Location**	**Date Sampled**	**Benzene**	**Toluene**	**Ethyl Benzene**	**Xylene**	**TPH C6 - C9**
A	Upstream of footbridge	3/01/2007	<1	<1	<1	<2	<25
	(end Martin Street, Coramba)	20/02/2007	<1	<1	<1	<2	<25
		14/03/2007	<1	<1	<1	<2	<25
		24/04/2007	<1	<1	<1	<2	<25
		27/06/2007	<1	<1	<1	<2	<25
		31/07/2007	<1	<1	<1	<2	<25
		27/08/2007	<1	<1	<1	<2	<25
		24/09/2007	<1	<1	<1	<2	<25
		22/10/2007	<1	<1	<1	<2	<25
		12/12/2007	<1	<1	<1	<2	<25
		23/01/2008	<1	<1	<1	<2	<25
		18/02/2008	<1	<1	<1	<2	<25
		17/03/2008	<1	<1	<1	<2	120
		28/04/2008	<1	<1	<1	<2	<25
		26/05/2008	<1	<1	<1	<2	<25
		25/06/2008	<1	<1	<1	<2	<25
		23/07/2008	<1	<1	<1	<2	<25
		18/08/2008	<1	<1	<1	<2	<25
		15/09/2008	<1	<1	<1	<2	<25
		27/10/2008	<1	<1	<1	<2	<25
		24/11/2008	<1	<1	<1	<2	<25
		8/12/2008	<1	<1	<1	<2	<25
		27/01/2009	<1	<1	<1	<2	<25
		23/02/2009	<1	<1	<1	<2	<25
		25/03/2009	<1	<1	<1	<2	<25
		20/04/2009	<1	<1	<1	<2	<25
		27/04/2009	<1	<1	<1	<2	<25
		18/05/2009	<1	<1	<1	<2	<25
		15/06/2009	<1	<1	<1	<2	<25
		28/07/2009	<1	<1	<1	<2	<25
		24/08/2009	<1	<1	<1	<2	<25
		21/09/2009	<1	<1	<1	<2	<25
		21/10/2009	<1	<1	<1	<2	<25
		17/11/2009	<1	<1	<1	<2	<20
		14/12/2009	<1	<1	<1	<2	<20
		18/01/2010	<1	<2	<2	<2	<20
		16/02/2010	<1	<2	<2	<2	<20
		15/03/2010	<1	<1	<1	<2	<25
		28/04/2010	<1	<1	<1	<2	<25
		25/05/2010	<1	<1	<1	<2	<25
		22/06/2010	<1	<1	<1	<2	<25
		19/07/2010	<1	<1	<1	<2	<25
		16/08/2010	<1	<1	<1	<2	<25
		27/09/2010	<1	<1	<1	<2	<25
		26/10/2010	<1	<1	<1	<2	<25
		23/11/2010	<1	<1	<1	<2	<25
		21/12/2010	<1	<1	<1	<2	<25
		24/01/2011	<1	<1	<1	<2	<25
		21/02/2011	<1	<1	<1	<2	<25
		21/03/2011	<1	<1	<1	<2	<25
		19/04/2011	<1	<1	<1	<2	<25
		17/05/2011	<1	<1	<1	<2	<25
		27/06/2011	<1	<1	<1	<2	<25
		25/07/2011	<1	<1	<1	<2	<25
		22/08/2011	<1	<1	<1	<2	<25
		19/09/2011	<1	<1	<1	<2	<25
		18/10/2011	<1	<1	<1	<2	<25
		29/11/2011	<1	<1	<1	<2	<25
		12/12/2011	<1	<1	<1	<2	<25
		16/01/2012	<1	<1	<1	<2	<25
		28/02/2012	<1	<1	<1	<2	<25
		27/03/2012	<1	<1	<1	<2	<25
		23/04/2012	<1	<1	<1	<2	<25
		21/05/2012	<1	<1	<1	<2	<25
		19/06/2012	<1	<1	<1	<2	<25
		16/07/2012	<1	<1	<1	<2	<25
		27/08/2012	<1	<1	<1	<2	<25
		24/09/2012	<1	<1	<1	<2	<25
		22/10/2012	<1	<1	<1	<2	<25
		19/11/2012	<1	<1	<1	<2	<25
		17/12/2012	<1	<1	<1	<2	<25
		22/01/2013	<1	<1	<1	<2	<25
		19/02/2013	<1	<1	<1	<2	<25
		19/03/2013	<1	<1	<1	<2	<25
		16/04/2013	<1	<1	<1	<2	<25
		14/05/2013	<1	<1	<1	<2	<25
		24/06/2013	<1	<1	<1	<2	<25
		22/07/2013	<1	<1	<1	<2	<25
		21/08/2013	<1	<1	<1	<2	<25
		17/09/2013	<1	<1	<1	<2	<25
		22/10/2013	<1	<1	<1	<2	<25
		12/11/2013	<1	<1	<1	<2	<25
		10/12/2013	<1	<1	<1	<2	<25
		14/01/2014	<1	<1	<1	<2	<25
		12/02/2014	<1	<1	<1	<2	<25
		25/03/2014	<1	<1	<1	<2	<25
		22/04/2014	<1	<1	<1	<2	<25
		20/05/2014	<1	<1	<1	<2	<25
		17/06/2014	<1	<1	<1	<2	<25
		15/07/2014	<1	<1	<1	<2	<25
		12/08/2014	<1	<1	<1	<2	<25
		18/11/2014	<1	<1	<1	<2	<25
		16/12/2014	<1	<1	<1	<2	<25
		20/01/2015	<1	<1	<1	<2	<25
		17/02/2015	<1	<1	<1	<2	<25
		16/03/2015	<1	<1	<1	<2	<25
		5/05/2015	<1	<1	<1	<2	<25
		26/05/2015	<1	<2	<2	<2	<20
		24/06/2015	<1	<2	<2	<2	<20
		29/03/2017	<1	<2	<2	<3	<20

Appendix C
Table 3
Current and Historic River Water Data

Coramba Orara River Water Monitoring		all results in micrograms per litre (ug/L)					
		< symbol indicates "less than", i.e. <25 is less than 25 micrograms per litre					
Location No.	**Sample Location**	**Date Sampled**	**Benzene**	**Toluene**	**Ethyl Benzene**	**Xylene**	**TPH C6 - C9**
Location No.	**Sample Location**	**Date Sampled**	**Benzene**	**Toluene**	**Ethyl Benzene**	**Xylene**	**TPH C6 - C9**
B	Outside bund	3/01/2007	<1	<1	<1	<2	
	(Sample site in backwater of river	20/02/2007	<1	<1	<1	<2	
	adjacent to problem area)	14/03/2007	<1	<1	<1	<2	
	(downstream from Site A)	24/04/2007	35	<1	5.5	12	
		27/06/2007	<1	<1	<1	<2	
		31/07/2007	<1	<1	<1	6.3	
		27/08/2007	<1	<1	5.3	10	
		24/09/2007	<1	<1	<1	<2	
		22/10/2007	2.6	<1	1.2	3.6	
		12/12/2007	<1	<1	<1	<2	
		23/01/2008	<1	<1	<1	<2	
		18/02/2008	<1	<1	<1	<2	
		17/03/2008	<1	<1	<1	<2	
		28/04/2008	<1	<1	<1	<2	
		26/05/2008	5.1	<1	2	4.8	
		25/06/2008	<1	<1	<1	<2	
		23/07/2008	<1	<1	<1	<2	
		18/08/2008	48	1.1	1.4	<2	
		15/09/2008	<1	<1	<1	<2	
		27/10/2008	<1	<1	<1	<2	
		24/11/2008	<1	<1	<1	<2	
		8/12/2008	<1	<1	<1	<2	
		27/01/2009	1.6	<1	<1	<2	
		23/02/2009	<1	<1	<1	<2	
		25/03/2009	<1	<1	<1	<2	
		20/04/2009	11	<1	5.1	16	
		27/04/2009	<1	<1	<1	<2	
		18/05/2009	<1	<1	1.3	2.5	
		15/06/2009	<1	<1	<1	<2	
		28/07/2009	13	<1	2.4	3.5	
		24/08/2009	<1	<1	<1	<2	
		21/09/2009	<1	<1	<1	<2	
		21/10/2009	<1	<1	<1	<2	
		17/11/2009	<1	<1	<1	<2	
		14/12/2009	<1	<1	<1	<2	
		18/01/2010	<1	<2	<2	<2	
		16/02/2010	14	<2	<2	16	
		15/03/2010	<1	<1	<1	<2	
		28/04/2010	<1	<1	<1	<2	
		25/05/2010	35	1.6	1	14.3	
		22/06/2010	<1	<1	<1	<2	
		19/07/2010	<1	<1	<1	<2	
		16/08/2010	<1	<1	<1	<2	
		27/09/2010	2.5	<1	<1	<2	
		26/10/2010	<1	<1	<1	<2	
		23/11/2010	<1	<1	<1	<2	
		21/12/2010	<1	<1	<1	<2	
		24/01/2011	<1	<1	<1	<2	
		21/02/2011	<1	<1	<1	<2	
		21/03/2011	<1	<1	<1	<2	
		19/04/2011	4.1	<1	<1	<2	
		17/05/2011	<1	<1	<1	<2	
		27/06/2011	2.1	<1	2.1	5	
		25/07/2011	<1	<1	<1	<2	
		22/08/2011	<1	<1	<1	<2	
		19/09/2011	<1	<1	<1	<2	
		18/10/2011	<1	<1	<1	<2	
		29/11/2011	<1	<1	<1	<2	
		12/12/2011	<1	<1	<1	<2	
		16/01/2012	<1	<1	<1	<2	
		28/02/2012	<1	<1	<1	<2	
		27/03/2012	<1	<1	<1	<2	
		23/04/2012	<1	<1	<1	<2	
		21/05/2012	1.1	<1	1.7	5.7	
		19/06/2012	<1	<1	<1	<2	
		16/07/2012	<1	<1	<1	<2	
		27/08/2012	<1	<1	<1	<2	
		24/09/2012	<1	<1	<1	<2	
		22/10/2012	<1	<1	<1	<2	
		19/11/2012	<1	<1	<1	<2	
		17/12/2012	<1	<1	<1	<2	
		22/01/2013	<1	<1	<1	<2	
		19/02/2013	<1	<1	<1	<2	
		19/03/2013	1.1	<1	<1	3.6	
		16/04/2013	<1	<1	<1	<2	
		14/05/2013	<1	<1	<1	<2	
		24/06/2013	<1	<1	<1	<2	
		22/07/2013	<1	<1	<1	<2	
		21/08/2013	<1	<1	<1	<2	
		17/09/2013	<1	<1	<1	<2	
		22/10/2013	<1	<1	<1	<2	
		12/11/2013	<1	<1	<1	<2	
		10/12/2013	<1	<1	<1	<2	
		14/01/2014	<1	<1	<1	<2	
		12/02/2014	<1	<1	<1	<2	
		25/03/2014	<1	<1	<1	<2	
		22/04/2014	<1	<1	<1	<2	
		20/05/2014	<1	<1	<1	<2	
		17/06/2014	<1	<1	<1	<2	
		15/07/2014	<1	<1	<1	<2	
		12/08/2014	<1	<1	<1	<2	
		18/11/2014	<1	<1	<1	<2	
		16/12/2014	<1	<1	<1	<2	
		20/01/2015	N/A	N/A	N/A	N/A	
		17/02/2015	<1	<1	<1	<2	
		16/03/2015	<1	<1	<1	<2	
		5/05/2015	<1	<1	<1	<2	
		26/05/2015	<1	<2	<2	<2	
		24/06/2015	<1	<2	<2	<2	
		29/03/2017	<1	<2	<2	<3	<20

Appendix C
Table 3
Current and Historic River Water Data

Coramba Orara River Water Monitoring		all results in micrograms per litre (ug/L)					
		< symbol indicates "less than", i.e. <25 is less than 25 micrograms per litre					
Location No.	**Sample Location**	**Date Sampled**	**Benzene**	**Toluene**	**Ethyl Benzene**	**Xylene**	**TPH C6 - C9**
Location No.	**Sample Location**	**Date Sampled**	**Benzene**	**Toluene**	**Ethyl Benzene**	**Xylene**	**TPH C6 - C9**
C	Former water supply location	3/01/2007	<1	<1	<1	<2	
	(Adjacent original intake location	20/02/2007	<1	<1	<1	<2	
	for Coramba supply (in river))	14/03/2007	<1	<1	<1	<2	
	(downstream from Sites A & B)	24/04/2007	1.4	<1	<1	<2	
		27/06/2007	<1	<1	<1	<2	
		31/07/2007	<1	<1	<1	<2	
		27/08/2007	<1	<1	<1	<2	
		24/09/2007	<1	<1	<1	<2	
		22/10/2007	<1	<1	<1	1.1	
		12/12/2007	<1	<1	<1	<2	
		23/01/2008	<1	<1	<1	<2	
		18/02/2008	<1	<1	<1	<2	
		17/03/2008	<1	<1	<1	<2	
		28/04/2008	<1	<1	<1	<2	
		26/05/2008	<1	<1	<1	<2	
		25/06/2008	<1	<1	<1	<2	
		23/07/2008	<1	<1	<1	<2	
		18/08/2008	<1	<1	<1	<2	
		15/09/2008	<1	<1	<1	<2	
		27/10/2008	<1	<1	<1	<2	
		24/11/2008	<1	<1	<1	<2	
		8/12/2008	<1	<1	<1	<2	
		27/01/2009	<1	<1	<1	<2	
		23/02/2009	<1	<1	<1	<2	
		25/03/2009	<1	<1	<1	<2	
		20/04/2009	<1	<1	<1	<2	
		27/04/2009	<1	<1	<1	<2	
		18/05/2009	<1	<1	<1	<2	
		15/06/2009	<1	<1	<1	<2	
		28/07/2009	<1	<1	<1	<2	
		24/08/2009	<1	<1	<1	<2	
		21/09/2009	<1	<1	<1	<2	
		21/10/2009	<1	<1	<1	<2	
		17/11/2009	<1	<1	<1	<2	
		14/12/2009	<1	<1	<1	<2	
		18/01/2010	<1	<2	<2	<2	
		16/02/2010	<1	<2	<2	<2	
		15/03/2010	<1	<1	<1	<2	
		28/04/2010	<1	<1	<1	<2	
		25/05/2010	<1	<1	<1	<2	
		22/06/2010	<1	<1	<1	<2	
		19/07/2010	<1	<1	<1	<2	
		16/08/2010	<1	<1	<1	<2	
		27/09/2010	<1	<1	<1	<2	
		26/10/2010	<1	<1	<1	<2	
		23/11/2010	<1	<1	<1	<2	
		21/12/2010	<1	<1	<1	<2	
		24/01/2011	<1	<1	<1	<2	
		21/02/2011	<1	<1	<1	<2	
		21/03/2011	<1	<1	<1	<2	
		19/04/2011	<1	<1	<1	<2	
		17/05/2011	<1	<1	<1	<2	
		27/06/2011	<1	<1	<1	<2	
		25/07/2011	<1	<1	<1	<2	
		22/08/2011	<1	<1	<1	<2	
		19/09/2011	<1	<1	<1	<2	
		18/10/2011	<1	<1	<1	<2	
		29/11/2011	<1	<1	<1	<2	
		12/12/2011	<1	<1	<1	<2	
		16/01/2012	<1	<1	<1	<2	
		28/02/2012	<1	<1	<1	<2	
		27/03/2012	<1	<1	<1	<2	
		23/04/2012	<1	<1	<1	<2	
		21/05/2012	<1	<1	<1	<2	
		19/06/2012	<1	<1	<1	<2	
		16/07/2012	<1	<1	<1	<2	
		27/08/2012	<1	<1	<1	<2	
		24/09/2012	<1	<1	<1	<2	
		22/10/2012	<1	<1	<1	<2	
		19/11/2012	<1	<1	<1	<2	
		17/12/2012	<1	<1	<1	<2	
		22/01/2013	<1	<1	<1	<2	
		19/02/2013	<1	<1	<1	<2	
		19/03/2013	<1	<1	<1	<2	
		16/04/2013	<1	<1	<1	<2	
		14/05/2013	<1	<1	<1	<2	
		24/06/2013	<1	<1	<1	<2	
		22/07/2013	<1	<1	<1	<2	
		21/08/2013	<1	<1	<1	<2	
		17/09/2013	<1	<1	<1	<2	
		22/10/2013	<1	<1	<1	<2	
		12/11/2013	<1	<1	<1	<2	
		10/12/2013	<1	<1	<1	<2	
		14/01/2014	<1	<1	<1	<2	
		12/02/2014	<1	<1	<1	<2	
		25/03/2014	<1	<1	<1	<2	
		22/04/2014	<1	<1	<1	<2	
		20/05/2014	<1	<1	<1	<2	
		17/06/2014	<1	<1	<1	<2	
		15/07/2014	<1	<1	<1	<2	
		12/08/2014	<1	<1	<1	<2	
		18/11/2014	<1	<1	<1	<2	
		16/12/2014	<1	<1	<1	<2	
		20/01/2015	<1	<1	<1	<2	
		17/02/2015	<1	<1	<1	<2	
		16/03/2015	<1	<1	<1	<2	
		5/05/2015	<1	<1	<1	<2	
		26/05/2015	<1	<2	<2	<2	
		24/06/2015	<1	<2	<2	<2	

Appendix C
Table 3
Current and Historic River Water Data

Coramba Orara River Water Monitoring		all results in micrograms per litre (ug/L)					
		< symbol indicates "less than", i.e. <25 is less than 25 micrograms per litre					
Location No.	**Sample Location**	**Date Sampled**	**Benzene**	**Toluene**	**Ethyl Benzene**	**Xylene**	**TPH C6 - C9**
Location No.	**Sample Location**	**Date Sampled**	**Benzene**	**Toluene**	**Ethyl Benzene**	**Xylene**	**TPH C6 - C9**
D	150-200m Downstream (of site C)	3/01/2007	<1	<1	<1	<2	
		20/02/2007	<1	<1	<1	<2	
		14/03/2007	<1	<1	<1	<2	
		24/04/2007	<1	<1	<1	<2	
		27/06/2007	<1	<1	<1	<2	
		31/07/2007	<1	<1	<1	<2	
		27/08/2007	<1	<1	<1	<2	
		24/09/2007	<1	<1	<1	<2	
		22/10/2007	<1	<1	<1	<2	
		12/12/2007	<1	<1	<1	<2	
		23/01/2008	<1	<1	<1	<2	
		18/02/2008	<1	<1	<1	<2	
		17/03/2008	<1	<1	<1	<2	
		28/04/2008	<1	<1	<1	<2	
		26/05/2008	<1	<1	<1	<2	
		25/06/2008	<1	<1	<1	<2	
		23/07/2008	<1	<1	<1	<2	
		18/08/2008	<1	<1	<1	<2	
		15/09/2008	<1	<1	<1	<2	
		27/10/2008	<1	<1	<1	<2	
		24/11/2008	<1	<1	<1	<2	
		8/12/2008	<1	<1	<1	<2	
		27/01/2009	<1	<1	<1	<2	
		23/02/2009	<1	<1	<1	<2	
		25/03/2009	<1	<1	<1	<2	
		20/04/2009	<1	<1	<1	<2	
		27/04/2009	<1	<1	<1	<2	
		18/05/2009	<1	<1	<1	<2	
		15/06/2009	<1	<1	<1	<2	
		28/07/2009	<1	<1	<1	<2	
		24/08/2009	<1	<1	<1	<2	
		21/09/2009	<1	<1	<1	<2	
		21/10/2009	<1	<1	<1	<2	
		17/11/2009	<1	<1	<1	<2	
		14/12/2009	<1	<1	<1	<2	
		18/01/2010	<1	<2	<2	<2	
		16/02/2010	<1	<2	<2	<2	
		15/03/2010	<1	<1	<1	<2	
		28/04/2010	<1	<1	<1	<2	
		25/05/2010	<1	<1	<1	<2	
		22/06/2010	<1	<1	<1	<2	
		19/07/2010	<1	<1	<1	<2	
		16/08/2010	<1	<1	<1	<2	
		27/09/2010	<1	<1	<1	<2	
		26/10/2010	<1	<1	<1	<2	
		23/11/2010	<1	<1	<1	<2	
		21/12/2010	<1	<1	<1	<2	
		24/01/2011	<1	<1	<1	<2	
		21/02/2011	<1	<1	<1	<2	
		21/03/2011	<1	<1	<1	<2	
		19/04/2011	<1	<1	<1	<2	
		17/05/2011	<1	<1	<1	<2	
		27/06/2011	<1	<1	<1	<2	
		25/07/2011	<1	<1	<1	<2	
		22/08/2011	<1	<1	<1	<2	
		19/09/2011	<1	<1	<1	<2	
		18/10/2011	<1	<1	<1	<2	
		29/11/2011	<1	<1	<1	<2	
		12/12/2011	<1	<1	<1	<2	
		16/01/2012	<1	<1	<1	<2	
		28/02/2012	<1	<1	<1	<2	
		27/03/2012	<1	<1	<1	<2	
		23/04/2012	<1	<1	<1	<2	
		21/05/2012	<1	<1	<1	<2	
		19/06/2012	<1	<1	<1	<2	
		16/07/2012	<1	<1	<1	<2	
		27/08/2012	<1	<1	<1	<2	
		24/09/2012	<1	<1	<1	<2	
		22/10/2012	<1	<1	<1	<2	
		19/11/2012	<1	<1	<1	<2	
		17/12/2012	<1	<1	<1	<2	
		22/01/2013	<1	<1	<1	<2	
		19/02/2013	<1	<1	<1	<2	
		19/03/2013	<1	<1	<1	<2	
		16/04/2013	<1	<1	<1	<2	
		14/05/2013	<1	<1	<1	<2	
		24/06/2013	<1	<1	<1	<2	
		22/07/2013	<1	<1	<1	<2	
		21/08/2013	<1	<1	<1	<2	
		17/09/2013	<1	<1	<1	<2	
		22/10/2013	<1	<1	<1	<2	
		12/11/2013	<1	<1	<1	<2	
		10/12/2013	<1	<1	<1	<2	
		14/01/2014	<1	<1	<1	<2	
		12/02/2014	<1	<1	<1	<2	
		25/03/2014	<1	<1	<1	<2	
		22/04/2014	<1	<1	<1	<2	
		20/05/2014	<1	<1	<1	<2	
		17/06/2014	<1	<1	<1	<2	
		15/07/2014	<1	<1	<1	<2	
		12/08/2014	<1	<1	<1	<2	
		18/11/2014	<1	<1	<1	<2	
		16/12/2014	<1	<1	<1	<2	
		20/01/2015	<1	<1	<1	<2	
		17/02/2015	<1	<1	<1	<2	
		16/03/2015	<1	<1	<1	<2	
		5/05/2015	<1	<1	<1	<2	
		26/05/2015	<1	<2	<2	<2	
		24/06/2015	<1	<2	<2	<2	

Appendix C
Table 3
Current and Historic River Water Data

Coramba Orara River Water Monitoring			all results in micrograms per litre (ug/L)				
		< symbol indicates "less than", i.e. <25 is less than 25 micrograms per litre					
Location No.	**Sample Location**	**Date Sampled**	**Benzene**	**Toluene**	**Ethyl Benzene**	**Xylene**	**TPH C6 - C9**
Additional downstream samples for reference							
downstream	500m Downstream	8/08/2006	<1	<1	<1	<2	
		24/08/2006	<1	<1	<1	<2	
downstream	Downstream 3km	27/07/2006	<1	<1	<1	<2	
	(near TOFOG sportsground)	8/08/2006	<1	<1	<1	<2	
		7/09/2006	<1	<1	<1	<2	
downstream	Adjacent Nana Glen Intake Location	27/07/2006	<1	<1	<1	<2	
	(downstream ~14km)	8/08/2006	<1	<1	<1	<2	
		24/08/2006	<1	<1	<1	<2	
		7/09/2006	<1	<1	<1	<2	
		3/01/2007	<1	<1	<1	<2	

Appendix C
Table 4
Groundwater RPD Results

Lab Report Number	541995	541995		541995	541995	
Field ID	MW12	DUP1	RPD	MW6	DUP2	RPD
Sampled Date/Time	5/04/2017	5/04/2017		5/04/2017	5/04/2017	

Chem_Group	ChemName	Units	LOR						
TRH - NEPM 2013	C6-C10 minus BTEX (F1)	µg/L	20	1400	1700	19	1500	1700	13
	C6 - C10 Fraction	µg/L	20	2200	2500	13	2200	2500	13
	>C10-C16 minus Naphthalene (F2)	µg/L	100	210	150	33	140	330	81
	>C10 - C16 Fraction	µg/L	100	210	210	0	140	390	94
	>C16 - C34 Fraction (F3)	µg/L	100	<100	<100	0	<100	<100	0
	>C34 - C40 Fraction (F4)	µg/L	100	<100	<100	0	<100	<100	0
TRH - NEPM 1999	C6 - C 9 Fraction	µg/L	20	1800	2100	15	1800	2000	11
	C10 - C14 Fraction	µg/L	50	750	480	44	510	900	**55**
	C15 - C28 Fraction	µg/L	100	<100	<100	0	<100	<100	0
	C29 - C36 Fraction	µg/L	100	<100	<100	0	<100	<100	0
	C10 - C36 (Sum of Total)	µg/L	100	750	480	44	510	900	55
BTEX	Benzene	µg/L	1	190	160	17	140	200	35
	Toluene	µg/L	1	27	50	**60**	50	28	**56**
	Ethylbenzene	µg/L	1	250	290	15	270	260	4
	Xylene (o)	µg/L	1	20	57	**96**	56	21	**91**
	Xylene (m & p)	µg/L	2	280	230	20	220	290	27
	Xylene Total	µg/L	3	300	290	3	270	310	14
PAH	Naphthalene	µg/L	10	<10	60	143	<10	60	143

*RPDs have only been considered where a concentration is greater than 1 times the LOR.
**High RPDs are in bold (Acceptable RPDs for each LOR multiplier range are: 200 (1-10 x LOR); 50 (10-30 x LOR); 50 (> 30 x LOR))

Appendix C
Table 5
Groundwater QA Results

			TRH - NEPM 2013							TRH - NEPM 1999					BTEX							PAH
			C6-C10 minus BTEX (F1)	C6 - C10 Fraction	>C10-C16 minus Naphthalene (F2	>C10 - C16 Fraction	>C16 - C34 Fraction (F3)	>C34 - C40 Fraction (F4)	>C10 - C40 (Sum of Total)	C6 - C 9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 (Sum of Total)	Benzene	Toluene	Ethylbenzene	Xylene (o)	Xylene (m & p)	Xylene Total	BTEX (Sum of Total) - Lab Calc	Naphthalene
LOR (TB and Rinsate)			20	20	50	50	100	100	-	20	50	100	100	100	1	2	2	2	2	2	1	10
Field_ID	**Sampled_Date**	**Units**																				
Rinsate1	5/04/2017	ug/L	<20	<20	<50	<50	<100	<100	-	<20	<50	<100	<100	<100	<1	<1	<1	<1	<2	<3	-	<10
Rinsate2	6/04/2017	ug/L	<20	<20	<50	<50	<100	<100	-	<20	<50	<100	<100	<100	<1	<1	<1	<1	<2	<3	-	<10
TB01	3/04/2017	ug/L	<20	<20	-	-	-	-	-	<20	-	-	-	-	<1	<1	<1	<1	<2	<3	-	<10
TB02	3/04/2017	ug/L	<20	<20	-	-	-	-	-	<20	-	-	-	-	<1	<1	<1	<1	<2	<3	-	<10
TS01	3/04/2017	%	83	-	-	-	-	-	-	70	-	-	-	-	110	96	96	101	92	95	-	82
TS02	3/04/2017	%	82	-	-	-	-	-	-	70	-	-	-	-	101	94	88	95	89	91	-	98

Appendix C
Table 6
Monitored Natural Attenuation Parameters

Coffs Harbour City Council
Coramba

		MNA indicators																					
		pH (lab derived)	EC (lab derived)	Total alkalinity	Chloride	Fluoride	Sulphate	NO2-N	NO3-N	Ammonia as N	Ferrous Iron	Calcium	Manganese	Magnesium	Sodium	Potassium	Sulphide	Methane	Hydroxide	Hardness	Bicarbonate as CaCO3	Carbonate as CaCO3	Free CO2
		pH units	uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	ug/L
LOR		0.1	1	5	1	0.1	1-5	0.01	0.01-0.02	0.005-0.01	0.1-0.5	0.1-0.5	0.005	0.1-0.5	0.1-0.5	0.1-0.5	0.1	0.05	5000	5	5	5	0-5
Field_ID	**Sampled_Date**																						
MW2	3/07/2006	6	202	36	21	-	14	0	0	0	29	3	-	2	23	3	-	-	-	-	-	-	-
	29/01/2008	-	-	33	21	0	10	0	0	0	1	4	-	2	25	3	<0.1	-	-	-	-	-	83000
	17/03/2011	-	-	100	27	-	2.6	-	-	0.2	26	4.7	-	4.4	22	2.1	-	-	-	-	-	-	44000
	21/08/2013	-	-	59	33	-	7	-	-	0.024	29	4.2	-	4.2	19	1.6	-	-	<5000	-	59	<5	150000
	4/12/2014	No access																					
	4/03/2015	-	-	<5	37	-	2	-	-	0.018	<0.05	0.7	-	3.3	16	1.3	-	-	-	-	-	<5	71000
	11/06/2015	Dry																					
	5/04/2017	-	-	<20	34	-	<5	-	0.17	<0.01	<0.05	1.1	0.022	3.8	15	1.8	-	<0.05	-	18	<20	<10	-
MW6	3/07/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	30/01/2008	-	-	144	21	<0.1	2	<0.01	<0.01	<0.01	10	4	-	11	26	4	<0.1	-	-	-	-	-	58000
	17/03/2011	-	-	92	18	-	8.8	-	-	0.05	8.6	2	-	4.4	29	3.1	-	-	-	-	-	-	240000
	21/08/2013	-	-	130	25	-	4	-	-	0.009	10	2.7	-	7.9	26	3.5	-	-	<5000	-	130	<5	120000
	3/12/2014	-	-	120	23	-	1	-	-	0.033	4.4	1.9	-	5	37	2.8	-	-	<5000	-	120	<5	120000
	4/03/2015	-	-	82	23	-	19	-	-	0.058	9	2.3	-	4.4	33	2.7	-	-	-	-	-	<5	90000
	10/06/2015	-	-	76	23	-	24	-	-	0.072	6.2	1.7	-	3.7	36	3	-	-	-	-	-	<5	94000
	5/04/2017	-	-	97	24	-	6.8	-	<0.02	0.04	12	1.5	17	5	32	2.5	-	0.52	-	24	97	<10	-
MW9	5/04/2017	-	-	<20	19	-	13	-	<0.02	<0.01	<0.05	0.9	0.054	9.9	16	3.1	-	<0.05	-	7.9	<20	<10	-
MW11	3/07/2006	7	357	120	24	-	<2	<0.05	<0.05	1	7	6	-	12	24	4	-	-	-	-	-	-	-
	29/01/2008	-	-	152	20	0	<2	<0.01	<0.01	0	15	5	-	12	21	4	<0.1	-	-	-	-	-	76000
	16/03/2011	-	-	160	20	-	<1	-	-	0.3	14	4	-	9.4	20	4.1	-	-	-	-	-	-	11000
	22/08/2013	Could not locate																					
	4/12/2014	-	-	140	21	-	<1	-	-	0.65	31	4.3	-	10	18	3.2	-	-	<5000	-	140	<5	140000
	3/03/2015	-	-	120	21	-	<1	-	-	0.14	27	4	-	9.1	16	3.7	-	-	-	-	-	<5	86000
	10/06/2015	-	-	130	19	-	<1	-	-	2	29	3.7	-	8.2	17	3.6	-	-	-	-	-	<5	130000
	5/04/2017	-	-	110	34	-	<5	-	<0.02	0.38	29	3.5	25	9.9	16	3.1	-	1.3	-	49	110	<10	-
MW14	4/07/2006	7	378	130	27	-	2	0	0	0	4	4	-	11	28	6	-	-	-	-	-	-	-
	30/01/2008	-	-	136	23	<0.1	2	<0.01	<0.01	<0.01	6	3	-	10	27	5	<0.1	-	-	-	-	-	68000
	16/03/2011	-	-	140	21	-	<1	-	-	0.03	8.7	2.7	-	8.2	25	6	-	-	-	-	-	-	310000
	21/08/2013	-	-	150	26	-	<1	-	-	<0.005	10	3.1	-	9	20	5.4	-	-	<5000	-	150	<5	970000
	4/12/2014	-	-	160	24	-	<1	-	-	<0.02	7.6	3.8	-	12	28	5.4	-	-	<5000	-	160	<5	90000
	2/03/2015	-	-	160	-	-	<1	-	-	0.055	0.97	3.7	-	11	26	6.1	-	-	-	-	-	<5	85000
	11/06/2015	-	-	160	26	-	<1	-	-	<0.005	9.9	3.1	-	10	25	6.5	-	-	-	-	-	<5	92000
	5/04/2017	-	-	160	28	-	<5	-	<0.02	<0.01	9	3	46	13	21	5.1	-	1.5	-	60	160	<10	-
MW15	10/06/2015	-	-	27	21	-	16	-	-	0.051	2	7.4	-	1.1	29	3	-	-	-	-	-	<5	310000
MW24	4/07/2006	6	247	44	27	-	7	0	3	<0.01	<0.5	13	-	4	30	3	-	-	-	-	-	-	-

Appendix D – Laboratory Documents

eurofins | mgt

Certificate of Analysis

GHD Pty Ltd NSW
Level 15, 133 Castlereagh Street
Sydney
NSW 2000

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Brian Cork**

Report **541995-W**
Project name CORAMBA GME
Project ID 2218605
Received Date Apr 11, 2017

Client Sample ID			**MW10**	**MW4B**	**MW12**	**MW6**
Sample Matrix			**Water**	**Water**	**Water**	**Water**
Eurofins | mgt Sample No.			**S17-Ap08863**	**S17-Ap08864**	**S17-Ap08865**	**S17-Ap08866**
Date Sampled			**Apr 05, 2017**	**Apr 05, 2017**	**Apr 05, 2017**	**Apr 05, 2017**
Test/Reference	LOR	Unit				
Ammonia (as N)	0.01	mg/L	-	-	-	0.04
Chloride	1	mg/L	-	-	-	24
Ferrous Iron - Fe2+	0.05	mg/L	-	-	-	12
Nitrate (as N)	0.02	mg/L	-	-	-	< 0.02
Sulphate (as SO4)	5	mg/L	-	-	-	6.8
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	0.56	1.8	1.8
TRH C10-C14	0.05	mg/L	< 0.05	0.07	0.75	0.51
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-36 (Total)	0.1	mg/L	< 0.1	< 0.1	0.75	0.51
BTEX						
Benzene	0.001	mg/L	< 0.001	0.012	0.19	0.14
Toluene	0.001	mg/L	< 0.001	0.058	0.027	0.050
Ethylbenzene	0.001	mg/L	< 0.001	0.043	0.25	0.27
m&p-Xylenes	0.002	mg/L	< 0.002	0.068	0.28	0.22
o-Xylene	0.001	mg/L	< 0.001	0.030	0.020	0.056
Xylenes - Total	0.003	mg/L	< 0.003	0.098	0.30	0.27
4-Bromofluorobenzene (surr.)	1	%	96	87	74	85
Dissolved Gases						
Methane	0.05	mg/L	-	-	-	0.52
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05	< 0.05	0.21	0.14
TRH C6-C10	0.02	mg/L	< 0.02	0.65	2.2	2.2
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	0.44	1.4	1.5
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	0.21	0.14
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	-	-	-	97
Carbonate Alkalinity (as CaCO3)	10	mg/L	-	-	-	< 10
Total Alkalinity (as CaCO3)	20	mg/L	-	-	-	97
Heavy Metals						
Manganese	0.005	mg/L	-	-	-	17

Client Sample ID			MW10	MW4B	MW12	MW6
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			S17-Ap08863	S17-Ap08864	S17-Ap08865	S17-Ap08866
Date Sampled			Apr 05, 2017	Apr 05, 2017	Apr 05, 2017	Apr 05, 2017
Test/Reference	LOR	Unit				
Alkali Metals						
Calcium	0.5	mg/L	-	-	-	1.5
Magnesium	0.5	mg/L	-	-	-	5.0
Potassium	0.5	mg/L	-	-	-	2.5
Sodium	0.5	mg/L	-	-	-	32
Hardness Set						
Hardness mg equivalent CaCO3/L	5	mg/L	-	-	-	24

Client Sample ID			MW2	MW15	MW18	MW20
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			S17-Ap08867	S17-Ap08868	S17-Ap08869	S17-Ap08870
Date Sampled			Apr 06, 2017	Apr 06, 2017	Apr 05, 2017	Apr 06, 2017
Test/Reference	LOR	Unit				
Ammonia (as N)	0.01	mg/L	< 0.01	-	-	-
Chloride	1	mg/L	34	-	-	-
Ferrous Iron - Fe2+	0.05	mg/L	< 0.05	-	-	-
Nitrate (as N)	0.02	mg/L	0.17	-	-	-
Sulphate (as SO4)	5	mg/L	< 5	-	-	-
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	0.32	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05	0.07	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-36 (Total)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	0.015	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	0.003	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	0.003	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003	0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	75	77	107	74
Dissolved Gases						
Methane	0.05	mg/L	< 0.05	-	-	-
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05	< 0.05	0.05	< 0.05
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02	0.36	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	< 0.02	0.34	< 0.02
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05	0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	< 20	-	-	-
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	-	-	-
Total Alkalinity (as CaCO3)	20	mg/L	< 20	-	-	-

Client Sample ID			MW2	MW15	MW18	MW20
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			S17-Ap08867	S17-Ap08868	S17-Ap08869	S17-Ap08870
Date Sampled			Apr 06, 2017	Apr 06, 2017	Apr 05, 2017	Apr 06, 2017
Test/Reference	LOR	Unit				
Heavy Metals						
Manganese	0.005	mg/L	0.022	-	-	-
Alkali Metals						
Calcium	0.5	mg/L	1.1	-	-	-
Magnesium	0.5	mg/L	3.8	-	-	-
Potassium	0.5	mg/L	1.8	-	-	-
Sodium	0.5	mg/L	15	-	-	-
Hardness Set						
Hardness mg equivalent CaCO3/L	5	mg/L	18	-	-	-

Client Sample ID			MW14	MW9	MW11	2017.3_DUP1
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			S17-Ap08871	S17-Ap08872	S17-Ap08873	S17-Ap08874
Date Sampled			Apr 06, 2017	Apr 06, 2017	Apr 06, 2017	Apr 05, 2017
Test/Reference	LOR	Unit				
Ammonia (as N)	0.01	mg/L	< 0.01	< 0.01	0.38	-
Chloride	1	mg/L	28	19	34	-
Ferrous Iron - Fe2+	0.05	mg/L	9.0	< 0.05	29	-
Nitrate (as N)	0.02	mg/L	< 0.02	< 0.02	< 0.02	-
Sulphate (as SO4)	5	mg/L	< 5	13	< 5	-
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	44	< 0.02	0.97	2.1
TRH C10-C14	0.05	mg/L	5.5	< 0.05	0.49	0.48
TRH C15-C28	0.1	mg/L	0.1	< 0.1	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH C10-36 (Total)	0.1	mg/L	5.6	< 0.1	0.49	0.48
BTEX						
Comments					R16	
Benzene	0.001	mg/L	6.6	< 0.001	0.11	0.16
Toluene	0.001	mg/L	7.2	< 0.001	0.024	0.050
Ethylbenzene	0.001	mg/L	2.3	< 0.001	< 0.01	0.29
m&p-Xylenes	0.002	mg/L	8.6	< 0.002	0.13	0.23
o-Xylene	0.001	mg/L	3.0	< 0.001	< 0.01	0.057
Xylenes - Total	0.003	mg/L	12	< 0.003	0.13	0.29
4-Bromofluorobenzene (surr.)	1	%	82	71	91	82
Dissolved Gases						
Methane	0.05	mg/L	1.5	< 0.05	1.3	-
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.01	mg/L	0.35	< 0.01	< 0.01	0.06
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	1.6	< 0.05	0.32	0.15
TRH C6-C10	0.02	mg/L	52	< 0.02	1.2	2.5
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	24	< 0.02	0.94	1.7
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
TRH >C10-C16	0.05	mg/L	1.9	< 0.05	0.32	0.21
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1

Client Sample ID			MW14	MW9	MW11	2017.3_DUP1
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			S17-Ap08871	S17-Ap08872	S17-Ap08873	S17-Ap08874
Date Sampled			Apr 06, 2017	Apr 06, 2017	Apr 06, 2017	Apr 05, 2017
Test/Reference	LOR	Unit				
Alkalinity (speciated)						
Bicarbonate Alkalinity (as CaCO3)	20	mg/L	160	< 20	110	-
Carbonate Alkalinity (as CaCO3)	10	mg/L	< 10	< 10	< 10	-
Total Alkalinity (as CaCO3)	20	mg/L	160	< 20	110	-
Heavy Metals						
Manganese	0.005	mg/L	46	0.054	25	-
Alkali Metals						
Calcium	0.5	mg/L	3.0	0.9	3.5	-
Magnesium	0.5	mg/L	13	1.4	9.9	-
Potassium	0.5	mg/L	5.1	2.2	3.1	-
Sodium	0.5	mg/L	21	19	16	-
Hardness Set						
Hardness mg equivalent CaCO3/L	5	mg/L	60	7.9	49	-

Client Sample ID			2017.3_DUP2	RINSATE1	RINSATE2	TS01
Sample Matrix			Water	Water	Water	Water
Eurofins | mgt Sample No.			S17-Ap08875	S17-Ap08876	S17-Ap08877	S17-Ap08878
Date Sampled			Apr 05, 2017	Apr 05, 2017	Apr 06, 2017	Apr 03, 2017
Test/Reference	LOR	Unit				
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	-	-	-	-
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	2.0	< 0.02	< 0.02	70%
TRH C10-C14	0.05	mg/L	0.90	< 0.05	< 0.05	-
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1	< 0.1	-
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1	< 0.1	-
TRH C10-36 (Total)	0.1	mg/L	0.9	< 0.1	< 0.1	-
BTEX						
Benzene	0.001	mg/L	0.20	< 0.001	< 0.001	110%
Toluene	0.001	mg/L	0.028	< 0.001	< 0.001	96%
Ethylbenzene	0.001	mg/L	0.26	< 0.001	< 0.001	96%
m&p-Xylenes	0.002	mg/L	0.29	< 0.002	< 0.002	92%
o-Xylene	0.001	mg/L	0.021	< 0.001	< 0.001	101%
Xylenes - Total	0.003	mg/L	0.31	< 0.003	< 0.003	95%
4-Bromofluorobenzene (surr.)	1	%	76	77	67	77
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
TRH C6-C10	0.02	mg/L	-	-	-	83%
Volatile Organics						
Naphthalene[N02]	0.01	mg/L	-	-	-	82%
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
Naphthalene[N02]	0.01	mg/L	0.06	< 0.01	< 0.01	-
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	0.33	< 0.05	< 0.05	-
TRH C6-C10	0.02	mg/L	2.5	< 0.02	< 0.02	-
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	1.7	< 0.02	< 0.02	-
Total Recoverable Hydrocarbons - 2013 NEPM Fractions						
TRH >C10-C16	0.05	mg/L	0.39	< 0.05	< 0.05	-
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1	< 0.1	-
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1	< 0.1	-

Client Sample ID			TB01	TS02	TB02
Sample Matrix			Water	Water	Water
Eurofins | mgt Sample No.			S17-Ap08879	S17-Ap08880	S17-Ap08881
Date Sampled			Apr 03, 2017	Apr 03, 2017	Apr 03, 2017
Test/Reference	LOR	Unit			
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	-	< 0.02
Total Recoverable Hydrocarbons - 1999 NEPM Fractions					
TRH C6-C9	0.02	mg/L	< 0.02	70%	< 0.02
BTEX					
Benzene	0.001	mg/L	< 0.001	101%	< 0.001
Toluene	0.001	mg/L	< 0.001	94%	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	88%	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	89%	< 0.002
o-Xylene	0.001	mg/L	< 0.001	95%	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	91%	< 0.003
4-Bromofluorobenzene (surr.)	1	%	73	83	70
Total Recoverable Hydrocarbons - 2013 NEPM Fractions					
TRH C6-C10	0.02	mg/L	< 0.02	82%	< 0.02
Volatile Organics					
Naphthalene[N02]	0.01	mg/L	< 0.01	98%	< 0.01

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
TRH C6-C10 less BTEX (F1)	Sydney	Apr 11, 2017	14 Day
- Method: LM-LTM-ORG-2010			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Sydney	Apr 18, 2017	7 Day
- Method: TRH C6-C36 - LTM-ORG-2010			
BTEX	Sydney	Apr 11, 2017	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Sydney	Apr 11, 2017	7 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Volatile Organics	Sydney	Apr 11, 2017	7 Days
- Method: LTM-ORG-2150 VOCs in Soils Liquid and other Aqueous Matrices			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Sydney	Apr 11, 2017	7 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Eurofins | mgt Suite B11			
Ammonia (as N)	Melbourne	Apr 28, 2017	28 Day
- Method: APHA 4500-NH3 Ammonia Nitrogen by FIA			
Chloride	Melbourne	Apr 28, 2017	28 Day
- Method: LTM-INO-4090 Chloride by Discrete Analyser			
Nitrate (as N)	Melbourne	Apr 12, 2017	7 Day
- Method: APHA 4500-NO3 Nitrate Nitrogen by FIA			
Sulphate (as SO4)	Melbourne	Apr 12, 2017	28 Day
- Method: LTM-INO-4110 Sulfate by Discrete Analyser			
Alkalinity (speciated)	Melbourne	Apr 28, 2017	14 Day
- Method: APHA 2320 Alkalinity by Titration			
Alkali Metals	Melbourne	Apr 28, 2017	180 Day
- Method: USEPA 6010 Alkali Metals			
Ferrous Iron - Fe2+	Melbourne	Apr 12, 2017	7 Days
- Method: LTM-INO-4190 Ferrous Iron in Water by Discrete Analyser			
Dissolved Gases	Melbourne	Apr 12, 2017	7 Day
- Method: LTM-ORG-2070 by Headspace GC-FID			
Heavy Metals	Melbourne	Apr 12, 2017	180 Day
- Method: LTM-MET-3040 Metals in Waters by ICP-MS			
Hardness Set			
Calcium	Melbourne	Apr 12, 2017	180 Day
- Method: LTM-MET-3010 Alkali Metals, S, Si and P by ICP-AES			
Magnesium	Melbourne	Apr 12, 2017	180 Day
- Method: LTM-MET-3010 Alkali Metals, S, Si and P by ICP-AES			
Hardness mg equivalent CaCO3/L	Melbourne	Apr 12, 2017	28 Day
- Method: APHA 2340B Hardness by Calculation			
Eurofins | mgt Suite B1			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Sydney	Apr 18, 2017	7 Day
- Method: TRH C6-C40 - LTM-ORG-2010			

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NATA # 1261
Site # 18217

Company Name: GHD Pty Ltd NSW
Address: Level 15, 133 Castlereagh Street
Sydney
NSW 2000

Project Name: CORAMBA GME
Project ID: 2218605

Order No.:
Report #: 541995
Phone: 02 9239 7100
Fax: 02 9239 7199

Received: Apr 11, 2017 9:45 AM
Due: May 5, 2017
Priority: 15 Day
Contact Name: Brian Cork

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Ferrous Iron - Fe2+	Manganese	Methane	Total Alkalinity (as CaCO3)	Hardness Set	Eurofins | mgt Suite B11	Eurofins | mgt Suite B1	BTEX and Volatile TRH
Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X		
Sydney Laboratory - NATA Site # 18217												X	X
Brisbane Laboratory - NATA Site # 20794													
Perth Laboratory - NATA Site # 18217													
External Laboratory													
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**								
1	MW10	Apr 05, 2017		Water	S17-Ap08863							X	
2	MW4B	Apr 05, 2017		Water	S17-Ap08864							X	
3	MW12	Apr 05, 2017		Water	S17-Ap08865							X	
4	MW6	Apr 05, 2017		Water	S17-Ap08866	X	X	X	X	X	X	X	
5	MW2	Apr 06, 2017		Water	S17-Ap08867	X	X	X	X	X	X	X	
6	MW15	Apr 06, 2017		Water	S17-Ap08868							X	
7	MW18	Apr 05, 2017		Water	S17-Ap08869							X	
8	MW20	Apr 06, 2017		Water	S17-Ap08870							X	
9	MW14	Apr 06, 2017		Water	S17-Ap08871	X	X	X	X	X	X	X	

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Melbourne Laboratory - NATA Site # 1254 & 14271						X	X	X	X	X	X		
Sydney Laboratory - NATA Site # 18217												X	X
Brisbane Laboratory - NATA Site # 20794													
Perth Laboratory - NATA Site # 18217													
10	MW9	Apr 06, 2017		Water	S17-Ap08872	X	X	X	X	X	X	X	
11	MW11	Apr 06, 2017		Water	S17-Ap08873	X	X	X	X	X	X	X	
12	2017.3_DUP1	Apr 05, 2017		Water	S17-Ap08874							X	
13	2017.3_DUP2	Apr 05, 2017		Water	S17-Ap08875							X	
14	RINSATE1	Apr 05, 2017		Water	S17-Ap08876							X	
15	RINSATE2	Apr 06, 2017		Water	S17-Ap08877							X	
16	TS01	Apr 03, 2017		Water	S17-Ap08878								X
17	TB01	Apr 03, 2017		Water	S17-Ap08879								X
18	TS02	Apr 03, 2017		Water	S17-Ap08880								X
19	TB02	Apr 03, 2017		Water	S17-Ap08881								X
Test Counts						5	5	5	5	5	5	15	4

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. All biota results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram

mg/L: milligrams per litre

ug/L: micrograms per litre

ppm: Parts per million

ppb: Parts per billion

%: Percentage

org/100mL: Organisms per 100 millilitres

NTU: Nephelometric Turbidity Units

MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs 20-130%

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Ammonia (as N)	mg/L	< 0.01			0.01	Pass	
Chloride	mg/L	< 1			1	Pass	
Ferrous Iron - Fe2+	mg/L	< 0.05			0.05	Pass	
Nitrate (as N)	mg/L	< 0.02			0.02	Pass	
Sulphate (as SO4)	mg/L	< 5			5	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
TRH C10-C14	mg/L	< 0.05			0.05	Pass	
TRH C15-C28	mg/L	< 0.1			0.1	Pass	
TRH C29-C36	mg/L	< 0.1			0.1	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
Method Blank							
Dissolved Gases							
Methane	mg/L	< 0.05			0.05	Pass	
Method Blank							
Volatile Organics							
Naphthalene	mg/L	< 0.01			0.01	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/L	< 0.01			0.01	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	mg/L	< 0.05			0.05	Pass	
TRH >C16-C34	mg/L	< 0.1			0.1	Pass	
TRH >C34-C40	mg/L	< 0.1			0.1	Pass	
Method Blank							
Alkalinity (speciated)							
Bicarbonate Alkalinity (as CaCO3)	mg/L	< 20			20	Pass	
Carbonate Alkalinity (as CaCO3)	mg/L	< 10			10	Pass	
Total Alkalinity (as CaCO3)	mg/L	< 20			20	Pass	
Method Blank							
Heavy Metals							
Manganese	mg/L	< 0.005			0.005	Pass	
Method Blank							
Alkali Metals							
Calcium	mg/L	< 0.5			0.5	Pass	
Magnesium	mg/L	< 0.5			0.5	Pass	
Potassium	mg/L	< 0.5			0.5	Pass	
Sodium	mg/L	< 0.5			0.5	Pass	
LCS - % Recovery							

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Ammonia (as N)	%	91			70-130	Pass	
Chloride	%	105			70-130	Pass	
Ferrous Iron - Fe2+	%	96			70-130	Pass	
Nitrate (as N)	%	92			70-130	Pass	
Sulphate (as SO4)	%	117			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	128			70-130	Pass	
TRH C10-C14	%	70			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	114			70-130	Pass	
Toluene	%	109			70-130	Pass	
Ethylbenzene	%	106			70-130	Pass	
m&p-Xylenes	%	106			70-130	Pass	
o-Xylene	%	117			70-130	Pass	
Xylenes - Total	%	110			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH C6-C10	%	130			70-130	Pass	
LCS - % Recovery							
Dissolved Gases							
Methane	%	114			70-130	Pass	
LCS - % Recovery							
Volatile Organics							
Naphthalene	%	109			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	107			70-130	Pass	
TRH C6-C10	%	112			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	%	72			70-130	Pass	
LCS - % Recovery							
Alkalinity (speciated)							
Carbonate Alkalinity (as CaCO3)	%	87			70-130	Pass	
Total Alkalinity (as CaCO3)	%	89			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Manganese	%	108			80-120	Pass	
LCS - % Recovery							
Alkali Metals							
Calcium	%	98			70-130	Pass	
Magnesium	%	109			70-130	Pass	
Potassium	%	94			70-130	Pass	
Sodium	%	97			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C10-C14	S17-Ap11109	NCP	%	77			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH >C10-C16	S17-Ap11109	NCP	%	87			70-130	Pass	
Spike - % Recovery									

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
				Result 1					
Chloride	P17-Ap07628	NCP	%	78			70-130	Pass	
Spike - % Recovery									
Dissolved Gases				Result 1					
Methane	M17-Ap08618	NCP	%	120			70-130	Pass	
Spike - % Recovery									
Alkalinity (speciated)				Result 1					
Total Alkalinity (as CaCO3)	P17-Ap09255	NCP	%	94			70-130	Pass	
Spike - % Recovery									
Alkali Metals				Result 1					
Calcium	M17-Ap10944	NCP	%	93			70-130	Pass	
Magnesium	M17-Ap10944	NCP	%	103			70-130	Pass	
Potassium	M17-Ap10035	NCP	%	90			70-130	Pass	
Sodium	M17-Ap10944	NCP	%	109			70-130	Pass	
Spike - % Recovery									
				Result 1					
Ammonia (as N)	S17-Ap08867	CP	%	91			70-130	Pass	
Nitrate (as N)	S17-Ap08867	CP	%	91			70-130	Pass	
Sulphate (as SO4)	S17-Ap08867	CP	%	95			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Manganese	M17-Ap10676	NCP	%	79			75-125	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	S17-Ap08868	CP	%	105			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	S17-Ap08868	CP	%	100			70-130	Pass	
Toluene	S17-Ap08868	CP	%	94			70-130	Pass	
Ethylbenzene	S17-Ap08868	CP	%	91			70-130	Pass	
m&p-Xylenes	S17-Ap08868	CP	%	90			70-130	Pass	
o-Xylene	S17-Ap08868	CP	%	101			70-130	Pass	
Xylenes - Total	S17-Ap08868	CP	%	94			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH C6-C10	S17-Ap08868	CP	%	103			70-130	Pass	
Spike - % Recovery									
Volatile Organics				Result 1					
Naphthalene	S17-Ap08868	CP	%	93			70-130	Pass	
Spike - % Recovery									
				Result 1					
Ferrous Iron - Fe2+	S17-Ap08872	CP	%	81			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	S17-Ap08877	CP	%	112			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	S17-Ap08877	CP	%	107			70-130	Pass	
Toluene	S17-Ap08877	CP	%	97			70-130	Pass	
Ethylbenzene	S17-Ap08877	CP	%	94			70-130	Pass	
m&p-Xylenes	S17-Ap08877	CP	%	89			70-130	Pass	
o-Xylene	S17-Ap08877	CP	%	100			70-130	Pass	
Xylenes - Total	S17-Ap08877	CP	%	93			70-130	Pass	
Spike - % Recovery									

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
TRH C6-C10	S17-Ap08877	CP	%	109			70-130	Pass	
Spike - % Recovery									
Volatile Organics				Result 1					
Naphthalene	S17-Ap08877	CP	%	114			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C10-C14	S17-Ap11108	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH C15-C28	S17-Ap11108	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH C29-C36	S17-Ap11108	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH >C10-C16	S17-Ap11108	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH >C16-C34	S17-Ap11108	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
TRH >C34-C40	S17-Ap11108	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Chloride	S17-Ap08866	CP	mg/L	24	25	1.5	30%	Pass	
Ferrous Iron - Fe2+	B17-Ap10552	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
Sulphate (as SO4)	S17-Ap08866	CP	mg/L	6.8	6.8	1.1	30%	Pass	
Duplicate									
Alkalinity (speciated)				Result 1	Result 2	RPD			
Bicarbonate Alkalinity (as CaCO3)	P17-Ap09254	NCP	mg/L	120	110	9.0	30%	Pass	
Carbonate Alkalinity (as CaCO3)	P17-Ap09254	NCP	mg/L	< 10	< 10	<1	30%	Pass	
Total Alkalinity (as CaCO3)	P17-Ap09254	NCP	mg/L	120	110	9.0	30%	Pass	
Duplicate									
Alkali Metals				Result 1	Result 2	RPD			
Calcium	M17-Ap09237	NCP	mg/L	78	79	2.0	30%	Pass	
Magnesium	M17-Ap09237	NCP	mg/L	46	46	<1	30%	Pass	
Potassium	M17-Ap09237	NCP	mg/L	6.7	6.8	2.0	30%	Pass	
Sodium	M17-Ap09237	NCP	mg/L	45	46	3.0	30%	Pass	
Duplicate									
Hardness Set				Result 1	Result 2	RPD			
Hardness mg equivalent CaCO3/L	M17-Ap09237	NCP	mg/L	380	390	1.3	30%	Pass	
Duplicate									
Heavy Metals				Result 1	Result 2	RPD			
Manganese	M17-Ap10676	NCP	mg/L	0.23	0.22	6.0	30%	Pass	
Duplicate									
Dissolved Gases				Result 1	Result 2	RPD			
Methane	S17-Ap08871	CP	mg/L	1.5	1.5	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Chloride	S17-Ap08872	CP	mg/L	19	17	7.7	30%	Pass	
Sulphate (as SO4)	S17-Ap08872	CP	mg/L	13	13	3.3	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	S17-Ap08876	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	S17-Ap08876	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	S17-Ap08876	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	S17-Ap08876	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
m&p-Xylenes	S17-Ap08876	CP	mg/L	< 0.002	< 0.002	<1	30%	Pass	

Duplicate									
BTEX				Result 1	Result 2	RPD			
o-Xylene	S17-Ap08876	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes - Total	S17-Ap08876	CP	mg/L	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C10	S17-Ap08876	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Duplicate									
Volatile Organics				Result 1	Result 2	RPD			
Naphthalene	S17-Ap08876	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
R16	The LORs have been raised due to the high concentration of one or more analytes

Authorised By

Nibha Vaidya	Analytical Services Manager
Alex Petridis	Senior Analyst-Metal (VIC)
Harry Bacalis	Senior Analyst-Volatile (VIC)
Huong Le	Senior Analyst-Inorganic (VIC)
Ryan Hamilton	Senior Analyst-Organic (NSW)
Ryan Hamilton	Senior Analyst-Volatile (NSW)

Glenn Jackson
National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

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Site # 1254 & 14271

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NATA # 1261 Site # 18217

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NATA # 1261 Site # 20794

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Phone : +61 8 9251 9600
NATA # 1261 Site # 18217

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Sample Receipt Advice

Company name:	**GHD Pty Ltd NSW**
Contact name:	Brian Cork
Project name:	CORAMBA GME
Project ID:	2218605
COC number:	Not provided
Turn around time:	15 Day
Date/Time received:	Apr 11, 2017 9:45 AM
Eurofins | mgt reference:	**541995**

Sample information

☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

☑ Sample Temperature of a random sample selected from the batch as recorded by Eurofins | mgt Sample Receipt : 12 degrees Celsius.

☑ All samples have been received as described on the above COC.

☑ COC has been completed correctly.

☑ Attempt to chill was evident.

☑ Appropriately preserved sample containers have been used.

☑ All samples were received in good condition.

☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

☑ Appropriate sample containers have been used.

☑ Sample containers for volatile analysis received with zero headspace.

☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Nibha Vaidya on Phone : +61 (2) 9900 8400 or by e.mail: NibhaVaidya@eurofins.com

Results will be delivered electronically via e.mail to Brian Cork - brian.cork@ghd.com.

eurofins | mgt

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☐ **Melbourne**
2 Kingston Town Close, Oakleigh, VIC 3166
Phone: +613 8564 5000 Fax: +613 8564 5090
Email: enquiries.melb@mgtlabmark.com.au

CHAIN OF CUSTODY RECORD

CLIENT DETAILS Page 1 of 2

Company Name: GHD Pty Ltd	**Contact Name:** Sam Turbill	**Purchase Order:**	**COC Number:**
Office Address: 230 Harbour Drive Coffs Harbour NSW 2450	**Project Manager:** Brian Cork	**PROJECT Number:** 2218605	**Eurofins | mgt quote ID:**
	Email for results: brian.cork@ghd.com	**PROJECT Name:** Coramba GME	**Data output format:**

Special Directions & Comments:

Eurofins | mgt DI water batch number:

Analytes

	Sample ID	Date	Matrix	TRH	BTEX	Nitrate	Sulphate	Ferrous Iron	methane	Anions	Cations	Hardness	Alkalinity	Ion Balance	Manganese	Containers: 1LP	250P	125P	1LA	40mL vial	125mL A	Jar	250A	Sample comments:
1	MW10	5/4/17	W	X	X															2			1	
2	MW4B	5/4/17		X	X															2			1	
3	MW12	5/4/17		X	X															2			1	
4	MW6	5/4/17		X	X	X	X	X	X	X	X	X	X	X	X	1	1	1		2			1	
5	MW2	6/4/17		X	X	X	X	X	X	X	X	X	X	X	X	1		2		2			1	
6	MW15	6/4/17		X	X															2			1	
7	MW18	5/4/17		X	X															2			1	
8	MW20	6/4/17		X	X															2			1	
9	MW14	6/4/17		X	X	X	X	X	X	X	X	X	X	X	X	1		2		2			1	
10	MW9	6/4/17		X	X	X	X	X	X	X	X	X	X	X	X	1		2		2			1	
11	MW11	6/4/17		X	X	X	X	X	X	X	X	X	X	X	X	1		2		2			1	
12	2017.3_DUP1	5/4/17		X	X															2			1	
13	2017.3-DUP2	5/4/17		X	X															2			1	
14	Rinsate 1	5/4/17		X	X															2			1	
15	Rinsate 2	6/4/17		X	X															2			1	
16	TS01	3/4/17		X	X															2				

Some common holding times (with correct preservation). For further information contact the lab

Waters		Soils	
BTEX, MAH, VOC	14 days	BTEX, MAH, VOC	14 days
TRH, PAH, Phenols, Pesticides	7 days	TRH, PAH, Phenols, Pesticides	14 days
Heavy Metals	6 months	Heavy Metals	6 months
Mercury, CrVI	28 days	Mercury, CrVI	28 days
Microbiological testing	24 hours	Microbiological testing	72 hours
BOD, Nitrate, Nitrite, Total N	2 days	Anions	28 days
Solids - TSS, TDS etc	7 days	SPOCAS, pH Field and FOX, CrS	24 hours
Ferrous iron	7 days	ASLP, TCLP	7 days

Laboratory Staff

Relinquished By: Stephanie Martin
Date & Time: 10/4/17 12:00pm
Signature:

Received By:
Date & Time: 11/4 9:45am
Signature:

Turn around time

1 DAY ☐ 2 DAY ☐ 3 DAY ☐
5 DAY ☑ 10 DAY ☐ Other:

Method Of Shipment

☑ Courier
☐ Hand Delivered
☐ Postal
Courier Consignment #:

Temperature on arrival:

Report number: 541995

eurofins

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2 Kingston Town Close, Oakleigh, VIC 3166
Phone: +613 8564 5000 Fax: +613 8564 5090
Email: enquiries.melb@mgtlabmark.com.au

CHAIN OF CUSTODY RECORD

CLIENT DETAILS

Company Name : GHD Pty Ltd	**Contact Name :** Sam Turbill	**Purchase Order :**	**COC Number :**
Office Address : 230 Harbour Drive Coffs Harbour NSW 2450	**Project Manager :** Brian Cork	**PROJECT Number :** 2218605	**Eurofins | mgt quote ID :**
	Email for results : brian.cork@ghd.com	**PROJECT Name :** Coramba GME	**Data output format:**

Special Directions & Comments :

Eurofins | mgt DI water batch number:

Analytes

	Sample ID	Date	Matrix	TRH	BTEXN
1	TB01	3/4/17	W		X
2	TS02	3/4/17	W		X
3	TG02	3/4/17	W		X
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					

Some common holding times (with correct preservation).
For further information contact the lab

Waters		Soils	
BTEX, MAH, VOC	14 days	BTEX, MAH, VOC	14 days
TRH, PAH, Phenols, Pesticides	7 days	TRH, PAH, Phenols, Pesticides	14 days
Heavy Metals	6 months	Heavy Metals	6 months
Mercury, CrVI	28 days	Mercury, CrVI	28 days
Microbiological testing	24 hours	Microbiological testing	72 hours
BOD, Nitrate, Nitrite, Total N	2 days	Anions	28 days
Solids - TSS, TDS etc	7 days	SPOCAS, pH Field and FOX, CrS	24 hours
Ferrous iron	7 days	ASLP, TCLP	7 days

Containers:

	1LP	250P	125P	1LA	40mL vial	125mL A	Jar		Sample comments:
1					2				
2					2				
3					2				
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									

Relinquished By
Stephanie Martin
Date & Time : 10/4/17 12:00pm
Signature:

Laboratory Staff
Received By:
Date & Time :
Signature:

Turn around time
1 DAY ☐ 2 DAY ☐ 3 DAY ☐
5 DAY ☑ 10 DAY ☐ Other:

Method Of Shipment
☑ Courier
☐ Hand Delivered
☐ Postal
Courier Consignment #

Temperature on arrival:

Report number:

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Certificate of Analysis

GHD Pty Ltd NSW
Level 15, 133 Castlereagh Street
Sydney
NSW 2000

NATA Accredited
Accreditation Number 1261
Site Number 18217

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Brian Cork**

Report **540853-W**
Project name CHCC GROUNDWATER MANAGEMENT PLAN
Project ID 2218605
Received Date Apr 04, 2017

Client Sample ID			**RIVER 1**	**RIVER 2**
Sample Matrix			**Water**	**Water**
Eurofins | mgt Sample No.			**S17-Ap01678**	**S17-Ap01679**
Date Sampled			**Mar 29, 2017**	**Mar 29, 2017**
Test/Reference	LOR	Unit		
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02
TRH C10-C14	0.05	mg/L	< 0.05	< 0.05
TRH C15-C28	0.1	mg/L	< 0.1	< 0.1
TRH C29-C36	0.1	mg/L	< 0.1	< 0.1
TRH C10-36 (Total)	0.1	mg/L	< 0.1	< 0.1
BTEX				
Benzene	0.001	mg/L	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001
Xylenes - Total	0.003	mg/L	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	91	86
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				
Naphthalene[N02]	0.01	mg/L	< 0.01	< 0.01
TRH >C10-C16 less Naphthalene (F2)[N01]	0.05	mg/L	< 0.05	< 0.05
TRH C6-C10	0.02	mg/L	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1)[N04]	0.02	mg/L	< 0.02	< 0.02
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				
TRH >C10-C16	0.05	mg/L	< 0.05	< 0.05
TRH >C16-C34	0.1	mg/L	< 0.1	< 0.1
TRH >C34-C40	0.1	mg/L	< 0.1	< 0.1

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Eurofins | mgt Suite B1			
Total Recoverable Hydrocarbons - 1999 NEPM Fractions	Sydney	Apr 07, 2017	7 Day
- Method: TRH C6-C36 - LTM-ORG-2010			
BTEX	Sydney	Apr 04, 2017	14 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Sydney	Apr 04, 2017	7 Day
- Method: TRH C6-C40 - LTM-ORG-2010			
Total Recoverable Hydrocarbons - 2013 NEPM Fractions	Sydney	Apr 07, 2017	7 Day
- Method: TRH C6-C40 - LTM-ORG-2010			

ABN– 50 005 085 521
e.mail : EnviroSales@eurofins.com
web : www.eurofins.com.au

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Brisbane
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NATA # 1261 Site # 20794

Perth
2/91 Leach Highway
Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 18217

Company Name:	GHD Pty Ltd NSW	**Order No.:**		**Received:**	Apr 4, 2017 9:30 AM
Address:	Level 15, 133 Castlereagh Street Sydney NSW 2000	**Report #:**	540853	**Due:**	Apr 11, 2017
		Phone:	02 9239 7100	**Priority:**	5 Day
		Fax:	02 9239 7199	**Contact Name:**	Brian Cork
Project Name:	CHCC GROUNDWATER MANAGEMENT PLAN				
Project ID:	2218605				

Eurofins | mgt Analytical Services Manager : Nibha Vaidya

Sample Detail						Eurofins | mgt Suite B1
Melbourne Laboratory - NATA Site # 1254 & 14271						
Sydney Laboratory - NATA Site # 18217						X
Brisbane Laboratory - NATA Site # 20794						
Perth Laboratory - NATA Site # 18217						
External Laboratory						
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**	
1	RIVER 1	Mar 29, 2017		Water	S17-Ap01678	X
2	RIVER 2	Mar 29, 2017		Water	S17-Ap01679	X
Test Counts						2

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil results are reported on a dry basis, unless otherwise stated.
3. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
4. Results are uncorrected for matrix spikes or surrogate recoveries.
5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Advice.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per Kilogram

ug/l: micrograms per litre

ppb: Parts per billion

org/100ml: Organisms per 100 millilitres

MPN/100mL: Most Probable Number of organisms per 100 millilitres

mg/l: milligrams per litre

ppm: Parts per million

%: Percentage

NTU: Nephelometric Turbidity Units

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands. In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 50-150%-Phenols & PFASs 20-130%

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
TRH C10-C14	mg/L	< 0.05			0.05	Pass	
TRH C15-C28	mg/L	< 0.1			0.1	Pass	
TRH C29-C36	mg/L	< 0.1			0.1	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total	mg/L	< 0.003			0.003	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	mg/L	< 0.01			0.01	Pass	
TRH C6-C10	mg/L	< 0.02			0.02	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	mg/L	< 0.05			0.05	Pass	
TRH >C16-C34	mg/L	< 0.1			0.1	Pass	
TRH >C34-C40	mg/L	< 0.1			0.1	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	%	111			70-130	Pass	
TRH C10-C14	%	98			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	85			70-130	Pass	
Toluene	%	86			70-130	Pass	
Ethylbenzene	%	91			70-130	Pass	
m&p-Xylenes	%	95			70-130	Pass	
o-Xylene	%	92			70-130	Pass	
Xylenes - Total	%	94			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
Naphthalene	%	89			70-130	Pass	
TRH C6-C10	%	98			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons - 2013 NEPM Fractions							
TRH >C10-C16	%	116			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1					
TRH C6-C9	S17-Ap03926	NCP	%	96			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	S17-Ap03926	NCP	%	76			70-130	Pass	
Toluene	S17-Ap03926	NCP	%	74			70-130	Pass	
Ethylbenzene	S17-Ap03926	NCP	%	78			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
m&p-Xylenes	S17-Ap03926	NCP	%	77			70-130	Pass	
o-Xylene	S17-Ap03926	NCP	%	81			70-130	Pass	
Xylenes - Total	S17-Ap03926	NCP	%	78			70-130	Pass	
Spike - % Recovery									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1					
Naphthalene	S17-Ap03926	NCP	%	98			70-130	Pass	
TRH C6-C10	S17-Ap03926	NCP	%	85			70-130	Pass	
Test	**Lab Sample ID**	**QA Source**	**Units**	**Result 1**			**Acceptance Limits**	**Pass Limits**	**Qualifying Code**
Duplicate									
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD			
TRH C6-C9	S17-Ap03925	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	S17-Ap03925	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	S17-Ap03925	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	S17-Ap03925	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
m&p-Xylenes	S17-Ap03925	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
o-Xylene	S17-Ap03925	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes - Total	S17-Ap03925	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Total Recoverable Hydrocarbons - 2013 NEPM Fractions				Result 1	Result 2	RPD			
Naphthalene	S17-Ap03925	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
TRH C6-C10	S17-Ap03925	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N01	F2 is determined by arithmetically subtracting the "naphthalene" value from the ">C10-C16" value. The naphthalene value used in this calculation is obtained from volatiles (Purge & Trap analysis).
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.

Authorised By

Nibha Vaidya	Analytical Services Manager
Ryan Hamilton	Senior Analyst-Organic (NSW)
Ryan Hamilton	Senior Analyst-Volatile (NSW)

Glenn Jackson

National Operations Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

Melbourne
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Oakleigh Vic 3166
Phone : +61 3 8564 5000
NATA # 1261
Site # 1254 & 14271

Sydney
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NATA # 1261 Site # 18217

Brisbane
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NATA # 1261 Site # 20794

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Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261 Site # 18217

ABN – 50 005 085 521 e.mail : EnviroSales@eurofins.com web : www.eurofins.com.au

Sample Receipt Advice

Company name: **GHD Pty Ltd NSW**

Contact name: Brian Cork
Project name: CHCC GROUNDWATER MANAGEMENT PLAN
Project ID: 2218605
COC number: Not provided
Turn around time: 5 Day
Date/Time received: Apr 4, 2017 9:30 AM
Eurofins | mgt reference: **540853**

Sample information

☑ A detailed list of analytes logged into our LIMS, is included in the attached summary table.

☑ Sample Temperature of a random sample selected from the batch as recorded by Eurofins | mgt Sample Receipt : 21 degrees Celsius.

☑ All samples have been received as described on the above COC.

☑ COC has been completed correctly.

☑ Attempt to chill was evident.

☑ Appropriately preserved sample containers have been used.

☑ All samples were received in good condition.

☑ Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.

☑ Appropriate sample containers have been used.

☑ Sample containers for volatile analysis received with zero headspace.

☒ Some samples have been subcontracted.

N/A Custody Seals intact (if used).

Contact notes

If you have any questions with respect to these samples please contact:

Nibha Vaidya on Phone : +61 (2) 9900 8400 or by e.mail: NibhaVaidya@eurofins.com

Results will be delivered electronically via e.mail to Brian Cork - brian.cork@ghd.com.

eurofins | mgt

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CHAIN OF CUSTODY RECORD

CLIENT DETAILS

Page 1 of 1

Company Name :	GHD	**Contact Name:**	Brian Cork	**Purchase Order**	**COC Number :** 1
Office Address :	Coffs Harbour 230 Harbour Drive 2450	**Project Manager :**	Brian Cork	**PROJECT Number** 2218605	**Eurofins | mgt quote ID :** #1018
		Email for results :	brian.cork@ghd.com	**PROJECT Name** CHCC Groundwater Management Plan	**Data output format:**

Special Directions & Comments :

Eurofins | mgt DI water batch number:

	Sample ID	Date	Matrix	Analytes: B1 (TRH & BTEX)
1	River 1	29/03/2017	W	X
2	River 2	29/03/2017	W	X
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				

Some common holding times (with correct preservation).
For further information contact the lab

Waters		Soils	
BTEX, MAH, VOC	14 days	BTEX, MAH, VOC	14 days
TRH, PAH, Phenols, Pesticides	7 days	TRH, PAH, Phenols, Pesticides	14 days
Heavy Metals	6 months	Heavy Metals	6 months
Mercury, CrVI	28 days	Mercury, CrVI	28 days
Microbiological testing	24 hours	Microbiological testing	72 hours
BOD, Nitrate, Nitrite, Total N	2 days	Anions	28 days
Solids - TSS, TDS etc	7 days	SPOCAS, pH Field and FOX, CrS	24 hours
Ferrous iron	7 days	ASLP, TCLP	7 days

Containers:

1LP	250P	125P	1LA	40mL vial	125mL A	Jar	
	1			2			
	1			2			

Sample comments:

Relinquished By: Sam Turbill
Date & Time:: 3/4/17
Signature:

Laboratory Staff
Received By: Dom Lawler
Date & Time: 4/4 9:30 AM
Signature:

Turn around time
1 DAY ☐ 2 DAY ☐ 3 DAY ☐
5 DAY ☑ 10 DAY ☐ Other:

Method Of Shipment
☑ Courier
☐ Hand Delivered
☐ Postal
Courier Consignment #

Temperature on arrival: 21.0°C
Report number: 540853

Appendix E – Field Sheets

GROUNDWATER PURGING AND SAMPLING RECORD

PROJECT NO.	2218605	BOREHOLE NO.	MW4B
PROJECT NAME	Groundwater management plan	GPS CO-ORDINATES (if Applicable)	
CLIENT	CHCC		
SITE	Coromba	LOGGED BY	Sam Turbill
		PAGE	1 of 1

FIELD MEASUREMENTS FOR PURGING

DEPTH TO WATER BEFORE PURGING (FROM TOC)	5.56	DATE	5/4/17
DEPTH OF BORE (FROM TOC)	10.01	PURGE METHOD	low flow
THICKNESS OF WATER COLUMN	4.45	CASING TYPE	PVC-peri
DEPTH TO WATER DURING PURGING (FROM TOC)	5.64	GROUNDWATER ELEVATION	
DEPTH TO WATER DURING PURGING (FROM TOC)	5.65		
DEPTH TO WATER AFTER PURGING (FROM TOC)	5.66		

PID: 113.5ppm - No odour - No PSH

BORE PURGING

SWL (m)	TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
5.64	4:04	0	21.8	5.46	109.4	1.13	0.4	1/2	Clear
5.66	4:11	2	21.4	5.51	121.8	0.97	-69.9	1/2	"
5.66	4:19	4	21.2	5.86	154	0.91	-81.5	1/2	"
	4:23	5	21.2	5.93	167.3	0.88	-84.2	1/2	"
	4:27	6	21.1	6.04	190.3	0.86	-88.5		

WELL SAMPLING

SAMPLING DATE	5/4/17	SAMPLING BY	Sam Turbill
SAMPLING TIME	4.35	WATER METER CALIBRATED Y/N (DATE)	y 5/4/17
SAMPLING METHOD/EQUIPMENT	low flow, Peristaltic Pump, Interphase		

SAMPLE COLLECTION RECORD

TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
4:35	9	21.0	6.23	233.3	0.81	-92		Clear

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
MW4B	3	Y	N	Clear

FIELD SUPERVISOR _____ CHECKED (SIGN & DATE) _____

5.66 4:31 7 21.1 6.15 212.9 0.84 -91.6
4:35 9 21.0 6.23 233.3 0.81 -92

GROUNDWATER PURGING AND SAMPLING RECORD

PROJECT NO.	2218605	BOREHOLE NO.	mw 10
PROJECT NAME	Groundwater management plan	GPS CO-ORDINATES (if Applicable)	
CLIENT	CHCC		
SITE	Coramba	LOGGED BY	Sam Tulbill
		PAGE	1 of 1

FIELD MEASUREMENTS FOR PURGING

DEPTH TO WATER BEFORE PURGING (FROM TOC)	0.76	DATE	5/4/17
DEPTH OF BORE (FROM TOC)	2.11	PURGE METHOD	low flow - peri.
THICKNESS OF WATER COLUMN	1.36	CASING TYPE	PVC
DEPTH TO WATER DURING PURGING (FROM TOC)	0.76	GROUNDWATER ELEVATION	
DEPTH TO WATER DURING PURGING (FROM TOC)	0.76		
DEPTH TO WATER AFTER PURGING (FROM TOC)	0.76		

BORE PURGING

SWL (m)	TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
0.76	1.28	0	22.2	5.09	92.8	1.99	51.5	3/4	Clear
0.76	1.36	2	22.2	5.06	90.6	1.74	-19.6	3/4	Clear
0.76	1.42	4	22.2	5.06	90.6	1.71	-39.2	3/4	Clear
0.76	1.50	6	22.2	5.06	89.9	1.67	-48.7	3/4	Clear
	1.53	7	22.2	5.06	89.5	1.57	-53.2		Clear

WELL SAMPLING

SAMPLING DATE	5/4/17	SAMPLING BY	Sam Tulbill
SAMPLING TIME	2.01	WATER METER CALIBRATED (Y)/N (DATE)	Y 5/4/17
SAMPLING METHOD/EQUIPMENT	low flow/peristaltic pump/ Interprobe		

SAMPLE COLLECTION RECORD

TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
2:01	10	22.2	5.05	88.3	1.52	-57		Clear

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
mw10	3	Y	N	Clear

FIELD SUPERVISOR _____ CHECKED (SIGN & DATE) _____

2:01 10 22.2 5.05 88.3 1.52 -57.0 -(0.76m)

GROUNDWATER PURGING AND SAMPLING RECORD

PROJECT NO.	2218605	BOREHOLE NO.	MW12
PROJECT NAME	Groundwater monagrent plan	GPS CO-ORDINATES	
CLIENT	CHCC	(if Applicable)	
SITE	Coiamba	LOGGED BY	Sam Turbill
		PAGE	1 of 1

FIELD MEASUREMENTS FOR PURGING

DEPTH TO WATER BEFORE PURGING (FROM TOC)	3.14	DATE	5/4/17
DEPTH OF BORE (FROM TOC)	6.51	PURGE METHOD	low flow-peri.
THICKNESS OF WATER COLUMN	3.37	CASING TYPE	PVC
DEPTH TO WATER DURING PURGING (FROM TOC)	3.16	GROUNDWATER ELEVATION	
DEPTH TO WATER DURING PURGING (FROM TOC)	3.16		
DEPTH TO WATER AFTER PURGING (FROM TOC)	3.16	PID - 376 ppm	No sheen light odour

BORE PURGING

SWL(m)	TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
3.15	2:45	0	24	6.35	2870	1.16	-71.3	3/4	Clear
3.16	2:53	2	23.7	6.36	294.8	0.72	-82.3	3/4	" "
3.16	3.00	4	23.7	6.37	294.0	0.72	-88.8	3/4	" "
3.16	3:10	7	23.7	6.37	292.3	0.73	-93.3	3/4	" "

WELL SAMPLING

SAMPLING DATE	5/4/17	SAMPLING BY	Sam Turbill
SAMPLING TIME	3.16	WATER METER CALIBRATED Y/N (DATE)	Y 5/4/17
SAMPLING METHOD/EQUIPMENT	low flow peristaltic pump/Interprobe		

SAMPLE COLLECTION RECORD

TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
3.16	10	23.6	6.37	291.4	0.72	-93.5		light odour

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
MW12	3	Y	dup2	
Dup2	3	Y	MW12	

FIELD SUPERVISOR _____ CHECKED (SIGN & DATE) _____

10L 23.6 6.37 291.4 0.72 -93.5

3.16pm

GROUNDWATER PURGING AND SAMPLING RECORD

PROJECT NO.	2218605	BOREHOLE NO.	mw6
PROJECT NAME	Groundwater managment plan	GPS CO-ORDINATES (if Applicable)	
CLIENT	CHCC		
SITE	Coramba	LOGGED BY	Sam Turbill
		PAGE	1 of 1

FIELD MEASUREMENTS FOR PURGING

DEPTH TO WATER BEFORE PURGING (FROM TOC)	[redacted] 4.81	DATE	5/4/17
DEPTH OF BORE (FROM TOC)	[redacted] 8.79	PURGE METHOD	low flow-peri.
THICKNESS OF WATER COLUMN	3.98	CASING TYPE	PVC
DEPTH TO WATER DURING PURGING (FROM TOC)	5.13	GROUNDWATER ELEVATION	
DEPTH TO WATER DURING PURGING (FROM TOC)	5.12	PID = 0	
DEPTH TO WATER AFTER PURGING (FROM TOC)	5.08	PSH - no odour - no sheen	

BORE PURGING

SWL (m)	TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
5.12 -	11:07	0	21.8	5.73	253	1.25	-58	1/2	Clear
	11:61	1	21.7	5.71	254	1.16	-90.9	1/2	Clear
5.15 -	11:21	3	21.7	5.78	260.4	1.24	-107	1/2	Clear
	11:28	4.5	21.7	6.02	279.3	1.29	-128.0	1/2	Clear

WELL SAMPLING

SAMPLING DATE	5/4/17	SAMPLING BY	Sam Turbill
SAMPLING TIME	11:52	WATER METER CALIBRATED Y/N (DATE)	y 5/4/17
SAMPLING METHOD/EQUIPMENT	low flow, peristaltic pump, Interprobe		

SAMPLE COLLECTION RECORD

TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
11.52	9	21.7	6.14	291.9	1.57	-122.2		Clear

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
mw6	6	Y	dup1	Clear
dup1	6	Y	mw6	Clear

FIELD SUPERVISOR _____ CHECKED (SIGN & DATE) _____

5.16 - 11:47 8 21.7 6.12 288.9 1.46 -122
11:52 9 21.7 6.14 291.9 1.57 -122.2

GROUNDWATER PURGING AND SAMPLING RECORD

PROJECT NO.	2218605	BOREHOLE NO.	MW14
PROJECT NAME	Groundwater managment plan	GPS CO-ORDINATES (if Applicable)	
CLIENT	CHCC		
SITE	Coramba	LOGGED BY	Sam Turbill
		PAGE	1 of 1

FIELD MEASUREMENTS FOR PURGING

DEPTH TO WATER BEFORE PURGING (FROM TOC)	12.54	DATE	6/4/17
DEPTH OF BORE (FROM TOC)	17.26	PURGE METHOD	bailer
THICKNESS OF WATER COLUMN	4.72	CASING TYPE	PVC -
DEPTH TO WATER DURING PURGING (FROM TOC)	12.55	GROUNDWATER ELEVATION	
DEPTH TO WATER DURING PURGING (FROM TOC)	12:55	PID: 314	No Sheen moderate odour
DEPTH TO WATER AFTER PURGING (FROM TOC)	12.55		

BORE PURGING

TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
11:02	10							
11:21	20							" "
11:46	30							" "
11:50	Sample							light Sheen, moderate odour

WELL SAMPLING

SAMPLING DATE	6/4/17	SAMPLING BY	Sam Turbill
SAMPLING TIME	11:50	WATER METER CALIBRATED Y/N (DATE)	
SAMPLING METHOD/EQUIPMENT	Bailer		

SAMPLE COLLECTION RECORD

TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
11:50	30							light Sheen, odour

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
MW14	6	Y	N	light Sheen, moderate odour

FIELD SUPERVISOR _____ CHECKED (SIGN & DATE) _____

*purged 30 litres

GROUNDWATER PURGING AND SAMPLING RECORD

PROJECT NO.	2218605	BOREHOLE NO.	MW9
PROJECT NAME	Groundwater managment plan	GPS CO-ORDINATES (if Applicable)	
CLIENT	CHCC	LOGGED BY	Sam Turbill
SITE	Coramba	PAGE	1 of 1

FIELD MEASUREMENTS FOR PURGING

DEPTH TO WATER BEFORE PURGING (FROM TOC)	4.17	DATE	6/4/17
DEPTH OF BORE (FROM TOC)	6.32	PURGE METHOD	low flow-peri
THICKNESS OF WATER COLUMN	2.15	CASING TYPE	PVC
DEPTH TO WATER DURING PURGING (FROM TOC)	4.18	GROUNDWATER ELEVATION	
DEPTH TO WATER DURING PURGING (FROM TOC)	4.18	PID = 0	
DEPTH TO WATER AFTER PURGING (FROM TOC)	4.18	Psh - No odour - No sheen	

BORE PURGING

	TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
(4.18)	4.24	0	19.9	4.99	138.6	3.31	65.4	3/4	Clear
(4.18)	4:30	1.5	19.9	4.97	139.6	3.32	43.0	" "	Clear
(4.18)	4:38	3	19.9	4.97	139	3.52	28.7	" "	Clear
(4.18)	4.48	4	19.8	4.95	140	3.43	24.2	" "	Clear
(4.18)	4.54	5	19.8	4.95	140.5	3.45	22.1		

WELL SAMPLING

SAMPLING DATE	6/4/17	SAMPLING BY	Sam Turbill
SAMPLING TIME	4.54 pm	WATER METER CALIBRATED Y/N (DATE)	y 5/4/17
SAMPLING METHOD/EQUIPMENT	low flow, peristaltic pump, YSI, Interprobe		

SAMPLE COLLECTION RECORD

TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
4.54	5	19.8	4.95	140.5	3.45	22.1		Clear

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
MW9	6	Y	N	Clear

FIELD SUPERVISOR _____ CHECKED (SIGN & DATE) _____

4.36

GROUNDWATER PURGING AND SAMPLING RECORD

PROJECT NO.	2218605	BOREHOLE NO.	MW2
PROJECT NAME	Groundwater managment plan	GPS CO-ORDINATES	
CLIENT	CHCC	(if Applicable)	
SITE	Coramba	LOGGED BY	Sam Turbill
		PAGE	1 of 1

FIELD MEASUREMENTS FOR PURGING

DEPTH TO WATER BEFORE PURGING (FROM TOC)	3.81	DATE	6/4/17
DEPTH OF BORE (FROM TOC)	4.78	PURGE METHOD	low flow-peri
THICKNESS OF WATER COLUMN	0.97	CASING TYPE	PVC
DEPTH TO WATER DURING PURGING (FROM TOC)	4.93	GROUNDWATER ELEVATION	
DEPTH TO WATER DURING PURGING (FROM TOC)	4.53	PIH = 0	
DEPTH TO WATER AFTER PURGING (FROM TOC)	4.62	PSH - No odour, No sheen	

BORE PURGING

depth	TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
(4.20)	3:06	0	20.1	4.69	130.8	4.13	103.5	1/2	Clear
(4.37)	3:17	1	20.2	4.69	133	3.21	67.2	1/2	" "
	3:31	2	20.2	4.71	138.0	3.51	48.6	1/2	" "
(4.62m)	3:45	3	20.1	4.73	138.3	3.31	34.1	1/2	" "

WELL SAMPLING

SAMPLING DATE	6/4/17	SAMPLING BY	Sam Turbill
SAMPLING TIME	3.45	WATER METER CALIBRATED Y/N (DATE)	y 5/4/17
SAMPLING METHOD/EQUIPMENT	low flow, perastaltic pump, Interprobe		

SAMPLE COLLECTION RECORD

TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
3.45	3	20.1	4.73	138.3	3.31	34.1		Clear

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
MW2	6	Y	N	not recharging

FIELD SUPERVISOR _____ CHECKED (SIGN & DATE) _____

GROUNDWATER PURGING AND SAMPLING RECORD

PROJECT NO.	2218605	BOREHOLE NO.	MW11
PROJECT NAME	Groundwater managment plan	GPS CO-ORDINATES (if Applicable)	
CLIENT	CHCC		
SITE	Coramba	LOGGED BY	Sam Turbill
		PAGE	1 of 1

FIELD MEASUREMENTS FOR PURGING

DEPTH TO WATER BEFORE PURGING (FROM TOC)	2.19	DATE	6/4/17
DEPTH OF BORE (FROM TOC)	5.58	PURGE METHOD	low flow - peri.
THICKNESS OF WATER COLUMN	3.39	CASING TYPE	PVC
DEPTH TO WATER DURING PURGING (FROM TOC)	2.19	GROUNDWATER ELEVATION	
DEPTH TO WATER DURING PURGING (FROM TOC)	2.19	PID: 0	
DEPTH TO WATER AFTER PURGING (FROM TOC)	2.19	PSH - no odour - no sheen	

BORE PURGING

TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
12:30	0	21.9	6.32	352.4	0.96	-95		Clear
12:37	2	21.4	6.44	336.8	0.64	-173		Clear
12:46	4	21.3	6.47	335.8	0.59	-196.4		Clear
12:52	6	21.3	6.46	336	0.55	-204.7		Clear
12:58	7.5	21.2	6.46	335.3	0.54	-209		

WELL SAMPLING

SAMPLING DATE	6/4/17	SAMPLING BY	Sam Turbill
SAMPLING TIME	12.58	WATER METER CALIBRATED Y/N (DATE)	y 5/4/17
SAMPLING METHOD/EQUIPMENT	low flow, perasketic pump, Interprobe		

SAMPLE COLLECTION RECORD

TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
12.58	7.5	21.2	6.46	335.3	0.54	-209		Clear

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
MW11	6	Y	N	Clear

FIELD SUPERVISOR

CHECKED (SIGN & DATE)

GROUNDWATER PURGING AND SAMPLING RECORD

PROJECT NO.	2218605	BOREHOLE NO.	MW15
PROJECT NAME	Groundwater managment plan	GPS CO-ORDINATES (if Applicable)	
CLIENT	CHCC		
SITE	Coramba	LOGGED BY	Sam Turbill
		PAGE	1 of 1

FIELD MEASUREMENTS FOR PURGING

DEPTH TO WATER BEFORE PURGING (FROM TOC)	3.99	DATE	6/4/17
DEPTH OF BORE (FROM TOC)	7.80	PURGE METHOD	low flow - Peri.
THICKNESS OF WATER COLUMN	3.81	CASING TYPE	PVC
DEPTH TO WATER DURING PURGING (FROM TOC)	3.99	GROUNDWATER ELEVATION	
DEPTH TO WATER DURING PURGING (FROM TOC)	4.0	PID = 0	
DEPTH TO WATER AFTER PURGING (FROM TOC)	3.99	PSH - No odour, No Sheen	

BORE PURGING

SWL depth

SWL depth	TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
3.99	1:48	0	19.9	5.08	113.3	1.65	84	3/4	Turbid, grey
4.0	1:55	2	19.5	4.88	144.8	2.72	5.7	"	"
3.99	2:00	3.5	19.5	4.91	156.3	3.31	3.0	"	"
4.0	2:06	5.5	19.5	4.93	160.6	3.60	-2.0	"	"
3.99	2:10	7	19.5	4.94	160.1	3.64	-6.2		

WELL SAMPLING

SAMPLING DATE	6/4/17	SAMPLING BY	Sam Turbill
SAMPLING TIME	2.10	WATER METER CALIBRATED Y/N (DATE)	y 5/4/17
SAMPLING METHOD/EQUIPMENT	low flow, perasteltic pump, interprobe		

SAMPLE COLLECTION RECORD

TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
2.10	8	19.5	4.95	163.4	3.70	-6.9		Turbid, grey

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
MW15	3	Y	N	Turbid, grey

FIELD SUPERVISOR _____ CHECKED (SIGN & DATE) _____

* Almost (all gone)

2.14 S 19.5 4.95 163.4 3.70 -6.9

GROUNDWATER PURGING AND SAMPLING RECORD

PROJECT NO.	2218605	BOREHOLE NO.	MW20
PROJECT NAME	Groundwater managment plan	GPS CO-ORDINATES (if Applicable)	
CLIENT	CHCC		
SITE	Colamba	LOGGED BY	Sam Turbill
		PAGE	1 of 1

FIELD MEASUREMENTS FOR PURGING

DEPTH TO WATER BEFORE PURGING (FROM TOC)	2.59m	DATE	6/4/17
DEPTH OF BORE (FROM TOC)	5.80	PURGE METHOD	low-flow-peri
THICKNESS OF WATER COLUMN	3.21	CASING TYPE	PVC
DEPTH TO WATER DURING PURGING (FROM TOC)	2.68	GROUNDWATER ELEVATION	
DEPTH TO WATER DURING PURGING (FROM TOC)	2.68	PID: 0	
DEPTH TO WATER AFTER PURGING (FROM TOC)	2.65	PSH: no sheen no odour	

BORE PURGING

SW1

TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
(2.65) 9.09	0	21.2	5.31	132.3	0.82	46.9	1/2	Clear
(2.68) 9:17	2	21.7	5.26	122.1	0.72	87.4	1/2	" "
(2.68) 9:25	4	21.8	5.23	121.0	0.86	45.6	1/2	" "
(2.68) 9:30	5	21.9	5.22	121.8	0.95	5.0	1/2	" "
2.68 9.37	7	21.8	5.22	119.9	1.08	-13.2	1/2	

WELL SAMPLING

SAMPLING DATE	6/4/17	SAMPLING BY	Sam Turbill
SAMPLING TIME	9.42	WATER METER CALIBRATED Y/N (DATE)	Y 5/4/17
SAMPLING METHOD/EQUIPMENT	low flow/peristaltic pump/Interprobe		

SAMPLE COLLECTION RECORD

TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
9.42	8	21.8	5.23	118.4	1.16	-16.7		Clear

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
MW20	3	Y	N	

FIELD SUPERVISOR _____ CHECKED (SIGN & DATE) _____

9.42 8 21.8 5.23 118.4 1.16 -16.7

GROUNDWATER PURGING AND SAMPLING RECORD

PROJECT NO.	2218605	BOREHOLE NO.	MW18
PROJECT NAME	Groundwater management plan	GPS CO-ORDINATES (if Applicable)	
CLIENT	CHCC		
SITE	Colomba	LOGGED BY	Sam Turbill
		PAGE	1 of 1

FIELD MEASUREMENTS FOR PURGING

DEPTH TO WATER BEFORE PURGING (FROM TOC)	4.58	DATE	5/4/17
DEPTH OF BORE (FROM TOC)	8.93	PURGE METHOD	low flow - per.
THICKNESS OF WATER COLUMN	4.35	CASING TYPE	PVC
DEPTH TO WATER DURING PURGING (FROM TOC)	4.59	GROUNDWATER ELEVATION	
DEPTH TO WATER DURING PURGING (FROM TOC)	4.59		
DEPTH TO WATER AFTER PURGING (FROM TOC)	4.59		

BORE PURGING

SWL

TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
(4.59) 10:02	1	22.0	6.43	320.0	1.81	-80.5	3/4	Clear
(4.59) 10:06	2	21.9	6.43	309.2	1.53	-101.3	3/4	Clear
(4.59) 10:11	3	21.9	6.42	304.6	1.51	-107.3	3/4	Clear
10:14	4	21.9	6.42	301.7	1.51	-109.1	3/4	Clear

WELL SAMPLING

SAMPLING DATE	5/4/17	SAMPLING BY	Sam Turbill
SAMPLING TIME	10.14	WATER METER CALIBRATED (Y)N (DATE)	Y 5/4/17
SAMPLING METHOD/EQUIPMENT	low flow, peristaltic pump, Interprobe		

SAMPLE COLLECTION RECORD

TIME	CUM. VOL (L)	TEMP (°C)	pH	E.COND (µs/cm)	DO (mg/L)	EH (mV)	PUMP RATE	COMMENTS (SHEEN, COLOUR, TURBID, SED, ODOUR)
10.14	4	21.8	6.42	301.7	1.51	-109.1		Clear

SAMPLE NO.	NO. OF CONTAINERS	PRESERVATIVE	DUPLICATE	COMMENTS
MW18	3	Y	N	

FIELD SUPERVISOR _____ CHECKED (SIGN & DATE) _____

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https://projects.ghd.com/OC/Newcastle/chcccorambagroundwat/Delivery/Documents/2218605_REP_A_GHD_CHCC Coramba Groundwater Monitoring Report.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	S. Martin/ B. Cork	I. Gregson		I. Gregson		10/08/2017

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