Waratah Coal

Galilee Coal (China First) Project Aquatic Ecology and Water Quality Monitoring Study SEIS

Rail Corridor Study Report

November 2012

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1. Introduction

1.1 Background to this study

The Galilee Coal Project (GCP), also known as the China First Project, is a proposed new coal mine and rail link development, for which Waratah Coal is the proponent. The mine Exploration Permit for Coal areas (EPC 1040 and EPC 1079) are located around 30km north of the township of Alpha.

Waratah Coal proposes to mine 1.4 billion tonnes of coal from EPC 1040 and 1079. The mine would comprise four longwall underground mines, two open cut mines and two coal preparation facilities (CHPP). The proposed rail construction associated with the GCP is between the mine and future stockpiling and loading facilities within the Port of Abbot Point and the Abbot Point State Development Area. Due to uncertainty regarding the location of future stockpiling and loading facilities, the limit of assessment is the boundary of the Abbot Point State Development Area. As such, the length of the rail alignment is 453km. The rail facility would include state of the art, heavy duty standard gauge rail to support 25,000 tonne haul trains. The final rail easement would cover both rail and adjacent service road infrastructure.

An Environmental Impact Study (EIS) was developed and released by Waratah Coal in August 2011 for public comment (henceforth referred to as Waratah Coal, 2011). There were 1842 submissions were received (15 from government agencies) indicating significant public interest in the GCP.

Subsequent to those comments being received, Waratah Coal, sought to carry out a supplementary EIS (SEIS) to address these comments. To that end, GHD were engaged in March 2012 to carry out an additional aquatic ecology and water quality monitoring technical study as part of the GCP SEIS.

1.2 Purpose of this report

This report will be a technical report appended to the GCP SEIS. Information presented in this report will be used to address public and agency comments on the EIS with respect to issues relating to aquatic ecology and water quality issues associated with the rail corridor component of the GCP. The GCP has two core components: a mine site in the Galilee Basin and a rail corridor between the mine and the Abbot Point State Development Area. GHD carried out aquatic ecology and water quality sampling in relation to both of these components. Waratah Coal has asked GHD to prepare separate reports for each. This report outlines the results and findings in relation to the rail corridor (henceforth referred to as the 'rail corridor' study).

1.3 Scope

The broad objectives of the GCP SEIS technical studies carried out by GHD were to:

- Develop and implement a study design and sampling approach that would address relevant comments on the GCP EIS; and
- Provide a technical report that can be used to inform the development of the GCP SEIS.

With respect to the first dot point, few of the GCP EIS submissions focussed on issues associated with the rail corridor component. The main issue that applies to the rail corridor component was the perceived lack of sufficient water quality data collection for the broader GCP Project Area and the absence of information about the environmental values (EVs) associated with waterways potentially impacted by the GCP. There were also perceived inadequacies in terms of the range of analytes tested as part of the GCP EIS process. To that end, additional

water quality monitoring was required for the rail corridor component. While not listed as a concern among public submissions on the GCP EIS, aquatic ecology sampling for both the rail corridor and mine components of the GCP was done as a single sampling event, so consequently temporal variability within the study area was not characterised adequately. Given that further water quality monitoring was required for the rail corridor component, with agreement from Waratah Coal, additional aquatic ecology sampling was also included as part of the scope of works for the rail corridor study.

The aquatic ecology monitoring targeted fish, aquatic macroinvertebrates and macro-crustacea, aquatic habitat assessment (including qualitative assessment of the macrophyte and riparian vegetation components) and the recording of incidental sighting or captures of aquatic reptiles and mammals. Water quality monitoring involved *in situ* water quality testing and the collection of samples for analytical laboratory testing. The study area is a remote area and the waterways sampled are predominantly ephemeral systems. Thus water sampling was done opportunistically in conjunction with the aquatic ecology survey to maximise the data collected by the GHD field team and while surface water was present. A detailed water quality monitoring program for the GCP is currently being developed.

A technical report outlining the results of the above monitoring program (i.e. this report) was required by Waratah Coal. Other requirements for this report include:

- Identifying how specific GCP EIS comments have been addressed by the study;
- A comparison of our results with those collected as part of the GCP EIS (i.e. the E3, 2010 study) and the Hancock Coal Alpha Coal Project EIS rail corridor assessment (GHD, 2010) in relation to the aquatic environment;
- An assessment of temporal variability (within the limitations of this study);
- Identify any amendments that need to be made with respect to data or statements put forward by E3 (2010) incorporated as part of the GCP EIS report; and
- Recommendations for further monitoring that could assist the development of the GCP SEIS impact assessment and the Environmental Management Plan (EM Plan), if deemed to be required.

No impact assessment or EM Plan details are provided in this report. Further, this report does not outline any legislative requirements or desktop assessment of significant aquatic flora, fauna or habitats, as this information is covered in the GCP EIS and has not been identified as requiring further update as part of the GCP SEIS.

1.4 Disclaimer

This report has been prepared by GHD for Waratah Coal and may only be used and relied on by Waratah Coal for the purpose agreed between GHD and the Waratah Coal as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Waratah Coal arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in sections 1.5 and 2 of this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Waratah Coal and that contained in other information sources (e.g. EIS reports for similar coal mine developments in the Galilee Basin). GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.5 Assumptions

This study contains comparisons between results presented in this study and those from other related studies. It has been assumed by GHD that all data contained in those reports that have been referred to in this report are true, accurate and free from error.

Details provided in this report regarding the locations of various monitoring sites sampled as part of this study relative to GCP rail corridor infrastructure are based on information given to GHD in the form of maps provided by Waratah Coal. GHD has assumed that those maps represent the most current design plan.

Analytical water testing data presented in this report were provided by the ALS laboratory in Brisbane. While this laboratory is NATA –accredited for all analyses performed as part of this study, and QAQC tests performed in relation to the analyses done are provided in this report, GHD take on good faith that all analyses were carried out according to NATA-approved protocols.

2. Methods

GHD was asked to carry out additional surface water, aquatic ecology and water quality sampling along the rail corridor alignment. The approach adopted by GHD for this additional survey work was developed based on the following:

- The need to address public submissions made in relation to original EIS report of relevance to the rail corridor alignment (as outlined in section 1.3);
- Discussions with Waratah Coal; and
- A review of the study sites and sampling methods used as part of the original EIS.

The following sections detail the study design, sampling methods, the timing of sampling and the intended timing of reporting.

2.1 Surface Water Aquatic Environment

2.1.1 Sampling Locations

There were 13 rail corridor sites sampled as part of the GCP EIS by E3 (2010). These were distributed across 13 creek systems, all but three of which (i.e. Elliot River, Saltwater Creek and Splitters Creek) are part of the Burdekin Catchment. Saltwater Creek and Splitter Creek are part of the Abbot Bay Catchment and the latter drains to the Caley Valley Wetland system, a high ecological significance wetland system within the Abbot Point State Development Area. Elliot River is a separate catchment from both the Burdekin and Abbott Bay catchment.

The 13 sites sampled by E3 (2010) as part of the GCP EIS aquatic ecology baseline survey were earmarked for repeated sampling as part of this study. However, due to access issues with regards to private property at the time of sampling, only nine sites could be sampled. One of those sites (AQ-13) was dry at the time of sampling. Further, all but two of the nine sites needed to be moved to alternative publicly accessible locations within the same system as part of the sampling round carried out for the SEIS. This is expected to compound the assessment of temporal variability to an extent. However, given the same systems were sampled on both occasions it was assumed that this would not altogether undermine the assessment of temporal variability as part of this study.

A map showing the location of sites sampled as part of this study in relation to those sampled as part of the GCP EIS is shown in Figure 2–1. Site coordinates for sites sampled in both studies are given in Table 2–1. Sites with 'Alt' in the site code represent sites sampled by GHD that were nearby alternative sites to the corresponding E3 (2010) sampling site.

Table 2–1 Location of rail corridor sites sampled as part of the GCP EIS and SEIS studies. All GPS data are based on WGS84 datum.

Site Code	System	Latitude	Longitude	Sampled in April 2012
AQ-1	Splitter Creek	19° 57.142' S	148° 0.840' E	N
AQ-2	Saltwater Creek	19° 57.975' S	147° 57.537' E	N
AQ-3	Elliot River	20° 3.149' S	147° 52.054' E	N
AQ-4	Bogie River	20° 14.078' S	147° 48.608' E	N
AQ-5	Sandy	20° 19.083' S	147° 48.177' E	N
AQ-6	Pelican Creek	20° 33.207' S	147° 37.160' E	N
AQ-7	Bowen River	20° 37.514' S	147° 38.283' E	N
AQ-8	Suttor River	21° 6.247' S	147° 44.835' E	Y
AQ-9	Logan Creek	21° 36.012' S	147° 12.831' E	N
AQ-10	Mistake Creek	22° 1.984' S	146° 58.467' E	N
AQ-11	Middle Creek	22° 16.252' S	146° 51.533' E	N
AQ-12	Belyando River	22° 42.952' S	146° 32.548' E	N
AQ-13	Lagoon Creek	23° 5.500' S	146° 29.878' E	Y
Alt-AQ-1	Splitter Creek	19° 59.152'S	147° 59.528'E	Y
Alt-AQ-2	Saltwater Creek	19° 56.894'S	147° 55.369'E	Y
Alt-AQ-4	Bogie River	20° 13.601'S	147° 48.109'E	Y
Alt-AQ-5	Sandy Creek	20° 12.737'S	147° 44.504'E	Y
Alt-AQ-6	Pelican Creek	20° 35.917'S	147° 45.429'E	Y
Alt-AQ-7	Bowen River	20° 44.410'S	147° 57.095'E	Y
Alt-AQ-12	Belyando Crossing	22° 42.147'S	146° 34.210'E	Y

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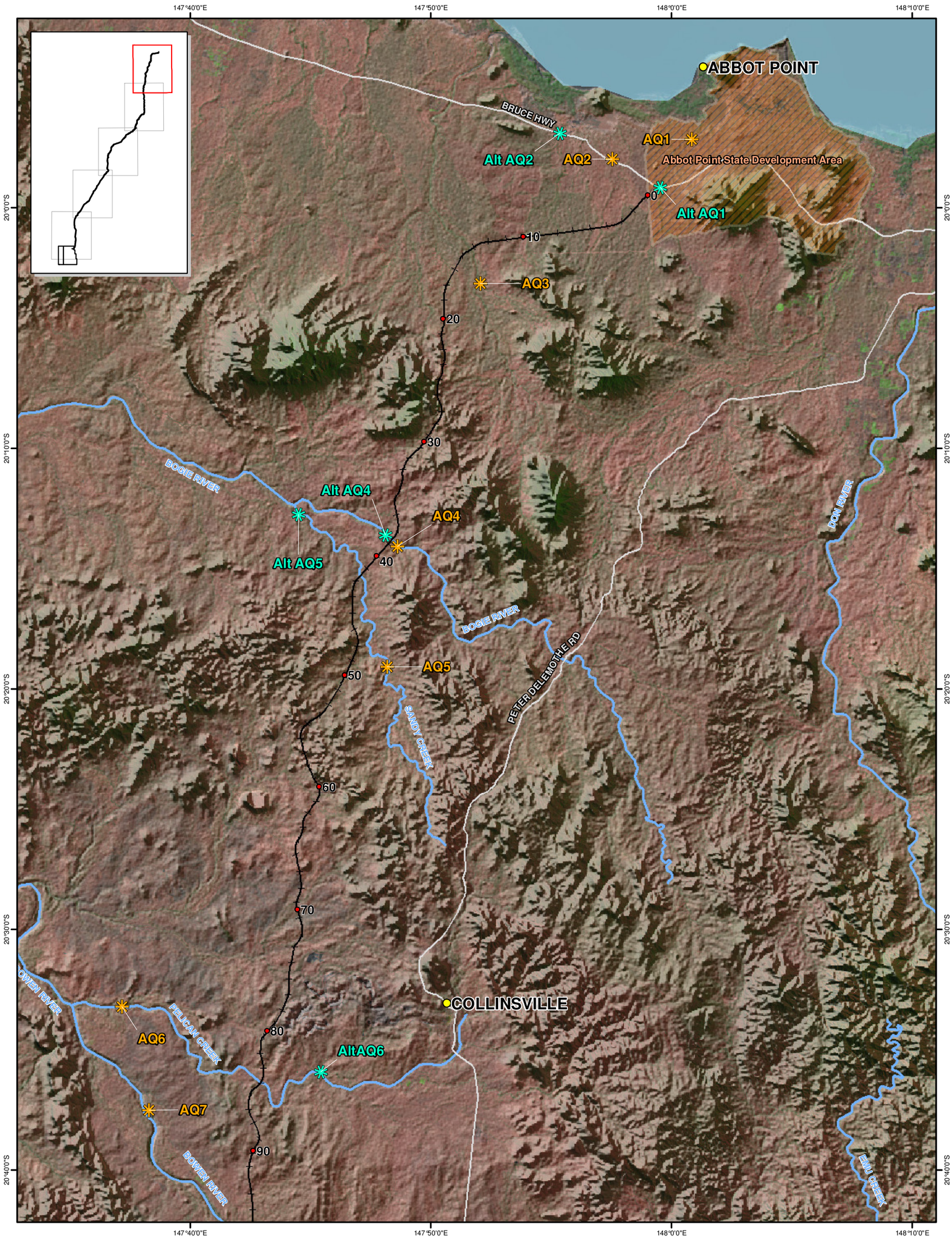

GALILEE COAL PROJECT
(Northern Export Facility)

Waratah Coal
THE NEW ENERGY IN COAL

Mineralogy House, Level 7, 380 Queen Street, Brisbane Qld 4000, Australia

Source:	LandSat Image: Geoscience Australia 2005 EPC: DEEDI 2012 Proposed Rail: Waratah Coal Pty. Ltd. 2012 Abbot Point State Development Area: Mipela 2009 Sampling Sites: E3 Consult (date unknown), GHD (2012) Roads: Geoscience Australia 2010 Watercourses: E3 Consult (date unknown)
Disclaimer:	This plan is based on or contains data provided by others. Waratah Coal Pty. Ltd. gives no warranty in relation to the data (including accuracy, reliability, completness, currency or suiability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to and use of the data. Data must not be used for disect marketing or be used in breach of privacy laws.
File:	File:WAR20-26-SEIS002-1a-RAIL-ALIGNMENT-AND-SAMPLING-SITES-RAIL-120713

0 2 4 6 8 10
Kilometers
A3 Scale 1:250,000
Coordinate System: GCS GDA 1994

- Proposed Rail Alignment (03.05.2012)
- 10km Marker Point
- Watercourse
- Arterial Road
- GHD Sampling Site
- E3 Sampling Site

FIGURE 2-1: *Sheet 1 of 5*
LOCATION OF GHD & E3 SURFACE WATER AQUATIC ECOLOGY SAMPLING SITES

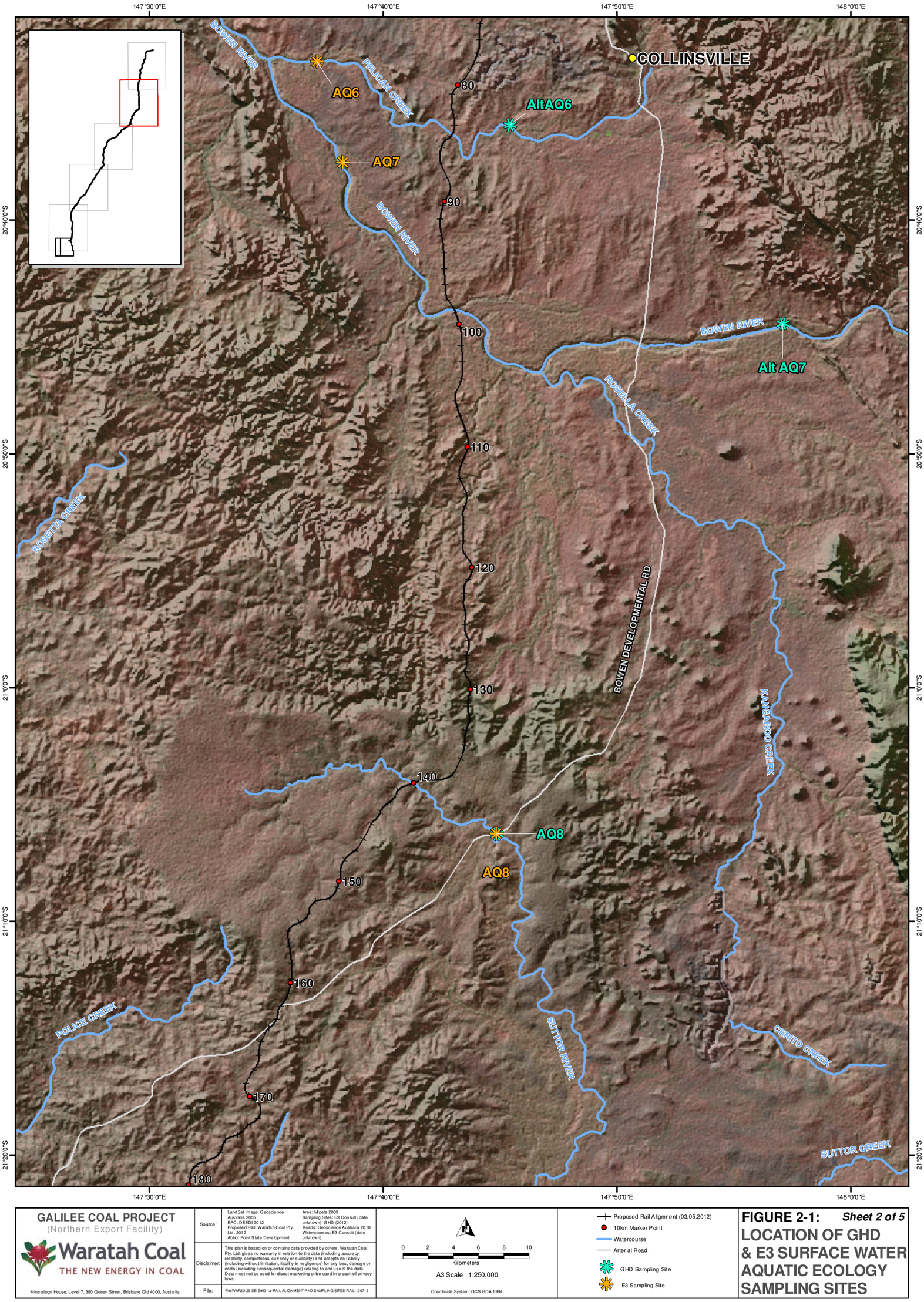

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FIGURE 2-1: *Sheet 2 of 5*
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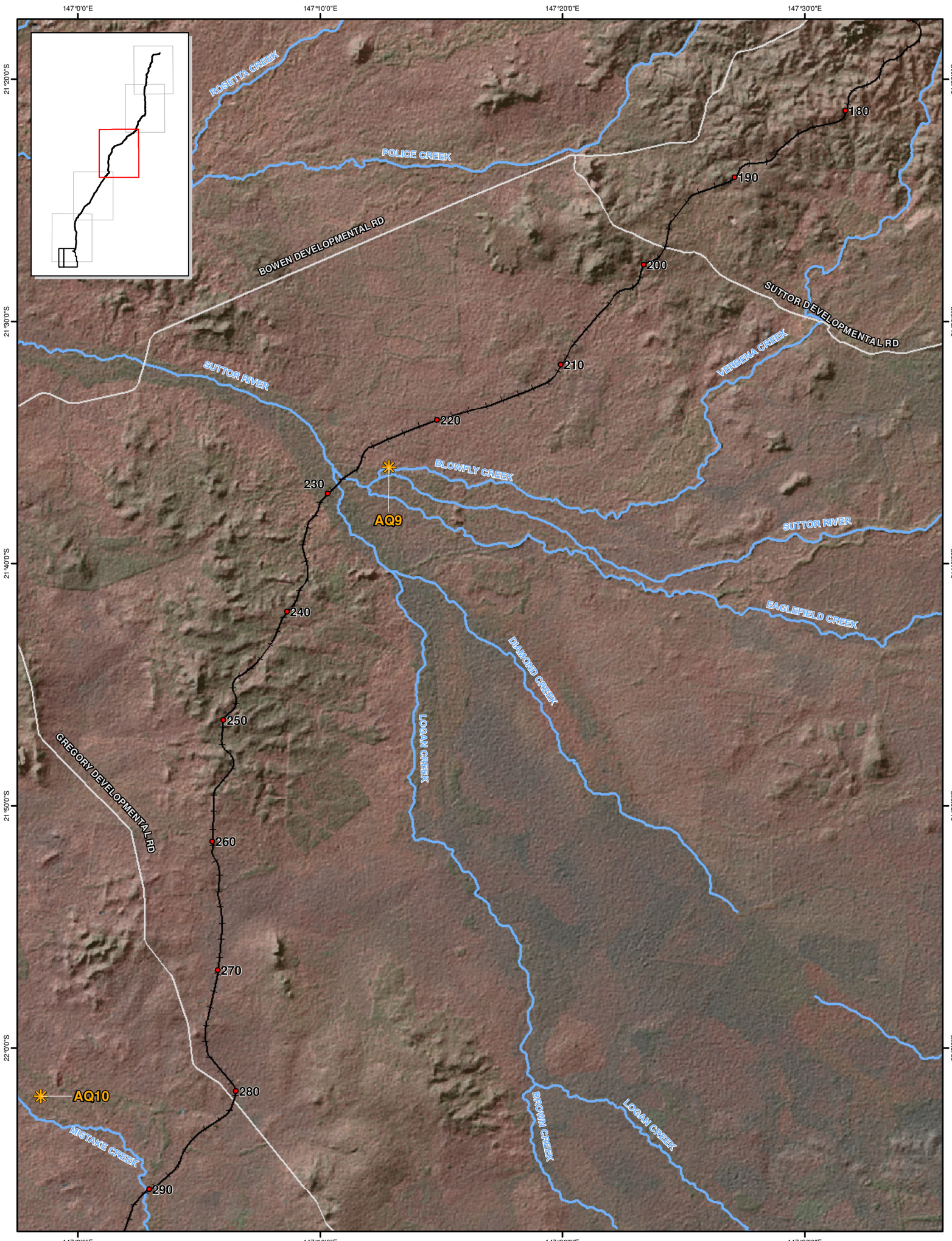

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FIGURE 2-1: ***Sheet 3 of 5***
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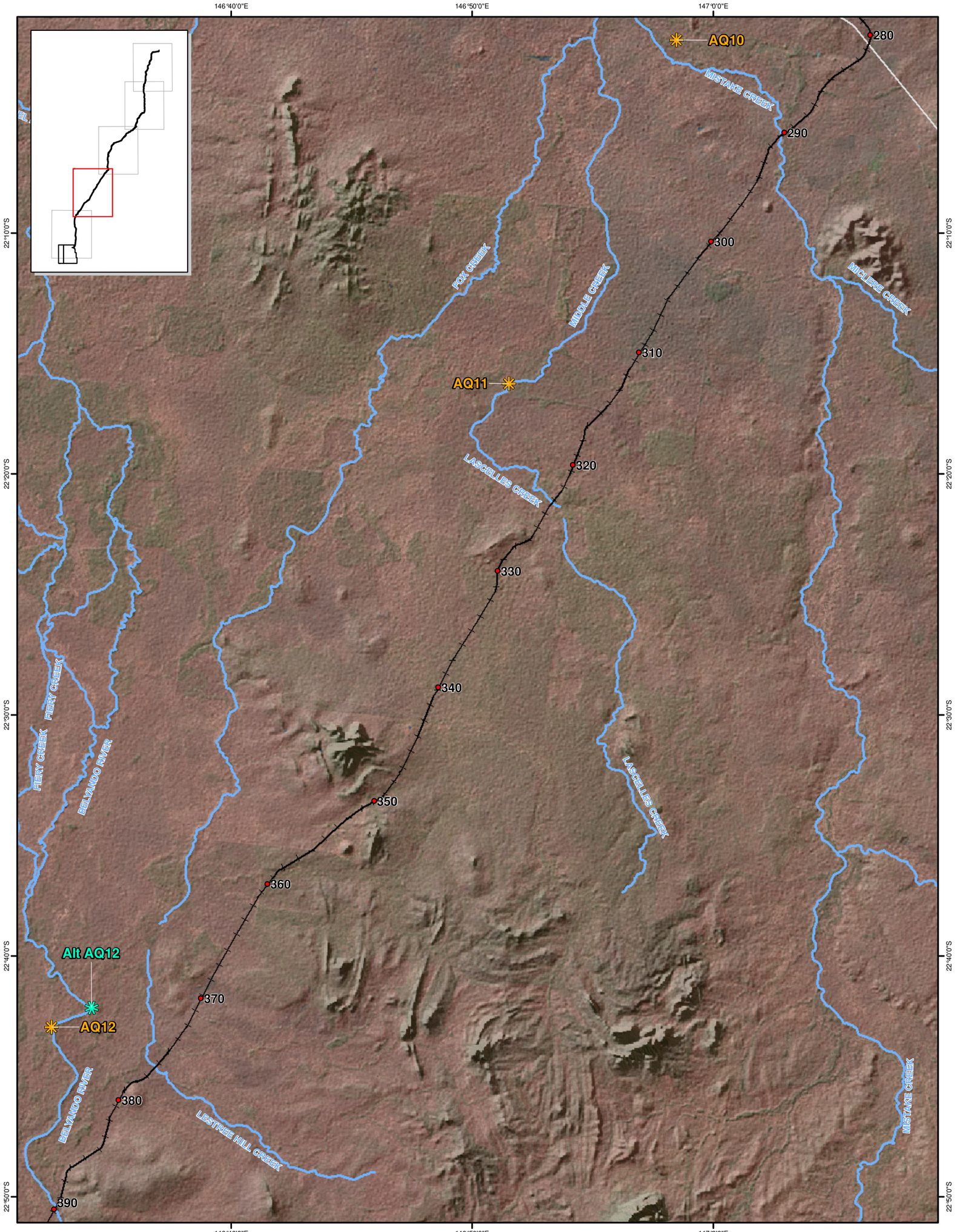

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Kilometers
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Coordinate System: GCS GDA 1994

Proposed Rail Alignment (03.05.2012)
10km Marker Point
Watercourse
Arterial Road
GHD Sampling Site
E3 Sampling Site

FIGURE 2-1: *Sheet 4 of 5*
LOCATION OF GHD & E3 SURFACE WATER AQUATIC ECOLOGY SAMPLING SITES

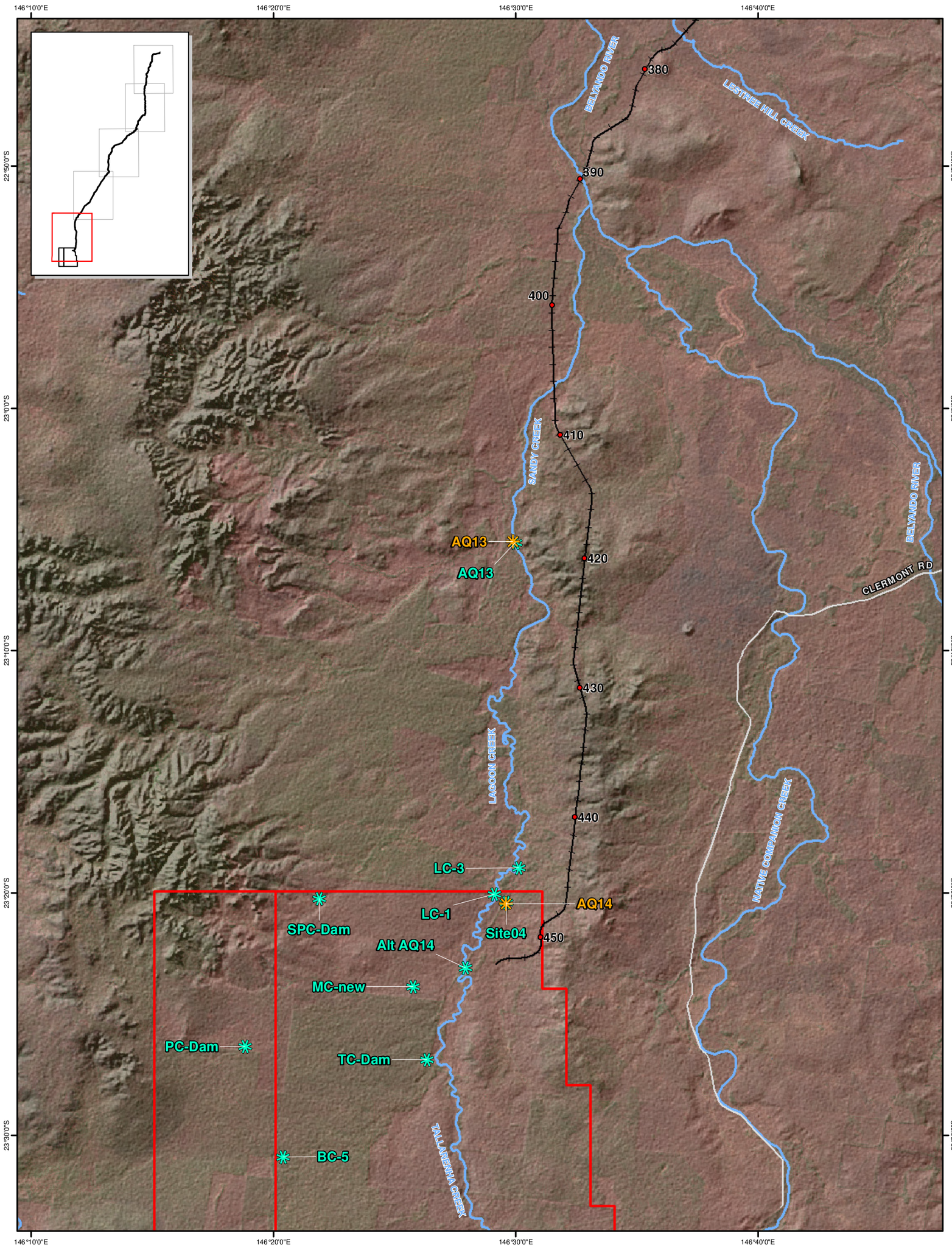

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FIGURE 2-1: *Sheet 5 of 5*
LOCATION OF GHD & E3 SURFACE WATER AQUATIC ECOLOGY SAMPLING SITES

2.1.2 Sampling Timing

Sampling for this study was carried out under late post-wet season conditions between 3 April and 10 April 2012. Sampling by E3 (2010) for the GCP EIS baseline survey was also conducted during the late post-wet season (May 2010). Sampling by GHD (2010) for the Alpha Coal Project EIS rail corridor assessment was also carried out in the post-wet season period (April 2010) and covered some of the same systems sampled as part of the GCP rail corridor assessment. Based on the above, the available data for the aquatic ecosystems of the study area only covers the post-wet period. However, the ephemeral nature of most of the waterways in the study area and the remoteness and bogginess of the terrain during the wet season means that opportunities to collect data at other times is limited. While sampling methods differed between various studies, the fact that all data were collected during the same season means that data comparisons can be made more readily.

2.1.3 Macroinvertebrate Sampling Methods

Macroinvertebrates are aquatic animals lacking a backbone that are small, but visible to the naked eye. They consist of fully aquatic and semi-aquatic invertebrate fauna including a range of crustaceans, insect larvae and snails. For this study, macroinvertebrates are defined as those aquatic invertebrate fauna retained in a 250 µm mesh net, as used as part of standard AUSRIVAS sampling protocols in Australia.

E3 (2010) collected replicate macroinvertebrate samples from riffle, run and pool habitat and processed samples by sieving them through sieves of various mesh sizes. That method, while covering key aquatic habitats, does not conform with standard Department of Environment and Heritage Protection (DEHP) macroinvertebrate sampling protocols, which are based on QLD AUSRIVAS sampling methods (DNRW, 2001) and do not involve the use of a sieve series. Further, sampling by E3 (2010) did not cover edge habitat and, therefore, neglected one of the more commonly occurring aquatic habitats present in waterways within the study area.

Based on our knowledge of the study area, true riffle habitat (flows over shallow cobble beds) is not common in inland ephemeral streams of the type found in the study area, but would be expected to occur in Bowen River and adjacent tributaries and perhaps some of the more coastal streams. Flows over shallow sand beds are, however, more common in inland ephemeral streams during early post wet season conditions and therefore represent a key aquatic habitat that should be sampled when characterising the aquatic environment of the study area. Such habitats are not among the key habitats targeted under the QLD AUSRIVAS sampling protocol, but can be incorporated as part of the composite habitat sampling approach used by DEHP.

With the above in mind, GHD carried out:

- AUSRIVAS sampling in edge habitat at each site;
- AUSRIVAS sampling in riffle bed at sites where that habitat occurred; and
- Composite habitat sampling consistent with DEHP sampling protocols that sampled pool bed and sections of waterways where flows over shallow sand bars occurred.

Three replicate edge habitat samples were collected at each site, but only one of these was processed on site using the AUSRIVAS live picking method. The remaining samples have been archived as whole ('bulk) and could be processed by laboratory picking at a later date if replicate sample data is required for statistical analysis. In addition to this, one riffle and / or composite habitat sample was taken at each site. This approach provided optimal characterisation of the macroinvertebrate community at each site and allowed the data collected to be compared against appropriate stream health benchmarks (e.g. AUSRIVAS QLD Coastal

Autumn edge and riffle models and the expected ranges for taxa richness, Plecoptera, Ephemeroptera and Trichoptera (PET) richness and SIGNAL 2 score for edge and composite habitat samples in Central Queensland given in the Queensland Water Quality Guidelines – DERM (2009a)). Macroinvertebrate data was not compared to these benchmarks in the original GCP EIS report.

Macroinvertebrate samples from the rail corridor study were processed in GHD's macroinvertebrate taxonomy laboratory. All specimens were counted and identified to taxonomic levels consistent with QLD AUSRIVAS requirements (generally family level, but order level for taxa such as Oligochaeta and Acarina and sub-family level for members of the chironomid midge family).

2.1.4 Macroinvertebrate Data Analysis

The macroinvertebrate sampling methods used by GHD for the supplementary EIS study were similar to those used by E3 (2010) to allow a level of between-sampling event data comparison. However, in order to compare our data with that collected by E3 (2010), all data were converted to presence/absence format prior to multivariate data analysis. Due to the samples being collected using different methods, even with the data transformation, the results need to be interpreted with caution. The Alpha Coal Project rail corridor survey carried out by GHD (2010) did not include macroinvertebrate sampling, so no between-study data comparisons were possible.

Data from this study and that by E3 (2010) were compared qualitatively based on graphed trends for the univariate biotic indices outlined above and based on multivariate analysis data interpretation, principally non-metric multidimensional scaling ordination (NMDS), Analysis of Similarities (ANOSIM) and Similarity Percentages Analysis (SIMPER). All multivariate data analyses were performed in PRIMER version 6.1.6 (Clarke & Gorley, 2006).

2.1.5 Fish Sampling Methods

Fish were sampled using techniques similar to those used by E3 for the original EIS. The following sampling methods were not done due to safety issues and the risk of fish and turtle mortality:

- Gill netting; and
- Spotlighting.

The sampling techniques used in this study included:

- Backpack electrofishing;
- Boat mounted electrofishing;
- Bait trapping;
- Fyke netting; and
- Seine netting.

Backpack electrofishing

Backpack electrofishing (EF) was carried out primarily using a Smith-Root Backpack unit LR24 model. In all cases, electrofishing was carried out by an experienced operator according to Australian Code of Electrofishing Practice procedures while a second team member assisted in the collection of stunned fish for identification and measurement. Sampling was carried out within a reach approximately 100 m in length from downstream to upstream covering all major habitat types to ensure a representative range of fish species were collected. Up to 5 shots of 90 seconds duration were conducted at each site, dependant on habitat availability and

operator safety, and the catch for each EF shot was recorded separately so that an estimate of catch per unit effort (CPUE) could be obtained and compared between sites. Backpack electrofishing was only used in shallow wadeable habitats where the risk of drowning and crocodile attack was considered low.

Boat electrofishing

Boat mounted electrofishing (BME) is suitable for carrying out in large, deep pools that have reasonable access (i.e. relatively shallow-gradient banks largely free of vegetation comprised of consolidated substratum material). In this study, the only site for which BME was carried out was Alt-AQ-7 (Collinsville Weir Pool on the Bowen River). The other sites lacked the necessary habitat requirements and safe access points, or did not require BME as they were wadeable stream habitat where crocodiles were considered unlikely to be present. BME was conducted using a Cairns Custom Craft 4.1 m boat fitted with a 7.5GPP Smith Root electrofishing unit. The waveform charge was delivered to the water via large electrodes on booms at the front of the boat, thereby producing an electric field in the water by which the fish are immobilised.

Procedures for boat electrofishing were in accordance with the Sustainable Rivers Audit (SRA) methods, whereby between 6 and 12 x 90 second 'shots' were carried out at a given site and the catch associated with each tallied separately. Sampling was carried out such that all major habitat types, including open water, were covered to ensure that a representative range of fish species were collected.

Bait trapping

A maximum of ten commercial concertina 3 mm mesh bait traps were deployed for a minimum of 4 hours, or overnight where sites were in close proximity. Traps were set along the river edge in slow flowing waters and were baited with dry pelletised cat food. Bait trapping was carried out wherever there was sufficient habitat and water depth, and currents were slow enough to prevent bait traps being swept off the substratum or washed downstream. Separate catch data were recorded for each trap deployed.

Fyke Netting

Fyke netting is a passive fish collection method used in shallow, slow flowing environments. At appropriate sites, a single-winged fyke net (1.2 m x 0.8 m opening, 6 mm mesh, 10 m wing) and a double-winged Fyke net (1.2 m x 0.8 m opening – 6 mm mesh, 10 m wings) were set with the mouth of the net facing downstream and the cod ends tied above the water level to avoid mortality of air breathing biota such as turtles. Fyke nets were set in shallow water, preferably just above the entry hoop but no greater than 1 m deep. The nets were set for a minimum of 4 hrs.

Seine Netting

A 25 m long seine net with a 2 m drop and 20 mm mesh was used where appropriate habitats were present. Seine netting involved one operator on the bank holding one end of the net, whilst the other end of the net was pulled out into the river and dragged back into the bank. The number of seine drags was dependent on available habitat and those sites where stream width, snag obstacles, deep pools or fast flowing water were present, seine netting was not conducted. Separate catch data were recorded for each seine drag.

Fish Catch Processing

For all gear types, all fish caught were identified and counted. Fish identifications of species were made using relevant keys (e.g. Allen *et. al.* 2003). A proportion of the fish catch (up to 20 individuals per species per site) were measured (total length to the nearest millimetre) and any wounds, lesions and deformities were recorded, if present. Native fish were released alive

wherever possible. Introduced fish were euthanized and disposed of appropriately and humanely and in accordance with animal ethics and fisheries scientific collection permits.

2.1.6 Fish Community Data

Key fish community data metrics assessed included total number of species and total abundance per site. The fish data were collected using a variety of sampling methods due to prevailing habitat conditions, which differed between sites. The data could not be converted to catch per unit effort (CPUE) for each site as a variety of gear types was deployed, each with a different means of calculating CPUE. Nonetheless, the total number of fish and species collected per site provides an indication of abundance and diversity and were used as a basis for assessment in this study and, where necessary, accompanied by explanations as to how sampling effort/methods used might have contributed to the observed results.

Unlike the macroinvertebrate data analysis, there are no models currently developed for fish communities and as such a health assessment cannot be made. Apart from assessing trends in fish abundance and diversity, the focus of the data analysis in this report was on the migratory status, native versus exotic/introduced status, conservation status and fisheries-value status of the species recorded.

2.1.7 Other Aquatic Vertebrates

Aquatic vertebrates other than fish were not specifically targeted as part of the SEIS aquatic surveys, though some turtle catch was expected as by-catch as part of fyke net sampling. At each site a record was kept of other aquatic vertebrates observed as catch, by-catch or incidental sightings. Where possible, turtles captured were identified using relevant keys (e.g. Cogger, 1992).

2.1.8 Aquatic Habitat Assessment Method

AUSRIVAS rapid assessment habitat description methods were used to characterise aquatic habitat. In addition to this, the growth form and species of any macrophytes present at a given site and their percentage cover were recorded. No detailed riparian vegetation assessment was carried out as this was done as part of the GCP EIS. A broad-level description of the riparian vegetation was, however, undertaken at each site based on criteria listed in the QLD AUSRIVAS habitat assessment sheets. This information was considered sufficient in terms of being able to characterise the general condition of the riparian zone at each site prior to the GCP going ahead and to identify any current pressures on the riparian zone in the study area.

2.1.9 Water Quality Assessment Method

In situ measurements of physico-chemical water quality parameters were measured at each site using a YSI 650 MDS multi-parameter water quality meter calibrated in accordance with the manufacturer's specifications. The YSI Water Quality meter was used to measure; pH; EC (µS/cm); Water Temperature (ºC) and Dissolved Oxygen (% saturation and mg/L). Turbidity (NTU) was measured using a Hach 2100P turbidity meter. Alkalinity, a key factor influencing the makeup of macroinvertebrate communities, was measured using a Chemetrics alkalinity field titration kit.

In addition to taking *in situ* water quality measurements, water samples were collected at each site to test for a range of parameters. Water samples were also collected as part of the EIS surveys (as reported in E3, 2010b). As part of the public consultation process DEHP commented that they would like to see additional parameters added to the GCP water quality monitoring program for the SEIS. DEHP also provided guidance as to what additional parameters should be measured. GHD added the suggested DEHP water quality parameters and also added organic pesticides to the monitoring program in order to properly characterise

the effects of adjacent agricultural landuse (an existing form of disturbance) on water quality. Table 2–2 provides a comparison between the range of parameters assessed as part of the GCP EIS and the range of parameters recommended by DEHP and monitored by GHD as part of the SEIS.

Samples were collected and stored in accordance to methods outlined in DERM (2009b) and sent to the ALS NATA-accredited laboratory in Brisbane for analysis. Because of the distances between sites and the remoteness of the study area, samples collected during the SEIS rail corridor surface aquatic ecology survey were not sent to the laboratory until the completion of that field program (12 days). As a result, a number of parameters (i.e. pH, Total Suspended Solids (SS), Nitrate, Nitrite, Soluble Reactive Phosphorus (SRP) and Chlorophyll-a) exceeded holding times. Consequently, the results for those parameters need to be interpreted with caution. They are, however, expected to provide some indication of the relative differences in the levels of these parameters between the sites monitored. All samples collected were sent to the ALS laboratory in Brisbane for analysis. The Limit of Reporting (LOR) applied by the Brisbane ALS Laboratory were, where possible, set below the trigger levels given in relevant water quality guidelines.

It should be noted that the water sample collection and analysis undertaken by GHD was not part of any coordinated water quality sampling program set up by Waratah Coal for the GCP. This program is currently still being developed and will be presented as part of the EM Plan. Sites sampled as part of the rail corridor assessment will likely be included in the GCP water quality monitoring program. Moreover, these data will help set the platform for eventually developing locally relevant water quality objectives in relation to the GCP that can be used as benchmarks for setting license condition trigger levels.

Table 2–2 Comparison between parameters monitoredas part of the GCP EIS, parameters recommended by DEHP and parameters monitored by GHD as part of the GCP SEIS survey.

Parameters Monitoried as part of the EIS	Parameters Recommended by DERM	Parameters Monitored by GHD
Physical		
		EC
		pH
		TSS
		TDS
Major Ions	Major Ions	Major Ions
Alkalinity as Ca CO_3	Alkalinity as Ca CO_3	Alkalinity as Ca CO_3
Sulphate	Sulphate	Sulphate
Chloride	Chloride	Chloride
Calcium	Calcium	Calcium
	Flouride	Flouride
Magnesium	Magnesium	Magnesium
Sodium	Sodium	Sodium
Potassium	Potassium	Potassium
Total Anions	Total Anions	Total Anions
Total Cations	Total Cations	Total Cations
Metals (Total concentration)		
	Aluminium	Aluminium
Arsenic	Arsenic	Arsenic
	Boron	Boron
Cadmium	Cadmium	Cadmium
Chromium	Chromium	Chromium
	Cobalt	Cobalt
Copper	Copper	Copper
Iron	Iron	Iron
Lead	Lead	Lead
	Manganese	Manganese
	Mercury	Mercury
	Molybdenum	Molybdenum
Nickel	Nickel	Nickel
	Selenium	Selenium
	Silver	Silver
	Uranium	Uranium
	Vanadium	Vanadium
Zinc	Zinc	Zinc
Metals (Dissolved)		
	Aluminium	Aluminium
	Arsenic	Arsenic
	Boron	Boron
	Cadmium	Cadmium

Parameters Monitoried as part of the EIS	Parameters Recommended by DERM	Parameters Monitored by GHD
	Chromium	Chromium
	Cobalt	Cobalt
	Copper	Copper
	Iron	Iron
	Lead	Lead
	Manganese	Manganese
	Mercury	Mercury
	Molybdenum	Molybdenum
	Nickel	Nickel
	Selenium	Selenium
	Silver	Silver
	Uranium	Uranium
	Vanadium	Vanadium
	Zinc	Zinc
Nutrients		
Ammonia a N	Ammonia a N	Ammonia a N
Nitrate as N	Nitrate as N	Nitrate as N
Nitrite as N	Nitrite as N	Nitrite as N
TKN	TKN	TKN
TN	TN	TN
TP	TP	TP
		SRP
Primary Production		
Chlorophyll a	Chlorophyll a	Chlorophyll a
Organic Contaminants		
PCB	PCB	PCB
PAH	PAH	PAH
TPH (C10-36)	TPH (C10-36)	TPH (C10-36)
		BTEX
		O-C Pesticides
		O-P Pesticides

Water quality measurements and water quality samples were taken before any other sampling to ensure that the results were not compromised by disturbance of bottom sediments caused by sampling activity. In addition, care was taken not to disturb any of the biological habitats that were be sampled for macroinvertebrates and fish when measuring water quality.

Flow conditions and water levels, along with water depth, were assessed on a qualitative basis at the time of sampling and information on these recorded to aid with the interpretation of the water quality data.

As a Quality Assurance / Quality Control (QAQC) measure, GHD arranged for trip blanks and for rinsate water to be provided by the laboratory so that the field team could collect field blanks. Blanks were only collected with respect to organic contaminant components. Data for the trip and field blanks were used to assess whether there was any evidence of sample contamination during sample transport or during sample collection.

One of the criticisms levelled at the GCP EIS report was that relevant Environmental Values (EVs) for waterways potentially affected by the GCP had not been identified and, as such, the water quality data were not interpreted with the relevant EVs in mind.

North Queensland Dry Tropics (the catchment management authority responsible for the Burdekin Dry Tropics region) developed the Burdekin Water Quality Improvement Plan (BWQIP) in 2009 (Dight, 2009). The BWQIP included the identification of draft waterway EVs for the 48 sub-catchments within the Burdekin River basin. The draft EVs were identified through:

- Literature review and collation from other sources of information;
- Surveys and workshops involving community groups, traditional owners, scientists and resource managers; and
- Community engagement activities.

Table 2–3 below outlines the BWQIP Draft EVs for each of the systems sampled. Note that the BWQIP (Dight, 2009) does not apply to Splitter Creek, Saltwater Creek and Elliot River as they are outside the Burdekin Catchment.

The water quality results were tabulated and assessed against relevant guideline ranges and trigger values set out in the following:

- ANZECC and ARMCANZ (2000) Water Quality Guidelines (slightly to moderate disturbed freshwater ecosystems of Tropical Australia –i.e. 95% ecosystem level protection level);
- Qld Water Quality Guidelines 2009 (DERM, 2009a) (95% ecosystem level protection level for Central Qld freshwater ecosystems); and
- ANZECC and ARMCANZ (2000) Water Quality Guidelines in relation to maintaining drinking water, livestock drinking water, irrigation water, human recreation, human consumption and visual amenity EVs.

Table 2–3: BWQIP Draft EVs for the various systems sampled as part of this study.

System	Basin	Sub-catchment	BWQIP Draft EVs
Splitter Creek	Abbot Bay Catchment	Splitter Creek	N/A
Saltwater Creek		Saltwater Creek	N/A
Elliot River	Elliot River	Elliot River	N/A
Bogie River	Bowen-Broken-Bogie	Bogie River	Environmental Protection, Recreation (swimming, fishing, visual appreciation), Stock Watering, Irrigation, Human Consumption, Drinking Water and Cultural and Spiritual values
Sandy Creek			
Pelican Creek		Pelican Creek	Environmental Protection, Stock Watering, Irrigation, Drinking Water and Cultural and Spiritual values
Bowen River		Bowen River	Environmental Protection, Recreation (swimming, fishing, visual appreciation), Stock Watering, Irrigation, Human Consumption, Drinking Water, Industry and Cultural and Spiritual values
Suttor River	Suttor	Upper Suttor River	Environmental Protection, Recreation (swimming, boating, visual appreciation), Stock Watering, Human Consumption, Industrial Use (Mining), and Cultural and Spiritual values
Logan Creek		Logan Creek	Environmental Protection, Recreation (visual appreciation), Stock Watering, Irrigation, and Cultural and Spiritual values
Mistake Creek	Belyando	Mistake Creek	Environmental Protection, Stock Watering, Cultural and Spiritual values
Middle Creek		Fox Creek	Environmental Protection, Recreation (swimming & visual appreciation), Stock Watering, Drinking Water, and Cultural and Spiritual values
Belyando River		Belyando Floodplain	Environmental Protection, Stock Watering, Irrigation, Cultural and Spiritual values
Lagoon Creek		Sandy Creek	Environmental Protection, Stock Watering, Cultural and Spiritual values

3. Results

3.1 Habitat Description

Habitat descriptions are given below for sites sampled by GHD in April 2012. Habitat descriptions for sites sampled as part of the E3 (2010) rail corridor survey are given in the E3 (2010) report, so are not repeated here.

3.1.1 Splitter Creek

This site (Alt-AQ-1) was chosen as an alternative site to the one sampled by E3 (2010) as part of the GCP EIS (AQ-1) as it represented the nearest publicly accessible access point to Splitter Creek. However, it coincided with a bridge crossing on the highway, so habitat conditions may not necessarily reflect those for the wider Splitter Creek or at the nominated GCP rail corridor crossing point. The proposed rail crossing and the existing road crossing are likely to have similar impacts on the aquatic ecosystem of Splitter Creek, so the habitat assessment information associated with Alt-AQ-1 provides useful predictive information for the GCP SEIS.

Site Alt-AQ-1 (see Figure 3–1) was characterised by a narrow, shallow stream with a mean wetted width of 8 m. The stream was flowing at the time of sampling and the water present was clear. The bed and banks were dominated by sand, with some gravel and sand bed aggradation (i.e. sand slugs) present at and downstream of the bridge crossing, indicating that this system is subject to erosion in the upstream reaches, though limited bank erosion was observed at the site. The riparian zone was well developed (15 m wide on both banks), with limited bare ground and a good mix of understorey and canopy vegetation. The riparian vegetation was mainly intact and continuous along the sampled reach and the canopy overhang provided good shading to the stream below. Canopy cover was mixed mature *Melaleuca/Eucalyptus,* while the understorey was made up of native shrubs, grasses and small trees. No weed species were recorded. Instream habitat was limited, with no floating or submerged macrophytes present and emergent species patchily distributed along the water margin, offering little structural habitat. Instream habitat consisted mainly of sticks, twigs and leaf litter. The meandering stream channel, sand bars and riffles provided additional habitat diversity.

Figure 3–1: Splitter Creek at Alt-AQ-1 looking downstream

3.1.2 Saltwater Creek

This site (Alt-AQ-2) was chosen as an alternative site to the one sampled by E3 (2010) as part of the GCP EIS (AQ-2) as it represented the nearest publicly accessible access point to Saltwater Creek. However, it too, coincided with bridge crossings on the highway (both car and rail bridge crossings), so habitat conditions may not necessarily reflect those for the wider Saltwater Creek or at the nominated GCP rail corridor crossing point. Again, though, the proposed rail crossing and the existing crossing are likely to have similar impacts on the aquatic ecosystem of Saltwater Creek, so the habitat assessment information associated with Alt-AQ-2 provides useful predictive information for the GCP SEIS.

Site Alt-AQ-2 (see Figure 3–2) was very similar to site Alt-AQ-1 in that it was characterised by a narrow, shallow stream with a mean wetted width of 8 m. The stream was flowing at the time of sampling and the water present was clear. The bed and banks were dominated by sand, with some gravel and sand bed aggradation (i.e. sand slugs) present downstream of the bridge crossing, indicating that this system is subject to erosion in the upstream reaches. Unlike site Alt-AQ-1, though, severe bank erosion was observed at the site. The riparian zone was less well developed (only 2 m wide on both banks) and featured more bare ground and less abundant and continuous canopy vegetation present. Nonetheless, the available canopy overhang provided reasonable shading to the stream below. Canopy cover was predominantly *Melaleuca,* while the understorey was made up of native shrubs, grasses and small trees. Exotic weed species were limited. Instream habitat was limited, with no floating or submerged macrophytes present and emergent species patchily distributed along the water margin, offering little structural habitat. Instream habitat consisted mainly of sticks, twigs and leaf litter. Standing timber, tree roots, and riffle habitat provided additional habitat diversity, as did the presence of a rock bar near one of the bridge crossings.

Figure 3–2: Saltwater Creek at Alt-AQ-2 looking across stream

3.1.3 Bogie River

This site (Alt-AQ-4) was chosen as an alternative site to the one sampled by E3 (2010) as part of the GCP EIS (AQ-4) as it represented the nearest publicly accessible access point to the Bogie River. Hence, the habitat conditions reported below may not necessarily reflect those for the wider Bogie River or at the nominated GCP rail corridor crossing point.

Site Alt-AQ-4 (see Figure 3–3) was characterised by a wide, but shallow stream with a mean wetted width of 25 m and a mean depth of around 0.5 m. The stream was flowing at the time of

sampling and the water present was clear. The bed and banks were dominated by sand, with some gravel. Banks were mainly intact with limited erosion observed at the site.The riparian zone was well developed (20-25 m wide on both banks and relatively continuous), but the understorey featured extensive bare ground and limited understorey vegetation. While there was some canopy overhang, due to the large stream width, this provided somewhat limited shading to the stream below. Canopy cover was predominantly *Eucalyptus,* while the understorey was made up of native shrubs, grasses and small trees, with shrubs being less abundant compared to other understorey vegetation. Some exotic weed species were observed at this site, perhaps due to the combination of available bare substrate in the understorey and light grazing activity in the adjacent land. Instream habitat was limited, with no floating or submerged macrophytes present. The bed bathymetry was uniform in the reach surveyed and instream habitat consisted mainly of logs, trailing vegetation and overhangs.

Figure 3–3: Bogie River at Alt-AQ-4 looking downstream

3.1.4 Sandy Creek

This site (Alt-AQ-5) was chosen as an alternative site to the one sampled by E3 (2010) as part of the GCP EIS (AQ-5) as it represented the nearest publicly accessible access point on Sandy Creek. Hence, the habitat conditions reported below may not necessarily reflect those for the wider Sandy Creek or at the nominated GCP rail corridor crossing point. This site also corresponded with a location of an old culvert ford crossing.

Site Alt-AQ-5 (see Figure 3–4) was characterised by a narrow, shallow stream with a mean wetted width of 8 m and a mean depth of around 0.5 m. The stream was flowing more than the other sites at the time of sampling and the water present was very clear. The bed and banks were dominated by gravel, but contained a range of other sediment particle size classes, including cobbles, boulders and pebbles. Banks were mainly intact with limited erosion observed at this site. The riparian zone was well developed (30 m wide on one bank, 100 m wide on the other and continuous along both banks). The understorey featured some bare ground, but grasses were abundant, as were native trees <10 m. Exotic weed species were common within the understorey, however, indicating that the riparian habitat in this system has undergone anthropogenic change associated with weed introduction. Canopy cover provided low to moderate stream shading at this site, mainly due to the fact that the taller trees tended to occur away from the stream channel. Instream habitat was diverse, despite the lack of floating or submerged macrophytes. Instream habitat included filamentous algae (small patches), bank overhand and trailing vegetation, detritus and woody debris. Standing timber in the form of

small *Melaleuca* and occasional boulders, along with the ford crossing structure identified above, also provided structural habitat.

Figure 3–4: Sandy Creek at Alt-AQ-5 looking downstream

3.1.5 Pelican Creek

This site (Alt-AQ-6) was chosen as an alternative site to the one sampled by E3 (2010) as part of the GCP EIS (AQ-6) as it represented the nearest publicly accessible access point on Pelican Creek. Hence, the habitat conditions reported below may not necessarily reflect those for the wider Pelican Creek or at the nominated GCP rail corridor crossing point. Like Alt-AQ-5, this site also corresponded with a location of an old ford crossing. This structure was partially inundated at the time of sampling.

Site Alt-AQ-6 (see Figure 3–5) was characterised by a narrow, shallow stream with a mean wetted width of 6 m and a mean depth of around 0.5 m, though there were parts of the assessed reach that were wider and deeper than this (up to 15 m wide and over 1 m deep for some pools). Further, it should be noted that Pelican Creek at this site was characterised by steep banks (around 10 m on one side) and the main low flow channel represents only a fraction of the 120 m flood channel bank to bank width. The stream was flowing more than the other sites at the time of sampling and the water present was very clear. The bed and banks were dominated by sand and gravel, but contained other sediment particle size classes, including cobbles and pebbles. Banks were mainly intact with limited erosion observed at this site, though there was evidence of long term scouring downstream of the ford structure away from the main channel (see Figure 3–5). Further, the floodplain channel contained a number of sand bars that have been deposited during high flow events, which have been colonised by terrestrial plants. This indicates that bank and bed erosion is prevalent in this catchment during high flows.

The riparian zone was well developed (10 m wide on one bank, 100 m wide on the other and continuous along both banks aside from near the ford crossing). The canopy was *Eucalyptus* – dominated and within the sampled reach, provided abundant stream shading. The understorey featured some bare ground, but grasses and shrubs were relatively abundant. Exotic weed species were common within the understorey, indicating that the riparian habitat in this system has undergone anthropogenic change associated with weed introduction.

Instream habitat was diverse, despite the lack of abundant floating or submerged macrophyte cover. Instream habitat included filamentous algae (small patches), bank overhang and trailing vegetation, detritus and woody debris. There were also a range of hydraulic habitats present

within the sampled reach, including, riffles, runs and deep and shallow pools. The ford structure itself and the cascades associated with it, provided additional habitat diversity.

Figure 3–5: Pelican creek at Alt-AQ-6 looking downstream

3.1.6 Bowen River

This site (Alt-AQ-7) was chosen as an alternative site to the one sampled by E3 (2010) as part of the GCP EIS (AQ-7) as it represented the nearest publicly accessible and safe boat access point on the Bowen. Boating was required in this system as it is inhabited by estuarine crocodile. This site is located upstream of the Collinsville Weir within the weir pool, so habitat conditions are unlike the Bowen River main channel closer to the nominated GCP rail corridor crossing point, but a habitat description for it is provided below to assist with data interpretation for this report.

Site Alt-AQ-7 (see Figure 3–6) was characterised by a wide, deep river channel with a mean wetted width of 120 m and a mean depth of around >2 m. The stream was not visibly flowing at the time of sampling, but this was due to the fact that it was within an impounded section of the river, where the system had been artificially transformed to a lentic (slow water moving) system from its original lotic (flowing stream) form. The water present at this site was clear, though due to the depths involved, it was difficult to establish a true point of reference based purely on visual observation. The bed and banks were dominated by sand and silt-clay, with the latter more prevalent on the lower bank. Banks were mainly intact with limited erosion observed at this site.

The riparian zone was well developed (15-30 m wide on both banks and relatively continuous along each bank). The canopy was *Melaleuca*–dominated and mostly of mature trees > 10 m. Despite this, the wide stream channel meant that the canopy provided limited stream shading. The understorey was poorly developed, though some grasses and shrubs were present. Very few weeds were observed in the understorey at this site. Instream habitat was limited, with no macrophyte cover observed and the single hydraulic habitat represented being a deep pool. Instream habitat did, however, contain bank overhang and trailing vegetation, tree roots, detritus and woody debris (large logs). The main Bowen River channel downstream of the Collinsville Weir offers more instream habitat in terms of channel morphology, hydraulic habitats present and sediment particle sizes.

Figure 3–6: Bowen River at Alt-AQ-7 looking downstream

3.1.7 Suttor Creek

This site (AQ-8) coincides with the one sampled by E3 (2010) as part of the GCP EIS. It was characterised by a narrow, shallow river channel with a mean wetted width of 5 m and depths typically >0.5 m. The stream was not visibly flowing at the time of sampling, but no isolated pools had formed within the visible range, indicating that flows had only recently receded in this ephemeral stream. The water present at this site was turbid (see Figure 3–7). The bed and banks were dominated by sand and silt-clay, with the latter more prevalent on the lower bank. Banks were mainly intact with limited erosion observed at this site. The riparian zone was well developed (10 m wide on both banks and relatively continuous along each bank). The canopy was *Eucalyptus*–dominated and mostly of mature trees > 10 m. Combined with the narrow stream channel this meant that the canopy provided abundant stream shading. The understorey featured some bare patches, but native grasses and trees < 10 m were quite common. Few weeds were observed in the understorey at the site. Instream habitat was limited, with no macrophyte cover observed and the single hydraulic habitat represented being a pool habitat. Instream habitat did, however, contain bank overhang and trailing vegetation, tree roots, detritus and woody debris (mainly branches).

Figure 3–7: Suttor Creek at AQ-8 looking downstream

3.1.8 Belyando River

This site (Alt-AQ-12) was chosen as an alternative site to the one sampled by E3 (2010) as part of the GCP EIS (AQ-12) as it represented the nearest publicly accessible point on the Belyando River. As such, habitat conditions at this site may differ from those closer to the nominated GCP rail corridor crossing point.

Site Alt-AQ-12 (see Figure 3–8) was characterised by a moderate sized channel with a mean wetted width of 15 m. The stream was visibly flowing at the time of sampling and the water was > 1.5 m deep in most of the assessed reach at this site. The site coincides with a ford crossing which was inundated to depths of around 0.5 m at the time of sampling. The water present at this site was turbid, though not as turbid as observed at Suttor Creek. The banks were dominated by sand and silt-clay, but the bed in the sampled reach was dominated by bedrock, presumably the reason the ford crossing was established there. Outside of this bedrock outcrop, bed material is expected to more closely resemble bank material. Banks showed signs of erosion, particularly near the causeway easement area, but otherwise no instances of severe bank erosion were observed at this site.

The riparian zone was well developed (20 m wide on one banks and >100 m wide on the other bank and relatively continuous along each bank aside from the ford crossing easement). The canopy was *Eucalyptus*–dominated and mostly of mature trees > 10 m, but given the size of the stream channel and the fact that most mature canopy occurred high on the bank profile, this meant that there was limited stream shading at this site. The understorey was poorly developed and bare patches were abundant, though native grasses and trees < 10 m were common. Very few weeds were observed in the understorey at this site despite the presence of bare substrate. Instream habitat was limited, with no macrophyte cover observed and the only hydraulic habitats represented being shallow and deep pool habitat. Instream habitat did, however, contain bank overhang and trailing vegetation, tree roots, detritus and woody debris (large logs).

Figure 3–8: Belyando River at AQ-12 looking upstream

3.1.9 Lagoon Creek

This site (AQ-13) coincides with the one sampled by E3 (2010) as part of the GCP EIS. It was characterised by a moderately wide (20 m) river channel with gently sloping banks. The stream was dry at the time of sampling, though isolated pools were observed in this same system further upstream as part of the GCP SEIS near-mine sampling carried out by another GHD field team around the same time. The bed and banks were dominated by sand and gravel. Banks were intact with limited erosion observed at this site. The riparian zone was well developed (15 m wide on one bank, 35 m wide on the other and relatively continuous along each bank). The canopy was *Eucalyptus*–dominated and mostly of mature trees > 10 m. The canopy would provide abundant stream shading in times of flow. The understorey featured some native grasses, shrubs and trees < 10 m and few bare patches. Very few weeds were observed in the understorey at this site. Instream habitat, when present, would be limited, with no macrophyte cover likely to be present and little bathymetric variability (see Figure 3–9), there would be little hydraulic habitat variation in this reach (probably only run habitat). Further, large woody debris cover and detritus were in limited supply at this site. Instream habitat would, however, likely contain bank overhang and trailing vegetation and tree roots during times of flow.

Figure 3–9: Lagoon Creek at AQ-13 looking upstream

3.2 Macroinvertebrates

3.2.1 Past Macroinvertebrate Surveys

Many of the creeks and streams within the Burdekin catchment are ephemeral in nature, particularly those within the inland sub-catchments. As such, these waterways are characterised by wide fluctuations in water level and flow characteristic of river systems with highly variable and unpredictable environmental conditions. This has a significant influence on the spatial and temporal variability in the diversity, composition and distribution of aquatic flora and fauna.

Macroinvetebrate surveys carried out in the Burdekin Basin reported in the published literature include those by Pearson (1991), Parsons Brinckerhoff (2009), AARC (2010), E3 (2010) and ALS (2011). The results of the E3 (2010) study are the most relevant to this study as it covers the streams potentially intersected by the rail corridor that were also sampled as part of this study. However, E3 (2010) used non-standard methods of macroinvertebrate sampling, so results for that study are not directly comparable to those collected as part of this study. E3 (2010) collected replicate macroinvertebrate samples from riffle, run and pool habitat and processed samples by sieving them through sieves of various mesh sizes. Further, sampling by E3 (2010) did not cover edge habitat and, therefore, neglected one of the more commonly occurring aquatic habitats present in waterways within the study area. Edge habitat was sampled as part of this study, along with riffle and composite habitat, as it was present at every site and would normally be expected to contain most of the same species present in pool bed habitat. Despite these differences, broad level comparisons in diversity and composition were made between the results obtained from this study and those of the study be E3 (2010).

3.2.2 Diversity

Taxa Richness

Parsons Brinckerhoff (2009) reported that macroinvertebrate diversity in the Burdekin Basin is considered relatively low and that macroinvertebrate communities in this catchment are dominated by generalist species with few pollution sensitive taxa. However, several previous studies have recorded a relatively high overall diversity of macroinvertebrate taxa, with over 50 taxa (Pearson, 1991; AARC, 2010). Note that sampling by Pearson (1991) and AARC (2001) took place over a two year period and covered a relatively large number of sites and habitats. Sampling by E3 (2010) covered 13 sites spread across a broad geographic area and multiple habitat types within the GCP rail corridor, but was carried out on a single sampling occasion. The E3 (2010) study recorded only 27 macroinvertebrate taxa (at the family level, but not including individual Ephemeroptera, Trichoptera and Zygoptera families). A total of 1344 individuals belonging to 52 taxa were collected from eight sites as part of the single sampling round carried out in the GCP rail corridor as part of the study for GCP SEIS. This result is therefore consistent with the diversity level recorded for the Pearson (1991) and AARC (2010), but greater than that recorded as part of the E3 (2010) study in the same geographic region two years previously. The latter is most likely attributable to differences in sampling methods and habitats covered by this study and the E3 (2010) study and this is discussed in more detail in section 3.2.1. Further, E3 (2010) did not identify some taxa beyond order level (e.g. Ephemeroptera, Trichoptera, Zygoptera), which would have reduced the overall diversity they recorded compared to other studies. Across the two studies carried out within the GCP rail corridor allignment, a total of 55 macroinvertebrate taxa were recorded at the family level.

Figure 3–10 shows the taxa richness results for edge habitat samples collected as part of this study and compares those results against the expected range for taxa richness from edge habitat in Central Queensland waterways based on data presented in DERM (2009a). All but

one edge habitat sample collected in this study had a lower than expected taxa richness when compared to the DERM (2009a) guideline range for edge habitat taxa richness for Central Coast Queensland waterways. Only the edge habitat sample collected from Alt-AQ6 (Pelican Creek) recorded a taxa richness value within the DERM (2009a) guideline range for waterways of Central Queensland. The edge habitat sample from Alt-AQ2 (Saltwater Creek) had particularly low macroinvertebrate diversity. This could have been due to several reasons, including scouring associated with recent high flows (as indicated by debris in the riparian vegetation in Figure 3–2), bank erosion (which was relatively severe at this site) and/or elevated electrical conductivity (EC) (see Table 3–11). The latter seems less likely as taxa richness in the composite habitat sample associated with this site were not similarly affected (see Figure 3–11).

Figure 3–11 shows the taxa richness results for composite and riffle habitat samples collected as part of this study and the study by E3 (2010) and compares those results against the expected range for taxa richness from composite habitat in Central Queensland waterways based on data presented in DERM (2009a). While the DERM (2009a) guidelines do not apply specifically to riffle habitat samples, composite habitat sampling can cover a variety of bed types, including riffle habitat, hence it was deemed legitimate, for the purpose of this study, to provide comparisons between riffle sample results and guideline ranges for composite samples. Also, E3 (2010) data were deemed to represent composite data as samples collected from the various habitats in the study were effectively pooled. All composite and riffle samples collected in this study were either within or above the expected range given in DERM (2009a) for taxa richness in composite samples collected from Central Queensland waterways. Taxa richness at Alt-AQ-6 was particularly high and this is most likely due to the large variety of microhabitats present at that site, given macroinvertebrate diversity often corresponds with habitat diversity. While the majority of composite samples collected by E3 (2010) recorded a taxa diversity within the expected range for Central Queensland waterways, a number did not.

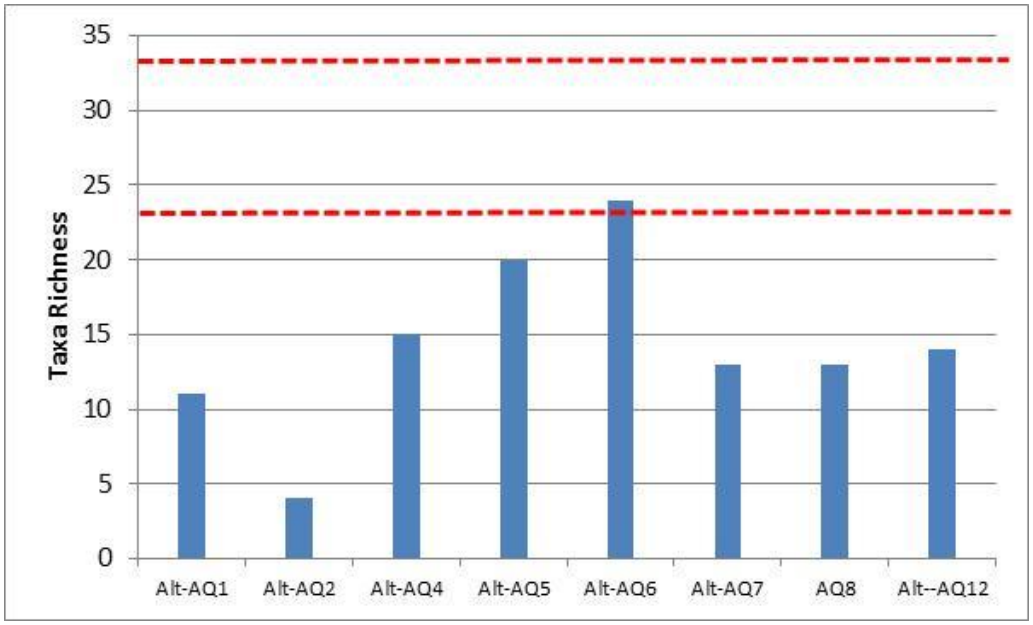

Figure 3–10: Variation in edge habitat taxa richness according to site and study. Dashed lines represent 20% percentile and 80th percentile ranges for edge habitat taxa richness in relation to Central Queensland edge habitat given in DERM (2009a)

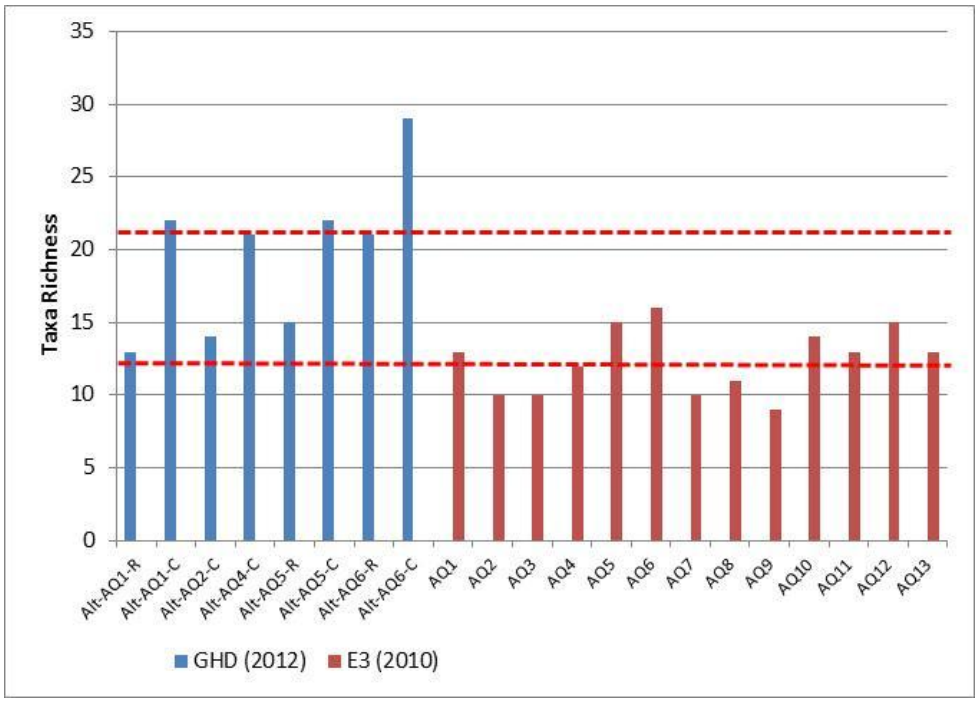

Figure 3–11: Variation in riffle (R) and composite (C) habitat taxa richness according to site and study. Dashed lines represent 20% percentile and 80th percentile ranges for composite habitat taxa richness in relation to Central Queensland edge habitat given in DERM (2009a)

3.2.3 Distribution

Occurrence

Dominant taxa recorded from the study by Parsons Brinckerhoff (2009) included mayfly nymphs (family Caenidae), Midge larvae (subfamily Chironominae), diving beetles (family Dyticidae) and freshwater shrimps (family Atyidae). A number of these macroinvertebrates families were also found to be widespread and abundant in the study by AARC (2010). For sites monitored within the GCP rail corridor, the most widespread macroinvertebrate taxa were Chironominae, Dytiscidae, Tanypodinae, Atyidae and Oligochaeta. These were collected from 70% or more of the sites sampled (Table 3–1). Therefore, our results are in general agreement with those of previous studies with respect to the most ubiquitous macroinvertebrate taxa present.

The taxa that were recorded from two or fewer sites including at least one of the sites sampled as part of this study are shown in Table 3–2. Based on the low SIGNAL sensitivity ratings for most of these taxa, it is unlikely that their rare occurrence was due to water quality degradation related factors. Possible exceptions to this include Elmidae and Dixidae, which have relatively high SIGNAL sensitivity ratings, but a more likely explanation for their rarity within the samples collected is the availability of suitable habitat. Elmidae (Riffle Beetles) are rheophilic (flow-loving) and, as their name would suggest, are closely associated with riffles. Riffles were not present at the majority of sites, which might explain their more restricted occurrence in this. Dixidae (Meniscus Midges) are usually found in fresh, still or slowly flowing waters such as dams, ponds, lake edges and stream backwaters (MDFRC website: http://www.mdfrc.org.au/bugguide/display.asp?type=5&class=17&subclass=&Order=7&family=250&couplet=0, accessed 26/10/2012). Most of the waterways sampled were ephemeral with

strong hydrological variation. When they do flow, higher flow velocities in these waterways are unlikely to support this taxon.

Table 3–1: Level of occurrence for various taxa among the samples collected as part of the GHD (2010) and E3 (2010) studies.

Taxa	No. Sites recorded from	% Occurrence
s-f Chironominae	21	100.00
Dytiscidae	18	85.71
s-f Tanypodinae	18	85.71
Atyidae	15	71.43
Oligochaeta	15	71.43
Palaemonidae	14	66.67
Acarina	12	57.14
Hydrophilidae	11	52.38
Simuliidae	10	47.62
Hygrobiidae	9	42.86
Gerridae	8	38.10
Lymnaeidae	8	38.10
Pleidae	8	38.10
Veliidae	8	38.10
Caenidae	7	33.33
Gomphidae	7	33.33
Baetidae	6	28.57
Janiridae	6	28.57
Libellulidae	6	28.57
Physidae	6	28.57
Ceratopogonidae	5	23.81
Coenagrionidae	5	23.81
Culicidae	5	23.81
Leptophlebiidae	5	23.81
s-f Orthocladiinae	5	23.81
Tabanidae	5	23.81
Corbiculidae	4	19.05
Gyrinidae	4	19.05
Hydraenidae	4	19.05
Hydrochidae	4	19.05
Planorbidae	4	19.05
Thiaridae	4	19.05
Tipulidae	4	19.05
Corixidae	3	14.29
Haliplidae	3	14.29
Hydropsychidae	3	14.29
Notonectidae	3	14.29
Philopotamidae	3	14.29
Psephenidae	3	14.29
Sphaeriidae	3	14.29
Corduliidae	2	9.52
Elmidae	2	9.52
Hydrometridae	2	9.52

Taxa	No. Sites recorded from	% Occurrence
Hydroptilidae	2	9.52
Nepidae	2	9.52
Scirtidae	2	9.52
Collembola	1	4.76
Dixidae	1	4.76
Dolichopodidae	1	4.76
Ecnomidae	1	4.76
Gelastocoridae	1	4.76
Isostictidae	1	4.76
Lindeniidae	1	4.76
Parastacidae	1	4.76
Stratiomyidae	1	4.76

Note: s-f = sub-family

Table 3–2: SIGNAL sensitivity ratings for the least common taxa among those recorded from the GHD (2012) and E3 (2010) studies.

Family/Sub-family	SIGNAL Sensitivity rating
Corduliidae	5
Elmidae	7
Hydrometridae	3
Hydroptilidae	4
Nepidae	3
Scirtidae	6
Collembola	1
Dixidae	7
Dolichopodidae	3
Ecnomidae	4
Gelastocoridae	5
Isostictidae	3
Lindeniidae	3
Parastacidae	4
Stratiomyidae	4

3.2.4 Community Condition

PET Richness and PET Taxa

PET richness refers to the proportional representation of key macroinvertebrate taxa belonging to orders Plecoptera, Ephemeroptera and Trichoptera (PET taxa)measured according to number of PET taxa recorded in a given sample. At a broad level, these orders have been established to be among the more sensitive to water quality (although at the family level within these orders, sensitivity to water pollution varies considerably). Hence, PET richness

represents a simple metric to assess the condition of macroinvertebrate communities in relation to water quality and habitat conditions.

Seven PET taxa were recorded from sites sampled within the GCP rail corridor as part of this study and that by E3 (2010) combined. These included three Ephemeroptera families (Baetidae, Caenidae and Leptophlebidae) and four Trichoptera families (Ecnomidae, Hydropsychidae, Hydroptilidae and Philopotamidae). No Plecoptera families were recorded, but this was expected, because Plecoptera prefer cool, clear water mountain streams which are not present in the study area. The study by AARC (2010) recorded six PET taxa including most of those recorded in the GCP rail corridor.

The Queensland Water Quality Guidelines (DERM, 2009a) present data on the expected ranges for PET taxa from edge and composite habitat in Central Queensland based on the 20th and 80th percentiles for PET richness in relation to 21 reference sites sampled by DEHP. PET richness data for edge habitat and composite habitat sampled are assessed in relation to these ranges in Figure 3–12 and Figure 3–13, respectively.

In this study, PET richness values recorded for edge habitat fell within the expected range for all sites except Alt-AQ2 and Alt-AQ7. No PET taxa were recorded at all at Alt-AQ2, which also had low overall taxonomic richness (**Error! Reference source not found.**). Alt-AQ6 recorded the highest PET richness for edge habitat, this site also had a high overall taxa richness (Figure 3–10).

PET richness values recorded for composite and riffle habitat in this study were either within or higher than the expected range for composite habitat samples in Central Queensland waterways given in DERM (2009a) (Figure 3–13). By contrast, all samples collected by E3 (2010) had a lower than expected PET richness; this would likely be an artefact of the lack of identification of individual families within the PET taxa group, rather than actual low PET richness.

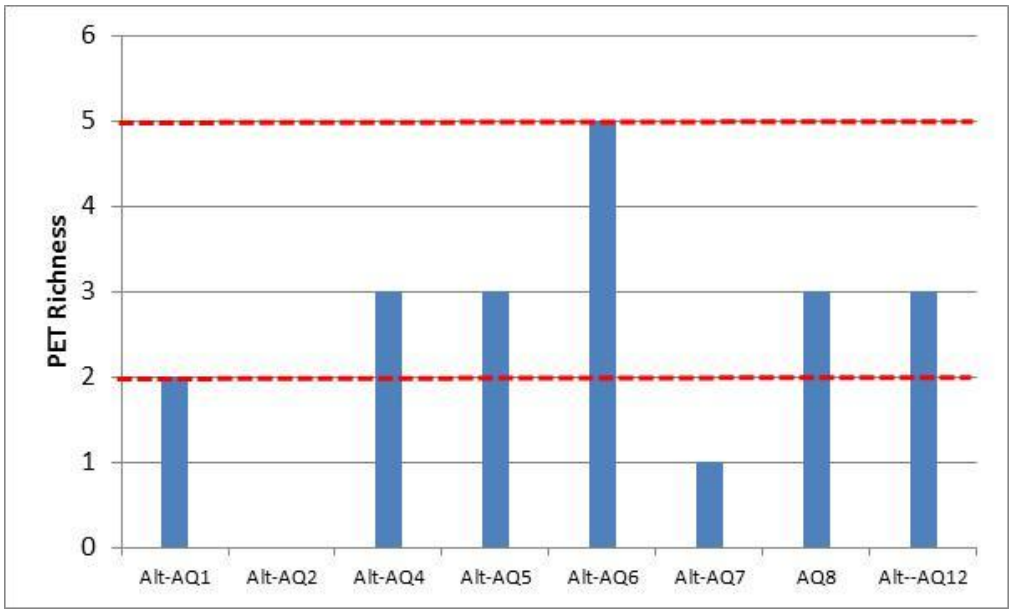

Figure 3–12: Variation in PET richness according to site and study. Dashed lines represent 20% percentile and 80th percentile ranges for PET richness in relation to Central Queensland edge habitat given in DERM (2009a)

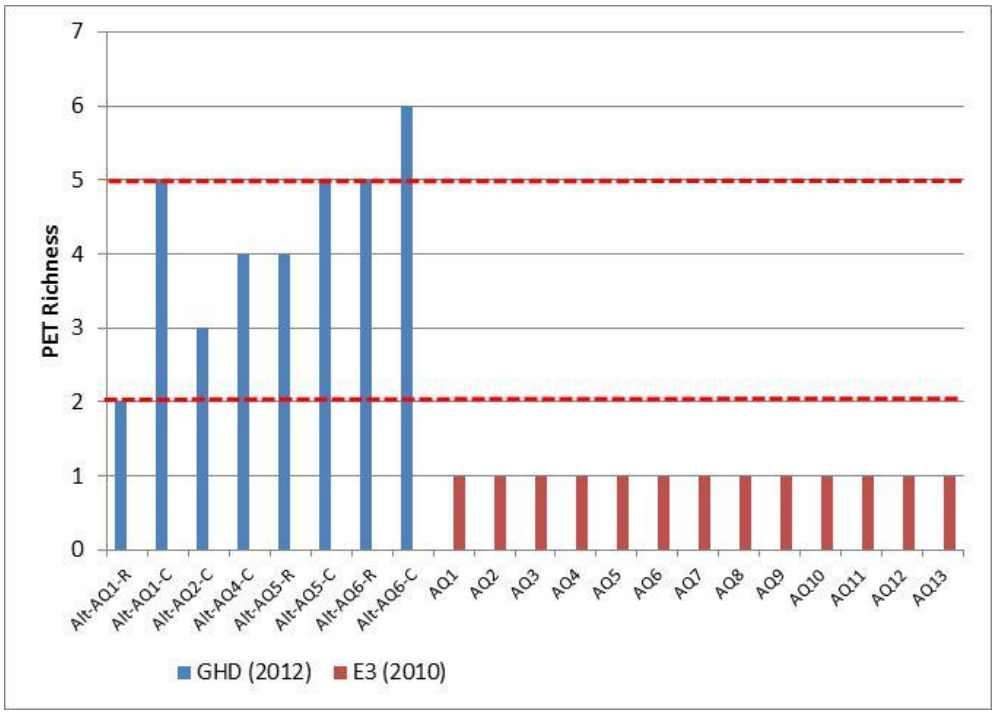

Figure 3–13: Variation in PET richness according to site and study. Dashed lines represent 20% percentile and 80th percentile ranges for PET richness in relation to Central Queensland composite habitat given in DERM (2009a).

SIGNAL 2 Scores and Sensitive Taxa

SIGNAL2 score (Stream Invertebrate Grade Number Average Level - Version 2) (Chessman, 2003) represents a scoring system for macroinvertebrates derived from known responses of various macroinvertebrate families and orders to water pollution. This score represents the average of the range of SIGNAL sensitivity scores associated with various families and orders collected from a given sample. While there are no absolute critical thresholds for determining condition status based on this metric, scores of 4.5 or above are generally considered to represent good condition as they indicate that on average there are a relatively high proportion of taxa present within that sample that are pollution-sensitive. However, as with taxa richness and PET richness, guideline ranges for SIGNAL2 are given for edge habitat samples from Central Queensland waterways in DERM (2009a) and these were used as a gauge of current condition for sites sampled as part of this study and that of ALS (2011) for the neighbouring South Galilee Coal Project (SGCP). Note that the studies by AARC (2010) and E3 (2010) also applied the SIGNAL2 scoring system, but they used the biplot system developed by Chessman (2003) to interpret these data. This approach was not used as part of this study because the guideline range given in DERM (2009a) supersedes any other evaluation system using SIGNAL2 scores and, because the values used to assign condition assessment quadrats in the biplot method can at times be fairly arbitrary.

Of the edge habitat sampled as part of this study, all but the sample collected at Alt-AQ-2 recorded SIGNAL2 values within or above the expected range for Central Queensland waterways given in DERM (2009a) (Figure 3–14). This finding suggests that, the edge habitat macroinvertebrate community of the waterways sampled, except for Alt-AQ-2, was not dominated by pollution-tolerant taxa at the time of sampling.

SIGNAL2 values for composite and riffle habitat samples collected as part of this study were all above the expected range for Central Queensland waterways given in DERM (2009a) based on composite habitat sample data Figure 3–15). Comparisons between riffle habitat sample data with these guidelines need to be interpreted with caution as there are no specific guidelines for riffle habitat for this region. The composite habitat data results suggest a higher than expected ratio of pollution-sensitive to pollution-tolerant macroinvertebrate taxa present at the sites monitored in April 2012. By contrast, the composite habitat samples collected by E3 (2010) recorded SIGNAL2 scores lower than the DERM (2009a) guideline range for Central Queensland waterways Figure 3–15). In combination with the results for taxa richness and PET richness, this finding suggests that the taxa present at the time of the E3 study time were predominantly pollution-tolerant taxa.

The trend with respect to the E3 (2010) data is similar to results from other studies and what is expected for ephemeral stream habitat. For instance, the study by AARC (2010) recorded SIGNAL2 scores between 3.75 and 4 at a number of sites. However, some of those scores corresponded to sites with low taxa richness and, as such, those sites were assigned to the most degraded category based on the Chessman (2003) biplot assessment system. Further, macroinvertebrates living in ephemeral waters would be expected to have wide tolerance ranges in order to survive the highly variable conditions. The results from this study, however, demonstrate that ephemeral waterways intersected by the GCP rail corridor alignment have pollution-sensitive (and by extension, narrower-tolerance range) macroinvertebrate taxa present.

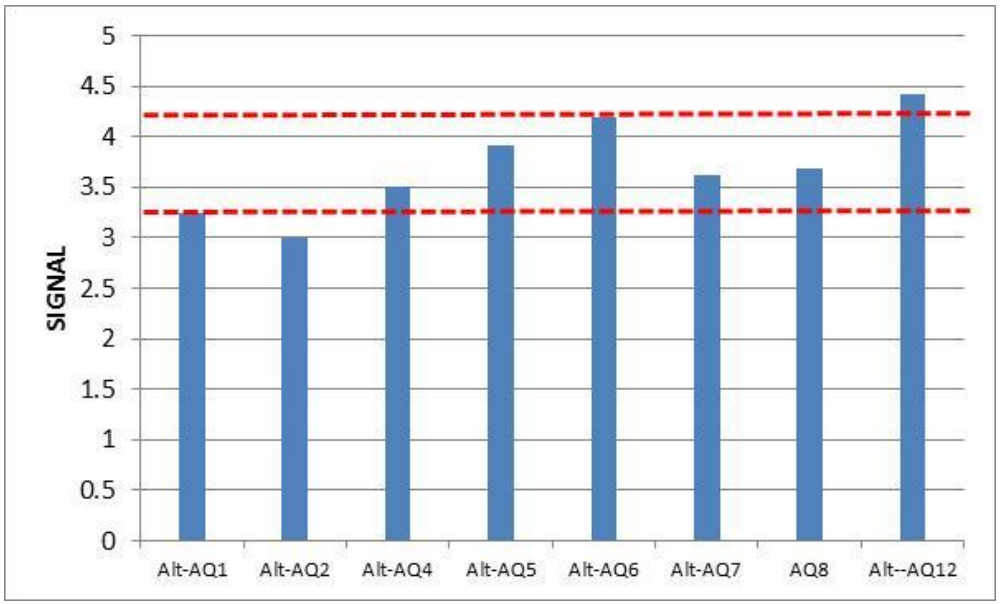

Figure 3–14: Variation in SIGNAL 2 Score according to site and study. Dashed lines represent 20% percentile and 80th percentile ranges for SIGNAL 2 Score in relation to Central Queensland edge habitat given in DERM (2009a)

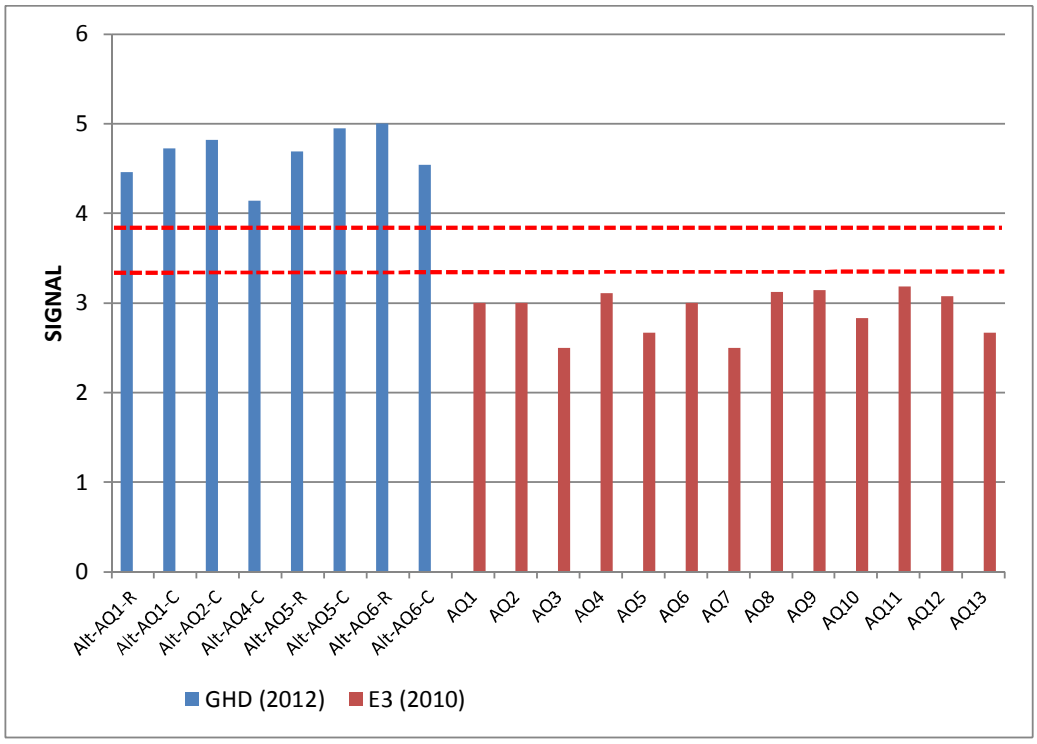

Figure 3–15: Variation in SIGNAL 2 Score according to site and study. Dashed lines represent 20% percentile and 80th percentile ranges for SIGNAL 2 Score in relation to Central Queensland composite habitat given in DERM (2009a)

There were only eight taxa recorded in the GCP rail corridor alignment that had SIGNAL sensitivity ratings > 5 (indicating above average pollution sensitivity). These were (in order of sensitivity):

- Leptophlebiidae (Mayfly) –SIGNAL=8;
- Philotopatmidae (Caddisfly) – SIGNAL = 8;
- Dixidae (Meniscus flies) – SIGNAL =7;
- Elmidae (Riffle Beetle) –SIGNAL = 7;
- Acarina (Water Mite) – SIGNAL = 6;
- Hydropsychidae (Caddisfly) – SIGNAL =6;
- Psephenidae (Water Penny Beetle) – SIGNAL =6; and
- Scirtidae (Marsh Beetle) – SIGNAL =6.

Of these, only Acarina and Dixidae were recorded in the study by E3 (2010) and the latter was only recorded from one site. Dixidae were not recorded in this study, so it is assumed that they are rare within the study area. As discussed in relation to PET taxa, the study by E3 (2010) did not identify Ephemeroptera or Trichoptera to family level. It is possible that some of the mayfly and caddisfly taxa identified in this study were also present in the E3 samples, but were not identified to family level. This will have artificially lowered the SIGNAL scores derived from the E3 samples, so results for the E3 (2010) samples need to be interpreted with caution.

With respect to the most sensitive macroinvertebrate taxa, Leptophlebiidae were recorded from most sites sampled in this study, while Philopotamidae were present at only three sites, Alt-AQ1, Alt-AQ5 and Alt-AQ6. The latter is expected as it is associated with faster flowing streams on the underside of rocks (MDFRC website: http://www.mdfrc.org.au/bugguide/display.asp?type=5&class=17&subclass=&Order=8&family=4&couplet=0, accessed 29/10/12) and such habitat was limited to a few of the streams sampled. A similar scenario applies to Elmidae (Riffle Beetle), which was only recorded from two sites which containedflowing riffle habitat.

AUSRIVAS O/E50 and Bandings

Another means of assessing macroinvertebrate community health that was used as part of this study was the QLD AUSRIVAS model. This model uses site-specific predictions of the macroinvertebrate fauna expected to be present in the absence of environmental stress based on site location and a set of predictor variables (physical and chemical characteristics which cannot be influenced due to human activities, e.g. altitude). The QLD AUSRIVAS model was used to assess whether the assemblages sampled at each site in this study were representative of what would be expected based on those location and habitat conditions. Unfortunately, this model could not be applied to the data collected by E3 (2010) because their sampling method did not follow QLD AUSRIVAS sampling protocols and data for key habitat parameters needed as part of the QLD AUSRIVAS were not recorded.

The QLD AUSRIVAS produces two main outputs:

- The O/E50 score, which is a ratio of the observed (O) fauna to the expected (E) fauna and can range from zero, when none of the expected taxa are found at a site, to one, when all the expected taxa are found. Values can be greater than one if more families are found at the site than predicted by the model; and
- 'Health' rating bands based on the O/E50 scores derived from the model. These bandings provide evidence of whether or not the diversity and makeup of the macroinvertebrate assemblages has diminished, potentially due to anthropogenic influences.

The specific AUSRIVAS models used for this study were the Queensland Coastal Autumn edge and riffle habitat models. This was based on the location of the study being east of the Great Dividing Range, the samples having commonly been collected from riffle and edge habitat, and sampling rounds having been carried out under autumn seasonal conditions. The outputs from this model are given below in Table 3–3. It is important to note, however, that the QLD AUSRIVAS model was not developed specifically for ephemeral stream habitat, so AUSRIVAS results presented in this study need to be interpreted with caution.

Results from this study carried out by GHD in April 2012 found that macroinvertebrate communities of the sites sampled range in condition from AUSRIVAS Band A (similar to reference system) to AUSRIVAS Band C (severely impaired). Site Alt-AQ2 recorded a Band C (severely impaired) rating. As noted in section 3.2.2, this site also recorded a very low macroinvertebrate diversity in this study. As AUSRIVAS modelling is based on comparisons between observed versus expected taxa, the low diversity at this site would have contributed to the AUSRIVAS Band C result. By contrast, Alt-AQ-6 recorded the highest macroinvertebrate taxa richness and was the only site to record edge habitat sample taxa richness within the expected guideline range for Central Queensland waterways. This high taxa richness would explain the AUSRIVAS Band A rating attributed to this site as it would mean fewer of the taxa expected to be present at that site were absent from the edge sample taken. However, AUSRIVAS bandings are not always directly correlated with taxa richness. Site Alt-AQ-7

recorded a modest level of taxa richness from edge habitat compared to Alt-AQ-6 and what is expected for Central Queensland waterways, but scored an AUSRIVAS Band A rating.

The remaining sites were rated Band B (significantly impaired). This suggests that they lacked some of the taxa predicted to occur based on location and habitat condition.

Both edge and riffle habitat samples were collected for some sites and the edge and riffle AUSRIVAS models produced the same ratings for those sites. This suggests that factors affecting the macroinvertebrate community at those sites affected both edge and riffle habitat to a similar degree.

AUSRIVAS results confirmed that there were 18 taxa expected to be present in all edge habitat samples collected from the current study and that at least one taxon was not present at each of the sites (see Table 3–4). These taxa mainly had low SIGNAL sensitivity ratings, so their absence is unlikely to be explained by water quality or habitat degradation. Further, the taxa with the highest sensitivity rating were only absent from one or two sites and their absence at those sites could potentially be partly explained by chance.

Among the 18 taxa outlined in Table 3–4, the taxa that were not collected from the majority of sites were Chironominae, Oligochaeta, Baetidae and Coroxidae. These taxa are generally common elements of edge habitat samples collected in Central Queensland and all have wide pollution tolerance ranges (see Table 3–4). The first two taxa are generally more associated with bed habitat, while the latter two are small invertebrates that occur near the water surface. It is possible their absence from most samples collected in April 2012 was due to scour removal during elevated flows in the waterways during the weeks prior to when sampling took place. Heavy rain occurred in the study region in mid-late March.

Table 3–3: AUSRIVAS O/E50 Scores for samples collected as part of the GCP SEIS and the SGCP EIS studies. Results based on the Queensland Coastal Autumn Edge and Riffle AUSRIVAS models.

Site	Habitat	O/E50	Band	Overall Band for Site
Alt-AQ1	Edge	0.5	B	B
	Riffle	0.74	B	
Alt-AQ2	Edge	0.28	C	C
Alt-AQ4	Edge	0.71	B	B
Alt-AQ5	Edge	0.71	B	B
	Riffle	0.82	B	
Alt-AQ6	Edge	1.07	A	A
	Riffle	1.09	A	
Alt-AQ7	Edge	0.96	A	A
AQ8	Edge	0.78	B	B
Alt-AQ12	Edge	0.69	B	B

Table 3–4: List of taxa with a greater than 50% likelihood of being present that were not collected from edge habitat samples as part of this study

Taxa	SIGNAL 2 Sensitivity	Number of Sites taxa not collected
Oligochaeta	2	7
Acarina	6	1
Atyidae	3	1
Palaemonidae	4	4
Dyticidae	2	1
Hydrophilidae	2	4
Ceratopogonidae	4	3
Tanypodinae	4	4
Chironominae	3	8
Baetidae	5	5
Caenidae	4	3
Veliidae	3	4
Gerridae	4	3
Corixidae	2	5
Pleidae	2	4
Coenagrionidae	2	3
Libellulidae	4	3
Leptoceridae	6	2

3.2.1 Spatio-Temporal Variability

Variation between Studies

The Non Metric Multidimensional Scaling (NMDS) plot in Figure 3–16 shows clear separation of samples in ordination space according to the study they relate to, suggesting that the composition of macroinvertebrate samples collected as part of this study and the E3 (2010) study was significantly different. Results of a one-way Analysis of Similarities (ANOSIM) showed that there was a significant difference in macroinvertebrate taxonomic composition between the two studies (Global R =0.784, p =0.01). Cluster analysis similarity bandings presented in Figure 3–16 indicate that the two sets of samples shared only 20% of taxa in common. This was expected due to the limited diversity collected during the E3 (2010) study and differences in the taxonomic resolution between the two studies.

As different sites were sampled as part of the two studies, with little overlap (apart from AQ-8), it is difficult to establish whether those differences relate to differences between the sites sampled, differences in the taxonomic resolution applied, difference in sample methodology, or to temporal variation in taxonomic composition between April 2010 and April 2012.

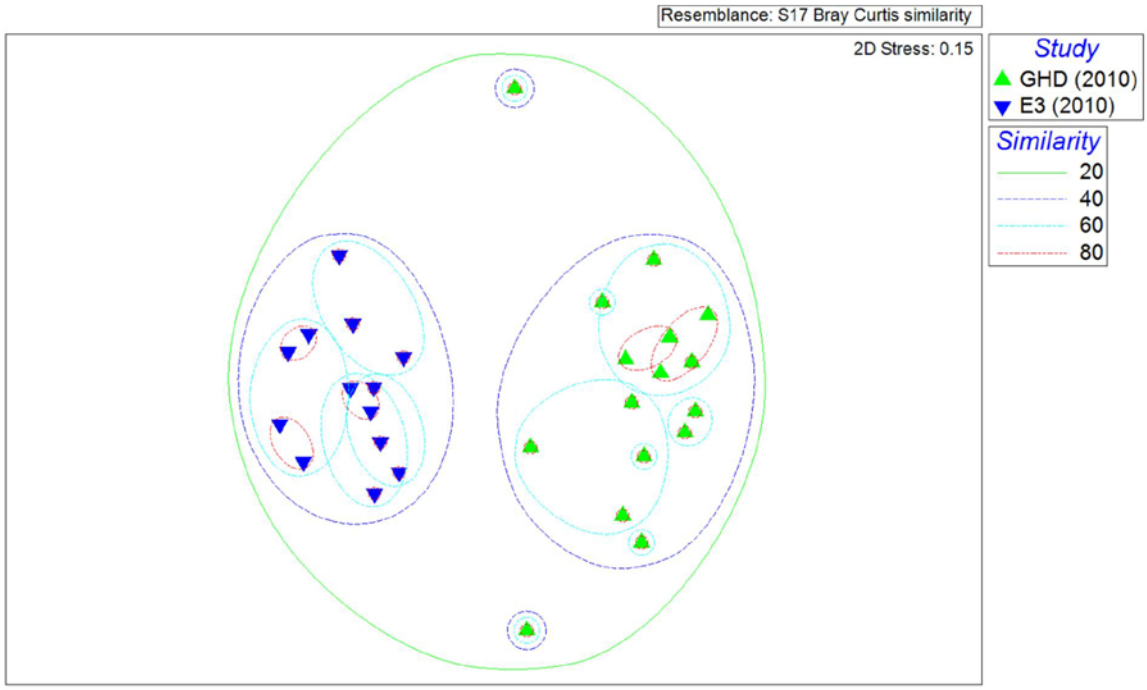

Figure 3–16: NMDS showing variation in macroinvertebrate taxonomic composition among samples collected as part of this study (GHD, 2012) and as part of the E3 (2010) study.

The results of the Similarity Percentages (SIMPER) analysis presented in Table 3–5 show the species that contributed to dissimilarity between samples collected as part of this study and those collected as part of the E3 (2010) study. Eighteen out of the thirty eight taxa listed in this table were only recorded from one study. Taxa collected in this study, but not in the study by E3 (2010) study included:

- Libellulidae (damselfly larvae);
- Caenidae (mayfly);
- Gomphidae (dragonfly larvae);
- Leptophlebiidae (may fly);

- Baetidae (may fly);
- Janiridae (isopod shrimp);
- Tabanidae (horse fly larvae);
- Thiaridae (snail);
- Ceratopogonidae (biting midges);
- Coenagrionidae (damsel fly);
- Hydropsychidae (caddis fly larvae);
- Leptophlebiidae (may fly larvae);
- Philopotamidae (caddis fly larvae);
- Elmidae (riffle beetle);
- Hydraenidae (minute moss beetle);
- Hydrochidae (water scavenger beetle); and
- Psephenidae (water penny beetle).

Taxa collected only from the E3 (2010) study included:

- Hygrobiidae (screech beetle);
- Planorbidae (snail)
- Corbiculidae (freshwater pipi);and
- Sphaeriidae (freshwater pipi).

As outlined in section 3.2.4, E3 (2010) did not take Ephermeroptera (may fly larvae) or Trichoptera (caddis fly larvae) beyond the order level. This would account for the large number of may fly and caddis fly families recorded in this study and not in the study by E3 (2010). The same scenario also applies to dragonfly and damselfly larvae as E3 (2010) pooled these families within Order Odonata. The taxa recorded exclusively from the E3 (2010) study potentially reflect differences in sampling methodology or habitat sampled between the two studies. Snails and pipis are often associated with benthic substrates. Such habitat was only specifically targeted as part of the E3 (2010) study, though composite habitat sampling in this study also included pool bed elements. The presence of Hygrobiidae in E3 (2010) samples also potentially indicates differences in flow conditions encountered by the two studies. Adult and larval hygrobid beetles occur in stagnant water where the bottom is covered with a fine ooze of mud and rotten plant debris (MDFRC website: http://www.mdfrc.org.au/bugguide/display.asp?type=5&class=17&subclass=&Order=1&family=226&couplet=0, accessed 30/10/12). None of the waterways sampled in April 2012 were stagnant.

Table 3–5: Results of SIMPER analysis highlighting which taxa contributed most to dissimilarity between samples collected as part of his study (GHD, 2012) and as part of the E3(2010) study.

Taxa	GHD (2012) Average Abundance	E3 (2010) Average Abundance	Average Dissimilarity	Dissimilarity / SD	Contrib. %	Cumulative %
Libellulidae	0.81	0	3.12	1.68	4.47	4.47
Oligochaeta	0.19	0.92	3.05	1.53	4.38	8.84
Caenidae	0.81	0	2.97	1.91	4.26	13.1
Hygrobiidae	0	0.69	2.72	1.32	3.89	16.99
Gomphidae	0.75	0	2.67	1.62	3.83	20.82
Baetidae	0.69	0	2.51	1.4	3.59	24.41
Janiridae	0.69	0	2.4	1.41	3.44	27.85
Tanypodinae	0.44	1	2.34	1.02	3.36	31.21
Tabanidae	0.63	0	2.24	1.25	3.22	34.42
Acarina	0.88	0.38	2.2	1.09	3.16	37.58
Lymnaeidae	0.06	0.54	2.03	0.99	2.91	40.49
Hydrophilidae	0.25	0.54	1.98	0.96	2.84	43.33
Palaemonidae	0.5	0.62	1.95	0.94	2.8	46.13
Simuliidae	0.5	0.46	1.93	0.94	2.76	48.89
Atyidae	0.81	0.62	1.78	0.8	2.56	51.45
s-f Orthocladiinae	0.44	0.08	1.64	0.87	2.34	53.79
Veliidae	0.31	0.23	1.63	0.74	2.33	56.13
Gerridae	0.38	0.23	1.62	0.83	2.32	58.44
Thiaridae	0.44	0	1.57	0.85	2.25	60.69
Pleidae	0.31	0.31	1.51	0.83	2.17	62.86
Ceratopogonidae	0.44	0	1.41	0.87	2.03	64.89
Coenagrionidae	0.38	0	1.31	0.75	1.87	66.76
Hydropsychidae	0.38	0	1.3	0.75	1.86	68.62
Physidae	0.25	0.23	1.29	0.72	1.84	70.47
Dytiscidae	0.88	0.77	1.21	0.62	1.73	72.2
Tipulidae	0.31	0.08	1.18	0.7	1.69	73.89
Leptophlebiidae	0.31	0	1.13	0.65	1.62	75.52
Philopotamidae	0.31	0	1.13	0.66	1.62	77.13
Planorbidae	0	0.31	1.12	0.63	1.6	78.74
Corbiculidae	0	0.31	1.11	0.64	1.6	80.34
Culicidae	0.13	0.23	1.09	0.63	1.57	81.9
Elmidae	0.31	0	1.08	0.65	1.54	83.45
Gyrinidae	0.06	0.23	1.07	0.57	1.53	84.98
Hydraenidae	0.25	0	0.88	0.57	1.27	86.24
Sphaeriidae	0	0.23	0.81	0.53	1.16	87.4
Hydrochidae	0.25	0	0.8	0.57	1.14	88.54
Psephenidae	0.25	0	0.79	0.57	1.13	89.68
Notonectidae	0.13	0.08	0.68	0.46	0.98	90.65

Variation between Catchments

The NMDS plot in Figure 3–17, shows variation in macroinvertebrate taxonomic composition between the waterways sampled. There is no clustering of sample scores in this plot according to system sampled. This was largely because between-study variation was significant and greater than any between-waterway variability that might have been apparent. Results of one-way ANOSIM indicate that there was indeed no significant variation in macroinvertebrate community composition according to waterway sampled (Global R = 0.026, p =0.391).

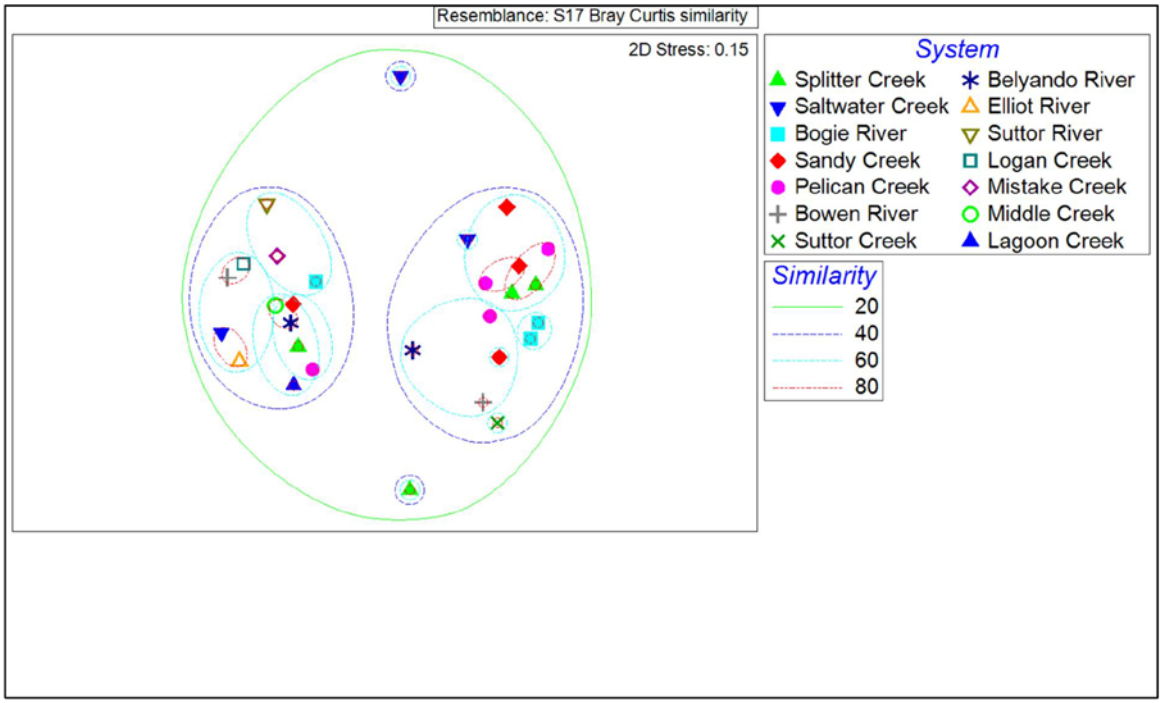

Figure 3–17: NMDS showing variation in macroinvertebrate taxonomic composition among samples collected from waterways sampled as part of this study (GHD, 2012) and as part of the E3 (2010) study.

3.2.2 Past Macroinvertebrate Surveys

Many of the creeks and streams within the Burdekin catchment are ephemeral in nature, particularly those within the inland sub-catchments. As such, these waterways are characterised by wide fluctuations in water level and flow characteristic of river systems with highly variable and unpredictable environmental conditions. This has a significant influence on the spatial and temporal variability in the diversity, composition and distribution of aquatic flora and fauna.

Macroinvetebrate surveys carried out in the Burdekin Basin reported in the published literature include those by Pearson (1991), Parsons Brinckerhoff (2009), AARC (2010), E3 (2010) and ALS (2011). The results of the E3 (2010) study are the most relevant to this study as it covers the streams potentially intersected by the rail corridor that were also sampled as part of this study. However, E3 (2010) used non-standard methods of macroinvertebrate sampling, so results for that study are not directly comparable to those collected as part of this study. E3 (2010) collected replicate macroinvertebrate samples from riffle, run and pool habitat and processed samples by sieving them through sieves of various mesh sizes. Further, sampling by E3 (2010) did not cover edge habitat and, therefore, neglected one of the more commonly

occurring aquatic habitats present in waterways within the study area. Edge habitat was sampled as part of this study, along with riffle and composite habitat, as it was present at every site and would normally be expected to contain most of the same species present in pool bed habitat. Despite these differences, broad level comparisons in diversity and composition were made between the results obtained from this study and those of the study be E3 (2010).

3.3 Fish and Macrocrustacea

3.3.1 Fish Biogeography for the Burdekin Catchment

The Burdekin River's fish fauna is distinctive, containing elements of the fauna from both northern and eastern Australia. The distribution of two biogeographically distinct fish fauna within the catchment is largely due to the presence of the Burdekin Falls at the lower quarter of the river's length providing an impassable barrier for many fish species (Pusey *et al.* 1998).

A total of 76 fish species identified in literature and other information sources occur in the Burdekin Basin (Alluvium, 2007). Of those, 58 are Australian species, including three potentially misidentified taxa and two species considered to have been introduced from other river basins (Yellowbelly -*Macquaria ambigua* and Eel-tailed Catfish, *Tandanus tandanus*). In addition there are 17 exotic species listed, most of which have been introduced into the Ross River. Among these, the highly invasive Tilapia (*Oreochromis mossambicus*) is now in the upper Burdekin River, including the Belyando catchment and continues to spread. Species that are now found outside their natural range include Sleepy Cod (*Oxyeleotris lineolatus*), Barramundi (*Lates calcarifer*) and Sooty Grunter (*Hephaestrus fuliginosus*) (Alluvium, 2007). Two species are endemic to the Burdekin River, the Small-headed Grunter (*Scortum parviceps*) and the Soft-spined Catfish (*Neosilurus mollepsiculum*) (GHD, 2010).

Historically fish assemblages below the Burdekin Falls were characterised by piscivorous fish (feed on fish), whereas such species were largely absent from upstream reaches. In recent decades, however, there have been numerous translocations of piscivorous fish species into the upper reaches of the Burdekin catchment mainly to satisfy recreational fishing demands (Pusey *et al.* 2006).

3.3.2 Diversity

In this study, 1411 fish belonging to 19 species were recorded from the nine sites sampled. This is lower than the 5675 fish belonging to 29 species recorded as part of the E3 (2010) study. Fish surveys were carried out at four fewer sites in this study. The differences in abundance and species captured are most likely attributed to the wider range of survey techniques and the use of various gill nets as part of the E3 (2010) study. The latter tend to catch fish in large quantities, particularly if set overnight, as was the case in the E3 (2010) study. Gill netting was not used in this study, partly because it results in a high proportion of fish mortalities. Details of the fish species caught in this study and the E3 (2010) study are provided in Figure 3–18 and Figure 3–19, respectively and in Table 3–6 It should be noted that E3 (2010) listed *Anas superciliosa* among its fish fauna in the data provided to GHD for this report. This species is the Pacific Black Duck and has been removed from the fish data presented in this report.

Apart from Freshwater Longtom (*Strongylura krefftii*), all other species recorded in this study were captured as part of the E3 (2010) study (see Table 3–6). One individual Freshwater Longtom was caught in this study and that specimen was captured at Alt-Q-6 (Pelican Creek). By contrast, nine fish species were recorded only from the E3 (2010) study. This included some of the larger, recreational fisheries-significant species such as Barramundi (*Lates calcarifer*), Sooty Grunter (*Hephaestus fuliginosus*) and Sea Mullet (*Mugil cephalus*), but also smaller, more cryptic species, such as Bigmouth Goby (*Redigobius bikolanus*) and the endemic species,

Small-headed Grunter (*Scortum parviceps*). E3 (2010) also recorded Sailfin Glass Perchlet (*Ambassis agrammus*) and Australian Spotted Gudgeon (*Mogurnda mogurnda*), which were not caught as part of this study. While both have been anecdotally reported for the Burdekin River catchment, this river basin represents the southern extent of their natural range (Pusey at al. 2004). Further, both share close morphological similarities with their congeners, Agassizi's Glassfish (*Ambassis agassizi)* and Purple Spotted Gudgeon (*Mogurnda adspersa*), which are more commonly encountered in the Burdekin catchment. It is therefore possible that their presence in the E3 (2010) fish community data set and not in the data set generated from this study could simply reflect misidentifications in the field from either party. Other species recorded by E3 (2010) but not in this study included Pacific Blue-eye (*Pseudomugil signifier*) and the Seven-spotted Archerfish (*Toxotes charateus*). Apart from Sailfin Glass Perchlet, none of the fish species recorded exclusively in the study by E3 (2010) were widely distributed or abundant in that study (see Figure 3–19).

Fish diversity on a site by site basis ranged between six and 11, which is broadly consistent with the ranges recorded by E3 (2010) for most sites. Sites AQ-5 (Sandy Creek) and AQ-6 (Pelican Creek) recorded higher fish diversity than the other sites monitored as part of either study (see Table 3–6. This may indicate a general trend of Sandy Creek and Pelican Creek hosting a more diverse fish community than the other waterways intersected by the GCP rail corridor.

While the fish diversity results presented in Table 3–6 do not reflect this, it should be noted that most of the species recorded in these systems are also known to the Bowen River, which is intersected by the GCP rail corridor as well. However, the Bowen River is a much larger system than Sandy Creek and Pelican Creek, which means fish are not as concentrated within the sampled reach and are therefore not as easy to catch. Further, the presence of estuarine crocodile in the Bowen River presents additional challenges to fish sampling, which could further compromise fish catch results. Another consideration is that the survey by GHD in April 2012 sampled within the weir pool upstream of the Collinsville Weir. This was done by necessity as it was the only publicly accessible reach of the Bowen River where the boat mounted electrofisher could be launched safely. While the Collinsville Weir is fitted with a fishway, it is possible that some fish species present in the Bowen River are not using this fishway as effectively as others. This in turn, could partly explain why more fish species were not caught in the Bowen River by GHD than the known range for the Bowen River.

The other thing to consider when comparing fish diversity among sites is that it is expected that diversity would be reduced for inland sites as the number of marine-associated and diadromous species (those that undertake movement between the sea and freshwater reaches for spawning) is likely to drop off with distance from the coast due to their need to move between coastal regions and freshwater reaches. However, the results from this study and that by E3 (2010) do not reflect this, with some of the inland sites recording the highest diversity of fish, while some of the coastal sites recording the lowest diversity of fish.

This trend might be explained by the fact that the coastal catchments sampled were small catchments and the streams sampled were also small. This may have reduced the occurrence of some of the larger species compared to the larger waterways sampled. The greater fish diversity recorded at inland sites may have been due to the fact that these are often characterised by isolated refugial pools, where the occurrence of a range of fish species is concentrated during drier times.

It may also have been likely that sites with greater habitat diversity supported greater fish diversity, however, this is beyond the scope of this study to assess this relationship formally.. Certainly Pelican Creek (AQ-6 and Alt-AQ-6) had among the highest instream habitat diversity and fish diversity, while Sandy Creek, which was essentially a sand bed stream with limited instream habitat diversity, recorded low fish diversity.

3.3.3 Abundance and Distribution

The fish species for which the greatest number of individuals were captured in this study was the Empire Gudgeon (*Hypseleotris compressa*), with nearly 500 specimens collected (Figure 3–18). The majority of these (90%) were collected at the coastal stream site Alt AQ-2 (Saltwater Creek). This species was the fifth most numerous species recorded as part of the E3 (2010) study and was only recorded from the three coastal stream sites (AQ-1 to AQ-3) (Figure 3–19, Table 3–6) . These results is consistent with the known habitat preference of this species (Allen *et al.* 2003; Pusey *et al.* 2004), though a number of individuals were recorded from streams further inland in this study (Table 3–6).

In this study, the other fish species for which over 100 individuals were recorded included Eastern Rainbowfish (*Melanotaenia splendida*), Bony Bream (*Nematalosa erebi) and* Agassiz's Glassfish (*Ambassis agassizi*) (Figure 3–18). *H. compressa*, *M. splendida and N. erebi* were also among the species for which more than 100 individuals were collected as part of the E3 (2010) study (Figure 3–19). The key difference in terms of the most abundant recorded fish species between the two studies was *A. agrammus*, which was not recorded in this study, however, it was the most abundant species in the E3 (2010) study. Most individuals of this species were collected at one site (AQ-5 -Sandy Creek) with 1646 individualsrecorded. Given that there was such large number of individuals caught at that site and that the Burdekin Catchment represents the southern extent of the distribution range of this species, it is highly likely that many or most of those specimens were actually *A. agassizi*, but due to time constraints with processing such a large catch, all Ambassids were simply classed as *A. agrammus*. *A. agassizi* were the fourth most abundant species caught in this study, so assuming that our assumption above is correct, then *A. agassizi* may have actually been well represented in both studies even if the data available for presentation in this report does not reflect this. Other species that were proportionally more abundant in the catch of E3 (2010) compared to this study included Hyrtl's Tandan (*Neosiluris hyrtlii*), Spangled Perch (*Leiopotherapon unicolor*) and Sleepy Cod (*Oxyeleotris lineolata*).

In terms of distribution, *M. splendida* and *L. unicolor* were the most widely recorded fish species. The former was recorded at every site sampled across this study and the E3 (2010) study, while the latter was only absent from site Alt–AQ7 (Bowen River), but is known to occur in this system (Table 3–6). The next most widely recorded fish species were *A. agassizi*, *M. adspersa*, *N. hyrtlii*, *N. erebi* and *O. lineolata,* all of which were recorded from more than 10 of the sites surveyed across these two studies. Thirteen out of the 28 fish species recorded by this study and E3 (2010) were only recorded from three sites or less across the two surveys (Table 3–6). The reasons for this include a mixture of habitat preference, catchability based on habitat conditions encountered, gear used and the location of the study area relatively to known distribution range. Apart from *A. agrammus* and *M. mogurnda,* none of those species can necessarily be regarded as being rare within the Burdekin Catchment, though the abundance of Pacific Blue-eye (*P. signifier*) in the Burdekin River is considered lower than in adjacent water basins, and it appears to be largely restricted to the Bowen and Broken Rivers (Pusey *et. al.* 2004). This is consistent with the results presented inTable 3–6, where *P. signifier* was only recorded from AQ-5 (Sandy Creek - a tributary of the Bogie River) and AQ-6 (Pelican Creek - a tributary of the Bowen River), with a low number of individuals of this species recorded at those sites. Further, information given in Pusey *et al.* (2004) indicates that *Hyseleotris* sp1 has not been recorded from coastal catchments around the Bowen/Proserpine area, which may also explain its absence from catches from coastal stream sites AQ-1 to AQ 3 (Table 3–6).

In terms of the distribution and abundance of exotic and translocated species, Gambusia (*G. holbrooki*) was more widely distributed and abundant in this study than in the study by E3 (2010). In both studies, only low numbers of this species were recorded (39 individuals). The majority (85%) of *G. holbrooki* were caught at a single site (Alt-AQ4 –Bogie River) in April 2012.

Tilapia (*O. mossambicus*) was recorded from eight sites across the two studies and combined, over 100 individuals were caught. The combined distribution of this species (Table 3–6) and, personal observation of the current distribution of this species in the Burdekin Catchment (Jamie Corfield, GHD, pers. obs.), suggests that *O. mossambicus* is present in all waterways intersected by the GCP rail corridor inland of the Elliot River. This is of concern as it was only introduced to the Burdekin Catchment in 2005. The translocated *O. lineolata*, occurred in most sites across the two studies, but occurred only in waterways including and inland of Sandy Creek. Yellow Belly (*Macquaria ambigua)* was only recorded at a single site (AQ-11 –Middle Creek) during the E3 (2010) study. This species is stocked in the Burdekin Dam as a recreational species, and was only found in a creek within the Belyando sub-catchment, which lies upstream of this dam. This species has also been observed in the Suttor River sub-catchment, which is also upstream of the dam (Jamie Corfield, GHD, pers. obs.).

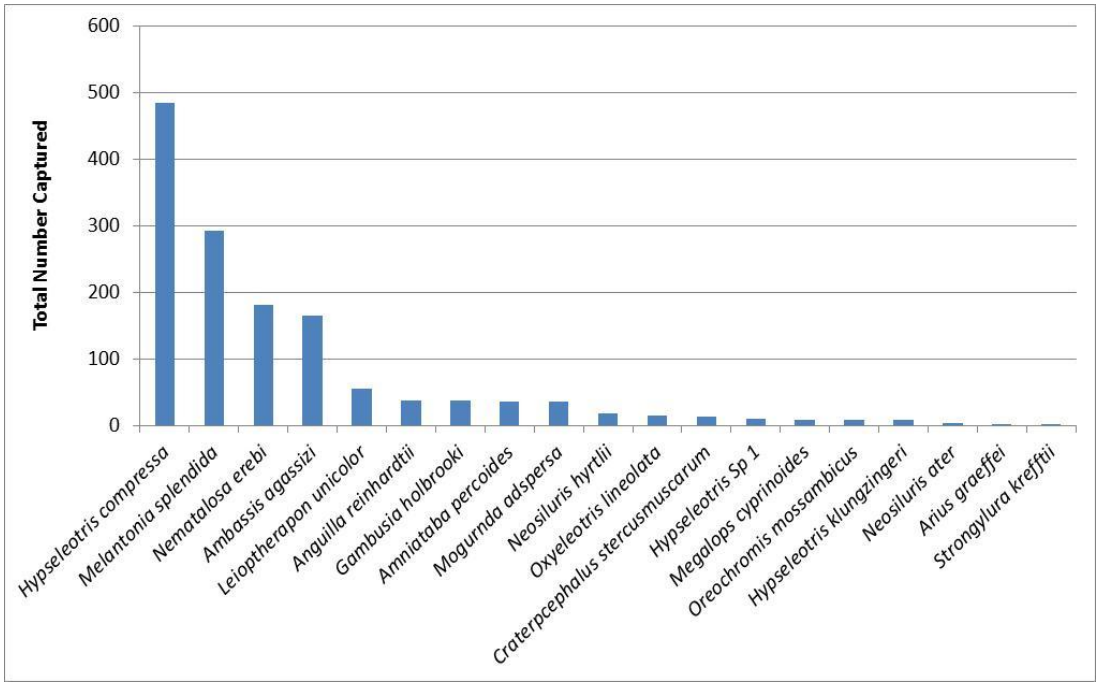

Figure 3–18: Numbers of individuals recorded for each fish species captured as part of this study (GHD, 2012).

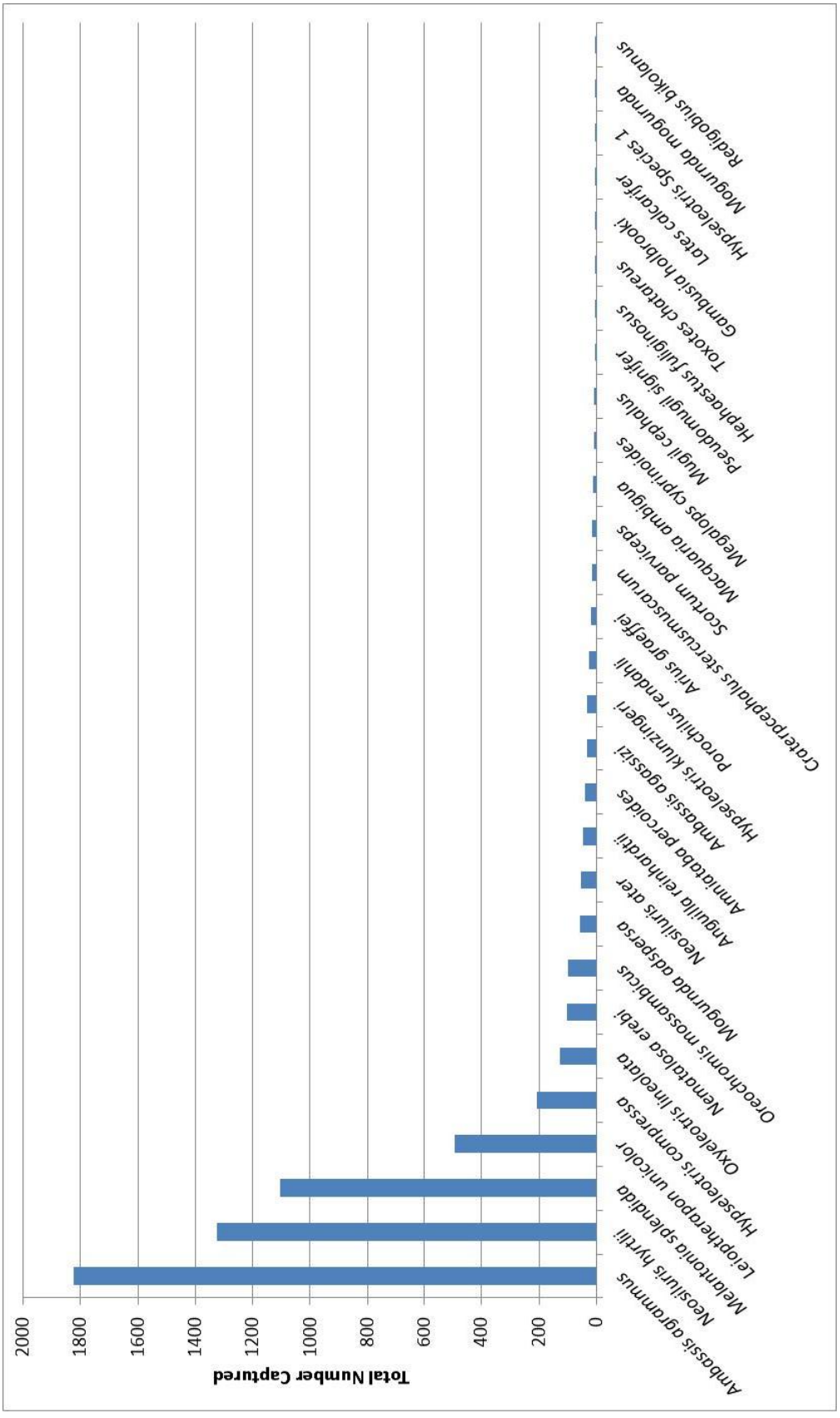

Figure 3–19: Numbers of individuals recorded for each fish species captured as part of the E3 (2010) study.

Table 3–6: Distribution of fish species recorded from this study and that of the E3 (2010) study for the GCP EIS. * = Exotic. + = translocated native. C = Catadromous[1], An =Anadromous[2], Am = Amphidromous[3]. X = Present.

	GHD (2012)								E3 (2010)												
Species	Alt-AQ1	Alt-AQ2	Alt-AQ4	Alt-AQ5	Alt- AQ6	Alt-AQ7	Alt-AQ8	Alt-AQ12	AQ1	AQ2	AQ3	AQ4	AQ5	AQ6	AQ7	AQ8	AQ9	AQ 10	AQ11	AQ12	**No. Occurrences**
Ambassis agassizi	X	X	X	X	X			X					X	X			X	X	X	X	**12**
Ambassis agrammus									X	X	X	X	X								**5**
Amniataba percoides				X	X								X	X							**4**
Anguilla reinhardtii (C)	X	X		X	X	X				X	X	X	X	X							**10**
Arius graeffei (An)						X								X							**2**
Craterpcephalus stercusmuscarum				X				X					X								**3**
*Gambusia holbrooki**	X		X	X						X											**4**
Hephaestus fuliginosus														X							**1**
Hypseleotris compressa (C)	X	X				X	X		X	X	X										**7**
Hypseleotris klunzingeri					X			X	X				X					X			**5**
Hypseleotris Sp1				X				X					X								**3**
Lates calcarifer (C)									X					X							**2**
Leioptherapon unicolor	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	**19**
Macquaria ambigua+																			X		**1**

[1] Catadromous species are those move downstream from freshwater reaches to the sea to spawn.
[2] Anadromous species are those that move upstream from the sea into frewshwater reaches to spawn.
[3] Amphidromous species are those that move between the sea and freshwater reaches, but not to spawn.

	GHD (2012)								E3 (2010)												
Species	Alt-AQ1	Alt-AQ2	Alt-AQ4	Alt-AQ5	Alt- AQ6	Alt-AQ7	Alt-AQ8	Alt-AQ12	AQ1	AQ2	AQ3	AQ4	AQ5	AQ6	AQ7	AQ8	AQ9	AQ 10	AQ11	AQ12	**No. Occurrences**
Megalops cyprinoides (C)		X							X					X							**3**
Melantonia splendida	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	**20**
Mogurnda adspersa			X		X		X	X					X	X	X	X		X	X	X	**11**
Mogurnda mogurnda												X									**1**
Mugil cephalus (C)									X												**1**
Nematalosa erebi		X				X	X	X	X				X	X		X	X	X	X		**11**
Neosiluris ater				X	X	X							X	X		X	X		X		**8**
Neosiluris hyrtlii				X			X	X					X	X	X	X	X	X	X	X	**11**
*Oreochromis mossambicus**			X	X	X			X					X			X		X	X		**8**
Oxyeleotris lineolata+					X	X	X						X	X	X	X	X	X	X	X	**11**
Porochilus rendahli																X	X				**2**
Pseudomugil signifier (C)													X	X							**2**
Redigobius bikolanus (Am)														X							**1**
Scortum parviceps															X	X	X		X		**4**
Strongylura krefftii (C)					X																**1**
Toxotes chatareus														X							**1**
No. Species Recorded	**6**	**7**	**6**	**11**	**11**	**7**	**7**	**10**	**9**	**6**	**5**	**5**	**16**	**17**	**6**	**11**	**9**	**9**	**11**	**6**	

3.3.4 Composition

Conservation Significance Species

None of the freshwater fish species recorded during this study or the E3 (2010) study are listed as threatened species under State or Commonwealth legislation and no threatened freshwater fish species are known to occur in the Burdekin Catchment, though the *Commonwealth Enviromental Protection and Biodiversity Consrevation Act (1999*) (EPBC)-listed, predominantly marine-associated Sawfish (*Pristis microdon*) may occur in the lower reaches of the Burdekin Catchment from time to time. The Alpha Coal Project EIS (AARC 2010) list Murray Cod (*Maccullochella peelii peelii*) as a listed vulnerable species occurring in the Central Highlands region, but this species is not known historically to the Burdekin Catchment. Volume 3, Chapter 7 of the GCP EIS (Waratah Coal, 2011) noted the occurrence of "Australian lung fish" at several rail corridor sites, though this species was not listed among the fish species caught in the E3 (2010) aquatic ecology technical report and only occurs in the Brisbane, Burnett, Mary and Pine Rivers located in South-East Queensland, the validity of these records is in question.

The Biodiversity Assessment and Mapping Methodology (EPA, 2002) provides a list of bio-regionally significant species for the Galilee Basin bioregion, which includes reaches of the Belyando sub-catchment. Appendix 7 of this document lists 'Priority Fauna Taxa Other Than EVR[4] Taxa' and among these, there are two species which occur in the parts of the Brigalow Belt and Desert Upland regions covered by the Belyando catchment. These are Midgley's Carp Gudgeon (*Hypseoltris* sp1) and Southern Purple-spotted Gudgeon (*M. adspersa*). It is unclear why Midgley's Carp Gudgeon was listed as a non-EVR priority species and no information is provided in EPA (2002). No particular threats are currently listed for this species. The inclusion of the Purple-spotted Gudgeon is that the southern population is listed as threatened in NSW and threats to this population continue to this day, particularly in the Murray-Darling Basin. Given the location of the study area, it is more likely that the Purple Spotted Gudgeon specimens captured were from the non-threatened northern population.

Small-headed Grunter (*Scortum parviceps*) was once listed as 'Rare' under the EPBC Act, because it was thought to occur only to the upper arm of Burdekin River. However, this was changed following advice to the Federal Government that this species is relatively common and is found elsewhere in the catchment including the Suttor-Belyando River complex. Regardless of this, it is endemic to the Burdekin Catchment, so has conservation significance in this regard. *S. parviceps* was recorded by E3 (2010) at a number of sites (Table 3–6) and could occur more widely than the systems in which it was recorded. Further, it is patchily distributed within the Burdekin Catchment (as results in Table 3–6 demonstrate) and is generally found in low abundance where it occurs (Pusey *et al.* 2004). Therefore, there are potential impacts of the GCP rail corridor on *S. parviceps* with regards to the status of local populations. Notably, this species has a high reliance on algae as part of its diet (Pusey *et al.* 2004). Hence, it could be indirectly impacted by reduced algal abundance through increased turbidity. This is relevant with regards to the GCP rail corridor construction phase.

The other endemic fish species that could potentially occur within waterways intersected by the GCP rail corridor, Soft-spined catfish (*N. mollespiculum*), was not recorded in this study or the study by E3 (2010), but has been observed in the Bowen River and tributaries (Jamie Corfield, GHD, pers. comm.). Also, this species has previously been recorded as one of the more commonly caught Plotosid catfish in the Burdekin Catchment (Pusey et al 1998) and could also potentially be impacted by the GCP rail corridor. However, it is not expected to occur in the Belyando or Suttor River sub-catchment based on information provided in Pusey *et al.* (2004),

[4] Endangered, Vulnerable, Rare

so would not be affected by rail corridor construction in those waterways. This endemic species may be vulnerable to suspended sediments generated through the GCP rail corridor construction, however, there are questions regarding the species tolerance to high levels of suspended sediment (Pusey *et al.* 2004).

Migratory Species

The creation of barriers as part of the GCP rail corridor construction, while likely to be temporary in nature, could affect the movement of migratory fish species, depending on their nature and duration. A number the species recorded in Table 3–6 move from freshwater to brackish/marine to spawn (catadromous species) and some that move in the opposite direction to spawn (anadromous species). Catadromous species include iconic species such as Barramundi (*L. calcarifer)*, Sea Mullet (*M. cephalus*) and Long-finned Eel (*Anguilla reinhardtii*), but also several smaller species, including Pacific Blue-eye (*P. signifier*) and Empire Gudgeon (*H. compressa*). Anadromous species include Fork-tailed Catfish (*Arius graefei*) Bigmouth Goby (*R. bikolanus*) is among a group of fish referred to as amphidromous, which means they undertake movement between freshwater reaches and the sea, but not for spawning. This is the only example of such a species recorded as part of baseline monitoring for the GCP. However, two other amphidromous gobies are known to occur in the Burdekin Catchment base on data presented in Alluvium (2007), these being Flathead Goby (*Gloddogobius giurus*) and the Roman Nose Goby (*Awaous acritosus*). All three of these goby species have been recorded from Elliot River, Splitter Creek and Sandy Creek. As with cardomous and anadromous species, these goby species are vulnerable to fish passage barrier impacts.

There are also a variety of potadromous (move wholly within freshwater reaches) species within the upper Burdekin Basin for which inter-basin movement is critical for their recruitment success and longer terms species vigour in terms of genetic viability (Alluvium, 2007). The temporary nature of barrier creation as part of the GCP rail corridor construction phase will not affect inter-basin movement for those potadromous species, but it might have some effect on their local population status. For instance, various studies have suggested that adult Spangled Perch (*Macquaria ambigua*) undertake spawning-related movement at the start of the wet season, though this is not confirmed as movement is neither uniformly upstream nor downstream (Pusey *et al.* 2004). There is also some evidence that Eastern Rainbowfish undergoes upstream migration in intermittent streams, although mass migration seems to be uncommon (Pusey *et al.* 2004). While there is little quantitative information concerning the movement biology of Agassiz's Glassfish, this species appears to undertake mass upstream dispersal movements often cued or facilitated by elevated discharges (Pusey *et al.* 2004). In addition, while originally thought to be a relatively sedentary species, recent studies have shown that large numbers of Carp Gudgeon (*H. klungzingeri*) attempt to move through fishways (Baumgartner 2003). Whether these movements reflect local dispersal or foraging movements is unknown.

Spangled Perch, one of the more commonly caught species in the GCP rail corridor alignment, are relatively good in terms of negotiating fish passage barriers (DPI, 2009), so this species is potentially less vulnerable to fish barrier impacts than some of the other species present in the GCP rail corridor alignment. Moreover, Spangled Perch are widely distributed, so any fish passage-related impacts associated with the GCP would not affect the long term viability of their population within the broader Burdekin Catchment or region.

Introduced / Exotic Species

As discussed in section 3.3.3, Tilapia (*O. mossambicus)*, were recorded in most of the waterways intersected by the GCP rail corridor alignment. Of concern is their rate of spread in the Burdekin Catchment since their introduction in 2005. Like other exotic fish species, Tilapia are thought to be more tolerant of polluted conditions than native fish, so if the GCP rail corridor construction and operation was to increase pollution and habitat disturbance in the waterways

intersected, it could be to the advantage of this species and their resultant proliferation could compound the direct impacts of the GCP rail corridor construction on the native fish community in these waterways. Apart from Tilapia, the presence of other exotic fish and translocated native fish in waterways intersected by the GCP rail corridor alignment appears to be limited.

Fisheries Significant Species

The Burdekin Catchment features several fish species that are important recreational and commercial fishery species (e.g. Barramundi – *L. calcarifer,* Sea Mullet – *M. cephalus* and Mangrove Jack (*Lutjanus argentimaculatus*). Yellowbelly (*M. ambigua*) have also been stocked in Burdekin Dam for the purposes of enhancing recreational fishing in this reservoir. Apart from Mangrove Jack, these species were all recorded in waterways intersected by the GCP rail corridor alignment. The above finding is of further relevance given that many of the waterways intersected by the GCP rail corridor alignment have EVs that correspond with recreational fishing and consumption of aquatic organisms. Such EV's could be potentially vulnerable to the effects of pollutants entering these waterways through activities associated with the GCP rail corridor construction and operation.

3.3.5 Condition / Appearance

In general, the fish collected during this study appeared to be in good condition and there was no fish that appeared to have fin deformation, external lesions or parasites. No records are available for condition/appearance with regards to the fish survey carried out by E3 (2010).

3.3.6 Tolerances and Sensitivities

Ephemeral streams are subject to wide physico-chemical fluctuations. This is reflected in the species composition of fish found in these types of waterways, and notably their tolerance to a wide range of water physico-chemical qualities (McNeil, 2005). Some of the species recorded in the GCP rail corridor alignment can be described as habitat generalists that are distributed widely within the broader region and, in some cases, within Australia. For instance, Spangled Perch is the second-most widespread of Australia's freshwater fish species and is often very abundant when present (Pusey *et. al.,* 2004). Purple-spotted Gudgeon are a relatively common species of coastal drainages of Eastern Australia north of the Clarence River, NSW. It is found in a range of lentic and lotic habitats, most commonly in slow flowing and weedy areas of rivers, creeks and billabongs. However, it has also been recorded from shallows with moderately high flow velocities (Pusey *et. al.* 2004). Eastern Rainbowfish is a very widely distributed species along the east coast of Queensland and is usually abundant where it occurs (Pusey *et. al.,* 2004). The wide distribution and high abundance are largely due to the fact the Eastern Rainbowfish are not dependent on any particular substrate or habitat type, although they do show a preference for slower moving streams and those that are relatively free of aquatic vegetation (Pusey *et. al.,* 2004).

Physiological preference ranges with respect to water quality for species caught in the study area are shown in Table 3–7. This information is based on information in Pusey et al (2004) and is derived from a combination of published literature and ranges for each parameter encountered where a given species was collected by research undertaken by those authors. As such, the actual physiological tolerance ranges for the species listed might differ from the preference ranges shown in Table 3–7. The habitat preference information given in Table 3–7 attempts to be the most spatially relevant available. Some values in Table 3–7 represent ranges experienced for the Burdekin catchment or wet tropics, while others are based on ranges recorded over a more broad geographic area.

Many of the fish listed are tolerant of mildly acidic conditions, which might be of relevance if acid sulphate runoff issues occur in relation to the GCP rail corridor construction, particularly in the

low lying coastal stream habitat potentially intersected by this rail infrastructure. *A. percoides, H. compressa, H. klungzingeri*, *Hyspseleotris* sp1, *L. unicolor, P. signifer* and *L. calcarifer* tolerate the lowest pHs of the fish listed in Table 3–7, so are unlikely to be directly susceptible to decreased pH should this occur. The same could not be said of most other species present, which have a narrow pH preference range of neutral to slightly alkaline water.

Several of the species listed in Table 3–7 can tolerate moderately low Dissolved Oxygen (DO) levels, at least for a short period, including *A. agassizi, A. percoides*, *M. adspersa, H. klungzingeri and L. unicolor*. These species would be less vulnerable to impacts where GCP rail corridor construction activities result in organic material in the stream bed being disturbed and a subsequent decline in DO levels occurs due to the breakdown of this organic material.

Salinity tolerances are not directly relevant to the GCP rail corridor construction, but might help explain the distribution patterns of the fish recorded in Table 3–6. Salinity tolerances may have relevance however, in the context of potential cumulative impacts associated with runoff and releases of mine affected water from the GCP and other mines currently proposed for the Galilee Basin. It is most likely, though that only species within the Belyando sub-catchment would be directly affected by this given the dilution effects of various non-impacted rivers entering the Burdekin Catchment downstream of these mines.

Turbidity tolerance for Australian native fish is poorly known, but it is likely that they can tolerant short periods of very high turbidity as occurs naturally with heavy rainfall events. They are, however, unlikely to tolerate elevated turbidity levels over extended periods. Suspended sediment can clog or damage gill membranes, causing poor health or mortality in extreme cases. Sub-lethal effects include reduced predation success for visual predators, reduced breeding success in species that rely on visual cues for spawning (e.g. Eastern Rainbowfish), reduced predation rates for visual predators such Spangled Perch and reduced prey and shelter abundance through effects on plant growth, macroinvertebrates and their habitats. Some of the species listed in Table 3–7 tolerate moderately high turbidity levels. This includes *A. agassizi, A. percoides*, *H. klungzingeri, Hypseleotris* sp1, *L. unicolor*, *L. calcarifer*, *M. cephalus* and *O. lineolata.* Further, some of the turbidity preference ranges given for certain fish species are known to not reflect their actual tolerance ranges (e.g. *A. graefei* is known to tolerate a wide range in turbidity, but prefers clearer water and the same is also thought to be true of *N. mollespiculum* – (Pusey *et al.* 2004). *H. klungzingeri and M. adspersa* were observed by ALS (2011) surviving in water of >1000 NTU, which greatly exceeds the tolerance range for these species given in Pusey et al (2004). The fish species present in waterways intersected by the the GCP rail corridor alignment that are most vulnerable to increased turbidity based on information presented in Table 3–7 are *C. stercusmuscarum, M. splendida, N. erebi, P. signifier* and *S. parviceps.* As such, managing and monitoring increases in turbidity associated with GCP rail corridor construction and operation activities are paramount in protecting the local populations of these species.

Table 3–7: Physiological preference ranges of some native fish species recorded from the GCP rail corridor alignment based on Pusey *et. al.* (2004)

Species	Water Temperature	Dissolved Oxygen	pH	Conductivity	Turbidity
	(ºC)	(mg/L)		(µS/cm)	(NTU)
Ambassis agassizi	11.0 - 33.6	0.30 - 19.5	6.3 - 9.9	19.5 - 15102	0.2 -144
Amniataba percoides	21 - 32	0.2 – 9.5	4.5 – 7.3	2 - 230	1 - 360
Arius graeffei	20.9 - 33	4.4 – 6.5	8.2 – 7.8	7.9 - 463	2.6 - 5.4
Craterpcephalus stercusmuscarum	15 - 33	2.6 - 11.9	6.8 – 8.3	50 - 790	0.3 – 8.0
Hypseleotris compressa	17.5 – 27.3	5.33 – 8.81	4.5 - 7.9	6.0 – 65.6	0.33 – 22.1
Hypseleotris klungzingeri	8.4 -31.7	0.6 – 12.8	4.8 – 9.1	19.5 – 5380	0.5 – 65.0
Hyseleotris sp1	8.4 – 31.2	0.3 – 19.5	4.4 – 8.9	51 - 4123	0.1 – 331.4
Leiopotherapon unicolor	5.0 – 40.0	≥ 0.4	4.0 – 8.6	0.2 – 35.5 ppt salinity	1.5 – 260
Lates calcarifer	15.5 - 36	1.1 - 6.8	3 - 9.12	Up to 38 ppt salinity	Tolerates wide range of turbidity
Mugil cephalus	21 - 32	N/A	N/A	28 – 80 ppt	Tolerates wide range of turbidity. Young attracted to turbid water.
Melanotaenia splendida	15.0 – 32.5	1.1 – 10.8	6.8 – 8.5	49 – 790	0.6 – 16
Mogurnda adspersa	11.9 - 31.7	0.6 – 12.8	5.6 – 8.8	72.0 – 2495	0.2 - 200
Nematalosa erebi	15 – 31	4.0 – 12.0	6.7 – 8.5	50 – 780	0.3 – 20
Neosiluris hyrtlii	12.8 – 32.2	5.2 – 11.4	6.76 – 8.46	56 - 790	0.25 - 120
Neosiluris mollespiculum	21.5 - 33	4.2 -10.0	6.76 -8.46	56 - 720	0.25 – 6.0
Oxyeleotris lineolata	18.3 - 32	4.4 – 11	7.0 -9.20	81 -650	1 -579
Psudomugil signifer	15.2 – 29.7	5.1 – 10.0	4.5 – 8.4	5.6 -65.6	0.2 -22.1
Scortum parviceps	23.0 – 32.9	4.0 – 10.0	6.66 – 8.47	55 -610	0.3 -20.8

3.4 Macro-crustaceans

3.4.1 Diversity

The Queensland Museum crustacean database identified a total of 41 crustacean species within the Burdekin Catchment. These taxa are dominated by marine and estuarine species with only seven species recorded by E3 (2010) in freshwater reaches. In this study, only four macro-crustacean taxa were observed from the freshwater streams sampled. , The only Crayfish caught was recorded as *Cherax* sp. Three Crayfish species, the Common Yabby (*Cherax destructor*), the Orange-Fingered Yabby (*Cherax depressus*) and Red Claw Crayfish (*Cherax quadricarinatus*), occur in the Burdekin catchment. The same classification was given to all *Cherax* recorded in the E3 (2010) study, of which there were two –*C. depressus and C. quadricarinatus.*

The macrocrustacean taxa recorded in this study were similar to those collected in the E3 (201a0) study, with differences relating mainly to taxonomic resolution and nomenclature (see below).

This study did not record the Freshwater Crab (*Austrothelphusa transversa*), which was recorded in the E3 (2010) study. However, *A. transversa* was not recorded as part of the fish survey by-catch, so no data are presented for this species in the section below. Atyid shrimp were recorded in this study and assigned to family Atyidae. For the E3 (2010) study, Atyid shrimp were assigned to *Caridina* sp. It is expected that the two classifications relate to the same species. As a result, the Atyidae family level identification for *Caridina* sp. was applied for the purpose of data comparison between this study and that by E3 (2010).

E3 (2010) identified *Macrobrachium* to species level, whereas this was not done as part of this study. Hence, this inflated the macro-crustacean diversity reported by E3 (2010) compared to figures associated with this study. The two *Macrobrachium* species reported by E3 (2010) were the Australian River Prawn - *M. australiense* and the East Australian River Prawn – *M. tolmerum*. The former was found at all E3 (2010) rail corridor monitoring sites. The latter was only found at a single site at the coastal end of the rail corridor. Hence, the *Macrobrachium* species recorded in this study were probably predominantly *M. australiense*, though this cannot be confirmed. As such, all *Macrobrachium* catch data from the E3 (2010) study were pooled into *Macrobrachium spp.* in order to be able to compare macro-crustacean catch data between this study and the E3 (2010) study.

E3 (2010) recorded an additional macro-crustacean species not recorded in this study (Riffle Shrimp – *Australotaya striolata*). This species was not recorded in this study despite sampling by GHD in April 2012 taking into account sites with riffle habitat.

3.4.2 Abundance and Distribution

In this study, only 42 macro-crustaceans were collected from the sites monitored. These were dominated by *Macrobrachium* spp., with Atyidae was the most abundant in terms of total catch followed by the *Cherax* spp. (Figure 3–20). By contrast, large numbers of macro-crustaceans were caught as part of the E3 (2010) survey (nearly 800). This finding may relate to temporal or spatial variability, though it might also relate to differences in sampling methods between the two studies. In the E3 (2010) study, *Macrobrachium* spp. also dominated the catch, with Atyidae the next most abundant common species recorded (Figure 3–21). The abundance of the other macro-crustacean taxa recorded in that study was limited, particularly *C. depressus,* for which only one specimen was collected (not shown in the figure below as data for *Cherax* species were pooled).

As well as being the most abundant macro-crustacean recorded in this study, *Macrobrachium* spp. were recorded from the majority of sites sampled across the two studies, though it was patchily distributed among the sites sampled by GHD in April 2012 (Table 3–8). A similar scenario applies to Atyidae, but this taxon was recorded at only one site (Alt-AQ1) as part of the fish and macro-crustacean survey[5] carried out by GHD in April 2012.

AARC (2010) reported that the translocated Red-claw Crayfish (*Cherax quadricarinatus*) is displacing the Orange-fingered Yabby (*Cherax depressus*) in the Burdekin as the species seldom occur together and the latter tends to be restricted to areas with higher habitat values. However, they did not record any in the study area (they only recorded Common Yabby – *C. destructor* and Red Claw Crayfish – *C. quadricarinatus*). *C. depressus* was also not recorded in this study but E3 (2010) recorded one specimen of *C. depressus* at site AQ-8. *C. quadricarinatus* did not co-occur at that site, lending support to the above statement made in AARC (2010) with regards to limited co-occurrence of these two species. In this study, *Cherax* spp. were only recorded at site AQ-8 (single unidentified specimen), compared with five sites in the study by E3 (2010) (Table 3–8). The reasons for the more limited distribution of *Cherax* spp. in this study are not known.

A. striolata was only recorded from a single rail corridor monitoring site at the coastal end of the rail corridor (AQ-1) and in limited numbers (Table 3–8, Figure 3–21). The restricted distribution and numbers of this species in the catch from this and the E3 (2010) study may reflect a combination of a habitat preference for lower-lying coastal streams (of which only a few were sampled) and a dependence on riffle habitat, which was not widely available in the study area.

While not recorded in this study, *A. transversa* was recorded in the study by E3 (2010). This species is common throughout the semi-desert central and northern parts of Australia extending south into the upper reaches of the Darling River System. It can burrow up to a one metre deep into heavy, dense, clay soils in the banks of freshwater rivers and creeks, drainage channels, pools, swamps and farm dams (Queensland Museum website: http://www.qm.qld.gov.au/Find+out+about/Animals+of+Queensland/Crustaceans/Common+freshwater+and+terrestrial+crustaceans/Inland+Freshwater+Crab accessed 18/10/12). The reasons for the absence of this species from this study are unclear.

[5] This figure does not include catches of Atyidae associated with macroinvertebrate sampling.

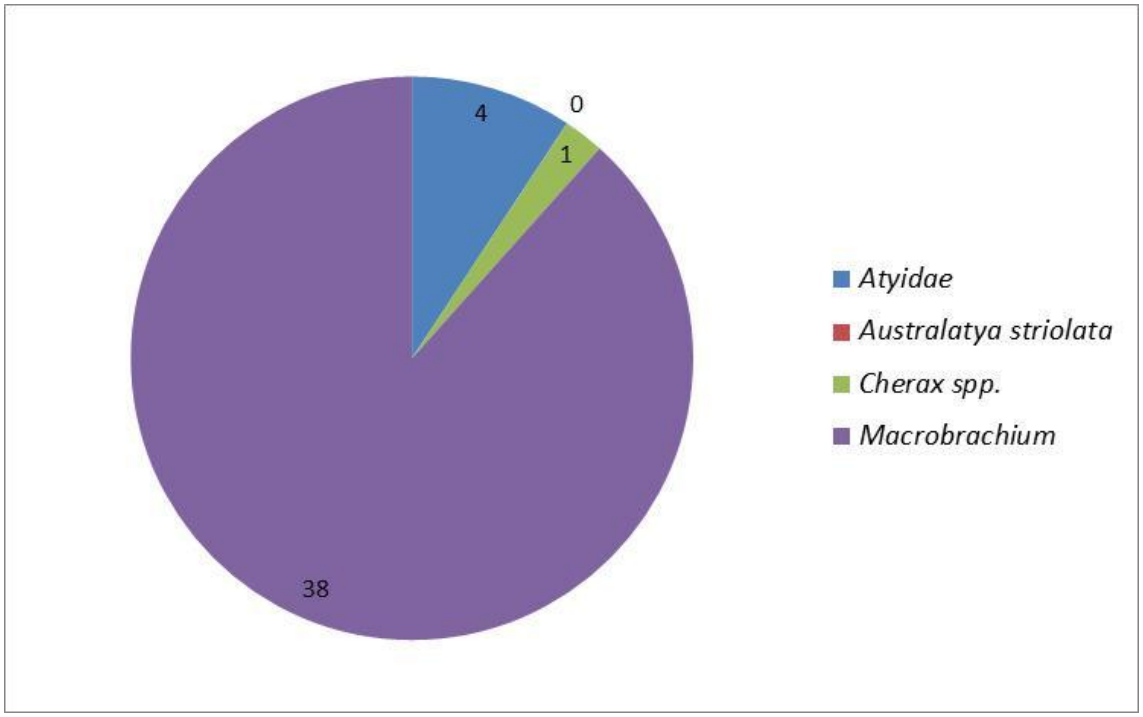

Figure 3–20: Macro-crustacean catch composition recorded in this study

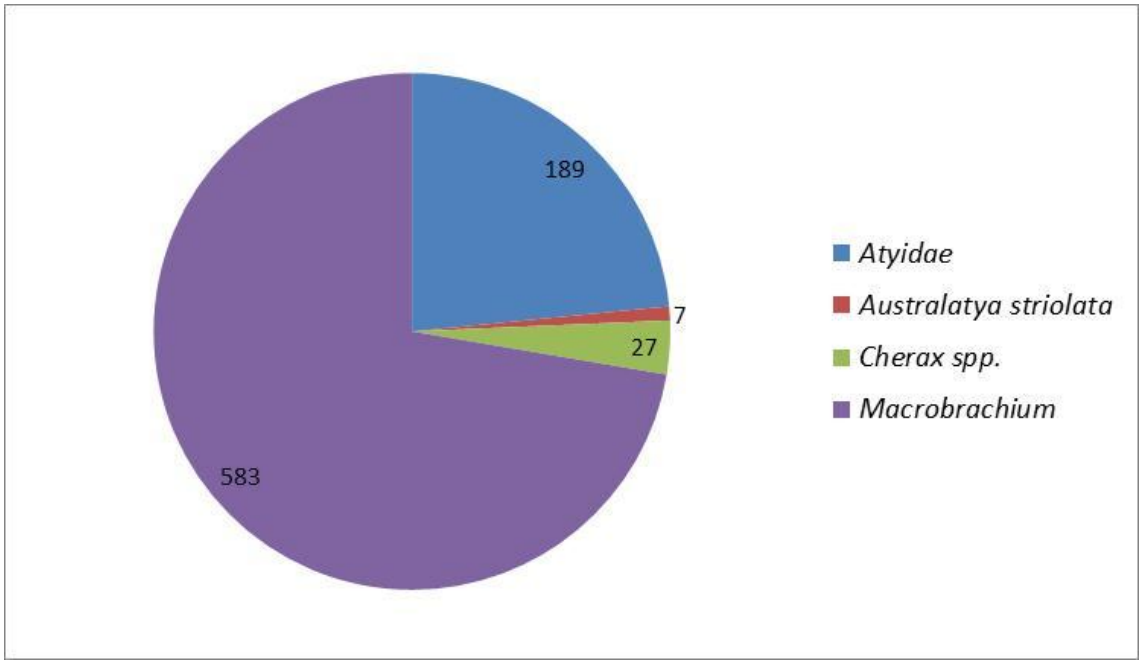

Figure 3–21: Macro-crustacean catch composition recorded in the study by E3 (2010)

Table 3–8: Distribution of macro-crustacean taxa recorded from this study and the E3 (2010) study for the GCP EIS. Note: Presence/absence data for these taxa is based only on fish survey catch data. X = Present.

	GHD (2012)								E2 (2010)												
Species	Alt-AQ1	Alt-AQ2	Alt-AQ4	Alt-AQ5	Alt- AQ6	Alt-AQ7	Alt-AQ8	Alt-AQ12	AQ1	AQ2	AQ3	AQ4	AQ5	AQ6	AQ7	AQ8	AQ9	AQ 10	AQ11	AQ12	**No. Occurrences**
Atyidae	X								X	X	X	X	X	X	X	X		X	X		**11**
Australatya striolata											X										**1**
Cherax spp.							X						X		X	X	X		X		**6**
Macrobrachium spp.	X				X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	**16**
No. Species Recorded	**2**	**0**	**0**	**0**	**1**	**0**	**3**	**1**	**2**	**2**	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**3**	**1**	

3.5 Aquatic Vertebrates other than Fish

There are two crocodile species known to the Burdekin Catchment, the estuarine crocodile (*Crocodylus porosus*) and freshwater crocodile (*Crocodylus johnstoni*). The estuarine crocodile is listed as 'Marine' and 'Migratory' under the EPBC Act and 'Vulnerable' under the *Nature Conservation Act 1992* (NCA). Overall, numbers of both species of crocodile in the Burdekin Catchment are small and Estuarine Crocodiles (*Crocodylus porosus*) only extend as far up the catchment as Burdekin River Dam wall, while Freshwater Crocodile (*Crocodylus johnstoni*) were translocated to the Burdekin River Catchment as part of pet trading and a small breeding population exists in this catchment (DERM, 2010b *In* GHD, 2010). Estuarine crocodiles would be expected to occur in the lower, more open reaches of the coastal streams sampled within the GCP rail corridor and are known to occur in the Bowen River main channel (Jamie Corfield, GHD, pers. obs.). The presence of Burdekin Falls and Burdekin Falls Dam would likely prevent estuarine crocodile occurring in the Suttor and Belyando sub-catchments as these lie upstream of these structures. Nonetheless, local landowners in the Suttor sub-catchment have occasionally reported to GHD staff that their cattle have gone missing near waterways and have expressed the opinion that estuarine crocodile may have been responsible. Hence, their occurrence in these sub-catchments cannot be ruled out altogether.

Freshwater turtle species known to the Burdekin Catchment include Cann's Long-Necked Turtle (*Chelodina canni*), Krefft's Turtle (*Emydura macquarii krefftii*), Irwin's Turtle (*Elseya irwini*), Saw-shelled Turtle (*Wollumbinia latisternum*) and Snake-necked Turtle (*Chelodina longicollis*). The Northern Long-necked Turtle (*Chelodina rugosa*), has also been reported in the catchment (DERM WetlandInfo), however this record has not been verified (E3, 2010a).

Whilst no turtle species within the Burdekin Catchment are listed under the EPBC Act or NC Act, Irwin's Turtle is endemic to the Burdekin Catchment and has been listed as high priority for conservation under the DEHP 'Back on Track' prioritisation framework for conservation management of Queensland's wildlife. It is also under consideration for EPBC listing based on their limited extent of occurrence (estimated to be only 25km^2 – DEWHA, 2009). Anecdotal information provided indirectly to GHD suggests that this species is present in the Bowen River below the Collinsville Weir. This is in agreement with information on its preferred habitat, which is permanently flowing, sandy stream habitat with abundant woody debris, but low macrophyte cover (DEWHA, 2009). As such, they would not be expected to occur in the ephemeral low order streams associated with the inland waterways intersected by the GCP rail corridor alignment, but would be expected to occur in the Bowen River and possibly in adjoining tributaries such as Pelican Creek and Coral Creek. The biology of Irwin's Turtle is poorly known, but based on similar species, Irwin's Turtle is likely to be omnivorous, tending towards herbivory as adults — diet is likely to be mainly small snails and terrestrial plant matter. Females may be exclusively herbivorous (Cann, 1997 *In* DEWHA, 2009). Based on this species' specialised water habitat, there is reason to suspect that its habitat has contracted to the upper reaches of the Burdekin River system due to a decline in water quality associated with releases of water of reduced quality from the Burdekin Falls Dam. Like other similar cloacal breathing turtles, respiratory function is likely to be affected by turbidity, and reduced respiratory function has been shown to have a direct effect on dive performance (Lawler, pers. comm., 2008 *In* DEWHA, 2009). This is of relevance to the GCP SEIS as construction activities, if not adequately controlled, could lead to increased turbidity in the receiving waters and subsequent effects on this species.

In this study, only two turtles were captured. Both were Saw-shelled Turtle (*Wollumbinia latisternum*). A juvenile of this species was recorded from Alt-AQ-6 (Pelican Creek), while an adult of this species was recorded from site AQ-8 (Suttor Creek). The study by E3 (2010) recorded this species at AQ-3 (Elliot River) and AQ-7 (Bowen River). E3 (2010) also recorded Krefft's Turtle (*E. maquaria krefftii*) at AQ-7 (Bowen River) and AQ-9 (Logan Creek). No Turtles were recorded from Belyando sub-catchment sites in either study, but *Chelodina longicollis* was collected in Lagoon Creek in the upper Belyando sub-catchment near site AQ-13 by AARC (2010). Krefft's Turtle is a widely distributed species, occurring in all types of aquatic habitats except farm dams, while Saw-shelled Turtle are most common in upstream rivers and creeks that support an abundance of aquatic habitat (Cann, 2008). Both species are omnivorous as adults, but their diets include aquatic plant material. Krefft's Turtle are often associated with reeded areas as this provides shelter habitat for young to hide in (Australian Museum website: http://australianmuseum.net.au/Kreffts-Turtle, accessed 1/11/12). Also of note is that *W. latisternum* is among the few native species that successfully prey on cane toads (Queensland Museum, 2007), so it plays an important ecological role within the Burdekin Catchment. Unlike Irwin's Turtle (*Elseya irwini*), neither are reported cloacal breathers, so neither are directly vulnerable to increases in suspended sediment, but might they be vulnerable to reduced submerged aquatic plant abundance through increases in turbidity. Further, Krefft's Turtle may be vulnerable to disturbance to emergent and trailing vegetation at sites coinciding with GCP rail corridor crossings, albeit that the scale of such impacts would be highly localised and unlikely to affect the wider population of this species in the affected catchments.

Figure 3–22: Juvenile Saw-shelled Turtle (*Wollumbinia latisternum*) recorded at Alt-AQ-6 in April 2012

Figure 3–23: Adult Saw-shelled Turtle (*Wollumbinia latisternum*) recorded at Alt-AQ-6 in April 2012

3.6 Macrophytes

3.6.1 Diversity and Composition

A total of 55 aquatic-dependent flora species are known to the Burdekin Catchment (Inglis and Howell, 2009). Of these 12 species live in the aquatic zone as opposed to the riparian zone. Limited data exist with regards to the macrophytes present within the study area.

Excluding trailing terrestrial flowering plants in the riparian zone, but including filamentous and diatomaceous algal species, E3 (2010) recorded 19 species of aquatic plants across the 13 GCP rail corridor sites monitored. This included:

- Two algal species;
- Nine emergent species;
- Two floating species; and
- Six submerged species.

The species recorded by E3 (2010) are given in Table 3–9. Members of family Cyperaceae dominated the composition of the taxa they recorded as this group includes all members of the genus *Cyperus* that were recorded as well as *Eleocharis* sp. and *Ghania* sp.

Submerged plants and algae are particularly vulnerable to the impact of high turbidity levels and, without appropriate mitigation measures in place, construction activities associated with the GCP rail corridor crossings could lead to elevated turbidity levels in adjacent waterways. It should be noted, however, that with the exception of *Spirogyra* sp. submerged aquatic plants were only observed at site AQ-6, though E3 (2010) presented historical data to indicate that a range of *Potamogeton* species have been previously recorded from the Bowen River (corresponding with site AQ-7). These waterways are within the Bowen sub-catchment, which is characterised by clear water and persistent flows, conducive for submerged macrophyte growth. By contrast, other waterways, intersected by the GCP rail alignment have less persistent flows and/or highly turbid water (e.g. those in the Suttor and Belyando sub-catchments), so it is unlikely that submerged macrophytes or algae would occur to any extent in those waterways.

Another key finding in relation to the E3 (2010) study is the presence of Queensland Lace Plant (*Aponogeton queenslandicus*). This species is listed as Least Concern under the NCA. It is

most common in shallow, still water habitats with clay substrates that are typically ephemeral in nature (Stephens and Dowling, 1992) and does not occur in flowing streams. Therefore it is somewhat surprising that it was only recorded from site AQ-6 (Pelican Creek), which is characterised by relatively persistent flowing water with sand-gravel beds. It is most likely, therefore, that the record of this species made by E3 (2010) at this site may be a case of mis-identification.

Aquatic macrophytes and algae were not identified to species level in this study, but were identified to genus level. At this level, five genera, including three emergent forms and two submerged forms were recorded. The details of the genera recorded are given in Table 3–8. Members of the genus *Cyperus* were recorded from three sites as part of this study. While it was unclear what range of *Cyperus* species was actually present at these sites, photographic evidence suggests that the exotic *C. involucratus* was present at site Alt AQ-6 (see Figure 3–24). This species was also recorded from AQ-6 (Pelican Creek) by E3 (2010).

Similarly, with the E3 (2010) study, submerged forms were also recorded from waterways within the GCP rail corridor alignment as part of this study. The two genera recorded were each isolated to a single site. Site Alt AQ-6 in Pelican Creek hosted one of these species (*Red Milfoil - Myriophyllum* sp.), while site Slt-AQ-2 in Saltwater Creek hosted the other (Ribbon Weed – *Vallisneria*). As above, the fact that Pelican Creek was among the only sites to host submerged macrophytes in this study is similar to the findings of the E3 (2010) study and most likely relates to the clear water and persistent flows in this waterway that are favourable conditions for submerged macrophyte growth.

While no site by site data were presented by E3 (2010), none of the species listed occurred in more than two of the GCP rail corridor zones covered by E3 (2010) (Table 3–9). This suggests that the distribution of the species recorded is patchy and that different section of the GCP rail alignment host different species. Site AQ-6 recorded the highest aquatic plant diversity, largely through the presence of floating and submerged species that were not found elsewhere. Most other site/zones hosted limited aquatic macrophyte diversity, suggesting that this is more typical of waterways intersected by the GCP rail corridor alignment. The above findings are corroborated by the results recorded in this study, where the highest number of sites that any genus was recorded from was three and the highest diversity for any given site was two genera (Table 3–10).

3.6.2 Abundance

Despite the range of macrophyte species recorded, E3 (2010) found that the waterways intersecting the GCP rail corridor lacked abundant macrophyte cover. This was also the case for sites monitored as part of this study. In both studies, emergent species were the dominant forms represented both in terms of range of species recorded and cover. This is typical of what would be expected for ephemeral stream habitat, as emergent macrophytes are able to survive in the predominantly dry conditions and are less subject to severe fluctuations in water level in general.

Table 3–9: Macrophyte species recorded as part of the E3 (2010) study. X = Present.

Growth Form	Species	AQ-3 to AQ-5	AQ-6	AQ-7	AQ-8 and AQ-9	AQ-10 to AQ-13
Algae	*Spirogyra*	X				
	Chara sp.			X		
Emergent	*Cyperus exaltatus*		X			X
	Cyperus difformis		X			X
	Cyperus involucratus		X			
	Cyperus polystachyos					X
	Typha domingensis		X			
	Eleocharis sp.				X	
	Fimbristylis sp.				X	
	Gahnia sp.				X	
	Persicaria attenuata				X	
Floating	*Ottelia alismoides*	X	X			
	Aponogeton queenslandicus		X			
Submerged	*Blyxa aubertii*		X			
	Najas tenuifolia		X			
	Myriophyllum verrucosum		X			
	Potamogeton crispus		X			
	Potamogeton pectinatus		X			
	Hydrilla verticillata	X				
No. Species Recorded		**3**	**11**	**1**	**4**	**3**

Table 3–10: Macrophyte species recorded as part of this study (April, 2012). X = Present.

Growth Form	Site Code	Alt-AQ-1	Alt-AQ-2	Alt-AQ-4	Alt-AQ-5	Alt-AQ-6	Alt-AQ-7	AQ-8	Alt-AQ-12	AQ-13
Emergent	*Cyperus* spp.			X		X		X		DRY
	Persicaria spp.						X		X	
	Juncus spp.			X				X		
Submerged	*Vallisneria* spp.		X							
	Myriophyllum spp.					X				
No. Genera Recorded		**0**	**2**	**2**	**0**	**2**	**1**	**2**	**1**	**0**

Figure 3–24: *Cyperus involucratus* growing at Alt-AQ-6 (Pelican Creek) in April 2012

3.7 Water Quality

3.7.1 *In situ* Water Quality Testing

In situ water quality measurements taken in April 2012 by GHD are compared to trigger values given in relevant guidelines for ecosystem level protection in Table 3–11. In this case, those guidelines were the Queensland Water Quality Guidelines (DERM, 2009a) for slightly to moderately (SMD) disturbed upland and lowland stream habitat in Central Queensland.

All electrical conductivity (EC) readings were above recommended guideline levels. . Note that specific ranges are provided in DERM (2009a) Appendix G for specific sub-catchments of relevance to this study and these are shown in Table 3–11. All EC trigger values given in this table are based on the 75th percentile for those sub-catchments given in DERM (2009a). Bowen/Burdekin sub-catchment values apply to sites Alt-AQ-4 to Alt-AQ-7. Belyando/Suttor sub-catchment values apply to site AQ-8 and Alt-AQ-12. Don River sub-catchment values apply to sites Alt-AQ-1 and Alt-AQ-2.

Dissolved oxygen saturation (DO%) were outside the recommended range at all but one site (Alt-AQ-4) (Table 3–11). However, caution is required when interpreting instantaneous spot DO% readings such as these given that DO% is subject to diel (24h cycle) fluctuations and readings were taken at different times of the day. Further, the readings taken from most sites represent only mildly reduced DO% readings and it is quite possible that mean DO% for the days monitored could have been within the guideline range. However, during periods of low flow when some of the waterways monitored form isolated pools, or during periods following flow events when terrestrial sources of organic matter are delivered to the aquatic environment, DO% is likely to be reduced more substantially. Note that all streams monitored as part of this study were flowing at the time.

pH was slightly above guideline levels for slightly to moderately disturbed Central Queensland upland stream habitat at most upland stream sites apart from Alt-AQ-12. Lowland stream sites recorded pH within the guideline ranges (Table 3–11).

Alkalinity readings recorded as part of this study ranged between that of soft water (e.g. at AQ-8) to very hard water (e.g. at Alt-AQ-2, Alt-AQ-5 and Alt-AQ-6). The soft to moderately hard status of water within the Bowen River (Alt-AQ-7), Suttor Creek (AQ-8) and Belando River (Alt-AQ-12) is notable as this means that those systems have less capacity to buffer the toxic effects of any metals released by activities associated with the GCP rail corridor crossing construction and operation.

Table 3–11: Results of *in situ* water quality testing carried out by GHD in April 2012. Trigger level/ranges based on DERM (2009a) values for upland slightly to moderately disturbed upland and lowland stream habitat of Central Queensland. Recorded values outside the recommended DERM (2009a) range are highlighted in orange.

Reach	(DERM 2009a) Guidelines		Upland						Lowland	
Site Code			Alt-AQ4	Alt-AQ5	Alt-AQ6	Alt-AQ7	AQ8	Alt-AQ12	Alt- AQ1	Alt- AQ2
Date			4/04/2012	5/04/2012	6/04/2012	7/04/2012	7/04/2012	9/04/2012	3/04/2012	3/04/2012
Time (24h)			1055	920	753	830	1330	1100	743	1415
	Upland River	Lowland River								
Water Temperature (°C)			27.1	24.5	24.09	24.95	23.15	25.1	23.5	27.1
Conductivity (mS/cm)	168 -Belyando/Suttor 271 - Bowen/Burdekin 680-Don River Catchment		619	910	628	401	211	293	1467	1631
pH	6.5-7.5	6.5-8.0	8.29	8.05	8	8.61	7.74	7.15	7.9	7.52
DO (mg/L)			7.65	6.2	6.58	7.34	6.74	6.75	6.8	5.8
DO (% sat)	90-110	85-110	95.8	75.7	78.7	88.3	80.9	81.9	81.2	74.5
Turbidity (NTU)	25	50	3.66	2.05	4.78	9.86	133	90.6	2.54	4.13
Total Alkalinity (mg/L)	0-59 = Soft Water 60-119 = Moderate Water 120-179 = Hard Water 180-240 =Very Hard Water 400+ =Extremely Hard Water		165	200	205	100	35	95	175	200

3.7.2 Analytical Testing

Results of analytical testing for samples collected as part of this study are given in the sections below.

Ecosystem Protection

Results for metals are given in Table 3–12. These results show that total metal concentration measurements for Aluminium, Chromium and Zinc were above the ANZECC and ARMCANZ (2000) guidelines for ecosystem protection. However, only Aluminium recorded dissolved (and therefore bioavailable) concentrations that exceeded these trigger levels. Dissolved Aluminium concentrations were well above trigger levels at two sites (AQ-8 and Alt-AQ-12). Dissolved Aluminium concentrations at site AQ-8 were almost 20 times greater than the guideline, while concentrations at site Alt-AQ-12 were two times greater than the guideline. Aluminium toxicity can be reduced and increased by a range of factors including low and high levels of pH, organic matter, and water hardness (ANZECC and ARMCANZ, 2000).

Electrical conductivity (EC) measured by the laboratory exceeded the DERM (2009a) guideline level at all upland and lowland sites (Table 3–13). Note that these values differ slightly (generaly by no more than by 10%) from EC values in Table 3–11, but this was likely due to the fact that the laboratory method for estimating EC is based on a constant temperature of 25 ºC, whereas EC measured in the field is based on ambient temperature.

Ammonia and Total Phosphorus (TP) exceeded the DERM (2009a) guidelines for upland streams at all upland stream sites (Table 3–13). Ammonia concentrations at the two lowland stream sites exceeded the DERM (2009a) guidelines for lowland streams, but TP levels for the two lowland stream sites were below detection level. TN exceeded the the DERM (2009a) guideline for upland streams at sites (Alt-AQ-6, AQ-8 and Alt-AQ-12, although the exceedance at Alt-AQ-6 was only minor (0.05mg/L). Note that there were no exceedances for Suspended Solids (SS) or a number of nutrients (Nitrate, Nitrite, and Soluble Reactive Phosphorus) recorded as part of this study. Since holding time breaches for these parameters occurred in relation to samples collected in April 2012, those results need to be interpreted with caution.

Human Consumption

In terms of human consumption environmental values, there are no water quality guidelines explicity for ensuring that wild stock aqutic fauna are fit for human consumption. The guiding document for protecting the human consumer environmental value is the Australian and New Zealand Food Standards (ANSFA). These guidelines, though, only present trigger values for contaminant levels in fish flesh. The ANZECC & ARMCANZ (2000) guidelines do, however, present guidelines for ensuring aqualcultured and wildstock species flesh is not tainted in terms of flavour. Of the parameters listed in these guidelines that could potentially taint fish flesh, only two were measured in this study, copper and zinc. The resultsshown in Table 3–12show that none of the concentrations of these metals exceeded the ANZECC & ARMCANZ (2000) guidelines.

Table 3–12: Analytical water quality testing results comparing measured metals concentrations against trigger values relating to 95% ecosystem level protection for slightly to moderately disturbed waters and trigger values related to protecting human consumption environmental values, as given in ANZECC and ARMCANZ (2000). All units are mg/L.

Analyte groupin	ANZECC and ARMCANZ (2000)	ANZECC (2000) Human Consumption	Site	Alt AQ6	Alt AQ5	Alt AQ4	Alt AQ7	AQ8	Alt AQ12	Alt AQ1	Alt AQ2
			Date	4/06/2012	4/05/2012	4/04/2012	4/07/2012	4/07/2012	4/09/2012	4/04/2012	4/04/2012
			LOR	Upland						Lowland	
Dissolved Metals by ICP-MS											
Aluminium	**0.055**		0.01	<0.01	<0.01	<0.01	<0.01	**1.07**	**0.11**	<0.01	<0.01
Arsenic	**0.013**		0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001
Copper	**0.014**	**1**	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
Cobalt			0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001
Nickel	**0.011**		0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001
Manganese	**1.9**		0.001	0.008	0.018	<0.001	<0.001	0.19	0.001	0.098	0.123
Molybdenum			0.001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Uranium			0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Vanadium			0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01
Boron	**0.37**		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	0.08
Iron			0.05	<0.05	<0.05	<0.05	<0.05	0.64	0.24	<0.05	<0.05
Total Metals by ICP-MS											
Aluminium	**0.055**		0.01	**0.11**	0.01	0.05	**0.08**	**3.91**	**1.87**	0.01	0.02
Arsenic	**0.013**		0.001	0.001	<0.001	<0.001	<0.001	0.001	0.003	<0.001	<0.001
Chromium	**0.001**		0.001	<0.001	<0.001	<0.001	<0.001	**0.004**	0.001	<0.001	<0.001
Copper	**0.014**		0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.002	<0.001	0.001
Cobalt			0.001	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001
Nickel	**0.011**		0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.002	<0.001	<0.001
Lead	**0.0034**		0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.001	<0.001	<0.001
Zinc	**0.008**	**5**	0.005	<0.005	**0.008**	**0.006**	**0.014**	<0.005	**0.01**	<0.005	<0.005
Manganese	**1.9**		0.001	0.035	0.021	0.006	0.032	0.284	0.092	0.12	0.179
Molybdenum			0.001	0.002	0.002	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Uranium			0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Boron	**0.37**		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	0.09
Iron			0.05	0.14	<0.05	0.07	0.21	7.18	3.35	0.08	0.18

Note: - Not all EV guidelines apply to all sites, refer to Table 2–3 for a list of EVs that apply to each aquatic system.

- This table only includes results that were greater than the LOR, refer to Appendix B for the full set of laboratory results.

Table 3–13: Analytical water quality testing results comparing measured physico-chemical, major cations and nutrient parameters against DERM (2009a) trigger values relating to 95% ecosystem level protection for slightly to moderately disturbed upland and lowland streams of Central Queensland. All units are mg/L unless expressed otherwise.

Analyte grouping/Analyte	QLD WQ Guidelines (DERM 2009)		Site	Alt AQ6	Alt AQ5	Alt AQ4	Alt AQ7	AQ8	Alt AQ12	Alt AQ1	Alt AQ2
			Date	4/06/2012	4/05/2012	4/04/2012	4/07/2012	4/07/2012	4/09/2012	4/04/2012	4/04/2012
	Upland	Lowland	LOR	Upland						Lowland	
Electrical Conductivity (µs/cm)	168 (Belyando / Suttor); 271 (Bowen / Burdekin); 680 (Don River)		10	**724**	**898**	**620**	**455**	**238**	**293**	**1620**	**1670**
Total Dissolved Solids @180°C				495	543	416	297	372	213	991	1030
Suspended Solids (SS)		**10**	5	<5	<5	<5	<5	66	36	<5	<5
Total Alkalinity as CaCO3				271	294	239	161	58	113	357	338
Sulfate as SO4 - Turbidimetric			1	<1	12	<1	<1	<1	<1	18	<1
Chlorophyll a (mg/m³)		**5**	1	<1	<1	<1	<1	<1	2	<1	<1
Dissolved Major Cations											
Chloride			1	60	109	56	40	37	20	333	357
Calcium			1	45	58	35	30	8	21	107	78
Magnesium			1	26	31	20	17	8	8	74	53
Sodium			1	63	87	64	35	26	25	103	175
Potassium			1	2	3	3	2	2	7	1	2
Fluoride (Total)			0.1	0.6	0.4	0.5	0.2	0.1	0.2	0.2	0.3
Nutrients											
Ammonia as N	**0.01**	**0.02**	0.01	**0.05**	**0.04**	**0.04**	**0.05**	**0.06**	**0.04**	**0.05**	**0.06**
Total Kjeldahl Nitrogen as N			0.1	0.2	0.2	0.2	0.2	0.6	0.5	0.3	0.2
Total Nitrogen as N	**0.25**	**0.5**	0.1	**0.3**	0.2	0.2	0.2	**0.6**	**0.5**	0.3	0.2
Total Phosphorus as P	**0.03**	**0.05**	0.01	**0.17**	**0.18**	**0.15**	**0.04**	**0.04**	**0.13**	<0.01	<0.01
Reactive Phosphorus as P			0.01	0.16	0.16	0.15	0.04	<0.01	0.05	<0.01	<0.01

Note: - An asterisk (*) indicates that 75th percentiles were used.

- Not all EV guidelines apply to all sites, refer to Table 2–3 for a list of EVs that apply to each aquatic system.

- This table only includes results that were greater than the LOR, refer to Appendix B for the full set of laboratory results.

- Sites Alt AQ5 and Alt AQ12 fall into the Belando / Suttor basin; sites Alt AQ4, Alt AQ6, Alt AQ7, AQ8 fall into the Bowen / Burdekin basin and sites Alt AQ1 and Alt AQ2 fall into the Wet Tropics basin (QWQG 2010)

Drinking Water

There are no guidelines trigger values that apply to drinking water quality with regards to raw water. The trigger levels for drinking water that have been developed apply to post-treatment water quality, so these values cannot be applied to the data collected from the streams sampled as part of this study. However, DERM (2009a) outlines guidelines for drinking water supply storages developed by the South East Queensland Water Corporation for its storages, but could be applied more generally to other parts of Queensland. Data from this study were compared against these guidelines. Note that there are two values for comparison, one relating to the Level 1 Hazard and Critical Control Point (HACCP) response rating (treatment plant process-change required to ensure water quality and quantity to customers is not compromised) and the other relaying to Level 2 Hazard and Critical Control Point (HACCP) response rating (treatment-plant process-change required but water quality and quantity to customers may still be compromised).

Results show that dissolved Manganese levels were higher than the Level 1 HACCP guideline value at sites Alt-AQ-1, Alt-AQ-2 and AQ-8, while dissolved Iron levels exceeded the Level 2 HACCP guideline value at sites AQ-8 and Alt-AQ-12. Suspended solid concentrations were above the Level 1 HACCP guideline at AQ-8 and Alt-AQ-12. The total dissolved solid concentrations at sites Alt-AQ-1 and Alt-AQ-2 were higher than the guideline value given in the Australian Drinking Water Guidelines (NHMRC, 2011), This value relates to issues of palatability rather than human health.

Recreation and Visual Amenity

There are no guideline trigger values that apply to aesthetics (NHMRC, 2008). The NHMRC (2008) guidelines focus mainly on the need to avoid slicks and litter and to maintain water clarity.

The NHMRC (2008) do, however, nominate guideline levels for protecting primary and secondary recreational contact EVs. Most of these relate to pathogens and blue green algae, which were not monitored as part of this sudy and are unlikely to be affected directly by activities associated with the construction and operation of the GCP rail corridoe. However, the NHMRC (2008) recommend that pH is between 6.5 and 8.5 to reduce the potential for skin irritation. Only the value recorded at Alt-AQ-7 was outside this range (see Table 3–11). The NHMRC (2008) guidelines also recommend DO% of > 80 as an indicator that the potential for the occurrence of blue green algae is low. Results in Table 3–11 show that most sites recorded instantaneous DO% readings above 80% saturation and those that did not recorded DO% levels only slightly below this.

Stock Watering

There were no total or dissolved metal concentrations above the ANZECC and ARMCANZ (2000) Stock Watering guideline trigger levels at any of the sites monitored(Table 3–14). Further, none of the nutrient and physico-chemical parameters monitored exceeded the ANZECC and ARMCANZ (2000) Stock Watering guideline trigger levels (Table 3–15). .

Irrigation

Levels of total Iron were higher than the ANZECC and ARMCANZ (2000) Irrigation guidelines at sites Alt-AQ-7, AQ-8 and Alt-AQ-12and levels of total Nickel were higher than the ANZECC and ARMCANZ (2000) Irrigation guidelines at site AQ-8. However, dissolved ron concentrations only exceeded the ANZECC and ARMCANZ (2000) Irrigation guidelines at sites AQ-8 and Alt-AQ-12 and dissolved Nickel concentrations at site AQ-8 were within guideline

levels(Table 3–14). Total alkalinity (as CaCO3) exceeded the ANZECC and ARMCANZ (2000) Irrigation guideline all but one site (Table 3–15). The guideline was also exceeded by almost two times at site Alt-AQ-12 and up to five times at site Alt-AQ-5. In relation to nutrients, TP concentrations exceeded the guideline at four sites (Alt-AQ-6, Alt-AQ-5, Alt-AQ-4 and Alt-AQ-12).

Table 3–14: Analytical water quality testing results of metals against trigger values relating to ANZECC guidelines for stock watering and for irrigation for samples collected in April 2012 for the GCP SEIS. All units are mg/L.

Analyte grouping/Analyte	ANZECC (2000) Stock watering	ANZECC (2000) Irrigation	DERM (2009a) SEQ Water Drinking Water	Site	Alt AQ6	Alt AQ5	Alt AQ4	Alt AQ7	AQ8	Alt AQ12	Alt AQ1	Alt AQ2
				Date	4/06/2012	4/05/2012	4/04/2012	4/07/2012	4/07/2012	4/09/2012	4/04/2012	4/04/2012
				LOR	Upland						Lowland	
Dissolved Metals by ICP-MS												
Aluminium	5	5		0.01	<0.01	<0.01	<0.01	<0.01	1.07	0.11	<0.01	<0.01
Arsenic	0.5	0.1		0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001
Copper	0.4	0.2		0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
Cobalt	1	0.05		0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001
Nickel	1	0.2		0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001
Manganese		0.2	0.05-0.2	0.001	0.008	0.018	<0.001	<0.001	0.19	0.001	0.098	0.123
Molybdenum	0.15	0.01		0.001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron	5	0.5		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	0.08
Iron		0.2	0.05-0.2	0.05	<0.05	<0.05	<0.05	<0.05	0.64	0.24	<0.05	<0.05
Total Metals by ICP-MS												
Aluminium	5	5		0.01	0.11	0.01	0.05	0.08	3.91	1.87	0.01	0.02
Arsenic	0.5	0.1		0.001	0.001	<0.001	<0.001	<0.001	0.001	0.003	<0.001	<0.001
Chromium	1	0.1		0.001	<0.001	<0.001	<0.001	<0.001	0.004	0.001	<0.001	<0.001
Copper	0.4	0.2		0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.002	<0.001	0.001
Cobalt	1	0.05		0.001	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001
Nickel		0.2		0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.002	<0.001	<0.001
Lead	0.1	2		0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.001	<0.001	<0.001
Zinc	20	20		0.005	<0.005	0.008	0.006	0.014	<0.005	0.01	<0.005	<0.005
Manganese		0.2		0.001	0.035	0.021	0.006	0.032	0.284	0.092	0.12	0.179
Molybdenum	0.15	0.01		0.001	0.002	0.002	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	0.2	0.1		0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Boron	5	0.5		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	0.09
Iron		0.2		0.05	0.14	<0.05	0.07	0.21	7.18	3.35	0.08	0.18

Note: - Not all EV guidelines apply to all sites, refer to Table 2–3 for a list of EVs that apply to each aquatic system.

- This table only includes results that were greater than the LOR, refer to Appendix B for the full set of laboratory results.

- Value given for copper is based on the trigger value for Sheep, which is the lowest for all likestock. The trigger values for beef cattle is 5 mg/L.

- Trigger values for Irrigation are based on based on long-term trigger values given in ANZECC & ARMCANZ (2000).

Table 3–15: Analytical water quality testing results of physico-chemical, major cations and nutrient parameters against trigger values relating to ANZECC guidelines for stock watering and irrigation for samples collected in April 2012 for the GCP SEIS. All units are mg/L.

Analyte grouping/Analyte	ANZECC (2000) Stock watering	ANZECC (2000) Irrigation	DERM (2009a) SEQ Water Drinking Water	Site	Alt AQ6	Alt AQ5	Alt AQ4	Alt AQ7	AQ8	Alt AQ12	Alt AQ1	Alt AQ2
				Date	4/06/2012	4/05/2012	4/04/2012	4/07/2012	4/07/2012	4/09/2012	4/04/2012	4/04/2012
				LOR	Upland						Lowland	
Electrical Conductivity				10	724	898	620	455	238	293	1620	1670
Total Dissolved Solids @180°C	4000		600		495	543	416	297	372	213	991	1030
Suspended Solids (SS)			25-100	5	<5	<5	<5	<5	66	36	<5	<5
Total Alkalinity as CaCO3		60			271	294	239	161	58	113	357	338
Sulfate as SO4 - Turbidimetric	1000			1	<1	12	<1	<1	<1	<1	18	<1
Chlorophyll a (mg/m³)				1	<1	<1	<1	<1	<1	2	<1	<1
Dissolved Major Cations												
Chloride				1	60	109	56	40	37	20	333	357
Calcium	1000			1	45	58	35	30	8	21	107	78
Magnesium				1	26	31	20	17	8	8	74	53
Sodium				1	63	87	64	35	26	25	103	175
Potassium				1	2	3	3	2	2	7	1	2
Fluoride (Total)	2			0.1	0.6	0.4	0.5	0.2	0.1	0.2	0.2	0.3
Nutrients												
Ammonia as N				0.01	0.05	0.04	0.04	0.05	0.06	0.04	0.05	0.06
Nitrate as N	400			0.01	0.09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrite + Nitrate as N				0.01	0.09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Kjeldahl Nitrogen as N				0.1	0.2	0.2	0.2	0.2	0.6	0.5	0.3	0.2
Total Nitrogen as N		5		0.1	0.3	0.2	0.2	0.2	0.6	0.5	0.3	0.2
Total Phosphorus as P		0.05		0.01	0.17	0.18	0.15	0.04	0.04	0.13	<0.01	<0.01
Reactive Phosphorus as P				0.01	0.16	0.16	0.15	0.04	<0.01	0.05	<0.01	<0.01

Note: - Not all EV guidelines apply to all sites, refer to Table 2–3 for a list of EVs that apply to each aquatic system.

- This table only includes results that were greater than the LOR, refer to Appendix B for the full set of laboratory results.

- Trigger value for TDS is based on minimum level for which deleterious effects have been observed for horses and beef cattle.

- Trigger values for Irrigation are based on based on long-term trigger values given in ANZECC & ARMCANZ (2000).

4. Discussion

4.1 How this Study has Addressed EIS Comments

This study addressed issues raised in relation to the GCP EIS through the public submissions process by:

- Carrying out further water quality monitoring based on the full suite of parameters recommended by DEHP; and
- Comparing water quality results to relevant guidelines, chosen based on knowledge of the EVs for the waterways intersected by the GCP rail corridor.

Beyond this, this study improved on the knowledge presented in the GCP EIS through:

- Characterising temporal variability based on repeat sampling in systems intersected by the GCP rail corridor alignment and comparisons between data collected in this study in April 2012 and that collected in the E3 (2010) study; and
- Providing more details on the sensitivities of taxa present in relation to degraded water quality and fish passage barriers.

4.2 Study Limitations

While the steps outlined above mean that there are now sufficient data to be able to properly assess potential impacts to aquatic ecosystems associated with the GCP rail corridor, the findings presented in this study are still based on only a limited number of sampling rounds in ephemeral streams that are highly variable. Based on comparisons with data from other studies, additional sampling of these sites is unlikely to result in a large number of new flora and fauna taxa being recorded. However, it is not possible to rule this out. This is particularly true with respect to aquatic macrophyte species, some of which are annuals whose occurrence in ephemeral streams is short-lived.

Attempts were made to carry out repeat sampling at the same locations sampled as part of the E3 (2010) study, but this could not be achieved at all sites due to private property access issues. This prevented direct comparison between results recorded as part of the present study and those recorded by E3 (2010) and whether any differences are due to true temporal variation or to the sampling different sites and methods used. However, given that both studies sampled the same systems, it has been assumed that some of the observed between-study variation was due to natural temporal variation. Moreover, the sampling of different sites means that the spatial characterisation of the waterways intersected by the GCP rail corridor alignment is increased through the sampling carried out as part of this study.

While this study provided a reasonable assessment of the aquatic biodiversity values present within streams intersected by the GCP rail corridor alignment, the standard AUSRIVAS family level taxonomic resolution applied to macroinvertebratre community sampling data as part of this study is likely to have underestimated true diversity present within these systems.

The water quality sampling carried out as part of this study was not intended to represent strategic water quality monitoring as part of a formal GCP water quality monitoring program. It is acknowledged that a water quality monitoring program is required as part of the EM Plan. The GCP water quality monitoring program is currently being developed as part of the GCP SEIS process. Some of the sites monitored as part of this study could be included in the GCP water quality monitoring program study design.

4.3 Discussion

Habitat Condition

This study found that the waterways in the the GCP rail corridor area were generally in good condition, though there was some evidence of erosion, riparian vegetation clearing, understorey disturbance and exotic weed occurrence at a number of sites. This was expected given that the landuse adjacent to most of the waterways sampled was light grazing. Causeways and bridges were also present on a number of waterways, though in most cases, these represented a highly localised disturbance, with little evidence that they have affected bed and bank stability and adjacent turbidity levels. The low lying causeways may, however, act as fish passage barriers during low flow conditions, but would be expected to be inundated in the wet season during any given year, so are unlikely to have resulted in any major changes to the fish community upstream.

Fish Community

The fish fauna recorded in this study was more limited in terms of abundance and diversity than that recorded by E3 (2010) and apart from Freshwater Longtom (*Strongylura krefftii*), no new species were recorded in this study compared to those recorded by E3 (2010). Freshwater Longtom are known to occur in waterways such as the Bowen River, so this is not unexpected. There were also some differences between the two studies in terms of which species were numerically most common, but this was most likely due to differences in sampling methods used, with E3 (2010) deploying gill nets, while this study did not for safety and fish mortality reasons. Further, the numerical dominance of *Ambassis agrammus* in the E3 (2010) catch is probably artificial, as the Burdekin Catchment is the southern-most distribution limit for this species.

The fish fauna recorded from the GCP rail corridor streams consisted predominantly of potadromous species. This was expected based on the inland location of the many of those waterways and their ephemeral nature. However, a number of catadromous and anadromous species were recorded from these waterways, which is important, given that rail corridor crossing construction may involve the creation of temporary fish passage barriers. If these are created at times when these species tend to migrate to spawn, there could be implications for spawning success of those species and subsequent effects on their local populations. While this is something that needs to be considered further as part of the GCP SEIS, the temporary nature of those barriers and the likelihood that fish movement timing will coincide with high flows, during which construction activities would be restricted, means that significant impacts are unlikely to occur. None of the species sampled were of conservation significance, but there were several fisheries-significant species recorded in waterways intersected by the GCP rail corridor alignment. Further, fishing activity and consumption of aquatic fauna are listed as an EVs for several of the waterways surveyed, so ensuring that GCP rail corridor construction and operation activities do not impact on those EV's is critical. Further, two endemic species, Small-headed Grunter (*Scortum parviceps*) and Soft-spined Catfish (*Neosiluris mollespiculum*) also occur in waterways intersected by the GCP rail corridor alignment. Existing data suggest that both have preferences for water of low turbidity (though they can tolerate somewhat turbid conditions), so it is important that GCP rail corridor construction and operation activities do not result in significant increases in turbidity. This concept also applies to some of the other more widely-distributed fish fauna, but the protection of endemic species is more critical given that they do not occur outside the Burdekin Catchment.

Macro-crustacean Community

The macro-crustacean community of the study area was of limited diversity compared to the diversity known to the Burdekin Catchment as a whole, but this was consistent with the findings

of previous studies. Further, this study did not identify macro-crustacean taxa beyond genus level. Based on the results of sampling by E3 (2010), at least seven macro-crustacean species occur within the waterways intersected by the GCP rail corridor alignment. Native crayfish, such as the Common Yabby and the Orange-fingered, were not commonly recorded Yabby in either this study or the E3 (2010), but the translocated native species, Red Claw Crayfish, was found at several sites. There is some evidence to suggest that the latter is displacing these native crayfish species. Freshwater Crab (*Austrothelphusa transversa*) and Riffle Shrimp (*Australotaya striolata*) were not recorded in this study, but were occasionally recorded as part of the E3 (2010) study. Their occurrence in the waterways intersected by the GCP rail corridor is also expected to be limited. However, where they occur, *A. striolata* would be potentially vulnerable to the impacts of increased suspended solid loads through activities associated with the GCP rail corridor construction and operation as this species is a suspension feeder. Other macro-crustaceans recorded included Atyid Shrimp and Freshwater Prawns (*Macrobrachium* spp.). These two taxa dominated the macro-crustacean community in both this study and that by E3 (2010). Atyid Shrimp and Freshwater Prawns rely partially on periphytic algae as a food source. While periphytic algae was not abundant or common among the sites sampled, a reduction in periphytic algal abundance through increases in turbidity due to the GCP rail corridor construction could still impact on these macro-crustaceans, so it is important that mitigation measures are put in place to avoid such impacts occurring.

Macroinvertebrate Community

The overall macroinvertebrate fauna diversity recorded in this study matched levels recorded from previous studies carried out in the Burdekin Catchment, apart from that by E3 (2010), for which a highly reduced macroinvertebrate diversity was recorded. The latter was due to a combination of the unique sampling technique used by E3 (2010) and their use of a higher taxonomic discrimination level for a number of macroinvertebrate faunal groups. The sampling carried out as part of this study improved the knowledge of macroinvertebrate taxa likely to be present in waterways potentially affected by the GCP rail corridor through the application of family level taxonomic resolution for the majority of taxa recorded and through the use of standard AUSRIVAS sampling protocols. The latter also meant that the data collected in this study could be assessed using a wider range of biotic indices than would have been possible based on repeat sampling using the methods deployed by E3 (2010).

Macroinvertebrate diversity in edge habitat samples was generally lower than expected, based on taxa richness ranges for edge habitat in Central Queensland waterways (DERM, 2009a) and based on the QLD Coastal AUSRIVAS autumn edge and riffle model predictions. However, the diversity associated with composite habitat samples was above the expected range for such habitat given in DERM (2009a). Diversity was highest in Pelican Creek and this was most likely due to a combination of greater flow permanence, clear water conditions and the presence of a diverse range of instream habitat. The lower than expected taxa richness meant that most sites recorded AUSRIVAS bandings indicative impaired macroinvertebrate communities. However, AUSRIVAS results also showed that the taxa predicted to occur at the sites sampled were mostly taxa with low pollution-sensitivity. Therefore, despite the fact that water quality did not always meet recommended guideline ranges, the absence of those taxa was most likely due to factors unrelated to water quality degradation.

Most edge habitat samples in this study recorded PET richness and SIGNAL2 scores within the expected range for Central Queensland waterways. The composite habitat samples collected in this study often recorded higher than expected PET richness and SIGNAL 2 scores. This indicates that while taxa richness may have been limited for edge habitat samples, the taxa represented had the expected mix of pollution-tolerant and pollution-sensitive taxa for this region. It also indicates that composite habitat samples had a higher than expected proportional representation of pollution-sensitive taxa. The latter is in direct contrast to results

for the E3 (2010), where all 'composite' habitat samples recorded lower than expected PET richness and SIGNAL2 scores. However, results for the E3 (2010) study are limited by the fact that PET taxa and some of the other taxa (e.g. Zygoptera) were not identified beyond order level. Collectively, seven PET taxa and seven taxa with a SIGNAL sensitivity rating > 5 were recorded from waterways intersected by the GCP rail corridor alignment. This included Leptophlebid mayflies (SIGNAL =8), which were found at most sites and Philopotamid caddisflies (SIGNAL = 8), which were only found at sites between the coast and Sandy Creek.

Aquatic Vertebrates other than Fish

Neither this study nor the study by E3 (2010) targeted aquatic vertebrates other than fish. However, turtles were caught as by-catch as part of both studies. In this study, only two turtles were captured. Both were Saw-shelled Turtle (*Wollumbinia latisternum.* The study by E3 (2010) recorded this species and Krefft's Turtle (*E. maquaria krefftì*). No Turtles were recorded from Belyando sub-catchment sites in either study, but a Snake-necked Turtle (*Chelodina longicollis*) was collected in Lagoon Creek in the study by AARC (2010). While the occurrence of turtles in these studies was limited, all three are widely distributed species, Of note is the fact that *W. latisternum* is among the few native species that successfully prey on cane toads. Further both *W. latisternum* and *E. maquaria kreffti* are potentially vulnerable to increased turbidity and disturbance to the riparian zone due to their partial reliance on macrophytes and algae as a food source and the use of reed beds as a nursery area for juveniles. While not recorded in either this study or that by E3 (2010), Irwin's Turtle (*Elseya irwini*) is likely to occur in the Bowen River and Pelican Creek. This endemic turtle species is a reported cloacal breather and this function is thought to be affected by elevated turbidity. Based on the above, there is potential for the GCP rail corridor to affect these turtle species through the generation of turbid plumes and the clearing of fringing riparian vegetation and reed beds to create the easement. However, such impacts are likely to be highly localised and/or short-term, so significant impacts on populations of these turtle species are unlikely.

Macrophyte Community

Macrophyte diversity and cover was generally low in the waterways sampled. This study only identified macrophytes to genus level, so macrophyte diversity was lower than that recorded by E3 (2010). However, in both studies emergent forms, particularly those belonging to family Cyperaceae, were the most commonly recorded. These findings are consistent with those of previous studies and conform to expectations with regards to the extreme hydrological variation within ephemeral streams generally not being conducive to the growth of submerged and floating macrophytes. Nonetheless, a surprising number of submerged macrophytes were recorded from the two studies (two in this study, six in the study by E3 (2010)). Results from both studies indicate these species were recorded mainly from Pelican Creek, which is likely due to the greater flow permanence and high water clarity present in this system. While not reflected in the results presented in this report, submerged species would also likely occur in the Bowen River, as it shares these same features. Submerged macrophytes and periphytic algae such as *Spirogyra* and *Chara* are potentially vulnerable to increases in turbidity, so are therefore, comparatively more vulnerable than other macrophyte growth forms to any turbidity increases that might be associated with the GCP rail corridor construction and operation.

No exotic or noxious macrophytes were recorded from this study or the E3 (2010), though several are known to occur in the study area. E3 (2010) recorded the NCA-listed species, Queensland Lace Plant (*Aponogeton queenslandicus*) from Pelican Creek, but this was likely an erroneous identification given that the habitat conditions in this system are not consistent with the favoured habitat of this species. A conservation significant *Myriophyllum* species, *Myriophyllum artesium,* occurs within the Burdekin catchment, but was not recorded in either

this study or by E3 (2010). This species is listed as endangered under the NCA and is associated with artesian spring mounds, so would not be expected to occur in the waterways intersected by the GCP rail corridor.

Water Quality

This study assessed water quality results against guidelines appropriate for use based on the EVs associated with waterways intersected by the GCP rail corridor alignment. This was a key objective of this study as part of the GCP SEIS process.

In situ water quality testing carried out as part of this study revealed exceedences with regards to the ANZECC & ARMCANZ (2000) and DERM (2009a) guidelines for 95% level ecosystem protection. The exceedences related to elevated EC levels at all sites, elevated pH and reduced DO% at most sites sampled and elevated turbidity for the Suttor Creek and the Belyando Creek sites.

Water quality testing carried out as part of this study revealed that total concentrations of some of the metals measured exceeded guideline levels, but of these, only aluminium exceeded guideline levels based on both total and dissolved concentrations, suggesting that apart from aluminium, the bioavailability of metals is currently limited in the waterways sampled. Only sites AQ-8 (Suttor Creek) and Belyando Creek (Alt-AQ-12) recorded dissolved Aluminium concentrations that exceeded ecosystem protection guidelines. Both had very high total Aluminium concentrations, which probably relates to the fact that these systems had high suspended solid concentrations and metals such as Aluminium bind preferentially to fine sediment particles. Further, Suttor Creek was characterised by soft water, so there would be limited carbonate sources available in this system to form Aluminium carbonate precipitates, hence the higher concentrations of dissolved forms of Aluminium relative to most other systems sampled.

Nutrients such as Ammonia and TP routinely exceeded guideline ranges for the protection of ecosystem values, particularly for upland stream sites sampled. . TP levels also exceeded the ANZECC and ARMCANZ (2000) guidelines for irrigation at most of the upland stream sites monitored. These elevated nutrient levels are probably the combination of agricultural activities in the adjacent land and the decomposition of allocthonous organic material delivered to these streams during times of high flow.

Alkalinity levels were greater than the ANZECC & ARMCANZ (2000) guidelines for irrigation at most sites.

The monitoring carried out in this study indicated that the water quality at the time of sampling was appropriate for Stock Watering.

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The other key findings of this study were that none of the pesticides or organic contaminants monitored recorded levels above LOR.

4.4 Conclusions

Based on evidence presented in this study, the ecosystems most vulnerable to the potential impacts associated with the GCP rail corridor construction and operation are Pelican Creek and the Bowen River. The reasons for this are as follows:

- These waterways are the main examples of clear-water steams with relatively permanent flows;
- Both offer high instream habitat diversity (considering parts of the Bowen River outside the influence of the Collinsville Weir pool) and have sand-gravel bedforms that are prone

to movement already prior to any further disturbance. Such bed movement could result in the smothering of riffle habitat and reduced of riffle-associated macroinvertebrate abundance and diversity;

- Aquatic flora and fauna diversity was highest in Pelican Creek and a similar overall diversity would be expected for the Bowen River;
- Fisheries-significant and catadromous fish species were found predominantly in the Bowen River;
- Of all sites monitored, the endemic Irwin's turtle is most likely found in the Bowen River and its tributaries. This species is a cloacal breather for which that physiological function has been reportedly reduced through increases in turbidity;
- Submerged macrophytes occurred predominantly in Pelican Creek (and would also be expected in the Bowen River) and these are vulnerable to impacts associated with increased turbidity; and
- These waterways are already subject to the impacts of mining and agricultural landuse, so the GCP rail corridor construction and operation could result in further cumulative impacts to the aquatic ecosystems associated with those systems.

The above finding is quite ironic given that Dight (2009) reported that Pelican Creek was classified as being a majorly disturbed system based on the fact that it is subject to the impacts of mining and agricultural landuse within its catchment. Further, water quality results presented in this study indicate that the water quality in Pelican Creek was good compared to some of the other waterways assessed.

In terms of the flora and fauna most at risk of impact, this study and the E3 (2010) study combined recorded:

- A number of fish with preferences for low turbidity water and those with narrow pH reference ranges favouring neutral to slightly alkaline conditions. These species would be vulnerable to impacts associated with sediment mobilisation and disturbance of acid sulphate soils in coastal lowland stream sections of the GCP rail corridor alignment;
- The fish community includes migratory fish species that are vulnerable to the effects of fish passage barriers, albeit that any barriers created as part of the GCP rail corridor construction would likely be temporary barriers constructed in times of lower flow when these fish are less likely to move;
- Submerged macrophytes and periphytic algae, albeit in reduced abundance and largely confined to Pelican Creek;
- Several macroinvertebrate taxa with above average pollution-sensitivity, which would potentially be vulnerable to water quality degradation associated with the GCP rail corridor construction; and
- Macro-crustaceans and turtles with partial dependence on aquatic macrophyte and algal food sources that would potentially be indirectly impacted by any increases in turbidity associated with the GCP rail-corridor construction through reduced food abundance.

As above, Irwin's Turtle, while not recorded by either study, would also be vulnerable to increase in turbidity associated with the GCP rail corridor construction and operation.

Water quality testing results highlighted some existing issues, which are follows:

- Routinely elevated EC levels;
- Routinely low DO% levels, albeit in most cases only slightly lower than the guideline range; and

- Exceedances of guideline levels for a number of total metals and dissolved Aluminium,as well as Ammonia, TN and TP and total alkalinity such that not all EV's for the waterways sampled could be satisfied even prior to any further impacts that might be associated with the GCP rail corridor; and

However, exceedance of guideline levels, particularly in relaton to ecosystem protection, does not necessarily indicate poor water quality and could reflect inadequacies in terms of the application of regional guidelines to the local sub-catchments assessed as part of this study. Nonetheless, it is still imperative that every attempt be made to put effective mitigation measures in place to prevent or limit erosion or spillages of coal, particularly in relation to rail crossings at Pelican Creek, the Bowen River and Suttor Creek.

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Appendices

Appendix A – Completed Field Sheets

AEF002

MACROINVERTEBRATE SAMPLING FIELD SHEET

Queensland Government
Natural Resources and Mines

Site Number [E|3|C| |A|Q|8] **Sample Number** [ ]
Site Name SUTTOR . RIVER
Project Code [ ] **Date** [0|7/0|4/2|0|1|2] **Time** (24 hrs) [1|3:3|0]
Run Code [ ] **Project Name** G.C.P.

EDGE/BACKWATER: Y [X] N [ ] Collected by: [M|D|] Picked By: [M|D|] No. vials: [1] QAQC Residue: Y [X] N [ ]
(average over 10 m sampled)

Velocity (m/sec): max [0|.|0|0] min [0|.|0|]
Mean Sample Depth: [0|.|4|0] m
Mean Wetted Width: [| |5|.|0] m
Method: 10 m sweep [X]
30 minutes random live-pick [X]
Other _____ [ ]
Canopy Cover: [|4|0] % **Densiometer:** [ ] %
Shading: [|4|0] %

Snags and LWD:

Detritus (leaves, twigs)	N	(L)	S	M	E
Sticks (<2cm diam)	N	(L)	S	M	E
Branches (<15cm diam)	N	(L)	S	M	E
Logs (>15cm diam)	N	(L)	S	M	E

Substrate Description:

Bedrock	[| |0] %	Gravel (2 - 4 mm)	[| |0] %
Boulder (> 256 mm)	[| |0] %	Sand (0.05 - 2 mm)	[|7|0] %
Cobble (64 - 256 mm)	[| |0] %	Silt/Clay (< 0.05 mm)	[|3|0] %
Pebble (4 - 64 mm)	[| |0] %		

Habitat Attributes:

Periphyton	(N)	L	S	M	E
Moss	(N)	L	S	M	E
Filamentous algae	(N)	L	S	M	E
Macrophytes	(N)	L	S	M	E
Bank overhang vegetation	N	(L)	S	M	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	N	(L)	S	M	E
Blanketing silt	N	L	(S)	M	E
Substrate anoxia	(N)	L	S	M	E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

BED: Y [ ] N [ ] Collected by: [| |] Picked By: [| |] No. vials: [ ] QAQC Residue: Y [ ] N [ ]
TYPE: Riffle [ ] Run [ ] Pool (rocky/gravel) [ ] Pool (sandy/silty) [ ]
(average over 10 m sampled)

Velocity (m/sec): max [|.| |] min [|.| |]
Mean Sample Depth: [|.| |] m
Mean Wetted Width: [| | |.|] m
Method: 10 m kick only [ ]
10 m kick & gleaning rocks of different sizes (5) [ ]
____ minutes random live-pick [ ]
Other _____ [ ]
Canopy Cover: [| |] % **Densiometer:** [| |] %
Shading: [| |] %

Snags and LWD:

Detritus (leaves, twigs)	N	L	S	M	E
Sticks (<2cm diam)	N	L	S	M	E
Branches (<15cm diam)	N	L	S	M	E
Logs (>15cm diam)	N	L	S	M	E

Substrate Description:

Bedrock	[| |] %	Gravel (2 - 4 mm)	[| |] %
Boulder (> 256 mm)	[| |] %	Sand (0.05 - 2 mm)	[| |] %
Cobble (64 - 256 mm)	[| |] %	Silt/Clay (< 0.05 mm)	[| |] %
Pebble (4 - 64 mm)	[| |] %		

Habitat Attributes:

Periphyton	N	L	S	M	E
Moss	N	L	S	M	E
Filamentous algae	N	L	S	M	E
Macrophytes	N	L	S	M	E
Bank overhang vegetation	N	L	S	M	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	N	L	S	M	E
Blanketing silt	N	L	S	M	E
Substrate anoxia	N	L	S	M	E

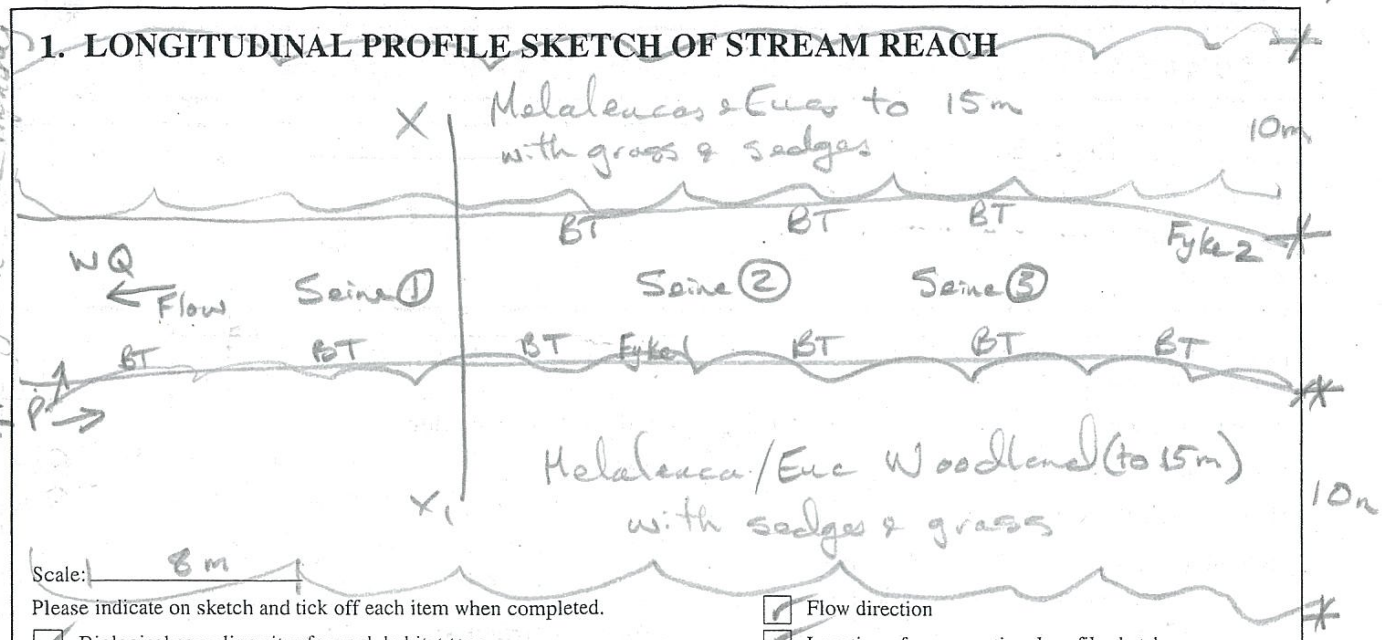
N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

Comments ENTERED TS 11/9/12

DU506400.ai (nr17621) 2/9/2002

TOTAL NO. VIALS: **OTHERS:**

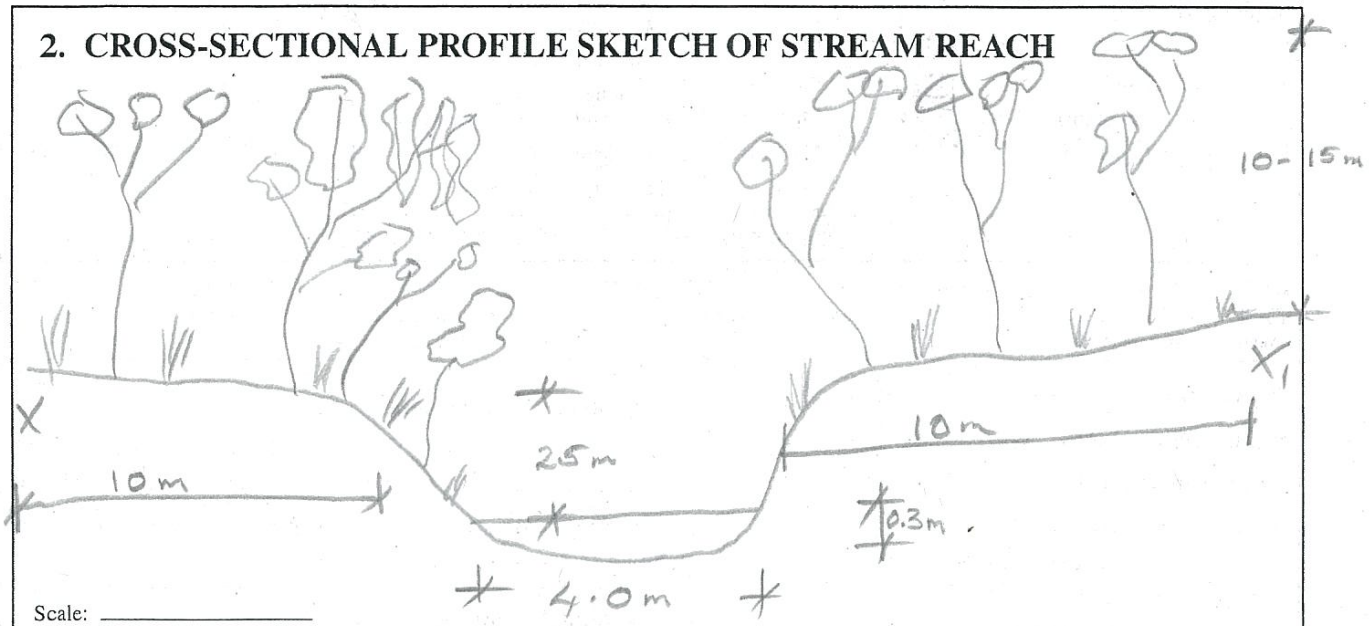
1. LONGITUDINAL PROFILE SKETCH OF STREAM REACH



Please indicate on sketch and tick off each item when completed.

- [x] Biological sampling sites for each habitat type.
- [x] Water quality measurement and water sample collection sites.
- [x] Location from where photograph(s) taken.
- [x] Flow direction
- [x] Location of cross-sectional profile sketch.
- [x] Riparian vegetation (include approx. heights).
- [x] Riparian zone width.

2. CROSS-SECTIONAL PROFILE SKETCH OF STREAM REACH



Scale: _____

Please indicate on sketch and tick off each item when completed.

- [x] Bankfull bank height
- [x] Bankfull stream width
- [x] Stream wetted width
- [x] "Normal" wetted width
- [x] Riparian vegetation height
- [x] Riparian zone width
- [x] Water depth

3. COMMENTS

turbid, shallow sand bottom stream.

ENTERED

(*Office use only*) Entered into AQEIS ___/___/___ by _____ Checked on ___/___/___ by _____

AEF003

WATER QUALITY SAMPLING FIELD SHEET

Queensland Government
Natural Resources and Mines

Site Number [A|L|S| |A|Q|8] Sample Number [ ]
Site Name SUTTOR RIVER
Date [D|7/0|4/2|0|1|2]
Time (24 hrs) [1|3:3|0]
Project Code [ ]
Run Code [ ]
Party [N|D|] [D|Z|] [ ]
Project Name G.C.P
QHSS Analysis No. [ ]
Submitted / Received

A	B	C	D	E	F	G	H	I	J	K	L	M	N

SAMPLING LOCATION: Latitude S 21° 06. 224' Longitude E 147° 44. 855'
Reach orientation (looking downstream): N NE E SE S SW W NW Datum: WGS84

WATER QUALITY

Parameter	Value	Quality	Variable
Conductivity µS/cm@25°C	[|2|1|1|]	[| |]	2010.5
Water Temperature °C	[2|3|•|1|5]	[| |]	2080.5
pH	[|7|•|7|4]	[| |]	2100.5
Dissolved O_2 mg/l	[|6|•|7|4] 80.9%	[| |]	2351.5
Turbidity NTU	[|1|3|3]	[| |]	2030.5
Air Temperature ~ °C	[3|0|•|0]	[| |]	2065.5
Total Alkalinity mg/l $CaCO_3$	[|3|5|•|0]	[| |]	2113.5
Phenol Alkalinity mg/l $CaCO_3$	[ ]	[| |]	2114.5
Transparency (secchi) m	[ ]	[| |]	2046.5
Velocity m/s	[ ]	[| |]	240.0
Gauge Height m	[ ]	[| |]	100.0
Discharge m^3/s	[ ]	[| |]	140.0

Discharge Method: measured (gauged) ☐ obtained from rating curve ☐ estimated: ☐ no flow ☐ trickle ☐ >0.01 cumecs

WEATHER: *Rain in past week:* Yes [ ] No [✓] Comments: .....
Today: Rain NIL Cloud cover LIGHT Wind LIGHT BREEZE
Comments: .....

OBSERVATIONS AT WATER SAMPLING SITE (within 2 metres of sampling point or on closest bank)

Shading: ..... % Water Odour: NIL
Water Surface Condition: (Normal) Slick Scum Foaming Other .....
Algae: On substrate: (N) L S M E In water column: (N) L S M E
Macrophytes: Emergent: (N) L S M E Submerged: (N) L S M E
Floating: (N) L S M E
Impacts: Human N L (S) M E Pastoral animals N (L) S M E Non-pastoral animals N (L) S M E
N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

PERCENT OF HABITAT TYPES IN 100 m REACH:

Riffle (R) [|0] % Run [|0] %
Pool (rocky-K) [|0] % Pool (sandy-S) [1|0|6] %
Dry [|0] % Riffle + Run + Pool + Dry = 100%
Edge [|6|0] %
Edge is % of habitat available to sample from L and R banks

Macrophytes [|0] % in: R 0 % E 0 % K 0 % S 0 % Run 0 %
Algae [|0] % in: R 0 % E 0 % K 0 % S 0 % Run 0 %
Blanketing silt [|2|0] %

COMMENTS: GPS 55K 0577643, 7666189

(Office use only) Entered into Hydsys ___/___/___ by _____ Checked on ___/___/___ by _____
Entered into AQEIS ___/___/___ by _____ Checked on ___/___/___ by _____

DU5IK405.ai (nr17621) 2/9/2002

REACH OBSERVATIONS (of 100 m stream length)

Upstream landuse: 3 LIGHT GRAZING

Adjacent landuse: Left bank: Score 3 Type 4: GRAZING Right bank: Score 3 Type 4: GRAZING

0. Urban/semi-urban, industrial
1. Irrigated cropping, intensive forestry or heavy grazing
2. Non-irrigated cropping, moderate grazing
3. Light grazing, vegetation clearing
4. Natural

Local catchment erosion:	None	(Little)	Some	Moderate	Extensive
Water colour:	Clear	Green	(Opaque)	Tannin	Other .....
Sediment deposits:	None	(Sand)	(Silt)	Other	
Algae: On substrate:	(None)	Little	Some	Moderate	Extensive
In water column:	(None)	Little	Some	Moderate	Extensive
Water odour:	(No)	Yes	Specify		
Substrate odour:	(No)	Yes	Specify		
Water surface:	(Normal)	Slick	Scum	Foaming	Other .....
Variety of habitat: (circle all types)	Shallow	Deep	(Pool)	Run	Riffle
	Undercut bank		LWD	Macrophytes	Other .....

Bars: (bed surface protruding from normal water level and forming a bar) 0 %

Flow level: (relative to 'watermark' i.e. normal inundation level shown by limit of terrestrial grasses, or by eroded area, or boundary in bank sediment types).

(No flow)	Low	Moderate	High	Flood
(dry/isolated)	(<watermark)	(=watermark)	(>watermark)	

RIPARIAN ZONE (to maximum 100 m width)

Width of riparian zone:	Left bank 100 m			Right bank 100 m	
* **Bare ground**	None	(Little)	Some	Moderate	Extensive
* **Grass**	None	Little	(Some)	Moderate	Extensive
* **Shrubs**	None	(Little)	Some	Moderate	Extensive
* **Trees <10 m high**	None	Little	(Some)	Moderate	Extensive
* **Trees >10 m high**	None	Little	Some	(Moderate)	Extensive
Presence of exotic riparian species	None	(Little)	Some	Moderate	Extensive
Width of continuous tree zone from bank:	Left bank >100 m			Right bank >100 m	

None = 0% Little = 1–10% Some = 10–50% Moderate = 50–75% Extensive >75% * Can add to >100%

MACROPHYTES Indicate the presence and abundance of the following common taxa in the 100 m reach:

Native											
Azolla	(N)	L	S	M	E	Water Ribbon (*Triglochin*)	(N)	L	S	M	E
Duckweed	(N)	L	S	M	E	Water Lettuce (*Pistia stratiotes*)	(N)	L	S	M	E
Hornwort (*Ceratophyllum*)	(N)	L	S	M	E	Water Primrose (*Ludwigia*)	(N)	L	S	M	E
Stoneworts (*Chara* or *Nitella*)	(N)	L	S	M	E	Sedge (*Cyperus*)	N	(L)	S	M	E
Hydrilla	(N)	L	S	M	E	Common Rush (*Juncus*)	N	(L)	S	M	E
Water Milfoil (*Myriophyllum*)	(N)	L	S	M	E	Cumbungi (*Typha*)	(N)	L	S	M	E
Pondweeds (*Potamogeton*)	(N)	L	S	M	E	Slender Knotweed (*Persicaria*)	(N)	L	S	M	E
Ribbonweed (*Vallisneria*)	(N)	L	S	M	E	.....	N	L	S	M	E
.....	N	L	S	M	E	.....	N	L	S	M	E
Exotic											
Water Hyacinth (*Eichhornia*)	(N)	L	S	M	E	Alligator Weed (*Alternanthera*)	(N)	L	S	M	E
Salvinia	(N)	L	S	M	E	Elodea	(N)	L	S	M	E
Para Grass (*Urochloa*)	(N)	L	S	M	E	*Egeria*	(N)	L	S	M	E
.....	N	L	S	M	E	.....	N	L	S	M	E

Comments: .....

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

AEF007

River Bioassessment Program

Queensland Government
Natural Resources and Mines

HABITAT ASSESSMENT FIELD SHEET

SITE NUMBER: [A|4|5|1 |A|0|8] **SITE NAME:** Sutton River

Date: 7/4/2012 **Time (24 hrs):** [1|3|3|0] **GPS:** S 21°06.224', E 147°44.855' **Project Name:** GCP

Habitat Variable	CATEGORY			
	Excellent	**Good**	**Fair**	**Poor**
1. Bottom substrate/available cover	Greater than 50% rubble, gravel, submerged logs, undercut banks or other stable habitat. 20, 19, 18, 17, 16	30-50% rubble, gravel or other stable habitat. Adequate habitat. 15, 14, 13, 12, 11	10-30% rubble, gravel or other stable habitat. Habitat availability less than desirable. 10, 9, 8, 7, 6	Less than 10% rubble, gravel or stable habitat. Lack of habitat is obvious. 5, (4), 3, 2, 1, 0
2. Embeddedness	Gravel, cobble and boulder particles are between 0 & 25% surrounded by fine sediment. 20, 19, 18, 17, 16	Gravel, cobble and boulder particles are between 25% & 50% surrounded by fine sediment. 15, 14, 13, 12, 11	Gravel, cobble and boulder particles are between 50 & 75% surrounded by fine sediment. 10, 9, 8, 7, 6	Gravel, cobble and boulder particles are over 75% surrounded by fine sediment. 5, 4, (3), 2, 1, 0
3. Velocity/depth category	Slow deep (<0.3 m/s & >0.5 m); slow shallow; fast deep; fast shallow; habitats all present. 20, 19, 18, 17, 16	Only 3 of the four habitat categories present (missing riffles or runs receive lower score than missing pools). 15, 14, 13, 12, 11	Only two of the four habitat categories present (missing riffles/runs receive lower score). 10, 9, 8, 7, 6	Dominating by one velocity/depth category (usually pool). 5, 4, 3, (2), 1, 0
4. Channel alteration	Little or no enlargement of islands or point bars and/or no channelisation. 15, 14, 13, (12)	Some new increase in bar formation, mostly from coarse gravel; and/or some channelisation present. 11, 10, 9, 8	Moderate deposition of new gravel, coarse sand, on old and new bars; pools partly filled with silt; and/or embankments on both banks. 7, 6, 5, 4	Heavy deposits of fine materials, increased bar development; most pools filled with silt; and/or extensive channelisation. 3, 2, 1, 0
5. Bottom scouring and deposition	Less than 5% of the bottom affected by scouring and deposition. 15, 14, 13, 12	5-30% affected. Scours at constrictions and where grades steepen, some deposition in pools. 11, 10, 9, 8	30-50% affected. Deposits and scours at obstructions and bends. Some deposition in pools. 7, 6, 5, 4	More than 50% of the bottom changing nearly year long. Pools almost absent due to deposition. Only large rocks in riffle exposed. (3), 2, 1, 0

DU5034400RSC_P&S (UM3883) 20/8/98

River Bioassessment Program

HABITAT ASSESSMENT FIELD SHEET cont.

NATURAL RESOURCES Queensland Government

Habitat Variable	CATEGORY			
	Excellent	**Good**	**Fair**	**Poor**
6. Pool/riffle, run/bend ratio. *(Distance between riffles divided by stream width)*	0-7 Variety of habitat. Deep riffles and pools. 15, 14, 13, 12	7-15 Adequate depth in pools and riffles. Bends provide habitat. 11, 10, 9, 8	15-25 Occasional riffle or bend. Bottom contours provide some habitat. 7, 6, 5, 4	>25 Essentially a straight stream. Generally all flat water or shallow riffle. Poor habitat. 3, (2), 1, 0
7. Bank stability	Stable. No evidence of erosion or bank failure. Side slopes generally <30%. Little potential for future problem. 10, 9	Moderately stable. Infrequent, small areas of erosion mostly healed over. Side slopes up to 40% on one bank. Slight potential in extreme floods. (8), 7, 6	Moderately unstable. Moderate frequency and size of erosional areas. Side slopes up to 60% on some banks. High erosion potential during extreme/high flows. 5, 4, 3	Unstable. Many eroded areas. Side slopes > 60% common. 'Raw' areas frequent along straight sections and bends. 2, 1, 0
8. Bank vegetative stability	Over 80% of the streambank surfaces covered by vegetation or boulders and cobble. (10), 9	50-79% of the streambank surfaces covered by vegetation, gravel or larger material. 8, 7, 6	25-49% of the streambank covered by vegetation, gravel or larger material. 5, 4, 3	Less than 25% of the streambank surfaces covered by vegetation, gravel or larger material. 2, 1, 0
9. Streamside cover	Dominant vegetation is of tree form. (10), 9	Dominant vegetation shrub. 8, 7, 6	Dominant vegetation is grass, sedge, ferns. 5, 4, 3	Over 50% of the streambank has no vegetation and dominant material is soil, rock, bridge materials, culverts, or mine tailings. 2, 1, 0

Column Totals	32	8	0	14

Score 54

FRESHWATER BIOLOGICAL RECORD

Page ☐ of ☐

REFERENCE No.

Date operation began (d m y): 7 4 12 — Site No.:

Site name: ALS AQ8 — Stream or dam name: Sutton Creek

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
Seine	1	Mel	spl		38	39	25	26	30
2		Hyp	Com		29				
Seine	2	Mel	spl		43	34	24	26	22
4					34	33	30	28	24
5					21	23	39	32	20
6		Hyp	Com		30	28			
7									
Seine	3	Mel	spl		36	28	34	32	36
9					34	22	26	19	20
10		Barra	Bream		48				
11		Hyp	Com		20	22			
12									
13									
Fyke 1	1	Sp ano	ol		137	134	138		
15		Leo	un						
16									
Fyke 2	2	Leo	un		192	144			
18		sleepy	cod		114				
19		Neo	hyr		111				
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
31 B	1								
32 B	2	Mog	adas		86				
33 B	3	Macrob	acium		(1)				
34 B	4	Macro	brachium		(2)				
+16 35 B	5								
36 B	6								
37 B	7								
+9 38 B	8								
39 B	9	Neo	hyrt		143	83			
40 B	10	Neo	hyrt		91				
41		Chera	sp		(1)				
42		Mog	ads		54				
43									
44									
45									
46									
47									
48									
49									
50									
51									
52									
53									
54									
55									
56									
57									
58									
59									
60									

* Fykes & Bait Traps set at 3.30 pm collected at: 9.00 am

B = Bait trap
S = total

No EF due to high turbidity.

FRESHWATER BIOLOGICAL RECORD

Page ☐ of ☐

REFERENCE No.

Date operation began d m y

Site No.

Site name

Stream or dam name

Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
31								
32								
33								
34								
35								
36								
37								
38								
39								
40								
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42								
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AEF002

MACROINVERTEBRATE SAMPLING FIELD SHEET

Queensland Government
Natural Resources and Mines

Site Number [A E 1 5 | A Q 1 7] Sample Number [| | | | | | | | | | | | | |]
Site Name BOWEN RIVER AT WEIR (U/S) NEAR COLLINSVILLE.
Project Code [| | | | | |] Date [0 1 7 / 0 1 4 / 2 0 1 2] Time (24 hrs) [0 8 : 3 0]
Run Code [| | | | | |] Project Name

EDGE/BACKWATER: Y [✓] N [ ] Collected by: [M D] Picked By: [M D] No. vials: [1] QAQC Residue: Y [ ] N [ ]
(average over 10 m sampled)

Velocity (m/sec): max [0 · 1 0] min [0 · 0 0]
Mean Sample Depth: [0 · 1 3] m
Mean Wetted Width: [1 2 0 · 0] m
Method: 10 m sweep [✓]
30 minutes random live-pick [✓]
Other _____ [ ]
Canopy Cover: [1 5] % Densiometer: [ ] %
Shading: [1 5] %

Snags and LWD:

Detritus (leaves, twigs)	N	(L)	S	M	E
Sticks (<2cm diam)	N	L	(S)	M	E
Branches (<15cm diam)	N	L	(S)	M	E
Logs (>15cm diam)	N	(L)	S	M	E

Substrate Description:

Bedrock	[ ]	0	%	Gravel (2 - 4 mm)	[5] %
Boulder (> 256 mm)	[ ]	0	%	Sand (0.05 - 2 mm)	[45] %
Cobble (64 - 256 mm)	[ ]	0	%	Silt/Clay (< 0.05 mm)	[50] %
Pebble (4 - 64 mm)	[ ]	0	%		

Habitat Attributes:

Periphyton	N	(L)	S	M	E
Moss	(N)	L	S	M	E
Filamentous algae	(N)	L	S	M	E
Macrophytes	N	(L)	S	M	E
Bank overhang vegetation	N	L	S	(M)	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	N	(L)	S	M	E
Blanketing silt	N	(L)	S	M	E
Substrate anoxia	(N)	L	S	M	E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

BED: Y [ ] N [ ] Collected by: [| |] Picked By: [| |] No. vials: [ ] QAQC Residue: Y [ ] N [ ]
TYPE: Riffle [ ] Run [ ] Pool (rocky/gravel) [ ] Pool (sandy/silty) [ ]
(average over 10 m sampled)

Velocity (m/sec): max [| · | |] min [| · | |]
Mean Sample Depth: [| · | |] m
Mean Wetted Width: [| | | · |] m
Method: 10 m kick only [ ]
10 m kick & gleaning rocks of different sizes (5) [ ]
—— minutes random live-pick [ ]
Other _____ [ ]
Canopy Cover: [| |] % Densiometer: [| |] %
Shading: [| |] %

Snags and LWD:

Detritus (leaves, twigs)	N	L	S	M	E
Sticks (<2cm diam)	N	L	S	M	E
Branches (<15cm diam)	N	L	S	M	E
Logs (>15cm diam)	N	L	S	M	E

Substrate Description:

Bedrock	[		] %	Gravel (2 - 4 mm)	[·		] %
Boulder (> 256 mm)	[		] %	Sand (0.05 - 2 mm)	[		] %
Cobble (64 - 256 mm)	[		] %	Silt/Clay (< 0.05 mm)	[		] %
Pebble (4 - 64 mm)	[		] %				

Habitat Attributes:

Periphyton	N	L	S	M	E
Moss	N	L	S	M	E
Filamentous algae	N	L	S	M	E
Macrophytes	N	L	S	M	E
Bank overhang vegetation	N	L	S	M	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	N	L	S	M	E
Blanketing silt	N	L	S	M	E
Substrate anoxia	N	L	S	M	E

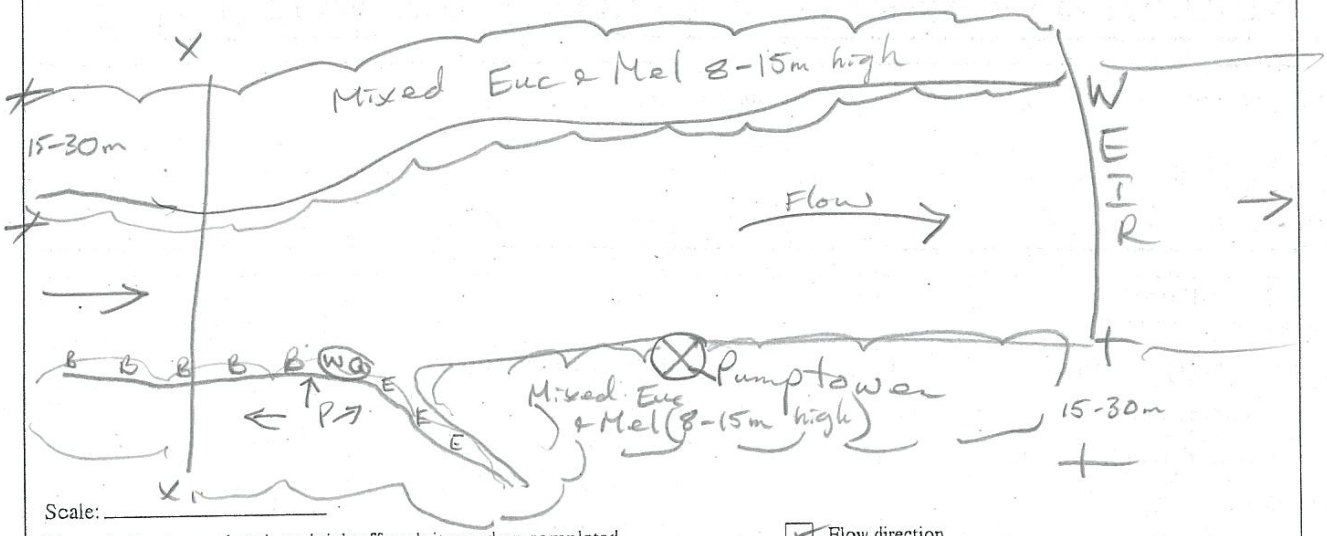
N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

Comments ENTERED KS 11/9/12

TOTAL NO. VIALS: OTHERS:

DNRM4190.ai (m17621) 2/9/2002

1. LONGITUDINAL PROFILE SKETCH OF STREAM REACH

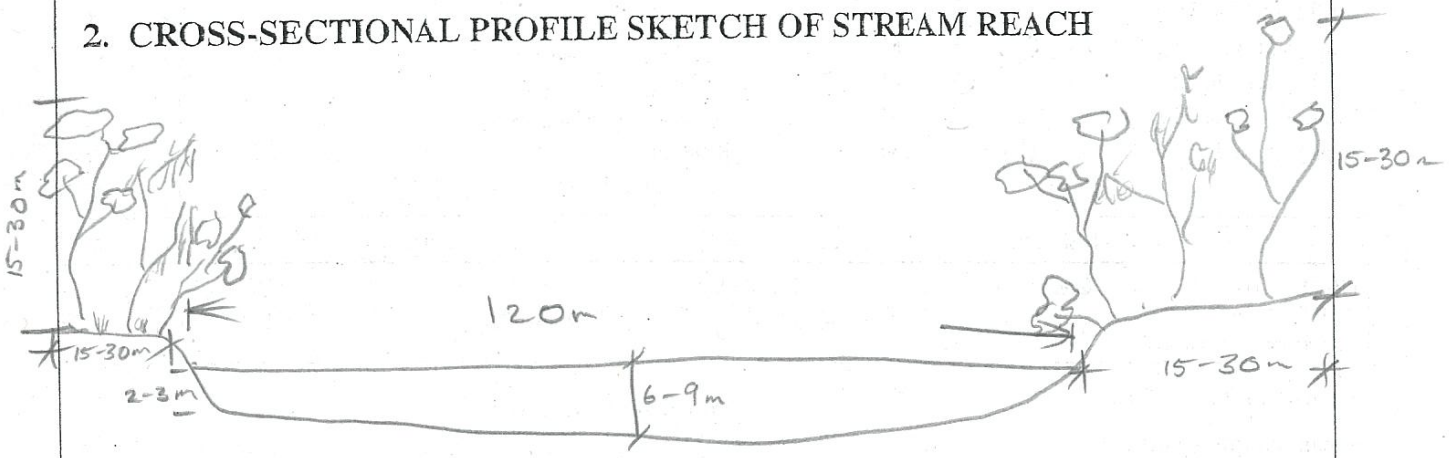


Scale: _____

Please indicate on sketch and tick off each item when completed.

- [x] Biological sampling sites for each habitat type.
- [x] Water quality measurement and water sample collection sites.
- [x] Location from where photograph(s) taken.
- [x] Flow direction
- [x] Location of cross-sectional profile sketch.
- [x] Riparian vegetation (include approx. heights).
- [x] Riparian zone width.

2. CROSS-SECTIONAL PROFILE SKETCH OF STREAM REACH



Scale: _____

Please indicate on sketch and tick off each item when completed.

- [x] Bankfull bank height
- [x] Bankfull stream width
- [x] Stream wetted width
- [x] "Normal" wetted width
- [x] Riparian vegetation height
- [x] Riparian zone width
- [x] Water depth

3. COMMENTS

Sampled above ^ Weir due to no public access at E3 AQ7, or ALS AQ7, or good launching sites @ Strathmore Crossing or at Bridge

(*Office use only*) Entered into AQEIS ___/___/___ by _____ Checked on ___/___/___ by _____

AEF003

Queensland Government
Natural Resources and Mines

WATER QUALITY SAMPLING FIELD SHEET

Site Number [A|6|5|1|A|0|7] Sample Number [ ]
Site Name Bowen River (Wash)
Date [0|7/0|4/2|0|1|2] Project Name GCP
Time (24 hrs) [0|8:3|0] QHSS Analysis No. [ ]
Project Code [ ]
Run Code [ ] Submitted / Received

A	B	C	D	E	F	G	H	I	J	K	L	M	N

Party [M|D|] [| |] [D|H]

SAMPLING LOCATION: Latitude S 20° 44.423 Longitude E 147° 57.054
Reach orientation (looking downstream): N NE E SE S SW W NW Datum:

WATER QUALITY

Parameter	Value	Quality	Variable
Conductivity µS/cm@25°C	[| 14|0|1]	[| |]	2010.5
Water Temperature °C	[2|4|.|9]5	[| |]	2080.5
pH	[|8|.|6]1	[| |]	2100.5
Dissolved O_2 mg/l	[|7|.|3]4 88.3 %	[| |]	2351.5
Turbidity NTU	[9|.|8|6]	[| |]	2030.5
~~Air Temperature~~ °C	[ ]	[| |]	2065.5
Total Alkalinity mg/l $CaCO_3$	[1|0|0|.|0]	[| |]	2113.5
Phenol Alkalinity mg/l $CaCO_3$	[ ]	[| |]	2114.5
Transparency (secchi) m	[ ]	[| |]	2046.5
Velocity m/s	[ ]	[| |]	240.0
Gauge Height m	[ ]	[| |]	100.0
Discharge m^3/s	[ ]	[| |]	140.0

Discharge Method: measured (gauged) ☐ obtained from rating curve ☐ estimated: ☐ no flow ☐ trickle ☐ >0.01 cumecs

WEATHER: *Rain in past week:* Yes [ ] No [✓] Comments: .....
Today: Rain NO ..... Cloud cover NIL ..... Wind NIL .....
Comments: .....

OBSERVATIONS AT WATER SAMPLING SITE (within 2 metres of sampling point or on closest bank)

Shading: 5 % Water Odour: None
Water Surface Condition: (Normal) Slick Scum Foaming Other .....
Algae: On substrate: (N) L S M E In water column: (N) L S M E
Macrophytes: Emergent: N (L) S M E Submerged: (N) L S M E
Floating: (N) L S M E
Impacts: Human N L S (M) E Pastoral animals N L (S) M E Non-pastoral animals N L S (M) E P.90

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

PERCENT OF HABITAT TYPES IN 100 m REACH:

Riffle (R) [| |0] % Run [| |0] %
Pool (rocky-K) [1|0|0] % Pool (sandy-S) [| |0] %
Dry [| |0] % Riffle + Run + Pool + Dry = 100%
Edge [|5|5] %
Edge is % of habitat available to sample from L and R banks

Macrophytes [|1|0] % in: R 0 % E 100 %
K 0 % S 0 % Run 0 %
Algae [| |0] % in: R ..... % E ..... %
K ..... % S ..... % Run ..... %
Blanketing silt [|1|5] %

COMMENTS: GPS SSK 0598999, 7706294

(*Office use only*) Entered into Hydsys ___/___/___ by _____ Checked on ___/___/___ by _____
Entered into AQEIS ___/___/___ by _____ Checked on ___/___/___ by _____

REACH OBSERVATIONS (of 100 m stream length)

Upstream landuse: LIGHT GRAZING

Adjacent landuse: Left bank: Score 3 Type L.GRAZING Right bank: Score 3 Type L.GRAZING

0. Urban/semi-urban, industrial
1. Irrigated cropping, intensive forestry or heavy grazing
2. Non-irrigated cropping, moderate grazing
3. Light grazing, vegetation clearing
4. Natural

Local catchment erosion:	None	(Little)	Some	Moderate	Extensive
Water colour:	(Clear)	Green	Opaque	Tannin	Other
Sediment deposits:	(None)	Sand	Silt	Other	
Algae: On substrate:	(None)	Little	Some	Moderate	Extensive
In water column:	(None)	Little	Some	Moderate	Extensive
Water odour:	(No)	Yes	Specify		
Substrate odour:	(No)	Yes	Specify		
Water surface:	(Normal)	Slick	Scum	Foaming	Other
Variety of habitat:	Shallow	(Deep)	(Pool)	Run	Riffle
(circle all types)	(Undercut bank)		(LWD)	Macrophytes	Other

Bars: (bed surface protruding from normal water level and forming a bar) ..... %

Flow level: (relative to 'watermark' i.e. normal inundation level shown by limit of terrestrial grasses, or by eroded area, or boundary in bank sediment types).

No flow	(Low)	Moderate	High	Flood
(dry/isolated)	(<watermark)	(=watermark)	(>watermark)	

RIPARIAN ZONE (to maximum 100 m width)

Width of riparian zone: Left bank 100 m Right bank 100 m

* Bare ground	None	(Little)	Some	Moderate	Extensive
* Grass	None	(Little)	Some	Moderate	Extensive
* Shrubs	None	(Little)	Some	Moderate	Extensive
* Trees <10 m high	None	Little	(Some)	Moderate	Extensive
* Trees >10 m high	None	Little	Some	(Moderate)	Extensive
Presence of exotic riparian species	None	(Little)	Some	Moderate	Extensive
Width of continuous tree zone from bank:	Left bank 100 m			Right bank 100 m	

None = 0% Little = 1–10% Some = 10–50% Moderate = 50–75% Extensive >75% * Can add to >100%

MACROPHYTES Indicate the presence and abundance of the following common taxa in the 100 m reach:

Native											
Azolla	(N)	L	S	M	E	Water Ribbon (*Triglochin*)	(N)	L	S	M	E
Duckweed	(N)	L	S	M	E	Water Lettuce (*Pistia stratiotes*)	(N)	L	S	M	E
Hornwort (*Ceratophyllum*)	(N)	L	S	M	E	Water Primrose (*Ludwigia*)	(N)	L	S	M	E
Stoneworts (*Chara* or *Nitella*)	(N)	L	S	M	E	Sedge (*Cyperus*)	(N)	L	S	M	E
Hydrilla	(N)	L	S	M	E	Common Rush (*Juncus*)	(N)	L	S	M	E
Water Milfoil (*Myriophyllum*)	(N)	L	S	M	E	Cumbungi (*Typha*)	(N)	L	S	M	E
Pondweeds (*Potamogeton*)	(N)	L	S	M	E	Slender Knotweed (*Persicaria*)	N	(L)	S	M	E
Ribbonweed (*Vallisneria*)	(N)	L	S	M	E	.....	N	L	S	M	E
.....	(N)	L	S	M	E	.....	N	L	S	M	E
Exotic											
Water Hyacinth (*Eichhornia*)	(N)	L	S	M	E	Alligator Weed (*Alternanthera*)	(N)	L	S	M	E
Salvinia	(N)	L	S	M	E	Elodea	(N)	L	S	M	E
Para Grass (*Urochloa*)	(N)	L	S	M	E	*Egeria*	(N)	L	S	M	E
.....	(N)	L	S	M	E	.....	(N)	L	S	M	E

Comments:

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

AEF007

River Bioassessment Program

HABITAT ASSESSMENT FIELD SHEET

Queensland Government
Natural Resources and Mines

SITE NUMBER: [A1L5I 1A1Q17] SITE NAME: Bowen River at Weir

Date: 07/04/2012 Time (24 hrs): [0 8 1 3 1 0] GPS: S 20°40.423 E 147°57.054 Project Name: GCP

Habitat Variable	CATEGORY			
	Excellent	Good	Fair	Poor
1. Bottom substrate/available cover ESTIMATED AS IT IS A WEIR POOL.	Greater than 50% rubble, gravel, submerged logs, undercut banks or other stable habitat. 20, 19, 18, 17, 16	30-50% rubble, gravel or other stable habitat. Adequate habitat. 15, 14, 13, 12, 11	10-30% rubble, gravel or other stable habitat. Habitat availability less than desirable. (10), 9, 8, 7, 6	Less than 10% rubble, gravel or stable habitat. Lack of habitat is obvious. 5, 4, 3, 2, 1, 0
2. Embeddedness	Gravel, cobble and boulder particles are between 0 & 25% surrounded by fine sediment. 20, 19, 18, 17, 16	Gravel, cobble and boulder particles are between 25% & 50% surrounded by fine sediment. 15, 14, 13, 12, 11	Gravel, cobble and boulder particles are between 50 & 75% surrounded by fine sediment. 10, 9, 8, 7, 6	Gravel, cobble and boulder particles are over 75% surrounded by fine sediment. (5), 4, 3, 2, 1, 0
3. Velocity/depth category	Slow deep (<0.3 m/s & >0.5 m); slow shallow; fast deep; fast shallow; habitats all present. 20, 19, 18, 17, 16	Only 3 of the four habitat categories present (missing riffles or runs receive lower score than missing pools). 15, 14, 13, 12, 11	Only two of the four habitat categories present (missing riffles/runs receive lower score). 10, 9, 8, 7, 6	Dominating by one velocity/depth category (usually pool). 5, 4, (3), 2, 1, 0
4. Channel alteration NO BARS AS IT IS A WEIR POOL	Little or no enlargement of islands or point bars and/or no channelisation. 15, 14, 13, (12)	Some new increase in bar formation, mostly from coarse gravel; and/or some channelisation present. 11, 10, 9, 8	Moderate deposition of new gravel, coarse sand, on old and new bars; pools partly filled with silt; and/or embankments on both banks. 7, 6, 5, 4	Heavy deposits of fine materials, increased bar development; most pools filled with silt; and/or extensive channelisation. 3, 2, 1, 0
5. Bottom scouring and deposition	Less than 5% of the bottom affected by scouring and deposition. 15, 14, 13, 12	5-30% affected. Scours at constrictions and where grades steepen, some deposition in pools. 11, 10, 9, 8	30-50% affected. Deposits and scours at obstructions and bends. Some deposition in pools. (7), 6, 5, 4	More than 50% of the bottom changing nearly year long. Pools almost absent due to deposition. Only large rocks in riffle exposed. 3, 2, 1, 0

DUSD3400RSC.765 (UA3883) 20/8/98

River Bioassessment Program

HABITAT ASSESSMENT FIELD SHEET cont.

NATURAL RESOURCES Queensland Government

Habitat Variable	CATEGORY			
	Excellent	**Good**	**Fair**	**Poor**
6. Pool/riffle, run/bend ratio. *(Distance between riffles divided by stream width)*	0-7 Variety of habitat. Deep riffles and pools. 15, 14, 13, 12	7-15 Adequate depth in pools and riffles. Bends provide habitat. 11, 10, 9, 8	15-25 Occasional riffle or bend. Bottom contours provide some habitat. 7, 6, 5, 4	>25 Essentially a straight stream. Generally all flat water or shallow riffle. Poor habitat. (3) 2, 1, 0
7. Bank stability	Stable. No evidence of erosion or bank failure. Side slopes generally <30%. Little potential for future problem. 10 (9)	Moderately stable. Infrequent, small areas of erosion mostly healed over. Side slopes up to 40% on one bank. Slight potential in extreme floods. 8, 7, 6	Moderately unstable. Moderate frequency and size of erosional areas. Side slopes up to 60% on some banks. High erosion potential during extreme/high flows. 5, 4, 3	Unstable. Many eroded areas. Side slopes > 60% common. 'Raw' areas frequent along straight sections and bends. 2, 1, 0
8. Bank vegetative stability	Over 80% of the streambank surfaces covered by vegetation or boulders and cobble. (10) 9	50-79% of the streambank surfaces covered by vegetation, gravel or larger material. 8, 7, 6	25-49% of the streambank covered by vegetation, gravel or larger material. 5, 4, 3	Less than 25% of the streambank surfaces covered by vegetation, gravel or larger material. 2, 1, 0
9. Streamside cover	Dominant vegetation is of tree form. (10) 9	Dominant vegetation shrub. 8, 7, 6	Dominant vegetation is grass, sedge, ferns. 5, 4, 3	Over 50% of the streambank has no vegetation and dominant material is soil, rock, bridge materials, culverts, or mine tailings. 2, 1, 0

Column Totals	41		17	11

Score	69

FRESHWATER BIOLOGICAL RECORD

REFERENCE No.

Date operation began: d 7 m 5 y 12 — Site No.

Site name: AH AQ 7

Stream or dam name: Bowen River (above Weir)

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
1	EF1	BONY	BREAM	5	336	285	290	286	295
2	EF2	RAINBOW	FISH	1	55				
3		BONY	BREAM	5	277	292	284	306	227
4	EF3	BONY	BREAM	2	288	286			
5	EF4	SLEEPY	COD	3	343	361	137		
6		BONY	BREAM	4	299	237	107	253	
7		RAINBOW			47	39			
8	EF5	BONY	BREAM	4	271	303	257	319	
9		SLEEPY	COD	3	419	308	393		
10	EF6	SLEEPY	COD	3	227	98	231		
11		RAINBOW		1	53				
12	EF7	NEO	ATTA	1	428				
13		SLEEPY	COD	1	376				
14		BONY	BREAM	1	181				
15		EEL		1	430				
16	EF8	BONY	BREAM	3	262	304	285		
17		AR 1	GRA	2	309	244			
18	EF9	BONY	BREAM	10					
19		EEL		1					
20	EF10	BONY	BREAM	2					
21	EF11	RAINBOW	FISH	2	67	89			
22		BONY	BREAM	1	321				
23	EF12	BONY	BREAM	2	349	52			
24									
25									
26									
27									
28									
29									
30									

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
31	BT 1	MAY	COM	4	21	23	18	22	
32	BT 2-10	NO	FISH						
33									
34									
35									
36									
37									
38									
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55									
56									
57									
58									
59									
60									

ALL FISH MEASURED AT TOTAL LENGTH.

EF EFFORT 12 x 90 SEC ACROSS EDGE, OPEN WATER + SNAG.

Bait traps: in 8.15 out 11.45

FRESHWATER BIOLOGICAL RECORD

REFERENCE No.

Date operation began d m y

Site No.

Site name

Stream or dam name

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
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22									
23									
24									
25									
26									
27									
28									
29									
30									

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
31									
32									
33									
34									
35									
36									
37									
38									
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60									

AEF002

MACROINVERTEBRATE SAMPLING FIELD SHEET

Queensland Government
Natural Resources and Mines

Site Number [A|L|S| |A|Q|6] **Sample Number** [| | | | | | | | | | | | | |]
Site Name PELICAN CREEK @ MYUNA RD
Project Code [| | | | | |] **Date** [0|6/0|4/2|0|1|2] **Time** (24 hrs) [0|7:3|0]
Run Code [| | | | | |] **Project Name** G.C.P.

EDGE/~~BACKWATER~~: Y [✓] N [ ] Collected by: [M|D|] Picked By: [M|D|] No. vials: [1] QAQC Residue: Y [ ] N [ ]
(average over 10 m sampled)

Velocity (m/sec): max [0|.|1|0] min [0|.|0|]
Mean Sample Depth: [0|.|2|0] m
Mean Wetted Width: [| |6|.|0] m
Method: 10 m sweep [✓]
30 minutes random live-pick [✓]
Other _____ [ ]
Canopy Cover: [|7|0] % **Densiometer:** [| |] %
Shading: [|7|0] %

Snags and LWD:

Detritus (leaves, twigs)	N	L	**S**	M	E
Sticks (<2cm diam)	N	L	**S**	M	E
Branches (<15cm diam)	N	**L**	S	M	E
Logs (>15cm diam)	N	**L**	S	M	E

Substrate Description:

Bedrock	[|0] %	Gravel (2 - 4 mm)	[2|5] %
Boulder (> 256 mm)	[|0] %	Sand (0.05 - 2 mm)	[3|0] %
Cobble (64 - 256 mm)	[1|0] %	Silt/Clay (< 0.05 mm)	[|5] %
Pebble (4 - 64 mm)	[3|0] %		

Habitat Attributes:

Periphyton	N	**L**	S	M	E
Moss	**N**	L	S	M	E
Filamentous algae	N	**L**	S	M	E
Macrophytes	N	**L**	S	M	E
Bank overhang vegetation	N	**L**	S	M	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	N	**L**	S	M	E
Blanketing silt	N	**L**	S	M	E
Substrate anoxia	**N**	L	S	M	E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

Riffle

BED: Y [✓] N [ ] Collected by: [M|D|] Picked By: [D|I|] No. vials: [1] QAQC Residue: Y [ ] N [ ]
TYPE: Riffle [✓] Run [ ] Pool (rocky/gravel) [ ] Pool (sandy/silty) [ ]
(average over 10 m sampled)

Velocity (m/sec): max [0|.|5|] min [0|.|3|]
Mean Sample Depth: [0|.|4|] m
Mean Wetted Width: [|8|.|0] m
Method: 10 m kick only [✓]
10 m kick & gleaning rocks of different sizes (5) [ ]
30 minutes random live-pick [✓]
Other _____ [ ]
Canopy Cover: [|7|0] % **Densiometer:** [| |] %
Shading: [|7|0] %

Snags and LWD:

Detritus (leaves, twigs)	N	**L**	S	M	E
Sticks (<2cm diam)	N	**L**	S	M	E
Branches (<15cm diam)	N	**L**	S	M	E
Logs (>15cm diam)	N	**L**	S	M	E

Substrate Description:

Bedrock	[|2] %	Gravel (2 - 4 mm)	[3|0] %
Boulder (> 256 mm)	[|3] %	Sand (0.05 - 2 mm)	[|3] %
Cobble (64 - 256 mm)	[3|0] %	Silt/Clay (< 0.05 mm)	[|2] %
Pebble (4 - 64 mm)	[3|0] %		

Habitat Attributes:

Periphyton	**N**	L	S	M	E
Moss	**N**	L	S	M	E
Filamentous algae	N	**L**	S	M	E
Macrophytes	N	**L**	S	M	E
Bank overhang vegetation	N	**L**	S	M	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	N	**L**	S	M	E
Blanketing silt	**N**	L	S	M	E
Substrate anoxia	**N**	L	S	M	E

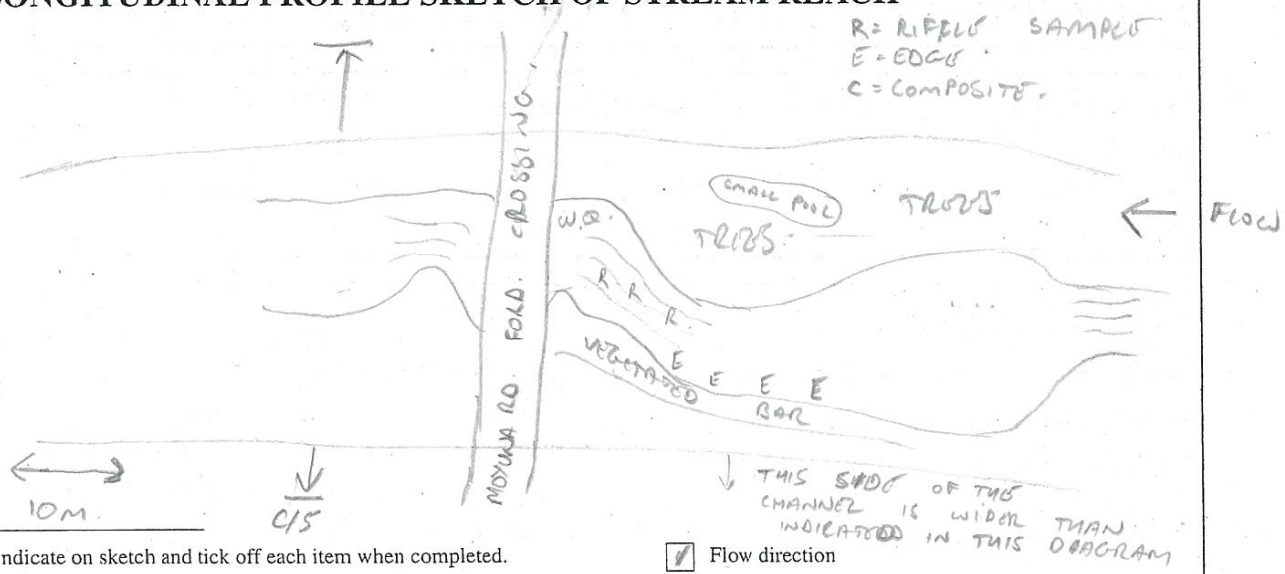
N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

Comments ENTERED 15 12/19/12

TOTAL NO. VIALS: OTHERS:

DU506400.ai (nr17621) 2/9/2002

1. LONGITUDINAL PROFILE SKETCH OF STREAM REACH

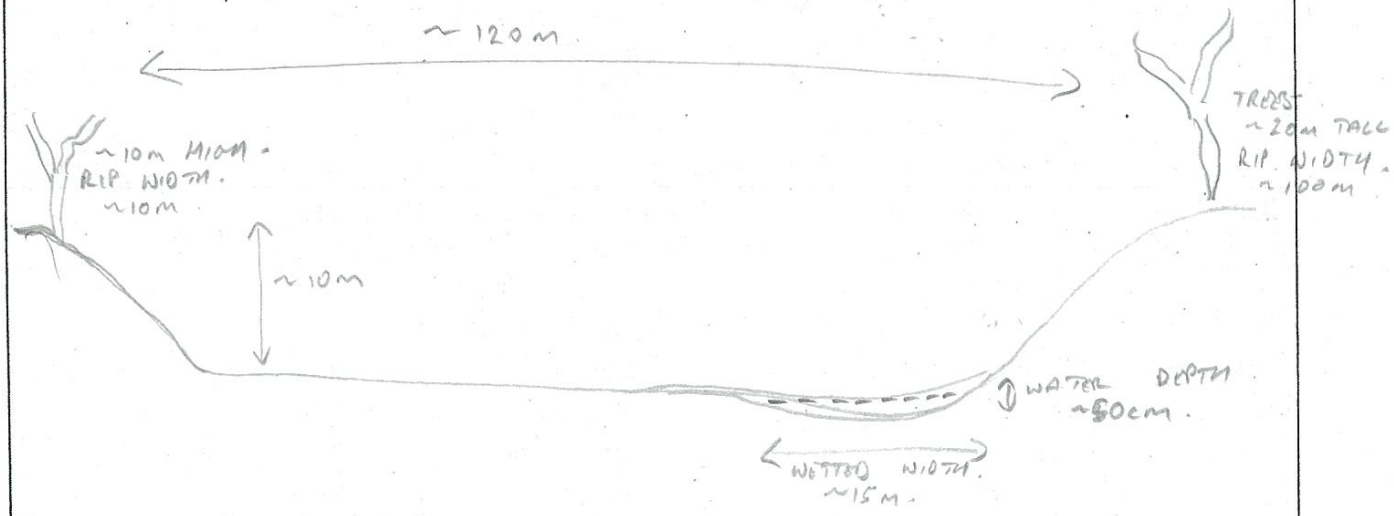


Scale: 10M

Please indicate on sketch and tick off each item when completed.

- [ ] Biological sampling sites for each habitat type.
- [x] Water quality measurement and water sample collection sites.
- [ ] Location from where photograph(s) taken.
- [x] Flow direction
- [ ] Location of cross-sectional profile sketch.
- [ ] Riparian vegetation (include approx. heights).
- [ ] Riparian zone width.

2. CROSS-SECTIONAL PROFILE SKETCH OF STREAM REACH



Scale: _____

Please indicate on sketch and tick off each item when completed.

- [x] Bankfull bank height
- [x] Bankfull stream width
- [x] Stream wetted width
- [x] "Normal" wetted width
- [x] Riparian vegetation height
- [x] Riparian zone width
- [ ] Water depth

3. COMMENTS

CREEK CHANNEL IS VERY WIDE DURING HIGH FLOW. VEGETATION + BARS PRESENT IN HIGH FLOW AREA WHERE DEPOSITION + EROSION OCCURS DURING EVENTS. LOW FLOW CHANNEL ON RIGHT BANK, APPEARS STABLE BASED ON VEGETATION.

(*Office use only*) Entered into AQEIS ___/___/___ · by _____ Checked on ___/___/___ by _____

AEF003

WATER QUALITY SAMPLING FIELD SHEET

Queensland Government
Natural Resources and Mines

Site Number [A|L|S|1|A|Q|6] Sample Number [ ]
Site Name Pelican CK
Date [0|6|0|4|2|0|1|2] Project Name GCP
Time (24 hrs) [17:53] QHSS Analysis No. [ ]
Project Code [ ]
Run Code [ ] Submitted
Party [M|D] [D|I] [ ] Received

A	B	C	D	E	F	G	H	I	J	K	L	M	N

SAMPLING LOCATION: Latitude S 20° 35.914' Longitude E 147° 45.391'
Reach orientation (looking downstream): N NE E SE S SW W NW Datum:

WATER QUALITY

Parameter	Value	Quality	Variable
Conductivity µS/cm@25°C	[1628]	[ ]	2010.5
Water Temperature °C	[24.09]	[ ]	2080.5
pH	[8.0]	[ ]	2100.5
Dissolved O_2 mg/l	[6.58] 78.7%	[ ]	2351.5
Turbidity NTU	[4-78]	[ ]	2030.5
Air Temperature °C	[ ]	[ ]	2065.5
Total Alkalinity mg/l $CaCO_3$	[250.0]	[ ]	2113.5
Phenol Alkalinity mg/l $CaCO_3$	[ ]	[ ]	2114.5
Transparency (secchi) m	[ ]	[ ]	2046.5
Velocity m/s	[ ]	[ ]	240.0
Gauge Height m	[ ]	[ ]	100.0
Discharge m^3/s	[ ]	[ ]	140.0

Discharge Method: measured (gauged) ☐ obtained from rating curve ☐ estimated: ☐ no flow ☐ trickle ☐ >0.01 cumecs

WEATHER: *Rain in past week:* Yes [ ] No [✓] Comments: .....

Today: Rain N/L Cloud cover N/L Wind N/L
Comments: CLEAR & SUNNY

OBSERVATIONS AT WATER SAMPLING SITE (within 2 metres of sampling point or on closest bank)

Shading: 0 % Water Odour: N/L

Water Surface Condition: (Normal) Slick Scum Foaming Other .....

Algae: On substrate: N (L) S M E In water column: (N) L S M E
Macrophytes: Emergent: (N) L S M E Submerged: (N) L S M E
Floating: (N) L S M E

Impacts: Human N L S (M) E Pastoral animals (N) L S M E Non-pastoral animals (N) L S M E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

PERCENT OF HABITAT TYPES IN 100 m REACH:

Riffle (R) [25] % Run [10] %
Pool (rocky-K) [15] % Pool (sandy-S) [25] %
Dry [25] % Riffle + Run + Pool + Dry = 100%
Edge [40] %
Edge is % of habitat available to sample from L and R banks

Macrophytes [5] % in: R 50 % E 50 %
K ..... % S ..... % Run ..... %
Algae [5] % in: R 25 % E 25 %
K 25 % S ..... % Run 25 %
Blanketing silt [ ] %

COMMENTS: SSK 0578835 / 7722096

(*Office use only*) Entered into Hydsys ___/___/___ by ___ Checked on ___/___/___ by ___
Entered into AQEIS ___/___/___ by ___ Checked on ___/___/___ by ___

DUSIK6405.ai (nr17621) 2/9/2002

REACH OBSERVATIONS (of 100 m stream length)

Upstream landuse: L. GRAZING + COAL MINES

Adjacent landuse: Left bank: Score 3 Type L. GRAZING Right bank: Score 3 Type L. GRAZING

0. Urban/semi-urban, industrial
1. Irrigated cropping, intensive forestry or heavy grazing
2. Non-irrigated cropping, moderate grazing
3. Light grazing, vegetation clearing
4. Natural

Local catchment erosion:	None	(Little)	Some	Moderate	Extensive
Water colour:	(Clear)	Green	Opaque	Tannin	Other .....
Sediment deposits:	None	Sand	Silt	Other	
Algae: On substrate:	None	(Little)	Some	Moderate	Extensive
In water column:	(None)	Little	Some	Moderate	Extensive
Water odour:	(No)	Yes	Specify		
Substrate odour:	(No)	Yes	Specify		
Water surface:	(Normal)	Slick	Scum	Foaming	Other .....
Variety of habitat: (circle all types)	(Shallow)	(Deep)	(Pool)	(Run)	(Riffle)
	(Undercut bank)		LWD	Macrophytes	Other .....

Bars: (bed surface protruding from normal water level and forming a bar) ..... 0 %

Flow level: (relative to 'watermark' i.e. normal inundation level shown by limit of terrestrial grasses, or by eroded area, or boundary in bank sediment types).

No flow	Low	Moderate	High	Flood
(dry/isolated)	(<watermark)	(=watermark)	(>watermark)	

RIPARIAN ZONE (to maximum 100 m width)

Width of riparian zone: Left bank 15 m Right bank 100 m

* **Bare ground**	None	Little	(Some)	Moderate	Extensive
* **Grass**	None	Little	(Some)	Moderate	Extensive
* **Shrubs**	None	Little	(Some)	Moderate	Extensive
* **Trees <10 m high**	None	(Little)	Some	Moderate	Extensive
* **Trees >10 m high**	None	Little	(Some)	Moderate	Extensive
Presence of exotic riparian species	None	Little	(Some)	Moderate	Extensive

Width of continuous tree zone from bank: Left bank 10 m Right bank 100 m

None = 0% Little = 1–10% Some = 10–50% Moderate = 50–75% Extensive >75% * Can add to >100%

MACROPHYTES Indicate the presence and abundance of the following common taxa in the 100 m reach:

Native

Azolla	(N)	L	S	M	E	Water Ribbon (*Triglochin*)	(N)	L	S	M	E
Duckweed	(N)	L	S	M	E	Water Lettuce (*Pistia stratiotes*)	(N)	L	S	M	E
Hornwort (*Ceratophyllum*)	(N)	L	S	M	E	Water Primrose (*Ludwigia*)	(N)	L	S	M	E
Stoneworts (*Chara* or *Nitella*)	(N)	L	S	M	E	Sedge (*Cyperus*)	N	(L)	S	M	E
Hydrilla	(N)	L	S	M	E	Common Rush (*Juncus*)	(N)	L	S	M	E
Water Milfoil (*Myriophyllum*)	N	(L)	S	M	E	Cumbungi (*Typha*)	(N)	L	S	M	E
Pondweeds (*Potamogeton*)	(N)	L	S	M	E	Slender Knotweed (*Persicaria*)	(N)	L	S	M	E
Ribbonweed (*Vallisneria*)	(N)	L	S	M	E	.....	N	L	S	M	E
.....	N	L	S	M	E	.....	N	L	S	M	E

Exotic

Water Hyacinth (*Eichhornia*)	(N)	L	S	M	E	Alligator Weed (*Alternanthera*)	(N)	L	S	M	E
Salvinia	(N)	L	S	M	E	Elodea	(N)	L	S	M	E
Para Grass (*Urochloa*)	(N)	L	S	M	E	*Egeria*	(N)	L	S	M	E
.....	N	L	S	M	E	.....	N	L	S	M	E

Comments: .....

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

AEF007

River Bioassessment Program

Queensland Government
Natural Resources and Mines

HABITAT ASSESSMENT FIELD SHEET

SITE NUMBER: [A IL I S I I A I Q I 6] **SITE NAME:** PELICAN CREEK @ MOUNA RD.

Date: 6 / 4 / 12 **Time (24 hrs):** [ ] **GPS:** _____ **Project Name:** G.C.P

Habitat Variable	CATEGORY			
	Excellent	**Good**	**Fair**	**Poor**
1. Bottom substrate/available cover	Greater than 50% rubble, gravel, submerged logs, undercut banks or other stable habitat.	30-50% rubble, gravel or other stable habitat. Adequate habitat.	10-30% rubble, gravel or other stable habitat. Habitat availability less than desirable.	Less than 10% rubble, gravel or stable habitat. Lack of habitat is obvious.
	(20) 19, 18, 17, 16	15, 14, 13, 12, 11	10, 9, 8, 7, 6	5, 4, 3, 2, 1, 0
2. Embeddedness	Gravel, cobble and boulder particles are between 0 & 25% surrounded by fine sediment.	Gravel, cobble and boulder particles are between 25% & 50% surrounded by fine sediment.	Gravel, cobble and boulder particles are between 50 & 75% surrounded by fine sediment.	Gravel, cobble and boulder particles are over 75% surrounded by fine sediment.
	20, 19, 18, 17, 16	(15) 14, 13, 12, 11	10, 9, 8, 7, 6	5, 4, 3, 2, 1, 0
3. Velocity/depth category	Slow deep (<0.3 m/s & >0.5 m); slow shallow; fast deep; fast shallow; habitats all present.	Only 3 of the four habitat categories present (missing riffles or runs receive lower score than missing pools).	Only two of the four habitat categories present (missing riffles/runs receive lower score).	Dominating by one velocity/depth category (usually pool).
	(20) 19, 18, 17, 16	15, 14, 13, 12, 11	10, 9, 8, 7, 6	5, 4, 3, 2, 1, 0
4. Channel alteration	Little or no enlargement of islands or point bars and/or no channelisation.	Some new increase in bar formation, mostly from coarse gravel; and/or some channelisation present.	Moderate deposition of new gravel, coarse sand, on old and new bars; pools partly filled with silt; and/or embankments on both banks.	Heavy deposits of fine materials, increased bar development; most pools filled with silt; and/or extensive channelisation.
	15, 14, (13) 12	11, 10, 9, 8	7, 6, 5, 4	3, 2, 1, 0
5. Bottom scouring and deposition	Less than 5% of the bottom affected by scouring and deposition.	5-30% affected. Scours at constrictions and where grades steepen, some deposition in pools.	30-50% affected. Deposits and scours at obstructions and bends. Some deposition in pools.	More than 50% of the bottom changing nearly year long. Pools almost absent due to deposition. Only large rocks in riffle exposed.
	15, (14) 13, 12	11, 10, 9, 8	7, 6, 5, 4	3, 2, 1, 0

DU50340RSC.P65 (IA3863) 20/8/98

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River Bioassessment Program

HABITAT ASSESSMENT FIELD SHEET cont.

Habitat Variable	CATEGORY			
	Excellent	**Good**	**Fair**	**Poor**
6. Pool/riffle, run/bend ratio. *(Distance between riffles divided by stream width)*	0-7 Variety of habitat. Deep riffles and pools. 15, 14, 13, (12)	7-15 Adequate depth in pools and riffles. Bends provide habitat. 11, 10, 9, 8	15-25 Occasional riffle or bend. Bottom contours provide some habitat. 7, 6, 5, 4	>25 Essentially a straight stream. Generally all flat water or shallow riffle. Poor habitat. 3, 2, 1, 0
7. Bank stability	Stable. No evidence of erosion or bank failure. Side slopes generally <30%. Little potential for future problem. (10), 9	Moderately stable. Infrequent, small areas of erosion mostly healed over. Side slopes up to 40% on one bank. Slight potential in extreme floods. 8, 7, 6	Moderately unstable. Moderate frequency and size of erosional areas. Side slopes up to 60% on some banks. High erosion potential during extreme/high flows. 5, 4, 3	Unstable. Many eroded areas. Side slopes > 60% common. 'Raw' areas frequent along straight sections and bends. 2, 1, 0
8. Bank vegetative stability	Over 80% of the streambank surfaces covered by vegetation or boulders and cobble. (10), 9	50-79% of the streambank surfaces covered by vegetation, gravel or larger material. 8, 7, 6	25-49% of the streambank covered by vegetation, gravel or larger material. 5, 4, 3	Less than 25% of the streambank surfaces covered by vegetation, gravel or larger material. 2, 1, 0
9. Streamside cover	Dominant vegetation is of tree form. (10), 9	Dominant vegetation shrub. 8, 7, 6	Dominant vegetation is grass, sedge, ferns. 5, 4, 3	Over 50% of the streambank has no vegetation and dominant material is soil, rock, bridge materials, culverts, or mine tailings. 2, 1, 0

Column Totals	109	15		

Score 124

FRESHWATER BIOLOGICAL RECORD

Page [ ] of [ ]

REFERENCE No.

Date operation began d	m	y	Site No.	Site name	Stream or dam name
6	4	12		Pelican Ck	ALS AQ6

Method	Row	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
EF	1	1	Leng	Tor		450				
	2		Barred	Grunter		48				
	3		Leo	uni		41				
	4		Mog	ads		36				
EF	5	2	Ang	rhe		40				
EF	6	3	Ang	rhe		180	452			
	7		Leo	uni		113				
|	8		Sleepy	cod		52				
	9		Mel	spl		48				
	10		Cherax	dest		115				
EF	11	4	Sleepy	cod		253				
	12		Amb	aga		51				
	13		Leo	uni		87				
	14		Kreft	Turtle		34				
EF	15	5	Amb	aga		42				
	16		Sleepy	cod		142				
	17		Ang	rhe		200	500			
EF	18	6	Ang	rhe		480				
EF	19	7	Ang	rhe		700	180			
EF	20	8	Leo	uni		50	66			
	21		Mog	ads		51	82	43	45	46
EF	22	9	Mog	ads		90	53	36	55	51
	23									
Fyke	24	1	Krefft's	Turtle		120	160			
	25		Neo	ell		168				
	26		Tilapia			164				
Fyke	27	2	Saw	Shell turtle		120	130			
	28									
	29									
	30									

Method	Row	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
Bait	31	1	Macro	ben		(3)				
Bait	32	2	Hyp	sp D		(2)	25	21	28	29
Bait	33	3	Amb	agb		31				
	34		Hyp	sp D		28				
Bait	35	4	Hyp	sp D		26				
Bait	36	5	Macrobrach			(2)				
	37		Hyp	sp D		25				
Bait	38	6	—	—						
Bait	39	7	—	—						
Bait	40	8	—	—						
Bait	41	9	—	—						
Bait	42	10	—	—						
	43									
	44									
	45									
	46									
	47									
	48									
	49									
	50									
	51									
	52									
	53									
	54									
	55									
	56									
	57									
	58									
	59									
	60									

Nets set @ 5:00 pm
collected @ 7:30 am

FRESHWATER BIOLOGICAL RECORD

Page ☐ of ☐

REFERENCE No.

Data operation began d m y

Site No.

Site name

Stream or dam name

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									
43									
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55									
56									
57									
58									
59									
60									

AEF002

MACROINVERTEBRATE SAMPLING FIELD SHEET

Queensland Government
Natural Resources and Mines

Site Number [AH| |AQ15|] Sample Number [ ]
Site Name Euri Creek
Project Code [ ] Date [0 |5/0|4/2|0|1|2] Time (24 hrs) [|9:2|0]
Run Code [ ] Project Name GCP

EDGE/BACKWATER: Y [ ] N [ ] Collected by: [| |] Picked By: [| |] No. vials: [ ] QAQC Residue: Y [ ] N [ ]
(average over 10 m sampled)

Velocity (m/sec): max [0|·|1|0] min [0|·|0|]
Mean Sample Depth: [0|·|2|0] m
Mean Wetted Width: [|8|·|0] m

Method: 10 m sweep [✓]
30 minutes random live-pick [✓]
Other _____ [ ]

Canopy Cover: [|2|5] % **Densiometer:** [ ] %
Shading: [|2|5] %

Snags and LWD:

Detritus (leaves, twigs)	N	L	(S)	M	E
Sticks (<2cm diam)	N	(L)	S	M	E
Branches (<15cm diam)	N	(L)	S	M	E
Logs (>15cm diam)	N	(L)	S	M	E

Substrate Description:

Bedrock	[|0] %	Gravel	(2 - 4 mm)	[|4|0] %
Boulder (> 256 mm)	[|2] %	Sand	(0.05 - 2 mm)	[|2|0] %
Cobble (64 - 256 mm)	[|3] %	Silt/Clay	(< 0.05 mm)	[|0] %
Pebble (4 - 64 mm)	[|3|5] %			

Habitat Attributes:

Periphyton	N	(L)	S	M	E
Moss	(N)	L	S	M	E
Filamentous algae	N	(L)	S	M	E
Macrophytes	(N)	L	S	M	E
Bank overhang vegetation	N	L	(S)	M	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	N	L	(S)	M	E
Blanketing silt	(N)	L	S	M	E
Substrate anoxia	(N)	L	S	M	E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

BED: Y [ ] N [ ] Collected by: [| |] Picked By: [| |] No. vials: [ ] QAQC Residue: Y [ ] N [ ]
TYPE: Riffle [ ] Run [ ] Pool (rocky/gravel) [ ] Pool (sandy/silty) [ ]
(average over 10 m sampled)

Velocity (m/sec): max [|·| |] min [|·| |]
Mean Sample Depth: [|·| |] m
Mean Wetted Width: [| | |·|] m

Method: 10 m kick only [ ]
10 m kick & gleaning rocks of different sizes (5) [ ]
____ minutes random live-pick [ ]
Other _____ [ ]

Canopy Cover: [| |] % **Densiometer:** [| |] %
Shading: [| |] %

Snags and LWD:

Detritus (leaves, twigs)	N	L	S	M	E
Sticks (<2cm diam)	N	L	S	M	E
Branches (<15cm diam)	N	L	S	M	E
Logs (>15cm diam)	N	L	S	M	E

Substrate Description:

Bedrock	[| |] %	Gravel	(2 - 4 mm)	[| |] %
Boulder (> 256 mm)	[| |] %	Sand	(0.05 - 2 mm)	[| |] %
Cobble (64 - 256 mm)	[| |] %	Silt/Clay	(< 0.05 mm)	[| |] %
Pebble (4 - 64 mm)	[| |] %			

Habitat Attributes:

Periphyton	N	L	S	M	E
Moss	N	L	S	M	E
Filamentous algae	N	L	S	M	E
Macrophytes	N	L	S	M	E
Bank overhang vegetation	N	L	S	M	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	N	L	S	M	E
Blanketing silt	N	L	S	M	E
Substrate anoxia	N	L	S	M	E

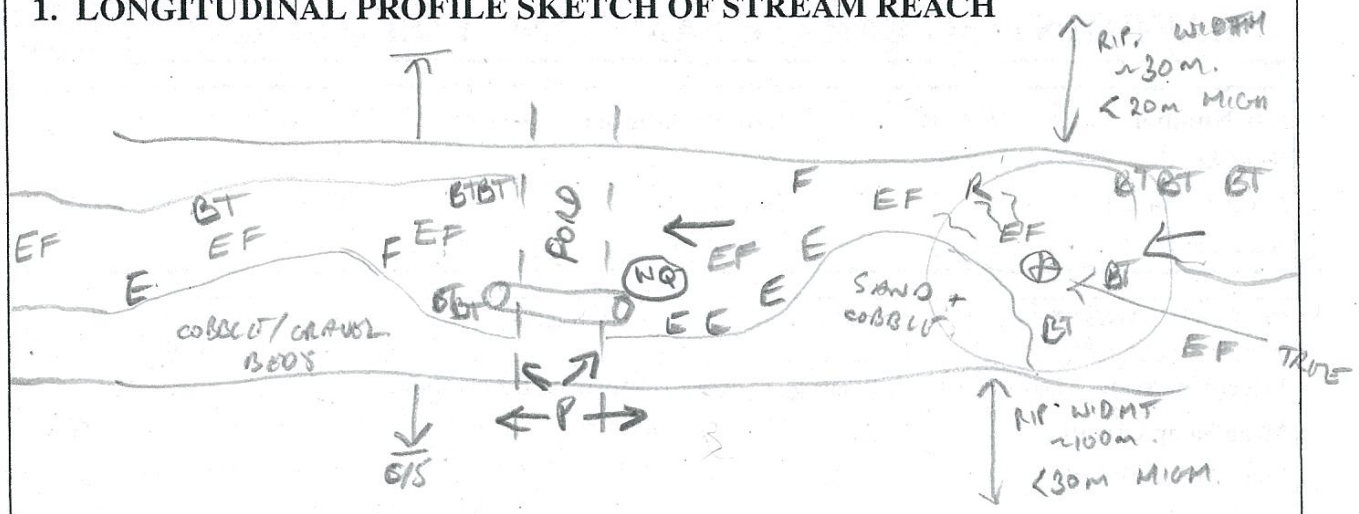
N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

Comments ENTERED 15 12/9/12

TOTAL NO. VIALS: OTHERS:

DU506400.ai (nr1762) 2/9/2002

1. LONGITUDINAL PROFILE SKETCH OF STREAM REACH

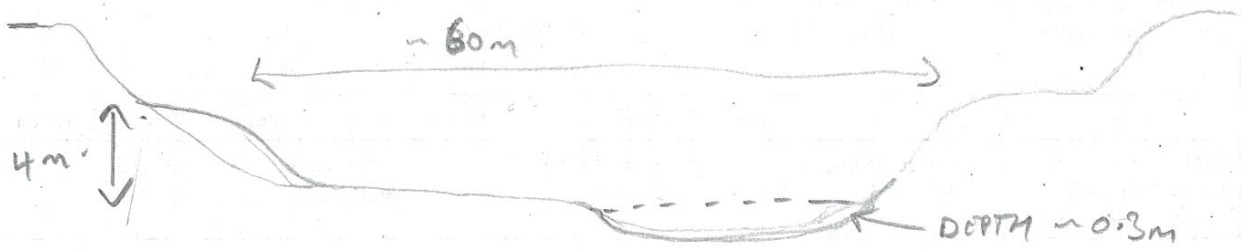


Scale: _____

Please indicate on sketch and tick off each item when completed.

- ☑ Biological sampling sites for each habitat type.
- ☑ Water quality measurement and water sample collection sites.
- ☑ Location from where photograph(s) taken.
- ☑ Flow direction
- ☑ Location of cross-sectional profile sketch.
- ☑ Riparian vegetation (include approx. heights).
- ☑ Riparian zone width.

2. CROSS-SECTIONAL PROFILE SKETCH OF STREAM REACH



Scale: 15

Please indicate on sketch and tick off each item when completed.

- ☑ Bankfull bank height
- ☑ Bankfull stream width
- ☑ Stream wetted width
- ☑ "Normal" wetted width
- ☑ Riparian vegetation height
- ☑ Riparian zone width
- ☑ Water depth

3. COMMENTS

_____

_____

_____

_____

_____

_____

_____

(*Office use only*) Entered into AQEIS ___/___/___ by _____ Checked on ___/___/___ by _____

AEF003

WATER QUALITY SAMPLING FIELD SHEET

Queensland Government
Natural Resources and Mines

Site Number [A 1 1 4] [A 1 0 5]
Site Name Euri Creek
Date [0 5/0 4/2 0 1 1]
Time (24 hrs) [1 9 : 2 0]
Project Code [ ]
Run Code [ ]
Party [M D] [D I] [ ]

Sample Number [ ]
Project Name GCP
QHSS Analysis No. [ ]
Submitted / Received

A	B	C	D	E	F	G	H	I	J	K	L	M	N

SAMPLING LOCATION: Latitude 20° 12.739 Longitude 147° 44.505
Reach orientation (looking downstream): N NE E SE S SW W NW Datum: WGS84

WATER QUALITY

Parameter	Value	Quality	Variable
Conductivity µS/cm@25°C	[1 9 1 0]	[ ]	2010.5
Water Temperature °C	[2 4 • 5]	[ ]	2080.5
pH	[8 • 0 5]	[ ]	2100.5
Dissolved O_2 mg/l	[6 • 2] 75.7%	[ ]	2351.5
Turbidity NTU	[2 • 0 5]	[ ]	2030.5
Air Temperature °C	[•]	[ ]	2065.5
Total Alkalinity mg/l $CaCO_3$	[2 0 0 • 0]	[ ]	2113.5
Phenol Alkalinity mg/l $CaCO_3$	[•]	[ ]	2114.5
Transparency (secchi) m	[•]	[ ]	2046.5
Velocity m/s	[•]	[ ]	240.0
Gauge Height m	[•]	[ ]	100.0
Discharge m^3/s	[•]	[ ]	140.0

Discharge Method: measured (gauged) ☐ obtained from rating curve ☐ estimated: ☐ no flow ☐ trickle ☐ >0.01 cumecs

WEATHER: *Rain in past week:* Yes [ ] No [✓] Comments: .....
Today: Rain ..No.. Cloud cover ..only light.. Wind ..No..
Comments: .....

OBSERVATIONS AT WATER SAMPLING SITE (within 2 metres of sampling point or on closest bank)

Shading: 25 % Water Odour: None.
Water Surface Condition: (Normal) Slick Scum Foaming Other .....
Algae: On substrate: N (L) S M E In water column: (N) L S M E
Macrophytes: Emergent: (N) L S M E Submerged: (N) L S M E
Floating: (N) L S M E
Impacts: Human N L S (M) E Pastoral animals N L (S) M E Non-pastoral animals N (L) S M E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

PERCENT OF HABITAT TYPES IN 100 m REACH:

Riffle (R) [2 5] % Run [0] %
Pool (rocky-K) [2 5] % Pool (sandy-S) [3 0] %
Dry [2 0] % Riffle + Run + Pool + Dry = 100%
Edge [4 0] %
Edge is % of habitat available to sample from L and R banks

Macrophytes [0] % in: R ..... % E ..... %
K ..... % S ..... % Run ..... %
Algae [5] % in: R 33 % E 33 %
K 34 % S ..... % Run ..... %
Blanketing silt [2] %

COMMENTS: .....

(*Office use only*) Entered into Hydsys __/__/__ by _____ Checked on __/__/__ by _____
Entered into AQEIS __/__/__ by _____ Checked on __/__/__ by _____

DU5106405.ai (nr17621) 2/9/2002

REACH OBSERVATIONS (of 100 m stream length)

Upstream landuse: 3 - LIGHT GRAZING

Adjacent landuse: Left bank: Score 3 Type L. GRAZING Right bank: Score 3 Type L. GRAZING

0. Urban/semi-urban, industrial
1. Irrigated cropping, intensive forestry or heavy grazing
2. Non-irrigated cropping, moderate grazing
3. Light grazing, vegetation clearing
4. Natural

Local catchment erosion:	None	(Little)	Some	Moderate	Extensive
Water colour:	(Clear)	Green	Opaque	Tannin	Other .....
Sediment deposits:	None	(Sand)	Silt	Other	
Algae: On substrate:	None	Little	(Some)	Moderate	Extensive
In water column:	(None)	Little	Some	Moderate	Extensive
Water odour:	(No)	Yes	Specify		
Substrate odour:	(No)	Yes	Specify		
Water surface:	(Normal)	Slick	Scum	Foaming	Other .....
Variety of habitat: (circle all types)	(Shallow)	(Deep)	(Pool)	Run	(Riffle)
	(Undercut bank)		LWD	Macrophytes	Other .....

Bars: (bed surface protruding from normal water level and forming a bar) ..... 5 ..... %

Flow level: (relative to 'watermark' i.e. normal inundation level shown by limit of terrestrial grasses, or by eroded area, or boundary in bank sediment types).

No flow	(Low)	Moderate	High	Flood
(dry/isolated)	(<watermark)	(=watermark)	(>watermark)	

RIPARIAN ZONE (to maximum 100 m width)

Width of riparian zone:		Left bank ..50..... m		Right bank ..30..... m	
* **Bare ground**	None	(Little)	Some	Moderate	Extensive
* **Grass**	None	Little	Some	Moderate	(Extensive)
* **Shrubs**	None	Little	(Some)	Moderate	Extensive
* **Trees <10 m high**	None	Little	Some	(Moderate)	Extensive
* **Trees >10 m high**	None	Little	(Some)	Moderate	Extensive
Presence of exotic riparian species	None	Little	Some	(Moderate)	Extensive
Width of continuous tree zone from bank:		Left bank ..100..... m		Right bank ..30..... m	

None = 0% Little = 1–10% Some = 10–50% Moderate = 50–75% Extensive >75% * Can add to >100%

MACROPHYTES Indicate the presence and abundance of the following common taxa in the 100 m reach:

Native											
Azolla	(N)	L	S	M	E	Water Ribbon (*Triglochin*)	(N)	L	S	M	E
Duckweed	(N)	L	S	M	E	Water Lettuce (*Pistia stratiotes*)	(N)	L	S	M	E
Hornwort (*Ceratophyllum*)	(N)	L	S	M	E	Water Primrose (*Ludwigia*)	(N)	L	S	M	E
Stoneworts (*Chara* or *Nitella*)	(N)	L	S	M	E	Sedge (*Cyperus*)	(N)	L	S	M	E
Hydrilla	(N)	L	S	M	E	Common Rush (*Juncus*)	(N)	L	S	M	E
Water Milfoil (*Myriophyllum*)	(N)	L	S	M	E	Cumbungi (*Typha*)	(N)	L	S	M	E
Pondweeds (*Potamogeton*)	(N)	L	S	M	E	Slender Knotweed (*Persicaria*)	(N)	L	S	M	E
Ribbonweed (*Vallisneria*)	(N)	L	S	M	E	.....	(N)	L	S	M	E
.....	(N)	L	S	M	E	.....	(N)	L	S	M	E
Exotic											
Water Hyacinth (*Eichhornia*)	(N)	L	S	M	E	Alligator Weed (*Alternanthera*)	(N)	L	S	M	E
Salvinia	(N)	L	S	M	E	Elodea	(N)	L	S	M	E
Para Grass (*Urochloa*)	(N)	L	S	M	E	*Egeria*	(N)	L	S	M	E
.....	(N)	L	S	M	E	.....	(N)	L	S	M	E

Comments: .....

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

AEF007

River Bioassessment Program

Queensland Government
Natural Resources and Mines

HABITAT ASSESSMENT FIELD SHEET

SITE NUMBER: [| | | | | |] **SITE NAME:** _____

Date: ___/___/___ **Time (24 hrs):** [| | |] **GPS:** _____ **Project Name:** _____

Habitat Variable	CATEGORY			
	Excellent	**Good**	**Fair**	**Poor**
1. Bottom substrate/available cover	Greater than 50% rubble, gravel, submerged logs, undercut banks or other stable habitat. 20, 19, 18, 17, (16)	30-50% rubble, gravel or other stable habitat. Adequate habitat. 15, 14, 13, 12, 11	10-30% rubble, gravel or other stable habitat. Habitat availability less than desirable. 10, 9, 8, 7, 6	Less than 10% rubble, gravel or stable habitat. Lack of habitat is obvious. 5, 4, 3, 2, 1, 0
2. Embeddedness	Gravel, cobble and boulder particles are between 0 & 25% surrounded by fine sediment. 20, 19, 18, 17, 16	Gravel, cobble and boulder particles are between 25% & 50% surrounded by fine sediment. 15, (14), 13, 12, 11	Gravel, cobble and boulder particles are between 50 & 75% surrounded by fine sediment. 10, 9, 8, 7, 6	Gravel, cobble and boulder particles are over 75% surrounded by fine sediment. 5, 4, 3, 2, 1, 0
3. Velocity/depth category	Slow deep (<0.3 m/s & >0.5 m); slow shallow; fast deep; fast shallow; habitats all present. 20, (19), 18, 17, 16	Only 3 of the four habitat categories present (missing riffles or runs receive lower score than missing pools). 15, 14, 13, 12, 11	Only two of the four habitat categories present (missing riffles/runs receive lower score). 10, 9, 8, 7, 6	Dominating by one velocity/depth category (usually pool). 5, 4, 3, 2, 1, 0
4. Channel alteration	Little or no enlargement of islands or point bars and/or no channelisation. 15, 14, 13, 12	Some new increase in bar formation, mostly from coarse gravel; and/or some channelisation present. 11, (10), 9, 8	Moderate deposition of new gravel, coarse sand, on old and new bars; pools partly filled with silt; and/or embankments on both banks. 7, 6, 5, 4	Heavy deposits of fine materials, increased bar development; most pools filled with silt; and/or extensive channelisation. 3, 2, 1, 0
5. Bottom scouring and deposition	Less than 5% of the bottom affected by scouring and deposition. 15, 14, 13, 12	5-30% affected. Scours at constrictions and where grades steepen, some deposition in pools. 11, 10, 9, 8	30-50% affected. Deposits and scours at obstructions and bends. Some deposition in pools. (7), 6, 5, 4	More than 50% of the bottom changing nearly year long. Pools almost absent due to deposition. Only large rocks in riffle exposed. 3, 2, 1, 0

DU503400I85C.P65 (LM3883) 20/8/98

River Bioassessment Program

HABITAT ASSESSMENT FIELD SHEET cont.

NATURAL RESOURCES Queensland Government

Habitat Variable	CATEGORY			
	Excellent	**Good**	**Fair**	**Poor**
6. Pool/riffle, run/bend ratio. *(Distance between riffles divided by stream width)*	0-7 Variety of habitat. Deep riffles and pools. 15, 14, (13), 12	7-15 Adequate depth in pools and riffles. Bends provide habitat. 11, 10, 9, 8	15-25 Occasional riffle or bend. Bottom contours provide some habitat. 7, 6, 5, 4	>25 Essentially a straight stream. Generally all flat water or shallow riffle. Poor habitat. 3, 2, 1, 0
7. Bank stability	Stable. No evidence of erosion or bank failure. Side slopes generally <30%. Little potential for future problem. 10, (9)	Moderately stable. Infrequent, small areas of erosion mostly healed over. Side slopes up to 40% on one bank. Slight potential in extreme floods. 8, 7, 6	Moderately unstable. Moderate frequency and size of erosional areas. Side slopes up to 60% on some banks. High erosion potential during extreme/high flows. 5, 4, 3	Unstable. Many eroded areas. Side slopes > 60% common. 'Raw' areas frequent along straight sections and bends. 2, 1, 0
8. Bank vegetative stability	Over 80% of the streambank surfaces covered by vegetation or boulders and cobble. 10, (9)	50-79% of the streambank surfaces covered by vegetation, gravel or larger material. 8, 7, 6	25-49% of the streambank covered by vegetation, gravel or larger material. 5, 4, 3	Less than 25% of the streambank surfaces covered by vegetation, gravel or larger material. 2, 1, 0
9. Streamside cover	Dominant vegetation is of tree form. 10, (9)	Dominant vegetation shrub. 8, 7, 6	Dominant vegetation is grass, sedge, ferns. 5, 4, 3	Over 50% of the streambank has no vegetation and dominant material is soil, rock, bridge materials, culverts, or mine tailings. 2, 1, 0

Column Totals	75	24	7	0

Score 106

FRESHWATER BIOLOGICAL RECORD

Nets: sd 1.00 fm
cathedral 5.40 fm

REFERENCE No.

Date operation began: d 5 m 4 y 12 — Site No.

Site name: Euri Creek

Stream or dam name: AM AQS

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
EF1 1	1	Leo	unic		135				
2									
3									
4		Neo	hurt		102				
5									
6									
7									
8	2	Mid Cat	gudgeon		21	29			
EF2 9		Tilapia			132	66			
10		Leo	unic		57				
11		Mel	spl		75				
12		Eel	Short		49				
13		Gam	hoak		33	31			
EF3 14		Neo	hurt		82				
15		Ano	sune		400				
16		Mel	spl		53				
17		Amb	ague		24	36			
EF4 18		Neo	hurt		87	172	226		
EF5 19		Neo	hurt		137	141	97	172	98
20					130	94			
21		Leo	unic		222	81	143	106	139
22	*	Neo	hurt		188				
EF6 23		Mel	spl		46	D			
24		Neo	hurt		107				
EF7 25		Leo	unic		166	170	72	65	
26		Tilapia			79	92	74		
EF8 27		Ano	sche		580				
28									
29									
30									

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
Fy Re 31	1	Nuchal							
Fy Re 32	2	Mel	spl		64	49	51	37	
33		Lem	unic		42				
Bar 34	1	Leo	unic		132				
35		Barcoo	Grunter		86	86	82	79	90
Bar 36	2	Cra	Sute		53				
37		Tilapia			100				
38		Neo	hurt		173				
Bar 39	3	Barcoo	Grunter		93	78	106	91	83
40					86	77	91	103	86
41					104	76	74	64	85
42					+	(15)			
Bar 43	4	NONE							
44	5	"	"						
45	6	"	"						
46	7	"	"						
47	8	"	"						
48	9	"	"						
49	10	Mel	spl		52				
50									
51									
52									
53									
54									
55									
56									
57									
58									
59									
60									

* Neosuchus otter

FRESHWATER BIOLOGICAL RECORD

Page ☐ of ☐

REFERENCE No.

Date operation began d m y | Site No.

Site name | Stream or dam name

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									
51									
52									
53									
54									
55									
56									
57									
58									
59									
60									

AEF002

MACROINVERTEBRATE SAMPLING FIELD SHEET

Queensland Government Natural Resources and Mines

Site Number [AL T:AQ4] Sample Number [ ]
Site Name Bogie River
Project Code [KQ2112984] Date [04/04/2012] Time (24 hrs) [1015]
Run Code [ ] Project Name GCP

Edge

EDGE/~~BACKWATER~~: Y [✓] N [ ] Collected by: [MD] Picked By: [MD] No. vials: [1] QAQC Residue: Y [ ] N [ ]
(average over 10 m sampled)

Velocity (m/sec): max [0.15] min [0.01]
Mean Sample Depth: [0.12] m
Mean Wetted Width: [25.0] m
Method: 10 m sweep [✓]
30 minutes random live-pick [✓]
Other _____ [ ]
Canopy Cover: [5] % **Densiometer:** [ ] %
Shading: [5] %

Snags and LWD:

Detritus (leaves, twigs)	N	L	S	M	E
Sticks (<2cm diam)	N	L	S	M	E
Branches (<15cm diam)	N	L	S	M	E
Logs (>15cm diam)	N	L	S	M	E

Substrate Description:

Bedrock	[0] %	Gravel (2 - 4 mm)	[≤1] %
Boulder (> 256 mm)	[0] %	Sand (0.05 - 2 mm)	[93] %
Cobble (64 - 256 mm)	[0] %	Silt/Clay (< 0.05 mm)	[2] %
Pebble (4 - 64 mm)	[0] %		

Habitat Attributes:

Periphyton	N	L	S	M	E
Moss	N	L	S	M	E
Filamentous algae	N	L	S	M	E
Macrophytes	N	L	S	M	E
Bank overhang vegetation	N	L	S	M	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	N	L	S	M	E
Blanketing silt	N	L	S	M	E
Substrate anoxia	N	L	S	M	E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

Composite

BED: Y [✓] N [ ] Collected by: [MD] Picked By: [DI] No. vials: [1] QAQC Residue: Y [ ] N [ ]
TYPE: Riffle [✓] Run [✓] Pool (rocky/gravel) [ ] Pool (sandy/silty) [✓]
(average over 10 m sampled)

Velocity (m/sec): max [0.4] min [0.20]
Mean Sample Depth: [0.15] m
Mean Wetted Width: [25.0] m
Method: 10 m kick only [✓]
10 m kick & gleaning rocks of different sizes (5) [ ]
30 minutes random live-pick [✓]
Other _____ [ ]
Canopy Cover: [10] % **Densiometer:** [ ] %
Shading: [30] %

Snags and LWD:

Detritus (leaves, twigs)	N	L	S	M	E
Sticks (<2cm diam)	N	L	S	M	E
Branches (<15cm diam)	N	L	S	M	E
Logs (>15cm diam)	N	L	S	M	E

Substrate Description:

Bedrock	[0] %	Gravel (2 - 4 mm)	[15] %
Boulder (> 256 mm)	[2] %	Sand (0.05 - 2 mm)	[70] %
Cobble (64 - 256 mm)	[2] %	Silt/Clay (< 0.05 mm)	[1] %
Pebble (4 - 64 mm)	[10] %		

Habitat Attributes:

Periphyton	N	L	S	M	E
Moss	N	L	S	M	E
Filamentous algae	N	L	S	M	E
Macrophytes	N	L	S	M	E
Bank overhang vegetation	N	L	S	M	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	N	L	S	M	E
Blanketing silt	N	L	S	M	E
Substrate anoxia	N	L	S	M	E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

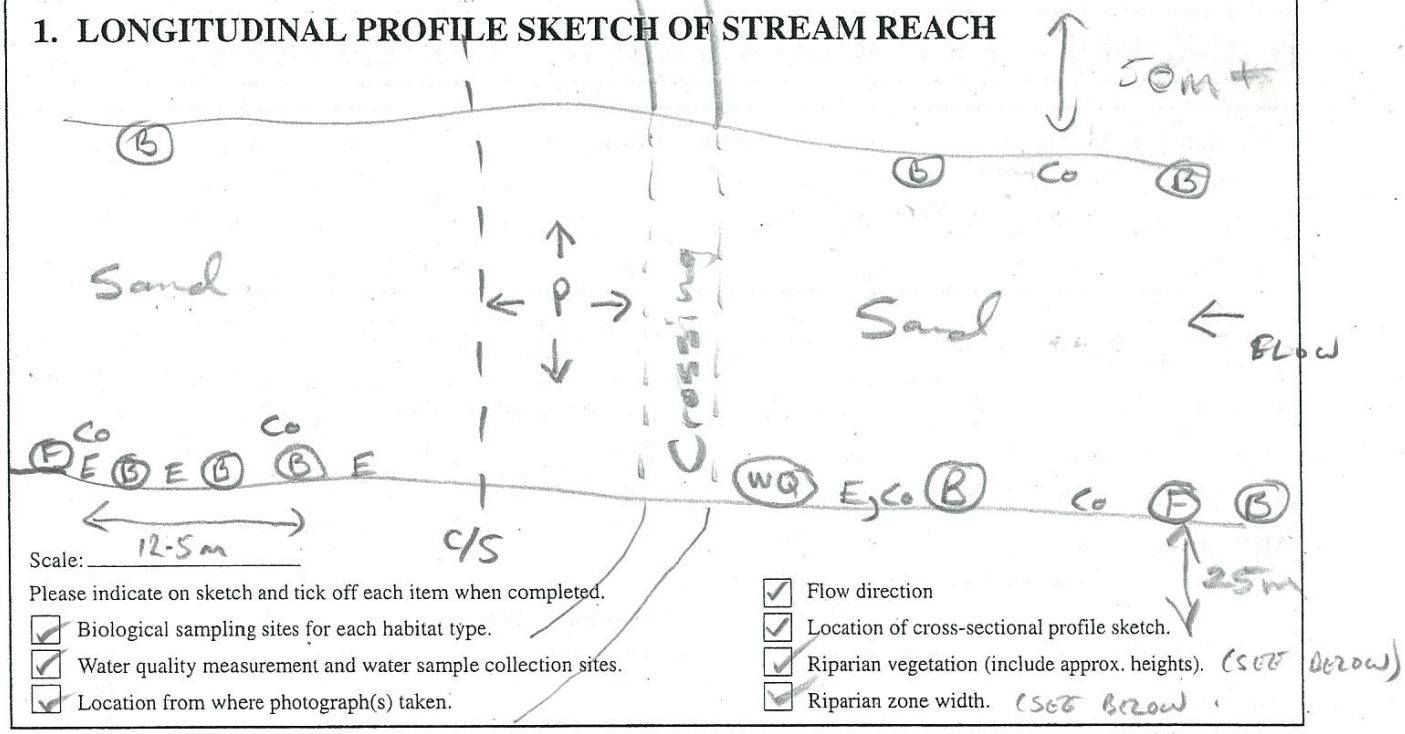
Comments UTM 55K 583755, 7763195
Wide shallow clear fast flowing sandbed creek.
20° 13.6211 S, 147° 48.1001

ENTERED TS 12/9/12

DU506400.ai (nr17621) 2/9/2002

TOTAL NO. VIALS: OTHERS:

1. LONGITUDINAL PROFILE SKETCH OF STREAM REACH

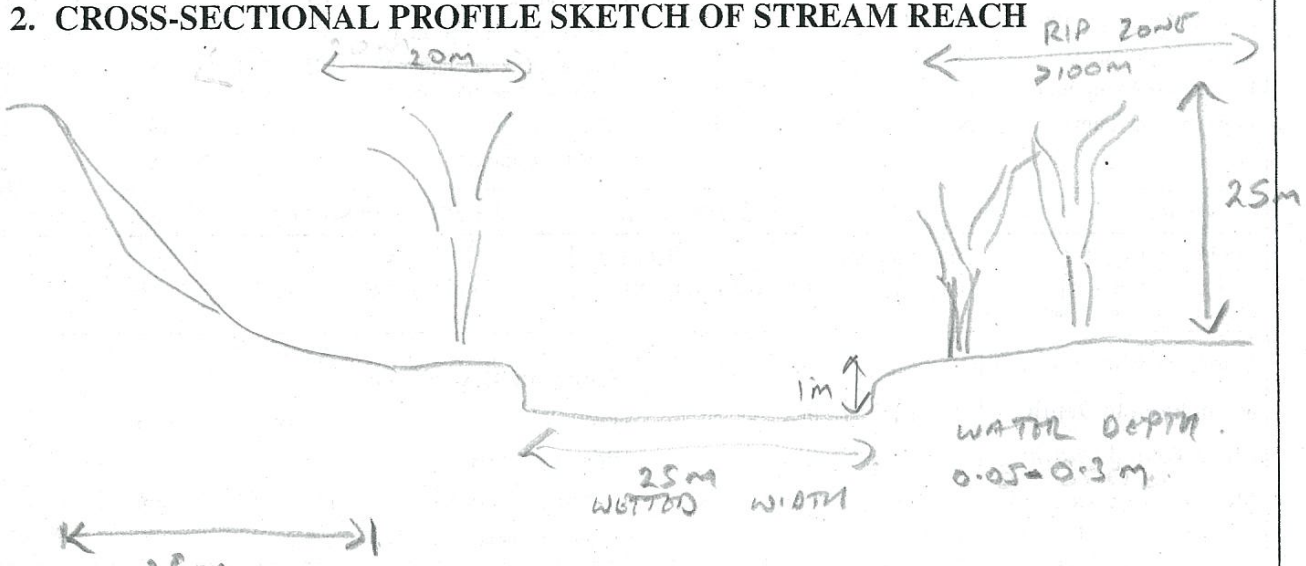


Scale: 12-5m

Please indicate on sketch and tick off each item when completed.

- ☑ Biological sampling sites for each habitat type.
- ☑ Water quality measurement and water sample collection sites.
- ☑ Location from where photograph(s) taken.
- ☑ Flow direction
- ☑ Location of cross-sectional profile sketch.
- ☑ Riparian vegetation (include approx. heights). (SEE BELOW)
- ☑ Riparian zone width. (SEE BELOW)

2. CROSS-SECTIONAL PROFILE SKETCH OF STREAM REACH



Scale: 25m

Please indicate on sketch and tick off each item when completed.

- ☑ Bankfull bank height
- ☑ Bankfull stream width
- ☑ Stream wetted width
- ☑ "Normal" wetted width
- ☑ Riparian vegetation height
- ☑ Riparian zone width
- ☑ Water depth

3. COMMENTS

LEFT BANK HAS NARROW RIP ZONE DUE TO TOPOGRAPHY. RIGHT BANK IS THE FLOOD PLAIN: BED IS VERY UNIFORM BECAUSE OF SAND. CATTLE HAVE OPEN ACCESS TO WATERWAY.

(*Office use only*) Entered into AQBIS __/__/__ by _____ Checked on __/__/__ by _____

ENTERED

AEF003

WATER QUALITY SAMPLING FIELD SHEET

Queensland Government Natural Resources and Mines

Site Number [E3] [AQ4] Sample Number [ ]
Site Name Boonie River
Date [04/04/2011 12]
Time (24 hrs) [10:55]
Project Code [ ]
Run Code [ ]
Party [MD] [DJ] [ ] [ ] [ ]
Project Name GCP
QHSS Analysis No. [ ]
Submitted / Received

A	B	C	D	E	F	G	H	I	J	K	L	M	N

SAMPLING LOCATION: Latitude 20° 15.620 Longitude 147° 48.109
Reach orientation (looking downstream): N NE E SE S SW (W) NW Datum:

WATER QUALITY

Parameter	Value	Quality	Variable
Conductivity µS/cm@25°C	[1619]	[ ]	2010.5
Water Temperature °C	[27.1]	[ ]	2080.5
pH	[8.29]	[ ]	2100.5
Dissolved O_2 mg/l	[7.65] 95.8%	[ ]	2351.5
Turbidity NTU	[3.66]	[ ]	2030.5
Air Temperature °C	[.]	[ ]	2065.5
Total Alkalinity mg/l $CaCO_3$	[165.0]	[ ]	2113.5
Phenol Alkalinity mg/l $CaCO_3$	[.]	[ ]	2114.5
Transparency (secchi) m	[.]	[ ]	2046.5
Velocity m/s	[.]	[ ]	240.0
Gauge Height m	[.]	[ ]	100.0
Discharge m^3/s	[.]	[ ]	140.0

Discharge Method: measured (gauged) ☐ obtained from rating curve ☐ estimated: ☐ no flow ☐ trickle ☐ >0.01 cumecs

WEATHER: *Rain in past week:* Yes [ ] No [✓] Comments: —
Today: Rain None Cloud cover Nos Clouds Wind No Wind
Comments: bright clear clear

OBSERVATIONS AT WATER SAMPLING SITE (within 2 metres of sampling point or on closest bank)

Shading: 5 % Water Odour: None
Water Surface Condition: (Normal) Slick Scum Foaming Other
Algae: On substrate: (N) L S M E In water column: (N) L S M E
Macrophytes: Emergent: (N) L S M E Submerged: (N) L S M E
Floating: (N) L S M E
Impacts: Human N L S (M) E Pastoral animals N L (S) M E Non-pastoral animals N (L) S M E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

PERCENT OF HABITAT TYPES IN 100 m REACH:

Riffle (R) S [40] % Run [30] %
Pool (rocky-K) [0] % Pool (sandy-S) [30] %
Dry [0] % Riffle + Run + Pool + Dry = 100%
Edge [30] %
Edge is % of habitat available to sample from L and R banks

Macrophytes [0] % in: R ..... % E ..... %
K ..... % S ..... % Run ..... %
Algae [0] % in: R ..... % E ..... %
K ..... % S ..... % Run ..... %
Blanketing silt [2] %

COMMENTS: —

(*Office use only*) Entered into Hydsys ___/___/___ by ___ Checked on ___/___/___ by ___
Entered into AQEIS ___/___/___ by ___ Checked on ___/___/___ by ___

DU5906405.ai (nr17621) 2/9/2002

REACH OBSERVATIONS (of 100 m stream length)

Upstream landuse: 3. Light GRAZING

Adjacent landuse: Left bank: Score 3 Type 1. GRAZING Right bank: Score 3 Type 1. GRAZING

0. Urban/semi-urban, industrial
1. Irrigated cropping, intensive forestry or heavy grazing
2. Non-irrigated cropping, moderate grazing
3. Light grazing, vegetation clearing
4. Natural

Local catchment erosion:	None	(Little)	Some	Moderate	Extensive
Water colour:	(Clear)	Green	Opaque	Tannin	Other .....
Sediment deposits:	None	(Sand)	Silt	Other	
Algae: On substrate:	None	(Little)	Some	Moderate	Extensive
In water column:	(None)	Little	Some	Moderate	Extensive
Water odour:	(No)	Yes	Specify		
Substrate odour:	(No)	Yes	Specify		
Water surface:	(Normal)	Slick	Scum	Foaming	Other .....
Variety of habitat: (circle all types)	(Shallow)	Deep	Pool	(Run)	(Riffle)
	Undercut bank		LWD	Macrophytes	Other .....

Bars: (bed surface protruding from normal water level and forming a bar) ..... 0 ... %

Flow level: (relative to 'watermark' i.e. normal inundation level shown by limit of terrestrial grasses, or by eroded area, or boundary in bank sediment types).

No flow	(Low)	Moderate	High	Flood
(dry/isolated)	(<watermark)	(=watermark)	(>watermark)	

RIPARIAN ZONE (to maximum 100 m width)

Width of riparian zone: Left bank ...40... m Right bank ...100... m

* **Bare ground**	None	Little	Some	(Moderate)	Extensive
* **Grass**	None	Little	(Some)	Moderate	Extensive
* **Shrubs**	None	(Little)	Some	Moderate	Extensive
* **Trees <10 m high**	None	Little	(Some)	Moderate	Extensive
* **Trees >10 m high**	None	Little	Some	Moderate	(Extensive)
Presence of exotic riparian species	None	Little	(Some)	Moderate	Extensive
Width of continuous tree zone from bank:	Left bank ...15... m			Right bank ...100... m	

None = 0% Little = 1–10% Some = 10–50% Moderate = 50–75% Extensive >75% * Can add to >100%

MACROPHYTES Indicate the presence and abundance of the following common taxa in the 100 m reach:

Native											
Azolla	(N)	L	S	M	E	Water Ribbon (*Triglochin*)	(N)	L	S	M	E
Duckweed	(N)	L	S	M	E	Water Lettuce (*Pistia stratiotes*)	(N)	L	S	M	E
Hornwort (*Ceratophyllum*)	(N)	L	S	M	E	Water Primrose (*Ludwigia*)	(N)	L	S	M	E
Stoneworts (*Chara* or *Nitella*)	(N)	L	S	M	E	Sedge (*Cyperus*)	N	(L)	S	M	E
Hydrilla	(N)	L	S	M	E	Common Rush (*Juncus*)	(N)	L	S	M	E
Water Milfoil (*Myriophyllum*)	(N)	L	S	M	E	Cumbungi (*Typha*)	(N)	L	S	M	E
Pondweeds (*Potamogeton*)	(N)	L	S	M	E	Slender Knotweed (*Persicaria*)	N	(L)	S	M	E
Ribbonweed (*Vallisneria*)	(N)	L	S	M	E	.....	N	L	S	M	E
.....	N	L	S	M	E	.....	N	L	S	M	E
Exotic											
Water Hyacinth (*Eichhornia*)	(N)	L	S	M	E	Alligator Weed (*Alternanthera*)	(N)	L	S	M	E
Salvinia	(N)	L	S	M	E	Elodea	(N)	L	S	M	E
Para Grass (*Urochloa*)	(N)	L	S	M	E	*Egeria*	(N)	L	S	M	E
.....	N	L	S	M	E	.....	N	L	S	M	E

Comments: .....

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

AEF007

River Bioassessment Program

Queensland Government
Natural Resources and Mines

HABITAT ASSESSMENT FIELD SHEET

SITE NUMBER: [E131 1A1Q141] SITE NAME: Bogie River

Date: 4/4/2012 Time (24 hrs): [1 10 15 15] GPS: _____ Project Name: GCP

Habitat Variable	CATEGORY			
	Excellent	**Good**	**Fair**	**Poor**
1. Bottom substrate/available cover	Greater than 50% rubble, gravel, submerged logs, undercut banks or other stable habitat. 20, 19, 18, 17, 16	30-50% rubble, gravel or other stable habitat. Adequate habitat. 15, 14, 13, 12, 11	10-30% rubble, gravel or other stable habitat. Habitat availability less than desirable. 10, 9, 8, 7, 6	Less than 10% rubble, gravel or stable habitat. Lack of habitat is obvious. (5) 4, 3, 2, 1, 0
2. Embeddedness	Gravel, cobble and boulder particles are between 0 & 25% surrounded by fine sediment. 20, 19, 18, 17, 16	Gravel, cobble and boulder particles are between 25% & 50% surrounded by fine sediment. 15, 14, 13, 12, 11	Gravel, cobble and boulder particles are between 50 & 75% surrounded by fine sediment. 10, 9, 8, 7, 6	Gravel, cobble and boulder particles are over 75% surrounded by fine sediment. 5, 4, 3, (2) 1, 0
3. Velocity/depth category	Slow deep (<0.3 m/s & >0.5 m); slow shallow; fast deep; fast shallow; habitats all present. 20, 19, 18, 17, 16	Only 3 of the four habitat categories present (missing riffles or runs receive lower score than missing pools). 15, (14) 13, 12, 11	Only two of the four habitat categories present (missing riffles/runs receive lower score). 10, 9, 8, 7, 6	Dominating by one velocity/depth category (usually pool). 5, 4, 3, 2, 1, 0
4. Channel alteration	Little or no enlargement of islands or point bars and/or no channelisation. 15, 14, 13, 12	Some new increase in bar formation, mostly from coarse gravel; and/or some channelisation present. 11, 10, 9, 8	Moderate deposition of new gravel, coarse sand, on old and new bars; pools partly filled with silt; and/or embankments on both banks. 7, 6, 5, 4	Heavy deposits of fine materials, increased bar development; most pools filled with silt; and/or extensive channelisation. (3) 2, 1, 0
5. Bottom scouring and deposition	Less than 5% of the bottom affected by scouring and deposition. 15, 14, 13, 12	5-30% affected. Scours at constrictions and where grades steepen, some deposition in pools. 11, 10, 9, 8	30-50% affected. Deposits and scours at obstructions and bends. Some deposition in pools. 7, 6, 5, 4	More than 50% of the bottom changing nearly year long. Pools almost absent due to deposition. Only large rocks in riffle exposed. (3) 2, 1, 0

DU503400RSC.P65 [LM3883] 20/8/98

River Bioassessment Program

HABITAT ASSESSMENT FIELD SHEET cont.

NATURAL RESOURCES Queensland Government

Habitat Variable	CATEGORY			
	Excellent	**Good**	**Fair**	**Poor**
6. Pool/riffle, run/bend ratio. *(Distance between riffles divided by stream width)*	0-7 Variety of habitat. Deep riffles and pools. 15, 14, 13, 12	7-15 Adequate depth in pools and riffles. Bends provide habitat. 11, 10, 9, 8	15-25 Occasional riffle or bend. Bottom contours provide some habitat. 7, 6, 5, 4	>25 Essentially a straight stream. Generally all flat water or shallow riffle. Poor habitat. 3, 2, 1, 0
7. Bank stability	Stable. No evidence of erosion or bank failure. Side slopes generally <30%. Little potential for future problem. 10, 9	Moderately stable. Infrequent, small areas of erosion mostly healed over. Side slopes up to 40% on one bank. Slight potential in extreme floods. 8, 7, 6	Moderately unstable. Moderate frequency and size of erosional areas. Side slopes up to 60% on some banks. High erosion potential during extreme/high flows. 5, 4, 3	Unstable. Many eroded areas. Side slopes > 60% common. 'Raw' areas frequent along straight sections and bends. 2, 1, 0
8. Bank vegetative stability	Over 80% of the streambank surfaces covered by vegetation or boulders and cobble. 10, 9	50-79% of the streambank surfaces covered by vegetation, gravel or larger material. 8, 7, 6	25-49% of the streambank covered by vegetation, gravel or larger material. 5, 4, 3	Less than 25% of the streambank surfaces covered by vegetation, gravel or larger material. 2, 1, 0
9. Streamside cover	Dominant vegetation is of tree form. 10, 9	Dominant vegetation shrub. 8, 7, 6	Dominant vegetation is grass, sedge, ferns. 5, 4, 3	Over 50% of the streambank has no vegetation and dominant material is soil, rock, bridge materials, culverts, or mine tailings. 2, 1, 0

Column Totals	9	28	0	16

Score 53

FRESHWATER BIOLOGICAL RECORD

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Nets set 10:45am
Collected 3:15pm

REFERENCE No.

Date operation began d 4 m 4 y 17 Site No.

Site name: E3 AQ4

Stream or dam name: Eur. Ck

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
EF	1	Leo	unsp		43				
		Mel	spp		82	28			
		Gam	hook		26	22	23		
EF	2	Mog	adsp		54	56			
EF	3	Mel	spp		53				
		Mog	adsp		56	55	46		
		Gam	hook		26	37	22		
EF	4	Amb	aga		26	35			
		Mog	adsp		63				
	5	Mel	spp		19				
EF		Gam	hook		21				
		Mog	adsp		37				
EF	6	Water Scorpion			17				
		Mel	spp		32				
		Gam	Hook		36	38			
		Mog	adsp		43	42			
		Amb	aga		32				
EF		Tilapia			78				
		Mel	spp		23	37			
		Mog	adsp		50				
		Gam	Hook		29				

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
ET	8	Mel	spp		19	47	18		
		Mog	adsp		43				
		Gam	hook		27				
Ba	1	Amb	aga		43				
Ba	2	Gam	hook		34				
Ba	3	Gam	hook		37	27	28	27	26
		Amb	aga		28				
		Mog	adsp		65	36			
Ba	4	Amb	aga		45	40	28	36	34
					40	22	26	23	
Ba	5	Amb	aga		39				
Ba	6	Mog	adsp		58	57	61	57	43
Ba	7	Gam	hook		37	29	24	24	24
					25	24	25	27	22
		Mog	adsp		52	35	49	62	
Ba	8	Mel	spp		50	44			
		Amb	aga		40	38	26	38	27
					29	38	25		
		Gam	hook		26	25	26		
Fyke	1	Mel	spp		22	27			
Fyke	2	Amb	aga		24				
		Leo	unsp		49				

EF = 8 x 150 sec/shots

FRESHWATER BIOLOGICAL RECORD

Page ☐ of ☐

REFERENCE No.

Date operation began d m y

Site No.

Site name

Stream or dam name

Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
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Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
31								
32								
33								
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36								
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AEF002

MACROINVERTEBRATE SAMPLING FIELD SHEET

Queensland Government Natural Resources and Mines

Site Number [AL|S|A|Q|2|] Sample Number [ ]
Site Name Saltwater CK
Project Code [C|Q|2|1|2|9|4|] Date [0|3/0|4/2|0|1|2] Time (24 hrs) [1|4:1|5]
Run Code [ ] Project Name SCP

EDGE/~~BACKWATER~~: Y [✓] N [ ] Collected by: [M|D|] Picked By: [M|D|] No. vials: [1] QAQC Residue: Y [ ] N [ ]
(average over 10 m sampled)

Velocity (m/sec): max [0|·|0|] min [0|·|0|]
Mean Sample Depth: [0|·|2|0] m
Mean Wetted Width: [|8|·|0] m
Method: 10 m sweep [✓]
30 minutes random live-pick [✓]
Other _____ [ ]
Canopy Cover: [|6|0] % **Densiometer:** [ ] %
Shading: [|6|0] %

Snags and LWD:

Detritus (leaves, twigs)	N	L	(S)	M	E
Sticks (<2cm diam)	N	(L)	S	M	E
Branches (<15cm diam)	N	(L)	S	M	E
Logs (>15cm diam)	N	(L)	S	M	E

Substrate Description:

Bedrock	[|0] %	Gravel (2 - 4 mm)	[|2|0] %		
Boulder (> 256 mm)	[|0] %	Sand (0.05 - 2 mm)	[|6|5] %		
Cobble (64 - 256 mm)	[|0] %	Silt/Clay (< 0.05 mm)	[|5] %		
Pebble (4 - 64 mm)	[|1|0] %				

Habitat Attributes:

Periphyton	N	(L)	S	M	E
Moss	(N)	L	S	M	E
Filamentous algae	(N)	L	S	M	E
Macrophytes	(N)	L	S	M	E
Bank overhang vegetation	N	(L)	S	M	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	N	(L)	S	M	E
Blanketing silt	N	(L)	S	M	E
Substrate anoxia	(N)	L	S	M	E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

BED: Y [✓] N [ ] Collected by: [M|D|] Picked By: [D|I|] No. vials: [1] QAQC Residue: Y [ ] N [ ]
TYPE: Riffle [✓] Run [ ] Pool (rocky/gravel) [ ] Pool (sandy/silty) [ ]
(average over 10 m sampled)

Velocity (m/sec): max [0|·|3|] min [0|·|1|0]
Mean Sample Depth: [0|·|1|5] m
Mean Wetted Width: [|3|·|5] m
Method: 10 m kick only [✓]
10 m kick & gleaning rocks of different sizes (5) [ ]
30 minutes random live-pick [✓]
Other _____ [ ]
Canopy Cover: [|6|0] % **Densiometer:** [ ] %
Shading: [|6|0] %

Snags and LWD:

Detritus (leaves, twigs)	N	(L)	S	M	E
Sticks (<2cm diam)	N	(L)	S	M	E
Branches (<15cm diam)	N	(L)	S	M	E
Logs (>15cm diam)	(N)	L	S	M	E

Substrate Description:

Bedrock	[|0] %	Gravel (2 - 4 mm)	[|3|0] %		
Boulder (> 256 mm)	[|0] %	Sand (0.05 - 2 mm)	[|6|0] %		
Cobble (64 - 256 mm)	[|0] %	Silt/Clay (< 0.05 mm)	[|0] %		
Pebble (4 - 64 mm)	[|1|0] %				

Habitat Attributes:

Periphyton	N	(L)	S	M	E
Moss	(N)	L	S	M	E
Filamentous algae	(N)	L	S	M	E
Macrophytes	(N)	L	S	M	E
Bank overhang vegetation	N	(L)	S	M	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	N	(L)	S	M	E
Blanketing silt	N	(L)	S	M	E
Substrate anoxia	(N)	L	S	M	E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

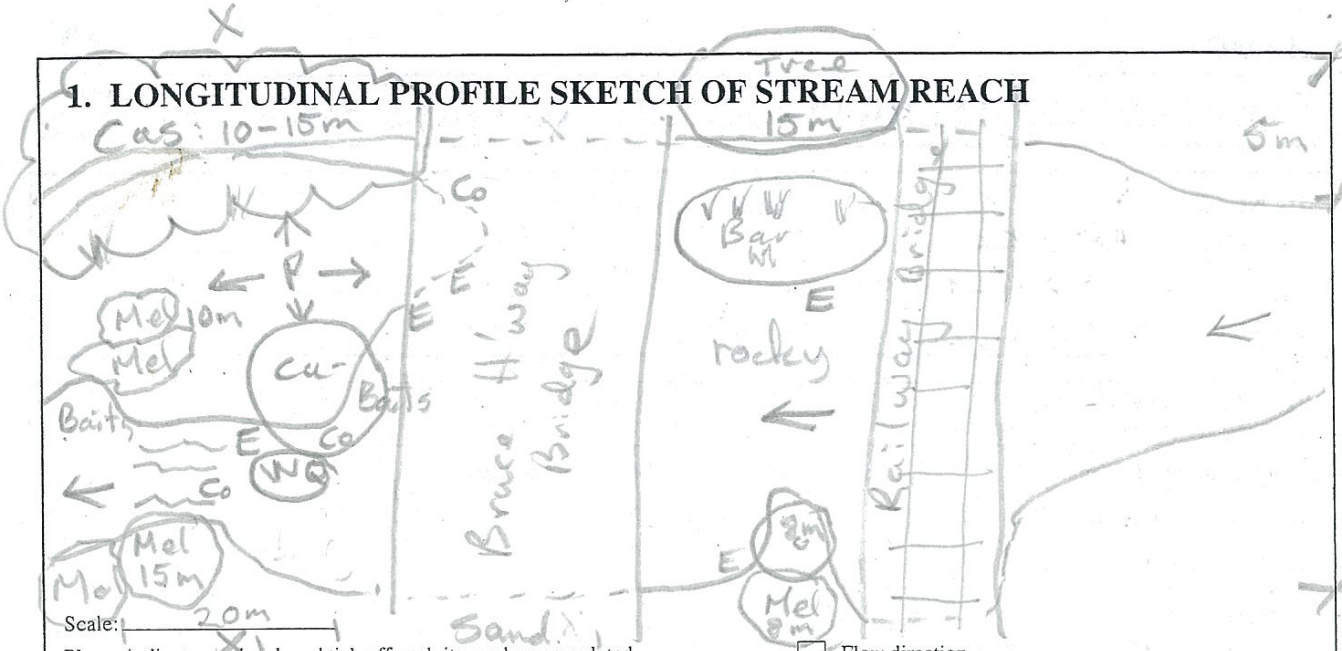
Comments Clear water sand bed creek with leaves & debris & LWD

ENTERED 12/9/12

TOTAL NO. VIALS: OTHERS:

DU506400.ai (ai17621) 2/9/2002

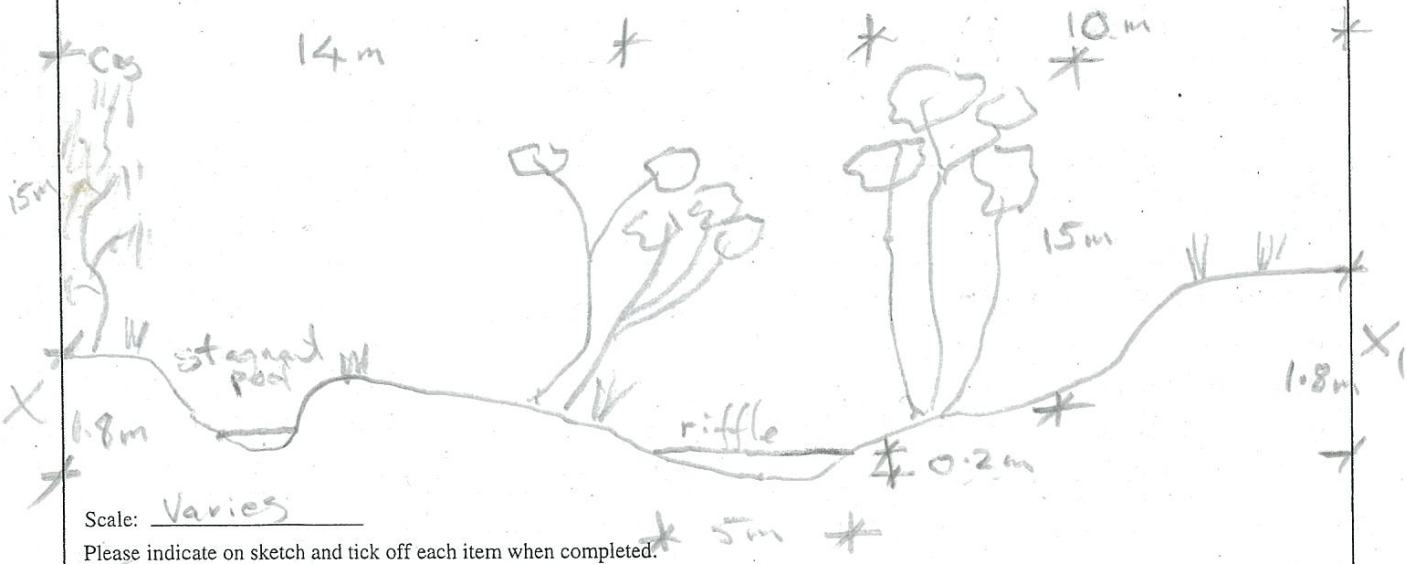
1. LONGITUDINAL PROFILE SKETCH OF STREAM REACH



Please indicate on sketch and tick off each item when completed.

- [x] Biological sampling sites for each habitat type.
- [x] Water quality measurement and water sample collection sites.
- [x] Location from where photograph(s) taken.
- [x] Flow direction
- [x] Location of cross-sectional profile sketch.
- [x] Riparian vegetation (include approx. heights).
- [x] Riparian zone width.

2. CROSS-SECTIONAL PROFILE SKETCH OF STREAM REACH



Scale: Varies

Please indicate on sketch and tick off each item when completed.

- [x] Bankfull bank height
- [x] Bankfull stream width
- [x] Stream wetted width
- [x] "Normal" wetted width
- [ ] Riparian vegetation height
- [ ] Riparian zone width
- [x] Water depth

3. COMMENTS

(*Office use only*) Entered into AQEIS __/__/__ by _____ Checked on __/__/__ by _____

AEF003

WATER QUALITY SAMPLING FIELD SHEET

Queensland Government
Natural Resources and Mines

Site Number [E|3| |A|Q|2|] Sample Number [ ]
Site Name Salt Water Creek.
Date [0|3/0|4/2|0|1|2] Project Name SCP
Time (24 hrs) [1|4:1|5] QHSS Analysis No. [ ]
Project Code [ ]
Run Code [ ]
Party [M|D|] [D|I|] [| |] Submitted / Received

A	B	C	D	E	F	G	H	I	J	K	L	M	N

SAMPLING LOCATION: Latitude —— Longitude ——
Reach orientation (looking downstream): (N) NE E SE S SW W NW Datum: ____

WATER QUALITY

Parameter	Value	Quality	Variable
Conductivity µS/cm@25°C	[1|6|2|1|]	[| |]	2010.5
Water Temperature °C	[2|7|•|1]	[| |]	2080.5
pH	[|7|•|5]2	[| |]	2100.5
Dissolved O_2 mg/l	[|5|•|8] 74.5%	[| |]	2351.5
Turbidity NTU	[4|<|1|3]	[| |]	2030.5
Air Temperature °C	[| • |]	[| |]	2065.5
Total Alkalinity mg/l $CaCO_3$	[2|0|0|•|0]	[| |]	2113.5
Phenol Alkalinity mg/l $CaCO_3$	[| | • |]	[| |]	2114.5
Transparency (secchi) m	[| • | |]	[| |]	2046.5
Velocity m/s	[0|•|0|]	[| |]	240.0
Gauge Height m	[| | • | |]	[| |]	100.0
Discharge m^3/s	[| | | • | | | |]	[| |]	140.0

Discharge Method: measured (gauged) ☐ obtained from rating curve ☐ estimated: ☐ no flow ☐ trickle ☐ >0.01 cumecs

WEATHER: *Rain in past week:* Yes [✓] No [ ] Comments: Heavy rain 10 days ago
Today: Rain ... None ... Cloud cover ... light ... Wind ... light
Comments: ....

OBSERVATIONS AT WATER SAMPLING SITE (within 2 metres of sampling point or on closest bank)

Shading: 40 % Water Odour: ... None ...
Water Surface Condition: (Normal) Slick Scum Foaming Other ....
Algae: On substrate: N (L) S M E In water column: N (L) S M E
Macrophytes: Emergent: (N) L S M E Submerged: N (L) S M E
Floating: (N) L S M E
Impacts: Human N L S (M) E Pastoral animals N L S M (E) Non-pastoral animals N (L) S M E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

PERCENT OF HABITAT TYPES IN 100 m REACH:

Riffle (R) [\| \|5] % Run [\|1\|0] %
Pool (rocky-K) [\| \|0] % Pool (sandy-S) [\|3\|5] %
Dry [\|5\|0] % Riffle + Run + Pool + Dry = 100%
Edge [\|4\|0] %
Edge is % of habitat available to sample from L and R banks

Macrophytes [\| \|5] % in: R ... 0 % E ... 50 %
K 50 % S ... 0 % Run ... 0 %
Algae [\| \|5] % in: R ... 0 % E 30 %
K 30 % S 30 % Run 10 %
Blanketing silt [\| \|5] %

COMMENTS: UTM 55K 5965691, 7793965

(*Office use only*) Entered into Hydsys ___/___/___ by ____ Checked on ___/___/___ by ____
Entered into AQEIS ___/___/___ by ____ Checked on ___/___/___ by ____

D1\506405.ai (ar17621) 2/9/2002

REACH OBSERVATIONS (of 100 m stream length)

Upstream landuse: Grazing

Adjacent landuse: Left bank: Score 3 Type light grazing Right bank: Score 3 Type light grazing

0. Urban/semi-urban, industrial
1. Irrigated cropping, intensive forestry or heavy grazing
2. Non-irrigated cropping, moderate grazing
3. Light grazing, vegetation clearing
4. Natural

Local catchment erosion:	None	Little	Some	(Moderate)	Extensive
Water colour:	(Clear)	Green	Opaque	Tannin	Other .....
Sediment deposits:	None	(Sand)	Silt	Other	
Algae: On substrate:	None	(Little)	Some	Moderate	Extensive
In water column:	(None)	Little	Some	Moderate	Extensive
Water odour:	(No)	Yes	Specify		
Substrate odour:	(No)	Yes	Specify		
Water surface:	(Normal)	Slick	Scum	Foaming	Other .....
Variety of habitat: (circle all types)	(Shallow)	(Deep)	(Pool)	(Run)	(Riffle)
	(Undercut bank)		(LWD)	Macrophytes	Other .....

Bars: (bed surface protruding from normal water level and forming a bar) 10 %

Flow level: (relative to 'watermark' i.e. normal inundation level shown by limit of terrestrial grasses, or by eroded area, or boundary in bank sediment types).

No flow	Low	Moderate	High	Flood
(dry/isolated)	(<watermark)	(=watermark)	(>watermark)	

RIPARIAN ZONE (to maximum 100 m width)

Width of riparian zone: Left bank 20 m Right bank 20 m

* Bare ground	None	Little	(Some)	Moderate	Extensive
* Grass	None	Little	(Some)	Moderate	Extensive
* Shrubs	None	Little	(Some)	Moderate	Extensive
* Trees <10 m high	None	Little	Some	(Moderate)	Extensive
* Trees >10 m high	None	Little	(Some)	Moderate	Extensive
Presence of exotic riparian species	None	(Little)	Some	Moderate	Extensive

Width of continuous tree zone from bank: Left bank 60 m Right bank 60 m

None = 0% Little = 1–10% Some = 10–50% Moderate = 50–75% Extensive >75% * Can add to >100%

MACROPHYTES Indicate the presence and abundance of the following common taxa in the 100 m reach:

Native						Native					
Azolla	(N)	L	S	M	E	Water Ribbon (*Triglochin*)	(N)	L	S	M	E
Duckweed	(N)	L	S	M	E	Water Lettuce (*Pistia stratiotes*)	(N)	L	S	M	E
Hornwort (*Ceratophyllum*)	(N)	L	S	M	E	Water Primrose (*Ludwigia*)	(N)	L	S	M	E
Stoneworts (*Chara* or *Nitella*)	(N)	L	S	M	E	Sedge (*Cyperus*)	(N)	L	S	M	E
Hydrilla	(N)	L	S	M	E	Common Rush (*Juncus*)	(N)	L	S	M	E
Water Milfoil (*Myriophyllum*)	(N)	L	S	M	E	Cumbungi (*Typha*)	(N)	L	S	M	E
Pondweeds (*Potamogeton*)	(N)	L	S	M	E	Slender Knotweed (*Persicaria*)	(N)	L	S	M	E
Ribbonweed (*Vallisneria*)	N	(L)	S	M	E	Water couch	N	(L)	S	M	E
.....	(N)	L	S	M	E	.....	N	L	S	M	E
Exotic						**Exotic**					
Water Hyacinth (*Eichhornia*)	(N)	L	S	M	E	Alligator Weed (*Alternanthera*)	(N)	L	S	M	E
Salvinia	(N)	L	S	M	E	Elodea	(N)	L	S	M	E
Para Grass (*Urochloa*)	(N)	L	S	M	E	*Egeria*	(N)	L	S	M	E
.....	N	L	S	M	E	.....	N	L	S	M	E

Comments: .....

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

AEF007

River Bioassessment Program

Queensland Government
Natural Resources and Mines

HABITAT ASSESSMENT FIELD SHEET

SITE NUMBER: [E13 1A1Q21] SITE NAME: Saltwater Ck

Date: 3/4/12 Time (24 hrs): [1 1 5 3 10] GPS: _____ Project Name: GCP

Habitat Variable	CATEGORY			
	Excellent	Good	Fair	Poor
1. Bottom substrate/available cover	Greater than 50% rubble, gravel, submerged logs, undercut banks or other stable habitat. 20, 19, 18, 17, 16	30-50% rubble, gravel or other stable habitat. Adequate habitat. 15, 14, 13, (12) 11	10-30% rubble, gravel or other stable habitat. Habitat availability less than desirable. 10, 9, 8, 7, 6	Less than 10% rubble, gravel or stable habitat. Lack of habitat is obvious. 5, 4, 3, 2, 1, 0
2. Embeddedness	Gravel, cobble and boulder particles are between 0 & 25% surrounded by fine sediment. 20, 19, 18, 17, 16	Gravel, cobble and boulder particles are between 25% & 50% surrounded by fine sediment. 15, 14, 13, 12, 11	Gravel, cobble and boulder particles are between 50 & 75% surrounded by fine sediment. 10, 9 (8) 7, 6	Gravel, cobble and boulder particles are over 75% surrounded by fine sediment. 5, 4, 3, 2, 1, 0
3. Velocity/depth category	Slow deep (<0.3 m/s & >0.5 m); slow shallow; fast deep; fast shallow; habitats all present. 20, 19, 18, 17, 16	Only 3 of the four habitat categories present (missing riffles or runs receive lower score than missing pools). 15, 14, (13) 12, 11	Only two of the four habitat categories present (missing riffles/runs receive lower score). 10, 9, 8, 7, 6	Dominating by one velocity/depth category (usually pool). 5, 4, 3, 2, 1, 0
4. Channel alteration	Little or no enlargement of islands or point bars and/or no channelisation. 15, 14, 13, 12	Some new increase in bar formation, mostly from coarse gravel; and/or some channelisation present. 11, 10, 9, 8	Moderate deposition of new gravel, coarse sand, on old and new bars; pools partly filled with silt; and/or embankments on both banks. 7, (6) 5, 4	Heavy deposits of fine materials, increased bar development; most pools filled with silt; and/or extensive channelisation. 3, 2, 1, 0
5. Bottom scouring and deposition	Less than 5% of the bottom affected by scouring and deposition. 15, 14, 13, 12	5-30% affected. Scours at constrictions and where grades steepen, some deposition in pools. 11, 10, 9, 8	30-50% affected. Deposits and scours at obstructions and bends. Some deposition in pools. (7) 6, 5, 4	More than 50% of the bottom changing nearly year long. Pools almost absent due to deposition. Only large rocks in riffle exposed. 3, 2, 1, 0

DU50340ORSC.P65 [LM3983] 20/8/98

River Bioassessment Program

HABITAT ASSESSMENT FIELD SHEET cont.

Habitat Variable	CATEGORY			
	Excellent	**Good**	**Fair**	**Poor**
6. Pool/riffle, run/bend ratio. *(Distance between riffles divided by stream width)*	0-7 Variety of habitat. Deep riffles and pools. 15, 14, 13, 12	7-15 Adequate depth in pools and riffles. Bends provide habitat. 11, 10, 9, 8	15-25 Occasional riffle or bend. Bottom contours provide some habitat. 7, 6, 5 (4)	>25 Essentially a straight stream. Generally all flat water or shallow riffle. Poor habitat. 3, 2, 1, 0
7. Bank stability	Stable. No evidence of erosion or bank failure. Side slopes generally <30%. Little potential for future problem. 10, 9	Moderately stable. Infrequent, small areas of erosion mostly healed over. Side slopes up to 40% on one bank. Slight potential in extreme floods. 8, 7, 6	Moderately unstable. Moderate frequency and size of erosional areas. Side slopes up to 60% on some banks. High erosion potential during extreme/high flows. 5 (4) 3	Unstable. Many eroded areas. Side slopes > 60% common. 'Raw' areas frequent along straight sections and bends. 2, 1, 0
8. Bank vegetative stability	Over 80% of the streambank surfaces covered by vegetation or boulders and cobble. 10, 9	50-79% of the streambank surfaces covered by vegetation, gravel or larger material. 8 (7) 6	25-49% of the streambank covered by vegetation, gravel or larger material. 5, 4, 3	Less than 25% of the streambank surfaces covered by vegetation, gravel or larger material. 2, 1, 0
9. Streamside cover	Dominant vegetation is of tree form. 10 (9)	Dominant vegetation shrub. 8, 7, 6	Dominant vegetation is grass, sedge, ferns. 5, 4, 3	Over 50% of the streambank has no vegetation and dominant material is soil, rock, bridge materials, culverts, or mine tailings. 2, 1, 0

Column Totals	9	32	29	0

Score 70

FRESHWATER BIOLOGICAL RECORD

Page ☐ of ☐

REFERENCE No.

Data operation began d m y: 4 4 12 Site No.: ☐

Site name: E3 102

Stream or dam name: Saltwater ck

Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
Seine 1	Rainbow			209	120	230	107	134
	Y			95	103	95		
	Bony			82	124	76	87	93
	bream			76	88	82	84	100
				89	72			
	Mel	spl		83	84	36	73	33
Seine 2	Bony	bream		107	132	10		
	Mel	spl		65	69	57	46	63
				40	33	29	34	65
	Rainbow			228				
Seine 3	Mel	spl		64	72	54	64	41
				+ (20)				
	Bony	bream		40	27	53	52	

Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
31								
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observed schools of Bream under

FRESHWATER BIOLOGICAL RECORD

Page ☐ of ☐

Nets: Set 4:30pm collected 7:00am

REFERENCE No.

Date operation began d 4 m 4 y 12 Site No.

Site name: Saltwater Ck

Stream or dam name:

Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
Fyke 1								
1	Ana	variegata		350	450			
2	Amb	agassizii		26	16	19		
3		juv						
4								
5								
6	Hyp	com		46	53	42	37	35
7				39	37	46	31	45
8				43	31	32	47	36
9				29	43	38	48	51
10				T	200			
11	Macro	crust		(6)				
12								
13								
14								
Fyke 2 15	Ana	variegata		350				
16	Hyp	com		(3)				
17	Hard	crust		(6)				
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
Bait 1 31								
32								
Bait 2 33	No							
Bait 3 34	No							
Bait 4 35	Hyp	com		(8)				
36	Amb	aga		(1)				
37								
38								
Bait 5 39	No							
Bait 6 40	Hyp	com		(40)				
41	Amb	aga		19	21	23	24	19
42	Macro	Crust		19	27	27		
Bait 7 43	Hyp	com		(5)				
Bait 8 44	Hyp	com						
Bait 9 45	Hyp	com		(30)	61	72	57	
46	Lep	uni		18				
47	Amb	aga		(3)				
48	Macro	Crust		(2)				
Bait 10 49	Hyp	com		(27)				
50	Amb	aga		(53)				
51	Macro	Crust		33				
52				28	28	37		
53				(1)				
54				64	(35)			
55				28	24			
56				(5)				
57								
58								
59								
60								

eels eat all fish in 3 bait traps — slime on nets

AEF002

MACROINVERTEBRATE SAMPLING FIELD SHEET

Queensland Government
Natural Resources and Mines

Site Number [A|L|S| A|Q|3] Sample Number [ ]
Site Name Lagoon CK — System is dry
Project Code [ ] Date [0|9/0|4/2|0|1|2] Time (24 hrs) [1|4:4|6]
Run Code [ ] Project Name GCP

EDGE/BACKWATER: Y [ ] N [ ] Collected by: [ ] Picked By: [ ] No. vials: [ ] QAQC Residue: Y [ ] N [ ]
(average over 10 m sampled)

Velocity (m/sec): max [|•| |] min [|•| |]
Mean Sample Depth: [|•| |] m
Mean Wetted Width: [| | |•|] m
Method: 10 m sweep [ ]
____ minutes random live-pick [ ]
Other _____ [ ]
Canopy Cover: [| |] % **Densiometer:** [| |] %
Shading: [| |] %
Snags and LWD:

Detritus (leaves, twigs)	N	L	S	M	E
Sticks (<2cm diam)	N	L	S	M	E
Branches (<15cm diam)	N	L	S	M	E
Logs (>15cm diam)	N	L	S	M	E

Substrate Description:
Bedrock [| |] % Gravel (2 - 4 mm) [| |] %
Boulder (> 256 mm) [| |] % Sand (0.05 - 2 mm) [| |] %
Cobble (64 - 256 mm) [| |] % Silt/Clay (< 0.05 mm) [| |] %
Pebble (4 - 64 mm) [| |] %

Habitat Attributes:

Periphyton	N	L	S	M	E
Moss	N	L	S	M	E
Filamentous algae	N	L	S	M	E
Macrophytes	N	L	S	M	E
Bank overhang vegetation	N	L	S	M	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	N	L	S	M	E
Blanketing silt	N	L	S	M	E
Substrate anoxia	N	L	S	M	E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

BED: Y [ ] N [ ] Collected by: [| |] Picked By: [| |] No. vials: [ ] QAQC Residue: Y [ ] N [ ]
TYPE: Riffle [ ] Run [ ] Pool (rocky/gravel) [ ] Pool (sandy/silty) [ ]
(average over 10 m sampled)

Velocity (m/sec): max [|•| |] min [|•| |]
Mean Sample Depth: [|•| |] m
Mean Wetted Width: [| | |•|] m
Method: 10 m kick only [ ]
10 m kick & gleaning rocks of different sizes (5) [ ]
____ minutes random live-pick [ ]
Other _____ [ ]
Canopy Cover: [| |] % **Densiometer:** [| |] %
Shading: [| |] %
Snags and LWD:

Detritus (leaves, twigs)	N	L	S	M	E
Sticks (<2cm diam)	N	L	S	M	E
Branches (<15cm diam)	N	L	S	M	E
Logs (>15cm diam)	N	L	S	M	E

Substrate Description:
Bedrock [| |] % Gravel (2 - 4 mm) [| |] %
Boulder (> 256 mm) [| |] % Sand (0.05 - 2 mm) [| |] %
Cobble (64 - 256 mm) [| |] % Silt/Clay (< 0.05 mm) [| |] %
Pebble (4 - 64 mm) [| |] %

Habitat Attributes:

Periphyton	N	L	S	M	E
Moss	N	L	S	M	E
Filamentous algae	N	L	S	M	E
Macrophytes	N	L	S	M	E
Bank overhang vegetation	N	L	S	M	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	N	L	S	M	E
Blanketing silt	N	L	S	M	E
Substrate anoxia	N	L	S	M	E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

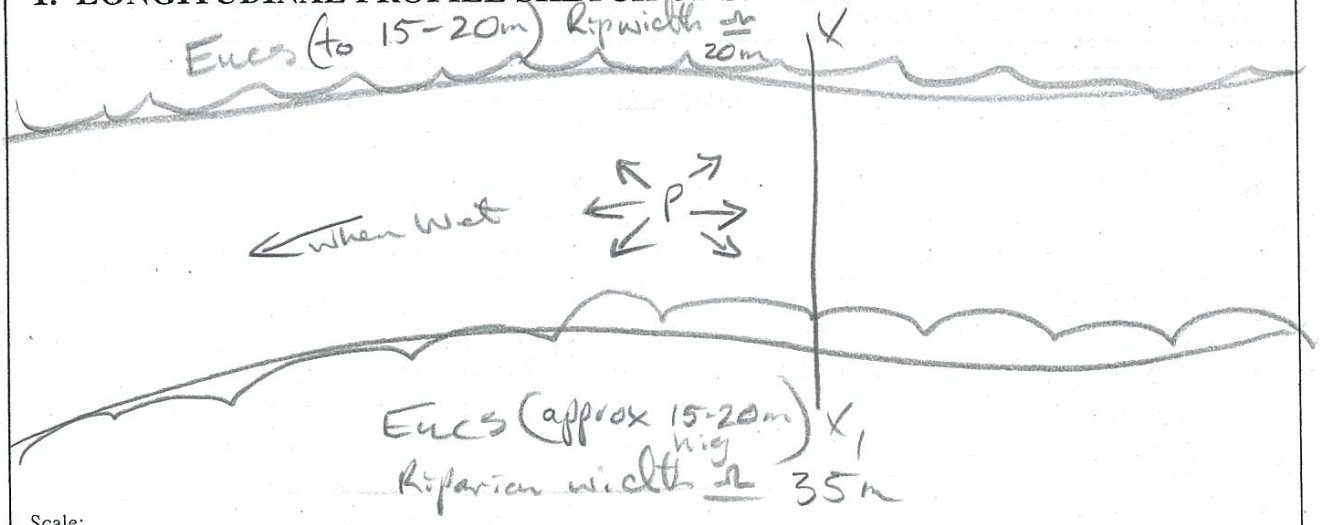
Comments Creek had recently dried up

ENTERED 12/9/12

TOTAL NO. VIALS: OTHERS:

DU506400.ai (nt17621) 2/9/2002

1. LONGITUDINAL PROFILE SKETCH OF STREAM REACH

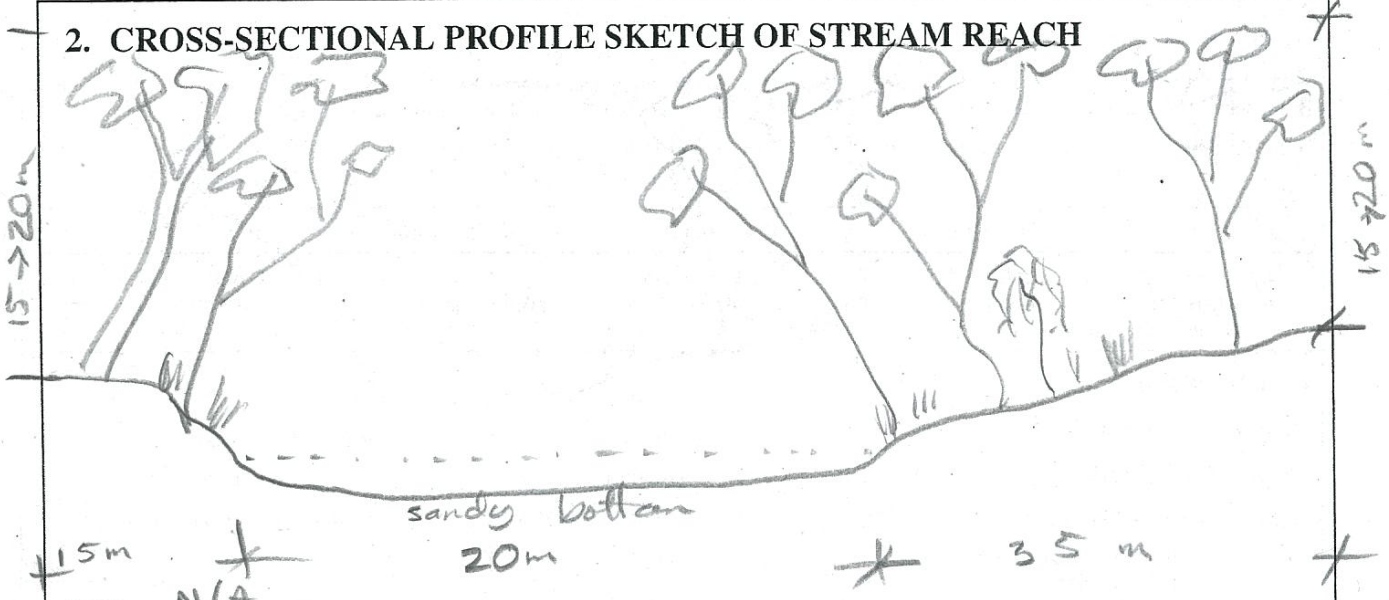


Scale: _____

Please indicate on sketch and tick off each item when completed.

- [x] Biological sampling sites for each habitat type.
- [x] Water quality measurement and water sample collection sites.
- [x] Location from where photograph(s) taken.
- [x] Flow direction
- [x] Location of cross-sectional profile sketch.
- [x] Riparian vegetation (include approx. heights).
- [x] Riparian zone width.

2. CROSS-SECTIONAL PROFILE SKETCH OF STREAM REACH



Scale: N/A

Please indicate on sketch and tick off each item when completed.

- [x] Bankfull bank height
- [x] Bankfull stream width
- [x] Stream wetted width
- [x] "Normal" wetted width
- [x] Riparian vegetation height
- [x] Riparian zone width
- [NA] Water depth

3. COMMENTS

Creek has recently dried

ENTERED

(*Office use only*) Entered into AQEIS ___/___/___ · by _____ Checked on ___/___/___ by _____

AEF003

WATER QUALITY SAMPLING FIELD SHEET

Queensland Government
Natural Resources and Mines

Site Number [ ] Sample Number [ ]
Site Name Lagoon Ck
Date [6/9/2014/2010 11 PM] Project Name GCP
Time (24 hrs) [1 4 : 4 6] QHSS Analysis No. [ ]
Project Code [ ]
Run Code [ ] Submitted
Party [MD] [DZ] [ ] Received

A	B	C	D	E	F	G	H	I	J	K	L	M	N

SAMPLING LOCATION: Latitude _____ Longitude _____
Reach orientation (looking downstream): N NE E SE S SW W NW Datum: _____

~~WATER QUALITY~~

Parameter	Value	Quality	Variable
Conductivity µS/cm@25°C	[ ]	[ ]	2010.5
Water Temperature °C	[•]	[ ]	2080.5
pH	[•]	[ ]	2100.5
Dissolved O_2 mg/l	[•]	[ ]	2351.5
Turbidity NTU	[ ]	[ ]	2030.5
Air Temperature °C	[•]	[ ]	2065.5
Total Alkalinity mg/l $CaCO_3$	[•]	[ ]	2113.5
Phenol Alkalinity mg/l $CaCO_3$	[•]	[ ]	2114.5
Transparency (secchi) m	[•]	[ ]	2046.5
Velocity m/s	[•]	[ ]	240.0
Gauge Height m	[•]	[ ]	100.0
Discharge m^3/s	[•]	[ ]	140.0

Discharge Method: measured (gauged) ☐ obtained from rating curve ☐ estimated: ☐ no flow ☐ trickle ☐ >0.01 cumecs

WEATHER: *Rain in past week:* Yes [ ] No [✓] Comments: .....
Today: Rain ..... None ..... Cloud cover ..... yes ..... Wind ..... light .....
Comments: .....

OBSERVATIONS AT WATER SAMPLING SITE (within 2 metres of sampling point or on closest bank)

Shading: ..... % Water Odour: .....
Water Surface Condition: Normal Slick Scum Foaming Other .....
Algae: On substrate: N L S M E In water column: N L S M E
Macrophytes: Emergent: N L S M E Submerged: N L S M E
Floating: N L S M E
Impacts: Human N L S M E Pastoral animals N L S M E Non-pastoral animals N L S M E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

PERCENT OF HABITAT TYPES IN 100 m REACH:

Riffle (R) [ ] % Run [ ] %
Pool (rocky-K) [ ] % Pool (sandy-S) [ ] %
Dry [ ] % Riffle + Run + Pool + Dry = 100%
Edge [ ] %
Edge is % of habitat available to sample from L and R banks

Macrophytes [ ] % in: R ..... % E ..... %
K ..... % S ..... % Run ..... %
Algae [ ] % in: R ..... % E ..... %
K ..... % S ..... % Run ..... %
Blanketing silt [ ] %

COMMENTS: .....

(*Office use only*) Entered into Hydsys __/__/__ by _____ Checked on __/__/__ by _____
Entered into AQEIS __/__/__ by _____ Checked on __/__/__ by _____

DU506405.ai (nr176211) 2/9/2002

REACH OBSERVATIONS (of 100 m stream length)

Upstream landuse: extensive grazing

Adjacent landuse: Left bank: Score 3 Type ..... Right bank: Score 3 Type .....

0. Urban/semi-urban, industrial
1. Irrigated cropping, intensive forestry or heavy grazing
2. Non-irrigated cropping, moderate grazing
3. Light grazing, vegetation clearing
4. Natural

Local catchment erosion:	None	Little	(Some)	Moderate	Extensive
Water colour: N/A	~~Clear~~	Green	Opaque	Tannin	Other .....
Sediment deposits:	None	(Sand)	(Silt)	Other	
Algae: On substrate:	~~None~~	~~Little~~	Some	Moderate	Extensive
N/A In water column:	~~None~~	~~Little~~	~~Some~~	~~Moderate~~	~~Extensive~~
Water odour: N/A	~~No~~	~~Yes~~	~~Specify~~		
Substrate odour: N/A	~~No~~	~~Yes~~	~~Specify~~		
Water surface: N/A	~~Normal~~	~~Slick~~	~~Scum~~	~~Foaming~~	~~Other~~ .....
Variety of habitat:	(Shallow)	Deep	Pool	(Run)	Riffle
(circle all types)	Undercut bank		(LWD)	Macrophytes	Other When wet!

Bars: (bed surface protruding from normal water level and forming a bar) ..... %

Flow level: (relative to 'watermark' i.e. normal inundation level shown by limit of terrestrial grasses, or by eroded area, or boundary in bank sediment types).

(No flow) (dry/isolated)	Low (<watermark)	Moderate (=watermark)	High (>watermark)	Flood

RIPARIAN ZONE (to maximum 100 m width)

Width of riparian zone: Left bank 35 m Right bank 15 m

* **Bare ground**	None	Little	(Some)	Moderate	Extensive
* **Grass**	None	Little	(Some)	Moderate	Extensive
* **Shrubs**	None	Little	(Some)	Moderate	Extensive
* **Trees <10 m high**	None	Little	(Some)	Moderate	Extensive
* **Trees >10 m high**	None	Little	Some	(Moderate)	Extensive
Presence of exotic riparian species	None	(Little)	Some	Moderate	Extensive

Width of continuous tree zone from bank: Left bank 100 m Right bank 100 m

None = 0% Little = 1–10% Some = 10–50% Moderate = 50–75% Extensive >75% * Can add to >100%

MACROPHYTES Indicate the presence and abundance of the following common taxa in the 100 m reach:

Native											
Azolla	N	L	S	M	E	Water Ribbon (*Triglochin*)	N	L	S	M	E
Duckweed	N	L	S	M	E	Water Lettuce (*Pistia stratiotes*)	N	L	S	M	E
Hornwort (*Ceratophyllum*)	N	L	S	M	E	Water Primrose (*Ludwigia*)	N	L	S	M	E
Stoneworts (*Chara* or *Nitella*)	N	L	S	M	E	Sedge (*Cyperus*)	N	L	S	M	E
Hydrilla	N	L	S	M	E	Common Rush (*Juncus*)	N	L	S	M	E
Water Milfoil (*Myriophyllum*)	N	L	S	M	E	Cumbungi (*Typha*)	N	L	S	M	E
Pondweeds (*Potamogeton*)	N	L	S	M	E	Slender Knotweed (*Persicaria*)	N	L	S	M	E
Ribbonweed (*Vallisneria*)	N	L	S	M	E	.....	N	L	S	M	E
.....	N	L	S	M	E	.....	N	L	S	M	E
Exotic											
Water Hyacinth (*Eichhornia*)	N	L	S	M	E	Alligator Weed (*Alternanthera*)	N	L	S	M	E
Salvinia	N	L	S	M	E	Elodea	N	L	S	M	E
Para Grass (*Urochloa*)	N	L	S	M	E	*Egeria*	N	L	S	M	E
.....	N	L	S	M	E	.....	N	L	S	M	E

Comments: .....

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

AEF007

River Bioassessment Program

Queensland Government
Natural Resources and Mines

HABITAT ASSESSMENT FIELD SHEET

SITE NUMBER: [ ] SITE NAME: Lagoon Ck

Date: 9 / 4 / 2012 Time (24 hrs): [1414] GPS: ____ Project Name: G.C.P

Habitat Variable	CATEGORY			
	Excellent	**Good**	**Fair**	**Poor**
1. Bottom substrate/available cover	Greater than 50% rubble, gravel, submerged logs, undercut banks or other stable habitat. 20, 19, 18, 17, 16	30-50% rubble, gravel or other stable habitat. Adequate habitat. 15, 14, 13, 12, 11	10-30% rubble, gravel or other stable habitat. Habitat availability less than desirable. 10, 9, 8, 7, 6	Less than 10% rubble, gravel or stable habitat. Lack of habitat is obvious. 5, 4, 3, (2), 1, 0
2. Embeddedness	Gravel, cobble and boulder particles are between 0 & 25% surrounded by fine sediment. 20, 19, 18, 17, 16	Gravel, cobble and boulder particles are between 25% & 50% surrounded by fine sediment. 15, 14, 13, 12, 11	Gravel, cobble and boulder particles are between 50 & 75% surrounded by fine sediment. 10, 9, 8, 7, 6	Gravel, cobble and boulder particles are over 75% surrounded by fine sediment. 5, 4, 3, (2), 1, 0
3. Velocity/depth category N/A	Slow deep (<0.3 m/s & >0.5 m); slow shallow; fast deep; fast shallow; habitats all present. 20, 19, 18, 17, 16	Only 3 of the four habitat categories present (missing riffles or runs receive lower score than missing pools). 15, 14, 13, 12, 11	Only two of the four habitat categories present (missing riffles/runs receive lower score). 10, 9, 8, 7, 6	Dominating by one velocity/depth category (usually pool). 5, 4, 3, (2), 1, 0
4. Channel alteration	Little or no enlargement of islands or point bars and/or no channelisation. 15, 14, 13, 12	Some new increase in bar formation, mostly from coarse gravel; and/or some channelisation present. 11, 10, 9, 8	Moderate deposition of new gravel, coarse sand, on old and new bars; pools partly filled with silt; and/or embankments on both banks. 7, 6, 5, 4	Heavy deposits of fine materials, increased bar development; most pools filled with silt; and/or extensive channelisation. 3, (2), 1, 0
5. Bottom scouring and deposition	Less than 5% of the bottom affected by scouring and deposition. 15, 14, 13, 12	5-30% affected. Scours at constrictions and where grades steepen, some deposition in pools. 11, 10, 9, 8	30-50% affected. Deposits and scours at obstructions and bends. Some deposition in pools. 7, 6, 5, 4	More than 50% of the bottom changing nearly year long. Pools almost absent due to deposition. Only large rocks in riffle exposed. 3, (2), 1, 0

DU503400RSC_P&S (LM3883) 20/8/98

River Bioassessment Program

HABITAT ASSESSMENT FIELD SHEET cont.

NATURAL RESOURCES Queensland Government

Habitat Variable	CATEGORY			
	Excellent	**Good**	**Fair**	**Poor**
6. Pool/riffle, run/bend ratio. *(Distance between riffles divided by stream width)*	0-7 Variety of habitat. Deep riffles and pools. 15, 14, 13, 12	7-15 Adequate depth in pools and riffles. Bends provide habitat. 11, 10, 9, 8	15-25 Occasional riffle or bend. Bottom contours provide some habitat. 7, 6, 5, 4	>25 Essentially a straight stream. Generally all flat water or shallow riffle. Poor habitat. 3, (2), 1, 0
7. Bank stability	Stable. No evidence of erosion or bank failure. Side slopes generally <30%. Little potential for future problem. 10, 9	Moderately stable. Infrequent, small areas of erosion mostly healed over. Side slopes up to 40% on one bank. Slight potential in extreme floods. 8, 7, 6	Moderately unstable. Moderate frequency and size of erosional areas. Side slopes up to 60% on some banks. High erosion potential during extreme/high flows. 5, (4), 3	Unstable. Many eroded areas. Side slopes > 60% common. 'Raw' areas frequent along straight sections and bends. 2, 1, 0
8. Bank vegetative stability	Over 80% of the streambank surfaces covered by vegetation or boulders and cobble. 10, 9	50-79% of the streambank surfaces covered by vegetation, gravel or larger material. 8, (7), 6	25-49% of the streambank covered by vegetation, gravel or larger material. 5, 4, 3	Less than 25% of the streambank surfaces covered by vegetation, gravel or larger material. 2, 1, 0
9. Streamside cover	Dominant vegetation is of tree form. 10, (9)	Dominant vegetation shrub. 8, 7, 6	Dominant vegetation is grass, sedge, ferns. 5, 4, 3	Over 50% of the streambank has no vegetation and dominant material is soil, rock, bridge materials, culverts, or mine tailings. 2, 1, 0

Column Totals	9	7	4	12

Score 32

FRESHWATER BIOLOGICAL RECORD

Page ☐ of ☐

REFERENCE No.

Date operation began: d 9 m 4 y 2012 Site No. —

Site name: Lagoon Ck

Stream or dam name: Lagoon Ck

System dry at time of field trip

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
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21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									
43									
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56									
57									
58									
59									
60									

FRESHWATER BIOLOGICAL RECORD

Page ☐ of ☐

REFERENCE No.

Date operation began d m y

Site No.

Site name

Stream or dam name

Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
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26								
27								
28								
29								
30								

Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
31								
32								
33								
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36								
37								
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AEF002

MACROINVERTEBRATE SAMPLING FIELD SHEET

Queensland Government
Natural Resources and Mines

Site Number [A|4|S| |A|Q|12] Sample Number [| | | | | | | | | |]
Site Name Ballyandoo Crossing
Project Code [| | | | |] Date [0|9/0|4/2|0|1|2] Time (24 hrs) [1|1|:|0|6]
Run Code [| | | | |] Project Name SCP

EDGE/BACKWATER: Y [✓] N [ ] Collected by: [M|D|] Picked By: [M|D|] No. vials: [1] QAQC Residue: Y [✓] N [ ]
(average over 10 m sampled)

Velocity (m/sec): max [0|·|1|1] min [0|·|0|1]
Mean Sample Depth: [0|·|2|0] m
Mean Wetted Width: [|1|5|·|0] m
Method: 10 m sweep [✓]
30 minutes random live-pick [✓]
Other _____ [ ]
Canopy Cover: [|1|0] % **Densiometer:** [| |] %
Shading: [|1|0] %

Snags and LWD:

Detritus (leaves, twigs)	N	(L)	S	M	E
Sticks (<2cm diam)	N	(L)	S	M	E
Branches (<15cm diam)	N	(L)	S	M	E
Logs (>15cm diam)	(N)	L	S	M	E

Substrate Description:

Bedrock	[1|7|0] %	Gravel (2 - 4 mm)	[| 1|5] %
Boulder (> 256 mm)	[| 1|0] %	Sand (0.05 - 2 mm)	[1|1|0] %
Cobble (64 - 256 mm)	[| 1|5] %	Silt/Clay (< 0.05 mm)	[| 1|5] %
Pebble (4 - 64 mm)	[| 1|5] %		

Habitat Attributes:

Periphyton	(N)	L	S	M	E
Moss	(N)	L	S	M	E
Filamentous algae	(N)	L	S	M	E
Macrophytes	N	(L)	S	M	E
Bank overhang vegetation	N	(L)	S	M	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	(N)	L	S	M	E
Blanketing silt	N	L	(S)	M	E
Substrate anoxia	N	(L)	S	M	E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

BED: Y [ ] N [ ] Collected by: [| |] Picked By: [| |] No. vials: [ ] QAQC Residue: Y [ ] N [ ]
TYPE: Riffle [ ] Run [ ] Pool (rocky/gravel) [ ] Pool (sandy/silty) [ ]
(average over 10 m sampled)

Velocity (m/sec): max [|·| |] min [|·| |]
Mean Sample Depth: [|·| |] m
Mean Wetted Width: [| | |·|] m
Method: 10 m kick only [ ]
10 m kick & gleaning rocks of different sizes (5) [ ]
—— minutes random live-pick [ ]
Other _____ [ ]
Canopy Cover: [| |] % **Densiometer:** [| |] %
Shading: [| |] %

Snags and LWD:

Detritus (leaves, twigs)	N	L	S	M	E
Sticks (<2cm diam)	N	L	S	M	E
Branches (<15cm diam)	N	L	S	M	E
Logs (>15cm diam)	N	L	S	M	E

Substrate Description:

Bedrock	[| |] %	Gravel (2 - 4 mm)	[| |] %
Boulder (> 256 mm)	[| |] %	Sand (0.05 - 2 mm)	[| |] %
Cobble (64 - 256 mm)	[| |] %	Silt/Clay (< 0.05 mm)	[| |] %
Pebble (4 - 64 mm)	[| |] %		

Habitat Attributes:

Periphyton	N	L	S	M	E
Moss	N	L	S	M	E
Filamentous algae	N	L	S	M	E
Macrophytes	N	L	S	M	E
Bank overhang vegetation	N	L	S	M	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	N	L	S	M	E
Blanketing silt	N	L	S	M	E
Substrate anoxia	N	L	S	M	E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

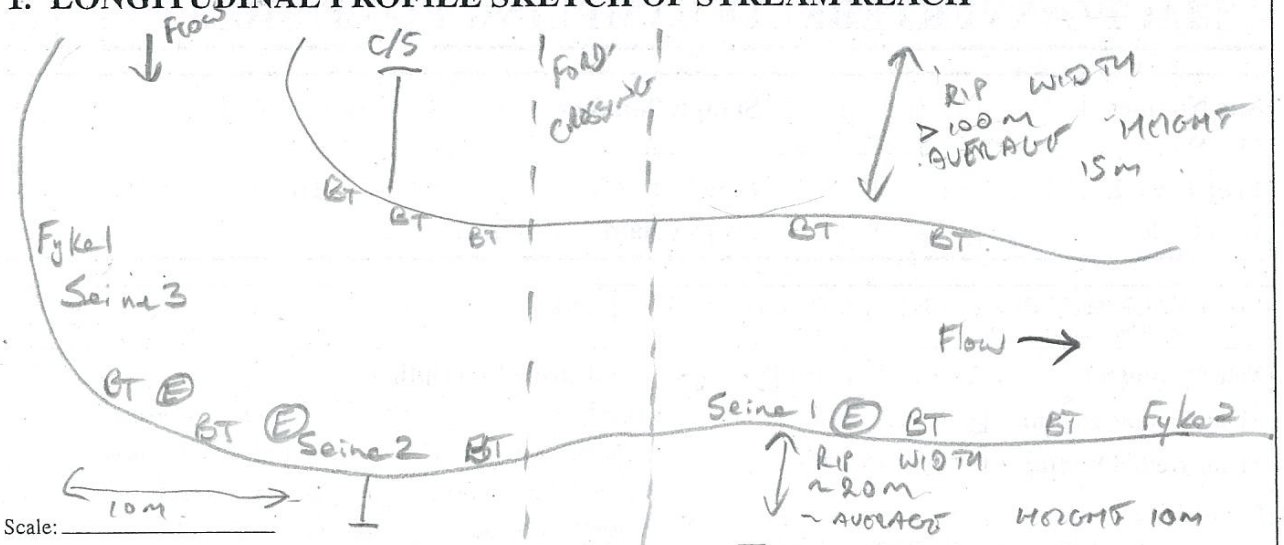
Comments SITE SURVEYED AT BELYANDO CROSSING
OUT TO DEEP WATER AT E3 SITE AND
NO ACCESS A SELECTED ALS AQ1

ENTERED 13/9/12

DU506400.ai (nr17621) 2/9/2002

TOTAL NO. VIALS: OTHERS:

1. LONGITUDINAL PROFILE SKETCH OF STREAM REACH

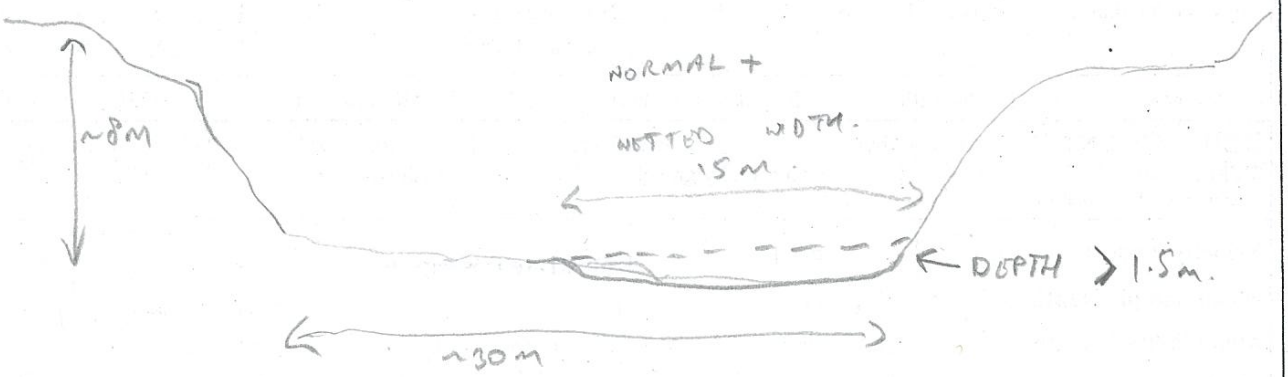


Scale: _____

Please indicate on sketch and tick off each item when completed.

- ☐ Biological sampling sites for each habitat type.
- ☐ Water quality measurement and water sample collection sites.
- ☐ Location from where photograph(s) taken.
- ☐ Flow direction
- ☐ Location of cross-sectional profile sketch.
- ☑ Riparian vegetation (include approx. heights).
- ☑ Riparian zone width.

2. CROSS-SECTIONAL PROFILE SKETCH OF STREAM REACH



Scale: _____

Please indicate on sketch and tick off each item when completed.

- ☑ Bankfull bank height
- ☑ Bankfull stream width
- ☑ Stream wetted width
- ☑ "Normal" wetted width
- ☐ Riparian vegetation height
- ☐ Riparian zone width
- ☑ Water depth

3. COMMENTS

Turbid slowish flowing river.

(*Office use only*) Entered into AQEIS ___/___/___ by _____ Checked on ___/___/___ by _____

AEF003

WATER QUALITY SAMPLING FIELD SHEET

Queensland Government
Natural Resources and Mines

Site Number [D|L|S|A|0|1|2] Sample Number [ ]
Site Name BALYANDO CROSSING
Date [0|9|0|K|2|0|1|2]
Time (24 hrs) [1|1:0|0]
Project Code [ ]
Run Code [ ]
Party [M|D|] [D|I|] [| |]
Project Name GCP
QHSS Analysis No. [ ]
Submitted / Received

A	B	C	D	E	F	G	H	I	J	K	L	M	N

SAMPLING LOCATION: Latitude 22° 42.141' Longitude 146° 36.209
Reach orientation (looking downstream): N NE E SE S SW W NW Datum:

WATER QUALITY

Parameter	Value	Quality	Variable
Conductivity µS/cm@25°C	[| 12|913]	[| |]	2010.5
Water Temperature °C	[25|•|1]	[| |]	2080.5
pH	[7|•|115	[| |]	2100.5
Dissolved O_2 mg/l	[6|•|715 81.9 %	[| |]	2351.5
Turbidity NTU	[910|•|6]	[| |]	2030.5
Air Temperature °C	[25|•|0]	[| |]	2065.5
Total Alkalinity mg/l $CaCO_3$	[ ] 95 mg/L	[| |]	2113.5
Phenol Alkalinity mg/l $CaCO_3$	[ ]	[| |]	2114.5
Transparency (secchi) m	[ ]	[| |]	2046.5
Velocity m/s	[ ]	[| |]	240.0
Gauge Height m	[ ]	[| |]	100.0
Discharge m^3/s	[ ]	[| |]	140.0

Discharge Method: measured (gauged) ☐ obtained from rating curve ☐ estimated: ☐ no flow ☐ trickle ☐ >0.01 cumecs

WEATHER: *Rain in past week:* Yes [ ] No [X] Comments:
Today: Rain N/G Cloud cover N/G Wind N/G
Comments: CLEAR & SUNNY

OBSERVATIONS AT WATER SAMPLING SITE (within 2 metres of sampling point or on closest bank)

Shading: 0 % Water Odour: N/G
Water Surface Condition: (Normal) Slick Scum Foaming Other
Algae: On substrate: (N) L S M E In water column: (N) L S M E
Macrophytes: Emergent: N (L) S M E Submerged: (N) L S M E
Floating: (N) L S M E
Impacts: Human N (L) S M E Pastoral animals N (L) S M E Non-pastoral animals N (L) S M E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

PERCENT OF HABITAT TYPES IN 100 m REACH:

Riffle (R) [\| 10] % Run [120] %
Pool (rocky-K) [16] % Pool (sandy-S) [40] %
Dry [30] % Riffle + Run + Pool + Dry = 100%
Edge [80] %
Edge is % of habitat available to sample from L and R banks

Macrophytes [\| 0] % in: R ..... % E ..... %
K ..... % S ..... % Run ..... %
Algae [\| 0] % in: R ..... % E ..... %
K ..... % S ..... % Run ..... %
Blanketing silt [15] %

COMMENTS: North / Eastings: 55K UTM: 455852, 7489369

(Office use only) Entered into Hydsys ___/___/___ by ___ Checked on ___/___/___ by ___
Entered into AQEIS ___/___/___ by ___ Checked on ___/___/___ by ___

DUS\KG405.ai (nr17621) 29/2002

REACH OBSERVATIONS (of 100 m stream length)

Upstream landuse: LIGHT GRAZING

Adjacent landuse: Left bank: Score 3 Type LIGHT GRAZING Right bank: Score 3 Type LIGHT GRAZ

0. Urban/semi-urban, industrial
1. Irrigated cropping, intensive forestry or heavy grazing
2. Non-irrigated cropping, moderate grazing
3. Light grazing, vegetation clearing
4. Natural

Local catchment erosion:	None	Little	(Some)	Moderate	Extensive
Water colour:	Clear	Green	(Opaque)	Tannin	Other
Sediment deposits:	None	(Sand)	Silt	Other	
Algae: On substrate:	(None)	Little	Some	Moderate	Extensive
In water column:	(None)	Little	Some	Moderate	Extensive
Water odour:	(No)	Yes	Specify		
Substrate odour:	No	(Yes)	Specify ANOXIC IN DEPOSITIONAL ZONES WHERE		
Water surface:	(Normal)	Slick	Scum	Foaming	Other LITTER HAS ACCUMULATED
Variety of habitat: (circle all types)	(Shallow)	(Deep)	(Pool)	Run	Riffle
	(Undercut bank)		(LWD)	Macrophytes	Other

Bars: (bed surface protruding from normal water level and forming a bar) 0 %

Flow level: (relative to 'watermark' i.e. normal inundation level shown by limit of terrestrial grasses, or by eroded area, or boundary in bank sediment types).

No flow (dry/isolated)	(Low) (<watermark)	Moderate (=watermark)	High (>watermark)	Flood

RIPARIAN ZONE (to maximum 100 m width)

Width of riparian zone: Left bank >100 m Right bank 20 m

* **Bare ground**	None	Little	Some	(Moderate)	Extensive
* **Grass**	None	Little	(Some)	Moderate	Extensive
* **Shrubs**	None	(Little)	Some	Moderate	Extensive
* **Trees <10 m high**	None	Little	Some	(Moderate)	Extensive
* **Trees >10 m high**	None	Little	(Some)	Moderate	Extensive
Presence of exotic riparian species	None	Little	Some	Moderate	Extensive

Width of continuous tree zone from bank: Left bank >100 m Right bank 20 m

None = 0% Little = 1–10% Some = 10–50% Moderate = 50–75% Extensive >75% * Can add to >100%

MACROPHYTES Indicate the presence and abundance of the following common taxa in the 100 m reach:

Native											
Azolla	(N)	L	S	M	E	Water Ribbon (*Triglochin*)	(N)	L	S	M	E
Duckweed	(N)	L	S	M	E	Water Lettuce (*Pistia stratiotes*)	(N)	L	S	M	E
Hornwort (*Ceratophyllum*)	(N)	L	S	M	E	Water Primrose (*Ludwigia*)	(N)	L	S	M	E
Stoneworts (*Chara* or *Nitella*)	(N)	L	S	M	E	Sedge (*Cyperus*)	(N)	L	S	M	E
Hydrilla	(N)	L	S	M	E	Common Rush (*Juncus*)	(N)	L	S	M	E
Water Milfoil (*Myriophyllum*)	(N)	L	S	M	E	Cumbungi (*Typha*)	(N)	L	S	M	E
Pondweeds (*Potamogeton*)	(N)	L	S	M	E	Slender Knotweed (*Persicaria*)	N	(L)	S	M	E
Ribbonweed (*Vallisneria*)	(N)	L	S	M	E	.....	N	L	S	M	E
.....	N	L	S	M	E	.....	N	L	S	M	E
Exotic											
Water Hyacinth (*Eichhornia*)	(N)	L	S	M	E	Alligator Weed (*Alternanthera*)	(N)	L	S	M	E
Salvinia	(N)	L	S	M	E	Elodea	(N)	L	S	M	E
Para Grass (*Urochloa*)	(N)	L	S	M	E	*Egeria*	(N)	L	S	M	E
.....	N	L	S	M	E	.....	N	L	S	M	E

Comments: .....

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

AEF007

River Bioassessment Program

Queensland Government
Natural Resources and Mines

HABITAT ASSESSMENT FIELD SHEET

SITE NUMBER: [A|L|S| |A|Q|1|2] **SITE NAME:** Ontario Crossing

Date: 9/4/2012 **Time (24 hrs):** [1|1|:|1|0|] **GPS:** _____ **Project Name:** G.C.P.

Habitat Variable	CATEGORY			
	Excellent	**Good**	**Fair**	**Poor**
1. Bottom substrate/available cover	Greater than 50% rubble, gravel, submerged logs, undercut banks or other stable habitat. 20, 19, 18, 17, (16)	30-50% rubble, gravel or other stable habitat. Adequate habitat. 15, 14, 13, 12, 11	10-30% rubble, gravel or other stable habitat. Habitat availability less than desirable. 10, 9, 8, 7, 6	Less than 10% rubble, gravel or stable habitat. Lack of habitat is obvious. 5, 4, 3, 2, 1, 0
2. Embeddedness	Gravel, cobble and boulder particles are between 0 & 25% surrounded by fine sediment. 20, 19, 18, 17, (16)	Gravel, cobble and boulder particles are between 25% & 50% surrounded by fine sediment. 15, 14, 13, 12, 11	Gravel, cobble and boulder particles are between 50 & 75% surrounded by fine sediment. 10, 9, 8, 7, 6	Gravel, cobble and boulder particles are over 75% surrounded by fine sediment. 5, 4, 3, 2, 1, 0
3. Velocity/depth category	Slow deep (<0.3 m/s & >0.5 m); slow shallow; fast deep; fast shallow; habitats all present. 20, 19, 18, 17, 16	Only 3 of the four habitat categories present (missing riffles or runs receive lower score than missing pools). 15, 14, 13, 12, (11)	Only two of the four habitat categories present (missing riffles/runs receive lower score). 10, 9, 8, 7, 6	Dominating by one velocity/depth category (usually pool). 5, 4, 3, 2, 1, 0
4. Channel alteration	Little or no enlargement of islands or point bars and/or no channelisation. 15, 14, (13) 12	Some new increase in bar formation, mostly from coarse gravel; and/or some channelisation present. 11, 10, 9, 8	Moderate deposition of new gravel, coarse sand, on old and new bars; pools partly filled with silt; and/or embankments on both banks. 7, 6, 5, 4	Heavy deposits of fine materials, increased bar development; most pools filled with silt; and/or extensive channelisation. 3, 2, 1, 0
5. Bottom scouring and deposition	Less than 5% of the bottom affected by scouring and deposition. 15, 14, 13, 12	5-30% affected. Scours at constrictions and where grades steepen, some deposition in pools. (11) 10, 9, 8	30-50% affected. Deposits and scours at obstructions and bends. Some deposition in pools. 7, 6, 5, 4	More than 50% of the bottom changing nearly year long. Pools almost absent due to deposition. Only large rocks in riffle exposed. 3, 2, 1, 0

DU503d00RSC.P65 [LW3883] 20/8/98

River Bioassessment Program

HABITAT ASSESSMENT FIELD SHEET cont.

NATURAL RESOURCES Queensland Government

Habitat Variable	CATEGORY			
	Excellent	**Good**	**Fair**	**Poor**
6. Pool/riffle, run/bend ratio. *(Distance between riffles divided by stream width)*	0-7 Variety of habitat. Deep riffles and pools. 15, 14, 13, 12	7-15 Adequate depth in pools and riffles. Bends provide habitat. 11, 10, 9, 8	15-25 Occasional riffle or bend. Bottom contours provide some habitat. 7, 6, 5, (4)	>25 Essentially a straight stream. Generally all flat water or shallow riffle. Poor habitat. 3, 2, 1, 0
7. Bank stability	Stable. No evidence of erosion or bank failure. Side slopes generally <30%. Little potential for future problem. 10, 9	Moderately stable. Infrequent, small areas of erosion mostly healed over. Side slopes up to 40% on one bank. Slight potential in extreme floods. 8, 7, (6)	Moderately unstable. Moderate frequency and size of erosional areas. Side slopes up to 60% on some banks. High erosion potential during extreme/high flows. 5, 4, 3	Unstable. Many eroded areas. Side slopes > 60% common. 'Raw' areas frequent along straight sections and bends. 2, 1, 0
8. Bank vegetative stability	Over 80% of the streambank surfaces covered by vegetation or boulders and cobble. 10, 9	50-79% of the streambank surfaces covered by vegetation, gravel or larger material. (8), 7, 6	25-49% of the streambank covered by vegetation, gravel or larger material. 5, 4, 3	Less than 25% of the streambank surfaces covered by vegetation, gravel or larger material. 2, 1, 0
9. Streamside cover	Dominant vegetation is of tree form. 10, 9	Dominant vegetation shrub. 8, 7, 6	Dominant vegetation is grass, sedge, ferns. 5, 4, 3	Over 50% of the streambank has no vegetation and dominant material is soil, rock, bridge materials, culverts, or mine tailings. 2, 1, 0

Column Totals	54	36	4	0

Score 94

FRESHWATER BIOLOGICAL RECORD

Page ☐ of ☐

REFERENCE No.

Date operation began d 9 m 4 y 12 — Site No. —

Site name: ALSAQ12 — Stream or dam name: Ballyandra Cross

Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
Seine 1	1	Barra		92	112	104	65	56
2				28	24	29	35	26
3				27	27	26	28	
4				+ 35				
5	Mel	spp		32	36	33	35	21
6				23	24	32	31	19
7				22	34	28	24	32
8				18	19	22	24	28
9	Amb	aga		36	42	40	23	26
10				25	27	23	24	20
11				21	33	25	28	29
12				24				
13	Cru	ste		29	27			
14								
15	Hyp	spp		25				
Seine 16	2 Bun	Bra		94	33	32	33	26
17				31	33	28	28	29
18				+ 83				
19	Mel	spp		+ 76				
20				19	18			
21	Amb	Aga		22	26	20	21	16
22				22	21	20	19	22
23	Cra	ste		26	32	29	29	
24								
25	Camp	gud		32				
26								
27	Leo	uni		76	36			
28								
29								
30								

Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
Seine 31	3 Mel	spp		+	(31)			
32	Bar	Bar		+	(15)			
33	Amb	aga		19	+			
34								
35								
+ 36								
41 37	Cam	gud		24				
38								
39								
40	Cra	ste		35	22	21	32	28
Fyke 41	1 Til	apia		90				
42								
43								
Fyke 44	2 Leo	uni		114	131	101		
45	Til	apia		34				
46								
Bait 47	1							
Bait 48	2							
Bait 49	3 Neo	hyp		71				
50	Hyp	spp		28	27			
51	Mdc	Mol		(1)				
52	Amb	aga		21				
Bait 53	4 Cla	cad		76				
54	Amb	aga		(9)				
Bait 55	5 Mog	ang		60				
Bait 56	6							
Bait 57	7							
58	Amb	aga		23				
59	Mog	ang		49				
Bait 60	Camp	gud		32	23			

Note: 2 purple spot gudgeon 57, 43 mm in bag net — No EF due to high turbidity
2x leathery grunter caught by hand.

FRESHWATER BIOLOGICAL RECORD

REFERENCE No.

Date operation began: d 9 m 4 y 12 — Site No. —

Site name: ALS AQ12 — Stream or dam name: Ballyandoo Clk

Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
Bait 1	9	Am	a		(2)				
2		Hy	-c		31				
3		Hydrobiosidae			(1)				
4		Neo	hy		72				
5			j						
Bait 6	10	Macrobiotidae			(3)				
7		Am	a		(5)				
8		Caridina	gu		31	35			
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									
43									
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58									
59									
60									

AEF002

MACROINVERTEBRATE SAMPLING FIELD SHEET

Queensland Government Natural Resources and Mines

Site Number [E3 |A|Q11 |] Sample Number [ ]
Site Name Splitter CK (@ Bruce Hwy)
Project Code [CQ|2|1 |2|9 |4|1] Date [0|3/0|4/2|0|1 |2] Time (24 hrs) [|7:4|3]
Run Code [ ] Project Name GCP

EDGE/~~BACKWATER~~: Y [✓] N [ ] Collected by: [M|D|] Picked By: [D|I|] No. vials: [1] QAQC Residue: Y [✓] N [ ]
(average over 10 m sampled)

Velocity (m/sec): max [0|·|0|] min [0|·|0|]
Mean Sample Depth: [0|·|2|0] m
Mean Wetted Width: [| |8|·|] m
Method: 10 m sweep [✓]
30 minutes random live-pick [ ]
Other _____ [ ]
Canopy Cover: [|6|0] % **Densiometer:** [ ] %
Shading: [|6|0] %

Snags and LWD:

Detritus (leaves, twigs)	N	L	(S)	M	E
Sticks (<2cm diam)	N	(L)	S	M	E
Branches (<15cm diam)	N	(L)	S	M	E
Logs (>15cm diam)	(N)	L	S	M	E

Substrate Description:

Bedrock	[	0] %	Gravel (2 - 4 mm)	[	15] %
Boulder (> 256 mm)	[	0] %	Sand (0.05 - 2 mm)	[	75] %
Cobble (64 - 256 mm)	[	0] %	Silt/Clay (< 0.05 mm)	[	5] %
Pebble (4 - 64 mm)	[	5] %			

Habitat Attributes:

Periphyton	N	(L)	S	M	E
Moss	(N)	L	S	M	E
Filamentous algae	(N)	L	S	M	E
Macrophytes	(N)	L	S	M	E
Bank overhang vegetation	N	(L)	S	M	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	N	(L)	S	M	E
Blanketing silt	N	(L)	S	M	E
Substrate anoxia	(N)	L	S	M	E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

BED: Y [✓] N [ ] Collected by: [M|D|] Picked By: [M|D|] No. vials: [1] QAQC Residue: Y [✓] N [ ]
TYPE: Riffle [✓] Run [ ] Pool (rocky/gravel) [ ] Pool (sandy/silty) [ ]
(average over 10 m sampled)

Velocity (m/sec): max [0|·|3|0] min [0|·|2|]
Mean Sample Depth: [0|·|1|5] m
Mean Wetted Width: [| |2|·|4] m
Method: 10 m kick only [✓]
10 m kick & gleaning rocks of different sizes (5) [ ]
30 minutes random live-pick [ ]
Other _____ [ ]
Canopy Cover: [|6|0] % **Densiometer:** [ ]%
Shading: [|6|0] %

Snags and LWD:

Detritus (leaves, twigs)	N	(L)	S	M	E
Sticks (<2cm diam)	N	(L)	S	M	E
Branches (<15cm diam)	N	(L)	S	M	E
Logs (>15cm diam)	(N)	L	S	M	E

Substrate Description:

Bedrock	[	0] %	Gravel (2 - 4 mm)	[	20] %
Boulder (> 256 mm)	[	0] %	Sand (0.05 - 2 mm)	[	70] %
Cobble (64 - 256 mm)	[	0] %	Silt/Clay (< 0.05 mm)	[	10] %
Pebble (4 - 64 mm)	[	10] %			

Habitat Attributes:

Periphyton	(N)	L	S	M	E
Moss	(N)	L	S	M	E
Filamentous algae	(N)	L	S	M	E
Macrophytes	(N)	L	S	M	E
Bank overhang vegetation	N	(L)	S	M	E
Trailing bank vegetation (tree roots, vegetation, grasses, etc)	N	(L)	S	M	E
Blanketing silt	N	(L)	S	M	E
Substrate anoxia	(N)	L	S	M	E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

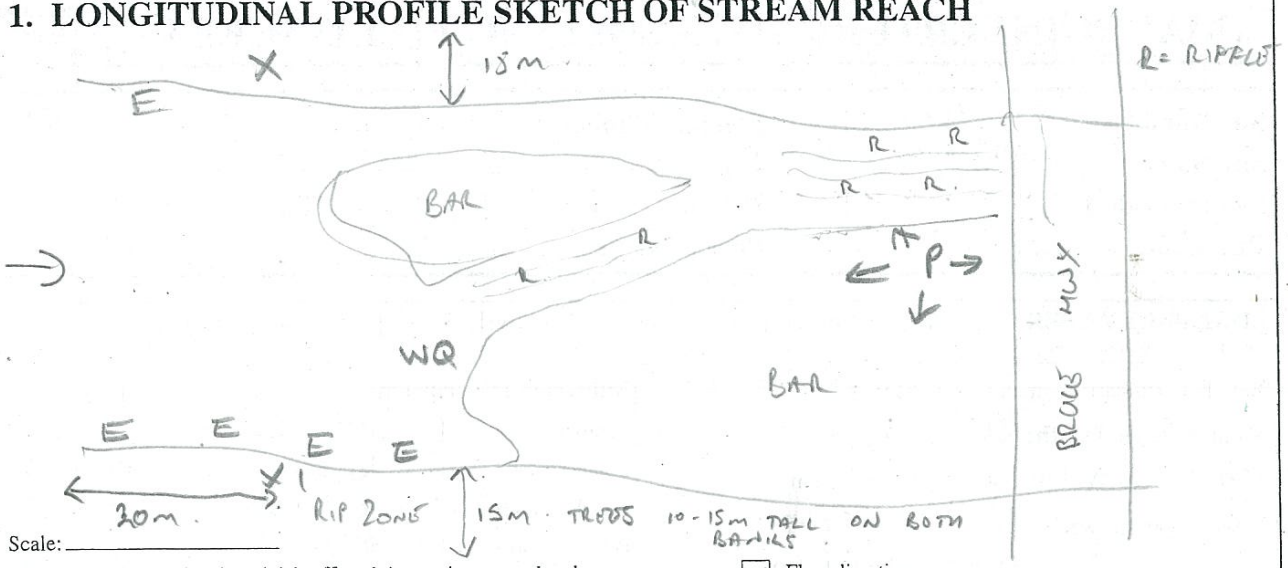
Comments UTM, 55K, 0603809 7789823

ENTERED TS 11/9/12

TOTAL NO. VIALS: OTHERS:

DU506400.ai (nr17621) 2/9/2002

1. LONGITUDINAL PROFILE SKETCH OF STREAM REACH

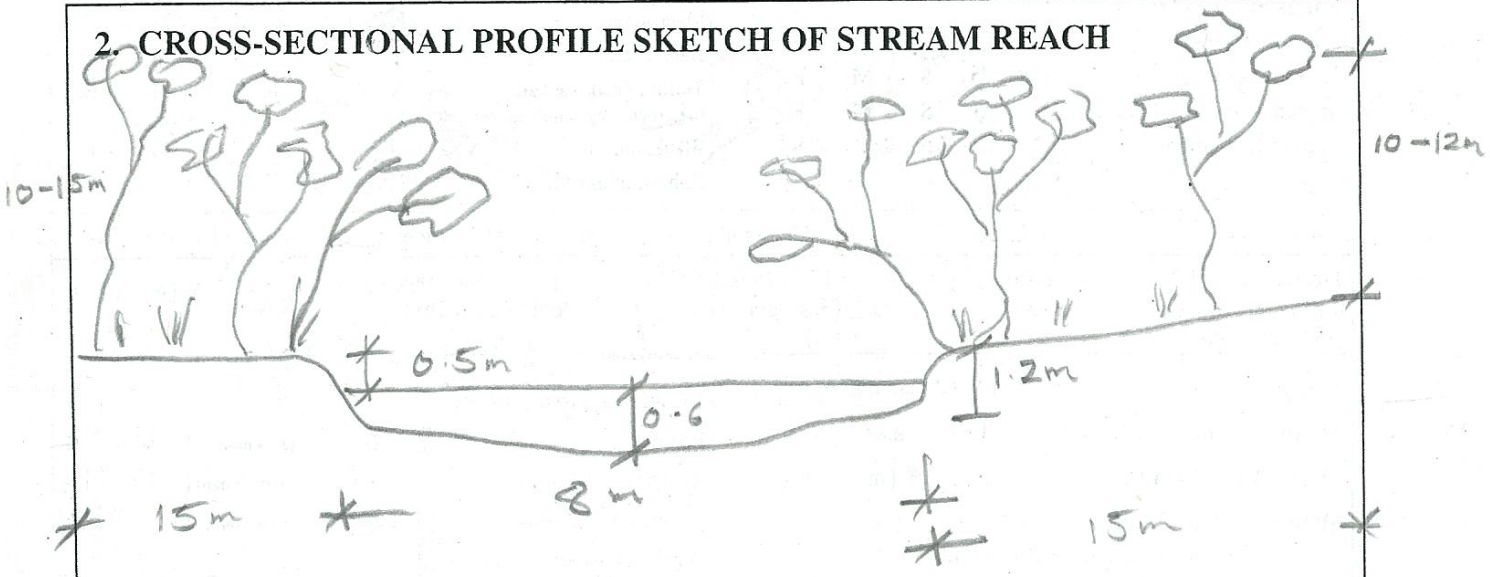


Scale: _____

Please indicate on sketch and tick off each item when completed.

- ☐ Biological sampling sites for each habitat type.
- ☑ Water quality measurement and water sample collection sites.
- ☐ Location from where photograph(s) taken.
- ☑ Flow direction
- ☐ Location of cross-sectional profile sketch.
- ☑ Riparian vegetation (include approx. heights).
- ☑ Riparian zone width.

2. CROSS-SECTIONAL PROFILE SKETCH OF STREAM REACH



Scale: _____

Please indicate on sketch and tick off each item when completed.

- ☑ Bankfull bank height
- ☑ Bankfull stream width
- ☑ Stream wetted width
- ☑ "Normal" wetted width
- ☑ Riparian vegetation height
- ☑ Riparian zone width
- ☐ Water depth

3. COMMENTS

ENTERED

(*Office use only*) Entered into AQEIS ___/___/___ by _____ Checked on ___/___/___ by _____

AEF003

WATER QUALITY SAMPLING FIELD SHEET

Queensland Government
Natural Resources and Mines

Site Number [E3 |A|0|1 |] Sample Number [ ]
Site Name Splitter Clk
Date [0 3/0 4/2 0 1 2] Project Name GCP
Time (24 hrs) [17:43] QHSS Analysis No. [ ]
Project Code [ ]
Run Code [ ] Submitted
Party [M D] [D I] [ ] Received

A	B	C	D	E	F	G	H	I	J	K	L	M	N

SAMPLING LOCATION: Latitude ____ Longitude ____
Reach orientation (looking downstream): N NE E SE S SW W NW Datum: ____

WATER QUALITY

Parameter	Value	Quality	Variable
Conductivity µS/cm@25°C	[1 1 4 6 7]	[ ]	2010.5
Water Temperature °C	[2 3 • 5]	[ ]	2080.5
pH	[7 • 9]	[ ]	2100.5
Dissolved 0_2 mg/l	[6 • 8] 81·2 %	[ ]	2351.5
Turbidity NTU	[2 5 4]	[ ]	2030.5
Air Temperature °C	[2 3 • 0]	[ ]	2065.5
Total Alkalinity mg/l $CaCO_3$	[1 7 5 • 0]	[ ]	2113.5
Phenol Alkalinity mg/l $CaCO_3$	[•]	[ ]	2114.5
Transparency (secchi) m	[•]	[ ]	2046.5
Velocity m/s	[•]	[ ]	240.0
Gauge Height m	[•]	[ ]	100.0
Discharge m^3/s	[•]	[ ]	140.0

Discharge Method: measured (gauged) ☐ obtained from rating curve ☐ estimated: ☐ no flow ☐ trickle ☐ >0.01 cumecs

WEATHER: *Rain in past week:* Yes [✓] No [ ] Comments: ____

Today: Rain No Cloud cover No Wind No
Comments: Clear conditions, Very Heavy rain previously

OBSERVATIONS AT WATER SAMPLING SITE (within 2 metres of sampling point or on closest bank)

Shading: 65 % Water Odour: None

Water Surface Condition: (Normal) Slick Scum Foaming Other

Algae: On substrate: N (L) S M E In water column: (N) L S M E
Macrophytes: Emergent: (N) L S M E Submerged: (N) L S M E
Floating: (N) L S M E

Impacts: Human N L (S) M E Pastoral animals N L S (M) E Non-pastoral animals N L S M E

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

PERCENT OF HABITAT TYPES IN 100 m REACH:

Riffle (R) [3 0] % Run [1 5] %
Pool (rocky-K) [1 0] % Pool (sandy-S) [4 5] %
Dry [1 0] % Riffle + Run + Pool + Dry = 100%
Edge [4 0] %
Edge is % of habitat available to sample from L and R banks

Macrophytes [1 0] % in: R 0 % E 0 %
K ____ % S 0 % Run 0 %
Algae [1 5] % in: R 0 % E 50 %
K 0 % S 50% Run 0 %
Blanketing silt [1 5] %

COMMENTS: ____

(*Office use only*) Entered into Hydsys ___/___/___ by ____ Checked on ___/___/___ by ____
Entered into AQEIS ___/___/___ by ____ Checked on ___/___/___ by ____

DUS(46405.ai (mr17621) 29/3/2002

REACH OBSERVATIONS (of 100 m stream length)

Upstream landuse: GRAZING

Adjacent landuse: Left bank: Score 2 Type MOD GRAZ Right bank: Score 2 Type MOD GRAZ

0. Urban/semi-urban, industrial
1. Irrigated cropping, intensive forestry or heavy grazing
2. Non-irrigated cropping, moderate grazing
3. Light grazing, vegetation clearing
4. Natural

Local catchment erosion:	None	(Little)	Some	Moderate	Extensive
Water colour:	(Clear)	Green	Opaque	Tannin	Other
Sediment deposits:	None	(Sand)	Silt	Other	
Algae: On substrate:	(None)	Little	Some	Moderate	Extensive
In water column:	(None)	Little	Some	Moderate	Extensive
Water odour:	(No)	Yes	Specify		
Substrate odour:	(No)	Yes	Specify		
Water surface:	(Normal)	Slick	Scum	Foaming	Other
Variety of habitat:	(Shallow)	Deep	(Pool)	(Run)	(Riffle)
(circle all types)	(Undercut bank)		LWD	Macrophytes	Other

Bars: (bed surface protruding from normal water level and forming a bar) 40 %

Flow level: (relative to 'watermark' i.e. normal inundation level shown by limit of terrestrial grasses, or by eroded area, or boundary in bank sediment types).

No flow	Low	Moderate	High	Flood
(dry/isolated)	(<watermark)	(=watermark)	(>watermark)	

RIPARIAN ZONE (to maximum 100 m width)

Width of riparian zone: Left bank 15 m Right bank 15 m

* **Bare ground**	None	(Little)	Some	Moderate	Extensive
* **Grass**	None	Little	(Some)	Moderate	Extensive
* **Shrubs**	None	Little	(Some)	Moderate	Extensive
* **Trees <10 m high**	None	Little	(Some)	Moderate	Extensive
* **Trees >10 m high**	None	Little	Some	Moderate	(Extensive)
Presence of exotic riparian species	None	Little	Some	Moderate	Extensive ?

Width of continuous tree zone from bank: Left bank 20 m Right bank 20 m

None = 0% Little = 1–10% Some = 10–50% Moderate = 50–75% Extensive >75% * Can add to >100%

MACROPHYTES Indicate the presence and abundance of the following common taxa in the 100 m reach:

Native											
Azolla	N	L	S	M	E	Water Ribbon (*Triglochin*)	(N)	L	S	M	E
Duckweed	N	L	S	M	E	Water Lettuce (*Pistia stratiotes*)	(N)	L	S	M	E
Hornwort (*Ceratophyllum*)	N	L	S	M	E	Water Primrose (*Ludwigia*)	(N)	L	S	M	E
Stoneworts (*Chara* or *Nitella*)	N	L	S	M	E	Sedge (*Cyperus*)	(N)	L	S	M	E
Hydrilla	N	L	S	M	E	Common Rush (*Juncus*)	(N)	L	S	M	E
Water Milfoil (*Myriophyllum*)	N	L	S	M	E	Cumbungi (*Typha*)	(N)	L	S	M	E
Pondweeds (*Potamogeton*)	N	L	S	M	E	Slender Knotweed (*Persicaria*)	(N)	L	S	M	E
Ribbonweed (*Vallisneria*)	N	L	S	M	E	.....	N	L	S	M	E
.....	N	L	S	M	E	.....	N	L	S	M	E
Exotic											
Water Hyacinth (*Eichhornia*)	N	L	S	M	E	Alligator Weed (*Alternanthera*)	N	L	S	M	E
Salvinia	N	L	S	M	E	Elodea	N	L	S	M	E
Para Grass (*Urochloa*)	N	L	S	M	E	*Egeria*	N	L	S	M	E
.....	N	L	S	M	E	.....	N	L	S	M	E

Comments: .....

N = none L = 1-10% (little) S = 10-50% (some) M = 50-75% (moderate) E = >75% (extensive)

AEF007

River Bioassessment Program

Queensland Government
Natural Resources and Mines

HABITAT ASSESSMENT FIELD SHEET

SITE NUMBER: [E 1 3 1 1 A 1 Q 1 1 1] SITE NAME: Splitter ck

Date: 3 / 4 / 12 Time (24 hrs): [0 8 1 0 1 0] GPS: _____ Project Name: GCP

Habitat Variable	CATEGORY			
	Excellent	**Good**	**Fair**	**Poor**
1. Bottom substrate/available cover	Greater than 50% rubble, gravel, submerged logs, undercut banks or other stable habitat. 20, 19, 18, 17, 16	30-50% rubble, gravel or other stable habitat. Adequate habitat. 15, 14, 13, 12, (11)	10-30% rubble, gravel or other stable habitat. Habitat availability less than desirable. 10, 9, 8, 7, 6	Less than 10% rubble, gravel or stable habitat. Lack of habitat is obvious. 5, 4, 3, 2, 1, 0
2. Embeddedness	Gravel, cobble and boulder particles are between 0 & 25% surrounded by fine sediment. 20, 19, 18, 17, 16	Gravel, cobble and boulder particles are between 25% & 50% surrounded by fine sediment. 15, 14, 13, 12, 11	Gravel, cobble and boulder particles are between 50 & 75% surrounded by fine sediment. 10, 9, 8, 7, 6	Gravel, cobble and boulder particles are over 75% surrounded by fine sediment. (5) 4, 3, 2, 1, 0
3. Velocity/depth category	Slow deep (<0.3 m/s & >0.5 m); slow shallow; fast deep; fast shallow; habitats all present. 20, 19, 18, 17, 16	Only 3 of the four habitat categories present (missing riffles or runs receive lower score than missing pools). (15) 14, 13, 12, 11	Only two of the four habitat categories present (missing riffles/runs receive lower score). 10, 9, 8, 7, 6	Dominating by one velocity/depth category (usually pool). 5, 4, 3, 2, 1, 0
4. Channel alteration	Little or no enlargement of islands or point bars and/or no channelisation. 15, 14, 13, 12	Some new increase in bar formation, mostly from coarse gravel; and/or some channelisation present. 11, 10, 9, (8)	Moderate deposition of new gravel, coarse sand, on old and new bars; pools partly filled with silt; and/or embankments on both banks. 7, 6, 5, 4	Heavy deposits of fine materials, increased bar development; most pools filled with silt; and/or extensive channelisation. 3, 2, 1, 0
5. Bottom scouring and deposition	Less than 5% of the bottom affected by scouring and deposition. 15, 14, 13, 12	5-30% affected. Scours at constrictions and where grades steepen, some deposition in pools. 11, 10, 9, 8	30-50% affected. Deposits and scours at obstructions and bends. Some deposition in pools. 7, 6, 5, 4	More than 50% of the bottom changing nearly year long. Pools almost absent due to deposition. Only large rocks in riffle exposed. (3) 2, 1, 0

DU503400RSC.P&S (LA3863) 20/8/98

River Bioassessment Program

HABITAT ASSESSMENT FIELD SHEET cont.

NATURAL RESOURCES Queensland Government

Habitat Variable	CATEGORY			
	Excellent	**Good**	**Fair**	**Poor**
6. Pool/riffle, run/bend ratio. *(Distance between riffles divided by stream width)*	0-7 Variety of habitat. Deep riffles and pools. 15, 14, 13, 12	7-15 Adequate depth in pools and riffles. Bends provide habitat. 11, 10, 9, 8	15-25 Occasional riffle or bend. Bottom contours provide some habitat. (7), 6, 5, 4	>25 Essentially a straight stream. Generally all flat water or shallow riffle. Poor habitat. 3, 2, 1, 0
7. Bank stability	Stable. No evidence of erosion or bank failure. Side slopes generally <30%. Little potential for future problem. 10, 9	Moderately stable. Infrequent, small areas of erosion mostly healed over. Side slopes up to 40% on one bank. Slight potential in extreme floods. (8), 7, 6	Moderately unstable. Moderate frequency and size of erosional areas. Side slopes up to 60% on some banks. High erosion potential during extreme/high flows. 5, 4, 3	Unstable. Many eroded areas. Side slopes > 60% common. 'Raw' areas frequent along straight sections and bends. 2, 1, 0
8. Bank vegetative stability	Over 80% of the streambank surfaces covered by vegetation or boulders and cobble. (10), 9	50-79% of the streambank surfaces covered by vegetation, gravel or larger material. 8, 7, 6	25-49% of the streambank covered by vegetation, gravel or larger material. 5, 4, 3	Less than 25% of the streambank surfaces covered by vegetation, gravel or larger material. 2, 1, 0
9. Streamside cover	Dominant vegetation is of tree form. (10), 9	Dominant vegetation shrub. 8, 7, 6	Dominant vegetation is grass, sedge, ferns. 5, 4, 3	Over 50% of the streambank has no vegetation and dominant material is soil, rock, bridge materials, culverts, or mine tailings. 2, 1, 0

Column Totals	20	42	7	8

Score	77

FRESHWATER BIOLOGICAL RECORD

Page ☐ of ☐

REFERENCE No.

Date operation began: d 3 m 4 y 12 — Site No. 1

Site name: Splitter CK — Stream or dam name: Splitter CK

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
Fyke	1	Ang	rhe		450	400	380	220	
		Hyp	Com		47	63	36	38	
		Leo	uni		39	48	34	36	
Fyke	2	Ang	rhe		450	400			
		Macro-	Brachium		(14)				
		Shrimp			(3)				
Bait	1	Shrimp			(1)				
		Toad	Bufo		(1)				
		Amb	aga		30				
		Hyp	com		26	49	36	25	24
					34				
Bait?	2	Amb	aga		24	29	29	32	31
					26	29	30	28	27
					30	31	29	24	31
					34	28	26	29	32
					+	13 others			
		Leo	uni		34	40	41	39	34
					38				
		Hyp	Com		61	34	32	41	39

	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
Bait	3	Amb	aga		38	38	37	39	34
					38	33	30	29	26
					28	33	37	26	29
					29	27	28	28	28
		Leo	uni		64				
		Hyp	com		67	47	55	46	43
					37	38	43		
		Mach-	Brach		(4)				
Bait	4	Macro-	Brach		(1)				
		Leo	uni		32				
		Hyp	com		31	32	26	28	28
					23	40	42	27	26
					42	34			
Bait	5	Hyp	com		46	48			
		Amb	aga		30	28	34		
		Leo	uni		38	37			
Bait	6	Hyp	com		(20)				
		Sam	hook		32				
		Amb	aga		(1)				
		Mel	spl		22				
		Mac	brac		(2)				

FRESHWATER BIOLOGICAL RECORD

Page [ ] of [ ]

REFERENCE No.

Date operation began: d 3 m 9 y 12 | Site No.: [ ]

Site name: E3AQ1

Stream or dam name: Splitter Ck

Method	Row	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
Bait	1	7	Leo	uni		34				
	2		Gam	hook		24				
	3		Hyp	com		(2)				
	4									
Bait	5	8	nothing							
	6									
	7									
Bait	8									
	9	9	nothing							
	10									
	11									
Bait	12	10	Mac	Brach		(4)				
	13									
EF	14	1	Ang	rhe		(12)	800	450		
	15		Leo	uni		(1)	178			
	16									
EF	17	2	Ang	rhe		(2)	220	150		
	18		Leo	uni		(1)	32			
	19									
	20									
EF	21	3	Ang	rhe		800	400			
	22									
EF	23	4	Ang	rhe		700	600	450	200	
	24		Mel	spl		65				
	25		Leo	uni		47	37			
EF	26	5	Ang	rhe		220	200	90		
	27		Mel	spl		43				
	28									
	29									
	30									

Method	Row	Operation No.	Genus	Species	Fish No.	L (mm)	L (mm)	L (mm)	L (mm)	L (mm)
EF	31	6	Ang	rho		120	110	120		
	32		Mel	spl		54				
	33									
EF	34	7	Mel	spl		80	39	47	42	54
	35					45	55			
	36		Hyp	com		37	30			
	37		Leo	uni		39	46			
	38		Amb	aga		30				
EF	39	8	Leo	uni		117	42	94	61	
	40									
	41		Mel	spl		72				
	42									
	43		Hyp	com		43	40	37	32	
	44									
	45									
	46									
	47									
	48									
	49									
	50									
	51									
	52									
	53									
	54									
	55									
	56									
	57									
	58									
	59									
	60									

* Note that high conductivity made EF unit relatively ineffective except on larger species.

Note:
Set 4:30pm
Collected 7:10am

Appendix B – Raw Water Quality Data

ALS Group
Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: **EB1209604**		
Client	: **ALS WATER RESOURCES GROUP**	Laboratory	: Environmental Division Brisbane
Contact	: MR MARK DAHM	Contact	: Customer Services
Address	: PO BOX 3216 YERONGA 4104	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: mark.dahm@alsglobal.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3859 7800	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3859 7820	Facsimile	: +61 7 3243 7218
Project	: CQ212941 Waratah Coal Project	Page	: 1 of 4
Order number	: ----		
C-O-C number	: ----	Quote number	: EB2012ECOENV0381 (BN/245/12)
Site	: ----		
Sampler	: Mark Dahm	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 11-APR-2012	Issue Date	: 13-APR-2012 10:40
Client Requested Due Date	: 18-APR-2012	Scheduled Reporting Date	: **18-APR-2012**

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 8.2'C <-> 11.3'C - Ice present
No. of coolers/boxes	: 4 x medium	No. of samples received	: 8
Security Seal	: Intact.	No. of samples analysed	: 8

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- Sample containers do not comply to pretreatment / preservation standards (AS, APHA, USEPA). Please refer to the Sample Container(s)/Preservation Non-Compliance Log at the end of this report for details.
- Samples submitted for dissolved metals analysis should be acidified with nitric acid, following field filtration. Additional charges of up to $5.00 will apply to each sample requiring filtration and preservation upon receipt by the laboratory.
- **Sample containers do not comply to pretreatment / preservation standards (AS, APHA, USEPA). Please refer to the Sample Container(s)/Preservation Non-Compliance Log at the end of this report for details.**
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- **Please be advised that all samples were logged as per COC.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Matt Goodwin.
- Analytical work for this work order will be conducted at ALS Brisbane.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.

Issue Date	: 13-APR-2012 10:40
Page	: 2 of 4
Work Order	: EB1209604
Client	: ALS WATER RESOURCES GROUP

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

Method / Client sample ID	Sample Container Received	Preferred Sample Container for Analysis
EG020A-F : Dissolved Metals by ICP-MS - Suite A		
ALS AQ6	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ5	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ4	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ7	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ8	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ12	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ1	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ2	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
EG020B-F : Dissolved Metals by ICP-MS - Suite B		
ALS AQ6	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ5	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ4	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ7	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ8	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ12	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ1	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ2	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
EG035F : Dissolved Mercury by FIMS		
ALS AQ6	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ5	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ4	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ7	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ8	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ12	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ1	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ2	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
EG094A-F : Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS		
ALS AQ6	- Clear Plastic Bottle - Natural	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Filtered
ALS AQ5	- Clear Plastic Bottle - Natural	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Filtered
E3 AQ4	- Clear Plastic Bottle - Natural	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Filtered
ALS AQ7	- Clear Plastic Bottle - Natural	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Filtered
ALS AQ8	- Clear Plastic Bottle - Natural	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Filtered
ALS AQ12	- Clear Plastic Bottle - Natural	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Filtered
E3 AQ1	- Clear Plastic Bottle - Natural	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Filtered
E3 AQ2	- Clear Plastic Bottle - Natural	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Filtered

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default to 15:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory for processing purposes and will be shown bracketed without a time component.

Issue Date : 13-APR-2012 10:40
Page : 3 of 4
Work Order : EB1209604
Client : ALS WATER RESOURCES GROUP

Matrix: **WATER**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	WATER - EA010P Conductivity (PC)	WATER - EA015H Total Dissolved Solids - High Level	WATER - EA025H Suspended Solids (High Level)	WATER - EG020F Dissolved Metals by ICPMS	WATER - EG020T Total Recoverable Metals by ICPMS	WATER - EG094A-F Dissolved Metals in Fresh Water Suite A by ORC-ICPMS	WATER - EG094A-T Total Metals in Fresh water Suite A by ORC-ICPMS	WATER - EN055 - PG Ionic Balance by ED037P, ED041G, ED045G & ED093F)
EB1209604-001	06-APR-2012 11:00	ALS AQ6	✓	✓	✓	✓	✓	✓	✓	✓
EB1209604-002	05-APR-2012 12:00	ALS AQ5	✓	✓	✓	✓	✓	✓	✓	✓
EB1209604-003	04-APR-2012 14:50	E3 AQ4	✓	✓	✓	✓	✓	✓	✓	✓
EB1209604-004	07-APR-2012 09:00	ALS AQ7	✓	✓	✓	✓	✓	✓	✓	✓
EB1209604-005	07-APR-2012 15:30	ALS AQ8	✓	✓	✓	✓	✓	✓	✓	✓
EB1209604-006	09-APR-2012 08:30	ALS AQ12	✓	✓	✓	✓	✓	✓	✓	✓
EB1209604-007	04-APR-2012 17:30	E3 AQ1	✓	✓	✓	✓	✓	✓	✓	✓
EB1209604-008	04-APR-2012 17:15	E3 AQ2	✓	✓	✓	✓	✓	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	WATER - EP008 Chlorophyll a	WATER - NT-01 Major Cations (Ca, Mg, Na, K)	WATER - NT-02A Major Anions (Chloride, Sulphate, Fluoride, Alkalinity)	WATER - NT-08A Total Nitrogen + NO2 + NO3 + NH3 + Total P + Reactive P	WATER - W-02T 8 metals (Total)	WATER - W-16 TPH/BTEX/PAH/OC/OP/PCB/8 Metals
EB1209604-001	06-APR-2012 11:00	ALS AQ6	✓	✓	✓	✓	✓	✓
EB1209604-002	05-APR-2012 12:00	ALS AQ5	✓	✓	✓	✓	✓	✓
EB1209604-003	04-APR-2012 14:50	E3 AQ4	✓	✓	✓	✓	✓	✓
EB1209604-004	07-APR-2012 09:00	ALS AQ7	✓	✓	✓	✓	✓	✓
EB1209604-005	07-APR-2012 15:30	ALS AQ8	✓	✓	✓	✓	✓	✓
EB1209604-006	09-APR-2012 08:30	ALS AQ12	✓	✓	✓	✓	✓	✓
EB1209604-007	04-APR-2012 17:30	E3 AQ1	✓	✓	✓	✓	✓	✓
EB1209604-008	04-APR-2012 17:15	E3 AQ2	✓	✓	✓	✓	✓	✓

Issue Date	: 13-APR-2012 10:40
Page	: 4 of 4
Work Order	: EB1209604
Client	: ALS WATER RESOURCES GROUP

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method		Due for extraction	Due for analysis	Samples Received		Instructions Received	
Client Sample ID(s)	Container			Date	Evaluation	Date	Evaluation
EK057G: Nitrite as N by Discrete Analyser							
ALS AQ5	Clear Plastic Bottle - Natural	07-APR-2012	----	11-APR-2012	×	----	----
ALS AQ6	Clear Plastic Bottle - Natural	08-APR-2012	----	11-APR-2012	×	----	----
ALS AQ7	Clear Plastic Bottle - Natural	09-APR-2012	----	11-APR-2012	×	----	----
ALS AQ8	Clear Plastic Bottle - Natural	09-APR-2012	----	11-APR-2012	×	----	----
E3 AQ1	Clear Plastic Bottle - Natural	06-APR-2012	----	11-APR-2012	×	----	----
E3 AQ2	Clear Plastic Bottle - Natural	06-APR-2012	----	11-APR-2012	×	----	----
E3 AQ4	Clear Plastic Bottle - Natural	06-APR-2012	----	11-APR-2012	×	----	----
EK071G: Reactive Phosphorus as P-By Discrete Analyser							
ALS AQ5	Clear Plastic Bottle - Natural	07-APR-2012	----	11-APR-2012	×	----	----
ALS AQ6	Clear Plastic Bottle - Natural	08-APR-2012	----	11-APR-2012	×	----	----
ALS AQ7	Clear Plastic Bottle - Natural	09-APR-2012	----	11-APR-2012	×	----	----
ALS AQ8	Clear Plastic Bottle - Natural	09-APR-2012	----	11-APR-2012	×	----	----
E3 AQ1	Clear Plastic Bottle - Natural	06-APR-2012	----	11-APR-2012	×	----	----
E3 AQ2	Clear Plastic Bottle - Natural	06-APR-2012	----	11-APR-2012	×	----	----
E3 AQ4	Clear Plastic Bottle - Natural	06-APR-2012	----	11-APR-2012	×	----	----
EP008: Chlorophyll a and Pheophytin a							
ALS AQ5	White Plastic Bottle - Unpreserve	----	07-APR-2012	11-APR-2012	×	----	----
ALS AQ6	White Plastic Bottle - Unpreserve	----	08-APR-2012	11-APR-2012	×	----	----
ALS AQ7	White Plastic Bottle - Unpreserve	----	09-APR-2012	11-APR-2012	×	----	----
ALS AQ8	White Plastic Bottle - Unpreserve	----	09-APR-2012	11-APR-2012	×	----	----
E3 AQ1	White Plastic Bottle - Unpreserve	----	06-APR-2012	11-APR-2012	×	----	----
E3 AQ2	White Plastic Bottle - Unpreserve	----	06-APR-2012	11-APR-2012	×	----	----
E3 AQ4	White Plastic Bottle - Unpreserve	----	06-APR-2012	11-APR-2012	×	----	----

Requested Deliverables

MR MARK DAHM

- *AU Certificate of Analysis - NATA (COA)	Email	mark.dahm@alsglobal.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	mark.dahm@alsglobal.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	mark.dahm@alsglobal.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	mark.dahm@alsglobal.com
- A4 - AU Tax Invoice (INV)	Email	mark.dahm@alsglobal.com
- Chain of Custody (CoC) (COC)	Email	mark.dahm@alsglobal.com
- EDI Format - ENMRG (ENMRG)	Email	mark.dahm@alsglobal.com
- EDI Format - ESDAT (ESDAT)	Email	mark.dahm@alsglobal.com
- EDI Format - XTab (XTAB)	Email	mark.dahm@alsglobal.com

ALS Group
Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: **EB1209604**		
Client	: **ALS WATER RESOURCES GROUP**	Laboratory	: Environmental Division Brisbane
Contact	: MR MARK DAHM	Contact	: Customer Services
Address	: PO BOX 3216 YERONGA 4104	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: mark.dahm@alsglobal.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3859 7800	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3859 7820	Facsimile	: +61 7 3243 7218
Project	: CQ212941 Waratah Coal Project	Page	: 1 of 4
Order number	: ----		
C-O-C number	: ----	Quote number	: EB2012ECOENV0381 (BN/245/12)
Site	: ----		
Sampler	: Mark Dahm	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 11-APR-2012	Issue Date	: 13-APR-2012 10:40
Client Requested Due Date	: 18-APR-2012	Scheduled Reporting Date	: **18-APR-2012**

Delivery Details

Mode of Delivery	: Carrier	Temperature	: 8.2'C <-> 11.3'C - Ice present
No. of coolers/boxes	: 4 x medium	No. of samples received	: 8
Security Seal	: Intact.	No. of samples analysed	: 8

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- Sample containers do not comply to pretreatment / preservation standards (AS, APHA, USEPA). Please refer to the Sample Container(s)/Preservation Non-Compliance Log at the end of this report for details.
- Samples submitted for dissolved metals analysis should be acidified with nitric acid, following field filtration. Additional charges of up to $5.00 will apply to each sample requiring filtration and preservation upon receipt by the laboratory.
- **Sample containers do not comply to pretreatment / preservation standards (AS, APHA, USEPA). Please refer to the Sample Container(s)/Preservation Non-Compliance Log at the end of this report for details.**
- **Breaches in recommended extraction / analysis holding times (if any) are displayed overleaf in the Proactive Holding Time Report table.**
- **Sample(s) requiring volatile organic compound analysis received in airtight containers (ZHE).**
- **Please be advised that all samples were logged as per COC.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Matt Goodwin.
- Analytical work for this work order will be conducted at ALS Brisbane.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

Method / Client sample ID	Sample Container Received	Preferred Sample Container for Analysis
EG020A-F : Dissolved Metals by ICP-MS - Suite A		
ALS AQ6	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ5	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ4	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ7	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ8	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ12	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ1	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ2	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
EG020B-F : Dissolved Metals by ICP-MS - Suite B		
ALS AQ6	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ5	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ4	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ7	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ8	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ12	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ1	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ2	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
EG035F : Dissolved Mercury by FIMS		
ALS AQ6	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ5	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ4	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ7	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ8	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
ALS AQ12	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ1	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
E3 AQ2	- Clear Plastic Bottle - Natural	- Clear Plastic Bottle - Nitric Acid; Filtered
EG094A-F : Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS		
ALS AQ6	- Clear Plastic Bottle - Natural	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Filtered
ALS AQ5	- Clear Plastic Bottle - Natural	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Filtered
E3 AQ4	- Clear Plastic Bottle - Natural	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Filtered
ALS AQ7	- Clear Plastic Bottle - Natural	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Filtered
ALS AQ8	- Clear Plastic Bottle - Natural	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Filtered
ALS AQ12	- Clear Plastic Bottle - Natural	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Filtered
E3 AQ1	- Clear Plastic Bottle - Natural	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Filtered
E3 AQ2	- Clear Plastic Bottle - Natural	- Clear HDPE (U-T ORC) - UHP Nitric Acid; Filtered

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default to 15:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory for processing purposes and will be shown bracketed without a time component.

Issue Date : 13-APR-2012 10:40
Page : 3 of 4
Work Order : EB1209604
Client : ALS WATER RESOURCES GROUP

Matrix: **WATER**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	WATER - EA010P Conductivity (PC)	WATER - EA015H Total Dissolved Solids - High Level	WATER - EA025H Suspended Solids (High Level)	WATER - EG020F Dissolved Metals by ICPMS	WATER - EG020T Total Recoverable Metals by ICPMS	WATER - EG094A-F Dissolved Metals in Fresh Water Suite A by ORC-ICPMS	WATER - EG094A-T Total Metals in Fresh water Suite A by ORC-ICPMS	WATER - EN055 - PG Ionic Balance by ED037P, ED041G, ED045G & ED093F)
EB1209604-001	06-APR-2012 11:00	ALS AQ6	✓	✓	✓	✓	✓	✓	✓	✓
EB1209604-002	05-APR-2012 12:00	ALS AQ5	✓	✓	✓	✓	✓	✓	✓	✓
EB1209604-003	04-APR-2012 14:50	E3 AQ4	✓	✓	✓	✓	✓	✓	✓	✓
EB1209604-004	07-APR-2012 09:00	ALS AQ7	✓	✓	✓	✓	✓	✓	✓	✓
EB1209604-005	07-APR-2012 15:30	ALS AQ8	✓	✓	✓	✓	✓	✓	✓	✓
EB1209604-006	09-APR-2012 08:30	ALS AQ12	✓	✓	✓	✓	✓	✓	✓	✓
EB1209604-007	04-APR-2012 17:30	E3 AQ1	✓	✓	✓	✓	✓	✓	✓	✓
EB1209604-008	04-APR-2012 17:15	E3 AQ2	✓	✓	✓	✓	✓	✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	WATER - EP008 Chlorophyll a	WATER - NT-01 Major Cations (Ca, Mg, Na, K)	WATER - NT-02A Major Anions (Chloride, Sulphate, Fluoride, Alkalinity)	WATER - NT-08A Total Nitrogen + NO2 + NO3 + NH3 + Total P + Reactive P	WATER - W-02T 8 metals (Total)	WATER - W-16 TPH/BTEX/PAH/OC/OP/PCB/8 Metals
EB1209604-001	06-APR-2012 11:00	ALS AQ6	✓	✓	✓	✓	✓	✓
EB1209604-002	05-APR-2012 12:00	ALS AQ5	✓	✓	✓	✓	✓	✓
EB1209604-003	04-APR-2012 14:50	E3 AQ4	✓	✓	✓	✓	✓	✓
EB1209604-004	07-APR-2012 09:00	ALS AQ7	✓	✓	✓	✓	✓	✓
EB1209604-005	07-APR-2012 15:30	ALS AQ8	✓	✓	✓	✓	✓	✓
EB1209604-006	09-APR-2012 08:30	ALS AQ12	✓	✓	✓	✓	✓	✓
EB1209604-007	04-APR-2012 17:30	E3 AQ1	✓	✓	✓	✓	✓	✓
EB1209604-008	04-APR-2012 17:15	E3 AQ2	✓	✓	✓	✓	✓	✓

Issue Date : 13-APR-2012 10:40
Page : 4 of 4
Work Order : EB1209604
Client : ALS WATER RESOURCES GROUP

Proactive Holding Time Report

The following table summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method		Due for extraction	Due for analysis	Samples Received		Instructions Received	
Client Sample ID(s)	Container			Date	Evaluation	Date	Evaluation
EK057G: Nitrite as N by Discrete Analyser							
ALS AQ5	Clear Plastic Bottle - Natural	07-APR-2012	----	11-APR-2012	×	----	----
ALS AQ6	Clear Plastic Bottle - Natural	08-APR-2012	----	11-APR-2012	×	----	----
ALS AQ7	Clear Plastic Bottle - Natural	09-APR-2012	----	11-APR-2012	×	----	----
ALS AQ8	Clear Plastic Bottle - Natural	09-APR-2012	----	11-APR-2012	×	----	----
E3 AQ1	Clear Plastic Bottle - Natural	06-APR-2012	----	11-APR-2012	×	----	----
E3 AQ2	Clear Plastic Bottle - Natural	06-APR-2012	----	11-APR-2012	×	----	----
E3 AQ4	Clear Plastic Bottle - Natural	06-APR-2012	----	11-APR-2012	×	----	----
EK071G: Reactive Phosphorus as P-By Discrete Analyser							
ALS AQ5	Clear Plastic Bottle - Natural	07-APR-2012	----	11-APR-2012	×	----	----
ALS AQ6	Clear Plastic Bottle - Natural	08-APR-2012	----	11-APR-2012	×	----	----
ALS AQ7	Clear Plastic Bottle - Natural	09-APR-2012	----	11-APR-2012	×	----	----
ALS AQ8	Clear Plastic Bottle - Natural	09-APR-2012	----	11-APR-2012	×	----	----
E3 AQ1	Clear Plastic Bottle - Natural	06-APR-2012	----	11-APR-2012	×	----	----
E3 AQ2	Clear Plastic Bottle - Natural	06-APR-2012	----	11-APR-2012	×	----	----
E3 AQ4	Clear Plastic Bottle - Natural	06-APR-2012	----	11-APR-2012	×	----	----
EP008: Chlorophyll a and Pheophytin a							
ALS AQ5	White Plastic Bottle - Unpreserve	----	07-APR-2012	11-APR-2012	×	----	----
ALS AQ6	White Plastic Bottle - Unpreserve	----	08-APR-2012	11-APR-2012	×	----	----
ALS AQ7	White Plastic Bottle - Unpreserve	----	09-APR-2012	11-APR-2012	×	----	----
ALS AQ8	White Plastic Bottle - Unpreserve	----	09-APR-2012	11-APR-2012	×	----	----
E3 AQ1	White Plastic Bottle - Unpreserve	----	06-APR-2012	11-APR-2012	×	----	----
E3 AQ2	White Plastic Bottle - Unpreserve	----	06-APR-2012	11-APR-2012	×	----	----
E3 AQ4	White Plastic Bottle - Unpreserve	----	06-APR-2012	11-APR-2012	×	----	----

Requested Deliverables

MR MARK DAHM

- *AU Certificate of Analysis - NATA (COA)	Email	mark.dahm@alsglobal.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	mark.dahm@alsglobal.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	mark.dahm@alsglobal.com
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	mark.dahm@alsglobal.com
- A4 - AU Tax Invoice (INV)	Email	mark.dahm@alsglobal.com
- Chain of Custody (CoC) (COC)	Email	mark.dahm@alsglobal.com
- EDI Format - ENMRG (ENMRG)	Email	mark.dahm@alsglobal.com
- EDI Format - ESDAT (ESDAT)	Email	mark.dahm@alsglobal.com
- EDI Format - XTab (XTAB)	Email	mark.dahm@alsglobal.com

ALS Group
Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EB1209604**	Page	: 1 of 21
Client	: ALS WATER RESOURCES GROUP	Laboratory	: Environmental Division Brisbane
Contact	: MR MARK DAHM	Contact	: Customer Services
Address	: PO BOX 3216 YERONGA 4104	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: mark.dahm@alsglobal.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3859 7800	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3859 7820	Facsimile	: +61 7 3243 7218
Project	: CQ212941 Waratah Coal Project	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 11-APR-2012
Sampler	: Mark Dahm	Issue Date	: 20-APR-2012
Order number	: ----		
		No. of samples received	: 8
Quote number	: BN/245/12	No. of samples analysed	: 8

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

This Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non-volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA010P: Conductivity by PC Titrator							
Clear Plastic Bottle - Natural (EA010-P) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	---	02-MAY-2012	----	**16-APR-2012**	02-MAY-2012	✓
Clear Plastic Bottle - Natural (EA010-P) ALS AQ5	**05-APR-2012**	---	03-MAY-2012	----	**16-APR-2012**	03-MAY-2012	✓
Clear Plastic Bottle - Natural (EA010-P) ALS AQ6	**06-APR-2012**	---	04-MAY-2012	----	**16-APR-2012**	04-MAY-2012	✓
Clear Plastic Bottle - Natural (EA010-P) ALS AQ7, ALS AQ8	**07-APR-2012**	---	05-MAY-2012	----	**16-APR-2012**	05-MAY-2012	✓
Clear Plastic Bottle - Natural (EA010-P) ALS AQ12	**09-APR-2012**	---	07-MAY-2012	----	**16-APR-2012**	07-MAY-2012	✓
EA015: Total Dissolved Solids							
Clear Plastic Bottle - Natural (EA015H) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	----	----	----	**13-APR-2012**	11-APR-2012	×
Clear Plastic Bottle - Natural (EA015H) ALS AQ5	**05-APR-2012**	----	----	----	**13-APR-2012**	12-APR-2012	×
Clear Plastic Bottle - Natural (EA015H) ALS AQ6	**06-APR-2012**	----	----	----	**13-APR-2012**	13-APR-2012	✓
Clear Plastic Bottle - Natural (EA015H) ALS AQ7, ALS AQ8	**07-APR-2012**	----	----	----	**13-APR-2012**	14-APR-2012	✓
Clear Plastic Bottle - Natural (EA015H) ALS AQ12	**09-APR-2012**	----	----	----	**13-APR-2012**	16-APR-2012	✓
EA025: Suspended Solids							
Clear Plastic Bottle - Natural (EA025H) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	----	----	----	**12-APR-2012**	11-APR-2012	×
Clear Plastic Bottle - Natural (EA025H) ALS AQ5	**05-APR-2012**	----	----	----	**12-APR-2012**	12-APR-2012	✓
Clear Plastic Bottle - Natural (EA025H) ALS AQ6	**06-APR-2012**	----	----	----	**12-APR-2012**	13-APR-2012	✓
Clear Plastic Bottle - Natural (EA025H) ALS AQ7, ALS AQ8	**07-APR-2012**	----	----	----	**12-APR-2012**	14-APR-2012	✓
Clear Plastic Bottle - Natural (EA025H) ALS AQ12	**09-APR-2012**	----	----	----	**12-APR-2012**	16-APR-2012	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED037P: Alkalinity by PC Titrator							
Clear Plastic Bottle - Natural (ED037-P) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	---	18-APR-2012	----	**16-APR-2012**	18-APR-2012	✓
Clear Plastic Bottle - Natural (ED037-P) ALS AQ5	**05-APR-2012**	---	19-APR-2012	----	**16-APR-2012**	19-APR-2012	✓
Clear Plastic Bottle - Natural (ED037-P) ALS AQ6	**06-APR-2012**	---	20-APR-2012	----	**16-APR-2012**	20-APR-2012	✓
Clear Plastic Bottle - Natural (ED037-P) ALS AQ7, ALS AQ8	**07-APR-2012**	---	21-APR-2012	----	**16-APR-2012**	21-APR-2012	✓
Clear Plastic Bottle - Natural (ED037-P) ALS AQ12	**09-APR-2012**	---	23-APR-2012	----	**16-APR-2012**	23-APR-2012	✓
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA							
Clear Plastic Bottle - Natural (ED041G) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	---	02-MAY-2012	----	**13-APR-2012**	02-MAY-2012	✓
Clear Plastic Bottle - Natural (ED041G) ALS AQ5	**05-APR-2012**	---	03-MAY-2012	----	**13-APR-2012**	03-MAY-2012	✓
Clear Plastic Bottle - Natural (ED041G) ALS AQ6	**06-APR-2012**	---	04-MAY-2012	----	**13-APR-2012**	04-MAY-2012	✓
Clear Plastic Bottle - Natural (ED041G) ALS AQ7, ALS AQ8	**07-APR-2012**	---	05-MAY-2012	----	**13-APR-2012**	05-MAY-2012	✓
Clear Plastic Bottle - Natural (ED041G) ALS AQ12	**09-APR-2012**	---	07-MAY-2012	----	**13-APR-2012**	07-MAY-2012	✓
ED045G: Chloride Discrete analyser							
Clear Plastic Bottle - Natural (ED045G) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	---	02-MAY-2012	----	**13-APR-2012**	02-MAY-2012	✓
Clear Plastic Bottle - Natural (ED045G) ALS AQ5	**05-APR-2012**	---	03-MAY-2012	----	**13-APR-2012**	03-MAY-2012	✓
Clear Plastic Bottle - Natural (ED045G) ALS AQ6	**06-APR-2012**	---	04-MAY-2012	----	**13-APR-2012**	04-MAY-2012	✓
Clear Plastic Bottle - Natural (ED045G) ALS AQ7, ALS AQ8	**07-APR-2012**	---	05-MAY-2012	----	**13-APR-2012**	05-MAY-2012	✓
Clear Plastic Bottle - Natural (ED045G) ALS AQ12	**09-APR-2012**	---	07-MAY-2012	----	**13-APR-2012**	07-MAY-2012	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED093F: Dissolved Major Cations							
Clear Plastic Bottle - Natural (ED093F) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	---	11-APR-2012	----	**13-APR-2012**	11-APR-2012	×
Clear Plastic Bottle - Natural (ED093F) ALS AQ5	**05-APR-2012**	---	12-APR-2012	----	**13-APR-2012**	12-APR-2012	×
Clear Plastic Bottle - Natural (ED093F) ALS AQ6	**06-APR-2012**	---	13-APR-2012	----	**13-APR-2012**	13-APR-2012	✓
Clear Plastic Bottle - Natural (ED093F) ALS AQ7, ALS AQ8	**07-APR-2012**	---	14-APR-2012	----	**13-APR-2012**	14-APR-2012	✓
Clear Plastic Bottle - Natural (ED093F) ALS AQ12	**09-APR-2012**	---	16-APR-2012	----	**13-APR-2012**	16-APR-2012	✓
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Natural (EG020A-F) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	---	01-OCT-2012	----	**17-APR-2012**	01-OCT-2012	✓
Clear Plastic Bottle - Natural (EG020A-F) ALS AQ5	**05-APR-2012**	---	02-OCT-2012	----	**17-APR-2012**	02-OCT-2012	✓
Clear Plastic Bottle - Natural (EG020A-F) ALS AQ6	**06-APR-2012**	---	03-OCT-2012	----	**17-APR-2012**	03-OCT-2012	✓
Clear Plastic Bottle - Natural (EG020A-F) ALS AQ7, ALS AQ8	**07-APR-2012**	---	04-OCT-2012	----	**17-APR-2012**	04-OCT-2012	✓
Clear Plastic Bottle - Natural (EG020A-F) ALS AQ12	**09-APR-2012**	---	06-OCT-2012	----	**17-APR-2012**	06-OCT-2012	✓
EG020T: Total Metals by ICP-MS							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	**16-APR-2012**	01-OCT-2012	✓	**16-APR-2012**	01-OCT-2012	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T) ALS AQ5	**05-APR-2012**	**16-APR-2012**	02-OCT-2012	✓	**16-APR-2012**	02-OCT-2012	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T) ALS AQ6	**06-APR-2012**	**16-APR-2012**	03-OCT-2012	✓	**16-APR-2012**	03-OCT-2012	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T) ALS AQ7, ALS AQ8	**07-APR-2012**	**16-APR-2012**	04-OCT-2012	✓	**16-APR-2012**	04-OCT-2012	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020A-T) ALS AQ12	**09-APR-2012**	**16-APR-2012**	06-OCT-2012	✓	**16-APR-2012**	06-OCT-2012	✓

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Work Order : EB1209604
Client : ALS WATER RESOURCES GROUP
Project : CQ212941 Waratah Coal Project

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020F: Dissolved Metals by ICP-MS								
Clear Plastic Bottle - Natural (EG020B-F) E3 AQ4, E3 AQ2	E3 AQ1,	**04-APR-2012**	**---**	01-OCT-2012	----	**17-APR-2012**	01-OCT-2012	✓
Clear Plastic Bottle - Natural (EG020B-F) ALS AQ5		**05-APR-2012**	**---**	02-OCT-2012	----	**17-APR-2012**	02-OCT-2012	✓
Clear Plastic Bottle - Natural (EG020B-F) ALS AQ6		**06-APR-2012**	**---**	03-OCT-2012	----	**17-APR-2012**	03-OCT-2012	✓
Clear Plastic Bottle - Natural (EG020B-F) ALS AQ7,	ALS AQ8	**07-APR-2012**	**---**	04-OCT-2012	----	**17-APR-2012**	04-OCT-2012	✓
Clear Plastic Bottle - Natural (EG020B-F) ALS AQ12		**09-APR-2012**	**---**	06-OCT-2012	----	**17-APR-2012**	06-OCT-2012	✓
EG020T: Total Metals by ICP-MS								
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020B-T) E3 AQ4, E3 AQ2	E3 AQ1,	**04-APR-2012**	**16-APR-2012**	01-OCT-2012	✓	**16-APR-2012**	01-OCT-2012	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020B-T) ALS AQ5		**05-APR-2012**	**16-APR-2012**	02-OCT-2012	✓	**16-APR-2012**	02-OCT-2012	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020B-T) ALS AQ6		**06-APR-2012**	**16-APR-2012**	03-OCT-2012	✓	**16-APR-2012**	03-OCT-2012	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020B-T) ALS AQ7,	ALS AQ8	**07-APR-2012**	**16-APR-2012**	04-OCT-2012	✓	**16-APR-2012**	04-OCT-2012	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG020B-T) ALS AQ12		**09-APR-2012**	**16-APR-2012**	06-OCT-2012	✓	**16-APR-2012**	06-OCT-2012	✓
EG035F: Dissolved Mercury by FIMS								
Clear Plastic Bottle - Natural (EG035F) E3 AQ4, E3 AQ2	E3 AQ1,	**04-APR-2012**	**---**	02-MAY-2012	----	**18-APR-2012**	02-MAY-2012	✓
Clear Plastic Bottle - Natural (EG035F) ALS AQ5		**05-APR-2012**	**---**	03-MAY-2012	----	**18-APR-2012**	03-MAY-2012	✓
Clear Plastic Bottle - Natural (EG035F) ALS AQ6		**06-APR-2012**	**---**	04-MAY-2012	----	**18-APR-2012**	04-MAY-2012	✓
Clear Plastic Bottle - Natural (EG035F) ALS AQ7,	ALS AQ8	**07-APR-2012**	**---**	05-MAY-2012	----	**18-APR-2012**	05-MAY-2012	✓
Clear Plastic Bottle - Natural (EG035F) ALS AQ12		**09-APR-2012**	**---**	07-MAY-2012	----	**18-APR-2012**	07-MAY-2012	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG035T: Total Recoverable Mercury by FIMS							
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	**----**	----	----	**16-APR-2012**	02-MAY-2012	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T) ALS AQ5	**05-APR-2012**	**----**	----	----	**16-APR-2012**	03-MAY-2012	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T) ALS AQ6	**06-APR-2012**	**----**	----	----	**16-APR-2012**	04-MAY-2012	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T) ALS AQ7, ALS AQ8	**07-APR-2012**	**----**	----	----	**16-APR-2012**	05-MAY-2012	✓
Clear Plastic Bottle - Unfiltered; Lab-acidified (EG035T) ALS AQ12	**09-APR-2012**	**----**	----	----	**16-APR-2012**	07-MAY-2012	✓
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS							
Clear Plastic Bottle - Natural (EG094A-F) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	**17-APR-2012**	01-OCT-2012	✓	**17-APR-2012**	01-OCT-2012	✓
Clear Plastic Bottle - Natural (EG094A-F) ALS AQ5	**05-APR-2012**	**17-APR-2012**	02-OCT-2012	✓	**17-APR-2012**	02-OCT-2012	✓
Clear Plastic Bottle - Natural (EG094A-F) ALS AQ6	**06-APR-2012**	**17-APR-2012**	03-OCT-2012	✓	**17-APR-2012**	03-OCT-2012	✓
Clear Plastic Bottle - Natural (EG094A-F) ALS AQ7, ALS AQ8	**07-APR-2012**	**17-APR-2012**	04-OCT-2012	✓	**17-APR-2012**	04-OCT-2012	✓
Clear Plastic Bottle - Natural (EG094A-F) ALS AQ12	**09-APR-2012**	**17-APR-2012**	06-OCT-2012	✓	**17-APR-2012**	06-OCT-2012	✓
EG094T: Total metals in Fresh water by ORC-ICPMS							
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG094A-T) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	**17-APR-2012**	01-OCT-2012	✓	**17-APR-2012**	01-OCT-2012	✓
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG094A-T) ALS AQ5	**05-APR-2012**	**17-APR-2012**	02-OCT-2012	✓	**17-APR-2012**	02-OCT-2012	✓
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG094A-T) ALS AQ6	**06-APR-2012**	**17-APR-2012**	03-OCT-2012	✓	**17-APR-2012**	03-OCT-2012	✓
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG094A-T) ALS AQ7, ALS AQ8	**07-APR-2012**	**17-APR-2012**	04-OCT-2012	✓	**17-APR-2012**	04-OCT-2012	✓
Clear HDPE (U-T ORC) - Unfiltered; Lab-acidified (EG094A-T) ALS AQ12	**09-APR-2012**	**17-APR-2012**	06-OCT-2012	✓	**17-APR-2012**	06-OCT-2012	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK040P: Fluoride by PC Titrator							
Clear Plastic Bottle - Natural (EK040P) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	---	02-MAY-2012	----	**16-APR-2012**	02-MAY-2012	✓
Clear Plastic Bottle - Natural (EK040P) ALS AQ5	**05-APR-2012**	---	03-MAY-2012	----	**16-APR-2012**	03-MAY-2012	✓
Clear Plastic Bottle - Natural (EK040P) ALS AQ6	**06-APR-2012**	---	04-MAY-2012	----	**16-APR-2012**	04-MAY-2012	✓
Clear Plastic Bottle - Natural (EK040P) ALS AQ7, ALS AQ8	**07-APR-2012**	---	05-MAY-2012	----	**16-APR-2012**	05-MAY-2012	✓
Clear Plastic Bottle - Natural (EK040P) ALS AQ12	**09-APR-2012**	---	07-MAY-2012	----	**16-APR-2012**	07-MAY-2012	✓
EK055G: Ammonia as N by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK055G) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	---	02-MAY-2012	----	**17-APR-2012**	02-MAY-2012	✓
Clear Plastic Bottle - Sulfuric Acid (EK055G) ALS AQ5	**05-APR-2012**	---	03-MAY-2012	----	**17-APR-2012**	03-MAY-2012	✓
Clear Plastic Bottle - Sulfuric Acid (EK055G) ALS AQ6	**06-APR-2012**	---	04-MAY-2012	----	**17-APR-2012**	04-MAY-2012	✓
Clear Plastic Bottle - Sulfuric Acid (EK055G) ALS AQ7, ALS AQ8	**07-APR-2012**	---	05-MAY-2012	----	**17-APR-2012**	05-MAY-2012	✓
Clear Plastic Bottle - Sulfuric Acid (EK055G) ALS AQ12	**09-APR-2012**	---	07-MAY-2012	----	**17-APR-2012**	07-MAY-2012	✓
EK057G: Nitrite as N by Discrete Analyser							
Clear Plastic Bottle - Natural (EK057G) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	---	06-APR-2012	----	**12-APR-2012**	06-APR-2012	×
Clear Plastic Bottle - Natural (EK057G) ALS AQ5	**05-APR-2012**	---	07-APR-2012	----	**12-APR-2012**	07-APR-2012	×
Clear Plastic Bottle - Natural (EK057G) ALS AQ6	**06-APR-2012**	---	08-APR-2012	----	**12-APR-2012**	08-APR-2012	×
Clear Plastic Bottle - Natural (EK057G) ALS AQ7, ALS AQ8	**07-APR-2012**	---	09-APR-2012	----	**12-APR-2012**	09-APR-2012	×
Clear Plastic Bottle - Natural (EK057G) ALS AQ12	**09-APR-2012**	---	11-APR-2012	----	**12-APR-2012**	11-APR-2012	×

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK059G) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	**---**	02-MAY-2012	----	**17-APR-2012**	02-MAY-2012	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G) ALS AQ5	**05-APR-2012**	**---**	03-MAY-2012	----	**17-APR-2012**	03-MAY-2012	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G) ALS AQ6	**06-APR-2012**	**---**	04-MAY-2012	----	**17-APR-2012**	04-MAY-2012	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G) ALS AQ7, ALS AQ8	**07-APR-2012**	**---**	05-MAY-2012	----	**17-APR-2012**	05-MAY-2012	✓
Clear Plastic Bottle - Sulfuric Acid (EK059G) ALS AQ12	**09-APR-2012**	**---**	07-MAY-2012	----	**17-APR-2012**	07-MAY-2012	✓
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK061G) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	**13-APR-2012**	02-MAY-2012	✓	**13-APR-2012**	02-MAY-2012	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G) ALS AQ5	**05-APR-2012**	**13-APR-2012**	03-MAY-2012	✓	**13-APR-2012**	03-MAY-2012	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G) ALS AQ6	**06-APR-2012**	**13-APR-2012**	04-MAY-2012	✓	**13-APR-2012**	04-MAY-2012	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G) ALS AQ7, ALS AQ8	**07-APR-2012**	**13-APR-2012**	05-MAY-2012	✓	**13-APR-2012**	05-MAY-2012	✓
Clear Plastic Bottle - Sulfuric Acid (EK061G) ALS AQ12	**09-APR-2012**	**13-APR-2012**	07-MAY-2012	✓	**13-APR-2012**	07-MAY-2012	✓
EK067G: Total Phosphorus as P by Discrete Analyser							
Clear Plastic Bottle - Sulfuric Acid (EK067G) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	**13-APR-2012**	02-MAY-2012	✓	**13-APR-2012**	02-MAY-2012	✓
Clear Plastic Bottle - Sulfuric Acid (EK067G) ALS AQ5	**05-APR-2012**	**13-APR-2012**	03-MAY-2012	✓	**13-APR-2012**	03-MAY-2012	✓
Clear Plastic Bottle - Sulfuric Acid (EK067G) ALS AQ6	**06-APR-2012**	**13-APR-2012**	04-MAY-2012	✓	**13-APR-2012**	04-MAY-2012	✓
Clear Plastic Bottle - Sulfuric Acid (EK067G) ALS AQ7, ALS AQ8	**07-APR-2012**	**13-APR-2012**	05-MAY-2012	✓	**13-APR-2012**	05-MAY-2012	✓
Clear Plastic Bottle - Sulfuric Acid (EK067G) ALS AQ12	**09-APR-2012**	**13-APR-2012**	07-MAY-2012	✓	**13-APR-2012**	07-MAY-2012	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EK071G: Reactive Phosphorus as P by discrete analyser							
Clear Plastic Bottle - Natural (EK071G) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	---	06-APR-2012	----	**12-APR-2012**	06-APR-2012	×
Clear Plastic Bottle - Natural (EK071G) ALS AQ5	**05-APR-2012**	---	07-APR-2012	----	**12-APR-2012**	07-APR-2012	×
Clear Plastic Bottle - Natural (EK071G) ALS AQ6	**06-APR-2012**	---	08-APR-2012	----	**12-APR-2012**	08-APR-2012	×
Clear Plastic Bottle - Natural (EK071G) ALS AQ7, ALS AQ8	**07-APR-2012**	---	09-APR-2012	----	**12-APR-2012**	09-APR-2012	×
Clear Plastic Bottle - Natural (EK071G) ALS AQ12	**09-APR-2012**	---	11-APR-2012	----	**12-APR-2012**	11-APR-2012	×
EP008: Chlorophyll a & Pheophytin a							
White Plastic Bottle - Unpreserved (EP008) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	**----**	----	----	**12-APR-2012**	06-APR-2012	×
White Plastic Bottle - Unpreserved (EP008) ALS AQ5	**05-APR-2012**	**----**	----	----	**12-APR-2012**	07-APR-2012	×
White Plastic Bottle - Unpreserved (EP008) ALS AQ6	**06-APR-2012**	**----**	----	----	**12-APR-2012**	08-APR-2012	×
White Plastic Bottle - Unpreserved (EP008) ALS AQ7, ALS AQ8	**07-APR-2012**	**----**	----	----	**12-APR-2012**	09-APR-2012	×
White Plastic Bottle - Unpreserved (EP008) ALS AQ12	**09-APR-2012**	**----**	----	----	**12-APR-2012**	11-APR-2012	×
EP066: Polychlorinated Biphenyls (PCB)							
Amber Glass Bottle - Unpreserved (EP066) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	**13-APR-2012**	11-APR-2012	×	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP066) ALS AQ5	**05-APR-2012**	**13-APR-2012**	12-APR-2012	×	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP066) ALS AQ6	**06-APR-2012**	**13-APR-2012**	13-APR-2012	✓	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP066) ALS AQ7, ALS AQ8	**07-APR-2012**	**13-APR-2012**	14-APR-2012	✓	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP066) ALS AQ12	**09-APR-2012**	**13-APR-2012**	16-APR-2012	✓	**17-APR-2012**	23-MAY-2012	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP068A: Organochlorine Pesticides (OC)							
Amber Glass Bottle - Unpreserved (EP068) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	**13-APR-2012**	11-APR-2012	×	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP068) ALS AQ5	**05-APR-2012**	**13-APR-2012**	12-APR-2012	×	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP068) ALS AQ6	**06-APR-2012**	**13-APR-2012**	13-APR-2012	✓	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP068) ALS AQ7, ALS AQ8	**07-APR-2012**	**13-APR-2012**	14-APR-2012	✓	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP068) ALS AQ12	**09-APR-2012**	**13-APR-2012**	16-APR-2012	✓	**17-APR-2012**	23-MAY-2012	✓
EP068B: Organophosphorus Pesticides (OP)							
Amber Glass Bottle - Unpreserved (EP068) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	**13-APR-2012**	11-APR-2012	×	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP068) ALS AQ5	**05-APR-2012**	**13-APR-2012**	12-APR-2012	×	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP068) ALS AQ6	**06-APR-2012**	**13-APR-2012**	13-APR-2012	✓	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP068) ALS AQ7, ALS AQ8	**07-APR-2012**	**13-APR-2012**	14-APR-2012	✓	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP068) ALS AQ12	**09-APR-2012**	**13-APR-2012**	16-APR-2012	✓	**17-APR-2012**	23-MAY-2012	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP071) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	**13-APR-2012**	11-APR-2012	×	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP071) ALS AQ5	**05-APR-2012**	**13-APR-2012**	12-APR-2012	×	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP071) ALS AQ6	**06-APR-2012**	**13-APR-2012**	13-APR-2012	✓	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP071) ALS AQ7, ALS AQ8	**07-APR-2012**	**13-APR-2012**	14-APR-2012	✓	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP071) ALS AQ12	**09-APR-2012**	**13-APR-2012**	16-APR-2012	✓	**17-APR-2012**	23-MAY-2012	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075(SIM)) E3 AQ4, E3 AQ1, E3 AQ2	**04-APR-2012**	**13-APR-2012**	11-APR-2012	×	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP075(SIM)) ALS AQ5	**05-APR-2012**	**13-APR-2012**	12-APR-2012	×	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP075(SIM)) ALS AQ6	**06-APR-2012**	**13-APR-2012**	13-APR-2012	✓	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP075(SIM)) ALS AQ7, ALS AQ8	**07-APR-2012**	**13-APR-2012**	14-APR-2012	✓	**17-APR-2012**	23-MAY-2012	✓
Amber Glass Bottle - Unpreserved (EP075(SIM)) ALS AQ12	**09-APR-2012**	**13-APR-2012**	16-APR-2012	✓	**17-APR-2012**	23-MAY-2012	✓
EP080: BTEXN							
Amber VOC Vial - Sulfuric Acid (EP080) E3 AQ4	**04-APR-2012**	**16-APR-2012**	18-APR-2012	✓	**16-APR-2012**	18-APR-2012	✓
Amber VOC Vial - Sulfuric Acid (EP080) E3 AQ1, E3 AQ2	**04-APR-2012**	**17-APR-2012**	18-APR-2012	✓	**17-APR-2012**	18-APR-2012	✓
Amber VOC Vial - Sulfuric Acid (EP080) ALS AQ5	**05-APR-2012**	**17-APR-2012**	19-APR-2012	✓	**17-APR-2012**	19-APR-2012	✓
Amber VOC Vial - Sulfuric Acid (EP080) ALS AQ6	**06-APR-2012**	**17-APR-2012**	20-APR-2012	✓	**17-APR-2012**	20-APR-2012	✓
Amber VOC Vial - Sulfuric Acid (EP080) ALS AQ7, ALS AQ8	**07-APR-2012**	**17-APR-2012**	21-APR-2012	✓	**17-APR-2012**	21-APR-2012	✓
Amber VOC Vial - Sulfuric Acid (EP080) ALS AQ12	**09-APR-2012**	**17-APR-2012**	23-APR-2012	✓	**17-APR-2012**	23-APR-2012	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft							
Amber VOC Vial - Sulfuric Acid (EP080) E3 AQ4	**04-APR-2012**	**16-APR-2012**	18-APR-2012	✓	**16-APR-2012**	18-APR-2012	✓
Amber VOC Vial - Sulfuric Acid (EP080) E3 AQ1, E3 AQ2	**04-APR-2012**	**17-APR-2012**	18-APR-2012	✓	**17-APR-2012**	18-APR-2012	✓
Amber VOC Vial - Sulfuric Acid (EP080) ALS AQ5	**05-APR-2012**	**17-APR-2012**	19-APR-2012	✓	**17-APR-2012**	19-APR-2012	✓
Amber VOC Vial - Sulfuric Acid (EP080) ALS AQ6	**06-APR-2012**	**17-APR-2012**	20-APR-2012	✓	**17-APR-2012**	20-APR-2012	✓
Amber VOC Vial - Sulfuric Acid (EP080) ALS AQ7, ALS AQ8	**07-APR-2012**	**17-APR-2012**	21-APR-2012	✓	**17-APR-2012**	21-APR-2012	✓
Amber VOC Vial - Sulfuric Acid (EP080) ALS AQ12	**09-APR-2012**	**17-APR-2012**	23-APR-2012	✓	**17-APR-2012**	23-APR-2012	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity by PC Titrator	ED037-P	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Ammonia as N by Discrete analyser	EK055G	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chlorophyll a and Pheophytin a	EP008	1	8	**12.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite B	EG020B-F	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Reactive Phosphorus as P-By Discrete Analyser	EK071G	2	12	**16.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	4	37	**10.8**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	4	33	**12.1**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	8	**12.5**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite B	EG020B-T	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	2	17	**11.8**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	4	40	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Alkalinity by PC Titrator	ED037-P	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Ammonia as N by Discrete analyser	EK055G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	2	20	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chlorophyll a and Pheophytin a	EP008	1	8	**12.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite B	EG020B-F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	8	**12.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	9	**11.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	8	**12.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Control Samples (LCS) - Continued							
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	12	**8.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	2	37	**5.4**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	33	**6.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	8	**12.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite B	EG020B-T	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	1	17	**5.9**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	9	**11.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	40	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Ammonia as N by Discrete analyser	EK055G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chlorophyll a and Pheophytin a	EP008	1	8	**12.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Conductivity by PC Titrator	EA010-P	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Mercury by FIMS	EG035F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite B	EG020B-F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Cations - Dissolved	ED093F	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	8	**12.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Pesticides by GCMS	EP068	1	9	**11.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Polychlorinated Biphenyls (PCB)	EP066	1	8	**12.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	12	**8.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Suspended Solids (High Level)	EA025H	2	37	**5.4**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Dissolved Solids (High Level)	EA015H	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	33	**6.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	8	**12.5**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals by ICP-MS - Suite B	EG020B-T	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	1	20	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	1	17	**5.9**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH - Semivolatile Fraction	EP071	1	9	**11.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	40	**5.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Ammonia as N by Discrete analyser	EK055G	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Chloride by Discrete Analyser	ED045G	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Matrix Spikes (MS) - Continued							
Dissolved Mercury by FIMS	EG035F	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Fluoride by PC Titrator	EK040P	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Nitrite as N by Discrete Analyser	EK057G	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Reactive Phosphorus as P-By Discrete Analyser	EK071G	1	12	**8.3**	**5.0**	✓	ALS QCS3 requirement
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	2	33	**6.1**	**5.0**	✓	ALS QCS3 requirement
Total Mercury by FIMS	EG035T	1	8	**12.5**	**5.0**	✓	ALS QCS3 requirement
Total Metals by ICP-MS - Suite A	EG020A-T	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	1	20	**5.0**	**5.0**	✓	ALS QCS3 requirement
Total Phosphorus as P By Discrete Analyser	EK067G	1	17	**5.9**	**5.0**	✓	ALS QCS3 requirement
TPH Volatiles/BTEX	EP080	2	40	**5.0**	**5.0**	✓	ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Conductivity by PC Titrator	EA010-P	WATER	APHA 21st ed., 2510 B This procedure determines conductivity by automated ISE. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Dissolved Solids (High Level)	EA015H	WATER	In-House, APHA 21st ed., 2540C A gravimetric procedure that determines the amount of `filterable` residue in an aqueous sample. A well-mixed sample is filtered through a glass fibre filter (1.2um). The filtrate is evaporated to dryness and dried to constant weight at 180+/-5C. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Suspended Solids (High Level)	EA025H	WATER	In-House, APHA 21st ed., 2540D A gravimetric procedure employed to determine the amount of `non-filterable` residue in a aqueous sample. The prescribed GFC (1.2um) filter is rinsed with deionised water, oven dried and weighed prior to analysis. A well-mixed sample is filtered through a glass fibre filter (1.2um). The residue on the filter paper is dried at 104+/-2C . This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Alkalinity by PC Titrator	ED037-P	WATER	APHA 21st ed., 2320 B This procedure determines alkalinity by automated measurement (e.g. PC Titrate) using pH 4.5 for indicating the total alkalinity end-point. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Sulfate (Turbidimetric) as SO4 2- by Discrete Analyser	ED041G	WATER	APHA 21st ed., 4500-SO4 Sulfate ions are converted to a barium sulfate suspension in an acetic acid medium with barium chloride. Light absorbance of the BaSO4 suspension is measured by a photometer and the SO4-2 concentration is determined by comparison of the reading with a standard curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Chloride by Discrete Analyser	ED045G	WATER	APHA 21st ed., 4500 Cl - G.The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition seal method 2 017-1-L april 2003
Major Cations - Dissolved	ED093F	WATER	Major Cations is determined based on APHA 21st ed., 3120; USEPA SW 846 - 6010 The ICPAES technique ionises the 0.45um filtered sample atoms emitting a characteristic spectrum. This spectrum is then compared against matrix matched standards for quantification. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) Sodium Absorption Ratio is calculated from Ca, Mg and Na which determined by ALS in house method QWI-EN/ED093F. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2) Total Hardness is calculated based on APHA 21st ed., 2340 B. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): Samples are 0.45 um filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite A	EG020A-T	WATER	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.

Analytical Methods	Method	Matrix	Method Descriptions
Dissolved Metals by ICP-MS - Suite B	EG020B-F	WATER	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): Samples are 0.45 um filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Total Metals by ICP-MS - Suite B	EG020B-T	WATER	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	AS 3550, APHA 21st ed. 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45 um filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Mercury by FIMS	EG035T	WATER	AS 3550, APHA 21st ed. 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the unfiltered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Dissolved Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-F	WATER	APHA 21st ed., 3125; USEPA SW846 - 6020 Samples are 0.45 um filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Metals in Fresh Water -Suite A by ORC-ICPMS	EG094A-T	WATER	APHA 21st ed., 3125; USEPA SW846 - 6020 Samples are 0.45 um filtered prior to analysis. The ORC-ICPMS technique removes interfering species through a series of chemical reactions prior to ion detection. Ions are passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to measurement by a discrete dynode ion detector. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Fluoride by PC Titrator	EK040P	WATER	APHA 21st ed., 4500 F--C CDTA is added to the sample to provide a uniform ionic strength background, adjust pH, and break up complexes. Fluoride concentration is determined by either manual or automatic ISE measurement. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Ammonia as N by Discrete analyser	EK055G	WATER	APHA 21st ed., 4500-NH3 G Ammonia is determined by direct colorimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Nitrite as N by Discrete Analyser	EK057G	WATER	APHA 21st ed., 4500-NO2- B. Nitrite is determined by direct colourimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Nitrate as N by Discrete Analyser	EK058G	WATER	APHA 21st ed., 4500-NO3- F. Nitrate is reduced to nitrite by way of a cadmium reduction column followed by quantification by Discrete Analyser. Nitrite is determined seperately by direct colourimetry and result for Nitrate calculated as the difference between the two results. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Nitrite and Nitrate as N (NOx) by Discrete Analyser	EK059G	WATER	APHA 21st ed., 4500-NO3- F. Combined oxidised Nitrogen (NO2+NO3) is determined by Cadmium Reduction and direct colourimetry by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Kjeldahl Nitrogen as N By Discrete Analyser	EK061G	WATER	APHA 21st ed., 4500-Norg D. 25mL water samples are digested using a traditional Kjeldahl digestion followed by determination by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Total Nitrogen as N (TKN + Nox) By Discrete Analyser	EK062G	WATER	APHA 21st ed., 4500-Norg / 4500-NO3-. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)

Analytical Methods	Method	Matrix	Method Descriptions
Total Phosphorus as P By Discrete Analyser	EK067G	WATER	APHA 21st ed., 4500-P B&F This procedure involves sulphuric acid digestion of a 100mL sample to break phosphorus down to orthophosphate. The orthophosphate reacts with ammonium molybdate and antimony potassium tartrate to form a complex which is then reduced and its concentration measured at 880nm using Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Reactive Phosphorus as P-By Discrete Analyser	EK071G	WATER	APHA 21st ed., 4500-P F Ammonium molybdate and potassium antimonyl tartrate reacts in acid medium with othophosphate to form a heteropoly acid -phosphomolybdic acid - which is reduced to intensely coloured molybdenum blue by ascorbic acid. Quantification is by Discrete Analyser. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Ionic Balance by PCT DA and Turbi SO4 DA	EN055 - PG	WATER	APHA 21st Ed. 1030F. The Ionic Balance is calculated based on the major Anions and Cations. The major anions include Alkalinity, Chloride and Sulfate which determined by PCT and DA. The Cations are determined by Turbi SO4 by DA. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Chlorophyll a and Pheophytin a	EP008	WATER	In-house (APHA 21st ed., 10200 H mod.) The pigments are extracted into aqueous acetone. The optical density of the extract before and after acidification at both 664 nm and 665 nm is determined spectrometrically.
Polychlorinated Biphenyls (PCB)	EP066	WATER	USEPA SW 846 - 8270D Sample extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Pesticides by GCMS	EP068	WATER	USEPA SW 846 - 8270D Sample extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
TPH - Semivolatile Fraction	EP071	WATER	USEPA SW 846 - 8015A The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	USEPA SW 846 - 8270D Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
TPH Volatiles/BTEX	EP080	WATER	USEPA SW 846 - 8260B Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)

Preparation Methods	Method	Matrix	Method Descriptions
TKN/TP Digestion	EK061/EK067	WATER	APHA 21st ed., 4500 Norg - D; APHA 21st ed., 4500 P - H. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Digestion for Total Recoverable Metals	EN25	WATER	USEPA SW846-3005 Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Digestion for Total Recoverable Metals - ORC	EN25-ORC	WATER	Modified USEPA SW846-3005. This is an Ultrapure Nitric acid digestion procedure used to prepare surface and ground water samples for analysis by ORC- ICPMS. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2)
Separatory Funnel Extraction of Liquids	ORG14	WATER	USEPA SW 846 - 3510B 500 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using 60mL DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (1999) Schedule B(3) (Appdx. 2). ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for sparging.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Laboratory Control Spike (LCS) Recoveries							
EP068B: Organophosphorus Pesticides (OP)	2671883-002	----	**Monocrotophos**	6923-22-4	15.9 %	16.4-100%	**Recovery less than lower control limit**
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons	2671883-012	----	**Chrysene**	218-01-9	119 %	48-114%	**Recovery greater than upper control limit**

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Matrix Spike outliers occur.**

Regular Sample Surrogates

Sub-Matrix: **WATER**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Samples Submitted							
EP066S: PCB Surrogate	EB1209604-001	ALS AQ6	**Decachlorobiphenyl**	2051-24-3	141 %	37-138.2 %	**Recovery greater than upper data quality objective**
EP066S: PCB Surrogate	EB1209604-003	E3 AQ4	**Decachlorobiphenyl**	2051-24-3	143 %	37-138.2 %	**Recovery greater than upper data quality objective**
EP066S: PCB Surrogate	EB1209604-007	E3 AQ1	**Decachlorobiphenyl**	2051-24-3	142 %	37-138.2 %	**Recovery greater than upper data quality objective**
EP066S: PCB Surrogate	EB1209604-002	ALS AQ5	**Decachlorobiphenyl**	2051-24-3	145 %	37-138.2 %	**Recovery greater than upper data quality objective**
EP066S: PCB Surrogate	EB1209604-004	ALS AQ7	**Decachlorobiphenyl**	2051-24-3	164 %	37-138.2 %	**Recovery greater than upper data quality objective**
EP066S: PCB Surrogate	EB1209604-008	E3 AQ2	**Decachlorobiphenyl**	2051-24-3	168 %	37-138.2 %	**Recovery greater than upper data quality objective**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: **WATER**

Method / Container / Client Sample ID(s)		Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA015: Total Dissolved Solids							
Clear Plastic Bottle - Natural							
E3 AQ4, E3 AQ2	E3 AQ1,	----	----	----	13-APR-2012	11-APR-2012	**2**

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA015: Total Dissolved Solids - Analysis Holding Time Compliance						
Clear Plastic Bottle - Natural						
ALS AQ5	----	----	----	13-APR-2012	12-APR-2012	**1**
EA025: Suspended Solids						
Clear Plastic Bottle - Natural						
E3 AQ4, E3 AQ1, E3 AQ2	----	----	----	12-APR-2012	11-APR-2012	**1**
ED093F: Dissolved Major Cations						
Clear Plastic Bottle - Natural						
E3 AQ4, E3 AQ1, E3 AQ2	----	----	----	13-APR-2012	11-APR-2012	**2**
Clear Plastic Bottle - Natural						
ALS AQ5	----	----	----	13-APR-2012	12-APR-2012	**1**
EK057G: Nitrite as N by Discrete Analyser						
Clear Plastic Bottle - Natural						
E3 AQ4, E3 AQ1, E3 AQ2	----	----	----	12-APR-2012	06-APR-2012	**6**
Clear Plastic Bottle - Natural						
ALS AQ5	----	----	----	12-APR-2012	07-APR-2012	**5**
Clear Plastic Bottle - Natural						
ALS AQ6	----	----	----	12-APR-2012	08-APR-2012	**4**
Clear Plastic Bottle - Natural						
ALS AQ7, ALS AQ8	----	----	----	12-APR-2012	09-APR-2012	**3**
Clear Plastic Bottle - Natural						
ALS AQ12	----	----	----	12-APR-2012	11-APR-2012	**1**
EK071G: Reactive Phosphorus as P by discrete analyser						
Clear Plastic Bottle - Natural						
E3 AQ4, E3 AQ1, E3 AQ2	----	----	----	12-APR-2012	06-APR-2012	**6**
Clear Plastic Bottle - Natural						
ALS AQ5	----	----	----	12-APR-2012	07-APR-2012	**5**
Clear Plastic Bottle - Natural						
ALS AQ6	----	----	----	12-APR-2012	08-APR-2012	**4**
Clear Plastic Bottle - Natural						
ALS AQ7, ALS AQ8	----	----	----	12-APR-2012	09-APR-2012	**3**
Clear Plastic Bottle - Natural						
ALS AQ12	----	----	----	12-APR-2012	11-APR-2012	**1**
EP008: Chlorophyll a & Pheophytin a						
White Plastic Bottle - Unpreserved						
E3 AQ4, E3 AQ1, E3 AQ2	----	----	----	12-APR-2012	06-APR-2012	**6**
White Plastic Bottle - Unpreserved						
ALS AQ5	----	----	----	12-APR-2012	07-APR-2012	**5**

Matrix: **WATER**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EP008: Chlorophyll a & Pheophytin a - Analysis Holding Time Compliance						
White Plastic Bottle - Unpreserved ALS AQ6	----	----	----	12-APR-2012	08-APR-2012	**4**
White Plastic Bottle - Unpreserved ALS AQ7, ALS AQ8	----	----	----	12-APR-2012	09-APR-2012	**3**
White Plastic Bottle - Unpreserved ALS AQ12	----	----	----	12-APR-2012	11-APR-2012	**1**
EP066: Polychlorinated Biphenyls (PCB)						
Amber Glass Bottle - Unpreserved E3 AQ4, E3 AQ1, E3 AQ2	13-APR-2012	11-APR-2012	**2**	----	----	----
Amber Glass Bottle - Unpreserved ALS AQ5	13-APR-2012	12-APR-2012	**1**	----	----	----
EP068A: Organochlorine Pesticides (OC)						
Amber Glass Bottle - Unpreserved E3 AQ4, E3 AQ1, E3 AQ2	13-APR-2012	11-APR-2012	**2**	----	----	----
Amber Glass Bottle - Unpreserved ALS AQ5	13-APR-2012	12-APR-2012	**1**	----	----	----
EP068B: Organophosphorus Pesticides (OP)						
Amber Glass Bottle - Unpreserved E3 AQ4, E3 AQ1, E3 AQ2	13-APR-2012	11-APR-2012	**2**	----	----	----
Amber Glass Bottle - Unpreserved ALS AQ5	13-APR-2012	12-APR-2012	**1**	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons						
Amber Glass Bottle - Unpreserved E3 AQ4, E3 AQ1, E3 AQ2	13-APR-2012	11-APR-2012	**2**	----	----	----
Amber Glass Bottle - Unpreserved ALS AQ5	13-APR-2012	12-APR-2012	**1**	----	----	----
EP080/071: Total Petroleum Hydrocarbons						
Amber Glass Bottle - Unpreserved E3 AQ4, E3 AQ1, E3 AQ2	13-APR-2012	11-APR-2012	**2**	----	----	----
Amber Glass Bottle - Unpreserved ALS AQ5	13-APR-2012	12-APR-2012	**1**	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft						
Amber Glass Bottle - Unpreserved E3 AQ4, E3 AQ1, E3 AQ2	13-APR-2012	11-APR-2012	**2**	----	----	----
Amber Glass Bottle - Unpreserved ALS AQ5	13-APR-2012	12-APR-2012	**1**	----	----	----

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

QUALITY CONTROL REPORT

Work Order	: **EB1209604**	Page	: 1 of 17
Client	: **ALS WATER RESOURCES GROUP**	Laboratory	: Environmental Division Brisbane
Contact	: MR MARK DAHM	Contact	: Customer Services
Address	: PO BOX 3216 YERONGA 4104	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: mark.dahm@alsglobal.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3859 7800	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3859 7820	Facsimile	: +61 7 3243 7218
Project	: CQ212941 Waratah Coal Project	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 11-APR-2012
Sampler	: Mark Dahm	Issue Date	: 20-APR-2012
Order number	: ----		
		No. of samples received	: 8
Quote number	: BN/245/12	No. of samples analysed	: 8

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Metals Production Chemist	Brisbane Inorganics
Jonathon Angell	Inorganic Coordinator	Brisbane Inorganics
Matt Frost	Senior Organic Chemist	Brisbane Organics
Stephen Hislop	Senior Inorganic Chemist	Brisbane Inorganics
Stephen Hislop	Senior Inorganic Chemist	WB Water Lab Brisbane

General Comments

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

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

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA010P: Conductivity by PC Titrator (QC Lot: 2256001)									
EB1209242-060	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	5850	5850	0.0	0% - 20%
EB1209660-001	Anonymous	EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	1080	1080	0.0	0% - 20%
EA015: Total Dissolved Solids (QC Lot: 2256216)									
EB1209559-001	Anonymous	EA015H: Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	205	200	2.5	0% - 20%
EB1209577-002	Anonymous	EA015H: Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	179	173	3.4	0% - 50%
EA025: Suspended Solids (QC Lot: 2253898)									
EB1208971-007	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	39	38	2.6	No Limit
EB1209621-002	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.0	No Limit
EA025: Suspended Solids (QC Lot: 2254193)									
EB1209552-010	Anonymous	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.0	No Limit
EB1209604-003	E3 AQ4	EA025H: Suspended Solids (SS)	----	5	mg/L	<5	<5	0.0	No Limit
ED037P: Alkalinity by PC Titrator (QC Lot: 2256004)									
EB1209660-001	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	2	4	57.0	No Limit
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	266	263	0.8	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	268	267	0.0	0% - 20%
EB1209682-002	Anonymous	ED037-P: Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	0.0	No Limit
		ED037-P: Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	139	144	3.8	0% - 20%
		ED037-P: Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	899	903	0.5	0% - 20%
		ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	1040	1050	0.9	0% - 20%
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QC Lot: 2255844)									
EB1209242-060	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	30	30	0.0	0% - 20%
EB1209796-001	Anonymous	ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	483	501	3.6	0% - 20%
ED045G: Chloride Discrete analyser (QC Lot: 2255845)									
EB1209796-001	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	3960	3970	0.2	0% - 20%
EB1209796-003	Anonymous	ED045G: Chloride	16887-00-6	1	mg/L	7	7	0.0	No Limit
ED093F: Dissolved Major Cations (QC Lot: 2255842)									
EB1209242-060	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	135	136	0.8	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	11	11	0.0	0% - 50%
		ED093F: Sodium	7440-23-5	1	mg/L	1010	1010	0.6	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	10	10	0.0	0% - 50%
EB1209796-001	Anonymous	ED093F: Calcium	7440-70-2	1	mg/L	86	86	0.0	0% - 20%
		ED093F: Magnesium	7439-95-4	1	mg/L	273	273	0.0	0% - 20%
		ED093F: Sodium	7440-23-5	1	mg/L	2200	2190	0.7	0% - 20%
		ED093F: Potassium	7440-09-7	1	mg/L	102	102	0.0	0% - 20%

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2255816)									
EB1209242-062	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.012	0.012	0.0	0% - 50%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.003	0.003	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.004	0.004	0.0	No Limit
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	0.037	0.038	0.0	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.001	0.001	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	0.02	0.02	0.0	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	0.06	0.06	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	<0.05	0.0	No Limit
EB1209604-005	ALS AQ8	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.001	0.0	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.190	0.189	0.0	0% - 20%
		EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-F: Aluminium	7429-90-5	0.01	mg/L	1.07	1.30	19.0	0% - 20%
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	0.0	No Limit
		EG020A-F: Iron	7439-89-6	0.05	mg/L	0.64	0.76	17.4	0% - 50%
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2255817)									
EB1209242-062	Anonymous	EG020B-F: Uranium	7440-61-1	0.001	mg/L	0.002	0.002	0.0	No Limit
EB1209604-005	ALS AQ8	EG020B-F: Uranium	7440-61-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 2255854)									
EB1209242-062	Anonymous	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	0.012	0.012	0.0	0% - 50%
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	0.004	0.004	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.002	0.002	0.0	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG020T: Total Metals by ICP-MS (QC Lot: 2255854) - continued									
EB1209242-062	Anonymous	EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.014	0.014	0.0	0% - 50%
		EG020A-T: Molybdenum	7439-98-7	0.001	mg/L	0.050	0.049	2.4	0% - 20%
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	0.003	0.002	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.27	0.26	0.0	0% - 20%
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	0.01	0.01	0.0	No Limit
		EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-T: Boron	7440-42-8	0.05	mg/L	0.07	0.07	0.0	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.34	0.33	0.0	No Limit
EB1209604-008	E3 AQ2	EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
		EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Copper	7440-50-8	0.001	mg/L	0.001	<0.001	0.0	No Limit
		EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Manganese	7439-96-5	0.001	mg/L	0.179	0.185	3.0	0% - 20%
		EG020A-T: Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	0.0	No Limit
		EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	0.0	No Limit
		EG020A-T: Aluminium	7429-90-5	0.01	mg/L	0.02	0.01	0.0	No Limit
		EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.0	No Limit
		EG020A-T: Boron	7440-42-8	0.05	mg/L	0.09	0.09	0.0	No Limit
		EG020A-T: Iron	7439-89-6	0.05	mg/L	0.18	0.19	7.1	No Limit
EG020T: Total Metals by ICP-MS (QC Lot: 2255855)									
EB1209242-062	Anonymous	EG020B-T: Uranium	7440-61-1	0.001	mg/L	0.002	0.002	0.0	No Limit
EB1209604-008	E3 AQ2	EG020B-T: Uranium	7440-61-1	0.001	mg/L	0.001	0.001	0.0	No Limit
EG035F: Dissolved Mercury by FIMS (QC Lot: 2255815)									
EB1209242-060	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EB1209604-006	ALS AQ12	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2258766)									
EB1209604-001	ALS AQ6	EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.0	No Limit
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QC Lot: 2258124)									
EB1209549-001	Anonymous	EG094A-F: Silver	7440-22-4	0.1	µg/L	0.3	0.3	0.0	No Limit
EB1209549-007	Anonymous	EG094A-F: Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
EG094T: Total metals in Fresh water by ORC-ICPMS (QC Lot: 2258128)									
EB1209604-001	ALS AQ6	EG094A-T: Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
EB1209794-002	Anonymous	EG094A-T: Silver	7440-22-4	0.1	µg/L	<0.1	<0.1	0.0	No Limit
EK040P: Fluoride by PC Titrator (QC Lot: 2256003)									

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EK040P: Fluoride by PC Titrator (QC Lot: 2256003) - continued									
EB1209242-060	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.3	0.2	0.0	No Limit
EB1209660-001	Anonymous	EK040P: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.0	No Limit
EK055G: Ammonia as N by Discrete Analyser (QC Lot: 2260159)									
EB1209573-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.16	0.15	0.0	0% - 50%
EB1209604-002	ALS AQ5	EK055G: Ammonia as N	7664-41-7	0.01	mg/L	0.04	0.04	0.0	No Limit
EK057G: Nitrite as N by Discrete Analyser (QC Lot: 2253745)									
EB1209575-001	Anonymous	EK057G: Nitrite as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EB1209577-001	Anonymous	EK057G: Nitrite as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QC Lot: 2260158)									
EB1209573-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EB1209604-002	ALS AQ5	EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2256168)									
EB1207807-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	5.4	5.3	2.4	0% - 20%
EB1209546-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.6	0.6	0.0	No Limit
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QC Lot: 2256173)									
EB1209574-004	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.5	<0.5	0.0	No Limit
EB1209636-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	0.7	0.8	0.0	No Limit
EK067G: Total Phosphorus as P by Discrete Analyser (QC Lot: 2256171)									
EB1209574-004	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.05	<0.05	0.0	No Limit
EB1209636-001	Anonymous	EK067G: Total Phosphorus as P	----	0.01	mg/L	0.09	0.10	10.6	0% - 50%
EK071G: Reactive Phosphorus as P by discrete analyser (QC Lot: 2253746)									
EB1209575-001	Anonymous	EK071G: Reactive Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EB1209604-007	E3 AQ1	EK071G: Reactive Phosphorus as P	----	0.01	mg/L	<0.01	<0.01	0.0	No Limit
EP008: Chlorophyll a & Pheophytin a (QC Lot: 2254331)									
EB1209604-001	ALS AQ6	EP008: Chlorophyll a	----	1	mg/m3	<1	<1	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 2255528)									
EB1209279-001	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EB1209350-017	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 2259996)									
EB1209604-001	ALS AQ6	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EB1209768-005	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QC Lot: 2255528)									
EB1209279-001	Anonymous	EP080: C6 - C10 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
		EP080: C6 - C10 Fraction minus BTEX (F1)	----	20	µg/L	<20	<20	0.0	No Limit
EB1209350-017	Anonymous	EP080: C6 - C10 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
		EP080: C6 - C10 Fraction minus BTEX (F1)	----	20	µg/L	<20	<20	0.0	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QC Lot: 2259996)									
EB1209604-001	ALS AQ6	EP080: C6 - C10 Fraction	----	20	µg/L	<20	<20	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QC Lot: 2259996) - continued									
EB1209604-001	ALS AQ6	EP080: C6 - C10 Fraction minus BTEX (F1)	----	20	µg/L	<20	<20	0.0	No Limit
EB1209768-005	Anonymous	EP080: C6 - C10 Fraction	----	20	µg/L	<20	<20	0.0	No Limit
		EP080: C6 - C10 Fraction minus BTEX (F1)	----	20	µg/L	<20	<20	0.0	No Limit
EP080: BTEXN (QC Lot: 2255528)									
EB1209279-001	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Sum of BTEX	----	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Total Xylenes	1330-20-7	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
EB1209350-017	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Sum of BTEX	----	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Total Xylenes	1330-20-7	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
EP080: BTEXN (QC Lot: 2259996)									
EB1209604-001	ALS AQ6	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Sum of BTEX	----	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Total Xylenes	1330-20-7	2	µg/L	<2	<2	0.0	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit
EB1209768-005	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.0	No Limit
		EP080: Sum of BTEX	----	1	µg/L	<1	<1	0.0	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.0	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.0	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.0	No Limit
		EP080: Total Xylenes	1330-20-7	2	µg/L	<2	<2	0.0	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP080: BTEXN (QC Lot: 2259996) - continued									
EB1209768-005	Anonymous	EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.0	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA010P: Conductivity by PC Titrator (QCLot: 2256001)								
EA010-P: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	4000 µS/cm	101	93	107
EA015: Total Dissolved Solids (QCLot: 2256216)								
EA015H: Total Dissolved Solids @180°C	GIS-210-010	10	mg/L	<10	2000 mg/L	97.2	80	120
EA025: Suspended Solids (QCLot: 2253898)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	104	82	120
EA025: Suspended Solids (QCLot: 2254193)								
EA025H: Suspended Solids (SS)	----	5	mg/L	<5	150 mg/L	98.7	82	120
ED037P: Alkalinity by PC Titrator (QCLot: 2256004)								
ED037-P: Total Alkalinity as CaCO3	----	1	mg/L	----	200 mg/L	97.4	88	112
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA (QCLot: 2255844)								
ED041G: Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	<1	25 mg/L	105	70	130
ED045G: Chloride Discrete analyser (QCLot: 2255845)								
ED045G: Chloride	16887-00-6	1	mg/L	<1	1000 mg/L	98.3	70	128
ED093F: Dissolved Major Cations (QCLot: 2255842)								
ED093F: Calcium	7440-70-2	1	mg/L	<1	----	----	----	----
ED093F: Magnesium	7439-95-4	1	mg/L	<1	----	----	----	----
ED093F: Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
ED093F: Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS (QCLot: 2255816)								
EG020A-F: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.500 mg/L	99.0	83	125
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.100 mg/L	95.8	86	124
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.100 mg/L	96.1	89	117
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.100 mg/L	109	89	127
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.100 mg/L	97.8	88	116
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.200 mg/L	97.1	86	115
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.100 mg/L	98.7	91	111
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.100 mg/L	96.1	85	118
EG020A-F: Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.100 mg/L	98.7	91	113
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.100 mg/L	96.0	88	115
EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	0.100 mg/L	101	86	122
EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.100 mg/L	96.8	81	113
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.200 mg/L	96.5	86	120
EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	0.50 mg/L	101	70	129

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Work Order : EB1209604
Client : ALS WATER RESOURCES GROUP
Project : CQ212941 Waratah Coal Project

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 2255816) - continued								
EG020A-F: Iron	7439-89-6	0.05	mg/L	<0.05	0.50 mg/L	94.1	84	124
EG020F: Dissolved Metals by ICP-MS (QCLot: 2255817)								
EG020B-F: Uranium	7440-61-1	0.001	mg/L	<0.001	----	----	----	----
EG020T: Total Metals by ICP-MS (QCLot: 2255854)								
EG020A-T: Aluminium	7429-90-5	0.01	mg/L	<0.01	0.500 mg/L	95.5	70	120
EG020A-T: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.100 mg/L	93.9	78	120
EG020A-T: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.100 mg/L	95.4	84	114
EG020A-T: Chromium	7440-47-3	0.001	mg/L	<0.001	0.100 mg/L	102	86	121
EG020A-T: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.100 mg/L	98.8	86	120
EG020A-T: Copper	7440-50-8	0.001	mg/L	<0.001	0.200 mg/L	88.2	70	119
EG020A-T: Lead	7439-92-1	0.001	mg/L	<0.001	0.100 mg/L	100	70	117
EG020A-T: Manganese	7439-96-5	0.001	mg/L	<0.001	0.100 mg/L	99.4	87	123
EG020A-T: Molybdenum	7439-98-7	0.001	mg/L	<0.001	0.100 mg/L	98.8	70	114
EG020A-T: Nickel	7440-02-0	0.001	mg/L	<0.001	0.100 mg/L	99.0	86	119
EG020A-T: Selenium	7782-49-2	0.01	mg/L	<0.01	0.100 mg/L	89.2	70	112
EG020A-T: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.100 mg/L	96.6	76	120
EG020A-T: Zinc	7440-66-6	0.005	mg/L	<0.005	0.200 mg/L	93.1	81	123
EG020A-T: Boron	7440-42-8	0.05	mg/L	<0.05	0.500 mg/L	94.5	76	129
EG020A-T: Iron	7439-89-6	0.05	mg/L	<0.05	0.500 mg/L	98.8	70	130
EG020T: Total Metals by ICP-MS (QCLot: 2255855)								
EG020B-T: Uranium	7440-61-1	0.001	mg/L	<0.001	----	----	----	----
EG035F: Dissolved Mercury by FIMS (QCLot: 2255815)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.010 mg/L	103	84	116
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2258766)								
EG035T: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.0100 mg/L	94.0	80	116
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS (QCLot: 2258124)								
EG094A-F: Silver	7440-22-4	0.1	µg/L	<0.1	10 µg/L	111	80	120
EG094T: Total metals in Fresh water by ORC-ICPMS (QCLot: 2258128)								
EG094A-T: Silver	7440-22-4	0.1	µg/L	<0.1	10 µg/L	107	80	120
EK040P: Fluoride by PC Titrator (QCLot: 2256003)								
EK040P: Fluoride	16984-48-8	0.1	mg/L	<0.1	10 mg/L	99.5	85	115
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2260159)								
EK055G: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	90.6	70	120
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2253745)								
EK057G: Nitrite as N	----	0.01	mg/L	<0.01	0.5 mg/L	104	78	128
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2260158)								
EK059G: Nitrite + Nitrate as N	----	0.01	mg/L	<0.01	0.5 mg/L	88.8	70	124

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2256168)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10.0 mg/L	81.9	70	115
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2256173)								
EK061G: Total Kjeldahl Nitrogen as N	----	0.1	mg/L	<0.1	10.0 mg/L	79.9	70	115
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2256171)								
EK067G: Total Phosphorus as P	----	0.01	mg/L	<0.01	4.2 mg/L	98.8	76	117
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 2253746)								
EK071G: Reactive Phosphorus as P	----	0.01	mg/L	<0.01	0.5 mg/L	105	81	121
EP008: Chlorophyll a & Pheophytin a (QCLot: 2254331)								
EP008: Chlorophyll a	----	5	mg/m3	<5	2000 mg/m3	86.9	70.7	118
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 2255636)								
EP066: Total Polychlorinated biphenyls	----	1	µg/L	<1	10 µg/L	104	57	125
EP068A: Organochlorine Pesticides (OC) (QCLot: 2255635)								
EP068: alpha-BHC	319-84-6	0.5	µg/L	<0.5	5 µg/L	99.0	55	127
EP068: Hexachlorobenzene (HCB)	118-74-1	0.5	µg/L	<0.5	5 µg/L	83.2	51	126
EP068: gamma-BHC	58-89-9	0.5	µg/L	<0.5	5 µg/L	97.1	53	131
EP068: delta-BHC	319-86-8	0.5	µg/L	<0.5	5 µg/L	102	49	131
EP068: Heptachlor	76-44-8	0.5	µg/L	<0.5	5 µg/L	94.5	43	128
EP068: Aldrin	309-00-2	0.5	µg/L	<0.5	5 µg/L	99.3	57	131
EP068: Heptachlor epoxide	1024-57-3	0.5	µg/L	<0.5	5 µg/L	94.8	57	124
EP068: trans-Chlordane	5103-74-2	0.5	µg/L	<0.5	5 µg/L	94.4	53.4	120
EP068: alpha-Endosulfan	959-98-8	0.5	µg/L	<0.5	5 µg/L	95.6	53	133
EP068: cis-Chlordane	5103-71-9	0.5	µg/L	<0.5	5 µg/L	94.8	52.4	120
EP068: Dieldrin	60-57-1	0.5	µg/L	<0.5	5 µg/L	95.4	51	128
EP068: 4.4`-DDE	72-55-9	0.5	µg/L	<0.5	5 µg/L	95.2	54.8	125
EP068: Endrin	72-20-8	0.5	µg/L	<0.5	5 µg/L	92.5	49.1	135
EP068: beta-Endosulfan	33213-65-9	0.5	µg/L	<0.5	5 µg/L	97.2	54	123
EP068: 4.4`-DDD	72-54-8	0.5	µg/L	<0.5	5 µg/L	93.0	54.3	129
EP068: Endrin aldehyde	7421-93-4	0.5	µg/L	<0.5	5 µg/L	108	54.3	127
EP068: Endosulfan sulfate	1031-07-8	0.5	µg/L	<0.5	5 µg/L	100	47	136
EP068: 4.4`-DDT	50-29-3	2.0	µg/L	<2	5 µg/L	89.2	40	130
EP068: Endrin ketone	53494-70-5	0.5	µg/L	<0.5	5 µg/L	97.0	43	138
EP068: Methoxychlor	72-43-5	2.0	µg/L	<2	5 µg/L	93.8	16.1	130
EP068B: Organophosphorus Pesticides (OP) (QCLot: 2255635)								
EP068: Dichlorvos	62-73-7	0.5	µg/L	<0.5	5 µg/L	101	53.6	128
EP068: Demeton-S-methyl	919-86-8	0.5	µg/L	<0.5	5 µg/L	79.1	49.2	135
EP068: Monocrotophos	6923-22-4	2.0	µg/L	<2	5 µg/L	# 15.9	16.4	100
EP068: Dimethoate	60-51-5	0.5	µg/L	<0.5	5 µg/L	85.8	51.3	129
EP068: Diazinon	333-41-5	0.5	µg/L	<0.5	5 µg/L	102	49	133

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP068B: Organophosphorus Pesticides (OP) (QCLot: 2255635) - continued								
EP068: Chlorpyrifos-methyl	5598-13-0	0.5	µg/L	<0.5	5 µg/L	102	54.6	123
EP068: Parathion-methyl	298-00-0	2.0	µg/L	<2	5 µg/L	111	47	130
EP068: Malathion	121-75-5	0.5	µg/L	<0.5	5 µg/L	106	51	129
EP068: Fenthion	55-38-9	0.5	µg/L	<0.5	5 µg/L	103	51	120
EP068: Chlorpyrifos	2921-88-2	0.5	µg/L	<0.5	5 µg/L	103	57.6	126
EP068: Parathion	56-38-2	2.0	µg/L	<2	5 µg/L	90.4	48	126
EP068: Pirimphos-ethyl	23505-41-1	0.5	µg/L	<0.5	5 µg/L	98.9	54.7	122
EP068: Bromophos-ethyl	4824-78-6	0.5	µg/L	<0.5	5 µg/L	95.8	54.8	120
EP068: Fenamiphos	22224-92-6	0.5	µg/L	<0.5	5 µg/L	88.6	48.3	126
EP068: Prothiofos	34643-46-4	0.5	µg/L	<0.5	5 µg/L	95.8	53.7	121
EP068: Ethion	563-12-2	0.5	µg/L	<0.5	5 µg/L	99.3	54.6	130
EP068: Carbophenothion	786-19-6	0.5	µg/L	<0.5	5 µg/L	98.1	53.4	128
EP068: Azinphos Methyl	86-50-0	0.5	µg/L	<0.5	5 µg/L	92.8	34	130
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 2255638)								
EP075(SIM): Naphthalene	91-20-3	1	µg/L	<1.0	10 µg/L	91.0	46	115
EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<1.0	10 µg/L	96.0	51	122
EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<1.0	10 µg/L	88.2	50	118
EP075(SIM): Fluorene	86-73-7	1	µg/L	<1.0	10 µg/L	89.8	55	121
EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<1.0	10 µg/L	90.7	54	110
EP075(SIM): Anthracene	120-12-7	1	µg/L	<1.0	10 µg/L	84.9	49	118
EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<1.0	10 µg/L	106	51	117
EP075(SIM): Pyrene	129-00-0	1	µg/L	<1.0	10 µg/L	104	51	117
EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<1.0	10 µg/L	117	53	120
EP075(SIM): Chrysene	218-01-9	1	µg/L	<1.0	10 µg/L	# 119	48	114
EP075(SIM): Benzo(b)fluoranthene	205-99-2	1	µg/L	<1.0	10 µg/L	110	48	133
EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<1.0	10 µg/L	107	43	127
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	10 µg/L	110	44	120
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<1.0	10 µg/L	106	45	132
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	1	µg/L	<1.0	10 µg/L	108	47	135
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	1	µg/L	<1.0	10 µg/L	104	42	131
EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	1	µg/L	<1.0	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2255528)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	160 µg/L	104	69	135
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2255637)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	1275 µg/L	78.3	49	125.5
EP071: C15 - C28 Fraction	----	100	µg/L	<100	1850 µg/L	85.1	58	131
EP071: C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2259996)								

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2259996) - continued								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	160 µg/L	106	69	135
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2255528)								
EP080: C6 - C10 Fraction	----	20	µg/L	<20	185 µg/L	107	64	136
EP080: C6 - C10 Fraction minus BTEX (F1)	----	20	µg/L	<20	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2255637)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	1670 µg/L	81.0	49	125.5
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	1285 µg/L	85.3	58	131
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2259996)								
EP080: C6 - C10 Fraction	----	20	µg/L	<20	185 µg/L	105	64	136
EP080: C6 - C10 Fraction minus BTEX (F1)	----	20	µg/L	<20	----	----	----	----
EP080: BTEXN (QCLot: 2255528)								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	105	76	124
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	105	71	123
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	101	73	125
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	20 µg/L	103	70.4	129
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	99.5	72	124
EP080: Total Xylenes	1330-20-7	2	µg/L	<2	----	----	----	----
EP080: Sum of BTEX	----	1	µg/L	<1	----	----	----	----
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	105	77	119
EP080: BTEXN (QCLot: 2259996)								
EP080: Benzene	71-43-2	1	µg/L	<1	10 µg/L	104	76	124
EP080: Toluene	108-88-3	2	µg/L	<2	10 µg/L	102	71	123
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	10 µg/L	100	73	125
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	20 µg/L	103	70.4	129
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	10 µg/L	98.6	72	124
EP080: Total Xylenes	1330-20-7	2	µg/L	<2	----	----	----	----
EP080: Sum of BTEX	----	1	µg/L	<1	----	----	----	----
EP080: Naphthalene	91-20-3	5	µg/L	<5	10 µg/L	99.3	77	119

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED045G: Chloride Discrete analyser (QCLot: 2255845)							
EB1209796-002	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	73.8	70	130
EG020F: Dissolved Metals by ICP-MS (QCLot: 2255816)							
EB1209369-001	Anonymous	EG020A-F: Aluminium	7429-90-5	0.500 mg/L	91.5	70	130
		EG020A-F: Arsenic	7440-38-2	0.100 mg/L	99.8	70	130
		EG020A-F: Cadmium	7440-43-9	0.100 mg/L	99.0	70	130
		EG020A-F: Chromium	7440-47-3	0.100 mg/L	99.8	70	130
		EG020A-F: Cobalt	7440-48-4	0.100 mg/L	96.6	70	130
		EG020A-F: Copper	7440-50-8	0.200 mg/L	96.6	70	130
		EG020A-F: Lead	7439-92-1	0.100 mg/L	91.0	70	130
		EG020A-F: Manganese	7439-96-5	0.100 mg/L	96.0	70	130
		EG020A-F: Molybdenum	7439-98-7	0.100 mg/L	96.7	70	130
		EG020A-F: Nickel	7440-02-0	0.100 mg/L	95.9	70	130
		EG020A-F: Selenium	7782-49-2	0.100 mg/L	103	70	130
		EG020A-F: Vanadium	7440-62-2	0.100 mg/L	103	70	130
		EG020A-F: Zinc	7440-66-6	0.200 mg/L	96.4	70	130
		EG020A-F: Boron	7440-42-8	0.500 mg/L	84.3	70	130
EG020T: Total Metals by ICP-MS (QCLot: 2255854)							
EB1209604-001	ALS AQ6	EG020A-T: Arsenic	7440-38-2	1.000 mg/L	103	70	130
		EG020A-T: Cadmium	7440-43-9	0.500 mg/L	100	70	130
		EG020A-T: Chromium	7440-47-3	1.000 mg/L	99.6	70	130
		EG020A-T: Cobalt	7440-48-4	1.000 mg/L	98.6	70	130
		EG020A-T: Copper	7440-50-8	1.000 mg/L	86.0	70	130
		EG020A-T: Lead	7439-92-1	1.000 mg/L	95.6	70	130
		EG020A-T: Manganese	7439-96-5	1.000 mg/L	96.8	70	130
		EG020A-T: Nickel	7440-02-0	1.000 mg/L	104	70	130
		EG020A-T: Vanadium	7440-62-2	1.000 mg/L	101	70	130
		EG020A-T: Zinc	7440-66-6	1.000 mg/L	94.7	70	130
EG035F: Dissolved Mercury by FIMS (QCLot: 2255815)							
EB1209367-001	Anonymous	EG035F: Mercury	7439-97-6	0.010 mg/L	104	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2258766)							
EB1209604-002	ALS AQ5	EG035T: Mercury	7439-97-6	0.010 mg/L	120	70	130
EK040P: Fluoride by PC Titrator (QCLot: 2256003)							
EB1209242-060	Anonymous	EK040P: Fluoride	16984-48-8	6.1 mg/L	96.7	70	130
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2260159)							

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2260159) - continued							
EB1209574-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	124	70	130
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2253745)							
EB1209575-002	Anonymous	EK057G: Nitrite as N	----	0.4 mg/L	101	70	130
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2260158)							
EB1209574-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.4 mg/L	71.8	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2256168)							
EB1208795-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	95.3	70	130
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2256173)							
EB1209604-005	ALS AQ8	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	82.2	70	130
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2256171)							
EB1209604-005	ALS AQ8	EK067G: Total Phosphorus as P	----	1.0 mg/L	84.0	70	130
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 2253746)							
EB1209575-002	Anonymous	EK071G: Reactive Phosphorus as P	----	0.4 mg/L	104	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2255528)							
EB1209348-001	Anonymous	EP080: C6 - C9 Fraction	----	40 µg/L	107	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2259996)							
EB1209604-002	ALS AQ5	EP080: C6 - C9 Fraction	----	40 µg/L	108	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2255528)							
EB1209348-001	Anonymous	EP080: C6 - C10 Fraction	----	40 µg/L	119	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2259996)							
EB1209604-002	ALS AQ5	EP080: C6 - C10 Fraction	----	40 µg/L	113	70	130
EP080: BTEXN (QCLot: 2255528)							
EB1209348-001	Anonymous	EP080: Benzene	71-43-2	10 µg/L	102	70	130
		EP080: Toluene	108-88-3	10 µg/L	105	70	130
EP080: BTEXN (QCLot: 2259996)							
EB1209604-002	ALS AQ5	EP080: Benzene	71-43-2	10 µg/L	99.8	70	130
		EP080: Toluene	108-88-3	10 µg/L	99.7	70	130

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

The quality control term Matrix Spike (MS) and Matrix Spike Duplicate (MSD) refers to intralaboratory split samples spiked with a representative set of target analytes. The purpose of these QC parameters are to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
ED045G: Chloride Discrete analyser (QCLot: 2255845)										
EB1209796-002	Anonymous	ED045G: Chloride	16887-00-6	400 mg/L	73.8	----	70	130	----	----
EG020F: Dissolved Metals by ICP-MS (QCLot: 2255816)										
EB1209369-001	Anonymous	EG020A-F: Aluminium	7429-90-5	0.500 mg/L	91.5	----	70	130	----	----
		EG020A-F: Arsenic	7440-38-2	0.100 mg/L	99.8	----	70	130	----	----
		EG020A-F: Cadmium	7440-43-9	0.100 mg/L	99.0	----	70	130	----	----
		EG020A-F: Chromium	7440-47-3	0.100 mg/L	99.8	----	70	130	----	----
		EG020A-F: Cobalt	7440-48-4	0.100 mg/L	96.6	----	70	130	----	----
		EG020A-F: Copper	7440-50-8	0.200 mg/L	96.6	----	70	130	----	----
		EG020A-F: Lead	7439-92-1	0.100 mg/L	91.0	----	70	130	----	----
		EG020A-F: Manganese	7439-96-5	0.100 mg/L	96.0	----	70	130	----	----
		EG020A-F: Molybdenum	7439-98-7	0.100 mg/L	96.7	----	70	130	----	----
		EG020A-F: Nickel	7440-02-0	0.100 mg/L	95.9	----	70	130	----	----
		EG020A-F: Selenium	7782-49-2	0.100 mg/L	103	----	70	130	----	----
		EG020A-F: Vanadium	7440-62-2	0.100 mg/L	103	----	70	130	----	----
		EG020A-F: Zinc	7440-66-6	0.200 mg/L	96.4	----	70	130	----	----
		EG020A-F: Boron	7440-42-8	0.500 mg/L	84.3	----	70	130	----	----
EG020T: Total Metals by ICP-MS (QCLot: 2255854)										
EB1209604-001	ALS AQ6	EG020A-T: Arsenic	7440-38-2	1.000 mg/L	103	----	70	130	----	----
		EG020A-T: Cadmium	7440-43-9	0.500 mg/L	100	----	70	130	----	----
		EG020A-T: Chromium	7440-47-3	1.000 mg/L	99.6	----	70	130	----	----
		EG020A-T: Cobalt	7440-48-4	1.000 mg/L	98.6	----	70	130	----	----
		EG020A-T: Copper	7440-50-8	1.000 mg/L	86.0	----	70	130	----	----
		EG020A-T: Lead	7439-92-1	1.000 mg/L	95.6	----	70	130	----	----
		EG020A-T: Manganese	7439-96-5	1.000 mg/L	96.8	----	70	130	----	----
		EG020A-T: Nickel	7440-02-0	1.000 mg/L	104	----	70	130	----	----
		EG020A-T: Vanadium	7440-62-2	1.000 mg/L	101	----	70	130	----	----
		EG020A-T: Zinc	7440-66-6	1.000 mg/L	94.7	----	70	130	----	----
EG035F: Dissolved Mercury by FIMS (QCLot: 2255815)										
EB1209367-001	Anonymous	EG035F: Mercury	7439-97-6	0.010 mg/L	104	----	70	130	----	----
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2258766)										
EB1209604-002	ALS AQ5	EG035T: Mercury	7439-97-6	0.010 mg/L	120	----	70	130	----	----
EK040P: Fluoride by PC Titrator (QCLot: 2256003)										
EB1209242-060	Anonymous	EK040P: Fluoride	16984-48-8	6.1 mg/L	96.7	----	70	130	----	----
EK055G: Ammonia as N by Discrete Analyser (QCLot: 2260159)										
EB1209574-001	Anonymous	EK055G: Ammonia as N	7664-41-7	0.4 mg/L	124	----	70	130	----	----
EK057G: Nitrite as N by Discrete Analyser (QCLot: 2253745)										
EB1209575-002	Anonymous	EK057G: Nitrite as N	----	0.4 mg/L	101	----	70	130	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2260158)										

Sub-Matrix: **WATER**

				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPDs (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser (QCLot: 2260158) - continued										
EB1209574-001	Anonymous	EK059G: Nitrite + Nitrate as N	----	0.4 mg/L	71.8	----	70	130	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2256168)										
EB1208795-001	Anonymous	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	95.3	----	70	130	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser (QCLot: 2256173)										
EB1209604-005	ALS AQ8	EK061G: Total Kjeldahl Nitrogen as N	----	5 mg/L	82.2	----	70	130	----	----
EK067G: Total Phosphorus as P by Discrete Analyser (QCLot: 2256171)										
EB1209604-005	ALS AQ8	EK067G: Total Phosphorus as P	----	1.0 mg/L	84.0	----	70	130	----	----
EK071G: Reactive Phosphorus as P by discrete analyser (QCLot: 2253746)										
EB1209575-002	Anonymous	EK071G: Reactive Phosphorus as P	----	0.4 mg/L	104	----	70	130	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2255528)										
EB1209348-001	Anonymous	EP080: C6 - C9 Fraction	----	40 µg/L	107	----	70	130	----	----
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2259996)										
EB1209604-002	ALS AQ5	EP080: C6 - C9 Fraction	----	40 µg/L	108	----	70	130	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2255528)										
EB1209348-001	Anonymous	EP080: C6 - C10 Fraction	----	40 µg/L	119	----	70	130	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft (QCLot: 2259996)										
EB1209604-002	ALS AQ5	EP080: C6 - C10 Fraction	----	40 µg/L	113	----	70	130	----	----
EP080: BTEXN (QCLot: 2255528)										
EB1209348-001	Anonymous	EP080: Benzene	71-43-2	10 µg/L	102	----	70	130	----	----
		EP080: Toluene	108-88-3	10 µg/L	105	----	70	130	----	----
EP080: BTEXN (QCLot: 2259996)										
EB1209604-002	ALS AQ5	EP080: Benzene	71-43-2	10 µg/L	99.8	----	70	130	----	----
		EP080: Toluene	108-88-3	10 µg/L	99.7	----	70	130	----	----

A trading name of: AUSTRALIAN LABORATORY SERVICES PTY LTD ABN 84 009 936 029
32 Shand Street, Stafford, Queensland Australia 4053 Telephone: +61-7-3243 7222 Facsimile: +61-7-3268 2279

TAX INVOICE

Invoice No. : **E822870**

Page : **1 of 1**

ALS WATER RESOURCES GROUP
MR MARK DAHM
PO BOX 3216
YERONGA 4104

Work Order	Project	Site	Order number	C-O-C number	Contact
EB1209604	CQ212941 Waratah Coal Project	----	----	----	MR MARK DAHM

Issue Date : 20-APR-2012

Taxable value : **AUD$ 5,790.00**

Tax Incurred (GST) : **AUD$ 579.00**

Due Date : **20-MAY-2012**

Amount Payable : **AUD$ 6,369.00**

Work Order Breakdown

Method	Method Descriptions	Quantity	Unit Value (AUD$)	Value (AUD$)	GST (AUD$)	Line Total (AUD$)
Work Order: **EB1209604**	Quote number: **BN/245/12**				Submatrix summary: **8 WATERS**	
Misc	Workorder Admin Fee	1	30.00	30.00	3.00	33.00
Misc	Acidified Filtration	8	3.00	24.00	2.40	26.40
EA010P	Conductivity (PC)	8	5.00	40.00	4.00	44.00
EA015H	Total Dissolved Solids - High Level	8	11.00	88.00	8.80	96.80
EA025H	Suspended Solids (High Level)	8	11.00	88.00	8.80	96.80
EG020F	Dissolved Metals by ICPMS (9 additional Analytes)	8	36.00	288.00	28.80	316.80
EG020T	Total Recoverable Metals by ICPMS (9 additional Analytes)	8	36.00	288.00	28.80	316.80
EG094A-F	Dissolved Metals in Fresh Water Suite A by ORC-ICPMS	8	107.00	856.00	85.60	941.60
EG094A-T	Total Metals in Fresh water Suite A by ORC-ICPMS	8	125.00	1,000.00	100.00	1,100.00
EP008	Chlorophyll a	8	28.00	224.00	22.40	246.40
NT-01	Major Cations (Ca, Mg, Na, K)	8	16.00	128.00	12.80	140.80
NT-02A	Major Anions (Chloride, Sulphate, Fluoride, Alkalinity)	8	31.00	248.00	24.80	272.80
NT-08A	Total Nitrogen + NO2 + NO3 + NH3 + Total P + Reactive P	8	70.00	560.00	56.00	616.00
W-02T	8 metals (Total)	8	41.00	328.00	32.80	360.80
W-16	TPH/BTEX/PAH/OC/OP/PCB/8 Metals	8	200.00	1,600.00	160.00	1,760.00

- Please direct all enquiries to Environmental Division Brisbane.

Cut here Cut here

REMITTANCE ADVICE

POST TO:
Australian Laboratory Services Pty Ltd
P.O. Box 66
Everton Park QLD 4053 Australia

Please note any adjustment if invoice is not paid in full.

Vendor bank details

Bank: **Commonwealth Bank** or
BSB: **064 000**
Account: **12672843**
Swift Code: **CTBAAU2S**

Credit Card
Visa
Mastercard

or Cheque
Payable to Australian Laboratory Services Pty Ltd

or Remittances
remittances@alsglobal.com

Amount Payable
AUD$ 6,369.00
ALS Client Reference
ECOENV

TAX INVOICE
E822870

CERTIFICATE OF ANALYSIS

Work Order	: **EB1209604**	Page	: 1 of 15
Client	: **ALS WATER RESOURCES GROUP**	Laboratory	: Environmental Division Brisbane
Contact	: MR MARK DAHM	Contact	: Customer Services
Address	: PO BOX 3216 YERONGA 4104	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: mark.dahm@alsglobal.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3859 7800	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3859 7820	Facsimile	: +61 7 3243 7218
Project	: CQ212941 Waratah Coal Project	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 11-APR-2012
Sampler	: Mark Dahm	Issue Date	: 20-APR-2012
Site	: ----		
		No. of samples received	: 8
Quote number	: BN/245/12	No. of samples analysed	: 8

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

NATA Accredited Laboratory 825

Accredited for compliance with ISO/IEC 17025.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Metals Production Chemist	Brisbane Inorganics
Jonathon Angell	Inorganic Coordinator	Brisbane Inorganics
Matt Frost	Senior Organic Chemist	Brisbane Organics
Stephen Hislop	Senior Inorganic Chemist	Brisbane Inorganics
Stephen Hislop	Senior Inorganic Chemist	WB Water Lab Brisbane

General Comments

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

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

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

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

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

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **No acidified filtered (ORC bottle) samples were supplied for EG094A-F therefore natural unacidified sample was filtered and then acidified overnight.**
- **TDS by method EA-015 may bias high due to the presence of fine particulate matter, which may pass through the prescribed GF/C paper.**

Analytical Results

Sub-Matrix: WATER				Client sample ID	ALS AQ6	ALS AQ5	E3 AQ4	ALS AQ7	ALS AQ8
				Client sampling date / time	06-APR-2012 11:00	05-APR-2012 12:00	04-APR-2012 14:50	07-APR-2012 09:00	07-APR-2012 15:30
Compound	CAS Number	LOR	Unit		EB1209604-001	EB1209604-002	EB1209604-003	EB1209604-004	EB1209604-005
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		724	898	620	455	238
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L		495	543	416	297	372
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		<5	<5	<5	<5	66
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		19	21	19	4	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		251	274	219	157	58
Total Alkalinity as CaCO3	----	1	mg/L		271	294	239	161	58
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		<1	12	<1	<1	<1
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		60	109	56	40	37
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		45	58	35	30	8
Magnesium	7439-95-4	1	mg/L		26	31	20	17	8
Sodium	7440-23-5	1	mg/L		63	87	64	35	26
Potassium	7440-09-7	1	mg/L		2	3	3	2	2
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	1.07
Arsenic	7440-38-2	0.001	mg/L		0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	0.002
Nickel	7440-02-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	0.002
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	<0.005	<0.005	<0.005
Manganese	7439-96-5	0.001	mg/L		0.008	0.018	<0.001	<0.001	0.190
Molybdenum	7439-98-7	0.001	mg/L		0.002	0.002	<0.001	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	7440-61-1	0.001	mg/L		<0.001	0.001	<0.001	<0.001	<0.001
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	0.64

Page	:	4 of 15
Work Order	:	EB1209604
Client	:	ALS WATER RESOURCES GROUP
Project	:	CQ212941 Waratah Coal Project

Analytical Results

Sub-Matrix: WATER				Client sample ID	ALS AQ6	ALS AQ5	E3 AQ4	ALS AQ7	ALS AQ8
				Client sampling date / time	06-APR-2012 11:00	05-APR-2012 12:00	04-APR-2012 14:50	07-APR-2012 09:00	07-APR-2012 15:30
Compound	CAS Number	LOR	Unit		EB1209604-001	EB1209604-002	EB1209604-003	EB1209604-004	EB1209604-005
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.11**	**0.01**	**0.05**	**0.08**	**3.91**
Arsenic	7440-38-2	0.001	mg/L		**0.001**	<0.001	<0.001	<0.001	**0.001**
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	**0.004**
Copper	7440-50-8	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	**0.002**
Cobalt	7440-48-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	**0.004**
Nickel	7440-02-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	**0.003**
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	**0.003**
Zinc	7440-66-6	0.005	mg/L		<0.005	**0.008**	**0.006**	**0.014**	<0.005
Manganese	7439-96-5	0.001	mg/L		**0.035**	**0.021**	**0.006**	**0.032**	**0.284**
Molybdenum	7439-98-7	0.001	mg/L		**0.002**	**0.002**	**0.001**	<0.001	<0.001
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	7440-61-1	0.001	mg/L		<0.001	**0.002**	<0.001	<0.001	<0.001
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L		**0.14**	<0.05	**0.07**	**0.21**	**7.18**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS									
Silver	7440-22-4	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1
EG094T: Total metals in Fresh water by ORC-ICPMS									
Silver	7440-22-4	0.1	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.6**	**0.4**	**0.5**	**0.2**	**0.1**
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.05**	**0.04**	**0.04**	**0.05**	**0.06**
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	<0.01
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		**0.09**	<0.01	<0.01	<0.01	<0.01
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		**0.09**	<0.01	<0.01	<0.01	<0.01
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									

Analytical Results

Sub-Matrix: WATER				Client sample ID	ALS AQ6	ALS AQ5	E3 AQ4	ALS AQ7	ALS AQ8
				Client sampling date / time	06-APR-2012 11:00	05-APR-2012 12:00	04-APR-2012 14:50	07-APR-2012 09:00	07-APR-2012 15:30
Compound	CAS Number	LOR	Unit		EB1209604-001	EB1209604-002	EB1209604-003	EB1209604-004	EB1209604-005
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser - Continued									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		0.2	0.2	0.2	0.2	0.6
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		0.3	0.2	0.2	0.2	0.6
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		0.17	0.18	0.15	0.04	0.04
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	----	0.01	mg/L		0.16	0.16	0.15	0.04	<0.01
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		7.11	9.20	6.35	4.35	2.20
Total Cations	----	0.01	meq/L		7.18	9.31	6.25	4.47	2.24
Ionic Balance	----	0.01	%		0.47	0.57	0.82	1.40	----
EP008: Chlorophyll a & Pheophytin a									
Chlorophyll a	----	1	mg/m³		<1	<1	<1	<1	<1
EP066: Polychlorinated Biphenyls (PCB)									
Total Polychlorinated biphenyls	----	1	µg/L		<1	<1	<1	<1	<1
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobenzene (HCB)	118-74-1	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
gamma-BHC	58-89-9	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
delta-BHC	319-86-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Heptachlor	76-44-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Aldrin	309-00-2	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Heptachlor epoxide	1024-57-3	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
trans-Chlordane	5103-74-2	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
alpha-Endosulfan	959-98-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
cis-Chlordane	5103-71-9	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Dieldrin	60-57-1	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
4.4`-DDE	72-55-9	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin	72-20-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
beta-Endosulfan	33213-65-9	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
4.4`-DDD	72-54-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Endrin aldehyde	7421-93-4	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Endosulfan sulfate	1031-07-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
4.4`-DDT	50-29-3	2	µg/L		<2	<2	<2	<2	<2
Endrin ketone	53494-70-5	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Methoxychlor	72-43-5	2	µg/L		<2	<2	<2	<2	<2

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	ALS AQ6	ALS AQ5	E3 AQ4	ALS AQ7	ALS AQ8
				Client sampling date / time	06-APR-2012 11:00	05-APR-2012 12:00	04-APR-2012 14:50	07-APR-2012 09:00	07-APR-2012 15:30
					EB1209604-001	EB1209604-002	EB1209604-003	EB1209604-004	EB1209604-005
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Demeton-S-methyl	919-86-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Monocrotophos	6923-22-4	2	µg/L		<2	<2	<2	<2	<2
Dimethoate	60-51-5	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Diazinon	333-41-5	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Chlorpyrifos-methyl	5598-13-0	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Parathion-methyl	298-00-0	2	µg/L		<2	<2	<2	<2	<2
Malathion	121-75-5	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Fenthion	55-38-9	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Chlorpyrifos	2921-88-2	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Parathion	56-38-2	2	µg/L		<2	<2	<2	<2	<2
Pirimphos-ethyl	23505-41-1	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Bromophos-ethyl	4824-78-6	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Fenamiphos	22224-92-6	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Prothiofos	34643-46-4	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Ethion	563-12-2	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Carbophenothion	786-19-6	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Azinphos Methyl	86-50-0	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(b)fluoranthene	205-99-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	<1.0	<1.0	<1.0
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	µg/L		<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: WATER				Client sample ID	ALS AQ6	ALS AQ5	E3 AQ4	ALS AQ7	ALS AQ8
				Client sampling date / time	06-APR-2012 11:00	05-APR-2012 12:00	04-APR-2012 14:50	07-APR-2012 09:00	07-APR-2012 15:30
Compound	CAS Number	LOR	Unit		EB1209604-001	EB1209604-002	EB1209604-003	EB1209604-004	EB1209604-005
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	<50	<50
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft									
C6 - C10 Fraction	----	20	µg/L		<20	<20	<20	<20	<20
^ C6 - C10 Fraction minus BTEX (F1)	----	20	µg/L		<20	<20	<20	<20	<20
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	<100	<100	<100
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	<1	<1
Toluene	108-88-3	2	µg/L		<2	<2	<2	<2	<2
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	<2	<2
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	<2	<2
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	<2	<2
^ Total Xylenes	1330-20-7	2	µg/L		<2	<2	<2	<2	<2
^ Sum of BTEX	----	1	µg/L		<1	<1	<1	<1	<1
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	<5	<5
EP066S: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.1	%		141	145	143	164	108
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.1	%		94.4	89.5	81.8	97.2	73.0
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.1	%		127	112	109	102	108
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		32.1	32.6	32.1	33.2	28.9
2-Chlorophenol-D4	93951-73-6	0.1	%		81.1	78.5	75.9	80.4	74.6
2.4.6-Tribromophenol	118-79-6	0.1	%		60.2	63.9	69.1	71.5	74.6
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		92.9	87.6	84.5	88.9	79.1
Anthracene-d10	1719-06-8	0.1	%		96.1	90.1	91.0	91.7	82.7
4-Terphenyl-d14	1718-51-0	0.1	%		113	99.3	105	109	91.8
EP080S: TPH(V)/BTEX Surrogates									

Analytical Results

Sub-Matrix: WATER				Client sample ID	ALS AQ6	ALS AQ5	E3 AQ4	ALS AQ7	ALS AQ8
				Client sampling date / time	06-APR-2012 11:00	05-APR-2012 12:00	04-APR-2012 14:50	07-APR-2012 09:00	07-APR-2012 15:30
Compound	CAS Number	LOR	Unit		EB1209604-001	EB1209604-002	EB1209604-003	EB1209604-004	EB1209604-005
EP080S: TPH(V)/BTEX Surrogates - Continued									
1.2-Dichloroethane-D4	17060-07-0	0.1	%		101	104	101	106	102
Toluene-D8	2037-26-5	0.1	%		98.3	99.4	99.2	98.0	103
4-Bromofluorobenzene	460-00-4	0.1	%		99.0	99.8	98.6	95.8	98.7

Analytical Results

Sub-Matrix: WATER				Client sample ID	ALS AQ12	E3 AQ1	E3 AQ2	----	----
				Client sampling date / time	09-APR-2012 08:30	04-APR-2012 17:30	04-APR-2012 17:15	----	----
Compound	CAS Number	LOR	Unit		EB1209604-006	EB1209604-007	EB1209604-008	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		293	1620	1670	----	----
EA015: Total Dissolved Solids									
Total Dissolved Solids @180°C	GIS-210-010	10	mg/L		213	991	1030	----	----
EA025: Suspended Solids									
Suspended Solids (SS)	----	5	mg/L		36	<5	<5	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	18	19	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		113	339	319	----	----
Total Alkalinity as CaCO3	----	1	mg/L		113	357	338	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		<1	18	<1	----	----
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		20	333	357	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		21	107	78	----	----
Magnesium	7439-95-4	1	mg/L		8	74	53	----	----
Sodium	7440-23-5	1	mg/L		25	103	175	----	----
Potassium	7440-09-7	1	mg/L		7	1	2	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.11	<0.01	<0.01	----	----
Arsenic	7440-38-2	0.001	mg/L		0.002	<0.001	<0.001	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Copper	7440-50-8	0.001	mg/L		0.001	<0.001	<0.001	----	----
Cobalt	7440-48-4	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Nickel	7440-02-0	0.001	mg/L		0.001	<0.001	<0.001	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	<0.005	----	----
Manganese	7439-96-5	0.001	mg/L		0.001	0.098	0.123	----	----
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	----	----
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	0.001	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	0.01	<0.01	----	----
Boron	7440-42-8	0.05	mg/L		0.05	<0.05	0.08	----	----
Iron	7439-89-6	0.05	mg/L		0.24	<0.05	<0.05	----	----

Analytical Results

Sub-Matrix: WATER				Client sample ID	ALS AQ12	E3 AQ1	E3 AQ2	----	----
				Client sampling date / time	09-APR-2012 08:30	04-APR-2012 17:30	04-APR-2012 17:15	----	----
Compound	CAS Number	LOR	Unit		EB1209604-006	EB1209604-007	EB1209604-008	----	----
EG020T: Total Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**1.87**	**0.01**	**0.02**	----	----
Arsenic	7440-38-2	0.001	mg/L		**0.003**	<0.001	<0.001	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L		**0.001**	<0.001	<0.001	----	----
Copper	7440-50-8	0.001	mg/L		**0.002**	<0.001	**0.001**	----	----
Cobalt	7440-48-4	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Nickel	7440-02-0	0.001	mg/L		**0.002**	<0.001	<0.001	----	----
Lead	7439-92-1	0.001	mg/L		**0.001**	<0.001	<0.001	----	----
Zinc	7440-66-6	0.005	mg/L		**0.010**	<0.005	<0.005	----	----
Manganese	7439-96-5	0.001	mg/L		**0.092**	**0.120**	**0.179**	----	----
Molybdenum	7439-98-7	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	----	----
Uranium	7440-61-1	0.001	mg/L		<0.001	<0.001	**0.001**	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	----	----
Boron	7440-42-8	0.05	mg/L		**0.06**	<0.05	**0.09**	----	----
Iron	7439-89-6	0.05	mg/L		**3.35**	**0.08**	**0.18**	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	----
EG094F: Dissolved Metals in Fresh Water by ORC-ICPMS									
Silver	7440-22-4	0.1	µg/L		<0.1	<0.1	<0.1	----	----
EG094T: Total metals in Fresh water by ORC-ICPMS									
Silver	7440-22-4	0.1	µg/L		<0.1	<0.1	<0.1	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	**0.2**	**0.3**	----	----
EK055G: Ammonia as N by Discrete Analyser									
Ammonia as N	7664-41-7	0.01	mg/L		**0.04**	**0.05**	**0.06**	----	----
EK057G: Nitrite as N by Discrete Analyser									
Nitrite as N	----	0.01	mg/L		<0.01	<0.01	<0.01	----	----
EK058G: Nitrate as N by Discrete Analyser									
Nitrate as N	14797-55-8	0.01	mg/L		<0.01	<0.01	<0.01	----	----
EK059G: Nitrite plus Nitrate as N (NOx) by Discrete Analyser									
Nitrite + Nitrate as N	----	0.01	mg/L		<0.01	<0.01	<0.01	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser									

Analytical Results

Sub-Matrix: WATER				Client sample ID	ALS AQ12	E3 AQ1	E3 AQ2	----	----
				Client sampling date / time	09-APR-2012 08:30	04-APR-2012 17:30	04-APR-2012 17:15	----	----
Compound	CAS Number	LOR	Unit		EB1209604-006	EB1209604-007	EB1209604-008	----	----
EK061G: Total Kjeldahl Nitrogen By Discrete Analyser - Continued									
Total Kjeldahl Nitrogen as N	----	0.1	mg/L		**0.5**	**0.3**	**0.2**	----	----
EK062G: Total Nitrogen as N (TKN + NOx) by Discrete Analyser									
^ Total Nitrogen as N	----	0.1	mg/L		**0.5**	**0.3**	**0.2**	----	----
EK067G: Total Phosphorus as P by Discrete Analyser									
Total Phosphorus as P	----	0.01	mg/L		**0.13**	<0.01	<0.01	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	----	0.01	mg/L		**0.05**	<0.01	<0.01	----	----
EN055: Ionic Balance									
Total Anions	----	0.01	meq/L		**2.82**	**16.9**	**16.8**	----	----
Total Cations	----	0.01	meq/L		**2.97**	**15.9**	**15.9**	----	----
Ionic Balance	----	0.01	%		----	**2.93**	**2.77**	----	----
EP008: Chlorophyll a & Pheophytin a									
Chlorophyll a	----	1	mg/m³		**2**	<1	<1	----	----
EP066: Polychlorinated Biphenyls (PCB)									
Total Polychlorinated biphenyls	----	1	µg/L		<1	<1	<1	----	----
EP068A: Organochlorine Pesticides (OC)									
alpha-BHC	319-84-6	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Hexachlorobenzene (HCB)	118-74-1	0.5	µg/L		<0.5	<0.5	<0.5	----	----
gamma-BHC	58-89-9	0.5	µg/L		<0.5	<0.5	<0.5	----	----
delta-BHC	319-86-8	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Heptachlor	76-44-8	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Aldrin	309-00-2	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Heptachlor epoxide	1024-57-3	0.5	µg/L		<0.5	<0.5	<0.5	----	----
trans-Chlordane	5103-74-2	0.5	µg/L		<0.5	<0.5	<0.5	----	----
alpha-Endosulfan	959-98-8	0.5	µg/L		<0.5	<0.5	<0.5	----	----
cis-Chlordane	5103-71-9	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Dieldrin	60-57-1	0.5	µg/L		<0.5	<0.5	<0.5	----	----
4.4`-DDE	72-55-9	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Endrin	72-20-8	0.5	µg/L		<0.5	<0.5	<0.5	----	----
beta-Endosulfan	33213-65-9	0.5	µg/L		<0.5	<0.5	<0.5	----	----
4.4`-DDD	72-54-8	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Endrin aldehyde	7421-93-4	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Endosulfan sulfate	1031-07-8	0.5	µg/L		<0.5	<0.5	<0.5	----	----
4.4`-DDT	50-29-3	2	µg/L		<2	<2	<2	----	----
Endrin ketone	53494-70-5	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Methoxychlor	72-43-5	2	µg/L		<2	<2	<2	----	----

Analytical Results

Sub-Matrix: WATER				Client sample ID	ALS AQ12	E3 AQ1	E3 AQ2	----	----
				Client sampling date / time	09-APR-2012 08:30	04-APR-2012 17:30	04-APR-2012 17:15	----	----
Compound	CAS Number	LOR	Unit		EB1209604-006	EB1209604-007	EB1209604-008	----	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Demeton-S-methyl	919-86-8	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Monocrotophos	6923-22-4	2	µg/L		<2	<2	<2	----	----
Dimethoate	60-51-5	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Diazinon	333-41-5	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Chlorpyrifos-methyl	5598-13-0	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Parathion-methyl	298-00-0	2	µg/L		<2	<2	<2	----	----
Malathion	121-75-5	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Fenthion	55-38-9	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Chlorpyrifos	2921-88-2	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Parathion	56-38-2	2	µg/L		<2	<2	<2	----	----
Pirimphos-ethyl	23505-41-1	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Bromophos-ethyl	4824-78-6	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Fenamiphos	22224-92-6	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Prothiofos	34643-46-4	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Ethion	563-12-2	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Carbophenothion	786-19-6	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Azinphos Methyl	86-50-0	0.5	µg/L		<0.5	<0.5	<0.5	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Fluorene	86-73-7	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Chrysene	218-01-9	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Benzo(b)fluoranthene	205-99-2	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	<0.5	<0.5	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	<1.0	<1.0	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	<1.0	<1.0	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		<0.5	<0.5	<0.5	----	----

Analytical Results

Sub-Matrix: WATER				Client sample ID	ALS AQ12	E3 AQ1	E3 AQ2	----	----
				Client sampling date / time	09-APR-2012 08:30	04-APR-2012 17:30	04-APR-2012 17:15	----	----
Compound	CAS Number	LOR	Unit		EB1209604-006	EB1209604-007	EB1209604-008	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	20	µg/L		<20	<20	<20	----	----
C10 - C14 Fraction	----	50	µg/L		<50	<50	<50	----	----
C15 - C28 Fraction	----	100	µg/L		<100	<100	<100	----	----
C29 - C36 Fraction	----	50	µg/L		<50	<50	<50	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L		<50	<50	<50	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2010 Draft									
C6 - C10 Fraction	----	20	µg/L		<20	<20	<20	----	----
^ C6 - C10 Fraction minus BTEX (F1)	----	20	µg/L		<20	<20	<20	----	----
>C10 - C16 Fraction	----	100	µg/L		<100	<100	<100	----	----
>C16 - C34 Fraction	----	100	µg/L		<100	<100	<100	----	----
>C34 - C40 Fraction	----	100	µg/L		<100	<100	<100	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L		<100	<100	<100	----	----
EP080: BTEXN									
Benzene	71-43-2	1	µg/L		<1	<1	<1	----	----
Toluene	108-88-3	2	µg/L		<2	<2	<2	----	----
Ethylbenzene	100-41-4	2	µg/L		<2	<2	<2	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L		<2	<2	<2	----	----
ortho-Xylene	95-47-6	2	µg/L		<2	<2	<2	----	----
^ Total Xylenes	1330-20-7	2	µg/L		<2	<2	<2	----	----
^ Sum of BTEX	----	1	µg/L		<1	<1	<1	----	----
Naphthalene	91-20-3	5	µg/L		<5	<5	<5	----	----
EP066S: PCB Surrogate									
Decachlorobiphenyl	2051-24-3	0.1	%		**135**	**142**	**168**	----	----
EP068S: Organochlorine Pesticide Surrogate									
Dibromo-DDE	21655-73-2	0.1	%		**75.4**	**77.7**	**85.2**	----	----
EP068T: Organophosphorus Pesticide Surrogate									
DEF	78-48-8	0.1	%		**109**	**110**	**125**	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.1	%		**27.4**	**29.1**	**33.2**	----	----
2-Chlorophenol-D4	93951-73-6	0.1	%		**68.8**	**75.7**	**82.8**	----	----
2.4.6-Tribromophenol	118-79-6	0.1	%		**66.2**	**68.7**	**70.4**	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.1	%		**77.5**	**79.2**	**85.5**	----	----
Anthracene-d10	1719-06-8	0.1	%		**78.8**	**84.7**	**94.9**	----	----
4-Terphenyl-d14	1718-51-0	0.1	%		**89.7**	**96.7**	**116**	----	----
EP080S: TPH(V)/BTEX Surrogates									

Analytical Results

Sub-Matrix: WATER	Client sample ID	ALS AQ12	E3 AQ1	E3 AQ2	----	----
	Client sampling date / time	09-APR-2012 08:30	04-APR-2012 17:30	04-APR-2012 17:15	----	----
Compound	CAS Number	LOR	Unit	EB1209604-006	EB1209604-007	EB1209604-008	----	----
EP080S: TPH(V)/BTEX Surrogates - Continued								
1.2-Dichloroethane-D4	17060-07-0	0.1	%	**104**	**101**	**103**	----	----
Toluene-D8	2037-26-5	0.1	%	**101**	**103**	**103**	----	----
4-Bromofluorobenzene	460-00-4	0.1	%	**101**	**98.9**	**100**	----	----

Surrogate Control Limits

Sub-Matrix: **WATER**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	37	138.2
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	40.4	134.4
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	41.8	143.3
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10.0	71.9
2-Chlorophenol-D4	93951-73-6	26.8	130.2
2.4.6-Tribromophenol	118-79-6	19.3	180.8
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	13.9	146.1
Anthracene-d10	1719-06-8	34.6	137.4
4-Terphenyl-d14	1718-51-0	36.2	154.2
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	66.1	137.9
Toluene-D8	2037-26-5	79.2	119.6
4-Bromofluorobenzene	460-00-4	74.2	118.0

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Document Status

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